Ampco Pumps Company

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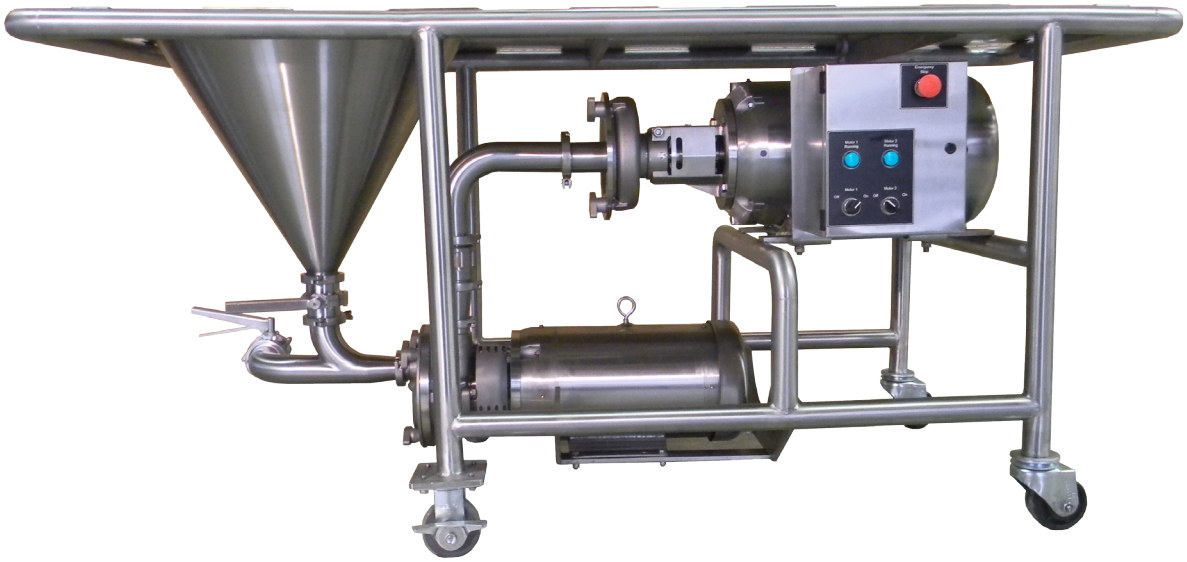
AMPCO PM MIXER
OPERATION AND MAINTENANCE MANUAL



THIS MANUAL CONTAINS:

- AMPCO PM MIXER OPERATION AND MAINTENANCE MANUAL
- AMPCO SBH SHEAR PUMP OPERATION AND MAINTENANCE MANUAL
- AMPCO SP SERIES PUMP OPERATION AND MAINTENANCE MANUAL

Operating Instructions
Ampco Pumps Company PM Mixer

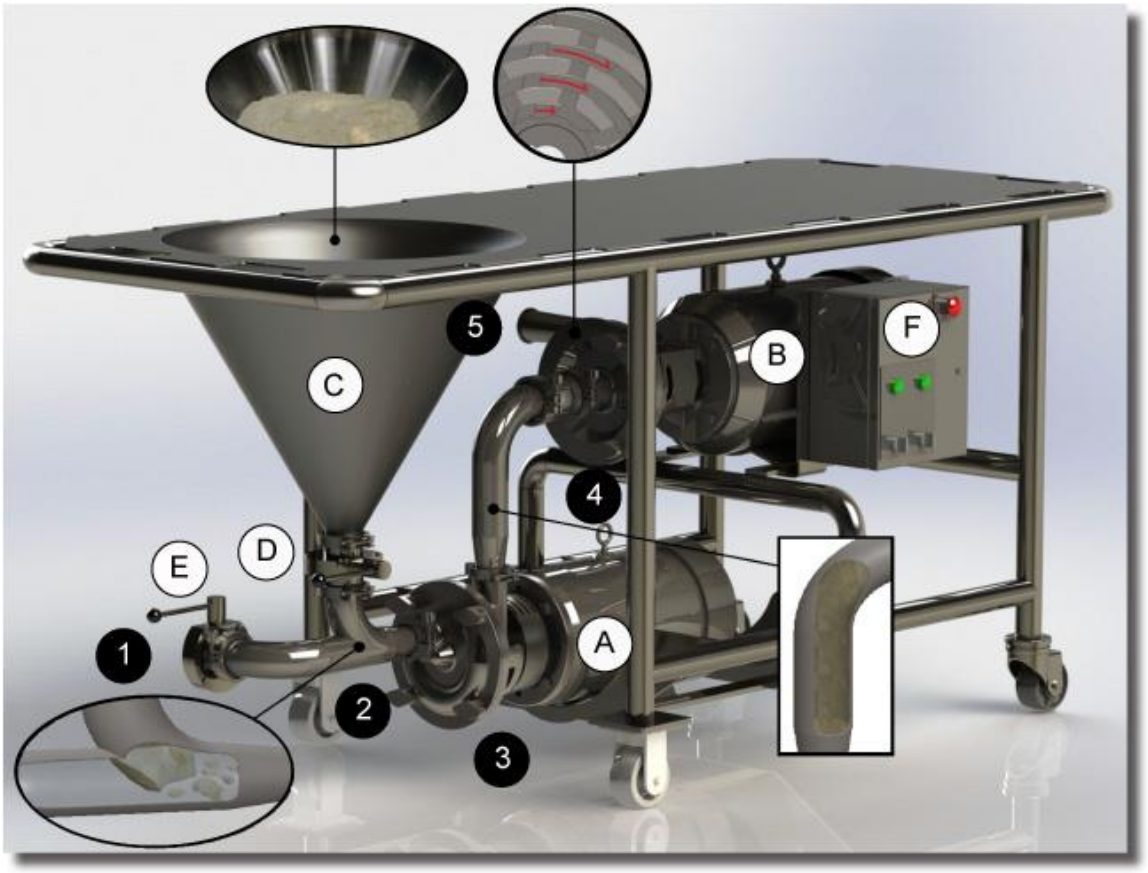
Ampco's PM Mixer is a proven design that includes a liquid ring pump and a shear blender for fast blending. The easy use design provides high-performance blending of wet and dry ingredients into one fluid stream.

Because the SP Liquid Ring Pump provides consistent suction from the hopper, there is no plugging of product in the inlet flow area. The powder addition rate is steady, even when viscosity increases.

The rotor-stator design of the SBH Shear Pump provides smooth blending of product, eliminating lumps and clumps and offers repeatable batch-to-batch blending.

How It Works

1) The fluid from the batch tank is drawn in from the SP liquid ring pump
2) Powder and fluid meet in the induction tube when the hopper's valve is opened
3) Mixing begins in the SP pump – the mixture flows through a short transfer tube into the Shear Pump
4) The Shear Pump (SBH) runs at high speed to thoroughly continue to mix the fluid and powder
5) The final mixture is then pumped to a batch or process tank



A - Ampco SP Liquid Ring Pump
B - Ampco SBH Shear Pump
C - Powder Hopper
D - Powder Control Valve
E - Fluid Control Valve
F - Dual-Motor Starter

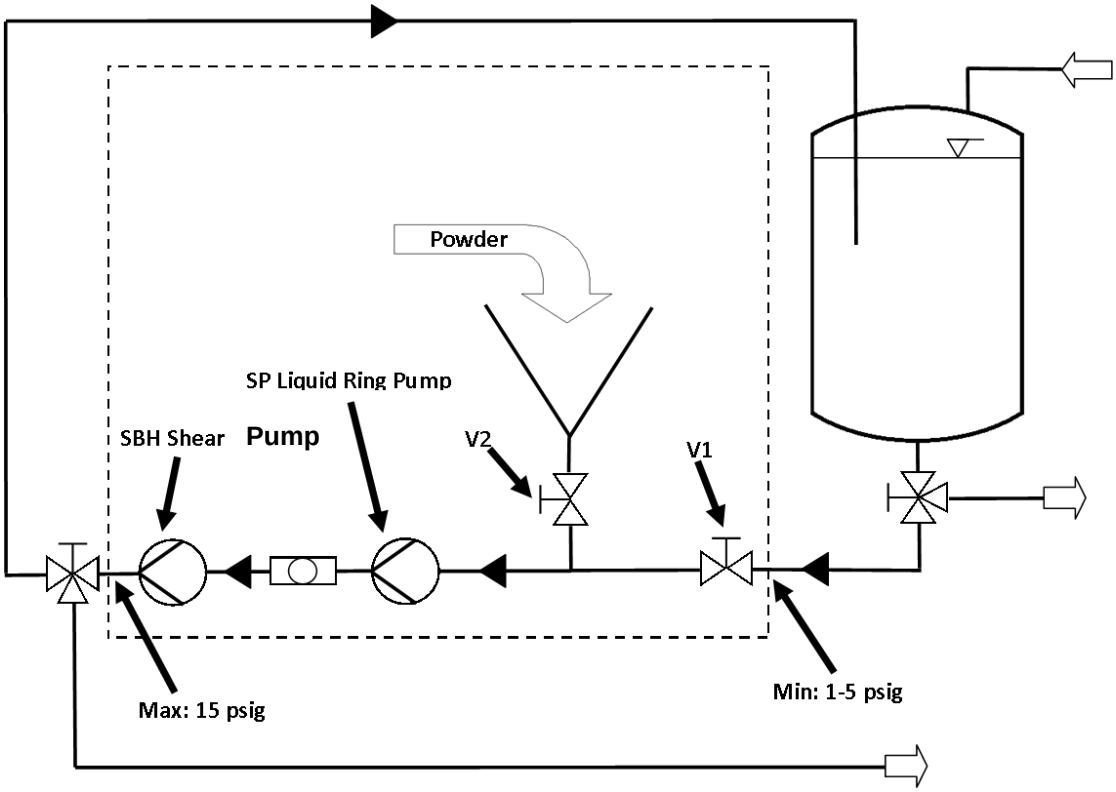
Placement and Set-up of the PM Mixer

To prevent suction head loss, be sure the PM Mixer is no more than ten (10) feet from the mixing tank. Study the drawing below. Check the system pressures listed. These pressures must be established so the PM mixer operates at its optimum efficiency

* In front of the liquid control valve (V1), pressure should be 1 to 5 psig.

*Placement of the PM Mixer more than ten feet from the batch tank may require using a feed pump to the mixer. If a feed pump is required, it is recommended that you use a balance tank to dissipate the pressure at the inlet of the mixer.

*Discharge pressure should be no more than 15 psig for the SBH Shear Pump. If the discharge pressure is higher than the 15 psig, it is recommended you add a booster pump to move the product from the mixer.



Due to the high vacuum created at the suction of the PM Mixer, it is recommended suction rated hoses are used on the inlet side of the mixer. Ampco also recommends using hoses of like size to the inlet and outlet ports of mixer.

Electrical Hook-up of the PM Mixer

Control panels on the PM Mixer are standard NEMA 3R & 12 and require 40 or 60 amps at 460 volts. Control panels can be customized to suit customer requirements. See chart below for voltage, volt, and amperage for each model.

	SP Liquid Ring Pump		SBH Shear Pump		Electrical Specifications	
Model	**Model**	**HP**	**Model**	**HP**	**Volts**	**Amps**
PM 210/522	210	7.5	522	10	460	23
PM 215/532	215	10	532	20	460	36
PM 220/532	220	10	532	20	460	36
PM 225/542	225	20	542	50	460	74
PM 225/552	225	20	552	60	460	92

For electrical hook up to the control box, run the electrical cord through the access hole in the bottom of the box. Connect the cord to the terminals near the main switch in the control panel.

A check should be made that the pumps have the correct impeller rotation. To do so, first shut the throttling valve (V1). Fill the unit with water until the water is visible in the sight glass. Mechanical seals should be completely wetted. Running the pumps dry can result in seal damage.

Switch on both the SP Liquid Ring pump and the SBH Shear Pump for a brief time to check the rotation. The direction of the rotation should be clockwise when viewing from the fan end of the motor. If the rotation is incorrect, switch the wires fed into the control panel.

