Liquiflo™
Chemical Processing Pumps

INSTALLATION, OPERATION & MAINTENANCE MANUAL

CENTRY® SERIES

MAGNETIC-DRIVE, CLOSE-COUPLED CENTRIFUGAL PUMPS

Models 621 & 622 – Mag-Drive

Document No.: 3.20.081

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Introduction

This manual provides instructions for the installation, operation and maintenance of the Centry® Series Centrifugal Pumps, Mag-Drive Models 621 & 622. It is critical for any user to read and understand the information in this manual along with any documents this manual refers to prior to installation and start-up.

Liquiflo pumps shall not be liable for damage or delays caused by a failure to follow the instructions for installation, operation and maintenance as outlined in this manual.

Thank you for purchasing a Liquiflo product.

LIQUIFLO STANDARD TERMS AND CONDITIONS APPLY UNLESS OTHERWISE SPECIFIED IN WRITING BY LIQUIFLO.

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Section 1: General Information

This manual covers the Centry® Series Mag-Drive, Close-Coupled Centrifugal Pumps – Models 621 & 622.

1.1 Pump Description

The Centry Series Mag-Drive pumps are end-suction centrifugal pumps with the following features:

- Sealless design (no mechanical seal to replace)
- Close-coupled design to eliminate manual alignment of pump and motor
- Sturdy Cast Iron mounting bracket that supports pump and motor
- Standard reduced impeller sizes to simplify pump selection
- Closed impellers that do not require manual adjustment
- Choice of threaded or ANSI flanged ports

The pump *Model Number* and *Serial Number* are stamped on the *Stainless Steel Tag* that is attached to the pump's housing. The Serial Number is also permanently stamped on the pump's volute.

The Model Number completely describes the pump's construction and is required when ordering either a new pump or replacement parts for an existing pump. The Model Number for the mag-drive pump is based on a 10-position *Model Coding* system that is described in **Section 1.4** (see page 5).

1.2 General Instructions

The materials of construction of the pump are selected based upon the chemical compatibility of the fluid being pumped. The user must verify that the materials are suitable for the surrounding atmosphere.

If the fluid is non-conductive, methods are available to mechanically ground the isolated shaft. This is only necessary if the surrounding atmosphere is extremely explosive or stray static charges are present.

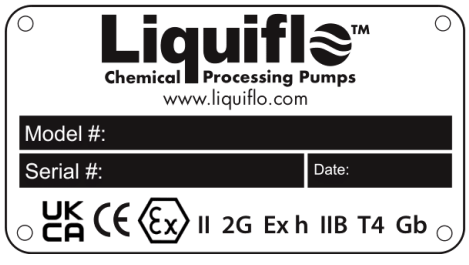
Upon receipt of your Liquiflo pump:

1) Inspect pump and verify that it was not damaged during transit.

2) Inspect tag and verify that the Model Number of the pump matches the Model Number of the pump that was ordered.

3) For UKCA, CE and ATEX certification, verify that the *Stainless Steel Tag* shown to the right is attached to the pump:

   Refer to **Appendix 7** for meaning of the Tag Certification Markings which are shown at the bottom of the tag.



4) Record the following information for future reference:

Model Number:
Serial Number:
Date Received:
Pump Location:
Pump Service:

1.3 Pump Specifications

Table 1: Dimensional Specifications

Specification		Model 621	Model 622	Unit
Ports	Type	Threaded (NPT) or Flanged (ANSI 150# RF)		–
	Suction Size	1 ¼	2	in
	Discharge Size	1	1 ½	in
Impeller	Diameter	5.0	5.0	in
	Standard Trims	4.5, 4.0, 3.5, 3.0	4.5, 4.0, 3.5, 3.0	in
	Axial Length	1.08	1.55	in
	Type	Closed	Closed	–
Mounting Bracket		Close-Coupled, Pedestal [1]		–
Motor Frames (C-Face)		NEMA 56C,143/145TC & 182/184TC; IEC 71, 80 & 90 (B5 Flange) [1]		–

1 S-Adapter is available for long-coupling pump mounting bracket to other motor frames.

Table 2: Performance & Torque Specifications

Specification		Model 621	Model 622	Unit
Maximum Speed		3600	3600	RPM
Maximum Flow Rate		90	160	GPM
Maximum Differential Head		105	95	ft
Magnetic Coupling Maximum Torque @ 20°C	MCF	120		in-lb
	MCW	200		in-lb

Table 3: Absolute Temperature & Pressure Ratings

Specification	Models 621 & 622	Unit
Minimum Operating Temperature	-40	°F
Maximum Operating Temperature	500	°F
Maximum Operating Pressure	300 [2]	PSIG

2 For flanged pumps, max rating is 285 PSIG @ -20 to 100°F; above 100°F, derate by 0.3 PSIG/°F.

Table 4: Weight Data

Item	Model 621	Model 622	Unit
Pump with Threaded Ports [3]	42	48	lb
Pump with Flanged Ports [3]	48	56	lb

3 Weight includes Pump Cartridge, Pedestal and Outer Magnet, and excludes motor.

Table 5: Material Data

Components		Materials
Pump Body, Impeller & Shaft		316 Stainless Steel
Shaft Coating		Chrome Oxide (Cr_2O_3) or Tungsten Carbide (WC)
Bearings		Carbon (Graphite) or Silicon Carbide (α-SiC)
Thrust Washers		Silicon Carbide (α-SiC)
O-rings & Gaskets		Teflon (PTFE), Viton (Type A) or Graphoil
Magnetic Coupling	Magnets	MCF & MCW: Samarium Cobalt (SmCo)
	Inner Magnet Casing	316 Stainless Steel
	Outer Magnet Casing	Carbon Steel/Epoxy
Mounting Bracket (Pedestal)		Cast Iron/Epoxy
Mounting Hardware		18-8 Stainless Steel

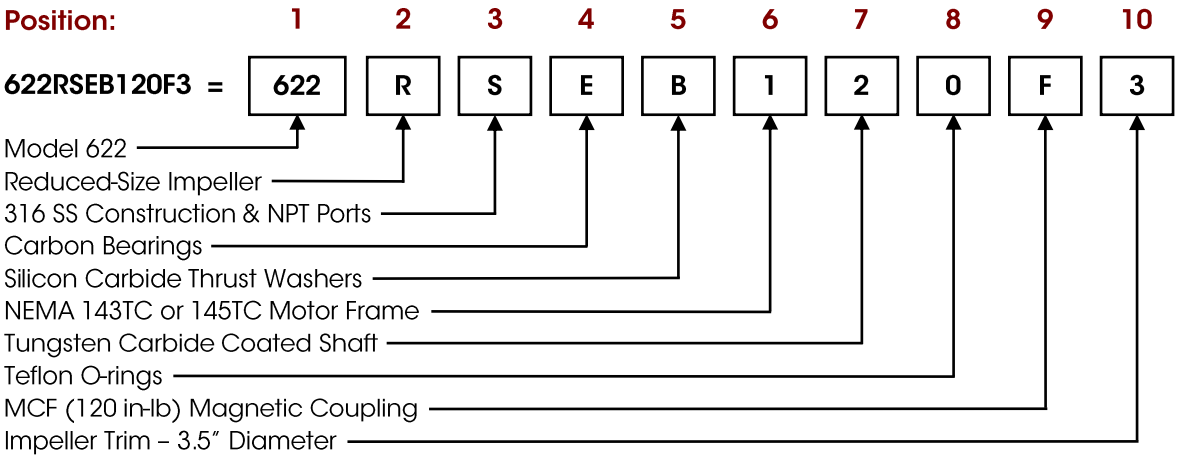
1.4 Model Coding

Table 6: Model Coding for Centry® MAG-DRIVE Models 621 & 622

Position	Description	Code	Selection	
1	Pump Model	621	Model 621	
		622	Model 622	
2	Impeller Size	F	Full-Size – 5.0″ Diameter	Pos. 10 = 0
		R	Reduced-Size	Pos. 10 = 1, 2, 3 or 4
3	Basic Material of Construction & Port Type	S	316 SS Construction & NPT Ports	
		L	316 SS Construction & Flanged Ports	
4	Bearings	E	Carbon	
		B	Silicon Carbide	
5	Thrust Washers	B	Silicon Carbide	
6	Motor Frame (Outer Magnet Bore)	0	NEMA 56C (5/8 in.)	
		1	NEMA 143TC or 145TC (7/8 in.)	
		2	IEC 71-B5 (14 mm)	
		3	IEC 80-B5 (19 mm)	
		4	IEC 90-B5 (24 mm)	
		5	NEMA 182TC or 184TC (1-1/8 in.)	
		8	IEC 100-B5 or 112-B5 or (28 mm)	
7	Shaft Coating	1	Chrome Oxide	
		2	Tungsten Carbide	
8	O-rings/Gaskets	0	Teflon O-rings	
		V	Viton O-rings	
		G	Graphoil Gaskets	
9	Magnetic Coupling	F	MCF (120 in-lb)	
		W	MCW (200 in-lb)	
10	Impeller Diameter (Trim)	0	No Trim	Pos. 2 = F
		1	4.5″ Diameter	Pos. 2 = R
		2	4.0″ Diameter	
		3	3.5″ Diameter	
		4	3.0″ Diameter	
Suffix	Options	-8(HT)[1]	High Temperature (300 to 500 °F)	
		-8(LT)[2]	Low Temperature (-100 to 32 °F)	

1 **HT** = High Temperature in °F (Example: **- 8(400)** = High Temperature Application at 400°F).
2 **LT** = Low Temperature in °F (Example: **- 8(-40)** = Low Temperature Application at -40°F).

Model Coding Example:



1.5 General Operation

The successful and safe operation of a pump is not only dependent on the pump but also on each of the system components. It is therefore important to monitor the entire pumping system during operation and to perform the necessary maintenance to keep the system running smoothly.

A normally operating magnetic-drive centrifugal pump will deliver a steady and pulse-less flow with no leakage, be relatively quiet and have a predictable flow rate and power requirement based on the impeller size, operating speed, differential head and fluid specific gravity. Centry performance curves can be obtained from the Liquiflo website: www.liquiflo.com. For viscous liquid applications, a performance correction is required (see **Section 3.8**).

If a significant problem is observed during operation, the pump should be stopped so that corrective action can be taken. The observed problem could have several possible causes, and multiple remedies for each cause. For help with problem solving, refer to the Troubleshooting Guide given in **Appendix 6**.

1.6 Maintenance & Repair

The magnetically-coupled sealless pump has internal bearings, thrust washers and a shaft which require replacement over time due to erosion wear. Possibly, other pump parts, such as the impeller, volute and containment can, may require replacement due to abrasion wear, corrosion wear or cavitation wear. O-rings and gaskets should always be replaced when rebuilding the pump.

