Liquiflo™ Chemical Processing Pumps

INSTALLATION, OPERATION & MAINTENANCE MANUAL

CENTRY® SERIES

MECHANICALLY-SEALED, CLOSE-COUPLED CENTRIFUGAL PUMPS

Models 621 & 622

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Introduction

This manual provides instructions for the installation, operation and maintenance of the Centry® Series Centrifugal Pumps, Models 621 & 622 – Sealed. 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 Sealed, Close-Coupled Centrifugal Pumps – Models 621 & 622.

1.1 Pump Description

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

- Choice of Type 21 or Type 9T single mechanical seal
- Choice of threaded or ANSI flanged ports
- Back pullout design to simplify maintenance
- Motor-supported drive shaft that simplifies pump design
- Close-coupled design to eliminate manual alignment of pump and motor
- Closed impellers to simplify impeller positioning and extend life of motor bearings
- Standard reduced impeller sizes to simplify pump selection

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 sealed pump is based on a 7-position *Model Coding* system that is described in **Section 1.4** (see page 5).

1.2 General Instructions

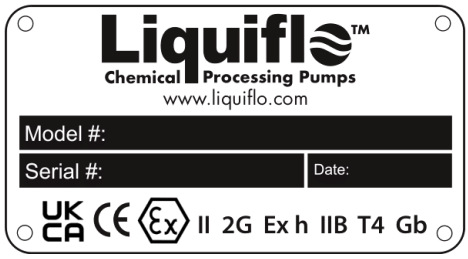
The materials of construction of the pump are selected based upon the chemical compatibility of the fluid being pumped. The user must verify that the materials are suitable for the surrounding atmosphere.

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 8** 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, Motor Supported [1]		–
Motor Frames (C-Face)		NEMA 56C, 143TC, 145TC, 182TC & 184TC [1]		–

1 Foot-Mount motor is required.

Table 2: Performance Specifications

Specification	Model 621	Model 622	Unit
Maximum Speed	3600	3600	**RPM**
Maximum Flow Rate	90	160	**GPM**
Maximum Differential Head	105	95	**ft**

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 275 PSIG @ -20 to 100°F; above 100°F, derate by 0.3 PSIG/°F.

Table 4: Pump Weights

Item	Model 621	Model 622	Unit
Pump with Threaded Ports [3]	17	22	**lb**
Pump with Flanged Ports [3]	23	30	**lb**

3 Weight includes mounting bracket and excludes motor.

Table 5: Pump Materials

Components			Materials
Pump Body, Impeller & Shaft			316 Stainless Steel
Mounting Bracket			316 Stainless Steel
Mounting Hardware			18-8 Stainless Steel
O-rings & Gaskets			Teflon (PTFE), Viton (Type A) or Graphoil
Mechanical Seal, Single Internal	**Type 21** [4]	**Spring Holder, Spring, Drive Band & Retainer**	18-8 Stainless Steel
		Flexible Bellows	Viton (Type A)
		Sealing Ring	Carbon
	Type 9T [5]	**Retainer (Body) & Drive Pin**	316 Stainless Steel
		Wedge	Teflon or Graphoil [6]
		Sealing Ring	Carbon
	Seal Seat		Silicon Carbide (α-SiC)
	O-ring, Seal Seat		Viton (Type A)

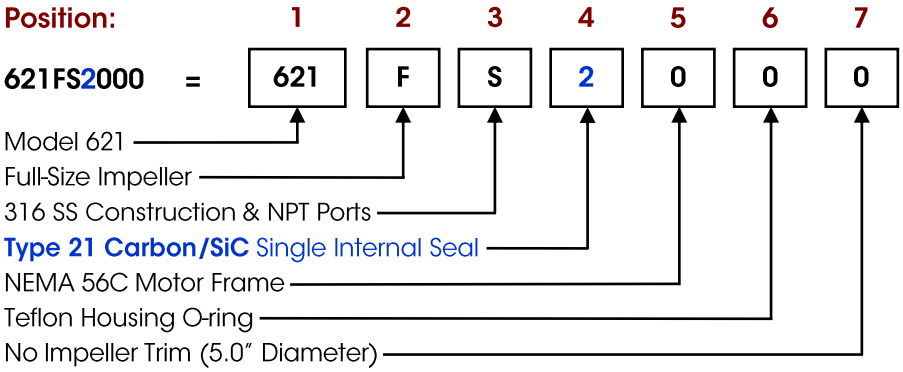
4 See pages 29 & 37 for drawings of **Type 21** seal.
5 See page 31 for drawing of **Type 9T** seal.
6 Teflon: ≤ 350°F; Graphoil: > 350°F.

1.4 Model Coding

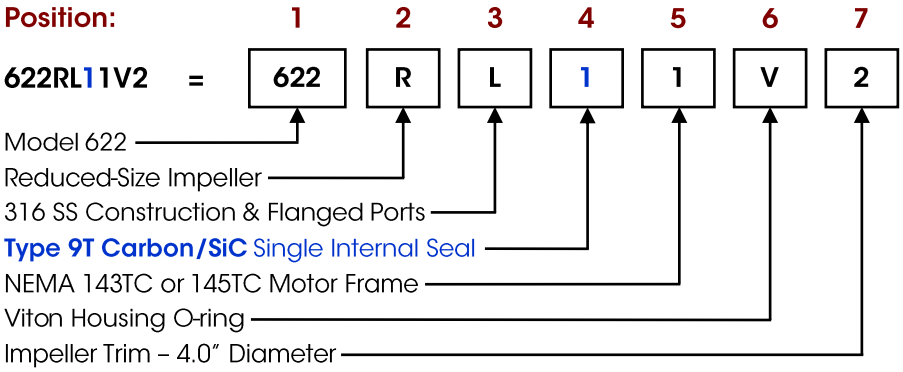
Table 6: Model Coding for Centry® SEALED Models 621 & 622

Position	Description	Code	Selection	
1	**Pump Model**	**621**	Model 621	
		622	Model 622	
2	**Impeller Size**	**F**	Full-Size – 5.0" Diameter	**Pos. 7 = 0**
		R	Reduced-Size	**Pos. 7 = 1, 2, 3 or 4**
3	**Housing Material & Port Type**	**S**	316 SS Construction & NPT Ports	
		L	316 SS Construction & 150# Flanged Ports	
4	**Seal Configuration**	**1**	**Type 9T Carbon/SiC** Single Internal Mech. Seal	
		2	**Type 21 Carbon/SiC** Single Internal Mech. Seal	
		6	**Type 9T Teflon/SiC** Single Internal Mech. Seal	
5	**Motor Frame**	**0**	NEMA 56C (Close-coupled)	
		1	NEMA 143TC or 145TC (Close-coupled)	
		5	NEMA 182TC or 184TC (Close-coupled)	
6	**O-ring/Gasket (Housing)**	**0**	Teflon O-ring	
		V	Viton O-ring	
		G	Graphoil Gasket	
7	**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	

Model Coding Example 1:



Model Coding Example 2:



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 centrifugal pump will deliver a steady and pulse-less flow, 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. Performance curves for centrifugal pumps are normally based on pumping water at room temperature. The performance curves for Centry Models 621 and 622 can be obtained from the Liquiflo website: www.liquiflo.com. For viscous liquid applications, a performance correction is required (see **Section 3.9**).

A normally operating pump with a mechanical seal will have no leakage of the process fluid. The pump must be primed before starting and dry-running must be avoided to prevent damage to the mechanical seal.

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 7**.

1.6 Maintenance & Repair

The main wear component of the pump is the mechanical seal. Repair of the pump is typically necessary when the mechanical seal starts to leak or when a decrease in head is observed. 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.

The common repair item of the pump due to erosion wear is the mechanical seal. Possibly, other pump parts, such as the impeller, shaft, volute and seal housing, may require replacement due to abrasion wear, corrosion wear or cavitation wear.

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 6** 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 seal housing. **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.

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 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.

Section 3: Pump & Motor Installation

3.1 Impeller Positioning

Centry Sealed pumps require that the impeller be positioned properly inside the pump housing prior to installation into the system. The positioning of the impeller of a new pump is dependent on how the pump was ordered. The three possible cases are described below:

Case 1: Pump Supplied Close-Coupled to Motor

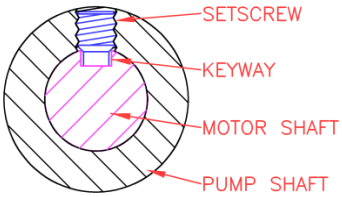
The impeller position was precisely set during assembly at the factory; no adjustment of the impeller is required. The pump-motor assembly is ready to be installed into the system.

Case 2: Pump Supplied with NPT Ports (without Motor)

Bare pumps supplied with NPT ports will have a threaded **impeller positioning device** installed in the suction inlet. The device will automatically position the impeller during the pump-motor assembly. **Do not remove the device until the pump is installed on a motor**. To install the pump on a motor, use the following procedure:

1 Slide pump onto motor while aligning the setscrews (14) on the pump shaft (4) with the keyway of the motor shaft.

Impeller Positioning Device Installed in Suction Port

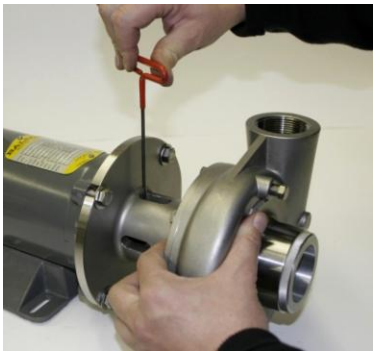


NOTE: The dog-point setscrews of the pump shaft must be inside the keyway groove of the motor shaft (see diagram at right).

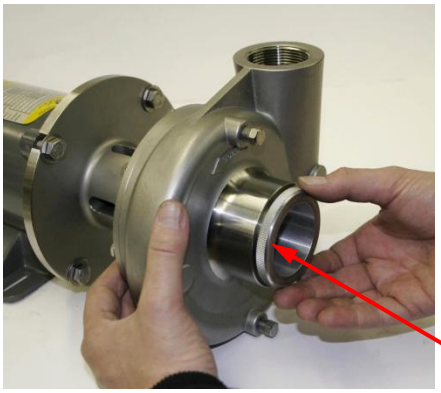
2 Install the bracket mounting bolts (15) and lock-washers (16); then tighten the bolts.

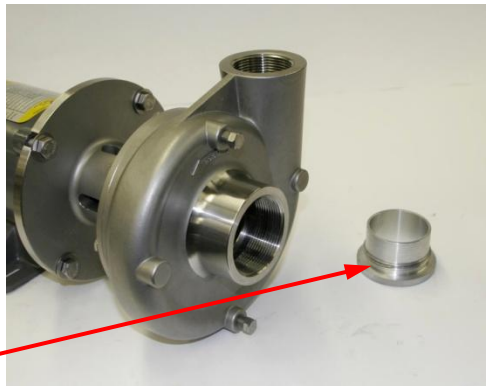
NOTE: Refer to **Appendix 1** for the torque specifications of the fasteners.

3 Tighten the two setscrews (14) on the drive shaft.



4 Remove impeller positioning device (17) from the suction inlet of the pump. The pump-motor assembly is now ready to be installed into the system.

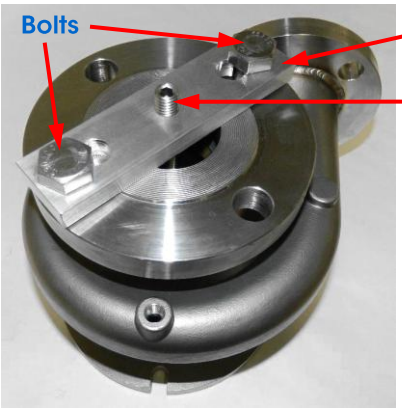




Impeller Positioning Device

Case 3: Pump Supplied with Flanged Ports (without Motor)

Bare pumps supplied with flanged ports will have an **impeller positioning device** bolted to the suction inlet (see photo below). The device will automatically position the impeller during the pump-motor assembly. **Do not remove the device until the pump is installed on a motor**. To install the pump on a motor, use the procedure described above. Once the drive shaft setscrews are tightened, the device can be removed and the pump-motor assembly can be installed into the system.