Operating the PM Mixer

1. Shut the valve for the powder inlet (2).
2. Allow liquid to flow from the tank to the mixer by fully opening the liquid control valve (1)
3. Turn on the SP Liquid Ring (3) pump and circulate the base liquid until there is full flow.
4. Turn on the SBH Shear Pump (4).
5. To allow sufficient vacuum to build, the liquid control valve (1) should be closed to approximately 50%. To decrease the vacuum and slow down the flow of the powder into the mix, slowly open the liquid control valve.
6. Open the valve for the powder inlet (2). Check the suction by placing the back of your hand over the opening at the bottom of the hopper. If there is not sufficient suction or liquid is coming up through the hopper, slowly close the liquid control valve (1) until you achieve sufficient suction.
7. Close the valve for the powder inlet (2).
8. Fill the hopper with powder.
9. Slowly open the valve for the powder inlet (2).
10. To prevent air from being drawn into the product, close the valve for the powder inlet as soon as the hopper is empty.
11. If the product is shear-sensitive, the SBH Shear Pump should be shut off immediately.
12. Product may be circulated back through the mix for more blending.

Note: Products like gums or pectins that swell require that you add the powder slowly so the pumps do not plug. To slow the addition of these powders, open the liquid control valve (1) to reduce vacuum. The valve for the powder inlet valve (2) should be only partially opened.

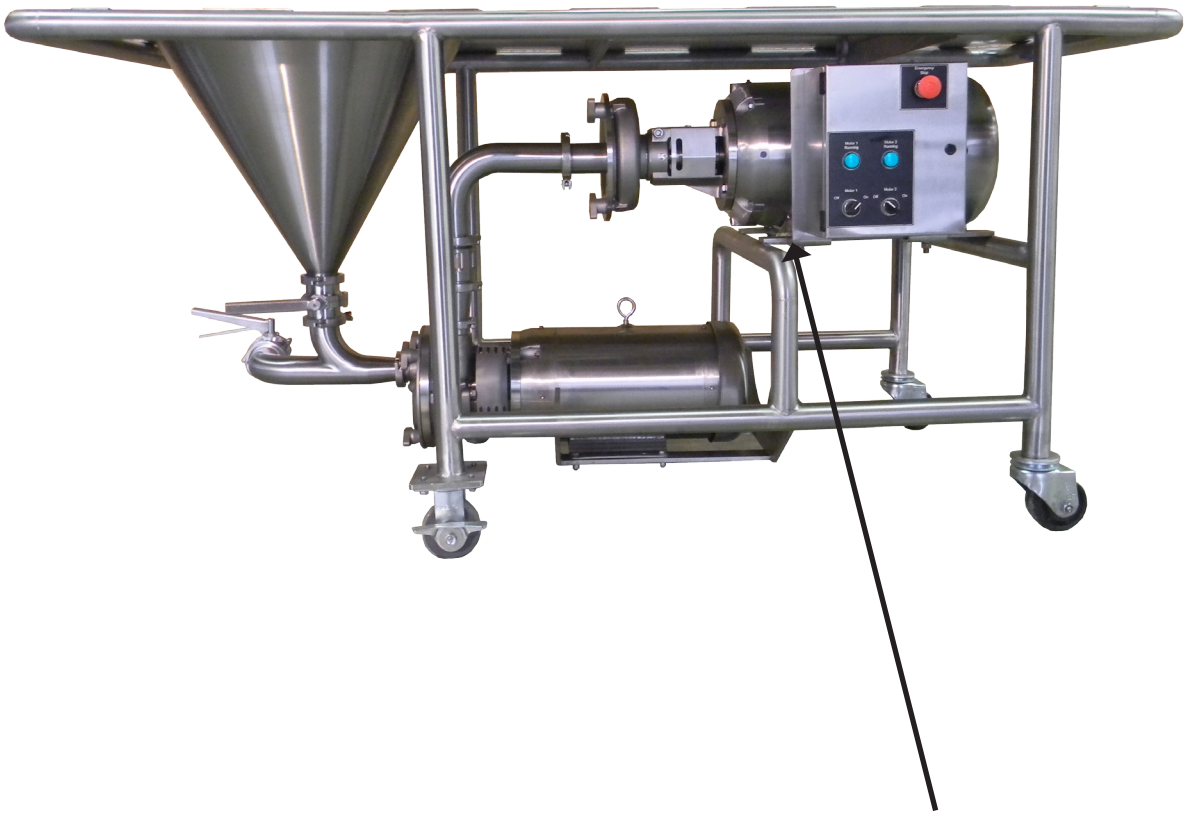
Clean and Care of the PM Mixer

The PM Mixer should be cleaned after every use. If not properly cleaned, product residue may dry on the mechanical seal faces of the pumps and cause damage when the mixer is next started.
The mixer may be included in an existing CIP system. The hopper, induction tube and control valves should be cleaned by hand after being removed from the unit. Simply disconnect the clamps and remove the pieces.

SPARE PARTS LIST

Part Number	Description
B5101E250CC-C	Butterfly Valve 2.5 in. 316L (Valve Seat: Contact Factory)
S1100-2.50-BB	Sight Glass 316L (Borosilicate Sight Glass with Buna Gaskets)
13MHHM200	2.0 in. Single Pin Heavy Duty Clamp
13MHHM250	3.0 in. Single Pin Heavy Duty Clamp
40MPF-U200	2.0 in. Clamp Gasket – Buna
40MPF-U250	2.5 in. Clamp Gasket – Buna

AMPCO SBH SHEAR PUMP
OPERATION AND MAINTENANCE MANUAL



AMPCO SBH SHEAR PUMP

Ampco Pumps

SB & SBH Series Pumps

Instruction & Maintenance Manual

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TECHNICAL DATA

SPECIFICATIONS

MAXIMUM INLET PRESSURE……...……150 PSIG /10.3 BAR
TEMPERATURE RANGE……...-40º F → 400º F
-40º C → 204º C

MATERIALS OF CONSTRUCTION

Casing……..……..….AISI 316L STAINLESS STEEL
Cover …..……...….AISI 316L STAINLESS STEEL
Impeller ……..……AISI 316L STAINLESS STEEL
Seal Driver……..……..……...……...….AISI 316L STAINLESS STEEL
Adapter……....……..……..……...…….AISI 304 STAINLESS STEEL
O-RINGS & GASKETS……..……...……..……VITON (standard)
Optional Materials……..……....EPDM, BUNA (others per request)

PRODUCT CONTACT SURFACE FINISH…..…….……32Ra (standard)

SEAL

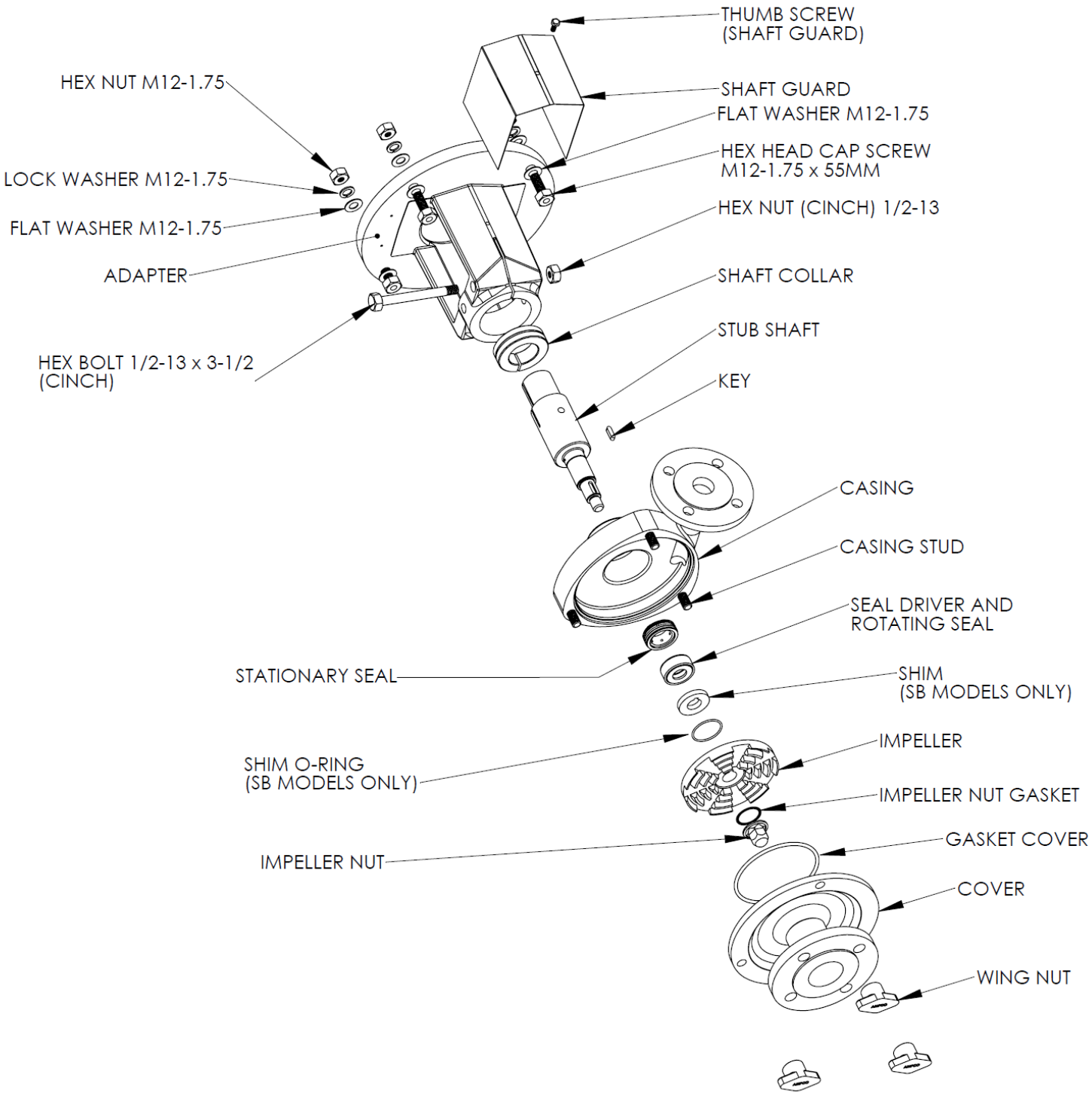
Type……...……..…..INTERNAL SINGLE MECHANICAL
Stationary Seal Material……...SILICON CARBIDE
Rotating Seal Material…….……..……SILICON CARBIDE

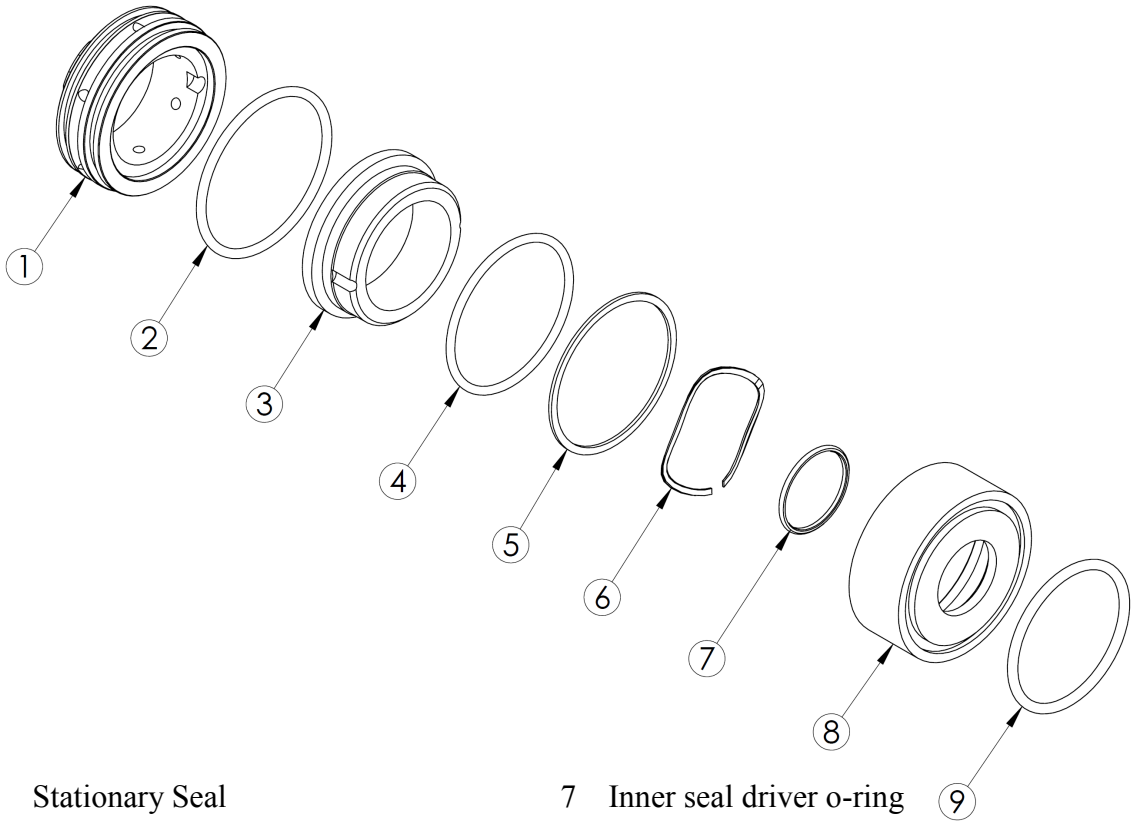
RECOMMENDED TORQUE VALUES

Impeller nut..……..……40ft-lbs.
Adapter Clamping bolt……...……...…55ft-lbs / 75N-m
Adapter Cap Screws
NEMA 56C-140TC/ IEC 80-112....…… ……..……20ft-lbs / 27N-m
NEMA 180TC-280TC/ IEC 132-200…….50ft-lbs / 68N-m
NEMA 320TC-360TC……110ft-lbs / 149N-m
Shaft Collar Socket Head Cap Screws
NEMA 56C-140TC/ IEC 80-112....…… ……..……..…...6ft-lbs / 8N-m
NEMA 180TC-280TC/ IEC 132-200……15ft-lbs / 20.5N-m
NEMA 320TC-360TC……40ft-lbs / 54N-m
Socket Head Cap Screw Size For Shaft Collar
NEMA 56C-180TC……..…….... 3/16” Hex socket
NEMA 210TC-280TC……...……...……..1/4” Hex socket
NEMA 320TC-360TC…….……5/16” Hex socket
IEC 80-200....…… ……..……..……...…...6mm Hex socket
IEC 225…….……8mm Hex socket