The main factors affecting the physical wear of the pump are operating speed, differential head, fluid viscosity, duty cycle, starting and stopping frequency, abrasives in the fluid and the wear properties of the materials. These factors can cause pump lifetimes to vary significantly from one application to another, making it difficult to predict when the pump will require maintenance. Therefore, the maintenance schedule for the pump is typically based on the maintenance history of the specific application. The main indicators that a pump may require maintenance are the following: (1) decreased flow rate or head, (2) fluid leakage, (3) unusual noise or vibrations and (4) increased power consumption.

Before performing maintenance on the pump, review the safety precautions and follow the included instructions.

1.7 Replacement Parts

Replacement parts for the pumps can be purchased from your local Liquiflo distributor. Refer to **Appendices 3 thru 5** for individual parts information.

1.8 Returned Merchandise Authorization (RMA)

If it is necessary to return the pump to the factory for service,

1) Contact your local Liquiflo distributor to discuss the return, obtain a Returned Merchandise Authorization Number (**RMA #**) and provide the distributor with the required information (see RMA Record below).

2) Clean and neutralize pump. Be sure no fluid remains in the containment can. **Liquiflo is not equipped to handle dangerous fluids.**

3) Package the pump carefully and include the **RMA #** in a visible location on the outside surface of the box. Always ship the outer magnet separately from the pump assembly. Shipping outer magnet over top of containment can will result in damage.

4) Ship pump to factory, freight prepaid.

Returned Merchandise Authorization (RMA) Record	
RMA #	(Supplied by Distributor)
Distributor Name	
Item(s) Returned	
Serial Number(s)	
Reasons for Return	
Fluid(s) Pumped	
Time in Service	

NOTE: The pump must be cleaned and neutralized prior to shipment to the factory.

Section 2: Safety Precautions

2.1 General Precautions

- **Always** lock out the power to the pump driver when performing maintenance on the pump
- **Always** lock out the suction and discharge valves when performing maintenance on the pump
- **Never** operate a long-coupled pump without the coupling guard installed
- **Never** operate the pump with suction and/or discharge valves closed
- **Never** start the pump without making sure that the pump is primed
- **Never** use heat to disassemble the pump
- Decontaminate pump using procedures in accordance with federal, state, local and company environmental regulations
- Before performing maintenance on the pump, check with appropriate personnel to determine if skin, eye or lung protection is required and how best to flush the pump

Caution!
Failure to observe safety precautions can result in personal injury, equipment damage or malfunction.

2.2 Precautions for Magnetic-Drive Pumps

Magnetic-drive pumps contain strong magnets, which pose health risks. Therefore, the following precautions must be observed:

Caution!

- *Individuals with cardiac pacemakers should avoid repairs on these units*
- *Individuals with internal wound clips, metallic wiring, or other metallic prosthetic devices should avoid repairs on these units*
- ***Strong magnetic fields can cause tools and parts to slam together, injuring hands and fingers***

Strong magnets will attract iron, cast iron, carbon steel and some types of stainless steel. Keep magnets away from credit cards, computers, computer discs and watches.

Section 3: Pump & Motor Installation

3.1 Installation of Pump, Motor & Base

Refer to the Hydraulic Institute Standards for proper installation procedures of the base, pump and motor.

1) **The pump inlet should be as close to the liquid source as practical and preferably below it.** Centrifugal pumps cannot be used in a suction lift arrangement unless the pump is primed before starting. Many issues can be avoided with a flooded suction arrangement.

NOTE: The pump models covered in this manual are close-coupled and no alignment procedure between the pump and motor is required.

3.2 General Piping Requirements

Refer to the Hydraulic Institute Standards for piping guidelines.

1) All piping must be supported independently and must line up naturally with pump ports.

2) Piping that handles both hot and cold liquids require proper installation of expansion loops and joints so that thermal expansion of the piping will not cause misalignment.

3) The piping should be arranged to allow the pump to be flushed and drained prior to the removal of the pump for servicing. Valves and unions should be installed to allow the pump to be isolated during maintenance. Valves which open to the full pipe diameter, such as ball valves, should be used.

4) **Suction and discharge piping should be the same size or larger than the inlet and outlet ports.** This is especially important for viscous services when the pipe diameter has a large effect on friction losses and NPSH available.

5) **Suction piping should be designed to minimize friction losses.** The length of the suction line should be as short as possible with no sharp turns or bends. Any elbows used should be long radius. There should be a minimum of five pipe diameters of straight pipe between the elbow and the suction inlet. Reducers, if used, should be eccentric at the pump suction port.

6) The **suction pipe** must be submerged sufficiently below the liquid surface to prevent vortices and air entrapment at the supply.

7) **Suction Head (Flooded Suction) Arrangement:** Piping should be level or slope gradually downward from the supply source to eliminate air pockets.

8) **Suction Lift Arrangement:** The suction pipe must slope continuously upward towards pump suction to eliminate air pockets. All connections must be air tight. A means of priming the pump must be provided.

9) Gasket materials used with flanged connections must be compatible with the fluid and operating temperature.

10) The piping system should be cleaned prior to installation of the pump.

3.3 Strainers & Solids Handling

1) Centry mag-drive pumps use internal sleeve bearings with very close bearing-shaft clearances and are designed to pump relatively clean fluids. If small abrasive particles are present, they can get in between the shaft and bearings, which will accelerate or increase wear over an extended period of time. Although some solids can be tolerated, **pumping abrasive particles is not suggested with these pumps.**

2) The maximum allowable particle size for Centry mag-drive pumps is 150 microns. **Regardless of particle size, these pumps are intended for relatively clean liquids** where the general concentration of solids is limited to 2% by volume. Higher concentration may cause the wear rate to increase, resulting in a decrease in pump performance. In addition to solids concentration, the specific wear rate also depends on the size, shape and hardness of the particles, the operating speed and the materials used to construct the pump. Since wear rate is proportional to the square of the speed, slower operating speeds will substantially increase pump lifetimes.

3) While occasional small particles may not be catastrophic to the pump, **the use of a strainer on the inlet will prevent large particulates from entering the pump.** If the strainer clogs with material and is not properly maintained, the pump may be starved of liquid, causing a loss of flow and damaging the pump via dry-running. When a suction strainer is used, it should have a net open area of at least three times the suction pipe area.

3.4 NPSH Requirement

All pumps require sufficient NPSH (Net Positive Suction Head) to function properly. The NPSH available in the system is the difference between the available suction pressure at the pump inlet and the vapor pressure of the fluid (which depends on the fluid temperature). The NPSH required by the pump is a function of pump speed and impeller diameter, and is included with the Performance Curves of the pump. NPSH values are typically given in units of **ft H_2O (a)** (feet of water, absolute) or **m H_2O (a)** (meters of water, absolute).

The NPSH available in the system must be greater than the NPSH required by the pump or the pump will go into cavitation, resulting in decreased flow, increased vibration and noise emission, and potential damage to internal components.

3.5 Flow Requirements

The pump must be operated with a minimum flow rate to prevent overheating of the process fluid. A generally accepted industry practice for minimum flow rate is 15% of the flow rate at the Best Efficiency Point (BEP). Alternatively, the minimum flow rate can be calculated based on the service conditions, power dissipation and the allowable temperature rise of the fluid. Consult the Hydraulic Institute Handbook or Liquiflo Engineering.

Operating the pump at over 90% of the flow rate at runout should be avoided to prevent a system fluctuation from causing the pump to "run off the curve," which can increase the NPSH required by the pump, possibly going above the NPSH available in the system and causing cavitation.

3.6 Controlling the Flow

A centrifugal pump is a kinetic type pump, and **flow is typically controlled by throttling the discharge valve**. The operating point for a centrifugal pump is the intersection of its Head vs. Flow Performance Curve (for a specific impeller diameter) and the System Resistance Curve (which is a function of the flow rate). Increasing the flow area of the valve reduces the system resistance and causes the flow rate to increase (i.e., further opening of the valve moves the operating point to the right on the performance curve). Conversely, decreasing the flow area of the valve increases the system resistance and causes the flow rate to decrease (i.e., further closing of the valve moves the operating point to the left on the performance curve).

3.7 Affinity Laws

The performance of a centrifugal pump at **any operating speed and impeller diameter** can be closely approximated from the performance at a standard motor speed and impeller diameter by using the Affinity Laws:

Affinity Laws for Centrifugal Pumps

$$(1)\ \frac{Q_1}{Q_2} = \frac{n_1 D_1}{n_2 D_2} \qquad (2)\ \frac{H_1}{H_2} = \frac{{n_1}^2 {D_1}^2}{{n_2}^2 {D_2}^2} \qquad (3)\ \frac{P_1}{P_2} = \frac{{n_1}^3 {D_1}^3}{{n_2}^3 {D_2}^3}$$

Where, **Q** = Flow Rate, **H** = Head, **P** = Power, **n** = Speed and **D** = Impeller Diameter.

3.8 Viscous Fluids

Centry sub-ANSI pumps are generally applied at viscosities under 200 centipoise (cP). For fluid viscosities over 2 cP, a **Viscosity Correction per Standard ANSI/HI 9.6.7** is required to size the pump and motor. For sizing of viscous fluid applications or for more assistance in general selection, contact the local distributor or Liquiflo Engineering.

3.9 Motor Selection

1) For the **Close-Coupled** configuration, the motor frame size is part of the pump model coding and is selected at the time the pump is ordered. The motor frame must have a C-face for compatibility with the pump mounting bracket. Refer to **Position 6** of the pump model code (see Table 6 on page 5).

2) The pump mounting bracket (pedestal) is compatible with NEMA 56C, 143TC & 145TC and IEC 71, 80 & 90 (with B5 Flange) motor frames. For NEMA 182TC/184TC or IEC 100/112 (B5) motor frames, an **adapter plate** is required to mount the motor to the pedestal (see **Appendices 1 & 4**). The adapter plate and mounting bolts are provided with the pump when applicable.

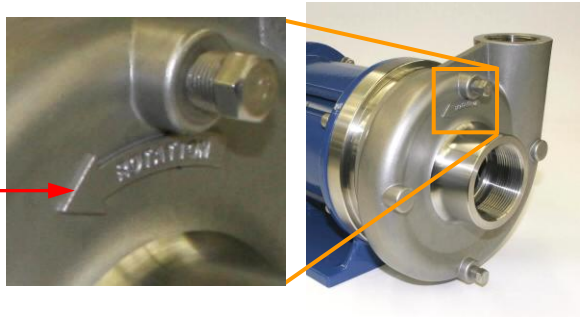
3) The motor must have an **enclosure** that is compatible with the application conditions. If an explosion-proof motor is required, the *temperature code* of the motor must be acceptable for the process fluid.