NOTE: The Impeller Positioning Device is factory set and assembled to the pump for ease of installation. If necessary, the following procedure can be used to install the device and to set the impeller position: (1) Fully assemble the pump but do not install it on the motor. (2) Attach the device to the suction inlet flange using two sets of bolts and nuts. (3) Using an Allen wrench, turn the impeller positioning screw **clockwise** until the rear side of the impeller contacts the inside surface of the pump bracket. (4) Turn the screw **counterclockwise** and count the number of turns it takes for the front side of the impeller to contact the inside surface of the volute. (5) Turn the screw **clockwise**, one-half the number of turns counted in Step 4. The impeller position is now properly set and the pump is ready to be installed on the motor.

3.2 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.

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

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

7) **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.

3.4 Strainers & Solids Handling

1) Centry sealed pumps rely on the motor bearings and therefore can tolerate larger particle sizes (up to 0.016 inches or 400 microns) compared with mag-drive pumps that use internal sleeve bearings. If small abrasive particles are present, they can accelerate wear of internal components and surfaces over an extended period of time. Although some solids can be tolerated, **pumping abrasive particles is not suggested with these pumps.**

2) **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.

3.5 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.

3.6 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.

3.7 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 <u>opening</u> of the valve moves the operating point to the <u>right</u> 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 <u>closing</u> of the valve moves the operating point to the <u>left</u> on the performance curve).

3.8 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.

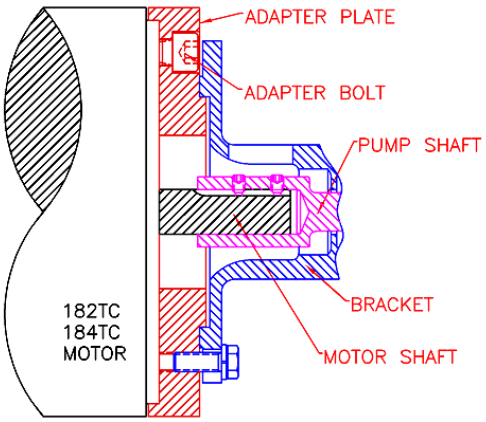
3.9 Viscous Fluids

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.

3.10 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 5** of the pump model code (see Table 6 on page 5).

2) The pump mounting bracket is compatible with NEMA 56C, 143TC and 145TC motor frames. For NEMA 182TC or 184TC motor frames, an **adapter plate** is required to mount the bracket to the motor (see diagram at right). The adapter plate and mounting bolts are provided with the pump when applicable.



3) A Foot-Mount motor is required for mounting to a base (see cover photo).

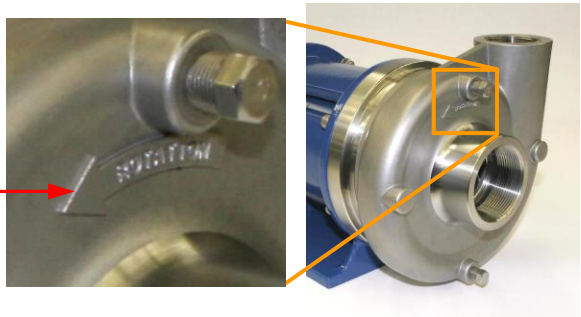
4) The motor must have an **enclosure** that is compatible with the application conditions. If an explosion-proof motor is required, the *temperature code* of the motor must be acceptable for the process fluid.

5) 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 3.9**). Additional power is required to overcome the friction losses due to viscosity.

3.11 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) Verify that the impeller was properly positioned inside the pump's housing. (Refer to **Sections 3.1** and **5.4**.)

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

4) 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.

5) **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 mechanical seal. The rotating and stationary seal faces of a single mechanical seal are lubricated by the pumped fluid. If run dry, heat can be generated which can crack the seal faces. **As a general rule, sealed pumps should not be run dry for more than 30 seconds**.

6) 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 3.11** on page 13.)

> ***Caution!***
> *Always prime the pump before operating. Do not run the pump dry for more than 30 seconds or damage to the mechanical seal will 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 3.9**.)

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 7** for troubleshooting.

Section 5: Maintenance & Repair

The main wear component of the pump is the mechanical seal. Repair of the pump is typically necessary when the mechanical seal starts to leak or when a decrease in head is observed.

5.1 Work Safety

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

5.2 Removal from System

Before servicing, prepare the pump as follows:

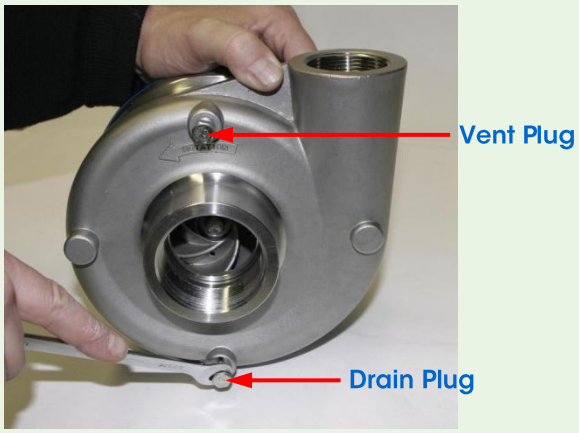
Caution!
If the pump was used on hazardous or toxic fluids, it must be flushed and decontaminated prior to removal from the system piping. Refer to the Material Safety Data Sheet (MSDS) for the liquid and follow all prescribed safety precautions and disposal procedures.

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 piping (see Note below) and move it to a clean work area.

NOTE: The Centry-Series Sealed pumps have a back pull-out design. This feature allows the pump-motor assembly to be separated from the volute, making it unnecessary to disconnect the volute from the system piping.

Location & Removal of Vent & Drain Plugs

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



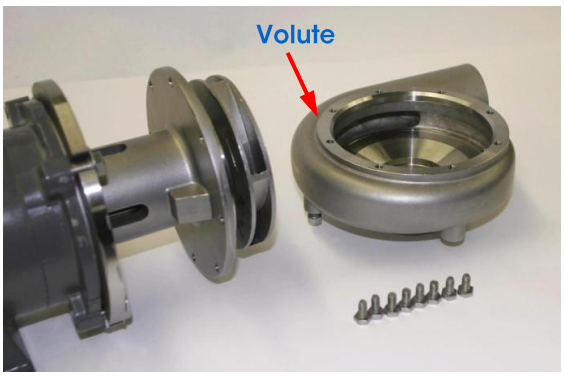
5.3 PUMP DISASSEMBLY

Follow the procedure below and refer to the Sectional and Exploded View drawings in **Appendix 4**. Drawing reference numbers are given in parentheses in the following procedure.

Separation of Volute:

1 Remove the eight volute mounting bolts (6) and separate the pump-motor assembly from the volute (2). Remove the volute O-ring (5) and discard.

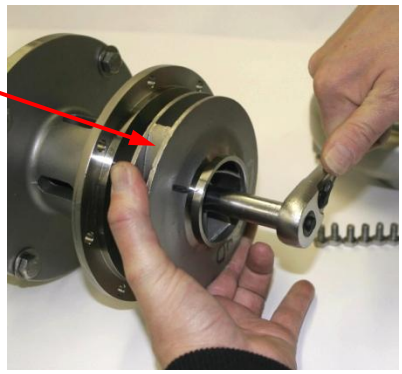
NOTE: The Centry-Series Sealed pumps have a back pullout design. This feature makes it unnecessary to disconnect the volute from the system piping.



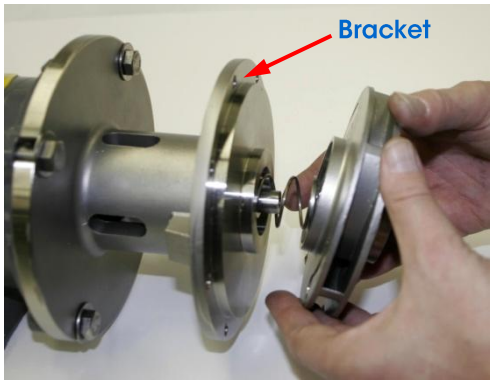
Removal of Impeller & Spring:

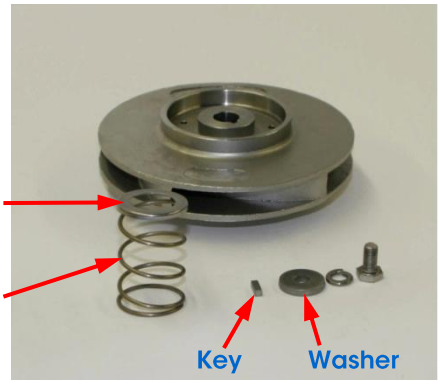
2 Carefully loosen impeller screw (8) while firmly holding the impeller (1).

> ***Caution!***
> *The impeller is spring loaded.*



3 Remove screw (8), lock-washer (9), washer (7), impeller (1) and key (10) from the shaft (4). For pump with **Type 21** seal, remove the spring and spring holder (if applicable).

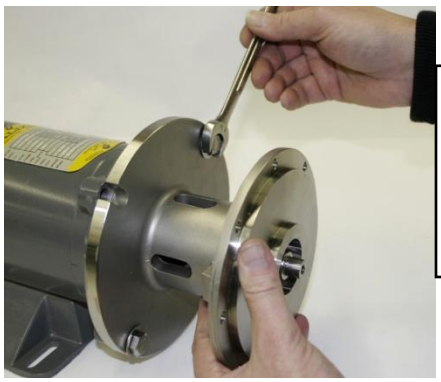




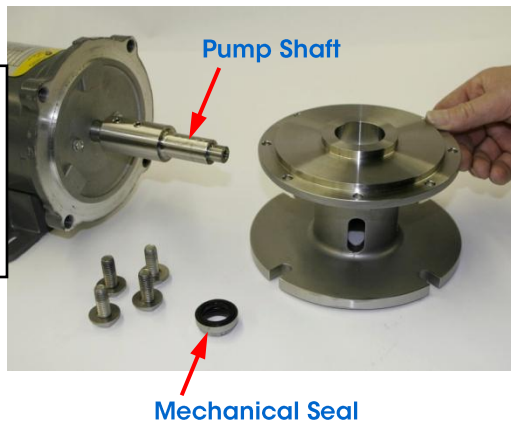
Removal of Bracket & Seal:

4 Remove the bracket mounting bolts (15) and separate the bracket (3) from the motor. Then remove the mechanical seal (11) from the bracket.

NOTE: Unless it is necessary, do not loosen the setscrews on the pump shaft. The pump shaft position on the motor shaft will automatically position the impeller during reassembly. If the pump shaft was removed inadvertently or it was necessary to remove from the motor, see **Step 3** of the **Pump Assembly** procedure to reinstall the shaft.



Do Not Remove Pump Shaft from Motor Shaft Unless Necessary



Removal of Seal Seat:

5 Press out the seal seat (12) from the bracket (3). Remove and discard the seal seat O-ring (13).

NOTE: The seal seat can be reused if found to be in acceptable condition. If the seal seat is worn, it should be replaced.

END OF DISASSEMBLY PROCEDURE

5.4 PUMP ASSEMBLY

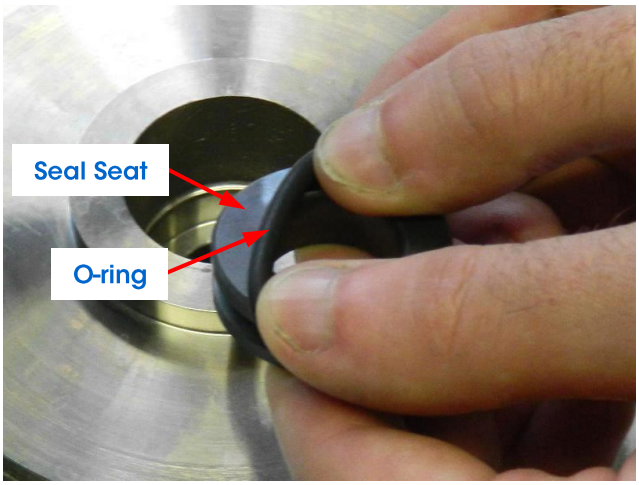
Follow the procedure below and refer to the Sectional and Exploded View drawings in **Appendix 4**. Drawing reference numbers are given in parentheses in the following procedure.