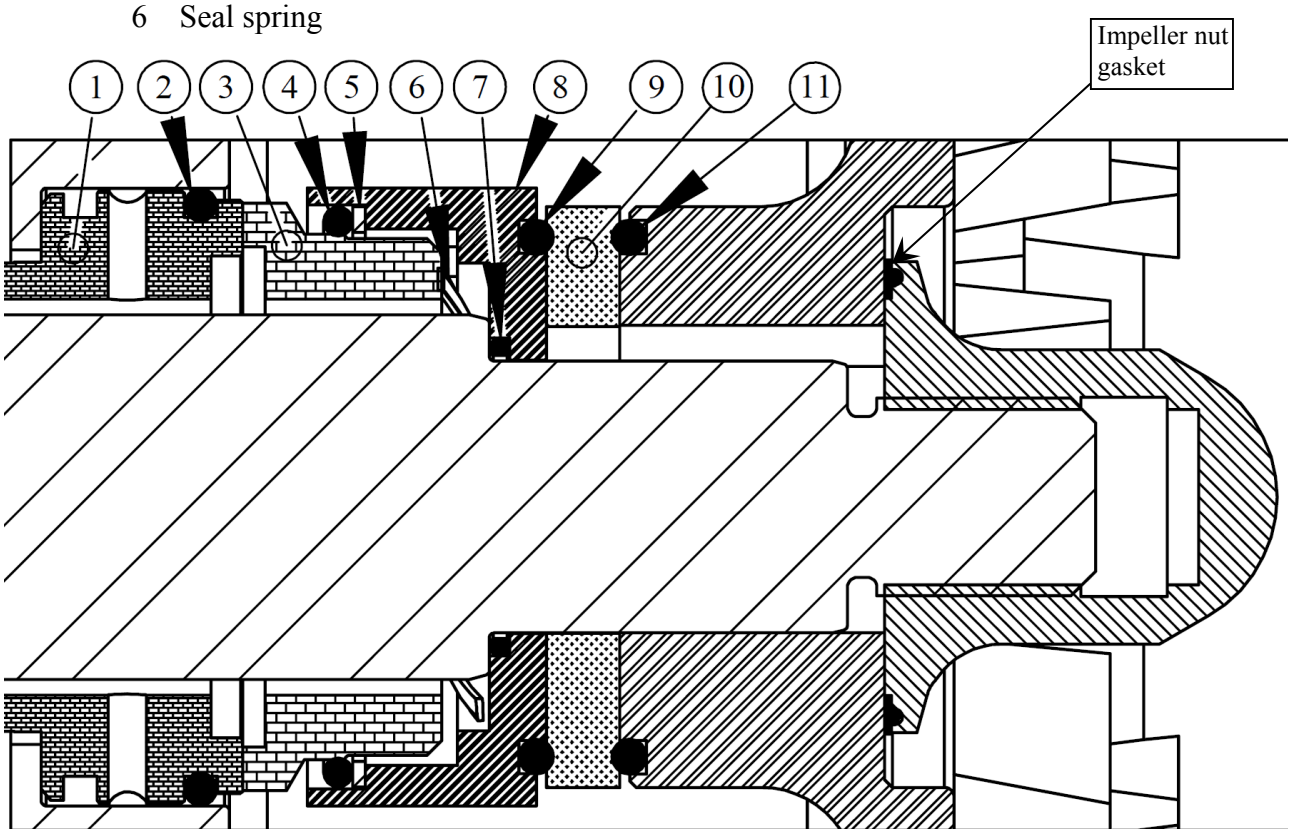
IMPELLER CLEARANCE

R (round internal cavity) SB and SBH pumps…..……....0.02” / 0.5mm
V (volute) SB and SBH pumps……..…...0.04” / 1.0mm


THUMB SCREW
(SHAFT GUARD)
HEX NUT M12-1.75
SHAFT GUARD
FLAT WASHER M12-1.75
HEX HEAD CAP SCREW
M12-1.75 x 55MM
LOCK WASHER M12-1.75
HEX NUT (CINCH) 1/2-13
FLAT WASHER M12-1.75
SHAFT COLLAR
ADAPTER
STUB SHAFT
HEX BOLT 1/2-13 x 3-1/2
(CINCH)
KEY
CASING
CASING STUD
SEAL DRIVER AND
ROTATING SEAL
STATIONARY SEAL
SHIM
(SB MODELS ONLY)
IMPELLER
SHIM O-RING
(SB MODELS ONLY)
IMPELLER NUT GASKET
GASKET COVER
IMPELLER NUT
COVER
WING NUT



1 Stationary Seal
2 Stationary seal o-ring
3 Single rotating seal
4 Single rotating seal o-ring
5 Backup ring
6 Seal spring
7 Inner seal driver o-ring
8 Seal driver
9 Outer seal driver o-ring
10 Shim (SB Blenders only)
11 Impeller o-ring (SB Blenders only)



SERVICE MAINTENANCE AND SCHEDULING

DAILY PUMP MAINTENANCE CHECKS

1. Pump leakage (seal or otherwise)
2. Pressure reading and flow indication
3. Change in operating sound
4. Change in bearing temperature
5. Flow through lip seal lines

Motor lubrication schedule:
Every 2200Hrs of standard service.
Every 1100Hrs of severe service.
Every 220Hrs of extreme service.

Standard service is 8-16 hours of service and up to 104ºF/40ºC in a clean/little corrosion atmospheric contamination.

Severe service is 16+ hours of service per day up to 120ºF/50ºC in a moderate dirt/corrosion atmospheric contamination.

Extreme service is 8-16 hours of service per day over 120ºF/50ºC in a severe dirt, abrasive dust, corrosive heavy shock or vibration environment.

SEMI-ANNUAL PUMP MAINTENANCE CHECKS

1. Mechanical seal assembly
2. Motor bearing lubrication

ANNUAL PUMP MAINTENANCE CHECKS-INCLUDES SEMI-ANNUAL MAINTENANCE CHECKS PLUS:

3. Remove seal for inspection
4. Bearing check
5. Check of axis/running clearance of impeller

CONTINGENCY PLAN

FOR INSPECTION FINDINGS AND BREAKDOWNS, AN ADEQUATE SUPPLY OF PROBABLE REPLACEMENT PARTS SHOULD BE KEPT ON HAND.

THE MININMUM SPARE PARTS ARE AS FOLLOWS:

1. Single mechanical seal kit
2. Cover gasket
3. Impeller key

IN ADDITION AMPCO RECOMMENDS

4. Impeller
5. Cover
6. Impeller nut

Where service cannot be interrupted, a complete stand-by pump unit fully assembled (in a by-pass line) is recommended.

SB & SBH PUMP INSTALLATION

Receiving pumps:

Visually inspect shipping crate(s)/pallet(s) for damage. Ampco pumps will be shipped in boxes labeled Ampco Pumps or in crates. If there is any damage it is imperative to notify the driver at the time of delivery. Failure to do so will make it difficult, if not impossible, to file a damage claim and Ampco Pumps will not be held accountable. Please contact Ampco Pumps shipping department with damage details ASAP.

Once unpacked, carefully inspect the pump for any damage that may have occurred during shipping. Using a 15/16" socket, an extension drive and ratchet turn the impeller nut to make sure the impeller turns freely. There should be a little noise from the seal which is normal. If there is metal to metal contact when the impeller is turned shipping damage is likely. Leave the protective covers on the inlet and discharge connections until the pump is installed and is ready to be connected to piping.

Pump location:

Install pump in an optimal location. Be sure that there is room around the pump so it can be accessed readily for maintenance. Ensure that the motor has adequate ventilation. Make sure the motor type is suitable for the environment in which it is installed.

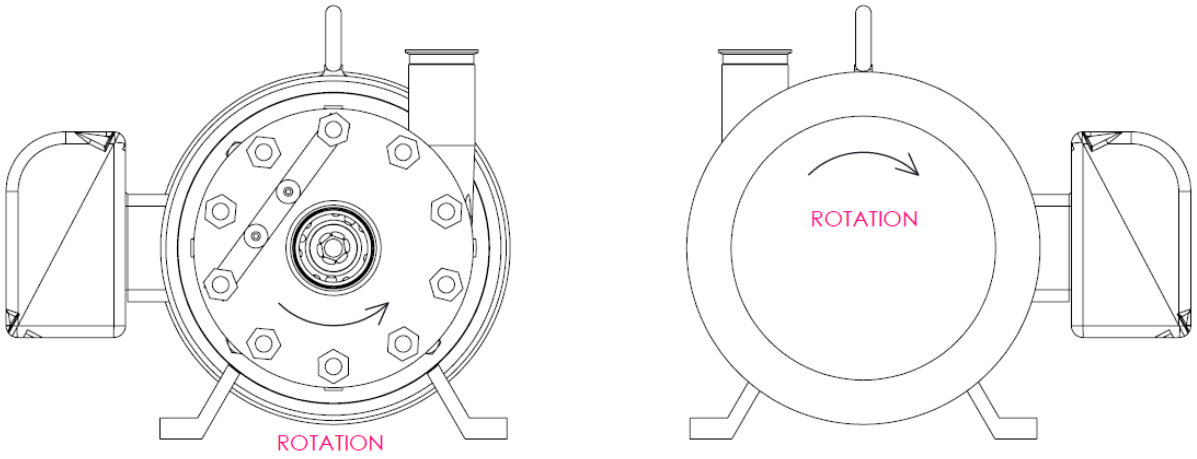
Electrical installation:

Have a qualified electrician connect the motor using sound electrical practices. Do not test run the motor with the pump dry. Mechanical seals can be damaged running dry even momentarily. The pump must be flooded and the flush must be connected with flushing water flowing before starting the pump. The pump and motor has been selected for a specific environment and system application. Changing the environment or system conditions (i.e. change of fluid, change in head losses, change in NPSHr) can overload the motor. When changing system conditions or when in doubt, contact Ampco Pumps Company for technical assistance and someone will be ready to assist.

Pump operation:

Make sure the pump is clean and free of any foreign matter.

Once the motor, flush and piping all have been properly connected, the flush is turned on and is visibly flowing (if the pump has a flush option) and the pump has been flooded, the pump can be momentarily turned on to check the motor rotation. The correct rotation is counter-clock wise while looking at the pump from the suction end clock wise if looking at the pump from the motor end.



SUCTION END MOTOR END

When the rotation of the motor has been verified to be correct the pump is ready to run continuously for service.

Shut down instructions:

Turn off power supply to the pump.
Close shut-off valves.
Drain and clean pump.

PUMP DISMANTLING, SEAL REMOVAL & CHANGING SHIMS

<u>ATTENTION!</u> BEFORE ATTEMPTING ANY SEVICE ON ANY PUMP OR MOTOR, DISCONNECT OR LOCKOUT ELECTRICAL POWER TO THE PUMP MOTOR. IF THE PUMP AND MOTOR ARE TO BE REMOVED AS A UNIT, NOTE THE WIRING AND CONFIGURATION. USE COLORED OR NUMBERED TAPE TO MARK THE WIRE CONNECTIONS OF THE PUMP MOTOR AND POWER SOURCE, FOR RE-CONNECTION.

