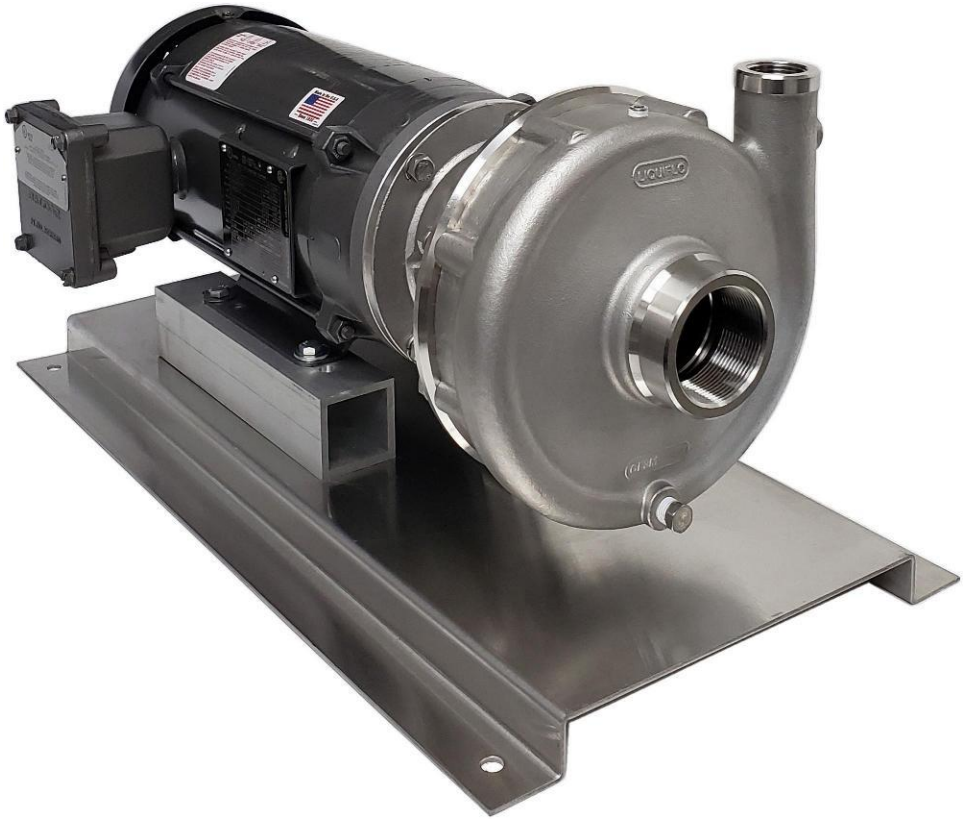
Liquiflo™
Chemical Processing Pumps

INSTALLATION, OPERATION & MAINTENANCE MANUAL

CENTRY® SERIES

MECHANICALLY-SEALED, CLOSE-COUPLED CENTRIFUGAL PUMPS



Model 623 – Sealed

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Introduction

This manual provides instructions for the installation, operation and maintenance of the Centry® Series Centrifugal Pump, **Model 623 – 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 Pump – Model 623.

1.1 Pump Description

The Centry Series Model 623 Sealed pump is an end-suction centrifugal pump with the following features:

- Type 9T single mechanical seal with Carbon or Teflon sealing rings
- Choice of threaded NPT or ANSI flanged ports
- Back pullout design to simplify maintenance
- Motor-supported 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.

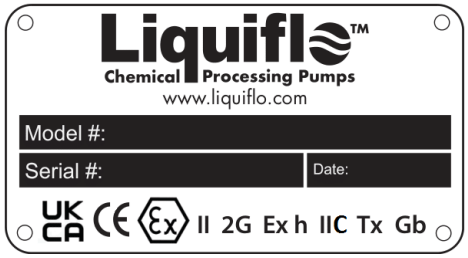
Upon receipt of your Liquiflo pump:

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 6** 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 623	Unit
Ports	Type	Threaded (NPT) or Flanged (ANSI 150# RF)	–
	Suction Size	2	in
	Discharge Size	1	in
Impeller	Diameter	6.56	in
	Standard Trims	6.00, 5.50, 5.00, 4.50	in
	Axial Length	1.945	in
	Type	Closed	–
Mounting Bracket		Close-Coupled, Motor Supported [1]	–
Motor Frames (C-Face)		NEMA 143/145TC, 182/184TC, 213/215TC & 254/256TC [1]	–

1 Foot-Mount motor is required.

Table 2: Performance Specifications

Specification	Model 623	Unit
Maximum Speed	3500	RPM
Maximum Flow Rate	167	GPM
Maximum Differential Head	180	ft

Table 3: Absolute Temperature & Pressure Ratings

Specification	Model 623	Unit
Minimum Operating Temperature	-100 [2]	°F
Maximum Operating Temperature	500 [2]	°F
Maximum Operating Pressure	300 [3]	PSIG

2 Temperature limit for sealed pumps depend on materials of construction and motor or driver.
3 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 623	Unit
Pump with Threaded Ports	36 [4]	lb
Pump with Flanged Ports	42 [4]	lb

4 Approximate weight of pump, excluding motor and base.

Table 5: Pump Materials

Components			Materials
Volute, Plugs, Shaft, Impeller, Key, Washer & Cap Nut			316 Stainless Steel
Shaft Setscrews			Carbon Steel
O-rings & Gasket, Volute			Teflon (PTFE), Viton (Type A), FFKM 4079, EPDM (Sulfur free) or Graphoil Gasket
Mechanical Seal, Single Internal	Type 9T [5]	Retainer (Body) & Drive Pin	316 Stainless Steel
		Wedge	Teflon or Graphoil [6]
		Sealing Ring	Carbon or Teflon
	Seal Seat		Silicon Carbide (α-SiC; pure, self-sintered)
	O-ring, Seal Seat		Viton (Type A), EPDM (Sulfur free) or FFKM 4079
Mounting Bracket/Seal Housing			316 Stainless Steel
Adapter Plate(s) for 182TC-256TC Motors			Anodized Aluminum
Bolts & Lock-washers			18-8 Stainless Steel

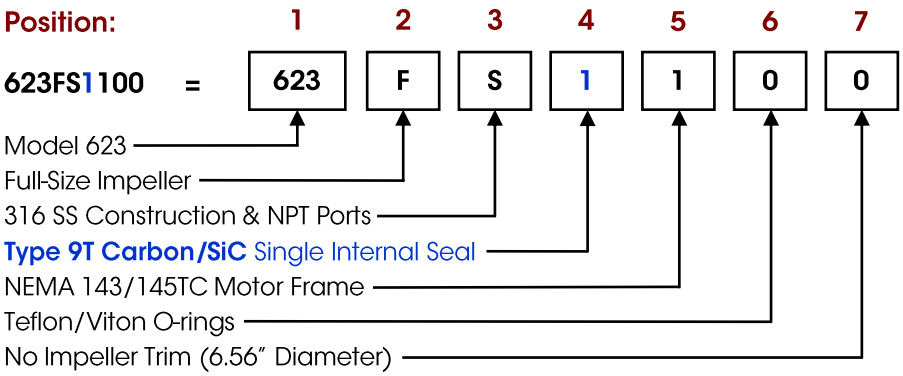
5 See page 32 for detailed drawing of **Type 9T** seal.
6 Teflon: ≤ 350°F; Graphoil: > 350°F.

1.4 Model Coding

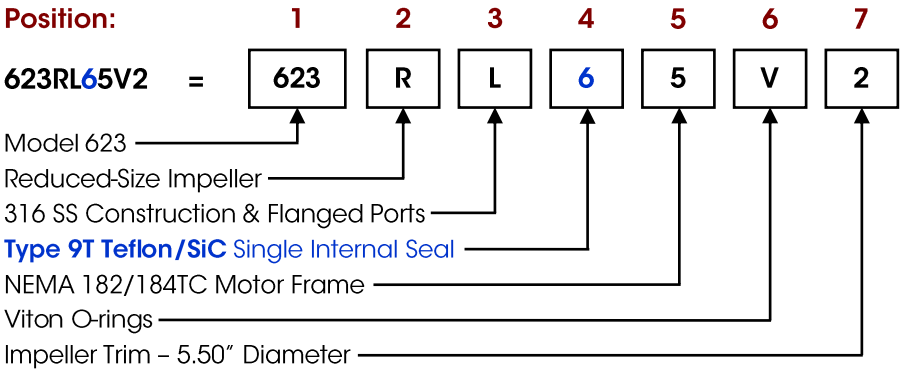
Table 6: Model Coding for Centry® SEALED Model 623

Position	Description	Code	Selection	
1	**Pump Model**	**623**	Model 623	
2	**Impeller Size**	**F**	Full-Size – 6.56" Diameter	**Pos. 7 = 0**
		R	Reduced-Size	**Pos. 7 = 1, 2, 3 or 4**
3	**Basic 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	
		6	**Type 9T Teflon/SiC** Single Internal Mech. Seal	
5	**Motor Frame**	**1**	NEMA 143TC or 145TC (Close-coupled)	
		5	NEMA 182TC or 184TC (Close-coupled)	
		6	NEMA 213TC or 215TC (Close-coupled)	
		7	NEMA 254TC or 256TC (Close-coupled)	
6	**O-rings/Gasket (Volute & Seal Seat)**	**0**	Teflon (Volute O-ring/Viton Seal Seat O-ring)	
		V	Viton O-rings	
		G	Graphoil (Volute Gasket/Viton Seal Seat O-ring)	
		E	EPDM O-rings	
		K	FFKM 4079 O-rings	
7	**Impeller Trim (Standard Sizes)**	**0**	No Trim (6.56" Dia.)	**Pos. 2 = F**
		1	6.00" Diameter	**Pos. 2 = R**
		2	5.50" Diameter	
		3	5.00" Diameter	
		4	4.50" 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. 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**).

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 5**.

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 & 4** 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 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 model covered in this manual is 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. 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.

3.3 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.

3.4 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 5** of the pump model code (see Table 6 on page 5).

2) The pump mounting bracket is directly compatible with NEMA 143TC & 145TC motor frames. For NEMA 182TC thru 256TC motor frames, one or more **adapter plates** are required to mount the bracket to the motor (see pages 19-20). The adapter plate(s) and mounting bolts are provided with the pump when applicable.

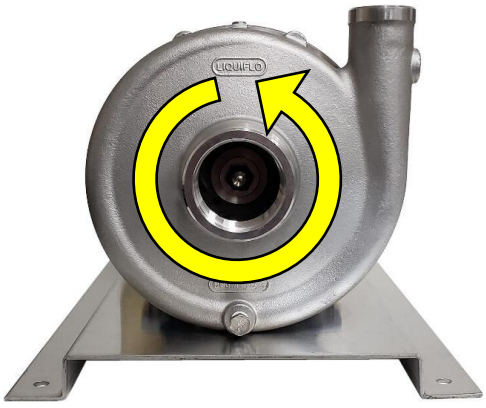
3) A Foot-Mount motor is required for mounting to a base (see cover photo).

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 3.8**). 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, as shown.



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 **Section 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 3.10** on page 11.)

