



Installation, Operation, and Maintenance Manual
For FW2100 End Suction Centrifugal Pumps



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Introduction

Thank you for purchasing a FloWise product. Our pumps are designed for safe operation, long life, and ease of service. This manual is intended to provide instructions to install, operate, and maintain FloWise open and enclosed lineshaft vertical turbine pumps. The procedures shown in this manual cover all our vertical turbine pump models with a few exceptions. Those exceptions will be noted as required within the manual.

It is necessary that you read and understand this manual in its entirety before installation or maintenance of the FloWise vertical turbine pump. Following the instructions and service procedures as noted herein will help extend the life of the pump and ensure trouble-free operation.

Note: FloWise shall not be liable for physical injury, death, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this manual.

Specific Pump Information

Pump Model: _____

Pump Serial: _____

Motor Model: _____

Motor Serial: _____

Contact Name: _____

Contact Phone: _____

Purchase Date: _____

Install Date: _____

Warranty

FloWise pumps are warranted to be free from defects in material and workmanship for a period of one year from the date of shipment. This warranty does not include wear parts or consumables such as seals, gaskets, elastomers, coatings, bearings, etc. Warranty void on items damaged due to misuse or improper handling by others.

Safety

The FW2100 series end suction pumps have been designed and manufactured for safe operation. Remember that every pump has the potential to be dangerous, because of the following factors:

- Parts rotating at high speeds
- High pressures may be present
- High temperatures may be present
- Highly corrosive and/or toxic chemicals may be present

Paying constant attention to safety is always extremely important. However, there are often situations that require special attention. The situations are indicated throughout this book by the following symbols:



Hazards marked by this symbol are severe and may cause serious personal injury, death, or result in major property damage.



Hazards marked by this symbol may cause personal injury or result in major property damage.

Safety Considerations:

- **DO NOT REMOVE** any safety decals found on the equipment.
 - **DO NOT** allow fluid to freeze inside the pump.
 - **DO NOT** allow the pump to run dry or start without proper submergence.
 - **DO NOT** allow the pump to run backwards. Proper motor rotation must be checked before starting the pump.
 - **DO NOT** operate the pump outside of its recommended flow range. Consult the pump curves and/or your FloWise factory representative to determine proper pump design points.
 - **DO NOT** operate the pump if noise or vibration is observed. Shutdown the pump immediately.
 - **DO NOT** operate the pump without the coupling guard and any other safety devices properly installed.
 - **DO NOT** apply heat during pump disassembly or impeller removal. Heat applied to components may cause entrapped liquid to vaporize, causing an explosion.
-
- Always make sure that proper lockout-tagout safety procedures have been performed and power is disconnected prior to starting maintenance on the pump.
 - Use extreme caution if the pumped liquid is hazardous. Follow necessary precautions to avoid contact and prevent spills during installation, removal, and maintenance.
 - Ensure adequate flow is available to the pump suction and that no valves are closed on the suction or discharge.

General Layout and Description

The FloWise FW2100 series end suction centrifugal pump has the overall typical configuration shown in figures 1 and 2. An electric motor or a diesel engine is mounted to the pump bracket. This motor's shaft runs through frame and the volute to drive the impeller. The FW2100 series impellers are all of a closed design. The impeller channels the flow from the intake through the volute to the outlet. Both the pump inlet and outlet have a flanged connection.

Figure 1 – FW2100 Series Engine Mounted Configuration



Figure 2 – FW2100 Series Close Coupled Configuration



Receiving

Perform a thorough inspection of the shipping crates for damage or signs of improper handling before unpacking. Then unpack and check all items for damage. Take extra care to ensure that all shafting is straight, threads are undamaged, and that all items are present and match the bill of lading (BOL).

Report any damage and/or missing items from the BOL immediately to your freight carrier. Also immediately report any damage and/or missing items (whether they were present on the BOL or not) to your local FloWise representative.

Storage

Short-Term (< 2 Months)

If the pump and components are to be stored in a dry, indoor environment for less than 2 months, standard factory shipping packaging will be adequate for protection. No less than once a month, the shaft shall be turned counterclockwise several times and left in a different position than it was before the rotation.

Long-Term (2-12 Months)

For storing the pump and components in a dry, indoor environment for 2 to 12 months, follow the instructions below:

- Construct a new solid wood skid that will elevate the pump and equipment no less than 3" off the ground and safely support the weight of all equipment. Ensure that there is room in the skid to allow all parts of the pump to pass through, while still being supported.
- Cover the wood skid with industrial polyethylene shrink wrap.
- Set the pump on top of the shrink wrap and wood skid.
- Install a bolt, washer, and rubber bushing from the bottom of the wood skid, through the shrink wrap, through the volute mounting holes, and secure with a hex nut. Continue installing bolts in this manner to adequately secure the equipment to the wood skid.
- When the equipment is all secured to the wood skid, place desiccant bags around the equipment (on top of the shrink wrap).
- Wrap the shrink wrap over the pump and apply heat to seal completely. Entrapped moisture will be absorbed by the desiccant.
- No less than once a month, the shaft shall be turned counterclockwise several times and left in a different position than it was before the rotation. After rotation, reseal the shrink wrap.

Uncontrolled Storage

If storage is to be outside, subject to relative humidity >50%, subject to dust, or subject to other potentially damaging environments, it is considered uncontrolled.