TOOLS REQUIRED TO DISASSEMBLE AND REMOVE SEAL

7/16” wrench
15/16” socket wrench
90 degree o-ring pick
Torque wrench
3/8” round bar
Dead blow hammer

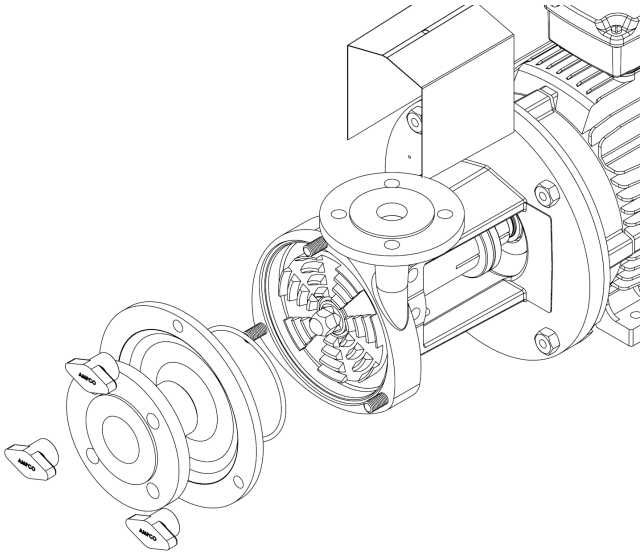


Figure 1

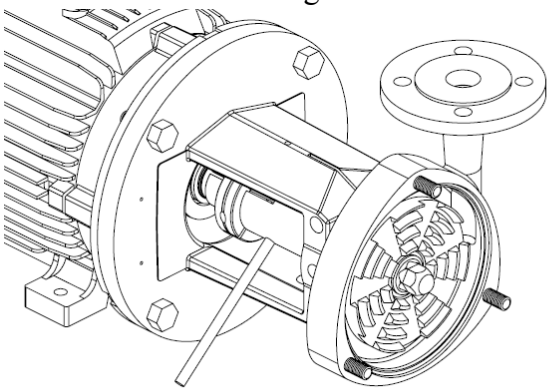


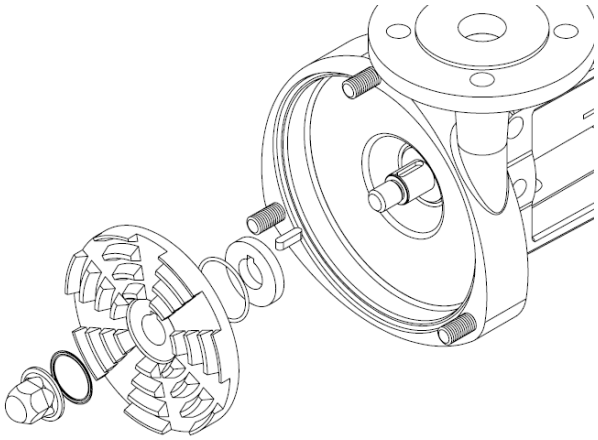
Figure 2

1. Disconnect electrical power to the pump motor and follow any lockout / tag-out procedures in place at your facility.

2. Disconnect pump from the suction piping. Drain all fluids from the pump.

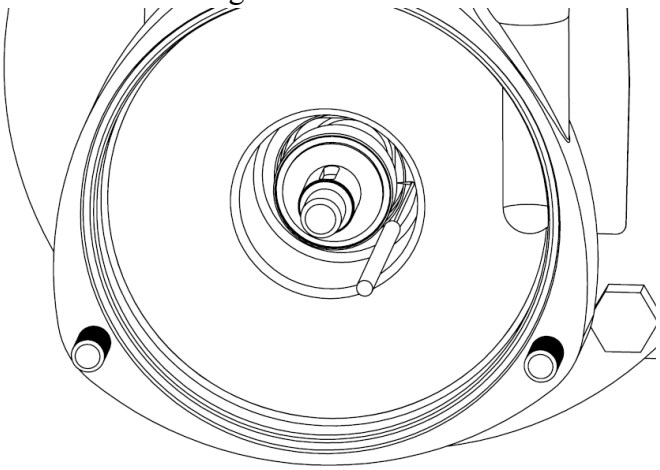
3. Loosen cover nuts with a 1-1/4” wrench. Remove cover wing nuts, flat washers (if provided), lock washers (if provided), cover, cover gasket and shaft guard. See figure 1.

4. Insert a 3/8” bar in the hole in the stub shaft. See figure 2. Loosen the impeller nut. Turn the impeller nut with a 15/16” wrench counterclockwise.



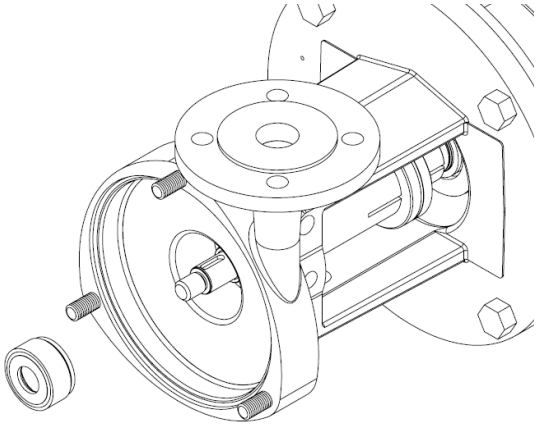
5. Remove the impeller nut, the nut gasket, impeller, shim and then the key. This process can be seen in Figure 3.

Figure 3



6. Pull out the seal driver. You may have to use a pick to separate the rotating seal from the stationary seal, figure 4.

Figure 4



7. The rotating seal, o-ring and spring will come out at as a single component, figure 5.

Figure 5

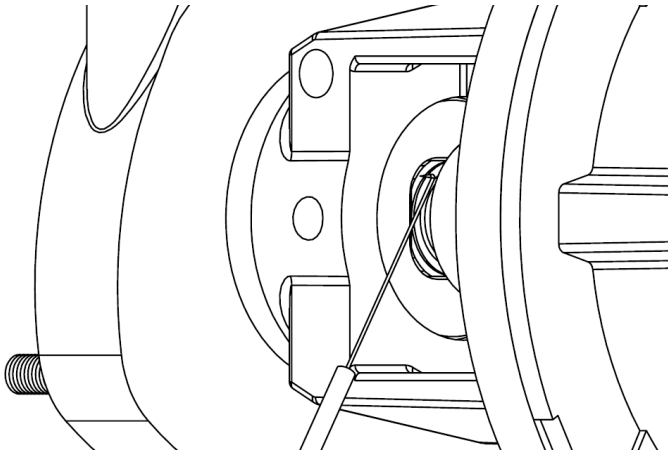


Figure 6

8. Push the stationary seal out from the back of the pump using an o-ring pick or your fingers or both. Pushing on opposite sides of the shaft with constant light pressure the best. Make sure to push outside of the rear seal face. See figure 6.

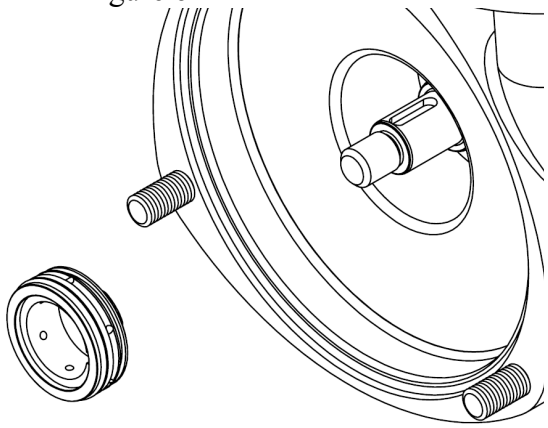


Figure 7

9. Remove stationary seal once pushed out of its' bore. See figure 7. Check the condition of the casing, rotating seal and stationary seal. Clean and remove any foreign matter before reinstalling the seal.

PUMP ASSEMBLY AND SEAL INSTALLATION

When replacing the seal assembly lubricate all o-rings with food grade lubricant. Once the pump is fully assembled turn the stub shaft a few revolutions by hand making sure it turn relatively freely and nothing is rubbing inside the pump. Running the pump with foreign objects in the pump or having the impeller making contact with either the cover or the casing will result in serious damage if not completely destroying the pump.

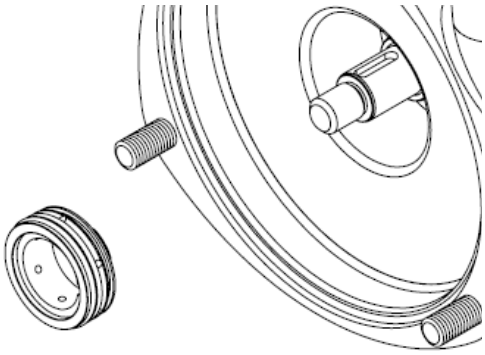


Figure 8

1. Use a food grade lubricant to lubricate all o-rings. It is important that the stationary and rotating seal o-rings are lubricated to ease assembly. Slide the stationary seal over the shaft and into the casing, figure 8. Line up a flat on the stationary seal to the a flat of the window of the casing and gently press the stationary seal into the casing bore. See figure 9.

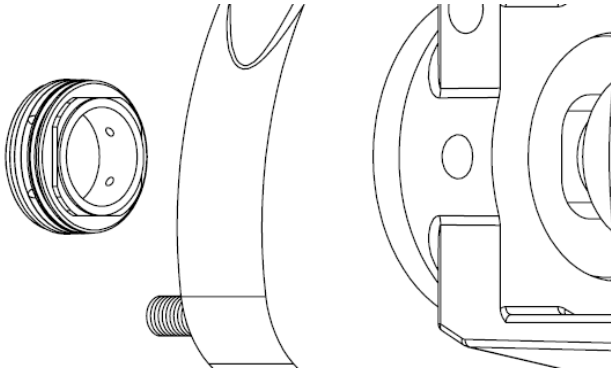


Figure 9

2. The stationary seal should be properly seated, as shown in figure 10, before continuing the assembly of the pump.

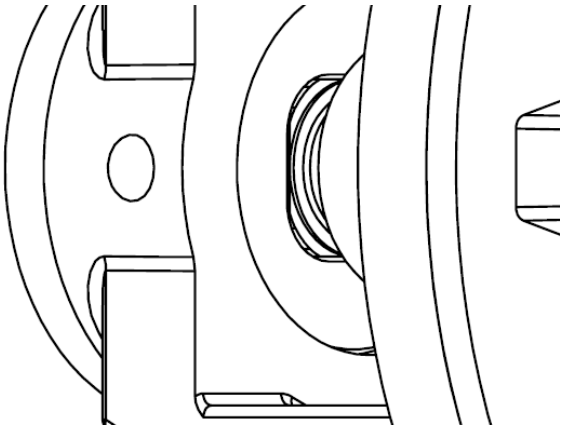


Figure 10

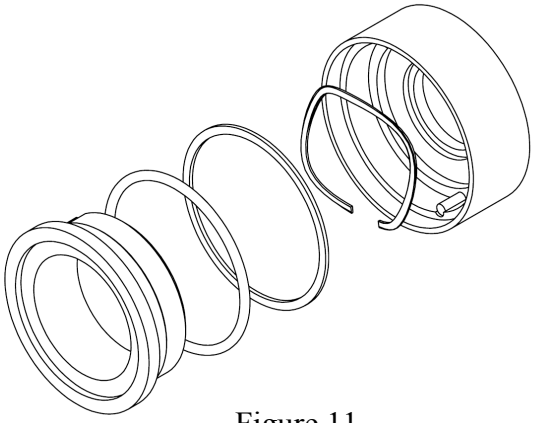


Figure 11

3. Assemble the rotating half of the seal. Insert the single seal spring into the seal driver. The single seal spring is smaller than the rotating double spring. Next insert the backup ring. Insert the single rotating seal o-ring then insert the single rotating seal. Be sure to line up the slots in the rotating seal with the pins in the seal driver.

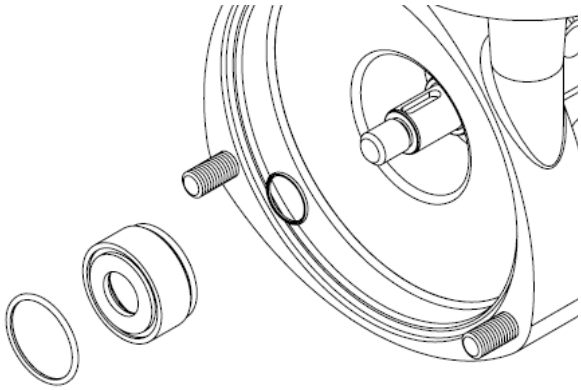


Figure 12

4. Install inner seal driver o-ring, then slide the rotating seal assembly onto the stub shaft, as seen in figure 12, against the stationary seal. Be sure the outer seal driver o-ring is in the o-ring groove in the seal driver.