4) The motor speed and power rating are usually determined at the time the pump is ordered to meet the specified conditions of service. For **thin liquids**, the Head vs. Flow Performance Curves can be used directly to determine the speed and brake horsepower (BHP) requirements, as well as the required impeller diameter. For **liquids heavier than water**, the BHP obtained from the Performance Curves must be multiplied by the Specific Gravity of the liquid to determine the BHP required. For **viscous fluids**, a viscosity correction is required (see **Section 3.8**). Additional power is required to overcome the friction losses due to viscosity.

3.10 Motor Shaft Direction

The motor shaft must turn in the direction required by the centrifugal pump. Looking directly at the suction end of the pump, the motor shaft must rotate counterclockwise.

NOTE: A **counterclockwise rotational arrow** is cast on the volute of the pump, below the vent plug and above the suction inlet.



Section 4: Start-Up & Operation

4.1 Starting the Pump

1) Verify that the pump and motor are suitable for the conditions of service.

2) A **power sensor** should be installed to stop the motor in the event of a loss-of-load or overload condition.

3) Verify that **all suction and discharge valves are open** before starting the pump.

   NOTE: Suction valves must be open to supply the pump with fluid. Fully closing a discharge valve when the pump is operating will cause circulation of fluid inside the pump's volute. Operating the pump continuously in this state will cause significant heating of the fluid.

4) **Prime the pump with fluid.**

   NOTE: For a flooded suction, allow the fluid time to enter the pump before starting. For a suction lift, a method of priming the pump must be available to prevent dry-running. Prolonged dry running will cause rapid wear and damage to the bearings and shaft due to overheating and thermal expansion. In addition, the pump could overheat due to eddy currents induced in the containment can. **As a general rule, mag-drive pumps should not be run dry for more than 30 seconds**.

5) Jog the motor to check the direction of rotation. Motor shaft direction must be counter-clockwise as seen from the suction end of the pump. (See **Section 3.10** on page 11.)

> ***Caution!***
> *Always prime the pump before operating. Do not run the pump dry for more than 30 seconds or damage to internal components may result.*

4.2 Operation & Troubleshooting

A normally operating centrifugal pump will deliver a steady and pulse-less flow, be relatively quiet and have a predictable flow rate based on the impeller size, operating speed and differential head across the pump. Refer to the performance curves for Centry Model 621 or 622, which are available on the Liquiflo website. (Note: If the fluid viscosity is significantly higher than the viscosity of water, a performance correction is required as explained in **Section 3.8**.)

The differential pressure can be measured with calibrated pressure gauges close to the suction and discharge ports. (Note: The true differential pressure must take into account the difference in gauge elevations and the velocity head (dynamic pressure) differential resulting from the increase in fluid velocity thru the centrifugal pump. Pressure is related to Head by the following formula: Pressure [PSI] = (Head [feet] x SG)/2.31, where SG is the Specific Gravity of the fluid.) The flow rate can be measured with a calibrated flowmeter in the discharge line.

After priming and start-up, monitor the pump for several minutes to ensure proper operation. If excessive noise is heard, or product leakage is observed, or performance is not as expected, stop the pump and refer to **Appendix 6** for troubleshooting.

Section 5: Maintenance & Repair

The magnetically-coupled pump has internal bearings, thrust washers and a shaft that require replacement over time due to wear. O-rings and gaskets should always be replaced when rebuilding the pump.

5.1 Work Safety

Before performing maintenance, review the safety precautions given in **Section 2** (see page 8).

> ***Caution!***
> *The magnetic couplings used in these pumps contain strong magnets. Observe the safety precautions given in Section 2.2.*

5.2 Removal from System

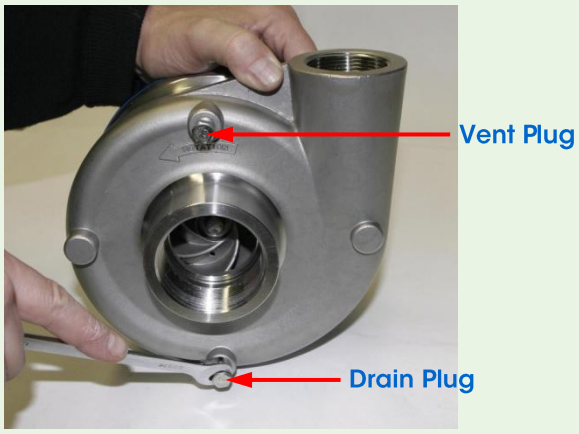
Before servicing, prepare the pump as follows:

> ***Caution!***
> *If the pump was used on hazardous or toxic fluids, it must be flushed and decontaminated prior to removal from the system piping. Refer to the Material Safety Data Sheet (MSDS) for the liquid and follow all prescribed safety precautions and disposal procedures.*

1. Flush the pump.
2. Stop the motor and lock out the electrical panel.
3. Close the suction and discharge isolation valves.
4. Drain the fluid from the pump by removing the vent and drain plugs (see photos below.)
5. Disconnect the pump from the system and move it to a clean work area.

Location & Removal of Vent & Drain Plugs

The pump has two **1/8" NPT plugs** located on the suction side of the volute, as shown.



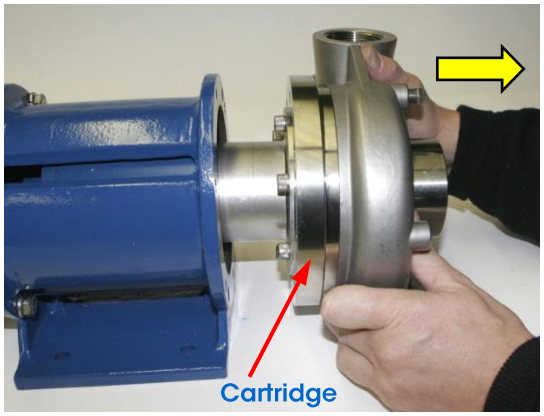
5.3 PUMP DISASSEMBLY

Follow the procedure below and refer to the Sectional and Exploded View drawings in **Appendix 5**. Drawing reference numbers are given in parentheses in the following procedure.

Cartridge Removal:

1 Remove four mounting bolts (21) and separate the **pump cartridge** from the pedestal (20).

NOTE: Force is required to overcome the magnetic attraction between the outer and inner magnets.

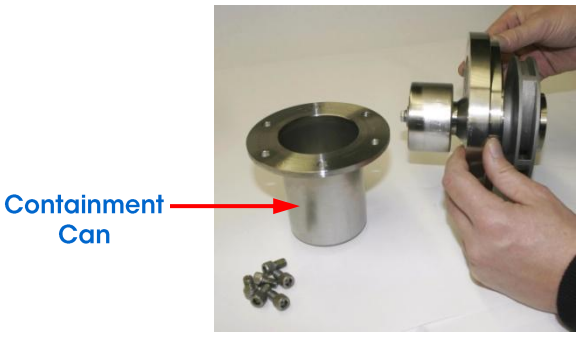


Caution!
Do not place hands or fingers between the Pedestal and Cartridge.

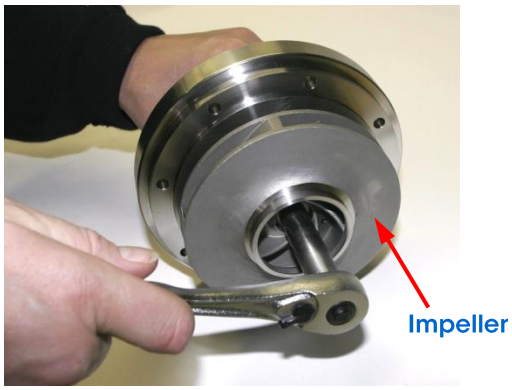
Cartridge Disassembly:

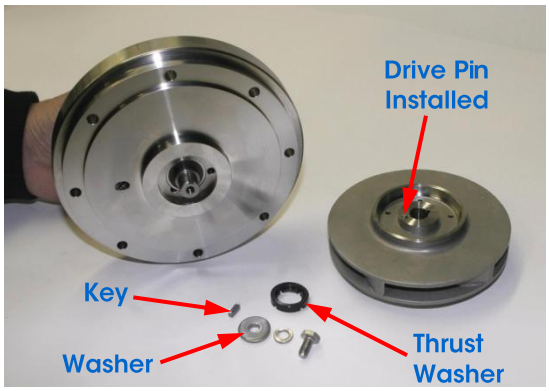
2 Remove eight bolts (6) and separate the volute (2). Discard volute O-ring (5).

3 Remove six screws (17) and separate the containment can (15). Discard O-ring (16).



4 Remove impeller screw (8) and separate the impeller (1) from the shaft (4). Remove the thrust washer (13), key (10), drive pin (18), lock-washer (9) and washer (7).





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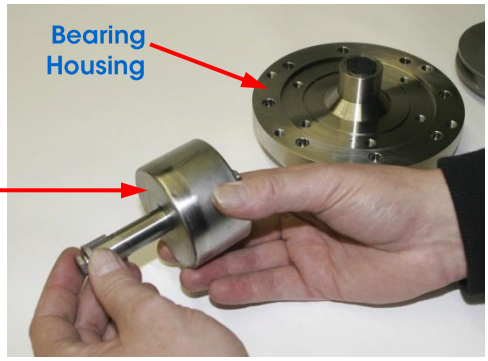
5 Separate the inner magnet & shaft assembly from the bearing housing (3).



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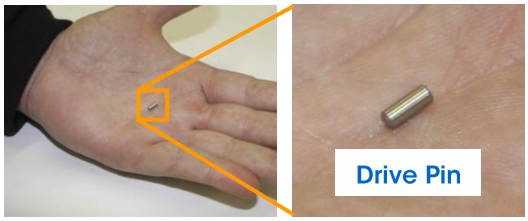
6 Remove the screw (8) from the shaft (4) and separate the inner magnet (14). Remove the thrust washer (13), key (11), drive pin (18), lock-washer (9) and washer (7).



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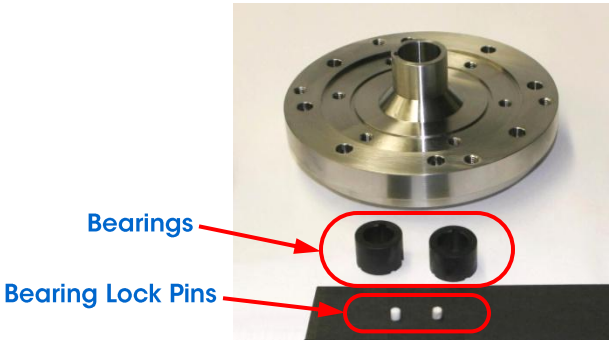
7 Remove the bearings (12) and bearing lock pins (25) from the bearing housing (3).