Seal Seat Installation:

1 Install new O-ring (13) onto seal seat (12).

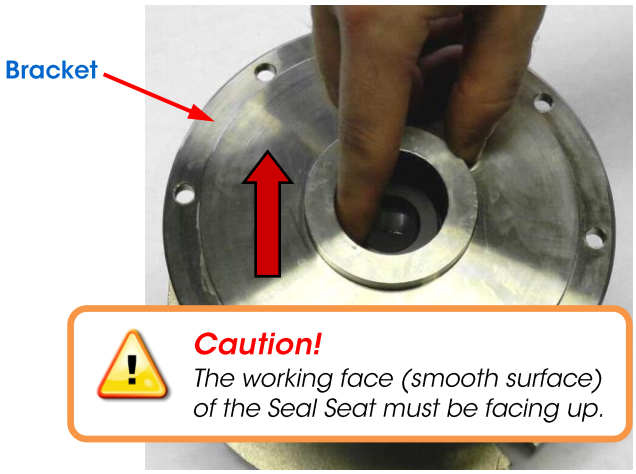
> ***Caution!***
> *Do not reuse O-rings.*

NOTE: After installation of the O-ring on the seal seat, lubricate the outside surface of the O-ring with vegetable oil or other lubricant compatible with the elastomer. This will ease installation of the seal seat into the bracket.



2 Press the seal seat (12) into the bracket (3) with the working face directed upwards, as shown.

NOTE: The working face of the seal seat is flat and smooth, as shown below. The reverse side has a V-groove.

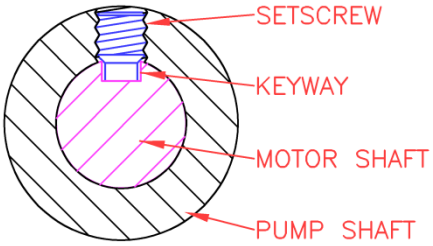


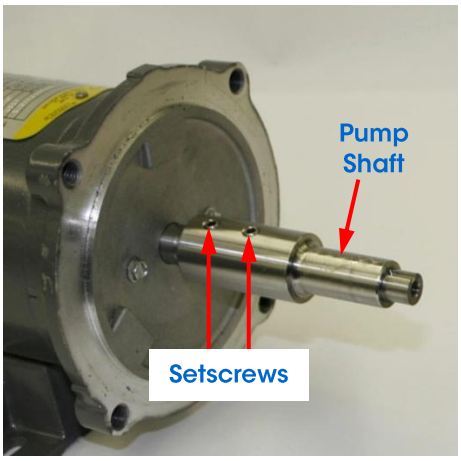
> ***Caution!***
> *The working face (smooth surface) of the Seal Seat must be facing up.*

Pump Shaft Installation: (If required; see Note on page 17.)

3 Install pump shaft (4) on the motor shaft but <u>do not</u> tighten the shaft setscrews (14).

NOTE: The dog-point setscrews of the pump shaft must be inside the keyway groove of the motor shaft. (See diagram at right.)

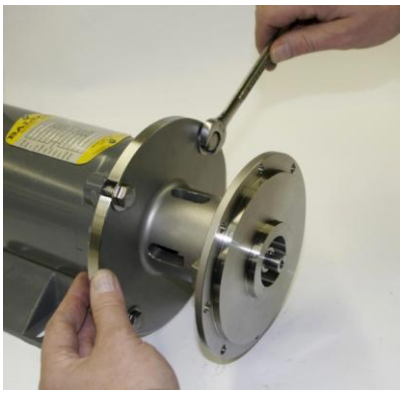




Bracket Installation:

4 Install bracket (3) onto motor frame using four sets of bolts (15) and lock-washers (16).

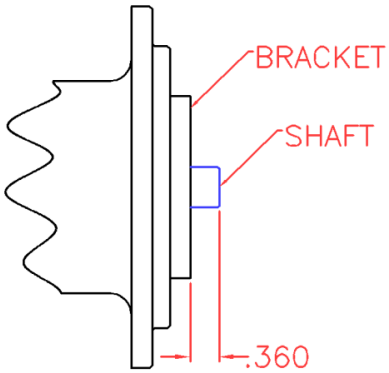
NOTE: Make certain the bracket mates properly and seats flat against the motor. Refer to **Appendix 1** for the torque specifications of the fasteners.

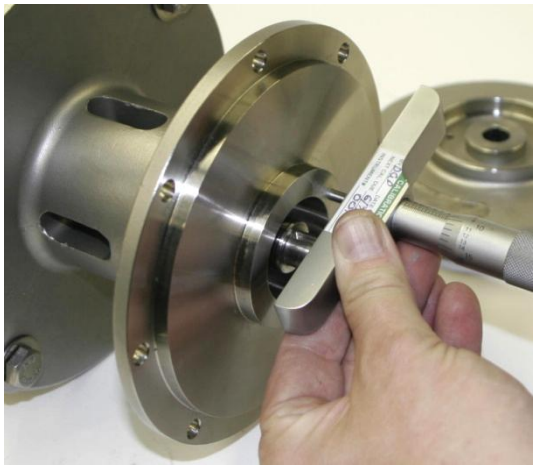


NOTE: If the pump has a **Type 21** seal, and the pump shaft was separated from the motor shaft, follow **Steps 5** & **6**; otherwise proceed directly to **Step 7**.

Pump Shaft Positioning: (If required; see **Note** above.)

5 Position the pump shaft (4) so that it protrudes 0.360" (~23/64") past the outside face of the bracket (3), as shown.





NOTE: This procedure will center the impeller in the volute once the pump is completely assembled. An **alternate method for impeller positioning** is the following: Approximate the pump shaft position and then temporarily tighten the setscrews. Fully assemble the pump as shown below. Loosen setscrews and then push impeller back 1/16" from front of volute. Tighten setscrews and then make certain the impeller rotates freely inside the pump housing.

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6 Being careful not to move the shaft (4), tighten both setscrews (14) on the shaft.

NOTE: After tightening the setscrews, verify the shaft position relative to the bracket, as shown above.

Mechanical Seal Installation:

7 Install the **Type 21** or **Type 9T** mechanical seal by following the applicable procedure below:

A. Type 21 Seal Installation (Refer to Drawings on Pages 28-29 & 37)

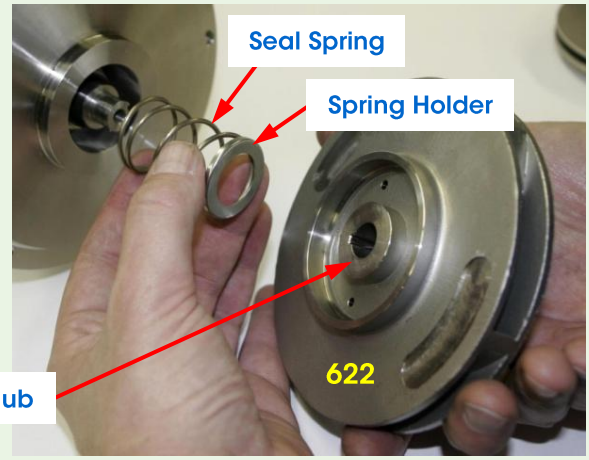
A1 Slide the new **mechanical seal assembly** (11A), consisting of the **sealing ring** and **holder assembly**, on the shaft (4) with the working surface facing the seal seat (12), as shown.

NOTE: Lubricate the inner surface of the **flexible bellows** of the seal with vegetable oil or other lubricant compatible with the elastomer. This will ease installation of the seal onto the shaft and into the bracket. See **Appendices 4, 5 & 6** for component and assembly information for the Type 21 mechanical seal used in these pumps.

Seal Spring Installation

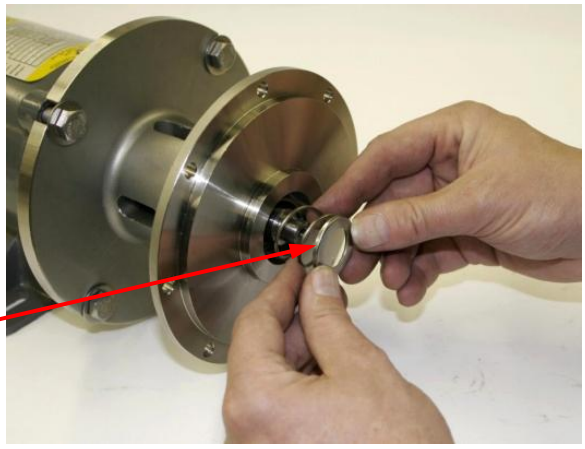
The **Type 21** Single Mechanical Seal used in these pumps come with a **spring** and **spring holder**. The holder is not used for Model 621. For Model 622, the holder must seat over the end of the spring and its flat surface must face the impeller hub, as shown.

NOTE: The Model 621 impeller is shown at near right. The Model 622 impeller is shown at far right.



A2 Install seal **spring** for Model 621 or seal **spring** and **spring holder** (11B) for Model 622, into the bracket (3), as shown.

NOTE: For Model 622 only, be certain **spring holder** seats properly over the end of the seal spring with the flat side of the spring holder facing outward.



CONTINUE PROCEDURE ON PAGE 22

Mechanical Seal Installation (Continued):

B. Type 9T Seal Installation (Refer to Drawings on Pages 30-31)

B1 Pull the shaft out of the bracket as far as possible and then temporarily tighten the setscrews (14) to prevent the shaft from moving axially (see drawing below).

B2 Remove the **four setscrews** on the body of the **Type 9T single mechanical seal**, which are not used.

Type 9T Single Mechanical Seal

Caution!
Do not handle or scratch the lapped face of the seal. Do not remove the retaining clips from the seal until after the seal is placed on the shaft.

NOTE: A new Type 9T single mechanical seal comes with four retaining clips installed on the seal body. The retaining clips compress the seal springs, eliminating spring pressure on the seal's wedge. Once the retaining clips are removed, the spring pressure will cause the wedge to seal against the shaft.

B3 Place the mechanical seal at least halfway on the end of the shaft so that the **seal wedge** is over the shaft. (Refer to the detailed drawing below for seal orientation.)

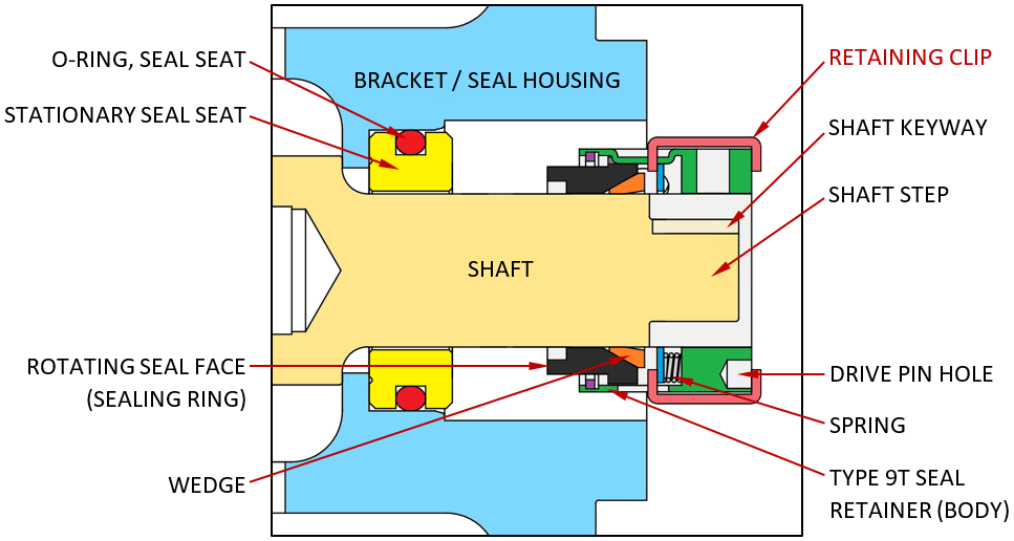
B4 Using a small flat screwdriver, carefully **remove all four retaining clips** from the seal.