> ***Caution!***
> *Always prime the pump before operating. Do not run the pump dry for more than 30 seconds or damage to 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 623, 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 5** 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:

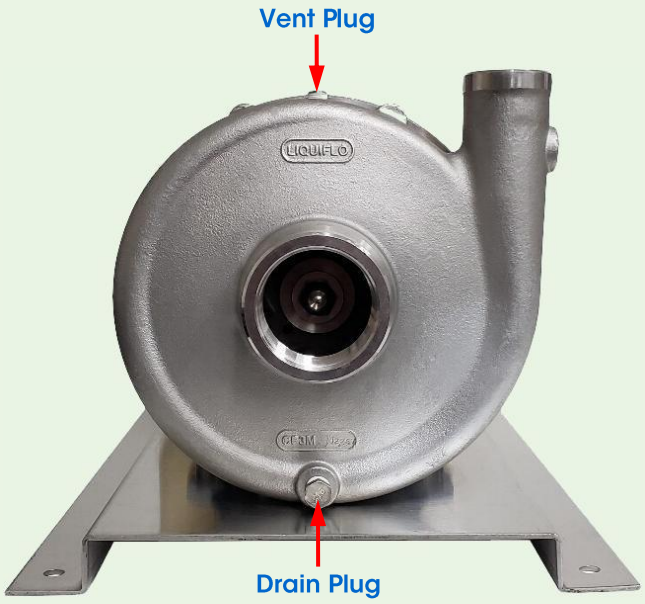
Caution!
If the pump was used on hazardous or toxic fluids, it must be flushed and decontaminated prior to removal from the system piping. Refer to the Material Safety Data Sheet (MSDS) for the liquid and follow all prescribed safety precautions and disposal procedures.

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 photo 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 of Vent & Drain Plugs

The pump has a **1/8" NPT vent plug** (socket head) located at the top of the pump's volute and a **1/4" NPT drain plug** (hex head) located at the bottom of the suction side of the volute, as shown.



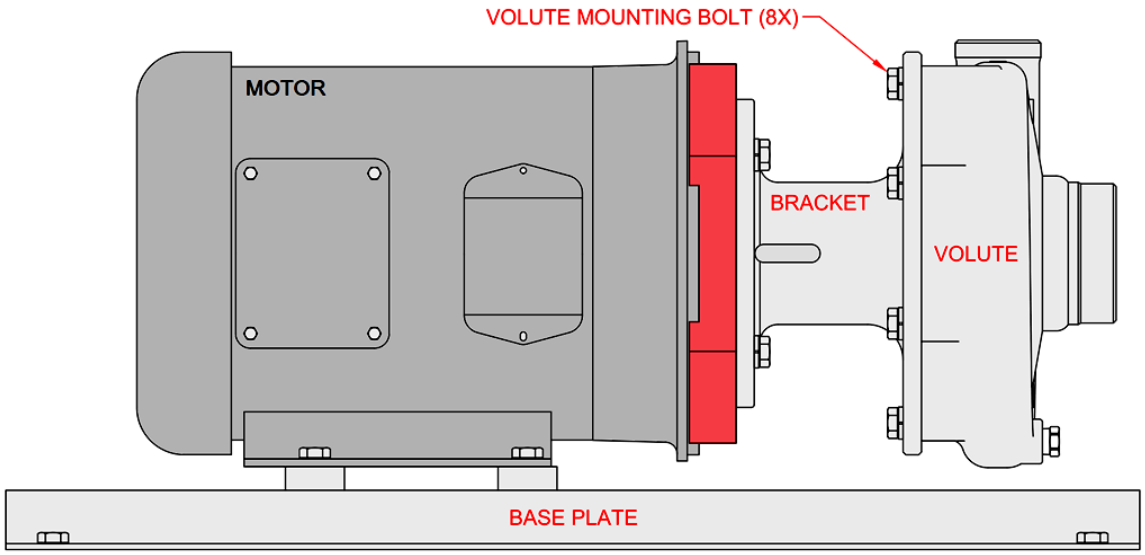
5.3 PUMP DISASSEMBLY

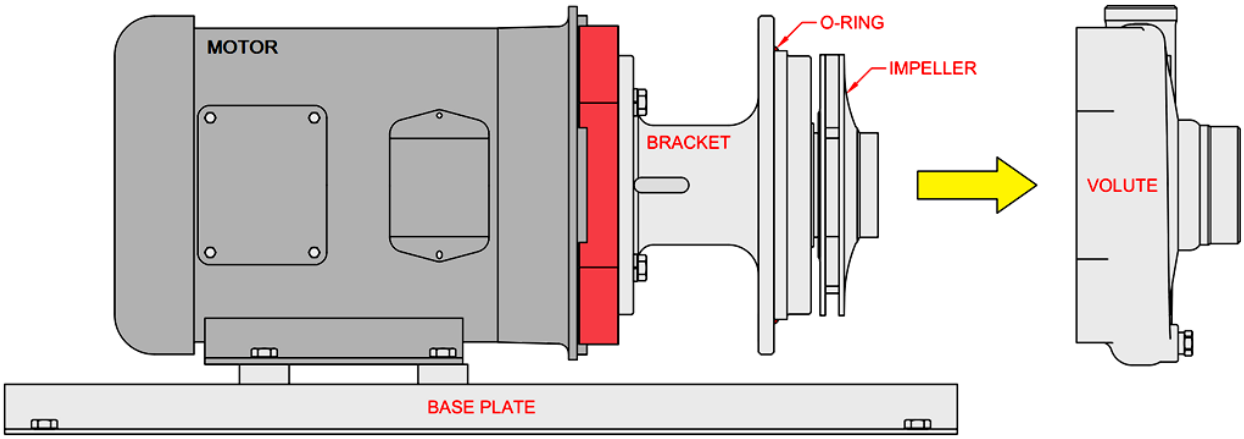
Follow the procedure below and refer to the Sectional and Exploded View drawings in **Appendix 4**. Drawing reference numbers are given in parentheses in the following procedure.

Separation of Volute:

1 Remove the eight volute mounting bolts (14) and separate the pump-motor assembly from the volute (1). Remove the volute **O-ring** (16) 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.

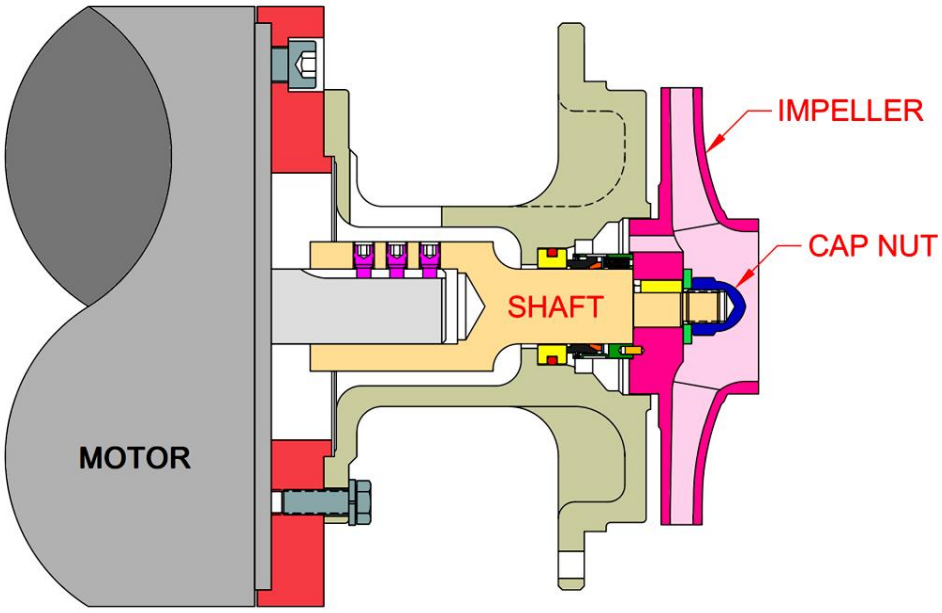




Removal of Impeller:

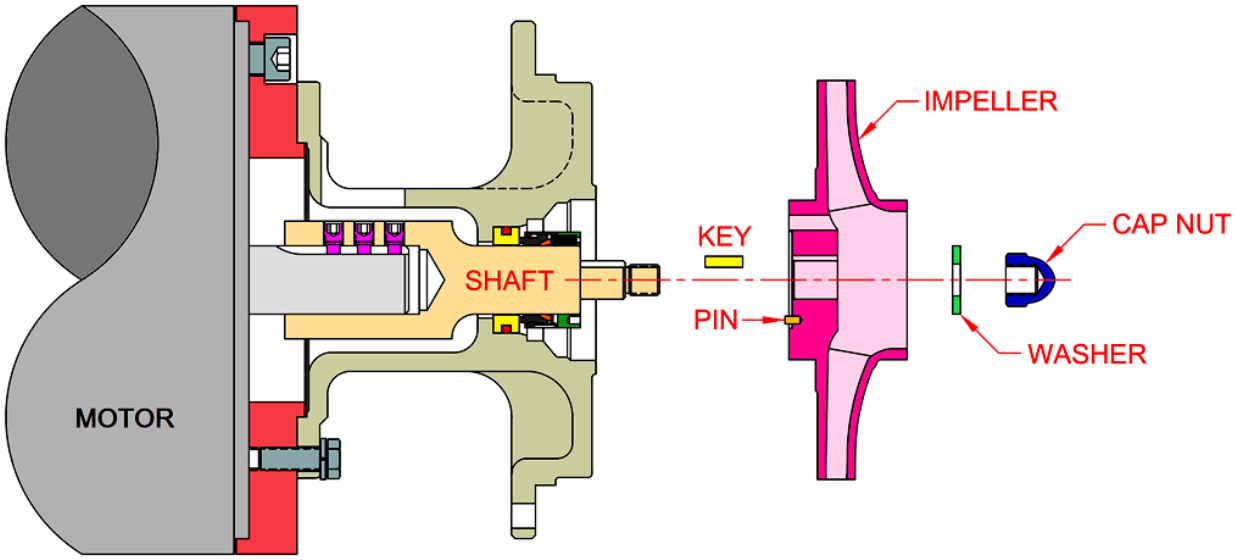
2 Loosen the impeller **cap nut** (11) with a socket wrench while holding the impeller (2).

> **NOTE:** A bar can be held in the side of the impeller to prevent the impeller from rotating when loosening the cap nut.