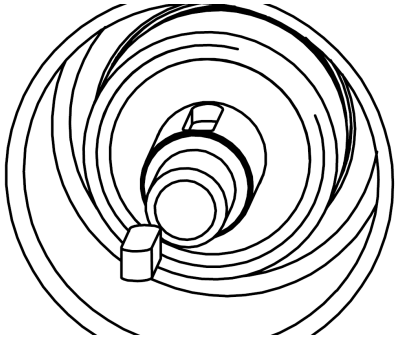


Figure 13

5. Insert key into the keyway in the stub shaft, figure 13.

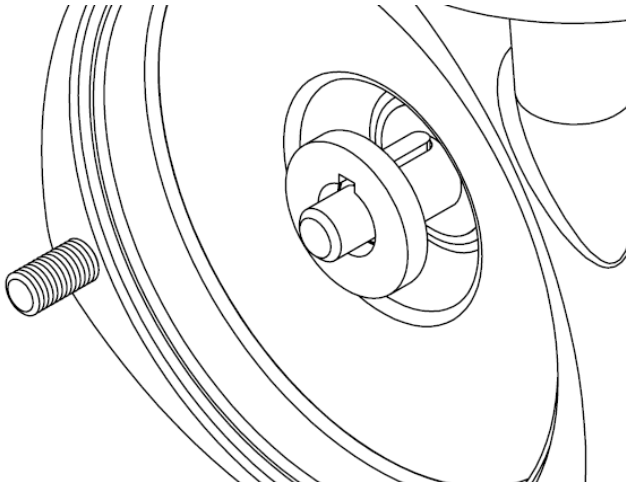
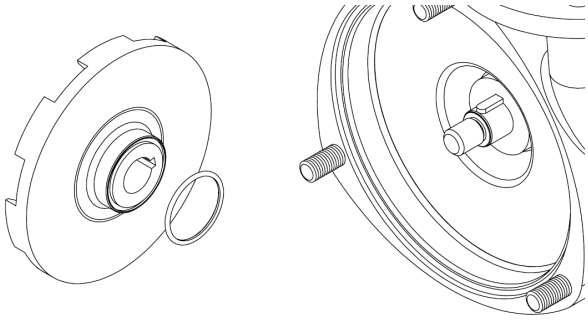


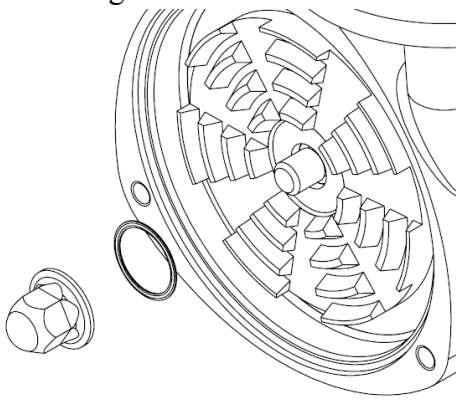
Figure 14

6. For SB Blenders install the shim as in figure 14



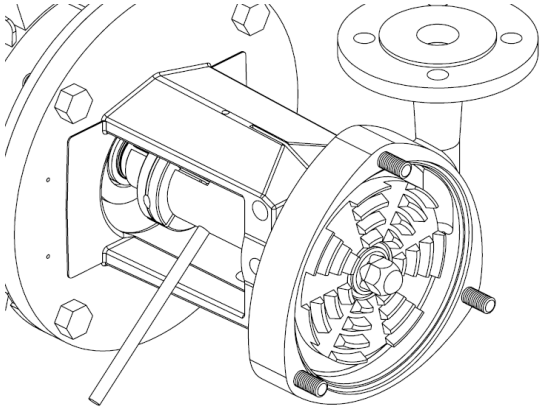
5. Before installing the impeller lubricate the impeller o-ring so it will stay in the impeller o-ring while installing the impeller (SB Blenders only). Slide impeller onto the shaft and over the key. Push impeller against the seal driver or shim (SB Blenders). See figure 15.

Figure 15



6. Install the impeller nut and impeller nut gasket, figure 16.

Figure 16



7. Once again insert a 3/8" bar into the hole of the stub shaft to hold the rotating parts while tightening the impeller nut. See figure 17.

Figure 17

8. Check the stub shaft run out. Fix an indicator to the pump. See figure 18. Total indicator run out should not be greater than 0.003" (0.075mm). If stub shaft run out is greater than 0.003" remove the shaft guard, loosen collar then just snug the shaft collar (do not torque yet). Mark the highest point of run out with a grease marker. Using a dead blow hammer tap stub shaft at high run out point and recheck run out. If run out is under 0.003" torque shaft collar screw and reassemble pump. If not repeat this step until run out is under 0.003".

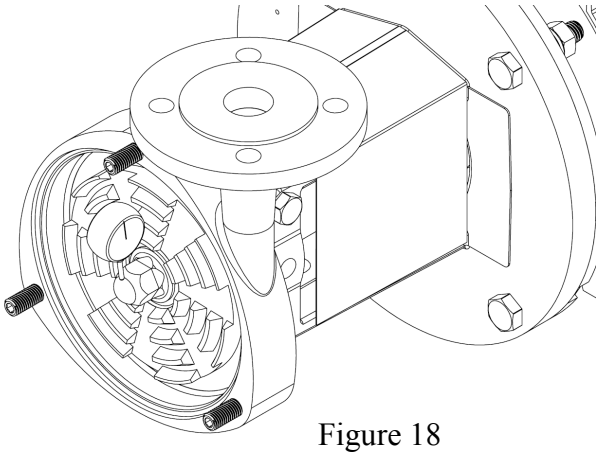


Figure 18

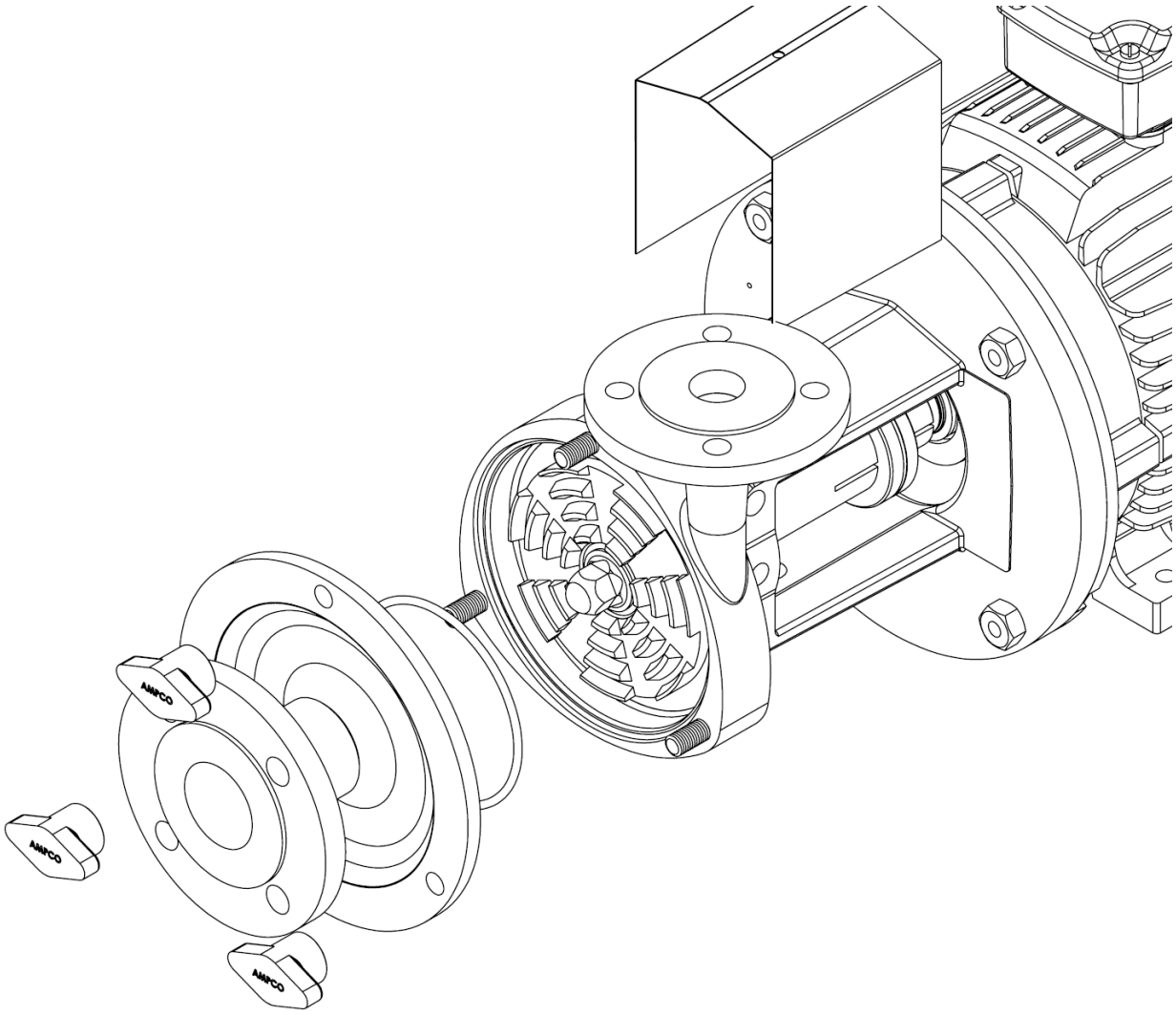


Figure 18

8. Replace cover gasket, cover, wing nuts, and shaft guard, figure 18. When replacing the cover, depending on the style of connection, the cover may only be installed correctly with only one orientation. Note the orientation of flange bolt hole patterns before installing the cover. Make sure the wing nuts are tight and turn the impeller slowly with a 15/16" socket, extension and ratchet to check if impeller turns freely.

Note: Always turn the stub shaft by hand before start up making sure nothing is rubbing inside the motor, such as foreign objects or the impeller touching either the back inside of the casing or the cover. Also never run this pump dry. Silicon carbide seals will heat up instantly at operating RPMs and will no longer seal when damaged.

WARNING: Mechanical seal must never run dry. Seal damage will result.

SETTING THE IMPELLER CLEARANCE

Assemble the pump as described in the Pump Assembly and Seal Installation section of this manual. For double seals perform steps 1-10 and for single seals perform steps 4-10 of the Pump Assembly and Seal Installation instructions. Take note that the shaft collar screw must be torqued to the proper torque value as determined by the frame size of the motor. Using a torque value less than the prescribed value may allow the shaft to move toward the cove and cause damage to the pump.

TOOLS REQUIRED

7/16" wrench	Torque wrench	15/16" socket wrench
3/8" round bar	mallet	Hex socket (for size see technical data page 3)

- 0.02" (0.5mm) Shim for SB & SBH R Pumps
- 0.04" (1.0mm) Shim for SB & SBH V Pumps

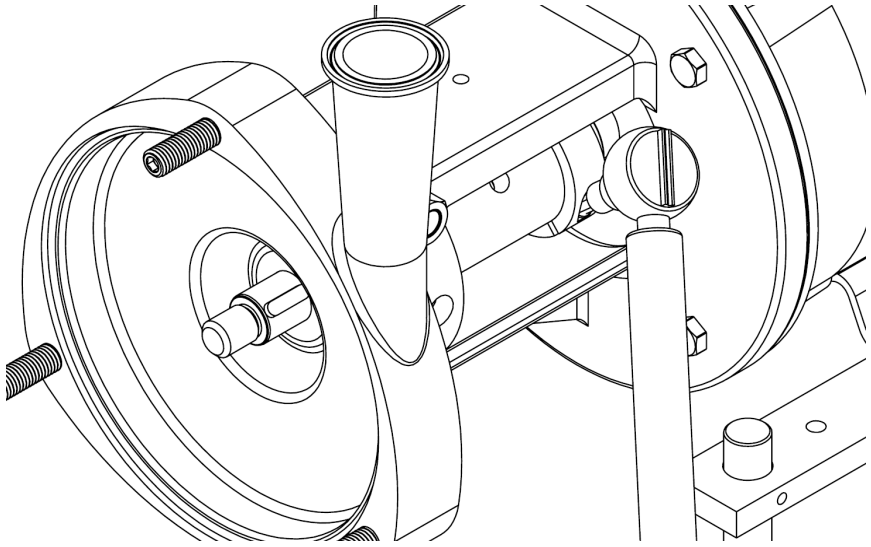


Figure 19

1. Remove the cover wing nuts, cover, cover o-ring, shaft guard, impeller nut, impeller nut gasket and impeller as described in the pump dismantling part of this manual. For SB models make sure the thinnest impeller shim is on the stub shaft.