B5 Using an Allen wrench in one setscrew to prevent the shaft from rotating, position the seal radially, so that the **drive pin hole** in the seal body is on the opposite side (or 180°) from the **keyway** in the step of the shaft (as shown in the drawing below).

NOTE: The orientation of the seal pin hole relative to the shaft keyway is required for installing the impeller.

B6 Push the mechanical seal into the seal housing until the **seal face** contacts the **seal seat**.

Type 9T Single Mechanical Seal Installation



CONTINUE PROCEDURE ON PAGE 22

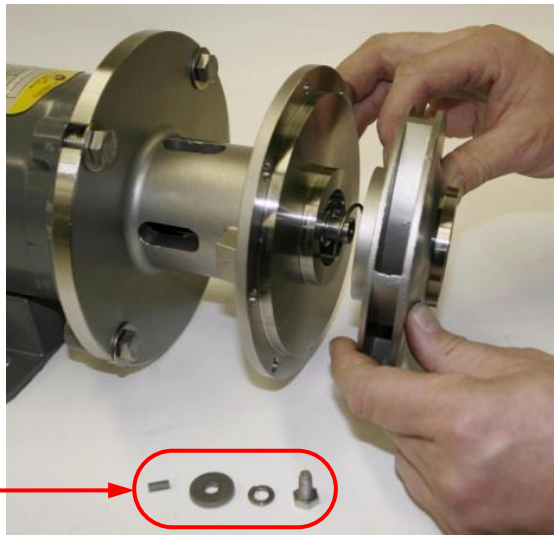
Impeller Installation: (Steps 8, 9 & 10)

8 Rotate the shaft (4) so that the keyway is facing upwards; then install the key (10) onto the shaft.

9 **a.** **For Type 21 Seal:** Install impeller (1) on pump shaft (4) while pressing against the seal spring.

b. **For Type 9T Seal:** Install drive pin (19) into the impeller (1); then install impeller on pump shaft (4) so that the drive pin engages into the pin hole on the seal body.

NOTE: When installing the impeller, align the keyway of the impeller with the key on the shaft.



10 While holding the impeller in position, install washer (7), lock-washer (9) and screw (8) on the end of the shaft; then tighten the screw.

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

11 **For pump with Type 9T seal:** Loosen the shaft setscrews (14) and then position the shaft relative to the bracket (3) as shown in **Step 5** on page 19. Then tighten the setscrews.

12 Turn the impeller by hand to ensure that it will rotate freely.

NOTE: The impeller should rotate easily but some drag from the seal will be felt.

Volute Installation: (Steps 13 & 14)

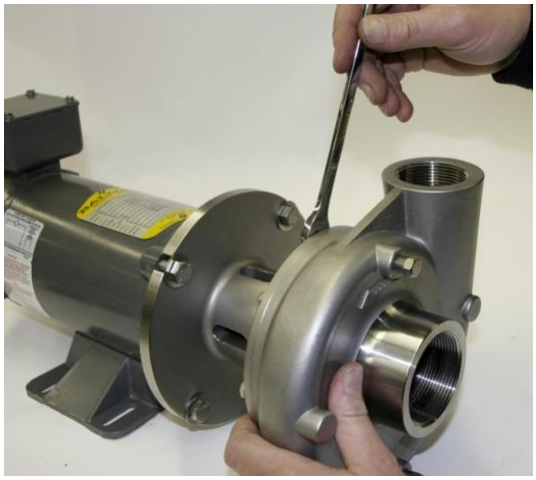
13 Install the volute O-ring (5).

Caution!
Do not reuse O-rings.

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

14 Install the volute (2) to the bracket (3) using eight sets of bolts (6) and lock-washers (6A); then tighten the screws.

NOTE: Apply anti-seize compound to the bolts. Refer to **Appendix 1**for the torque specifications of the fasteners. When tightening the housing bolts, 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 bolts no longer require retightening.

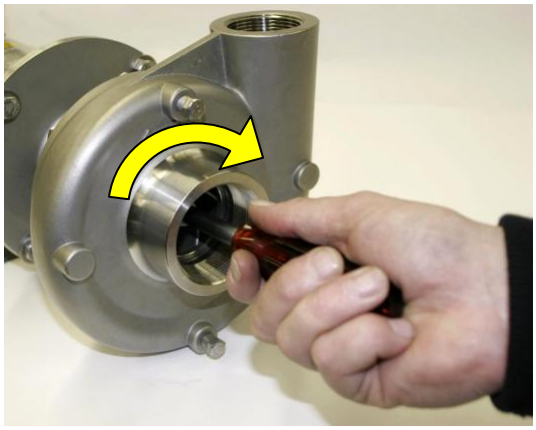


Checking Impeller Position:

NOTE: The following step should be performed to make certain the impeller position was properly set:

15 Turn the impeller by hand to ensure that the impeller will rotate freely inside the housing. This can be done by using a socket-head wrench, as shown. If rubbing occurs, follow the alternate method given below for setting the impeller position.

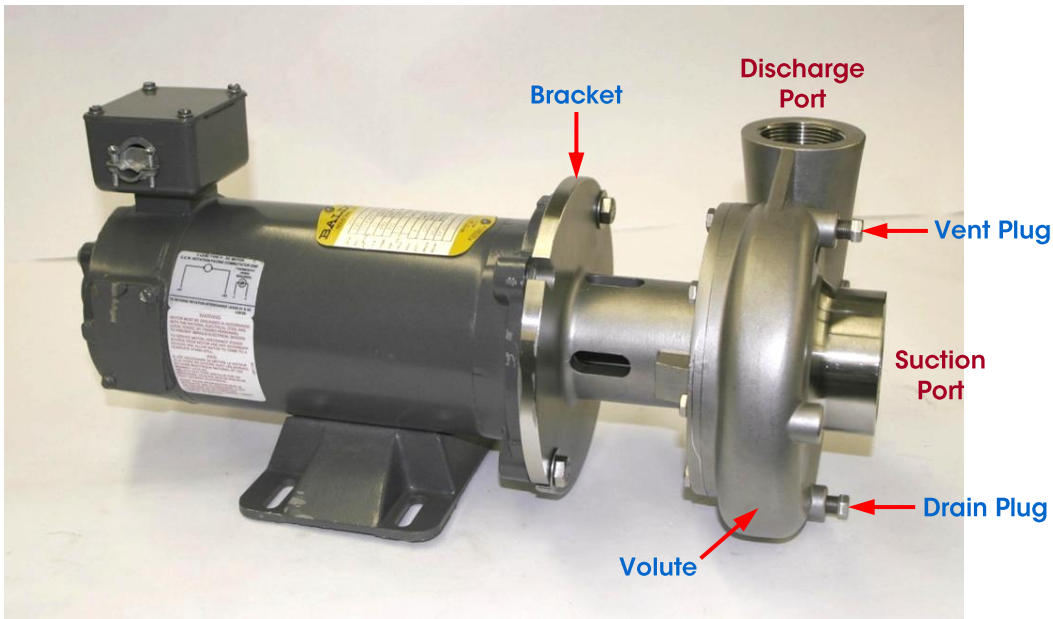
Alternate Impeller Positioning Method: (1) Loosen the two setscrews on the pump shaft. (2) Push impeller back 1/16" from front of volute. (3) Tighten the setscrews. (4) Recheck impeller rotation, as shown.



Installation of Plugs:

16 If not previously done, install the **two** 1/8" NPT plugs (18) into the volute.

NOTE: Apply Teflon tape or pipe lubricant the threads of the plugs, to prevent leakage and galling.



Centry Model 622-Sealed shown with NPT Ports & Close-Coupled to Motor

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END OF ASSEMBLY PROCEDURE

Appendix 1: Fastener Torque Specifications

Maximum Torque Values for 18-8 Stainless Steel Bolts

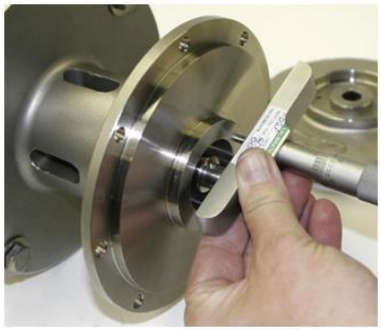
Function	Model Code Position 5	Bolt Size	Bolt Type	Quantity (per Pump)	Torque Specifications	
					(in-lb)	(N-m)
Volute - Bracket Assembly	**0, 1, 5**	1/4-28 UNF x 1/2	HHCS	8	94.0	10.6
Impeller - Shaft Assembly	**0, 1, 5**	1/4-28 UNF x 5/8	HHCS	1	94.0	10.6
BOLTS for MOTOR-BRACKET ASSEMBLY:						
Motor(1) - Bracket 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) - Bracket Assembly		3/8-16 UNC x 1	HHCS	4	236	26.7

1 NEMA 56C, 143TC & 145TC motor frames
2 NEMA 182TC & 184TC motor frames

HHCS = Hex Head Cap Screw
SHCS = 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	**Wrench, 7/16"**	For volute bolts and 1/8" NPT plugs.	
2	**Wrench, 9/16"**	For bracket-to-motor mounting bolts.	
3	**Ratchet Wrench with 7/16" Hex Socket**	For impeller screw.	
4	**Socket Head Wrench, 7/16" Hex**	For checking impeller rotation after pump is fully assembled to motor.	
5	**Allen Wrench, 1/8" Hex**	For shaft setscrews.	
6	**Allen Wrench, 3/8" Hex**	For adapter mounting bolts (NEMA 182/184TC motor frames only).	
7	**Precision Caliper ***	For setting shaft position relative to bracket (which will center the impeller inside the volute).	

* Optional tool. If this tool is not available, the alternate Impeller Positioning Method given on page 23 can be used.

Appendix 3: Pump Bill of Materials (BOM)

BOM for Centry® Models 621 & 622 – Sealed

Drawing Ref. #	Part Description		Material	Model 621 Part No.	Model 622 Part No.	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	Bracket	NEMA 56C & 143/145TC	316 SS	622200	622200	1
		NEMA 182/184TC	316 SS	622201	622201	
4	Shaft	5/8" Bore (NEMA 56C)	316 SS	622300	622300	1
		7/8" Bore (NEMA 143/145TC)	316 SS	622301	622301	
		1-1/8" Bore (NEMA 182/184TC)	316 SS	622302	622302	
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 1/2 SHCS)		18-8 SS	S620012	S620012	8
6A	Lock-washer, Volute (1/4)		18-8 SS	863701	863701	8
7	Washer, Impeller		316 SS	622500	622500	1
8	Screw, Impeller (1/4-28 x 1 HHCS)		316 SS	S620033	S620033	1
9	Lock-washer, Impeller (1/4)		316 SS	863704	863704	1
10	Key, Impeller		316 SS	621900	621900	1
11	**Mechanical Seal, Single ***	**Type 21**	18-8 SS/Carbon	A-627011	A-627011	1
		Type 9T	316 SS/Carbon	A-627020	A-627020	
		Type 9T	316 SS/Teflon	A-627021	A-627021	
12	**Seal Seat ***		Silicon Carbide	781547	781547	1
13	**O-ring, Seal Seat (2-216) ***		Viton	781691	781691	1
14	Setscrew, Shaft (1/4-28 x 3/8 SHSS-FD) [1]		18-8 SS	621104	621104	2
15	Bolt, Motor (3/8-16 x 1 HHCS)		18-8 SS	620825	620825	4
16	Lock-washer, Motor (3/8)		18-8 SS	S1004	S1004	4
17	Impeller Positioning Device [2]	NPT Ports	Aluminum	621700	621701	1
		Flanged Ports	Aluminum	621702	621703	
18	Plug (1/8" NPT), Volute		18-8 SS	864007	864007	2
19	Drive Pin, Type 9T Seal		316 SS	622750	622750	1
20	Adapter (NEMA 182/184TC Motor) [3]		Carbon Steel/ Epoxy	SP0046	SP0046	1
21	Bolt, Adapter (1/2-13 x 1 SHCS) [3]		18-8 SS	641105	641105	4