Removal of Outer Magnet:

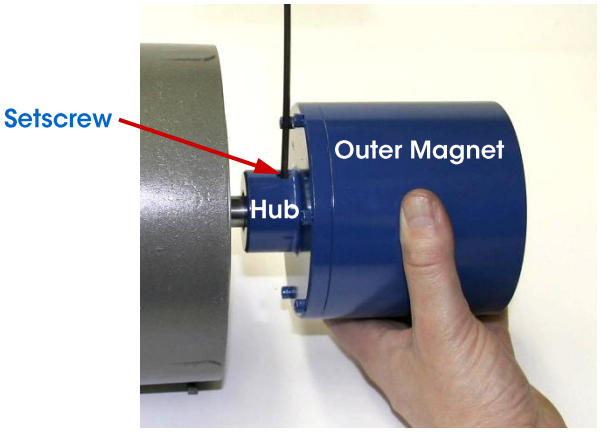
NOTE: The following step is required only if it is necessary to remove the motor from the pedestal or the outer magnet from the motor shaft. If only a **cartridge** replacement is needed, skip **Step 8**. The assembly and installation of the pump cartridge is covered in **Section 5.4**, **Parts A** & **B**, respectively.

---

8 **a.** Detach the motor (with outer magnet) from the pedestal (25) by removing four bolts (29).

---

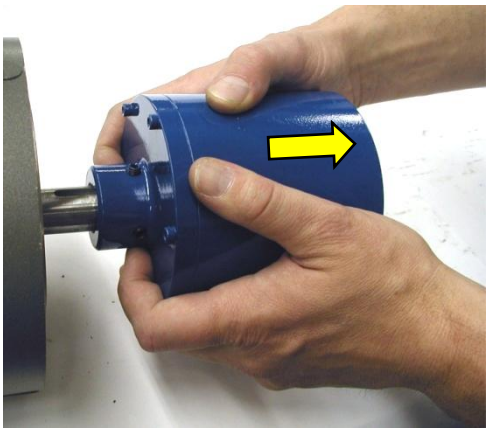
b. Loosen the two setscrews (17) on the hub (23) of the outer magnet (24).



---

c. Remove the outer magnet from the motor shaft.

> ***Caution!***
> *Move the outer magnet to a safe location, away from the inner magnet, tools and other metal objects.*



END OF DISASSEMBLY PROCEDURE

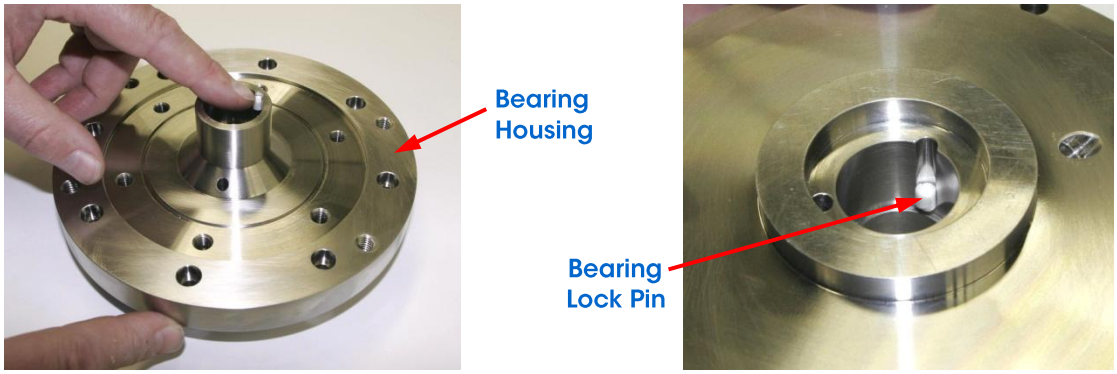
5.4 PUMP ASSEMBLY

Follow the procedure below and refer to the Sectional and Exploded View drawings in **Appendix 5**. Drawing reference numbers are given in parentheses in the following procedure.

Part A: Cartridge Assembly

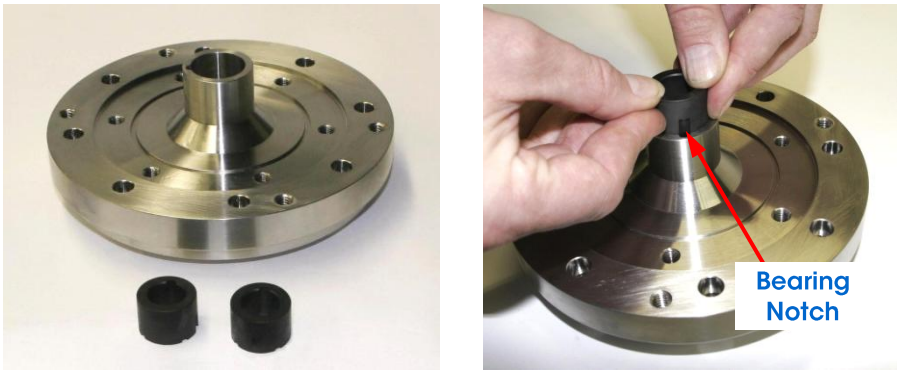
Installation of Bearings:

1 Install the bearing lock pins (25) into both sides of the bearing housing (3).



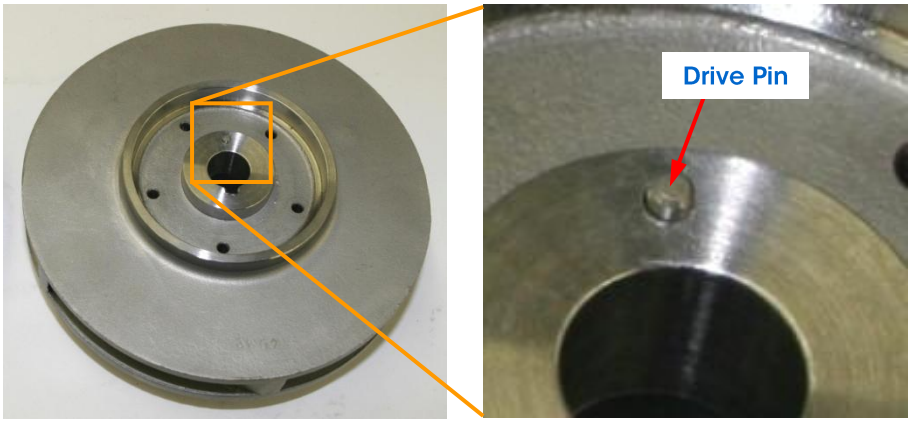
2 Install the bearings (12) into both sides of the bearing housing (3).

NOTE: The Bearing notch must face down, towards the bearing lock pin.



3 Insert drive pin (18) into the impeller (1).

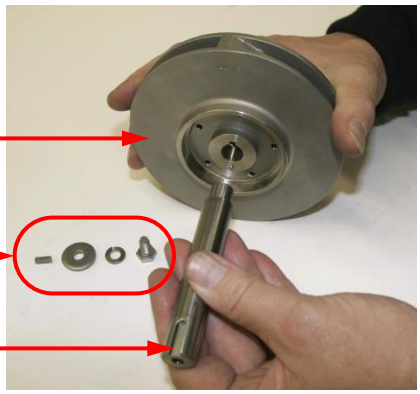
NOTE: Make certain pin is pushed in fully. Pin should stick out .060 to .080 in.



Shaft-Impeller Assembly:

4 Assemble the shaft (4) and impeller (1) with key (10), washer (7), lock-washer (9) and screw (8).

NOTE: Refer to **Appendix 1** for the torque specifications of the fastener.

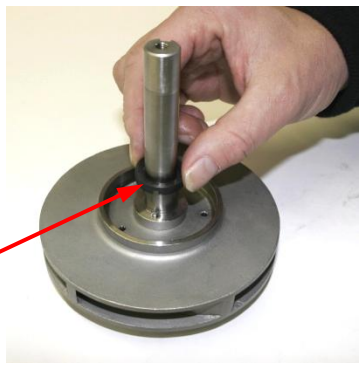


Installation of Thrust Washers:

5 Install thrust washer (13) onto drive shaft (4) and impeller (1).

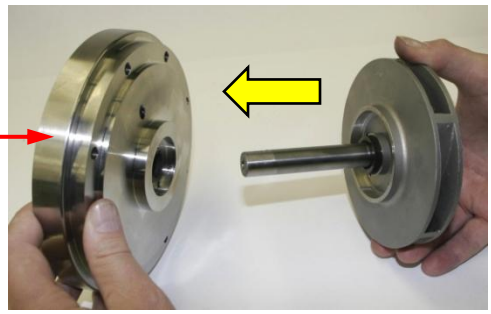
> ***Caution!***
> *There must be clearance between top of pin and bottom of drive notch or breakage of thrust washer may result.*

NOTE: Apply a small amount of lubricant to the thrust washer, such as mineral oil or grease that is compatible with the fluid to be pumped. This will allow the thrust washer to stay in place during assembly. Be certain thrust washer seats properly over the drive pin.



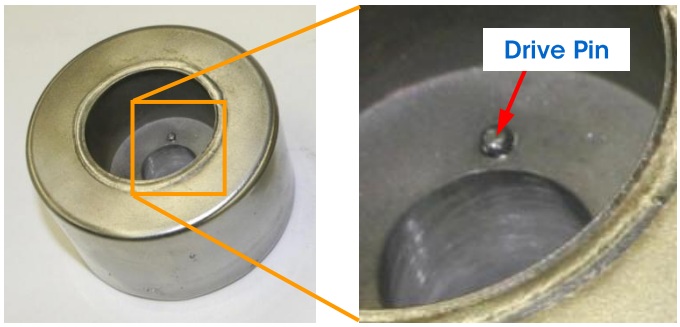
6 Slide shaft-impeller assembly into the bearing housing (3); then place the assembly on the bench top with the impeller facing down.

NOTE: The thrust washer should seat firmly against the bearing.



7 Insert drive pin (18) into the inner magnet (14).

NOTE: Make certain pin is pushed in fully. Pin should stick out .060 to .080 in.



8 Install thrust washer (13) into the inner magnet (14).

> ***Caution!***
> *There must be clearance between top of pin and bottom of drive notch or breakage of thrust washer may result.*

NOTE: Apply a small amount of lubricant to the thrust washer, such as mineral oil or grease that is compatible with the fluid to be pumped. This will allow the thrust washer to stay in place during assembly. Be certain thrust washer seats properly over the drive pin.

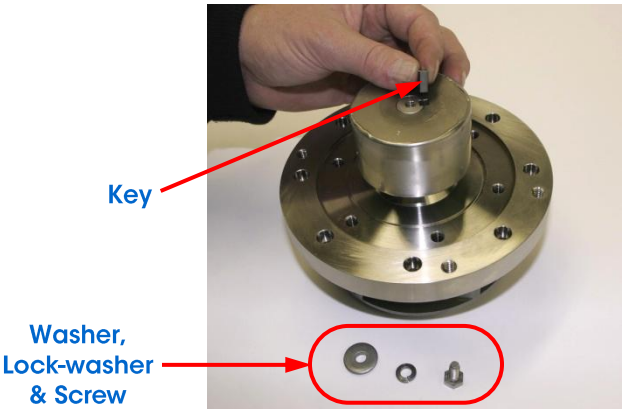
Installation of Inner Magnet:

9 Slide inner magnet (14) onto shaft (4).

NOTE: Align keyways of the inner magnet and shaft. Be certain thrust washer seats firmly against bearing and remains properly seated over the drive pin.