3 Unscrew and remove the cap nut (11) from the shaft (6).

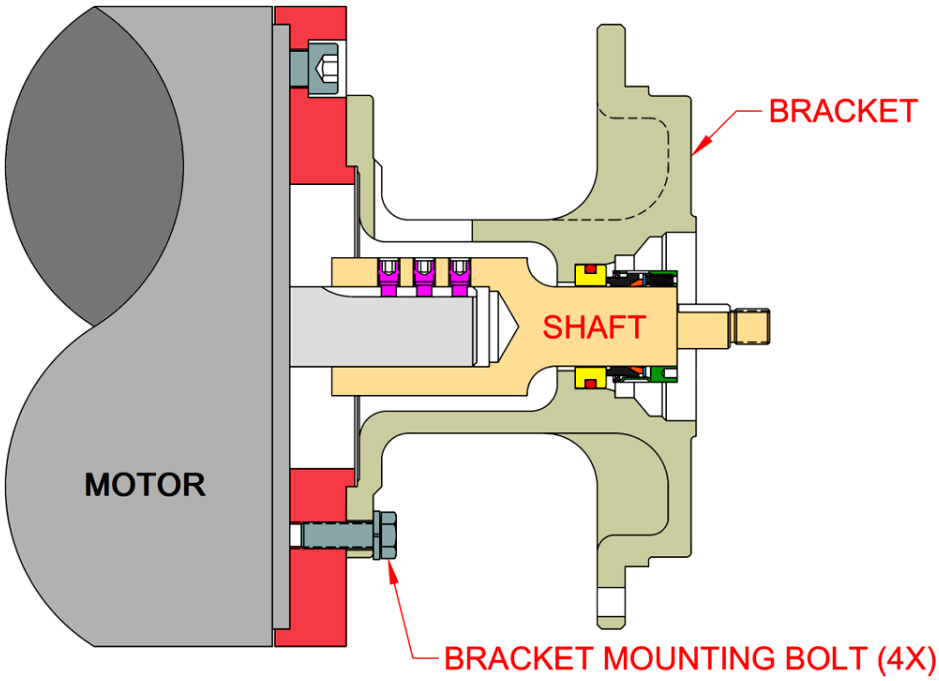
4 Remove the **washer** (12), **impeller** (2) with **drive pin** (4A), and **key** (9), from the shaft (6).

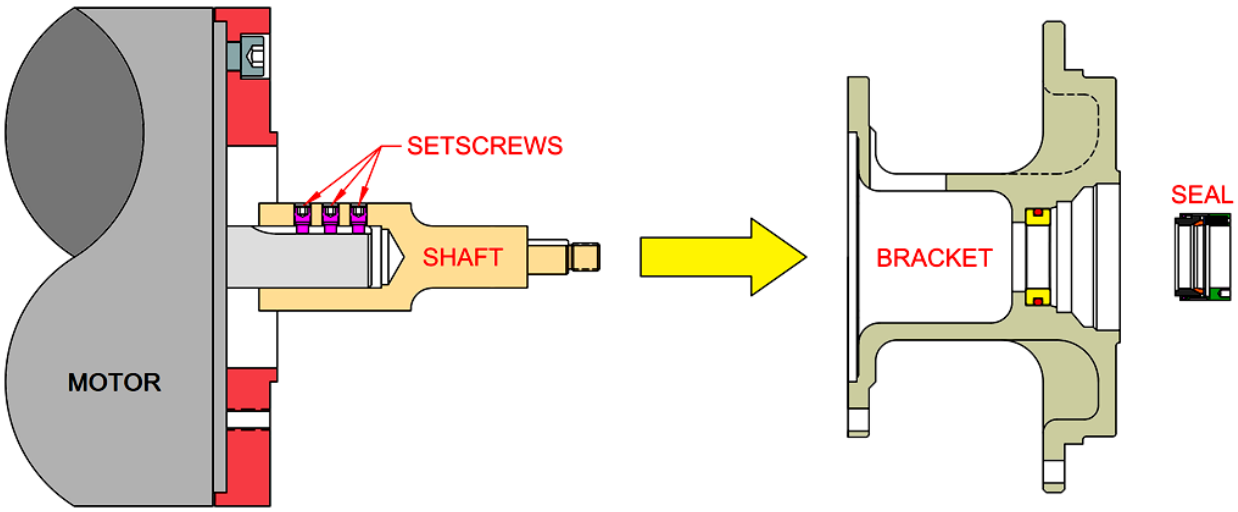


Removal of Bracket & Seal:

5 Remove the **Type 9T mechanical seal** (4) from the shaft (6). Then remove the four bracket mounting bolts (25) and separate the **bracket** (3) from the motor.

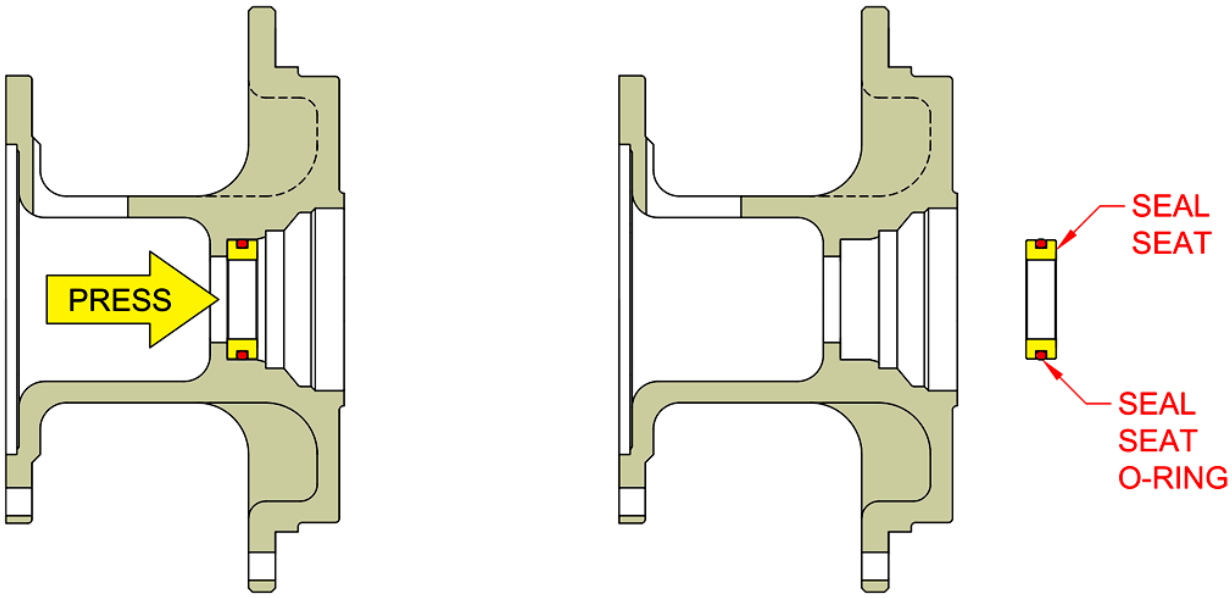
NOTE: Unless it is necessary, do not loosen the setscrews (31) on the pump shaft. The pump shaft position on the motor shaft will automatically position the impeller during reassembly. If the pump shaft was removed inadvertently or it was necessary to remove from the motor, see **Step 3** of the **Pump Assembly** procedure to reinstall the shaft.





Removal of Seal Seat:

6 Press out the **seal seat** (5) from the bracket (3). Remove and discard the seal seat **O-ring** (17).



NOTE: The SiC seal seat can be pressed out of the bracket from the side opposite the seal housing, as shown above. The seal seat can be reused if found to be in acceptable condition. If the seal seat is worn, it should be replaced.



SiC Seal Seat Viton O-ring

END OF DISASSEMBLY PROCEDURE

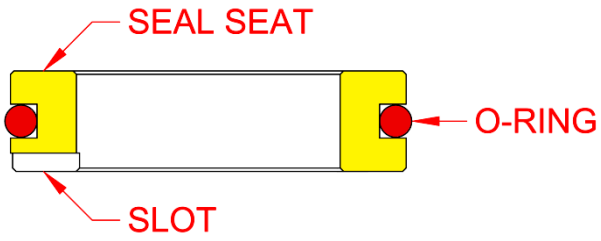
5.4 PUMP ASSEMBLY

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** (17) onto seal seat (5).

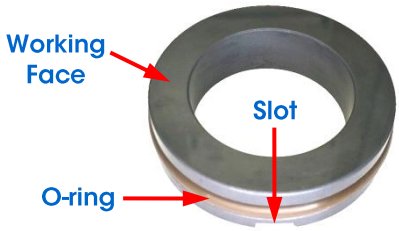
> ***Caution!***
> *Do not re-use O-rings.*



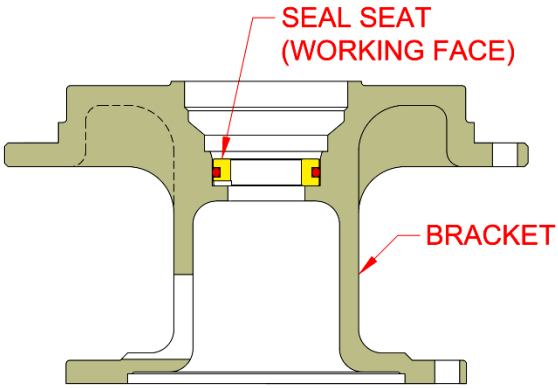
NOTE: After installation of the O-ring (size 2-222) on the seal seat, lubricate the outside surface of the O-ring with vegetable oil or other lubricant compatible with the elastomer. This will ease installation of the seal seat into the bracket.

2 Press **seal seat** (5) into the seal housing of the bracket (3) with the working face directed upwards, as shown.

NOTE: The working face of the seal seat is flat and smooth, and the reverse side has a 1/4" wide slot, as shown below. Keep the working face clean.



Silicon Carbide Seal Seat with Viton O-ring installed

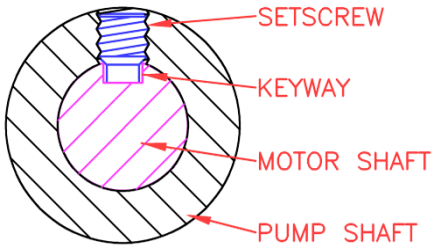


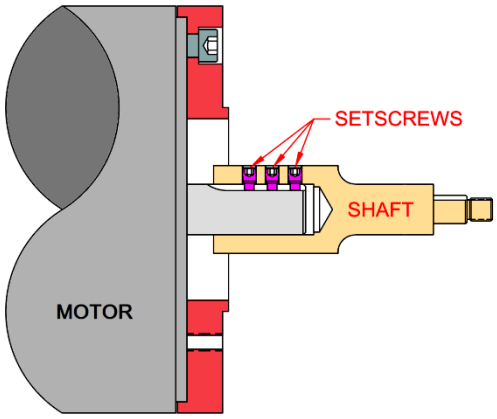
> ***Caution!***
> *The working face (smooth surface) of the Seal Seat must be facing up.*

Pump Shaft Installation: (If required; see **Note** on page 16.)