2. Loosen the socket head cap screw in the shaft collar and retighten it just enough so the stub shaft is still able move on the motors shaft. Figure 19.

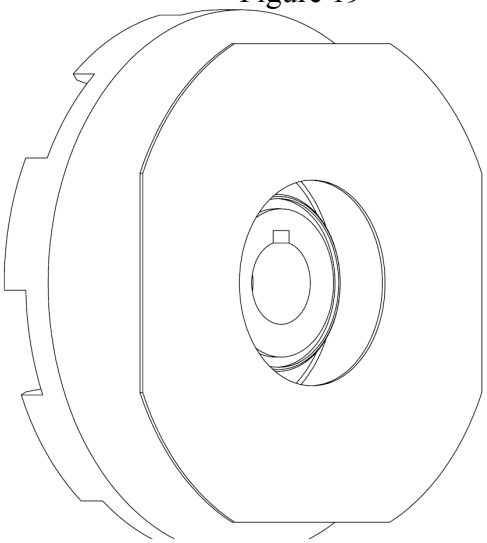


Figure 20

3. Once the stub shaft is able to slide on the motor shaft place the plastic stub-shaft setting shim on the back of the impeller, over the impeller hub. Figure 20.

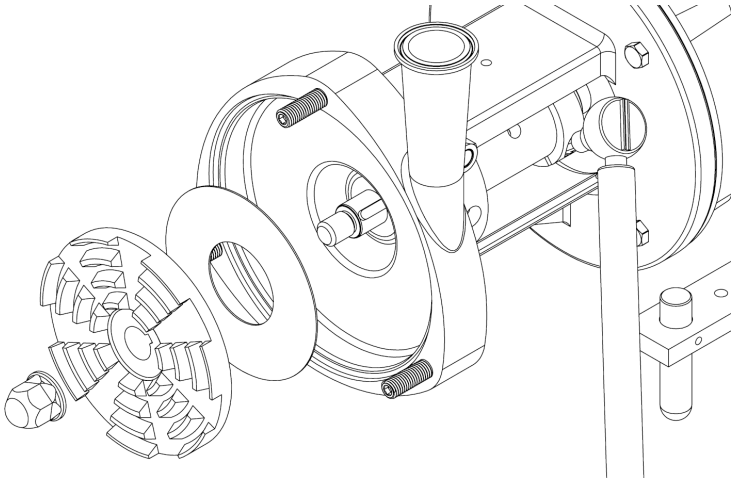


Figure 21

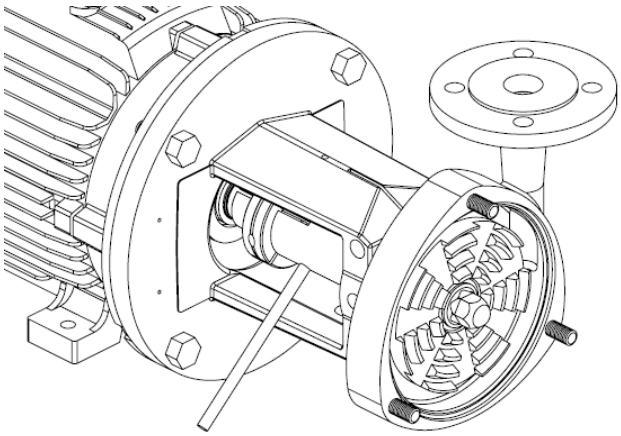


Figure 22

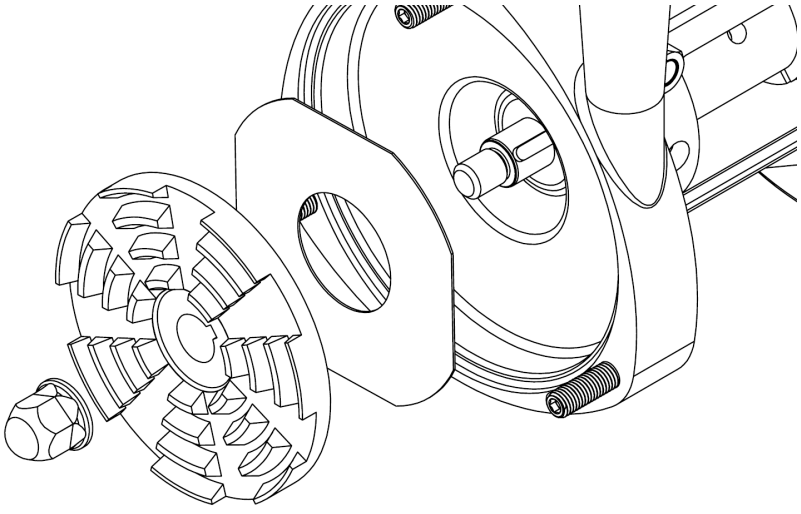


Figure 23

4. With the seal driver, shim (SB models) and key on the stub shaft, insert the impeller and impeller clearance shim into the casing on the stub shaft and tighten the impeller nut on the stub shaft, figure 21. While pushing the impeller nut, impeller, and shaft collar towards the motor slightly pinching the impeller clearance shim, tighten the socket head cap screw in the shaft collar. Torque the socket cap screw to the right torque value that correlates to the frame size of the motor. When the shaft collar screw is not torqued to the correct value the shaft may move during pump operation although the shaft cannot be moved by hand along the motors axis. Torquing the shaft collar screw more than the recommended value may break the screw.

5. Now that the impeller clearance is set the clearance shim has to be removed and pump reassembled. Insert a 3/8” bar into the hole of the stub shaft and loosen the impeller nut. See figure 22.

6. Remove the impeller nut, impeller, stub-shaft setting shim and clearance shim, figure 23.

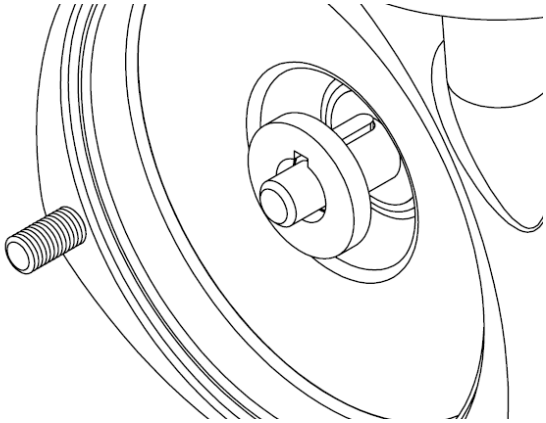


Figure 24

7. Insert the desired impeller shim (SB models only) figure 24.

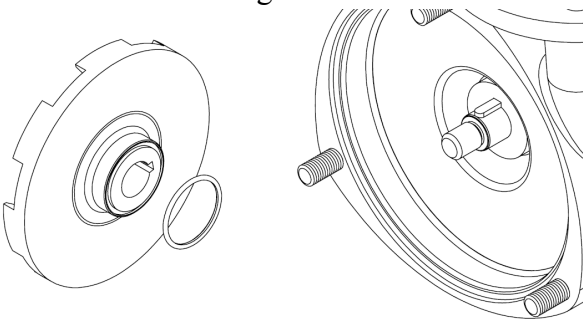


Figure 25

8. Install the impeller o-ring into the back of the impeller (SB models only) figure 25.

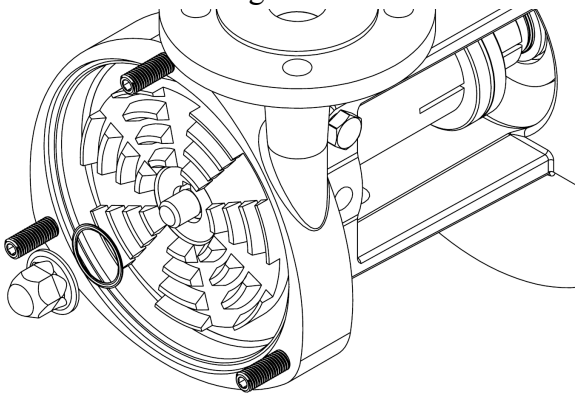


Figure 26

9. Install the impeller nut gasket and impeller nut. See figure 26.

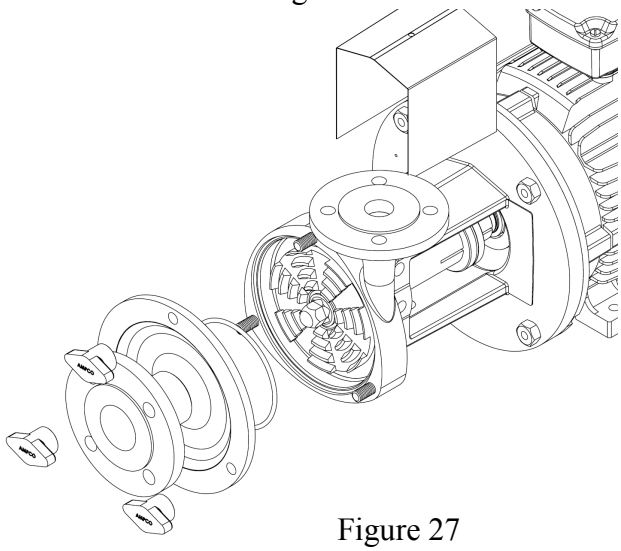


Figure 27

10. Replace cover gasket, cover, wing nuts, and shaft guard, figure 27. When replacing the cover, depending on the style of connection, the cover may only be installed correctly with only one orientation. Note the orientation of flange bolt hole patterns before installing the cover. Make sure the wing nuts are tight and turn the impeller slowly with a 15/16" socket, extension and ratchet to check if impeller turns freely. If the impeller does not turn freely do not force it to turn and absolutely do not run the pump. Reset the impeller clearance.

Sound piping practices

Suction and discharge piping must be properly supported and aligned with the pumps suction and discharge ports.

Avoid throttling valves in the suction line of the system.

Check valves must be at a minimum of 5 feet (1.5m) from the pump's discharge, figure 28.

Keep the suction piping short and direct as possible. Avoid elbows in the suction line of the system. If this is unavoidable, locate the elbow as least 5 pipe diameters away from the pumps inlet and elbows should not have a radii less than twice the diameter of pipe, figure 28.

Make sure that the NPSH available is always greater than the system's NPSH required.

Avoid bending piping over piping as this will cause the formation of an air pocket in the suction line. Figure 29.

Route piping under any obstructions whenever possible. Figure 30.

When using a reducer on the suction end the reduced centerline should not be below the suction centerline as in figure 31. The centerline of the small diameter end of the reducer should be above the centerline of the suction line as in figure 32.

Injection line angles should be 45º or less. Figure 33.