10 Insert the key (11).

NOTE: The top of the shaft should be flush with or slightly above the top surface of the inner magnet.



11 Install washer (7), lock-washer (9) and screw (8); then tighten the screw.

NOTE: Refer to **Appendix 1** for the torque specifications of the fastener.

Installation of Containment Can:

12 Install containment can O-ring (16) into the circular groove.

> ***Caution!***
> *Do not reuse O-rings.*

---

13 Install containment can (15) with six screws (17).

NOTE: Apply anti-seize compound to the screws. Refer to **Appendix 1** for the torque specifications of the fasteners. When tightening the containment can screws, use a star-pattern torque sequence to ensure even compression on the O-ring's surface. With Teflon (PTFE) O-rings, repeat this process several times, waiting between retightening. This is necessary because Teflon will cold flow and require some time to properly seat. Continue the process until the screws no longer require retightening.

Installation of Volute:

14 Install volute O-ring (5).

> ***Caution!***
> *Do not reuse O-rings.*

NOTE: Be careful not to bend or twist O-ring during installation. The O-ring should seat naturally into position.

---

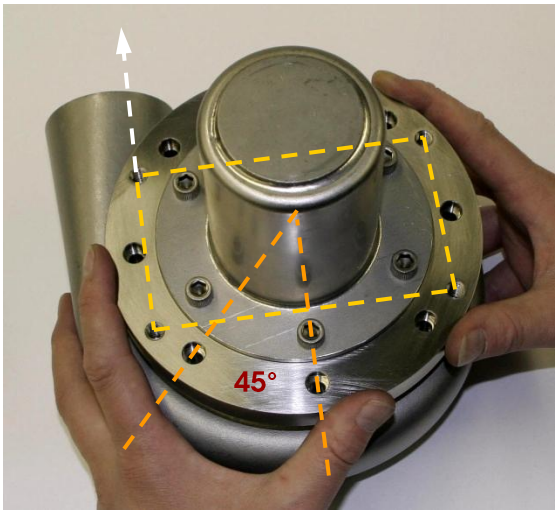
15 Place volute (2) onto the bearing housing (3).

NOTE: If not previously done, Install the vent and drain plugs into the volute. Use Teflon tape or pipe lubricant to prevent leakage and galling. (See page 13 for description of the plugs.)

---

16 Carefully turn the assembly over and align the bearing housing (3) with the volute (2), as shown.

NOTE: For vertical discharge, orient the four drilled and tapped holes as shown. The bearing housing can be rotated in 45° steps relative to the volute to obtain seven other discharge angles.



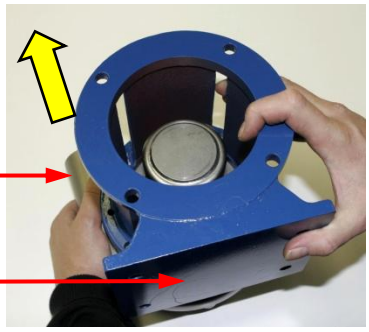
17 Bolt the volute (2) to the bearing housing (3) using eight screws (6). This completes the **pump cartridge** assembly.

NOTE: Apply anti-seize compound to the screws. Refer to **Appendix 1** for the torque specifications of the fasteners. When tightening the housing screws, use a star-pattern torque sequence to ensure even compression on the O-ring's surface. With Teflon (PTFE) O-rings, repeat this process several times, waiting between retightening. This is necessary because Teflon will cold flow and require some time to properly seat. Continue the process until the screws no longer require retightening.

Part B: Cartridge-Pedestal Assembly

18 Place pedestal (20) on pump cartridge as shown; then align mounting holes.

NOTE: For a **Cartridge replacement** to an existing pedestal with attached motor and outer magnet, carefully install the Pump Cartridge to the pedestal. Refer to photos in **Step 1** on page 14.
CAUTION: Do not place hands or fingers between the pedestal and cartridge. The magnets will suddenly pull together with significant force.



19 Attach bearing housing (3) to pedestal (20) using four bolts (21).

NOTE: Refer to **Appendix 1** for the torque specifications of the fasteners.

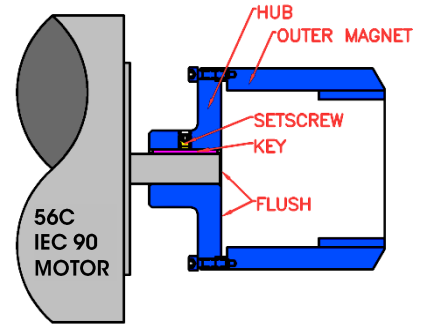
Part C: Outer Magnet-Motor Assembly

Outer Magnet Installation Diagrams

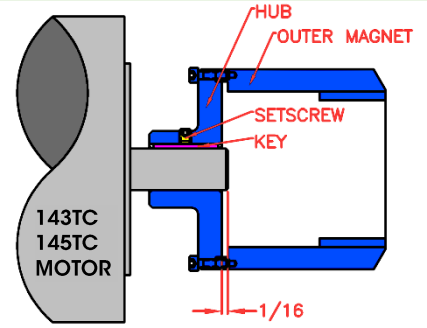
The procedure for installing the outer magnet on the motor shaft is dependent on the **motor frame** used with the pump. The four standard cases are described below:

I. NEMA 56C & IEC 90 Frames:
The end of the motor shaft must be flush with the inner surface of the outer magnet's hub.

NOTE: The IEC motor must have a B5 Flange to be compatible with the pump mounting bracket.

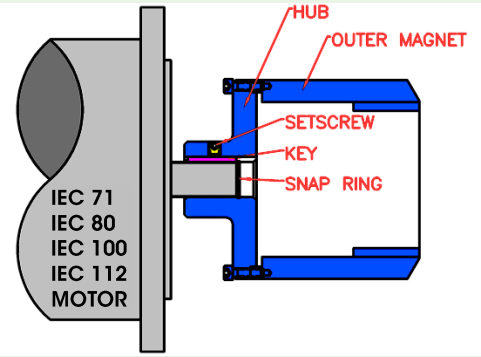


II. NEMA 143TC & 145TC Frames:
The motor shaft must protrude past the inner surface of the outer magnet's hub by 1/16 in. (1.6 mm).



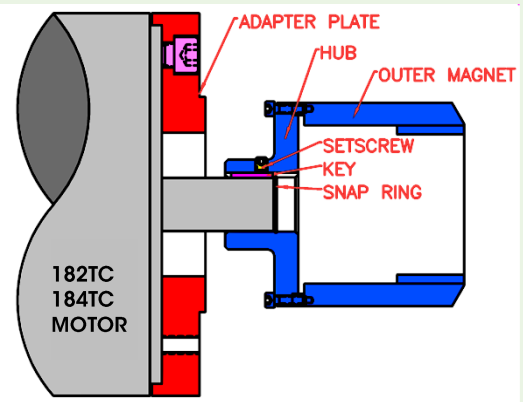
III. IEC 71, 80, 100 & 112 Frames:
The outer magnet's hub is positioned by a snap ring installed in the hub. The end of the motor shaft must contact the snap ring.

NOTE: The IEC motor must have a B5 Flange, as shown, to be compatible with the pump mounting bracket. IEC 100 & 112 frames utilize an adapter plate (provided, but not shown) similar to the picture below.



IV. NEMA 182TC & 184TC Frames:
An **adapter plate** is required to mount the motor to the pedestal. The outer magnet's hub is positioned by a snap ring installed in the hub. The end of the motor shaft must contact the snap ring.

NOTE: Complete pumps ordered for use with NEMA 182/184TC motor frames will be supplied with the Adapter Plate (Part No. SP0046) and Adapter Mounting Bolts (Part No. 641105).



20 Install the outer magnet as follows:

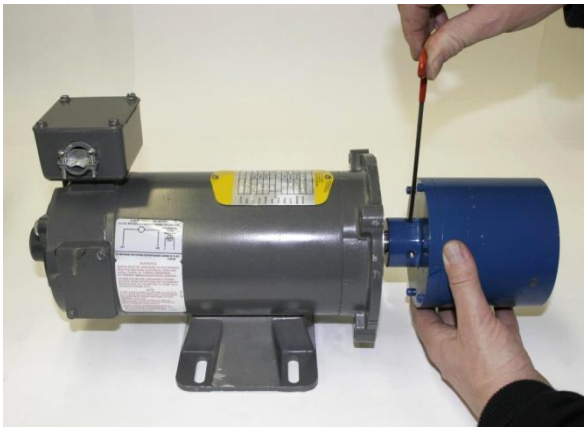
a. Insert motor key into the keyway on the motor shaft.

b. Apply a small amount of anti-seize compound to the motor shaft.

c. Align keyway of the outer magnet's hub with the key on the motor shaft.

d. Slide the outer magnet onto the shaft and position the hub as shown on page 22.

e. Tighten the two setscrews on the hub.



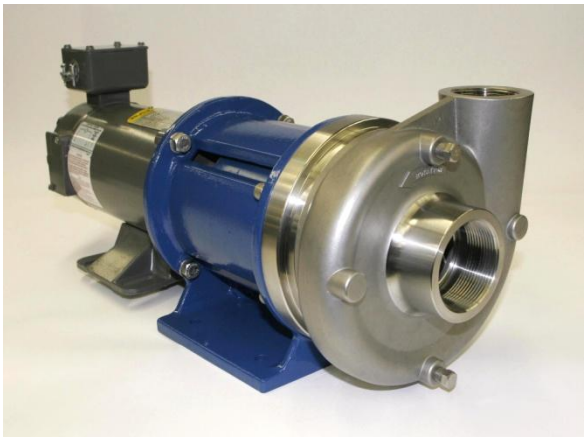
Part D: Motor-Pedestal Assembly

21

> ***Caution!***
> ***Do not place hands or fingers between the Pedestal and Motor C-Faces.*** *The Outer and Inner Magnets will suddenly pull together with significant force.*

Install the motor-outer magnet assembly to the pedestal-cartridge assembly using four sets of bolts (22) and lock-washers (23).

NOTE: The pedestal base should be securely fastened to the base plate before installing the motor to the pedestal. Keep hands and fingers away from the space between the C-faces of the motor and pedestal. The C-faces should mate freely and mount flush. Refer to **Appendix 1** for the torque specifications of the fasteners.