3 Install **pump shaft** (6) on the motor shaft but <u>do not</u> tighten the shaft setscrews (31).

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



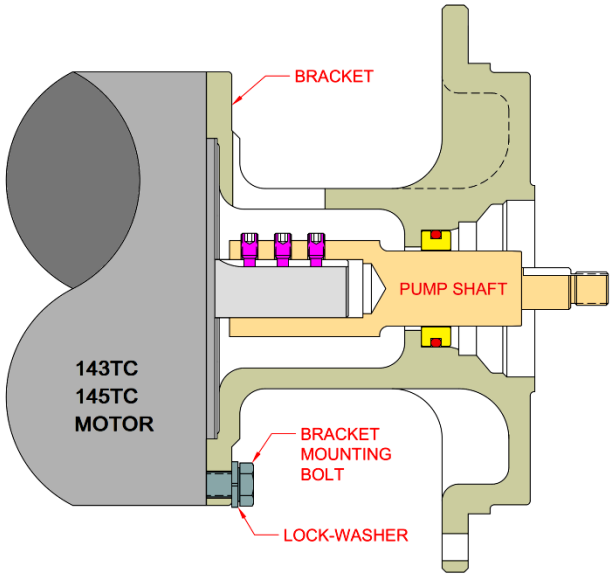


Bracket Installation:

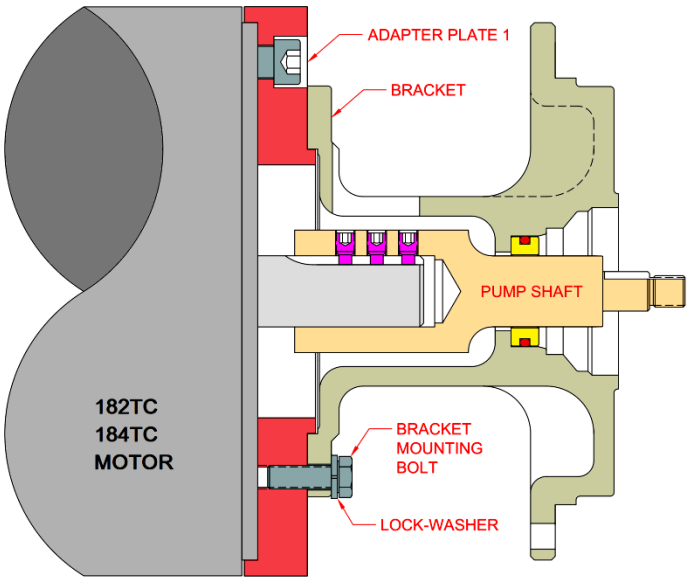
The procedure for installing the pump bracket is dependent on the motor frame used with the pump.

4 Install the **bracket** (3) to the motor or adapter(s) as explained below:

I. NEMA 143TC & 145TC Motor Frames: Install the **bracket** (3) directly onto motor frame using four sets of 3/8-16 x 1 HHCS bolts (25) and 3/8" lock-washers (26).



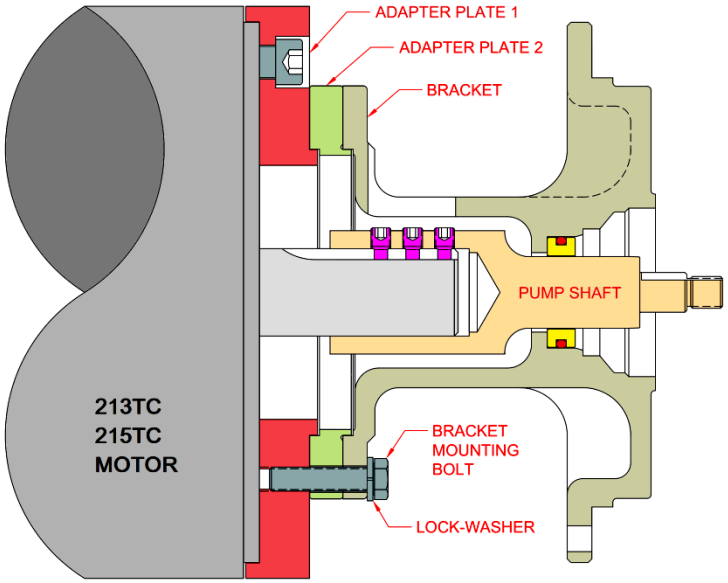
II. NEMA 182TC & 184TC Motor Frames: Install **Adapter 1** (27) to motor using four 1/2-13 x 1 SHCS bolts (30). Then install the **bracket** (3) to the adapter with four sets of 3/8-16 x 1 HHCS bolts (25) and 3/8" lock-washers (26).



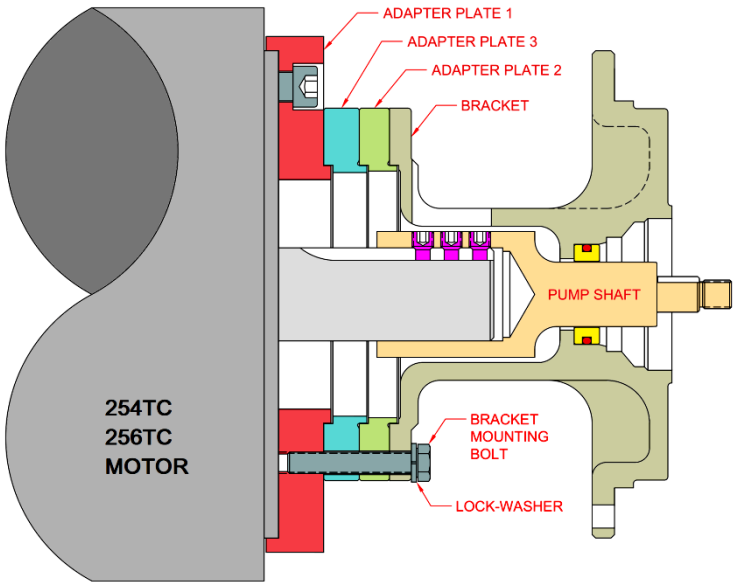
NOTE: Make certain the bracket seats properly on the C-face of the motor or adapter plate and the **LIQUIFLO imprint** on the back of the bracket flange is oriented upwards. Refer to **Appendix 1** for the torque specifications of the fasteners.

Bracket Installation (Continued):

III. **NEMA 213TC & 215TC Motor Frames:** Install **Adapter 1** (27) to motor using four 1/2-13 x 1 SHCS bolts (30). Then place **Adapter 2** (28) onto **Adapter 1** (27). Then install the **bracket** (3) to the adapters with four sets of 3/8-16 x 1-1/2 HHCS bolts (25) and 3/8" lock-washers (26).



IV. **NEMA 254TC & 256TC Motor Frames:** Install **Adapter 1** (27) to motor using four 1/2-13 x 1 SHCS bolts (30). Then place **Adapter 3** (29) onto **Adapter 1** (27). Then place **Adapter 2** (28) onto **Adapter 3** (29). Then install the **bracket** (3) to the adapters with four sets of 3/8-16 x 2-1/4 HHCS bolts (25) and 3/8" lock-washers (26).



NOTE: Make certain the bracket seats properly on the C-face of the adapter plate and the **LIQUIFLO imprint** on the back of the bracket flange is oriented upwards. Refer to **Appendix 1** for the torque specifications of the fasteners.

Mechanical Seal Installation:

5 Install the **Type 9T mechanical seal** (4) as explained below. Refer to drawings on pages 30-32.

a. Pull the shaft out of the bracket as far as possible and then temporarily tighten the setscrews (31) to prevent the shaft from moving axially (see drawing below).

b. 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.

c. 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.)

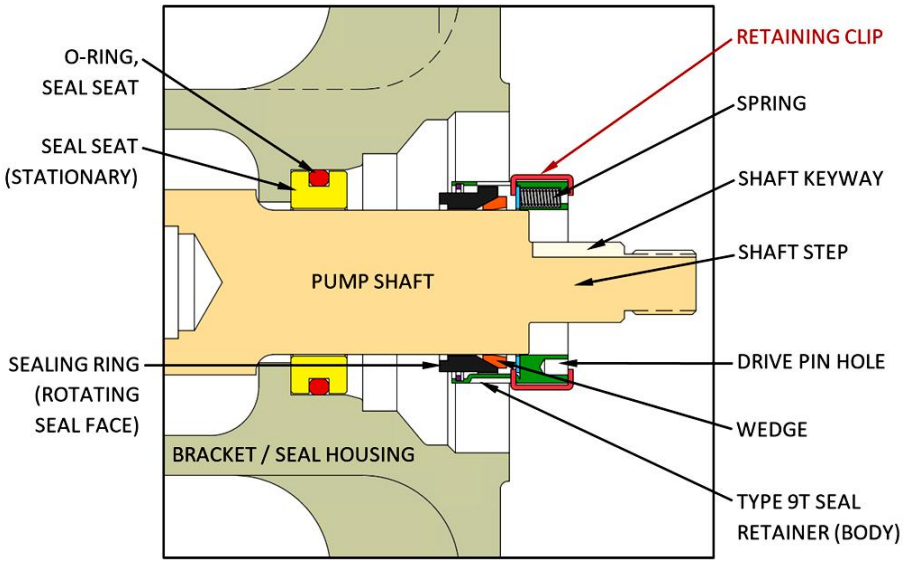
d. Using a small flat screwdriver, carefully **remove all four retaining clips** from the seal.

e. 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: Orientation of the seal pin hole relative to the shaft keyway is required for installing the impeller.

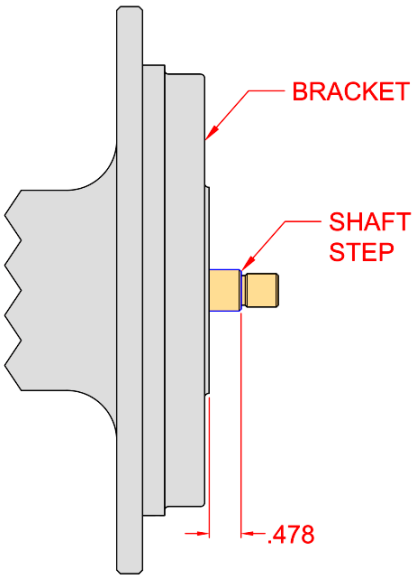
f. Push the mechanical seal into the seal housing until the **seal face** contacts the **seal seat**.

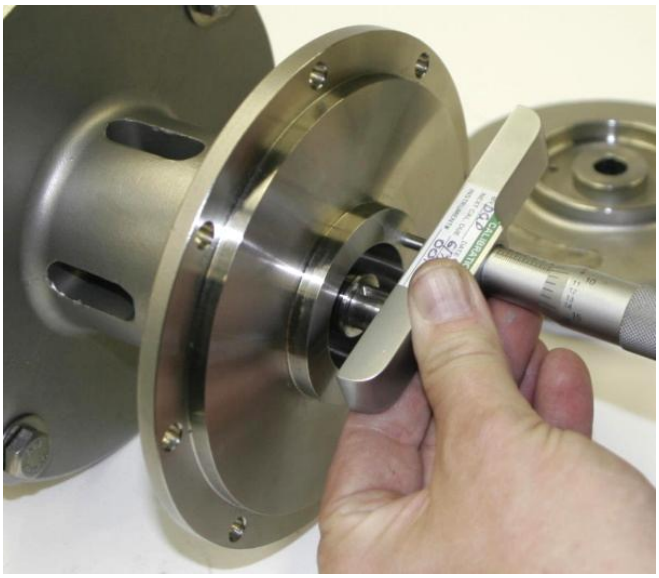
Type 9T Single Mechanical Seal Installation



Pump Shaft Positioning:

6 Position the **pump shaft** (6) so that the end of its step is **0.478"** from the outside face of the bracket (3), as shown in the diagram below.