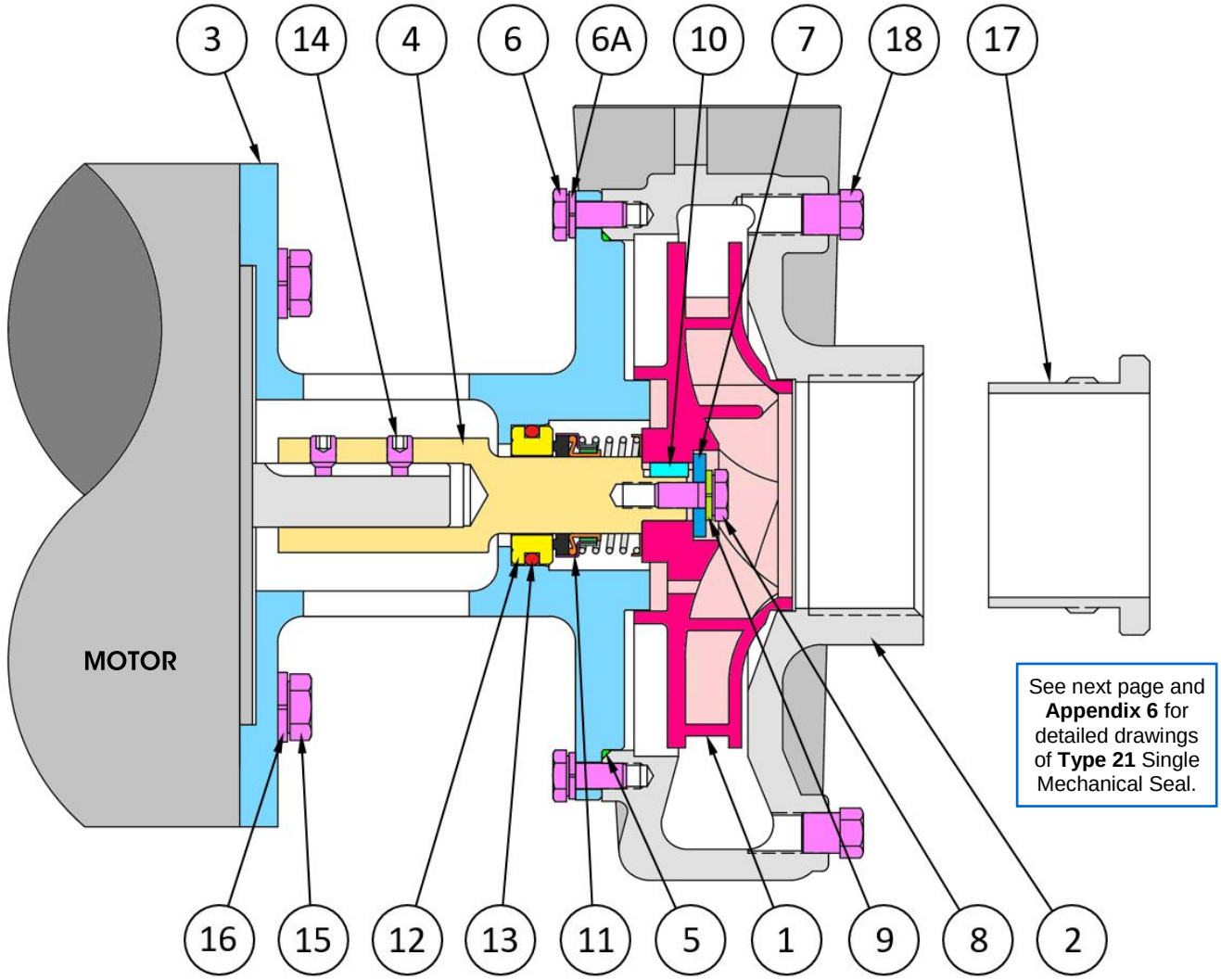
* Primary repair components.

1 Setscrews are included with Shaft (Ref. # 4).
2 See pages 9 & 10 for photos of Impeller Positioning Device.
3 Item not shown. (See page 13 for Adapter assembly diagram.)

NOTE: Drawing Reference Numbers above correspond to Sectional & Exploded View Reference Drawings on pages 28-31.

Appendix 4: Reference Drawings

Sectional Drawing #1 – Models 621 & 622 with SINGLE MECHANICAL SEAL, Type 21

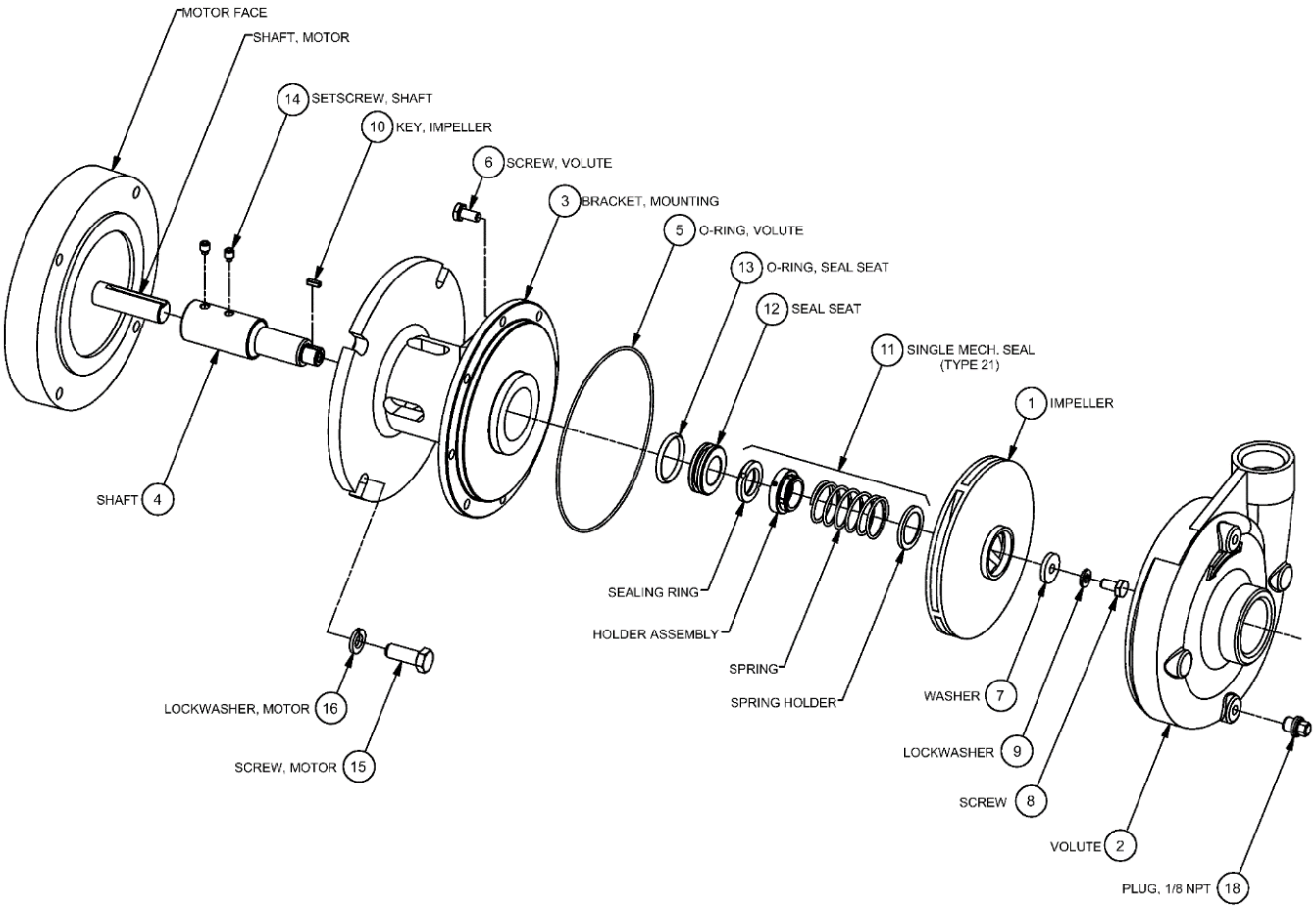


Ref. #	Description	Qty.	Ref. #	Description	Qty.
1	Impeller	1	11	11A Mechanical Seal Assembly [1]	1 set
2	Volute	1		11B Spring & Spring Holder	1 set
3	Bracket / Seal Housing	1	12	Seal Seat	1
4	Shaft	1	13	O-ring, Seal Seat (2-216)	1
5	O-ring/Gasket, Volute	1	14	Setscrew, Shaft (1/4-28 x 3/8 SHSS-FD) [2]	2
6	Bolt, Volute (1/4-28 x 1/2 SHCS)	8	15	Bolt, Motor (3/8-16 x 1 HHCS)	4
6A	Lock-washer, Volute (1/4)	8	16	Lock-washer, Motor (3/8)	4
7	Washer, Impeller	1	17	Impeller Positioning Device [3]	1
8	Screw, Impeller (1/4-28 x 1 HHCS)	1	18	Plug, 1/8" NPT, Volute	2
9	Lock-washer, Impeller (1/4)	1	20	Adapter (NEMA 182/184TC Motor) [4]	1
10	Key, Impeller	1	21	Bolt, Adapter (1/2-13 x 1 SHCS) [4]	4

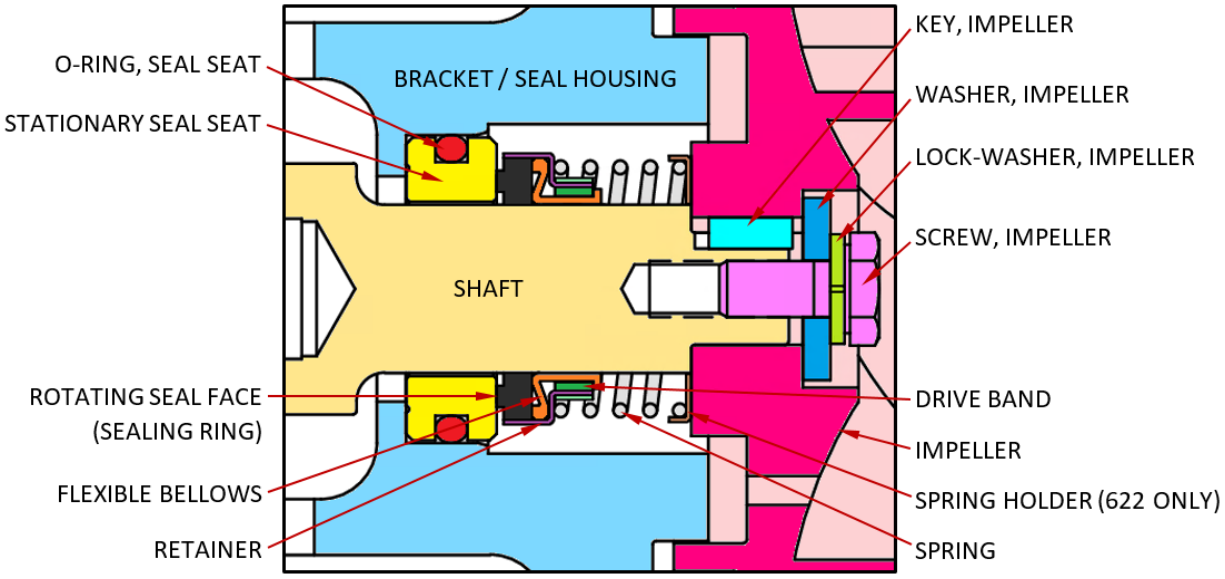
1 Sealing Ring & Holder Assembly (see p. 29, 36 & 37).
2 Setscrews are included with Shaft (Ref. # 4).
3 Device for NPT Ports is shown above (see pages 9-10).
4 Item not shown (see p. 13 for Adapter assembly diagram).