END OF ASSEMBLY PROCEDURE

Appendix 1: Fastener Torque Specifications

Maximum Torque Values for 18-8 Stainless Steel Bolts

Function	Model Code Position 6	Bolt Size	Bolt Type	Quantity (per Pump)	Torque Specifications	
					(in-lb)	(N-m)
Volute - Bearing Housing Assembly	0 - 5, 8	1/4-28 UNF x 1	SHCS	8	94.0	10.6
Impeller - Shaft Assembly	0 - 5, 8	1/4-28 UNF x 5/8	HHCS	1	94.0	10.6
Inner Magnet - Shaft Assembly	0 - 5, 8	1/4-28 UNF x 5/8	HHCS	1	94.0	10.6
Containment Can - Bearing Housing Assembly	0 - 5, 8	5/16-24 UNF x 1/2	SHCS	6	142	16.0
Cartridge - Pedestal Assembly	0 - 5, 8	5/16-18 UNC x 1	SHCS	4	132	14.9
BOLTS for MOTOR-PEDESTAL ASSEMBLY:						
Motor(1) - Pedestal Assembly	0, 1	3/8-16 UNC x 1	HHCS	4	236	26.7
Motor(2) - Adapter Assembly	5	1/2-13 UNC x 1	SHCS	4	517	58.4
Adapter(2) - Pedestal Assembly		3/8-16 UNC x 1	HHCS	4	236	26.7
Motor(3) - Pedestal Assembly	2	3/8-16 UNC x 1-1/2	SHCS	4	236	26.7
Motor(4) - Pedestal Assembly	3, 4	M10 x 40 mm	SHCS	4	327	37.0
Motor(5) - Adapter Assembly	8	1/2-13 UNC x 2	FH-SHCS	4	517	58.4
Adapter(5) - Pedestal Assembly		3/8-16 UNC x 1	SHCS	4	236	26.7

1 NEMA 56C, 143TC & 145TC motor frames
2 NEMA 182TC & 184TC motor frames
3 IEC 71 (B5) motor frame
4 IEC 80 & 90 (B5) motor frames
5 IEC 100 & 112 (B5) motor frames

HHCS = Hex Head Cap Screw
SHCS = Socket Head Cap Screw
FH-SHCS = Flat Head, Socket Head Cap Screw

Appendix 2: Maintenance Tool List

The following tools (or equivalents) are required when performing maintenance on the pumps:

Tool #	Tool	Function	Photo
1	**Allen Wrench, 3/16" Hex**	For volute screws.	
2	**Ratchet Wrench with 7/16" Hex Socket**	For impeller screw.	
3	**Wrench, 7/16"**	For inner magnet screw and 1/8" NPT plugs.	
4	**Allen Wrench, 1/4" Hex**	For containment can screws and cartridge mounting bolts.	
5	**Wrench, 9/16"**	For NEMA 56C-184TC motor mounting bolts.	
6	**Allen Wrench, 5/16" Hex**	For IEC 71 motor mounting bolts.	
7	**Allen Wrench, 8 mm Hex**	For IEC 80 & 90 motor mounting bolts.	
8	**Allen Wrench, 3/8" Hex**	For adapter mounting bolts (NEMA 182/184TC motor frames only).	

Appendix 3: Pump Parts List

Parts List for Centry® Mag-Drive Models 621 & 622:

Ref. #	Part	Qty.	Ref. #	Part	Qty.
1	Impeller	1	**14**	Inner Magnet	1
2	Volute	1	**15**	Containment Can	1
3	Bearing Housing	1	**16**	O-ring for containment can	1
4	Shaft	1	**17**	Screws for containment can	6
5	O-ring for volute	1	**18**	Drive Pins for thrust washers	2
6	Bolts for volute assembly	8	**19**	Outer Magnet	1
7	Washers for shaft	2	**20**	Pedestal	1
8	Screws for shaft	2	**21**	Bolts for cartridge mounting	4
9	Lock-washers for shaft	2	**22**	Bolts for motor mounting	4
10	Key for impeller	1	**23**	Lock-washers for motor mounting	4
11	Key for inner magnet	1	**24**	Plugs for volute	2
12	Bearings	2	**25**	Lock Pins for bearings	2
13	Thrust Washers	2	–	–	–

NOTE: For Liquiflo Part Numbers, see Consolidated BOM on Pages 27-28.

Appendix 4: Pump Bill of Materials (BOM)

BOM for Centry® Mag-Drive Models 621 & 622 – Part 1

Drwg. Ref. #	Part Description		Material	Model 621 Part Number	Model 622 Part Number	Qty.
1	Impeller	5.0" Dia. (Full Size)	316 SS	622700	622701	1
		4.5" Dia. (Reduced Size)	316 SS	622702	622706	
		4.0" Dia. (Reduced Size)	316 SS	622703	622707	
		3.5" Dia. (Reduced Size)	316 SS	622704	622708	
		3.0" Dia. (Reduced Size)	316 SS	622705	622709	
2	Volute	Threaded (NPT)	316 SS	622100	622101	1
		Flanged (ANSI 150# RF)	316 SS	622110	622111	
3	Bearing Housing		316 SS	622800	622800	1
4	**Shaft ***		316 SS/CO	S622302-CO	S622302-CO	1
			316 SS/TC	S622302-TC	S622302-TC	
5	**O-ring/Gasket, * Volute**	O-ring (2-049)	Teflon	3121103	3121103	1
		O-ring (2-049)	Viton	3121119	3121119	
		Gasket	Graphoil	622603	622603	
6	Bolt, Volute (1/4-28 x 1 SHCS)		18-8 SS	S622005	S622005	8
7	Washer, Shaft		316 SS	622500	622500	2
8	Screw, Shaft (1/4-28 x 5/8 HHCS)		316 SS/Teflon	S620034	S620034	2
9	Lock-washer, Shaft		18-8 SS	863701	863701	2
10	Key, Impeller		316 SS	621900	621900	1
11	Key, Inner Magnet		316 SS	S622901	S622901	1
12	**Bearing ***		SiC	622901	622901	2
			Carbon	622902	622902	
13	**Thrust Washer ***		SiC	622905	622905	2
14	Inner Magnet	MCF (120 in-lb)	316 SS/SmCo	SIMCE-05	SIMCE-05	1
		MCW (200 in-lb)	316 SS/SmCo	SIMCW-05	SIMCW-05	
15	Containment Can		316 SS	740913	740913	1
16	**O-ring/Gasket, * Containment Can**	O-ring (2-042)	Teflon	S4000	S4000	1
		O-ring (2-042)	Viton	S4002	S4002	
		Gasket	Graphoil	S4005	S4005	
17	Screw, Containment Can (5/16-24 x 1/2 SHCS)		18-8 SS	864007	864007	6
18	Pin, Thrust Washer		316 SS	622750	622750	2
19	Outer Magnet – MCF (120 in-lb)	NEMA 56C	Cast Iron/Epoxy	SOMCB-5	SOMCB-5	1
		NEMA 143/145TC	Cast Iron/Epoxy	SOMCB-7	SOMCB-7	
		IEC 71 – B5	Cast Iron/Epoxy	SOMCB-71	SOMCB-71	
		IEC 80 – B5	Cast Iron/Epoxy	SOMCB-80	SOMCB-80	
		IEC 90 – B5	Cast Iron/Epoxy	SOMCB-90	SOMCB-90	
		NEMA 182/184TC	Cast Iron/Epoxy	SOMCB-9	SOMCB-9	
	Outer Magnet – MCW (200 in-lb)	NEMA 56C	Cast Iron/Epoxy	SOMCV-5	SOMCV-5	
		NEMA 143/145TC	Cast Iron/Epoxy	SOMCV-7	SOMCV-7	
		IEC 71 – B5	Cast Iron/Epoxy	SOMCV-71	SOMCV-71	
		IEC 80 – B5	Cast Iron/Epoxy	SOMCV-80	SOMCV-80	
		IEC 90 – B5	Cast Iron/Epoxy	SOMCV-90	SOMCV-90	
		NEMA 182/184TC	Cast Iron/Epoxy	SOMCV-9	SOMCV-9	

* Primary repair components.

Appendix 4: Pump Bill of Materials (BOM) (Continued)

BOM for Centry® Mag-Drive Models 621 & 622 – Part 2

Drwg. Ref. #	Part Description		Material	Model 621 Part Number	Model 622 Part Number	Qty.
20	Pedestal	NEMA Frames [1]	Cast Iron/Epoxy	SP003	SP003	1
		IEC 71 (B5)	Cast Iron/Epoxy	SP004	SP004	
		IEC 80/90/100/112 (B5)	Cast Iron/Epoxy	SP005	SP005	
21	Bolt, Bearing Housing (5/16-18 x 1 SHCS)		18-8 SS	621105	621105	4
22	Bolt, Motor [2]	3/8-16 - NEMA Frames [1]	18-8 SS	620825	620825	4
		3/8-16 - IEC 71 (B5)	18-8 SS	781117	781117	
		M10 - IEC 80/90 (B5)	18-8 SS	S1011	S1011	
		1/2-13 - IEC 100/112 (B5)	18-8 SS	S641111	S641111	
23	Lock-washer, Motor	3/8 - NEMA Frames [1]	18-8 SS	S1004	S1004	4
		3/8 - IEC 71 (B5)	18-8 SS	S1004	S1004	
		M10 - IEC 80/90 (B5)	18-8 SS	S1012	S1012	
		1/2 - IEC 100/112 (B5)	18-8 SS	641107	641107	
24	Plug, 1/8" NPT (Volute)		316 SS	362304	362304	2
25	Pin, Bearing Lock		Teflon	361801	361801	2
26	Nut, Motor [3]	3/8-16 - IEC 71 (B5)	18-8 SS	S1003	S1003	4
		M10 - IEC 80/90 (B5)	18-8 SS	S1003	S1003	
		1/2-13 - IEC 100/112 (B5)	18-8 SS	641108	641108	
27	Adapter [3]	NEMA 182/184TC	CS/Epoxy	SP0046	SP0046	1
		IEC 100/112 (B5)	CS/Epoxy	SP0048	SP0048	
28	Bolt, Adapter [3]	1/2-13 - NEMA 182/184TC	18-8 SS	641105	641105	4
		3/8-16 - IEC 100/112 (B5)	18-8 SS	781118	781118	
29	Lock-washer, Adapter [3]	3/8 - IEC 100/112 (B5)	18-8 SS	S1004	S1004	4

HIGH-TEMPERTURE PARTS (-8(HT) Suffix)						
12	**Bearing, Trimmed** *	300 to 499 °F	SiC	622901A	622901A	2
			Carbon	622902A	622902A	
		500 °F	SiC	622901B	622901B	
			Carbon	622902B	622902B	
–	Gasket, Insulating [4]	300 to 500 °F	Non-Asbestos 3160	371113	371113	1