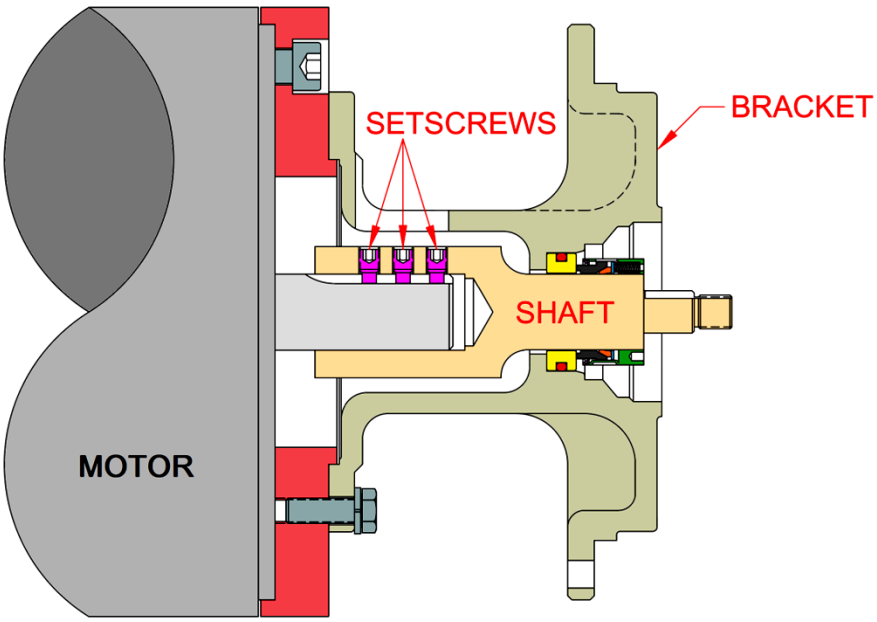


NOTE: This procedure is important for setting the mechanical seal compression and to ensure that the impeller will be centered inside the volute once the pump is completely assembled. A **precision caliper** should be used for this step, as shown in the photo above.

---

7 Being careful not to move the shaft (6), tighten **all three setscrews** (31) on the shaft.

NOTE: After tightening the setscrews, verify the shaft position relative to the bracket, as shown above. A tolerance of **+/- .010"** is acceptable.



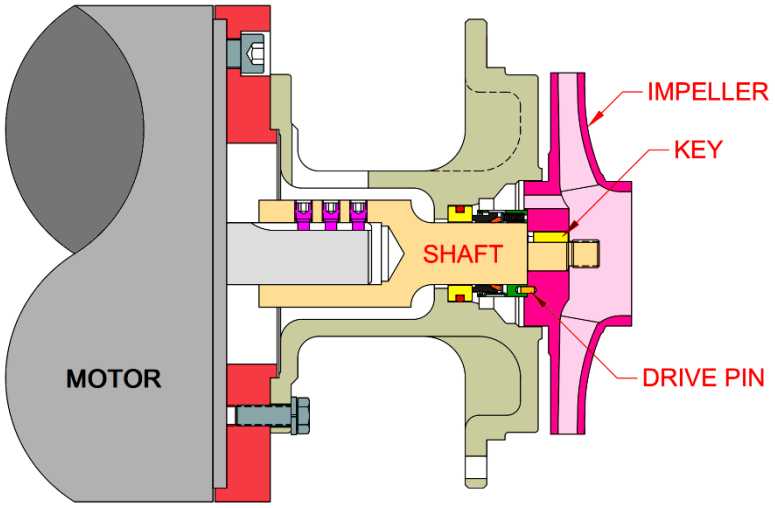
Impeller Installation:

8 Rotate the shaft (6) so that the keyway is facing upwards; then install the **key** (9) onto the shaft.

9 Install **drive pin** (4A) into the impeller (2).

10 Install **impeller** (2) on pump shaft (6) so that the drive pin (4A) engages into the pin hole on the seal body and the impeller contacts the shaft.

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



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11 Attach impeller to end of shaft as follows:

a. Install **washer** (12) on the pump shaft (6).

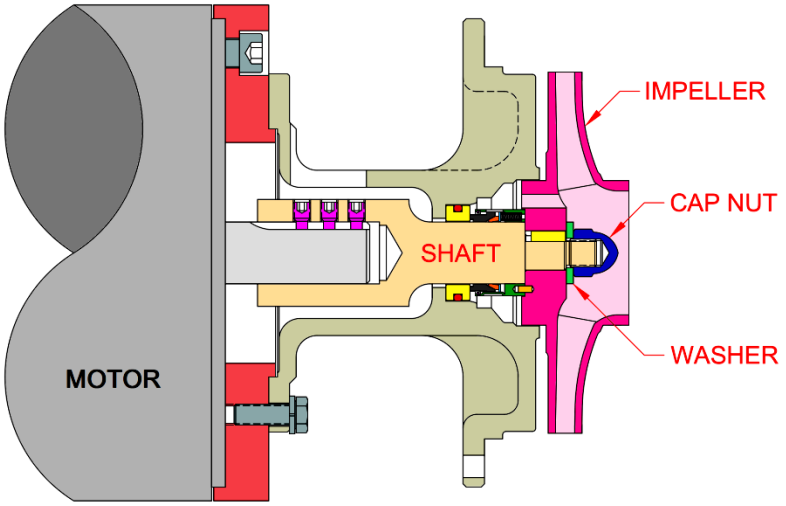
b. Apply **anti-seize compound** to the internal threads of the **cap nut** (11).

c. Install **cap nut** (11) to the external threads of the shaft (6).

d. Torque the **316 SS cap nut** to **240 in-lbs**.


316 SS 1/2" Flat Washer


316 SS 1/2-20 Cap Nut (3/4" Hex)

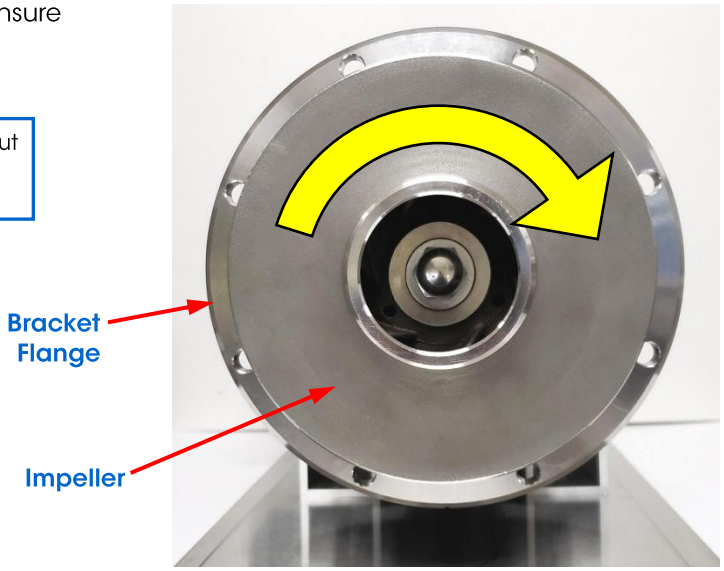


NOTE: The rounded edge of the washer should be facing out, towards the cap nut. A bar can be held in the side of the impeller to prevent the impeller from rotating when tightening the cap nut.

Checking Impeller Rotation:

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

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

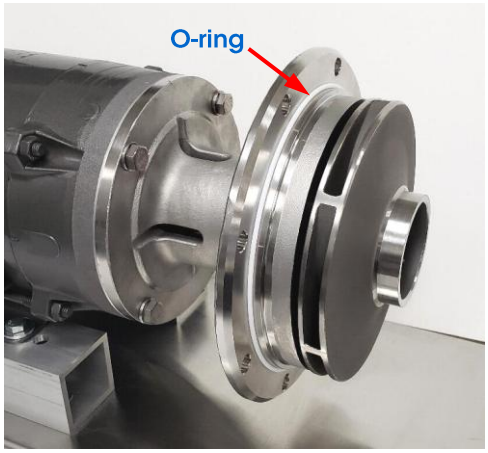


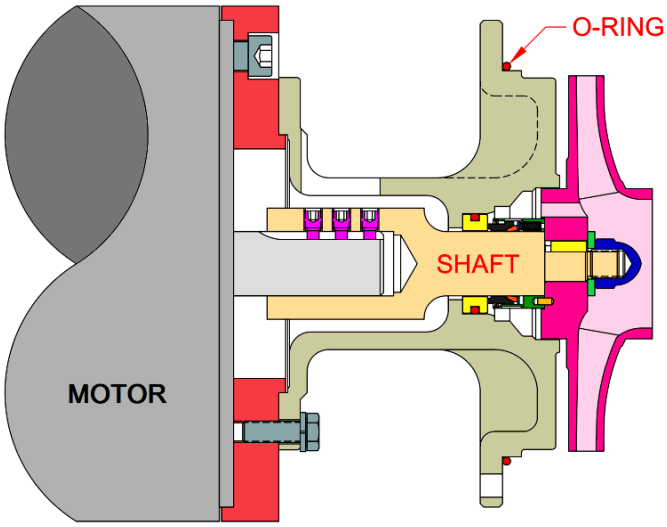
Volute Installation:

13 Install the volute **O-ring** or **gasket** (16).

Caution!
Do not re-use O-rings or gaskets.

NOTE: Be careful not to twist, bend or pinch the O-ring (size 2-166) during installation. The O-ring should seat naturally into position.