Appendix 4: Reference Drawings (Continued)

Exploded View Drawing #1 – Models 621 & 622 with SINGLE MECHANCIAL SEAL, Type 21

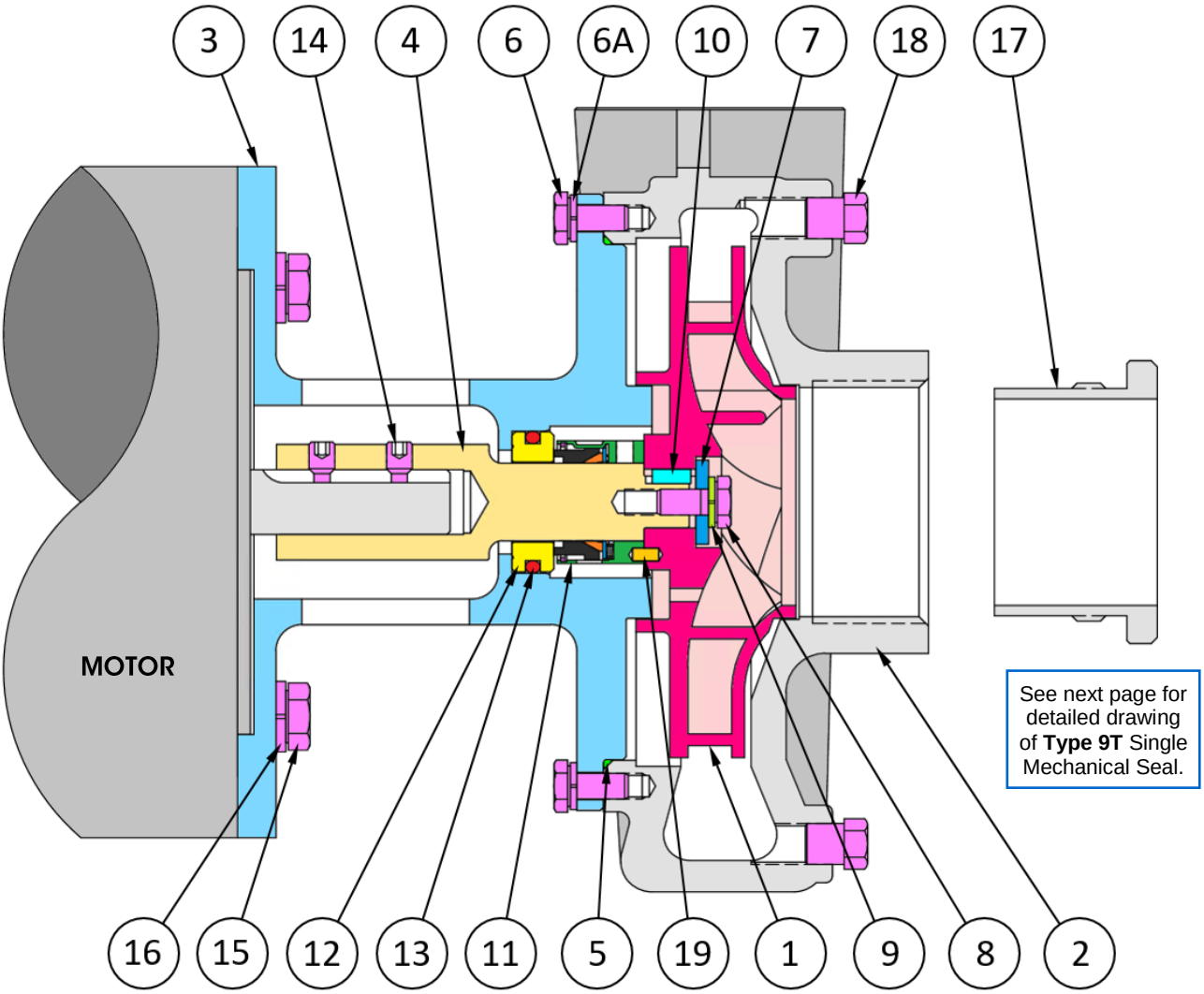


Sectional Drawing #1A – Type 21 Single Mechanical Seal



Appendix 4: Reference Drawings (Continued)

Sectional Drawing #2 – Models 621 & 622 with SINGLE MECHANICAL SEAL, Type 9T

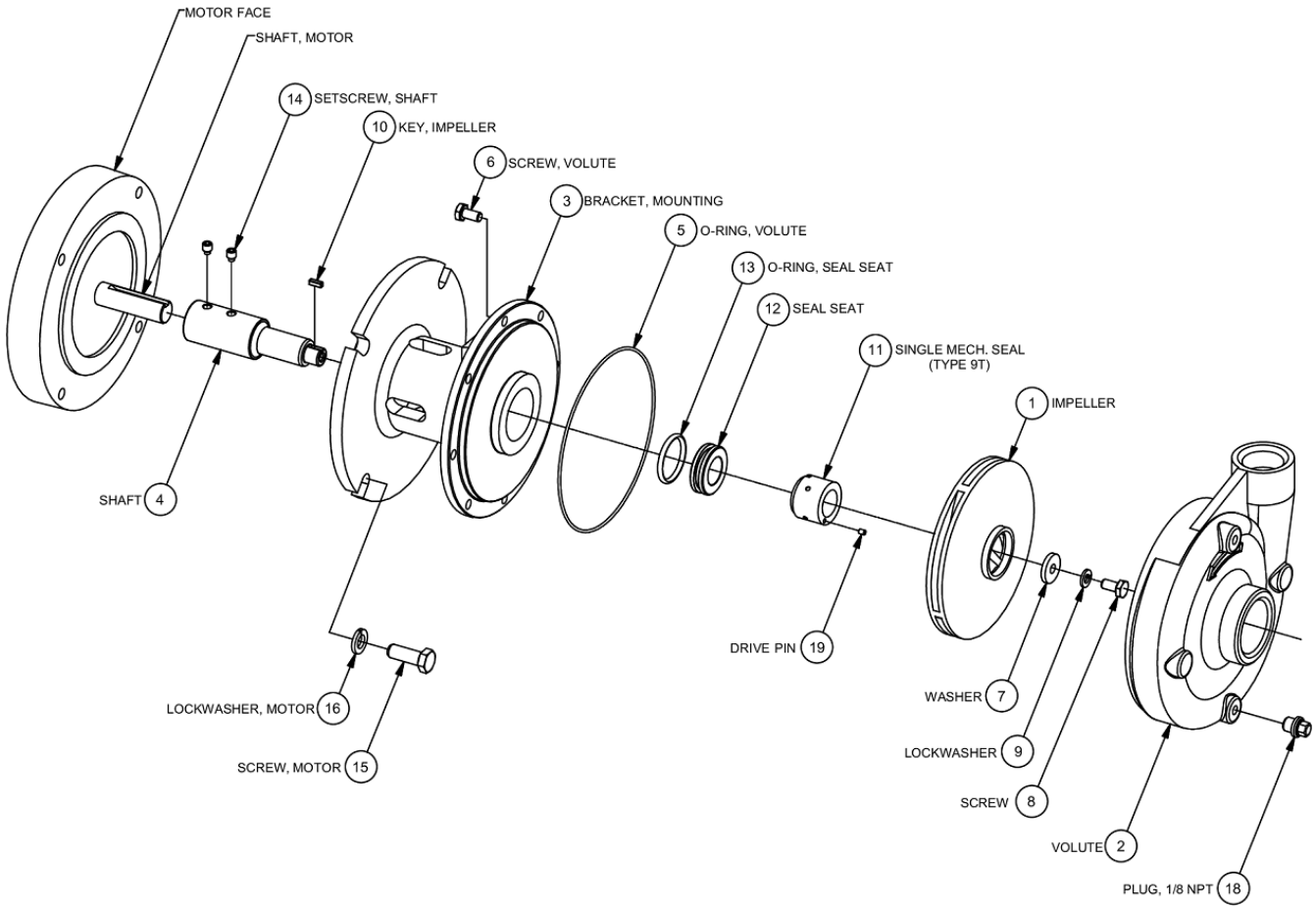


Ref. #	Description	Qty.	Ref. #	Description	Qty.
1	Impeller	1	11	Single Mechanical Seal, Type 9T	1
2	Volute	1	12	Seal Seat	1
3	Bracket / Seal Housing	1	13	O-ring, Seal Seat (2-216)	1
4	Shaft	1	14	Setscrew, Shaft (1/4-28 x 3/8 SHSS-FD) [1]	2
5	O-ring/Gasket, Volute	1	15	Bolt, Motor (3/8-16 x 1 HHCS)	4
6	Bolt, Volute (1/4-28 x 1/2 SHCS)	8	16	Lock-washer, Motor (3/8)	4
6A	Lock-washer, Volute (1/4)	8	17	Impeller Positioning Device [2]	1
7	Washer, Impeller	1	18	Plug, 1/8" NPT, Volute	2
8	Screw, Impeller (1/4-28 x 1 HHCS)	1	19	Drive Pin, Type 9T Seal	1
9	Lock-washer, Impeller (1/4)	1	20	Adapter (NEMA 182/184TC Motor) [3]	1
10	Key, Impeller	1	21	Bolt, Adapter (1/2-13 x 1 SHCS) [3]	4

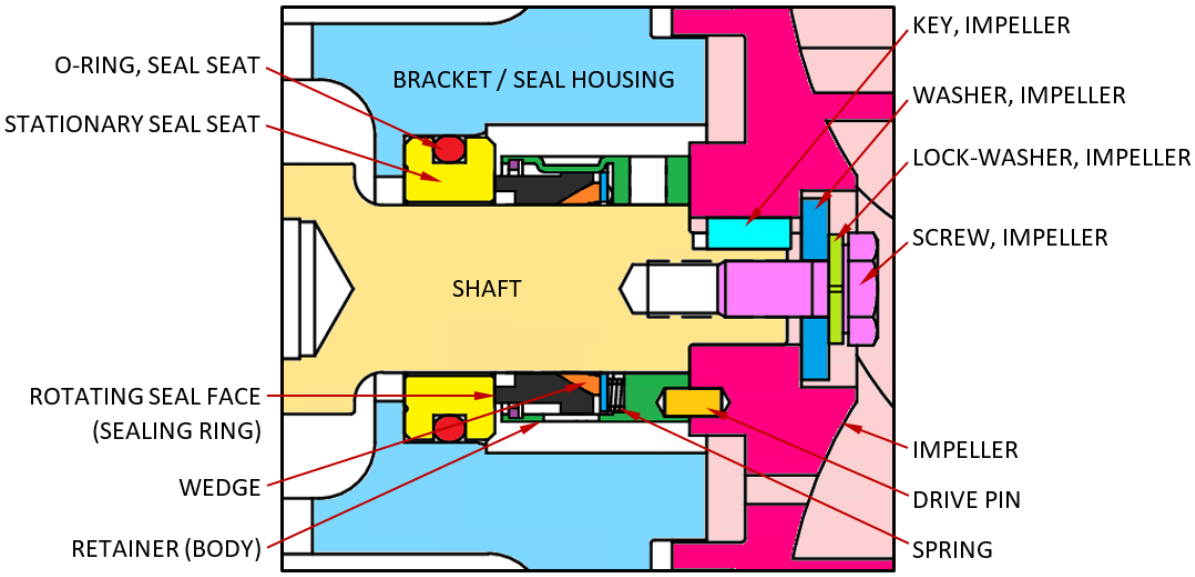
1 Setscrews are included with Shaft (Ref. # 4).
2 Device for NPT Ports is shown above (see p. 9-10).
3 Item not shown (see p. 13 for Adapter assembly diagram).