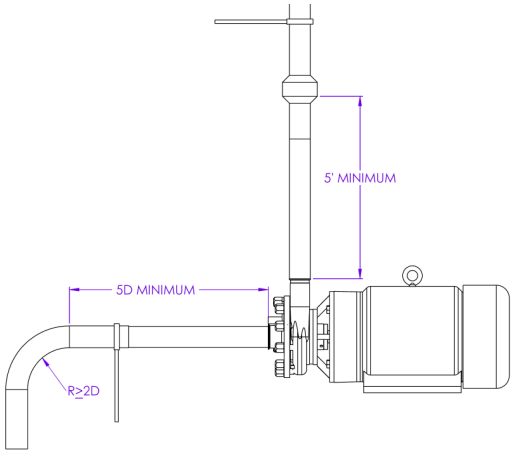


Figure 28

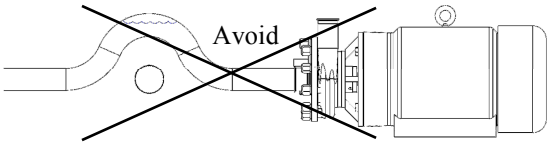


Figure 29

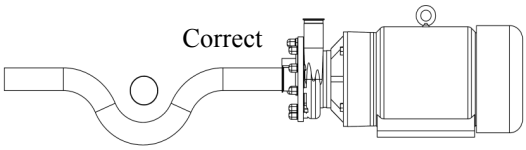


Figure 30

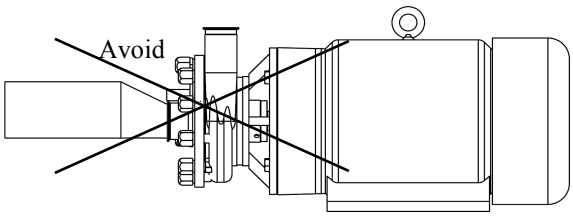


Figure 31

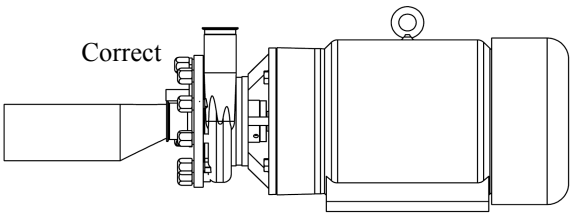


Figure 32

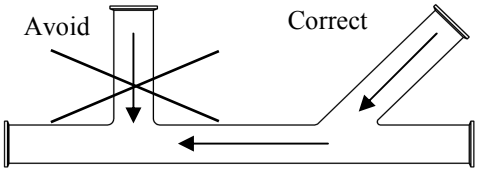


Figure 33

TROUBLESHOOTING

COMMON TROUBLES AND THEIR CAUSES

It is to the user's advantage to be familiar with a systematic procedure to determine reasons and causes for unsatisfactory pump operation. The following list of troubles and causes is intended to assist users in determining the cause of any pumping trouble. Faulty installations can then be corrected and clear description given the manufacturer if assistance is required. Human judgment should not be relied on to measure operating conditions. Use proper instruments to measure values of pressure,, suction lift, speeds, temperature rise of motors, etc. When motor speeds are incorrect, check connections and measure voltage at motor terminals.

1. No liquid delivered

- Pump and suction line not completely primed
- Speed too low
- Required discharge too high
- Suction lift too high
- Impeller, piping, or fittings completely plugged up
- Wrong direction of rotation

2. Not sufficient capacity

- Air leaks in suction pipe for shaft seal
- Speed too low
- Required discharge head too high
- Suction lift too high or insufficient NPSH available
- Impeller, piping, or fittings partially plugged
- Insufficient positive suction head for hot water or other volatile liquids
- Liquid viscosity too high
- Mechanical problems-impeller damaged, shaft seal defective
- Wrong direction of rotation
- Suction pipe entrance too close to surface of liquid
- Air pockets in pipe high points

3. Not sufficient pressure

- Speed too low
- Mechanical problems– impeller damaged, shaft seal defective
- Small impeller diameter
- Air or gas in liquid
- Wrong direction of rotation
- Air pockets in pipe high points

4. Pump operates for a while, then quits

- Leaky suction line
- Air leaking in through shaft seal
- Suction lift too high or insufficient NPSH available
- Air or gas in liquid
- Suction piping and fitting not completely freed of air during priming
- Air pockets in pipe high points

5. Pump takes too much power

- Speed too high
- Pumping too much liquid because required head is lower than anticipated.
- Viscosity and / or specific gravity is higher than specified
- Mechanical problems—binding inside seal from distortion due to piping strains, shaft bent, impeller rubbing casing
- Wrong direction of rotation

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Visit www.ampcopumps.com for more information.

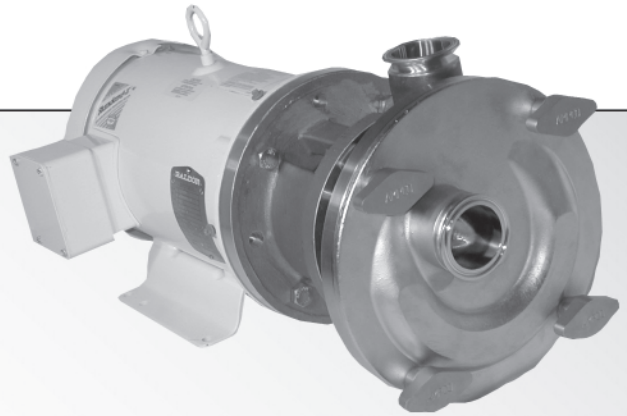
REV. TML 5/7/10

Ampco Pumps Company

AMPCO SP SERIES CENTRIFUGAL PUMP OPERATION AND MAINTENANCE MANUAL

AMPCO SP SERIES
CENTRIFUGAL PUMP

SP Series Pumps



INSTRUCTIONS

Your Ampco centrifugal pump is a rugged unit designed to provide years of low cost pumping service. There is a small amount of necessary care required to ensure you of this expected long service. It is recommended that you carefully review the installation and operating sections in this manual.

Every Ampco pump receives a careful running test at the factory to ensure that the head-capacity rating is met in accordance the Hydraulic Institute Standards and to ensure mechanical soundness. Special instructions and advice for unusual conditions, such as corrosive, abrasive, and other problems are too numerous to be included in this general book, but will be the subject of specific discussion on orders or inquires for special applications..

LOCATION

The immediate environment, in which the unit is located, while usually of prime importance to the pump, may determine the enclosure needed for the motor. Ampco can supply several different motor enclosures to meet specific requirements.

The SP Series pumps series are supplied with totally enclosed motors as standard. They may be installed where dirt, moisture and mild corrosion are present or in outdoor locations. Washdown duty motors, with epoxy paint or paint free stainless steel, are designed for applications where the motor is frequently subject to washdown to maintain a bacteria-free operating environment. Specialty motors may be required for moist, corrosive, or explosive environments. Motor drain plugs (if not equipped with automatic drains) must be removed periodically to drain accumulated condensation.

Pump units should be located where daily visual inspection is possible and no surrounding structure interferes with ventilating air over or through the motor.

Submerged suction is the most economical and convenient method of priming a pump when installed in such a position that the top of the casing is below the surface of the liquid to be pumped. The liquid will flow by gravity into the pump and displace the air (through the discharge if possible or a vent when available).

INSTALLATION

Begin with a suction line as direct and as simple as possible. The suction line is usually the most sensitive part of the entire pumping system being totally dependent on outside forces to provide liquid flow into the center of the impeller.

Locate the pump as close to the supply of liquid as possible, with short and direct suction piping. Use wide radius elbows to help reduce friction loss. Air pockets due to high sections, concentric reducers, valve bonnets, etc. should be eliminated by installing a suction having a continual rise or at very least a straight horizontal run with an air eliminator near the pump suction entry. To prevent air pockets use eccentric pipe reducers that are mounted in a horizontal position across the top of the pipeline and valves that can be positioned in a plane rather than the normal upright position as an air pocket may exist in the upright valve bonnet.

Above all, remember that until the liquid reaches the leading edges of the rotating impeller vane the pump cannot impart its energy to move the liquid.

If possible, try not to connect an elbow directly to the inlet of the pump. This may cause excessive turbulence and hinder pump performance.

STARTING

The pump must be primed before starting, as the mechanical seal depends on the liquid being pumped for lubrication and cooling. Even a short run to determine direction of rotation without first priming may seriously damage the seal. Even though the SP Series are "self-priming" they require fluid inside the pump casing to draw a proper vacuum to initiate the priming.

The correct direction of rotation is counter-clockwise when viewed from the suction end of the pump. It is recommended to turn the pump by hand before starting the first time to ensure the unit is not binding.

MAINTENANCE

Since long-term breakdown cannot be tolerated in most services, maintenance procedures and a contingency plan must be established in advance to minimize any production loss caused by down time.

During building and start-up it is common to use outside personnel. Operating personnel should acquaint themselves with the pump, particularly its running performance. This will aid in establishing a standard for future reference. This manual and other information provided with the pump should be filed for future reference.

All possible performance data should be recorded once the system is functioning properly and stable. Suction and discharge pressure readings, flow rate, seal leakage rate, bearing temperature, noise and vibration levels all provide input to a pump's performance in the system. It is unlikely that all of this data can be measured, but any information gathered can help alert the user of problems with the pump or system.

Operating personnel should know that any changes in the system or the liquid being pumped might have an effect on the pump's performance. It is advisable to also record the fluid temperature, specific gravity, viscosity, liquid concentration, percent of solid concentration, other additives and properties.

Single Mechanical Seal

A proper maintenance procedure should begin with a file for each pump. All known data relative to the pump, fluid handled and system should be included. Complete records of maintenance and repair costs along with a log of the unit's operating hours should be kept.

In addition, complete pump identification- size, type, operating speed, manufacturer, serial number, model number, and material of construction should be noted.

Maintenance Procedures
Daily Check-possibly the most important inspection will be the daily observation.

1. Seal leakage rate
2. Pressure reading and flow indication
3. Change in operating sound
4. Change in bearing temperature
5. Check to make sure flow is going through the double seal flush lines (for Double Seal pumps)

Semi-Annual Inspection-typically made at 6-month intervals with results noted in pump's maintenance file.

1. Check of mechanical seal assembly
2. Check of bearing lubrication

Annual Inspection-includes Semi-Annual inspection plus:

3. Removal of seal for inspection
4. Bearing Check
5. Check of axis/running clearance of impeller

Contingency Plan
For inspection findings and breakdowns, a contingency plan should be developed. To begin, an adequate supply of probable replacement parts should be kept on hand.

The minimum recommended spare parts are as follows:

1. Mechanical seal kit (complete with o-ring set)
2. Casing o-ring
3. Impeller Key

In addition Ampco recommends

4. Impeller
5. Impeller Nut

Where service cannot be interrupted, a complete stand-by pump unit fully assembled (and in a by-pass line) is recommended.

DISMANTLE AND REPLACE PARTS AS FOLLOWS :

Before attempting any service on the pump or motor, disconnect or lock out electrical power to the pump motor. If the pump and motor are to be removed as a unit, note the wiring configuration. Use colored or numbered tape to mark the wire connections of the motor and power source, for reconnection.

These instructions are limited to fluid ends only. See other drawings and literature applicable to motors, pedestals, frames, shafts, etc., if additional repairs are required.

1. Disconnect pump from both suction and discharge piping. Remove the shaft cover guard at this time by taking off the cover guard bolts.

2. Remove cover by taking off casing nuts. A rubber mallet may be necessary to loosen the nuts.

3. Remove the impeller nut using a 15/16" socket and holding the stub shaft with a 3/8" rod in the predrilled hole. Ease the impeller off the shaft. Pinch bars between the impeller and cover may be required. Be careful not to mar the pump's surface finish. Remove the impeller.

4. Use a 3/4" wrench to remove all three bolts between the pump volute and the adapter and gently slide slide the pump volute off the pump shaft.

5. Lay the pump volute down on the casing studs, and remove the stationary seal. The wave springs for the seal should also be removed. In double seal pumps, there is an extra stationary piece and wave spring to remove.

6. Remove the two stationary seal o-rings. This is best down by using a small flat-blade screwdriver.

7. Remove the rotating seal and rotating seal o-ring from the stub shaft.

The Mechanical seal is the only expendable pump part. It is suggested that the complete mechanical seal, both stationary and rotating members, be replaced whenever dripping or leakage occurs at the shaft, or whenever parts are removed to the point of separating the primary sealing surfaces.

The fluid end is now completely dismantled: Additional procedures are dictated by purpose for which unit was dissembled.

Mechanical Seal Replacement and Reassembly
Please see the table on page 5 for proper identification of all pump components. The numbers in parenthesis refer to the diagram on page 5 for mechanical seal components.

1. Begin by installing the rotating assembly onto the stub shaft. Lubricate the rotating o-ring with a food grade lubricant (use de-ionized water if oil is not permitted i.e. EPDM) and fit it into the rotating seal. Slide the assembly onto the shaft and line it up with the notches on the shaft.

2. Set the pump volute down on the casing studs. Lubricate the inner stationary seal o-ring and put it in groove in the seal cavity. For double seal pumps, the outer stationary o-ring fits into the larger groove in the seal cavity.

3. Place the inner (and outer) wave spring into the seal cavity and align it around the pins in the seal cavity. The wave spring should be positioned so that the waves with the notches face downward by the pins.

4. Install the inner stationary seal. The notches in the seal will line up with the pins in the cavity. For a double seal, install the outer rotating seal second.

5. Being careful not to bump the seal on the pump stub shaft, gently slide the volute over the stub shaft and shoulder it against the adapter.

6. Using a 3/4" wrench to alternately tighten all bolts between the volute and the adapter.

7. Place the impeller key onto the shaft keyway in the pump.

8. Lubricate the impeller o-ring and fit it into the groove on the back of the impeller.

9. Slide the impeller onto the pump shaft over the key. Next, lubricate the impeller nut gasket (11) and install it on the impeller along with threading on the impeller nut. Be sure that the gasket fits into the groove in the impeller nut.