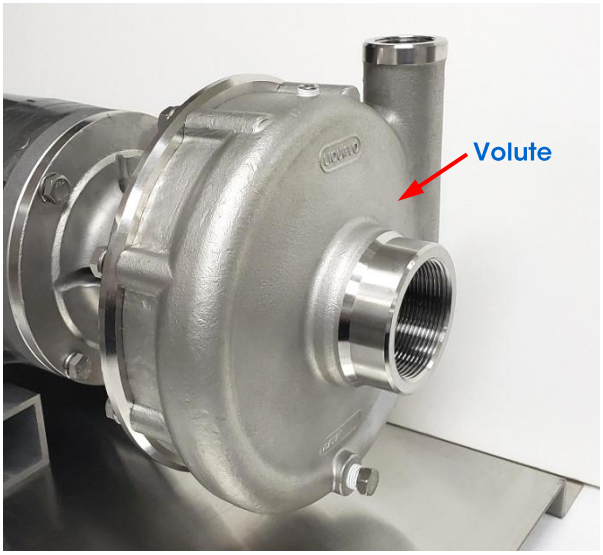


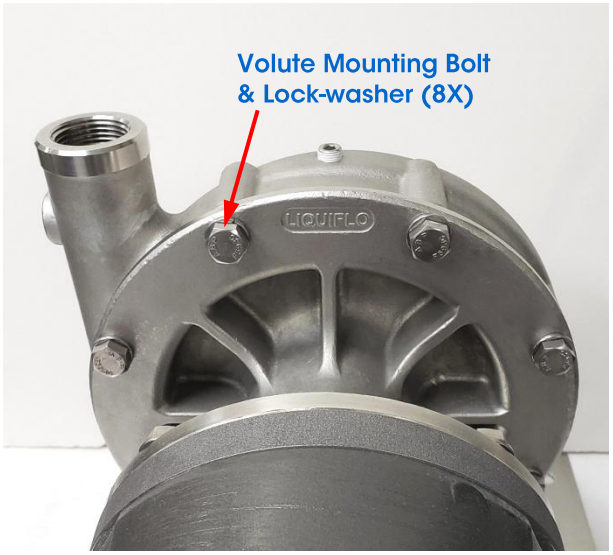


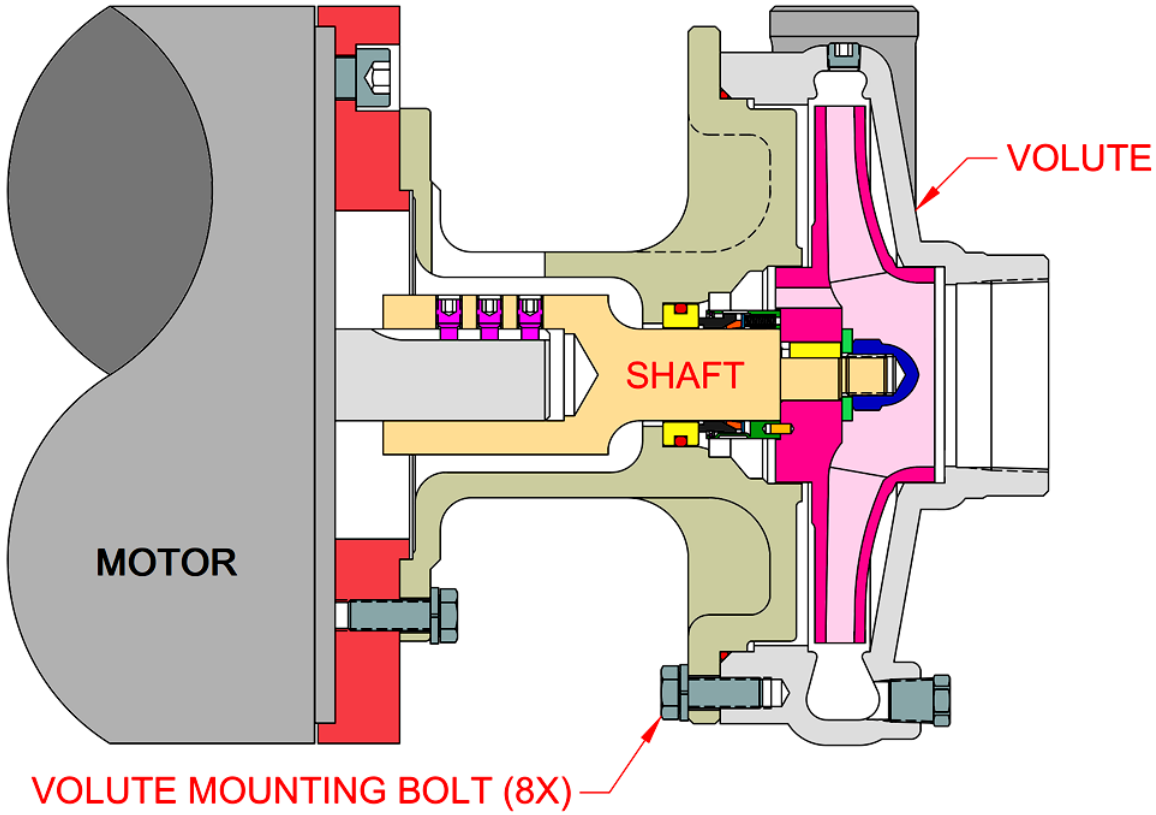
Volute Installation (Continued):

14 Install the **volute** (1) to the bracket (3) using eight sets of bolts (14) and lock-washers (15); then tighten the bolts.

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 surface of the O-ring or gasket. 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.



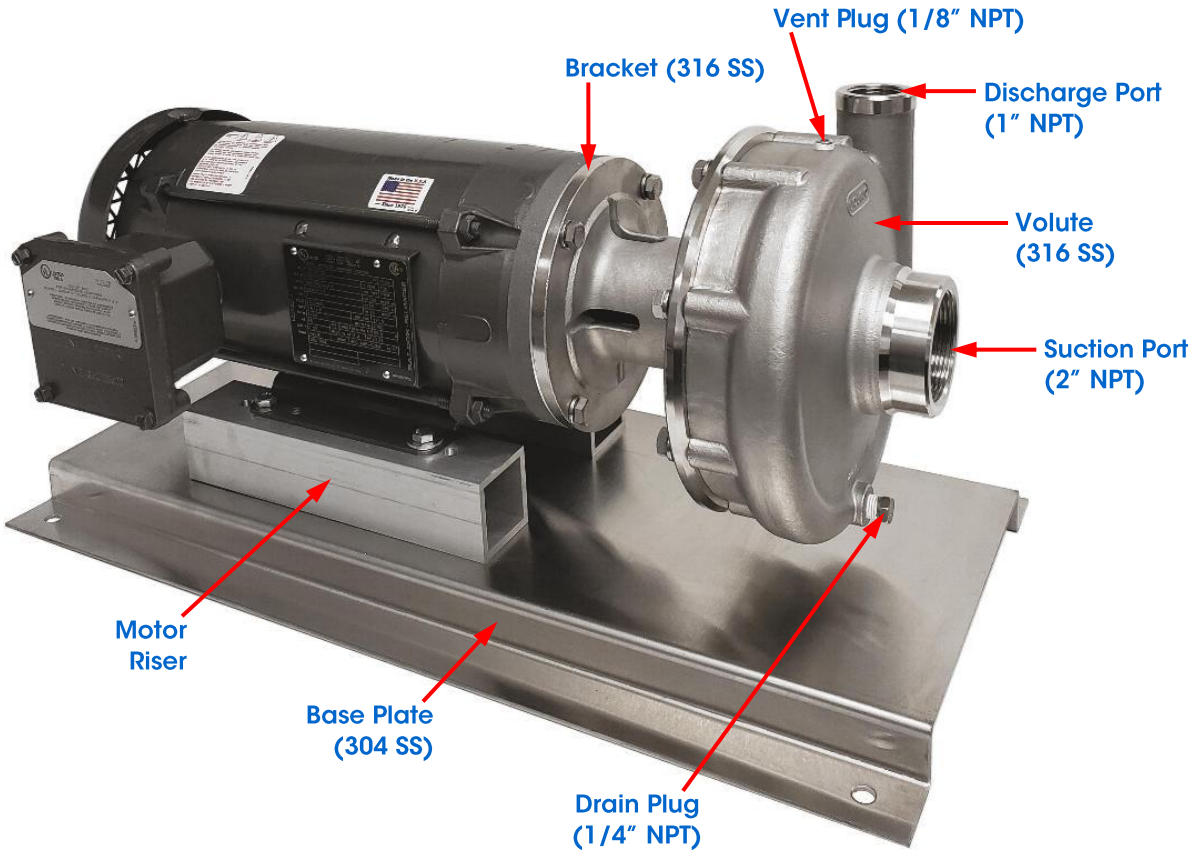




Installation of Plugs:

15 Install the **1/4" NPT drain plug** (18) and the **1/8" NPT vent plug** (19), into the volute (1).

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



Centry® Model 623 Sealed with NPT Ports & Close-Coupled to NEMA 145TC Motor

NOTE: The Standard Base Plate shown above has **Liquiflo Part Number 865032**. It is suitable for NEMA 143TC & 145TC motor frames. It is made of 1/8" thick 304 Stainless Steel with dimensions of 24.0" Length x 12.5" Width x 1.25" Height.

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 to Bracket Assembly	1, 5, 6, 7	3/8-24 UNF x 1	HHCS	8	259	29.3
BOLTS for MOTOR-BRACKET ASSEMBLY:						
Bracket to Motor Assembly	1	3/8-16 UNC x 1	HHCS	4	236	26.7
Adapter 1 to Motor Assembly	5, 6, 7	1/2-13 UNC x 1	SHCS	4	517	58.4
Bracket to Adapter 1 Assembly	5	3/8-16 UNC x 1	HHCS	4	236	26.7
Bracket to Adapter 2 to Adapter 1 Assembly	6	3/8-16 UNC x 1-1/2	HHCS	4	236	26.7
Bracket to Adapter 2 to Adapter 3 to Adapter 1 Assembly	7	3/8-16 UNC x 2-1/4	HHCS	4	236	26.7

Pos. 5 Motor Frame Codes:

1 NEMA 143TC & 145TC
5 NEMA 182TC & 184TC
6 NEMA 213TC & 215TC
7 NEMA 254TC & 256TC

Bolt Types:

HHCS = Hex Head Cap Screw
SHCS = Socket Head Cap Screw

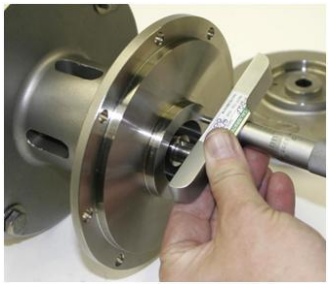
Adapter Plates:

Adapter 1: Part No. SP0046 (attaches to Motor)
Adapter 2: Part No. 859-1 (goes between Adapter 1 and Bracket)
Adapter 3: Part No. 970045 (goes between Adapter 1 and Adapter 2)

NOTE: When anti-seize compound is used on bolt threads, limit tightening torque to 85% of the values given above.

Appendix 2: Maintenance Tool List

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

Tool #	Tool	Function	Photo
1	**Wrench, 9/16"**	For 3/8" HHCS **volute**-to-bracket & **bracket**-to-motor/adapter mounting bolts; and 1/4" NPT Hex Head **drain plug**.	
2	**Ratchet Wrench with 3/4" Hex Socket**	For 1/2" **cap nut** for removing or attaching impeller to shaft.	
3	**Allen Wrench, 1/8" Hex**	For 1/4" **shaft setscrews** (NEMA 143TC & 145TC motor frames).	
4	**Allen Wrench, 5/32" Hex**	For 5/16" **shaft setscrews** (NEMA 182TC thru 215TC motor frames).	
5	**Allen Wrench, 3/16" Hex**	For 3/8" **shaft setscrews** (NEMA 254TC & 256TC motor frames) & 1/8" NPT Socket Head **vent plug**.	
6	**Allen Wrench, 3/8" Hex**	For 1/2" SHCS **Adapter 1** mounting bolts (NEMA 182TC thru 256TC motor frames).	
7	**Precision Caliper**	For setting shaft position relative to bracket (which will center the impeller inside the volute).	