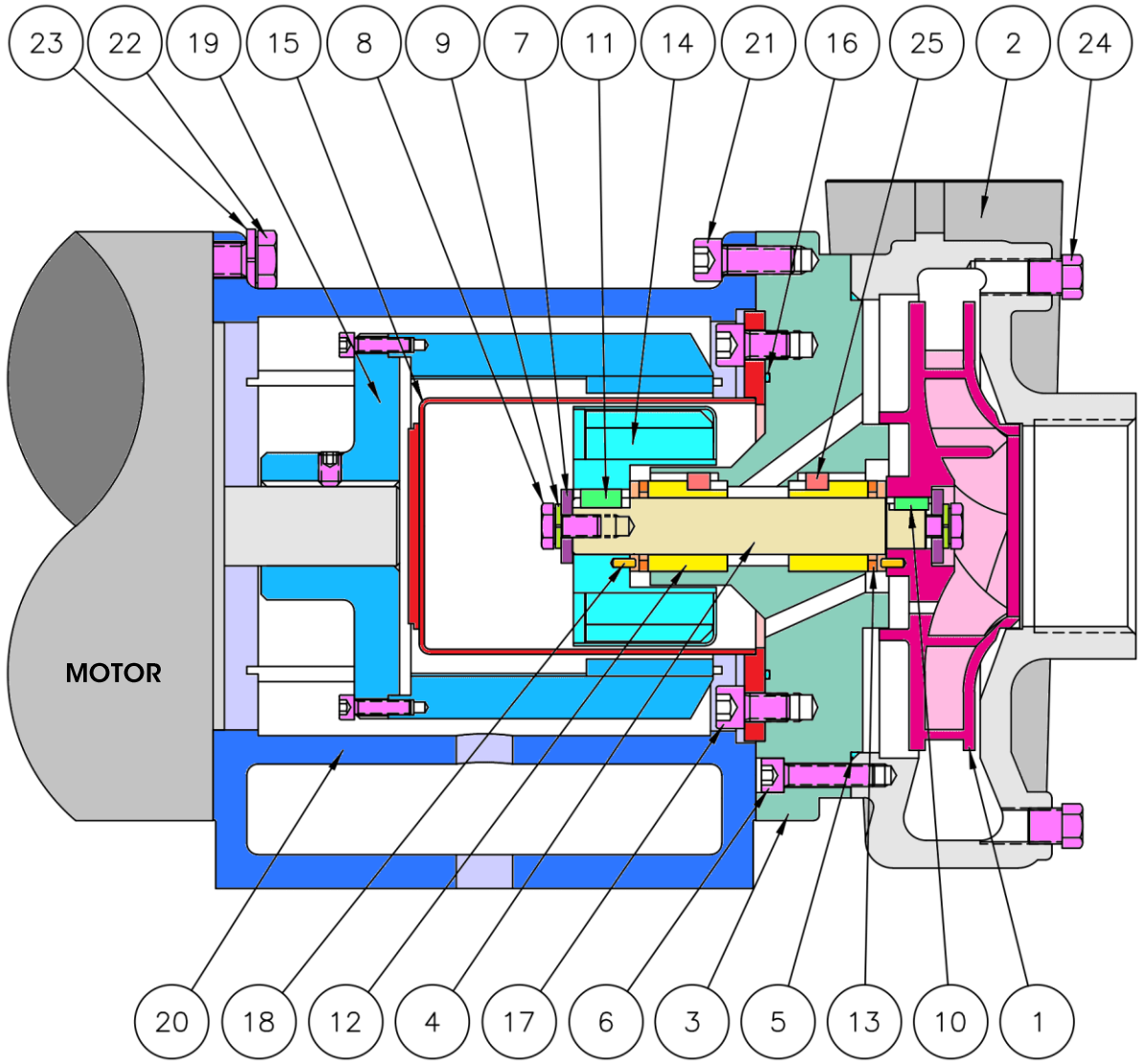
LOW-TEMPERTURE PARTS (-8(LT) Suffix)						
12	**Bearing, Split** *	-100 to 32 °F	Carbon	622902-SB	622902-SB	2
–	Gasket, Insulating [4]		Non-Asbestos 3160	371113	371113	1
–	Shroud, Pedestal [5]		304 SS	865080	865080	1

1 NEMA 56C, 143TC, 145TC, 182TC & 184TC.
2 See page 24 for Motor Bolt information.
3 Item not shown.
4 For isolation of Pump and Pedestal.
5 For frost protection of Outer Magnet and Containment Can.

NOTE: Drawing Reference Numbers above correspond to Reference Drawings on pages 29 & 30.

Appendix 5: Reference Drawings

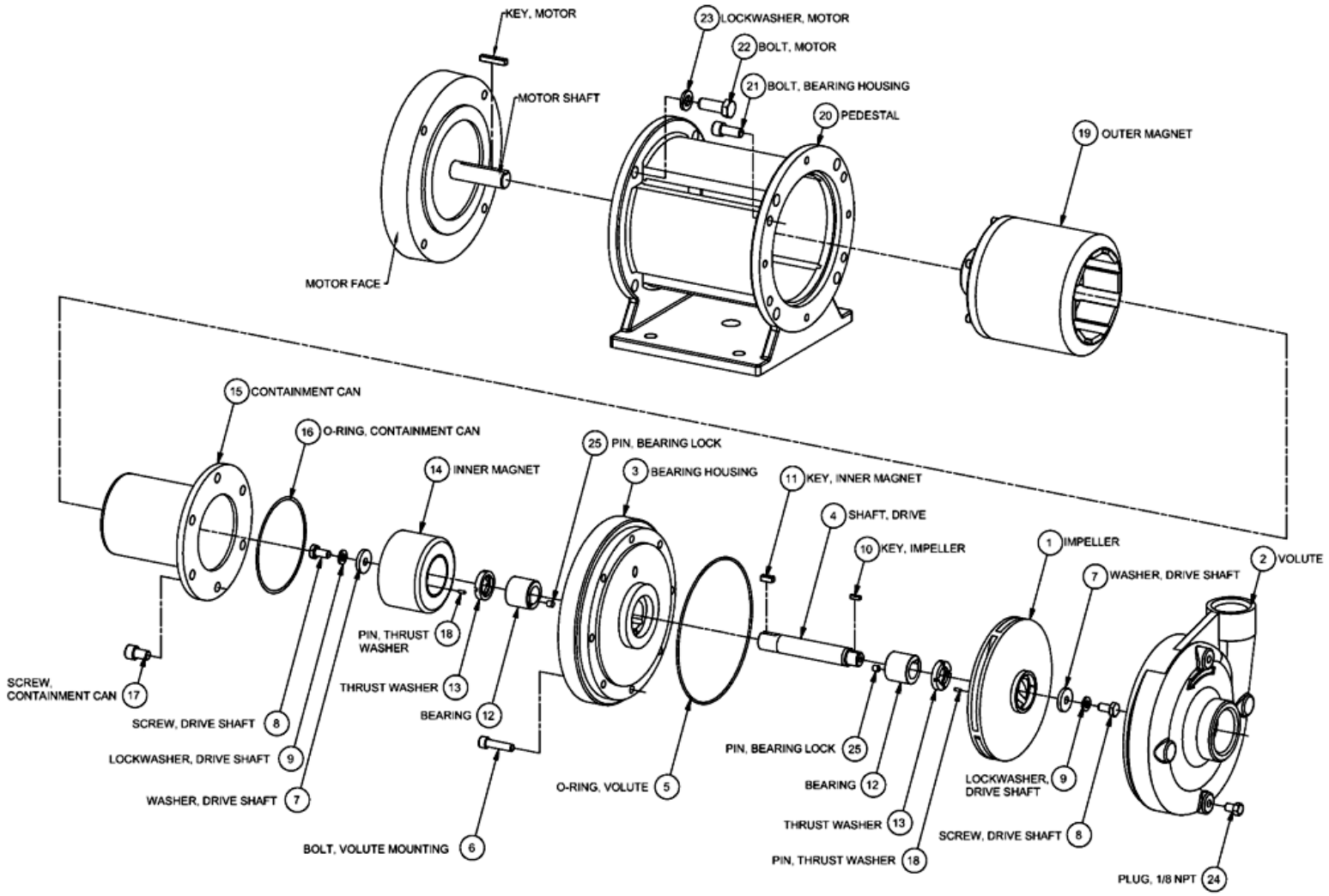
Sectional Drawing – Mag-Drive Models 621 & 622



Ref. #	Description	Qty.	Ref. #	Description	Qty.
1	Impeller	1	14	Inner Magnet	1
2	Volute	1	15	Containment Can	1
3	Bearing Housing	1	16	O-ring (2-042)/Gasket, Cont. Can	1
4	Shaft	1	17	Screw, C. Can (5/16-24 x 1/2 SHCS)	6
5	O-ring (2-049)/Gasket, Volute	1	18	Pin, Thrust Washer	2
6	Bolt, Volute (1/4-28 x 1 SHCS)	8	19	Outer Magnet	1
7	Washer, Shaft	2	20	Pedestal	1
8	Screw, Shaft (1/4-28 x 5/8 HHCS)	2	21	Bolt, Bearing Housing (5/16-18 x 1 SHCS)	4
9	Lock-washer, Shaft	2			
10	Key, Impeller	1	22	Bolt, Motor	4
11	Key, Inner Magnet	1	23	Lock-washer, Motor	4
12	Bearing	2	24	Plug, 1/8" NPT (Volute)	2
13	Thrust Washer	2	25	Pin, Bearing Lock	2

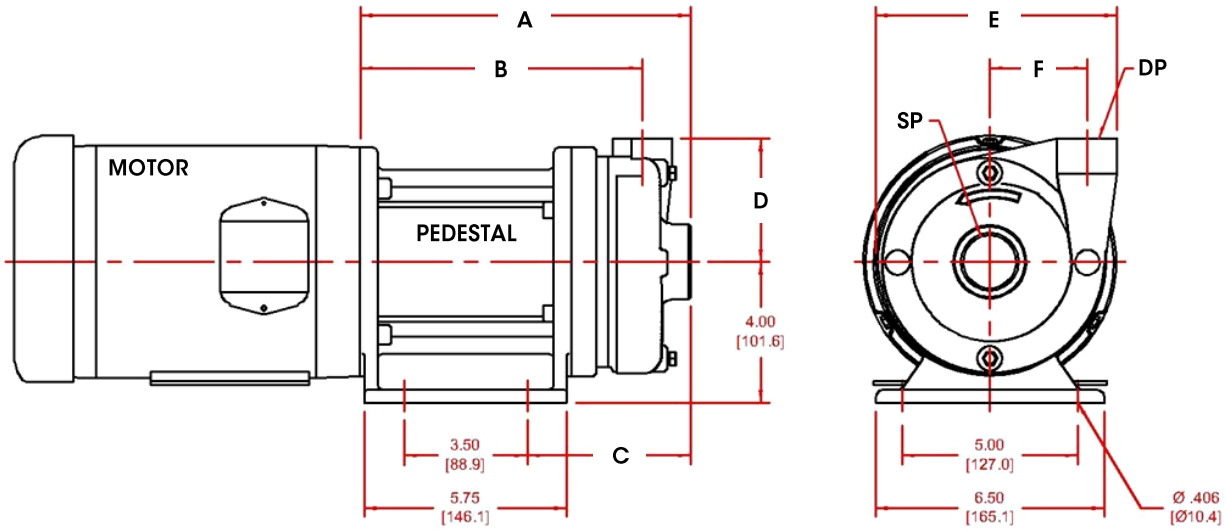
Appendix 5: Reference Drawings (Continued)