10. Tighten the impeller nut. This should be done with a 15/16" six point socket while using a 3/8" rod in the stub shaft hole to keep the pump shaft from rotating. Check the freedom of parts by hand rotating the impeller.

11. Install the cover onto the pump volute with a new cover o-ring. It is best to put the o-ring on the cover as it is placed against the volute. Tighten all cover nuts uniformly. Rotate the shaft again by hand again to check for rubbing.

12. Re-install the shaft cover guard.

13. For double seal pumps, install the flush lines through the back of the casing. Run flush water at about 1-2 gallons per hour. The maximum pressure for the seal is 5 PSI. Flush water should be throttled before the pump, and there should be about 2-5 feet of vertical tubing after the flush water exits the pump to maintain this.

14. Place the pump back into service and inspect for proper rotation and leaks.

Motor / Pump Shaft Disassembly
Before attempting any service on the pump or motor, disconnect or lock out electrical power to the pump motor. If the pump and motor are to be removed as a unit, note the wiring configuration. Use colored or numbered tape to mark the wire connections of the motor and power source, for reconnection.

1. Begin with pump disassembly as noted previously.

2. Loosen the shaft collar with an Allen wrench (3/16" or 1/4": see sizes in table on page 5) so that the stub shaft can be taken off the motor. A rubber mallet may be used to tap the stub shaft if it will not slide off. Be careful not to drop the shaft collar when the stub shaft comes off the motor.

At this time the motor can be replaced by unbolting the adapter from it and separating the two items.

Motor / Pump Shaft Assembly
If the pump stub shaft is being replaced, it is recommended that a new shaft collar also be installed.

1. Begin by bolting the adapter onto the motor. Please note correct tightness of all fastening components in the table on page 5.

2. Slide the shaft collar onto the stub shaft and slide the two together onto the motor shaft, keeping the motor keyway in line with one of the slots in the stub shaft. If the collar has an identification groove in it, this will rest against the step in the stub shaft.

3. Line up the slot in the collar with the stub shaft slot and motor keyway gap. Do not tighten the shaft collar yet.
Since the shaft was disassembled, the impeller clearance in the volute may have changed. The impeller must be repositioned to ensure the impeller will not rub and also for proper pump performance. The critical impeller gap is the gap between the volute and the impeller. This will be measured using the spacer provided with the SP Series pumps. *Please see the table on page 5 within the manual for the correct impeller gaps.*

4. Slide the volute over the pump shaft and shoulder it against the adapter.

5. Using a 3/4" wrench to alternately tighten all bolts between the volute and the adapter.

6. Place the spacer provided with the pump between the casing and the impeller. Install the impeller key, followed by the impeller, impeller nut gasket, and impeller nut. Tighten the impeller nut using a socket wrench and the 3/8" rod to hold the shaft to secure the assembly.

7. With a rubber mallet, gently tap the impeller nut to drive the stub shaft towards the motor while the spacer is between the impeller and volute. This will create the critical impeller gap.

8. When the impeller gap is correct, align the shaft collar slot with the slot in the stub shaft and the motor shaft keyway, and tighten the shaft collar with an Allen wrench, (3/16" or 1/4": see sizes in table on page 5) to secure the shaft position.

9. Remove the impeller nut, gasket, and impeller from the shaft, and spacer. Now finish reassembling the pump.

SP PUMPS
EXTERNAL SEAL
SP Series Pumps

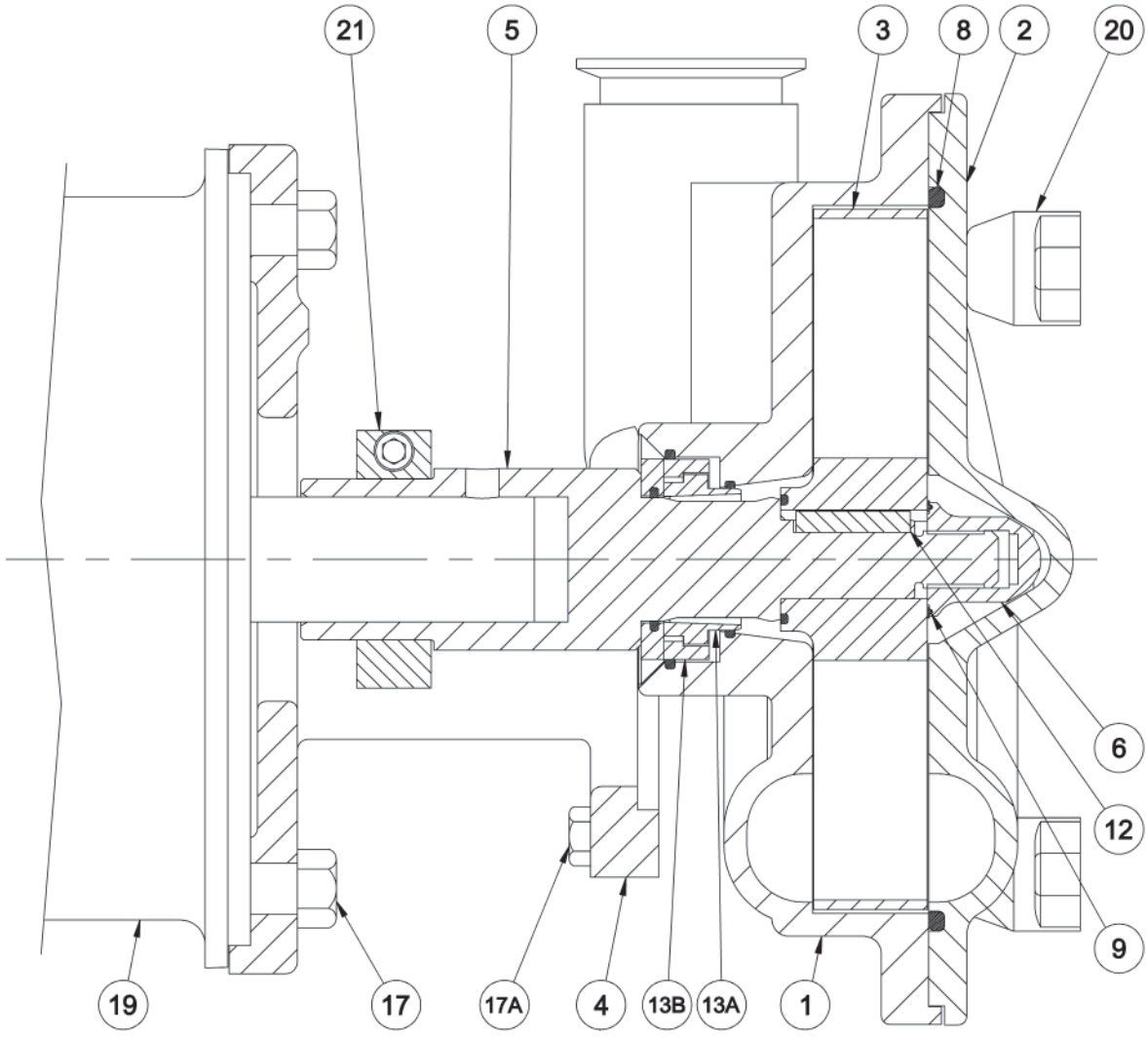
AMPCO PUMPS COMPANY
PARTS BREAKDOWN

DETAIL NO.	REQ. NO.	PART NAME
21	1	SHAFT COLLAR
20	X[2]	STAR NUT
19	1	MOTOR
17A	3	CAP SCREW (CASING/ADAPTER)
17	4	CAP SCREW (MOTOR/ADAPTER)
16[1]	2	DRIVE SCREW
15[1]	1	NAME PLATE
13B	1	DOUBLE MECHANICAL SEALv
13A	1	SINGLE MECHANICAL SEAL
12	1	IMPELLER KEY

DETAIL NO.	REQ. NO.	PART NAME
11B[1]	2	SHAFT GUARD CAP SCREW
11A[1]	1	SHAFT GUARD
9	1	GASKET (IMPELLER SCREW)
8	1	O-RING (CASING/COVER)
6	1	IMPELLER NUT
5	1	STUB SHAFT
4	1	ADAPTER
3	1	IMPELLER
2	1	COVER
1	1	CASING

[1]NOT SHOWN
[2]STAR NUT QUANTITY VARIES WITH PUMP MODEL

NOTE: Please be sure to always include pump type, size, and serial number with any reference to above numbers and names.

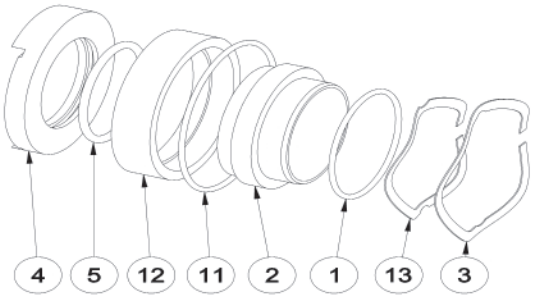


Single Internal Mechanical Seal

Seal Breakdown For SP Series Pumps (Items 11-13 for double seal pumps only)

DETAIL NO.	PART NAME
1	STATIONARY O-RING
2	STATIONARY SEAL
3	SPRING
4	ROTATING SEAL

DETAIL NO.	PART NAME
5	ROTATING O-RING
11*	STATIONARY O-RING
12*	STATIONARY SEAL
13*	SPRING



Proper Torque For Bolts on SP Series Pumps

Item	Torque (ft-lbs)	Pumps Included
Motor Bolts	50	All SP200 Pumps
Adapter / Casing Bolts	50	All SP200 Pumps
Volute Casing Nuts	50	280 + Frame
Shaft Collar Bolt(s)	15	180 Frame
	30	210 - 250 Frame
Impeller Nut	40	SP200 Series

Proper Impeller Gaps For SP Series Pumps

Pump Series	Impeller toVolute
SP200	0.008”

Required Tools

1. Rubber Mallet

2. 15/16" socket - for impeller nut

3. 3/8" diameter steel rod - to hold stub shaft

4. One - 3/4" wrench (frame sizes 280 & larger) - adapter bolts

5. Food grade lubricant

6. 3/16" Allen wrench - shaft collar bolt 180 frames
1/4" Allen wrench - shaft collar bolt 210-280 frames

7. Impeller puller / pinch bars (may be necessary)

8. Shim (see Impeller Gap chart for sizes)

COMMON TROUBLES AND THEIR CAUSES

It is to the user's advantage to be familiar with a systematic procedure to determine reasons and causes for unsatisfactory pump operation. The following list of troubles and causes is intended to assist users in determining the cause of any pumping trouble. Faulty installations can then be corrected and a clear description given the manufacturer if assistance is required. Human judgment should not be relied on to measure operating conditions. Use proper instruments to measure values of pressure, suction lift, speeds, temperature rise of motors, etc. When motor speeds are incorrect, check connections and measure voltage at motor terminals.

1. No liquid delivered
a. Pump and suction line not completely primed
b. Speed too low
c. Required discharge too high
d. Suction lift too high
e. Impeller, piping, or fittings completely plugged up
f. Wrong direction of rotation

2. Not sufficient capacity
a. Air leaks in suction pipe or shaft seal
b. Speed too low
c. Required discharge head too high
d. Suction lift too high or insufficient NPSH available
e. Impeller, piping, or fittings partially plugged
f. Insufficient positive suction head for hot water or other volatile liquids
g. Liquid viscosity too high
h. Mechanical problems - impeller damaged, shaft seal defective
i. Wrong direction of rotation
j. Suction pipe entrance too close to surface of liquid
k. Air pockets in pipe high points

3. Not sufficient pressure
a. Speed too low
b. Mechanical problems - impeller damaged, shaft seal defective
c. Small impeller diameter
d. Air or gas in liquid
e. Wrong direction of rotation
f. Air pockets in pipe high points

4. Pump operates for a while, then quits
a. Leaky suction line
b. Air leaking in through shaft seal
c. Suction lift too high or insufficient NPSH available
d. Air or gas in liquid
e. Suction piping and fittings not completely freed of air during priming
f. Air pockets in pipe high points

5. Pump takes too much power
a. Speed too high
b. Pumping too little water (too much pressure) because required head is higher than anticipated
c. Viscosity and/or specific gravity is higher than specified
d. Mechanical problems - binding inside seal from distortion due to piping strains, shaft bent, impeller rubbing casing
e. Wrong direction of rotation
f. Wrong motor voltage or wiring

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