Appendix 3: Pump Bill of Materials (BOM)

BOM for Centry® Model 623 – Sealed

Drawing Ref. #	Part Description		Material	Model 623 Part No.	Qty.
1	Volute	Threaded (NPT)	316 SS	623101	1
		Flanged (ANSI 150# RF)	316 SS	623111	
2	Impeller	6.56" Dia. (Full Size)	316 SS	623400	1
		6.00" Dia. (Reduced Size)	316 SS	623401	
		5.50" Dia. (Reduced Size)	316 SS	623402	
		5.00" Dia. (Reduced Size)	316 SS	623403	
		4.50" Dia. (Reduced Size)	316 SS	623404	
3	Bracket	NEMA 143TC & 145TC	316 SS	623200	1
4	**Single Mechanical Seal (Type 9T)***		316 SS/Carbon	623500	1
			316 SS/Teflon	623501	
4A	Drive Pin, Mechanical Seal		316 SS	622750	1
5	**Seal Seat ***		SiC	990062	1
6	**Shaft ***	7/8" Bore (NEMA 143TC & 145TC)	316 SS	623301	1
		1-1/8" Bore (NEMA 182TC & 184TC)	316 SS	623302	
		1-3/8" Bore (NEMA 213TC & 215TC)	316 SS	623303	
		1-5/8" Bore (NEMA 254TC & 256TC)	316 SS	623304	
9	Key, Impeller		316 SS	970010	1
11	Nut, Impeller (1/2-20 Cap Nut)		316 SS	623850	1
12	Washer, Impeller (1/2 Flat)		316 SS	623851	1
14	Bolt, Volute (3/8-24 x 1 HHCS)		18-8 SS	623700	8
15	Lock-washer, Volute (3/8)		18-8 SS	S1004	8
16	**O-ring/Gasket, * Volute**	O-ring (2-166)	Teflon	623601	1
		O-ring (2-166)	Viton	623602	
		Gasket	Graphoil	623603	
		O-ring (2-166)	EPDM	623605	
		O-ring (2-166)	FFKM 4079	623604	
17	**O-ring, Seal Seat (2-222) ***		Viton	990030	1
			EPDM	990031	
			FFKM 4079	990047	
18	Plug, Drain (1/4 NPT Hex Head)		316 SS	641317	1
19	Plug, Vent (1/8 NPT Socket Head)		316 SS	362308	1
25	Bolt, Bracket to Motor [1]	NEMA 143TC & 145TC	18-8 SS	620825	4
	Bolt, Bracket to Adapter(s) [1]	NEMA 182TC & 184TC	18-8 SS	620825	
		NEMA 213TC & 215TC	18-8 SS	620833	
		NEMA 254TC & 256TC	18-8 SS	620839	
26	Lock-washer, Motor/Adapter (3/8)		18-8 SS	S1004	4
27	**Adapter Plate 1** (NEMA 182TC thru 256TC)		Al, Anodized	SP0046	1
28	**Adapter Plate 2** (NEMA 213TC thru 256TC)		Al, Anodized	859-1	1
29	**Adapter Plate 3** (NEMA 254TC & 256TC)		Al, Anodized	970045	1
30	Bolt, Adapter 1 to Motor (1/2-13 x 1 SHCS)		18-8 SS	641105	4
31	Setscrew, Shaft (1/4-28 x 1/2 SHSS-FD)	143TC/145TC	Carbon Steel	623720	3
	Setscrew, Shaft (5/16-24 x 1/2 SHSS-FD)	182TC-215TC	Carbon Steel	623721	
	Setscrew, Shaft (3/8-24 x 1/2 SHSS-FD)	254TC/256TC	Carbon Steel	623722	

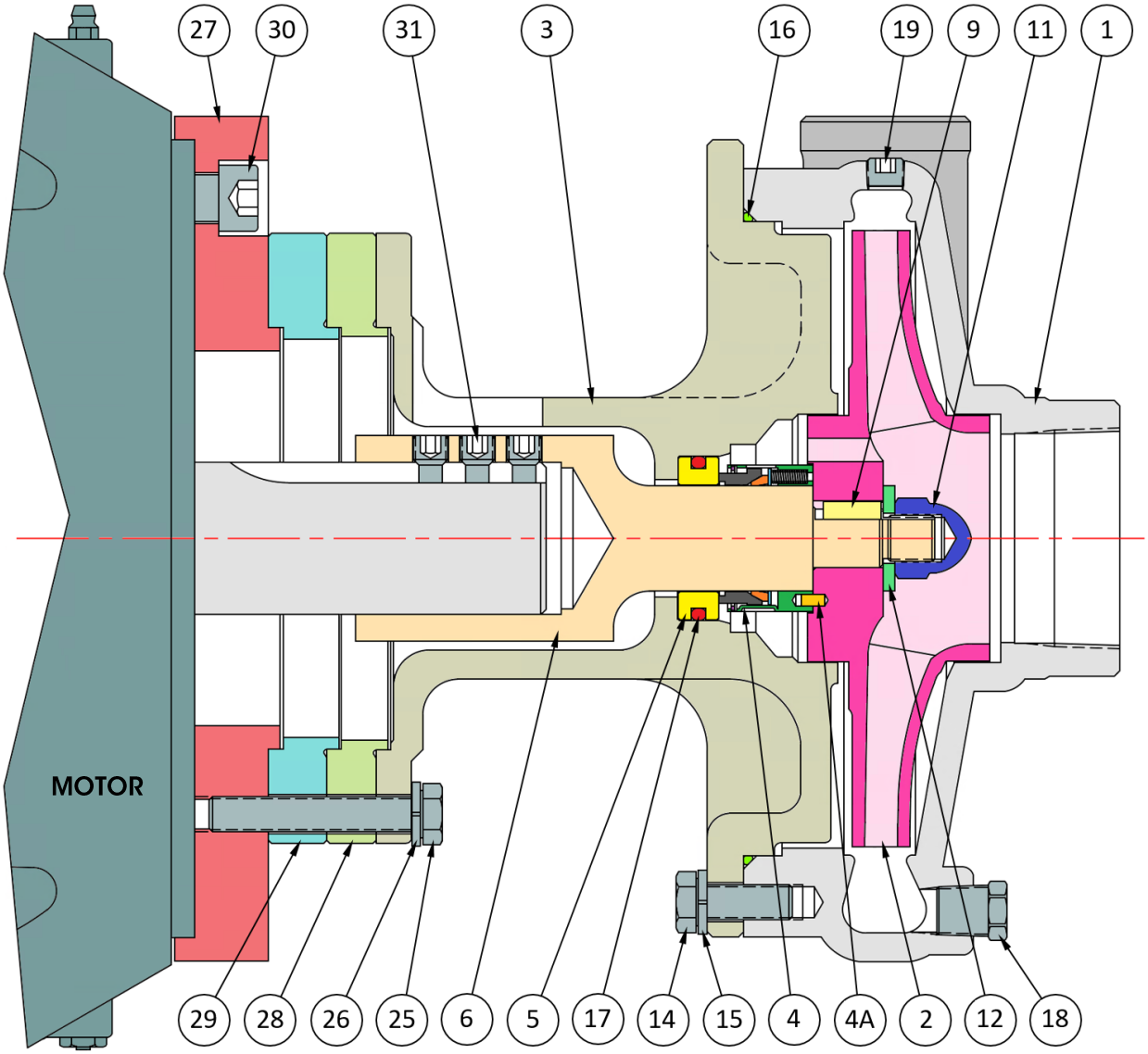
* Primary repair components.

1 See **Appendix 1** for Motor Bolt information.

NOTE: Drawing Reference Numbers above correspond to Reference Drawings on pages 30-31.

Appendix 4: Reference Drawings

Sectional Drawing #1 – Model 623 with SINGLE MECHANICAL SEAL, Type 9T

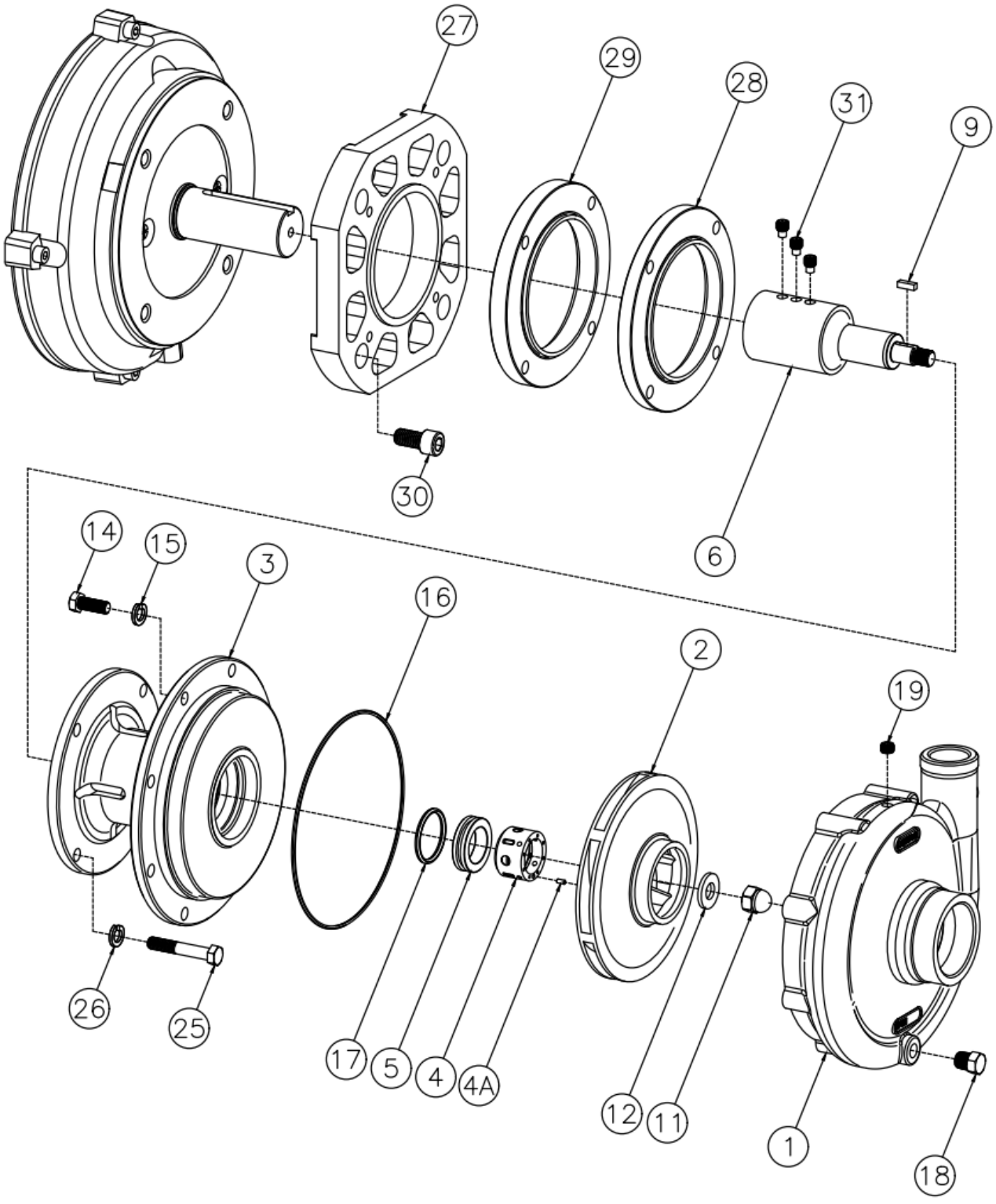


Ref. #	Description	Qty.	Ref. #	Description	Qty.
1	Volute	1	16	O-ring (2-166)/Gasket, Volute	1
2	Impeller	1	17	O-ring, Seal Seat (2-222)	1
3	Bracket / Seal Housing	1	18	Plug, Drain (1/4 NPT Hex Head)	1
4	Single Mechanical Seal (Type 9T)	1	19	Plug, Vent (1/8 NPT Socket Head)	1
4A	Pin, Drive, Mechanical Seal	1	25	Bolt, Motor or Adapter(s) (3/8-16 HHCS) [1]	4
5	Seal Seat	1	26	Lock-washer, Motor or Adapter(s) (3/8)	4
6	Shaft	1	27	Adapter Plate 1 (182TC thru 256TC)	1
9	Key, Impeller	1	28	Adapter Plate 2 (213TC thru 256TC)	1
11	Nut, Impeller (1/2-20 Cap Nut)	1	29	Adapter Plate 3 (254TC & 256TC)	1
12	Washer, Impeller (1/2 Flat)	1	30	Bolt, Adapter 1 to Motor (1/2-13 x 1 SHCS)	4
14	Bolt, Volute (3/8-24 x 1 HHCS)	8			
15	Lock-washer, Volute (3/8)	8	31	Setscrew, Shaft [2]	3