Exploded View Drawing – Mag-Drive Models 621 & 622



Appendix 5: Reference Drawings (Continued)

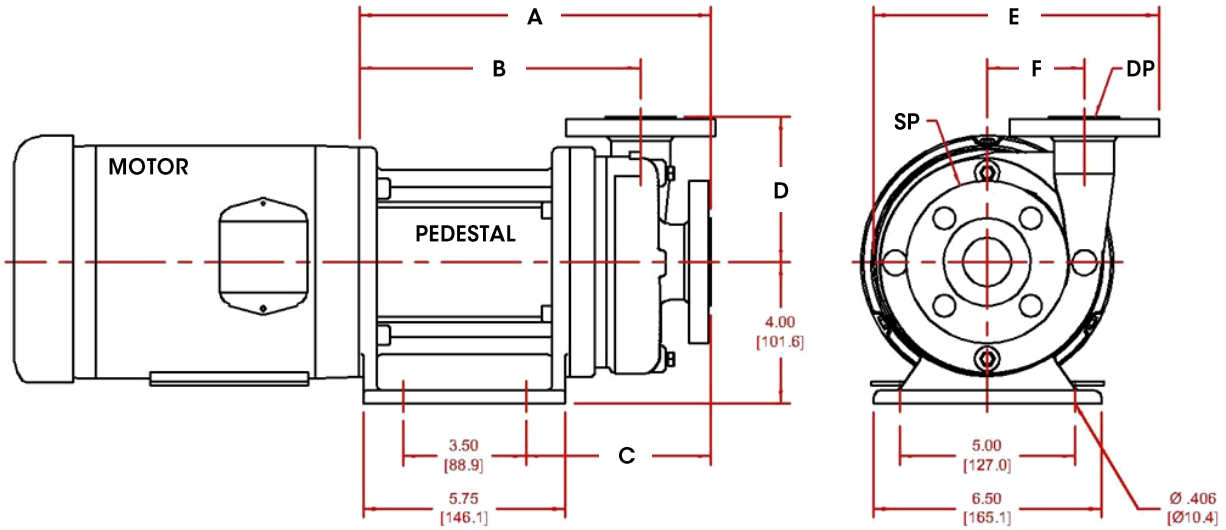
Dimensional Drawing #1 – Mag-Drive Models 621 & 622 with Threaded Ports



Dimensional Data: inches [mm]

Pump Models	Port Sizes		Dimensions with Threaded (NPT) Ports					
	SP	DP	A	B	C	D	E	F
621	1-1/4"	1"	9.39 [238]	8.01 [203]	4.64 [118]	3.50 [88.9]	6.85 [174]	2.75 [69.9]
622	2"	1-1/2"	10.20 [259.1]	8.08 [205]	5.45 [138]	3.82 [97.0]	7.91 [201]	3.13 [79.4]

Dimensional Drawing #2 – Mag-Drive Models 621 & 622 with Flanged Ports



Dimensional Data: inches [mm]

Pump Models	Port Sizes		Dimensions with Flanged (ANSI 150# RF) Ports					
	SP	DP	A	B	C	D	E	F
621	1-1/4"	1"	10.01 [254.3]	8.01 [203]	5.26 [134]	4.13 [105]	8.13 [206]	2.75 [69.9]
622	2"	1-1/2"	10.96 [278.3]	8.08 [205]	6.21 [158]	4.52 [115]	9.10 [231]	3.13 [79.4]

SP = Suction Port **DP** = Discharge Port

Appendix 6: Troubleshooting Guide

Troubleshooting Guide – Part 1

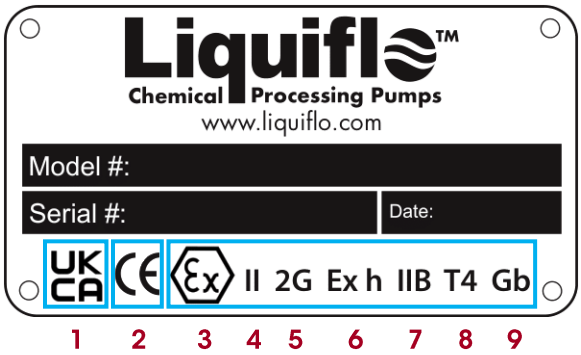
Problem	Possible Cause	Corrective Action
No discharge	Pump not primed	Verify suction pipe is submerged. Increase suction pressure. Open suction valve.
	Wrong direction of rotation	Reverse motor leads.
	Valves closed	Open all suction and discharge valves.
	Bypass valve open	Close bypass valve.
	Air leak in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Clogged strainer	Clean strainer.
	Clogged impeller	Disassemble and remove blockage.
	Impeller greatly worn or damaged	Disassemble and replace impeller.
	Magnetic coupling has decoupled	Stop driver and check temperature and viscosity of fluid. Stronger magnetic coupling may be needed.
Insufficient discharge	Suction pressure too low	Increase suction pressure. Verify suction piping is not too long. Fully open any suction valves.
	Bypass valve open	Close bypass valve.
	Partly clogged strainer	Clean strainer.
	Partly clogged impeller	Disassemble and remove blockage.
	Speed too low	Increase driver speed, if possible. Use larger size pump, if required.
	Impeller worn or damaged	Disassemble and replace impeller.
Loss of suction after satisfactory operation	Pump not properly primed	Reprime pump.
	Air leaks in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Air or vapor pockets in suction line	Rearrange piping as necessary.
	Increase in fluid viscosity	Heat fluid to reduce viscosity. Reduce pump speed.
Excessive power consumption	Fluid viscosity higher than specified	Heat fluid to reduce viscosity. Reduce pump speed. Increase driver horsepower.
	Liquid specific gravity higher than expected	Reduce pump speed. Increase driver horsepower.
	Total head greater than specified	Increase pipe diameter. Decrease pipe run.
	Total head lower than specified, pumping higher flow than expected	Install throttle valve.
	Total head higher than rating with flow at rating	Install impeller with correct diameter.
	Rotating parts binding or severely worn	Disassemble and replace worn parts.

Appendix 6: Troubleshooting Guide (Continued)

Troubleshooting Guide – Part 2

Problem	Possible Cause	Corrective Action
Rapid pump wear	Abrasives in fluid	Install suction strainer. Limit solids concentration. Reduce pump speed or use larger pump running at lower speed.
	Corrosion wear	Use materials of construction that are acceptable for fluid being pumped.
	Extended dry running	Install power sensor to stop pump.
	Discharge pressure too high	Increase pipe diameter. Decrease pipe run.
Excessive noise and vibration	Partly clogged impeller causing imbalance	Disassemble and remove blockage.
	Damaged impeller and/or shaft	Disassemble and replace damaged parts.
	Suction and/or discharge piping not anchored or properly supported	Anchor per Hydraulic Institute Standards.
	Base not rigid enough	Tighten hold-down bolts on pump and motor or adjust stilts. Inspect grout and regrout if necessary.
	Worn pump bearings	Replace bearings.
	Worn motor bearings	Replace bearings or motor.
	Pump cavitation	Increase NPSH available.
Excessive product leakage	Static seal failure caused by chemical incompatibility or thermal breakdown	Use O-rings or gaskets made of material compatible with fluid and temperature of the application.
	Static seal failure caused by improper installation	Install O-rings or gaskets without twisting, bending or pinching. Use star-pattern torque sequence on housing bolts during assembly. Allow Teflon O-rings to cold flow and seat during tightening. Torque bolts to specification.
	Pump port connections not properly sealed	Use Teflon tape or other suitable sealant. Use gaskets compatible with fluid and temperature of the application.
	Crevice corrosion of pump housing material	Only pump chemicals that are compatible with the pump housing material. Decrease temperature to reduce corrosion rate to acceptable value. Flush idle pumps that are used to pump corrosive chemicals. Eliminate contaminants in the fluid that can accelerate corrosion wear.

Appendix 7: Tag Certification Markings



The Liquiflo tag provides important information about the pump's use in potentially explosive atmospheres. Markings 3 to 9 comprise the complete ATEX marking. **NOTE: The tag does not provide information about the motor or other devices used with the pump.** It is the responsibility of the user to confirm that all equipment is safe for use in the intended environment.

No.	Marking	Meaning
1	UK CA	This marking confirms that this pump meets the requirements of the UK Regulation **SI 2016/1107** – The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016. **UK Conformity Assessed (UKCA) marking** is a certification mark that indicates conformity with the applicable requirements for products sold within Great Britain. The UKCA marking became part of UK law on EU exit day, January 31, 2020.
2	CE	This marking confirms that this pump is compliant with the European Union's **Machinery Directive 2006/42/EC**. **Conformitè Europëenne (CE) marking** (French for "European Conformity") indicates that a product has been assessed by the manufacturer and certified to meet EU safety, health and environmental protection requirements. The CE marking originated in 1985 and is mandatory for any products marketed in the EU and the European Economic Area (EEA).
3	Ex	This marking confirms that this pump meets the requirements of **ATEX 114 "equipment" Directive 2014/34/EU** – Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (published on March 29, 2014 by the European Parliament). **ATEX** is a codeword which comes from the French description – "Appareils destinés à être utilisés en **AT**mosphères **EX**plosives." The English translation is: "Devices intended for use in explosive atmospheres."
4	II	**Equipment Group II** indicates that this pump is suitable for surface (non-mining) applications and can be used in areas having explosive gases or liquids.
5	2G	**Equipment Category 2 – Gases/Vapors (G)**: This indicates that the pump is suitable for use in Zones 1 & 2: **Zone 1 (gases):** An area in which an explosive mixture is likely to occur in normal operation **Zone 2 (gases):** An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will only exist for a short time
6	Ex h	This marking indicates **Explosion Protection** of the pump as defined in standard **EN ISO 80079-37**. Protection type is Constructional Design Safety (**c**).
7	IIB	This marking indicates that the pump is suitable for use in atmospheres containing **Ignitable Gases: Group IIB** (e.g., ethylene, ethyl ether or gases of similar hazard).
8	T4	This marking indicates the **Temperature Class** (Maximum Allowable Surface Temperature of the pump) for the Ignitable Gases Group above (**IIB**): **T4** = 135°C (275°F) max
9	Gb	This marking indicates the **Equipment Protection Level** of the pump as defined in standard **EN ISO 80079-36**. **Gb** = High protection level for Zone 1 gases and vapors; the equipment remains safe in normal operation and also when single faults occur.

NOTES