Appendix 4: Reference Drawings (Continued)

Exploded View Drawing #2 – Models 621 & 622 with SINGLE MECHANCIAL SEAL, Type 9T

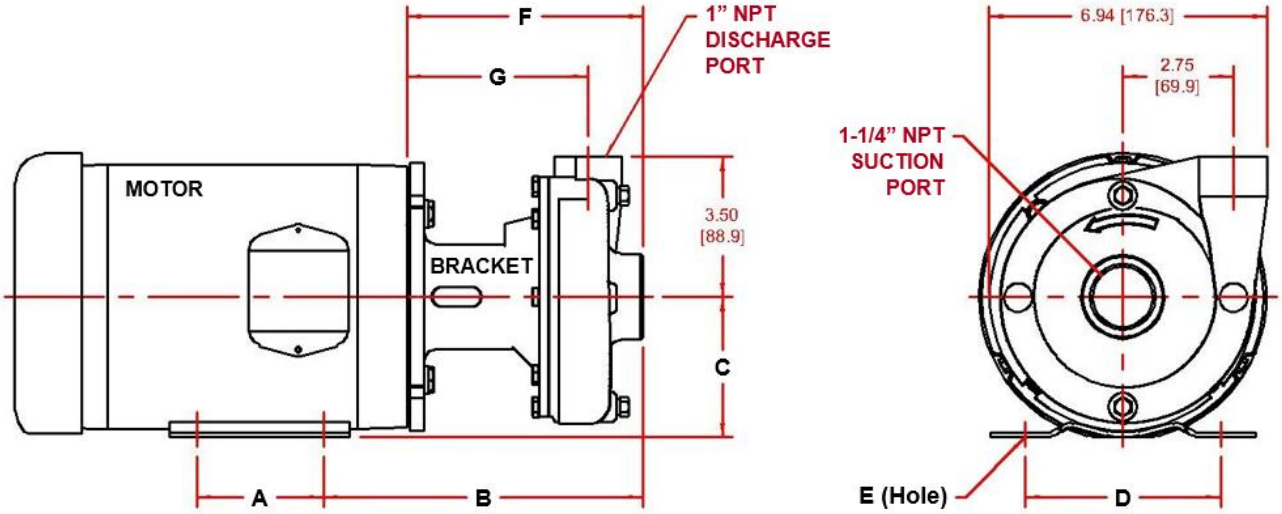


Sectional Drawing #2A – Type 9T Single Mechanical Seal



Appendix 4: Reference Drawings (Continued)

Dimensional Drawing #1 – Centry® Model 621-Sealed with Threaded Ports



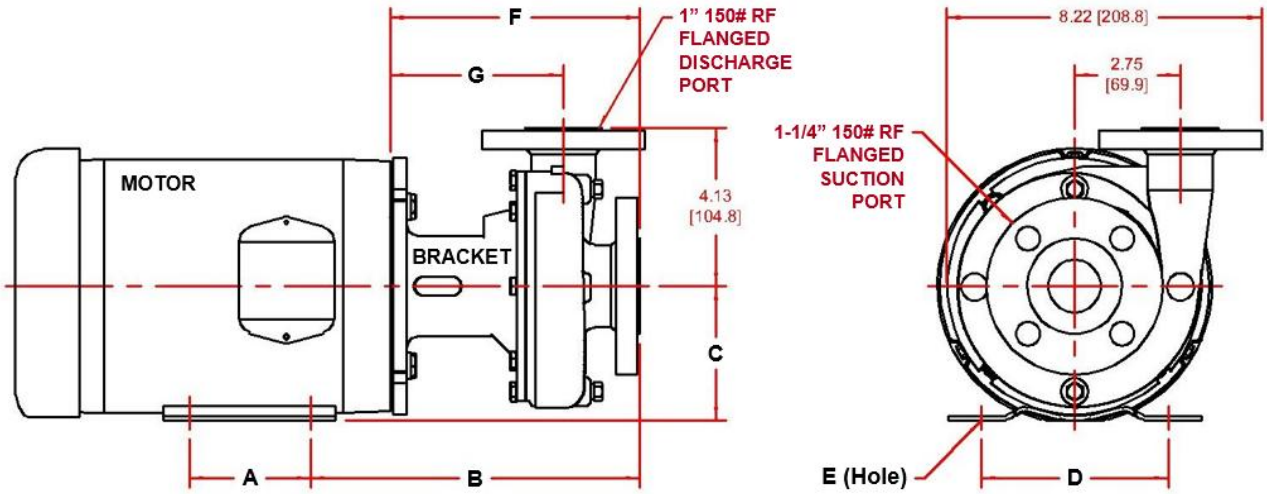
Dimensional Data (inches [mm]) – Model 621-Sealed with Threaded Ports

NEMA Motor	A	B	C	D	E	F	G
56C	3.00 [76.2]	8.45 [215]	3.50 [88.9]	4.87 [124]	2 x .34 [8.7] Wide Slot	5.89 [150]	4.51 [115]
143TC	4.00 [102]	8.76 [223]	3.50 [88.9]	5.50 [140]	4 x .34 [8.7] Dia. Thru	5.89 [150]	4.51 [115]
145TC	5.00 [127]	8.76 [223]	3.50 [88.9]	5.50 [140]	4 x .34 [8.7] Dia. Thru	5.89 [150]	4.51 [115]
182TC	4.50 [114]	10.30 [261.7]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	6.89 [175]	5.51 [140]
184TC	5.50 [140]	10.30 [261.7]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	6.89 [175]	5.51 [140]

NOTE: B, F and **G** dimensions include 1.00 [25.4] thick Adapter Plate (not shown) for NEMA 182/184TC motor frames.

Appendix 4: Reference Drawings (Continued)

Dimensional Drawing #2 – Centry® Model 621-Sealed with Flanged Ports



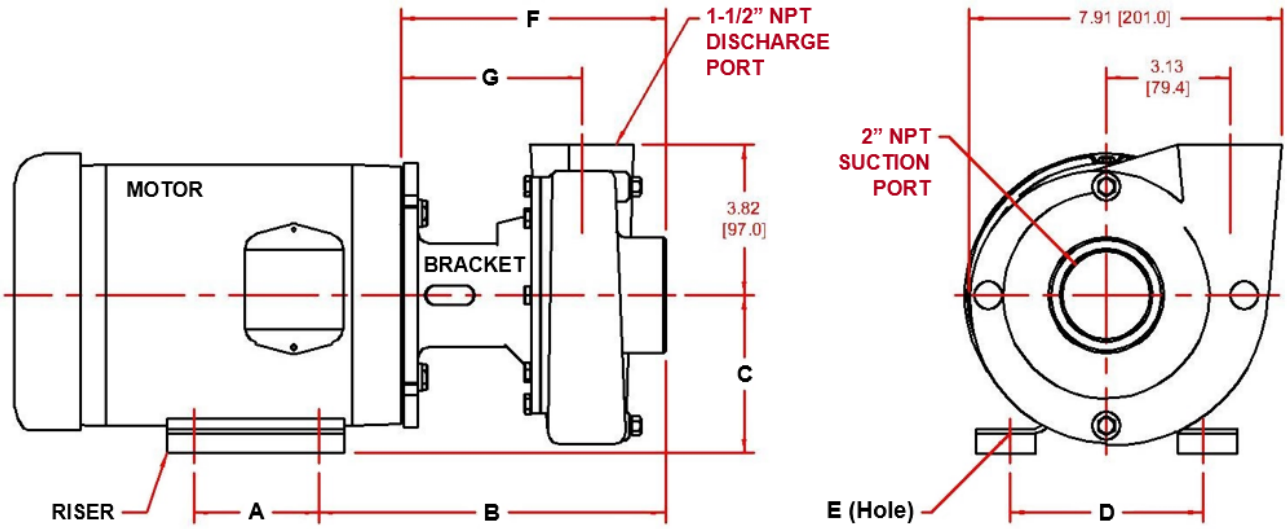
Dimensional Data (inches [mm]) – Model 621-Sealed with Flanged Ports

NEMA Motor	A	B	C	D	E	F	G
56C	3.00 [76.2]	9.07 [230]	3.50 [88.9]	4.87 [124]	2 x .34 [8.7] Wide Slot	6.51 [165]	4.51 [115]
143TC	4.00 [102]	9.38 [238]	3.50 [88.9]	5.50 [140]	4 x .34 [8.7] Dia. Thru	6.51 [165]	4.51 [115]
145TC	5.00 [127]	9.38 [238]	3.50 [88.9]	5.50 [140]	4 x .34 [8.7] Dia. Thru	6.51 [165]	4.51 [115]
182TC	4.50 [114]	10.93 [277.6]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	7.51 [191]	5.51 [140]
184TC	5.50 [140]	10.93 [277.6]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	7.51 [191]	5.51 [140]

NOTE: B, F and **G** dimensions include 1.00 [25.4] thick Adapter Plate (not shown) for NEMA 182/184TC motor frames.

Appendix 4: Reference Drawings (Continued)

Dimensional Drawing #3 – Centry® Model 622-Sealed with Threaded Ports



Dimensional Data (inches [mm]) – Model 622-Sealed with Threaded Ports

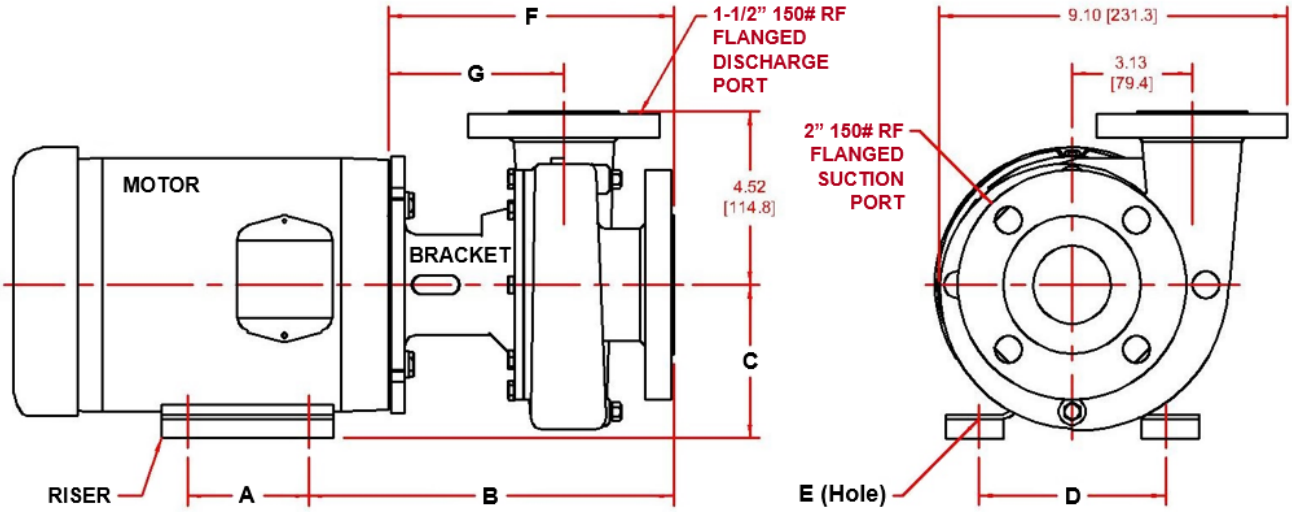
NEMA Motor	A	B	C	D	E	F	G
56C	3.00 [76.2]	9.26 [235]	4.00 [102]	4.87 [124]	2 x .34 [8.7] Wide Slot	6.70 [170]	4.58 [116]
143TC	4.00 [102]	9.58 [243]	4.00 [102]	5.50 [140]	4 x .34 [8.7] Dia. Thru	6.70 [170]	4.58 [116]
145TC	5.00 [127]	9.58 [243]	4.00 [102]	5.50 [140]	4 x .34 [8.7] Dia. Thru	6.70 [170]	4.58 [116]
182TC	4.50 [114]	11.12 [282.4]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	7.70 [196]	5.58 [142]
184TC	5.50 [140]	11.12 [282.4]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	7.70 [196]	5.58 [142]

NOTES:

1. **B, F** and **G** dimensions include 1.00 [25.4] thick Adapter Plate (not shown) for NEMA 182/184TC motor frames.
2. **C** dimension includes 0.50 [12.7] high Risers only for NEMA 56C thru 145TC motor frames. (Risers are not required for NEMA 182/184TC motor frames.)