1 See **Appendix 1** for bolt lengths. **2** See **Appendix 3** for setscrew information.

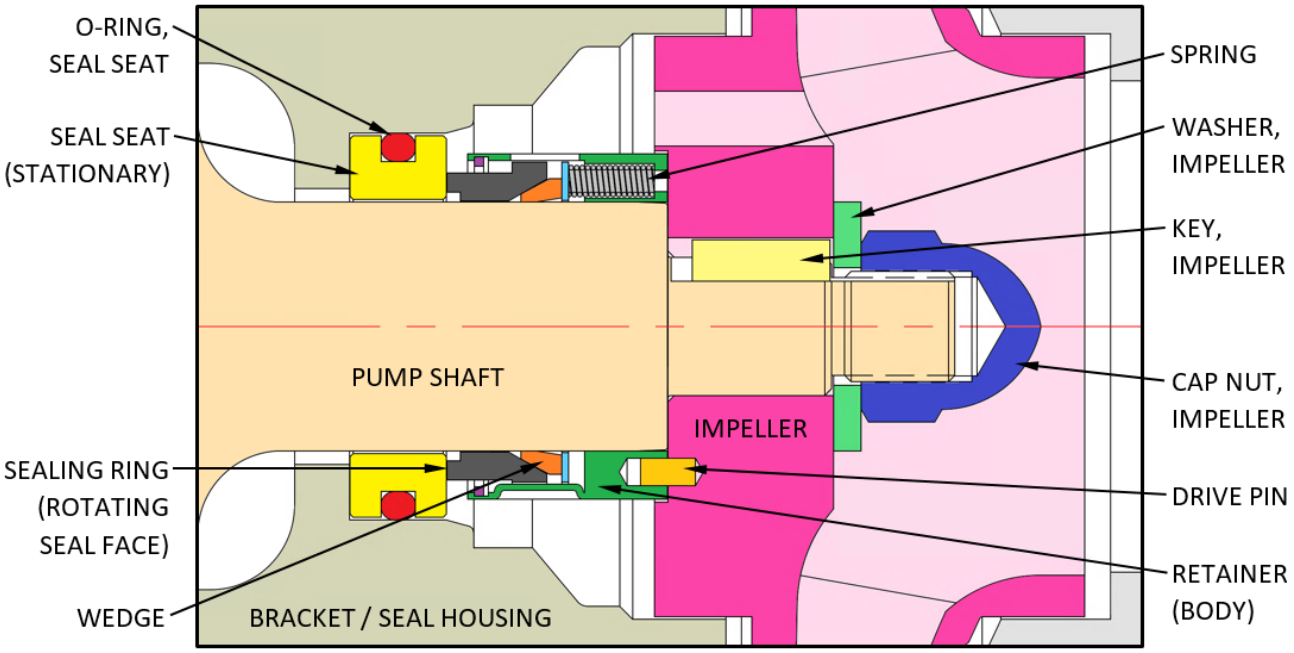
Appendix 4: Reference Drawings (Continued)

Exploded View Drawing – Model 623 with SINGLE MECHANCIAL SEAL, Type 9T



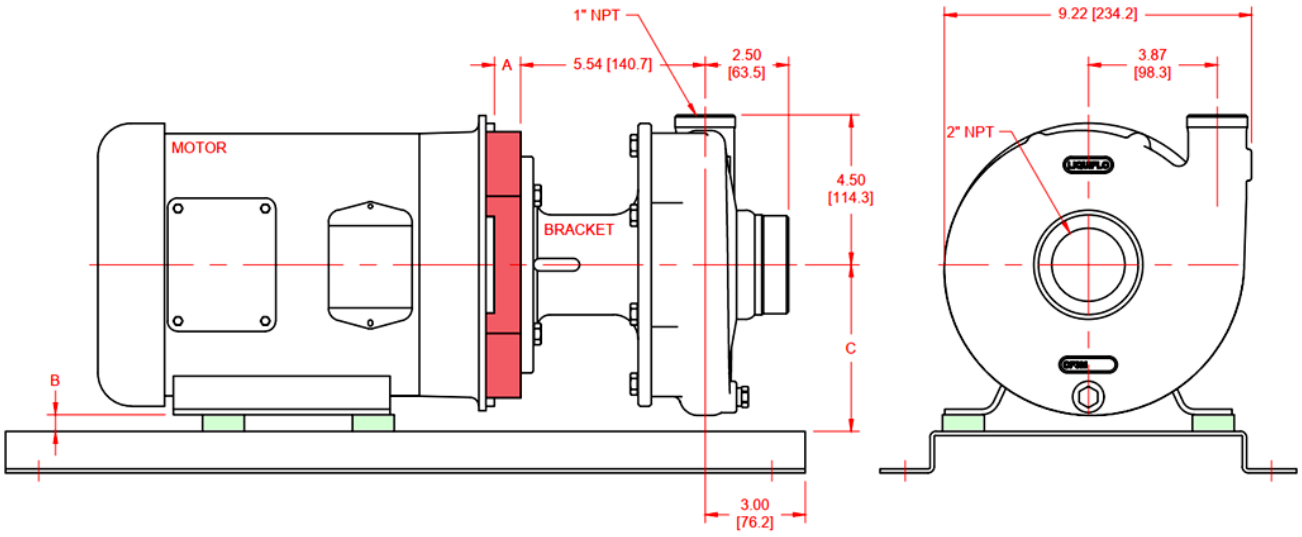
Appendix 4: Reference Drawings (Continued)

Sectional Drawing #2 – SINGLE INTERNAL MECHANICAL SEAL, Type 9T

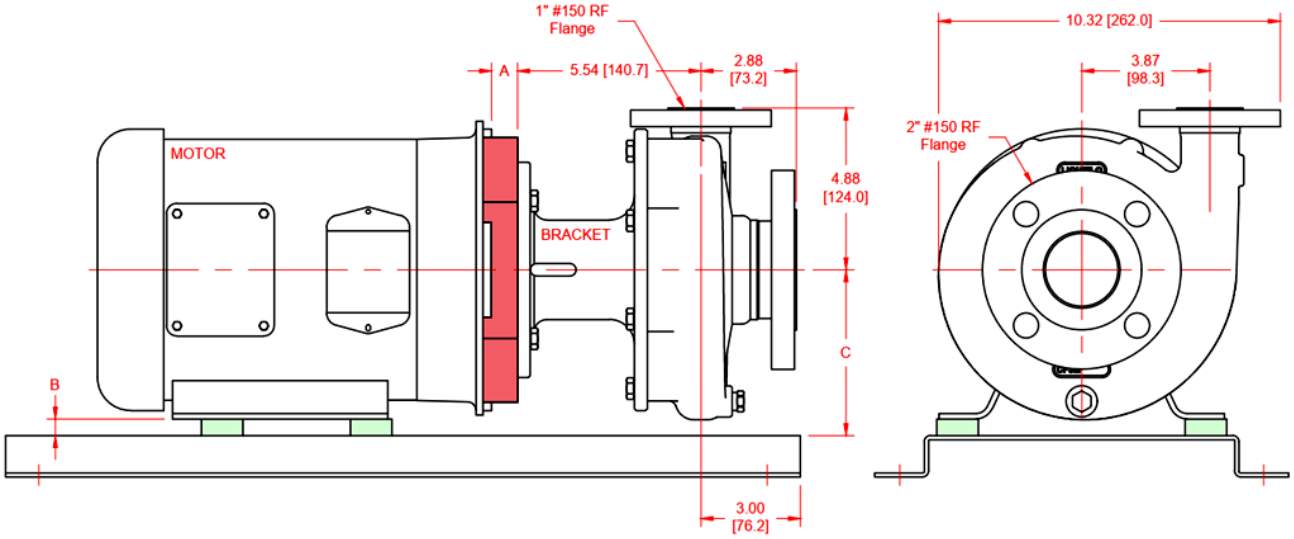


Appendix 4: Reference Drawings (Continued)

Dimensional Drawing #1 – Centry® Model 623-Sealed with Threaded Ports



Dimensional Drawing #2 – Centry® Model 623-Sealed with Flanged Ports



Dimensional Data: inches [mm]

NEMA Motor Frame	A	B	C	Adapter Plates Required
143TC & 145TC	–	1.50 [38.1]	5.00 [127.0]	–
182TC & 184TC	0.79 [20.0]	0.50 [12.7]	5.00 [127.0]	Adapter 1
213TC & 215TC	1.29 [32.7]	–	5.25 [133.3]	Adapters 1 & 2
254TC & 256TC	1.91 [48.5]	–	6.25 [158.8]	Adapters 1, 2 & 3

NOTES:

1. **A** Dimension is effective width of Adapter Plate(s).
2. **B** Dimension is height of Motor Risers.
3. Motor back should not extend beyond base.
4. **Adapter 1** attaches to motor with four bolts.
5. **Adapter 2** goes between **Adapter 1** & Bracket.
6. **Adapter 3** goes between **Adapter 1** & **Adapter 2**.

Appendix 5: Troubleshooting Guide

Troubleshooting Guide – Part 1

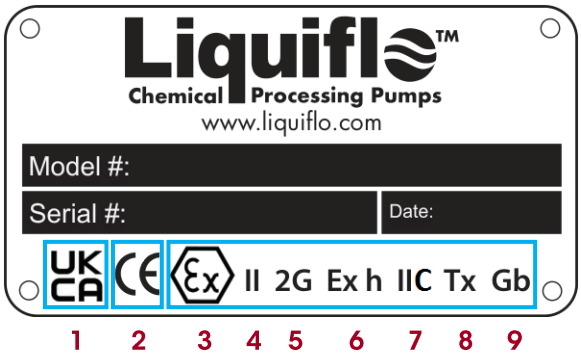
Problem	Possible Cause	Corrective Action
No discharge	Pump not primed	Verify suction pipe is submerged. Increase suction pressure. Open suction valve.
	Wrong direction of rotation	Reverse motor leads.
	Valves closed	Open all suction and discharge valves.
	Bypass valve open	Close bypass valve.
	Air leak 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 5: 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 6: 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	IIC	This marking indicates that the pump is suitable for use in atmospheres containing **Ignitable Gases: Group IIC** (e.g., hydrogen, acetylene, CS_2 or gases of similar hazard).
8	Tx	This marking indicates the **Temperature Class** (Maximum Allowable Surface Temperature) of the pump which depends on the materials of construction. **It is the responsibility of the operator to ensure that the fluid temperature does not exceed the maximum use temperature of the pump's materials.** Refer to ATEX document on Liquiflo website.
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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