Appendix 4: Reference Drawings (Continued)

Dimensional Drawing #4 – Centry® Model 622-Sealed with Flanged Ports



Dimensional Data (inches [mm]) – Model 622-Sealed with Flanged Ports

NEMA Motor	A	B	C	D	E	F	G
56C	3.00 [76.2]	10.02 [254.4]	4.00 [102]	4.87 [124]	2 x .34 [8.7] Wide Slot	7.46 [189]	4.58 [116]
143TC	4.00 [102]	10.33 [262.4]	4.00 [102]	5.50 [140]	4 x .34 [8.7] Dia. Thru	7.46 [189]	4.58 [116]
145TC	5.00 [127]	10.33 [262.4]	4.00 [102]	5.50 [140]	4 x .34 [8.7] Dia. Thru	7.46 [189]	4.58 [116]
182TC	4.50 [114]	11.87 [301.6]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	8.46 [215]	5.58 [142]
184TC	5.50 [140]	11.87 [301.6]	4.50 [114]	7.50 [191]	4 x .41 [10.3] Dia. Thru	8.46 [215]	5.58 [142]

NOTES:

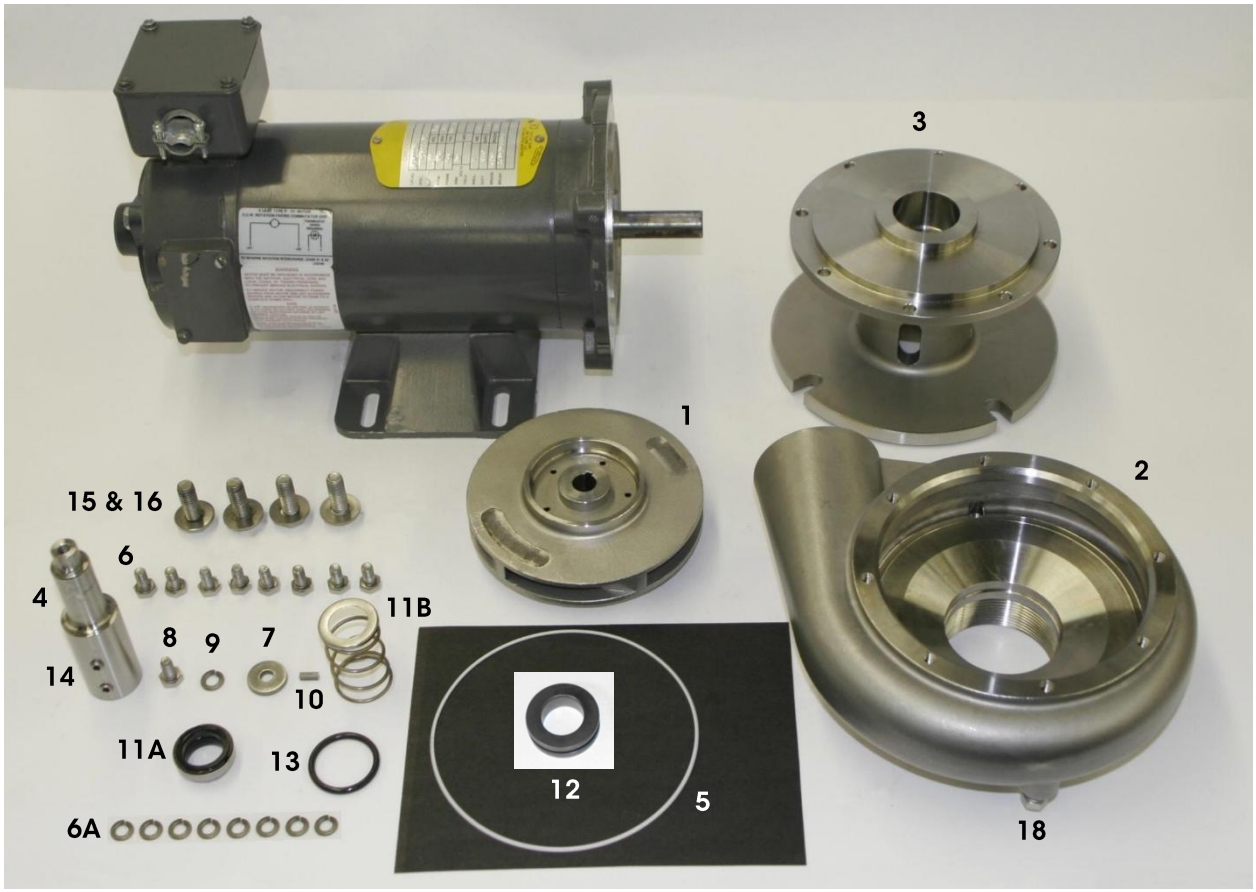
1. **B, F** and **G** dimensions include 1.00 [25.4] thick Adapter Plate (not shown) for NEMA 182/184TC motor frames.
2. **C** dimension includes 0.50 [12.7] high Risers only for NEMA 56C thru 145TC motor frames. (Risers are not required for NEMA 182/184TC motor frames.)

Appendix 5: Pump Parts List

Parts List for Centry® Models 621 & 622 – Sealed

Ref. #	Part Description	Material	Qty./Pump
1	Impeller (Closed Type)	316 SS	1
2	Volute	316 SS	1
3	Bracket w/ Integral Seal Housing	316 SS	1
4	Shaft	316 SS	1
5	O-ring (2-049) or Gasket for volute	Teflon (O-ring)[2]	1
6	Bolts (1/4-28 x 1/2 SHCS) for volute-bracket assembly	18-8 SS	8
6A	Lock-washers (1/4) for volute-bracket assembly	18-8 SS	8
7	Washer for impeller-shaft assembly	316 SS	1
8	Screw (1/4-28 x 1 HHCS) for impeller-shaft assembly	316 SS	1
9	Lock-washer (1/4) for impeller-shaft assembly	316 SS	1
10	Key for impeller-shaft assembly	316 SS	1
11A	Sealing Ring & Holder Assembly for **Type 21** Mech. Seal	Carbon/18-8 SS	1 set
11B	Spring & Spring Holder for **Type 21** Mechanical Seal	18-8 SS	1 set
12	Seal Seat	SiC	1
13	O-ring (2-216) for seal seat	Viton	1
14	Setscrews (1/4-28 x 3/8 SHSS-FD) for shaft	316 SS	2
15	Bolts (3/8-16 x 1 HHCS) for bracket-motor assembly	18-8 SS	4
16	Lock-washers (3/8) for bracket-motor assembly	18-8 SS	4
17	Impeller Positioning Device[1]	Aluminum	1
18	Plugs for volute (1/8 NPT)	316 SS	2

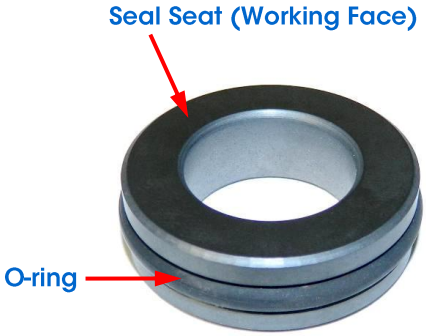
1 Item not shown. (See pages 9-10 for photos.) **2** Viton O-ring or Graphoil Gasket is optional.



NOTE: For Liquiflo Part Numbers, see Consolidated BOM in **Appendix 3**.

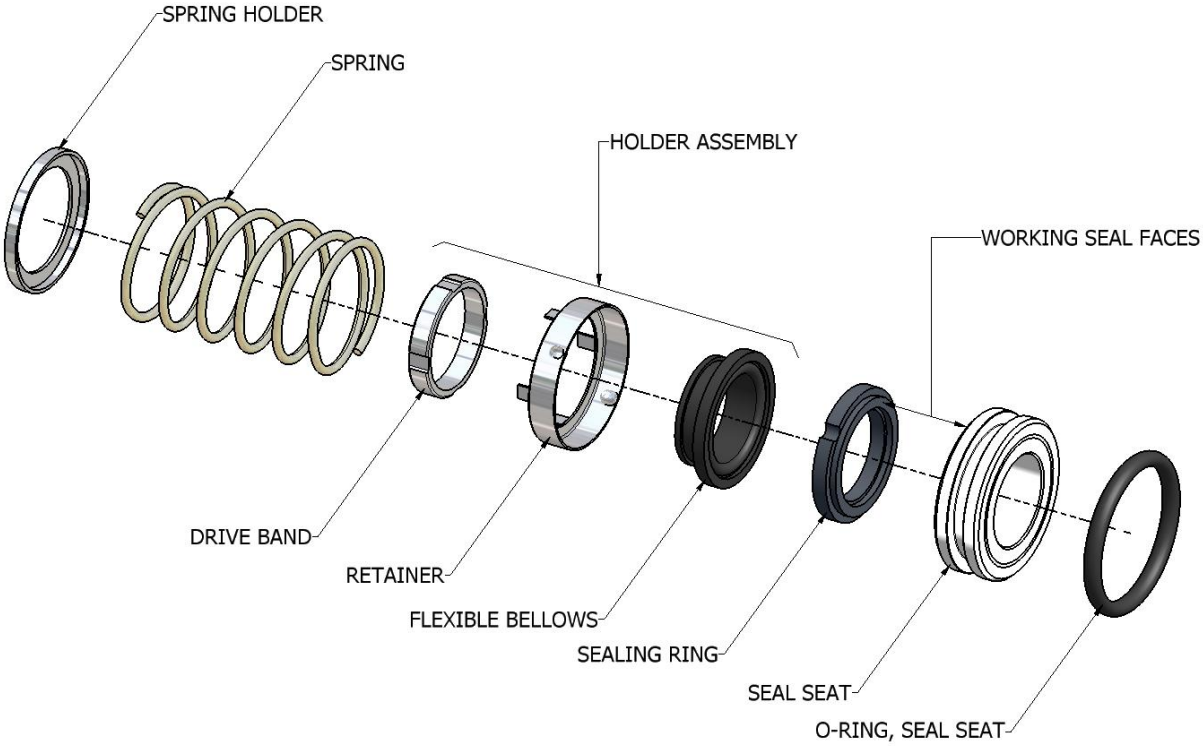
Appendix 6: Type 21 Single Mechanical Seal

Type 21 Single Mechanical Seal shown with Carbon Seal Face



Silicon Carbide Seal Seat shown with Viton O-ring installed

Exploded View Drawing #3 – Type 21 Single Mechanical Seal



Appendix 7: Troubleshooting Guide

Troubleshooting Guide – Part 1

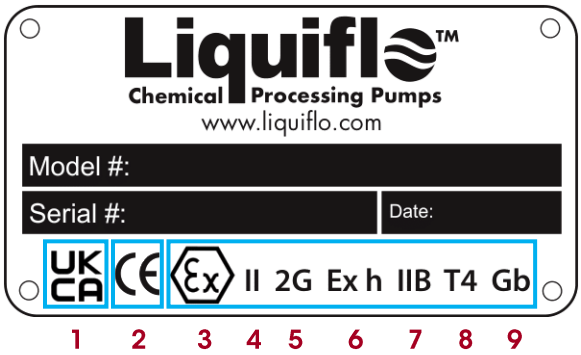
Problem	Possible Cause	Corrective Action
No discharge	Pump not primed	Verify suction pipe is submerged. Increase suction pressure. Open suction valve.
	Wrong direction of rotation	Reverse motor leads.
	Valves closed	Open all suction and discharge valves.
	Bypass valve open	Close bypass valve.
	Air leak 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.
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 7: 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 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.
	Mechanical seal worn or damaged	Disassemble and replace mechanical seal. Prime pump and avoid dry running.
	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 8: 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.

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