For uncontrolled storage, take the steps listed above for long term storage and follow the additional instructions below:

- Seal all pipe threads with tape.
- Do not store in an area subject to flooding or pooling of water.
- Tarps or other weatherproof coverings used shall be flame resistant and tied down securely.
- Any stacking of components shall be such that all weight is supported by the crates, rack, etc. and no weight is transferred to the components.
- If outdoors, equipment should be stored under a roof or shed when possible.

Handling



In handling the pump and its components, great care must be taken to ensure that none of the precision machined parts are damaged. Damage to any parts may result in failure or malfunction of the pump. Never allow the pump or components to be dropped from the carrier vehicle to the ground.

Always ensure that lifting devices and equipment are rated and suitable for the equipment being handled. Also, always make sure all lifting devices are securely fastened.

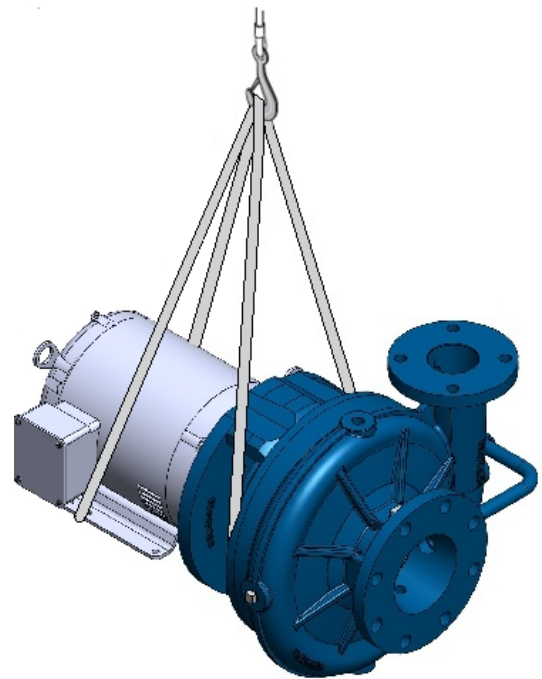
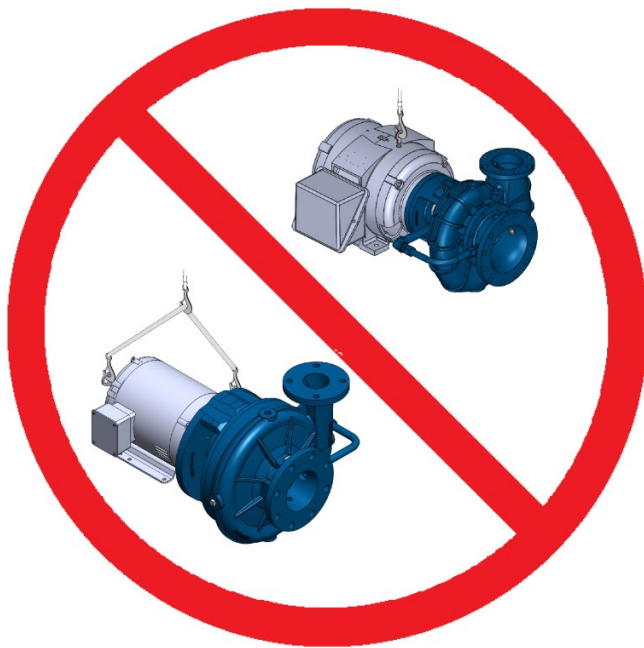
If the pump is not immediately installed during delivery to the jobsite, create an installation area that is clean and convenient. Leave the pump assembly in its crating and protect any power cables or motor leads from damage. Make sure all components are present and identify them as needed to prevent confusion with other on-site equipment.

Close Coupled Pump Lifting Procedure

DO NOT screw an eye bolt into the motor housing and attempt to lift assembly! The lifting point on a motor case is not designed to support the combined weight of the motor and pump.

Wrap the first chain or strap under the fan end of the motor up tight against the motor feet, and the second chain or strap under the pump bracket between the pump end and the motor.

Raise the motor/pump assembly slowly to ensure that the chains or straps will not slip when put under tension. Balance motor and pump with chains or straps to maintain proper weight stability. If the pump is not stable, release tension on the chains or straps and readjust.



HEAVY WEIGHTS: Use care and proper equipment when handling pump, NEVER walk or reach under a suspended pump

Installation

Location

Locate the pump as near the water source as practical. Make the pipe run as short and straight as possible, especially if a suction lift is required.

Careful attention should be taken to assure that net positive suction head available (NPSHa) exceeds net positive suction head required (NPSHr) by the pump. If this requirement is not met, reduced performance and severe pump damage may result. If there is doubt, consult with FloWise Engineering. Install pump in a dry, clean, and drained location readily accessible for inspection and maintenance. Always provide adequate ventilation.

Foundation

The pump should be set on a concrete foundation which is sufficiently substantial to absorb vibration and which provides a rigid and permanent support.

- Multiple types of permanent pump/ foundation installations can be used.
- If grout is used, top of concrete should be left rough to provide a good bonding surface.
- Foundation should slope away from the pump to prevent liquid from pooling.

Piping

System Piping should be at least one commercial pipe size larger than pump connections and flow velocity should not exceed eight (8) feet per second. Pay attention to align the piping with pump case. Misalignment or excessive pipe strain can cause distortion of pump components resulting in rubbing, breakage, and reduced pump life.

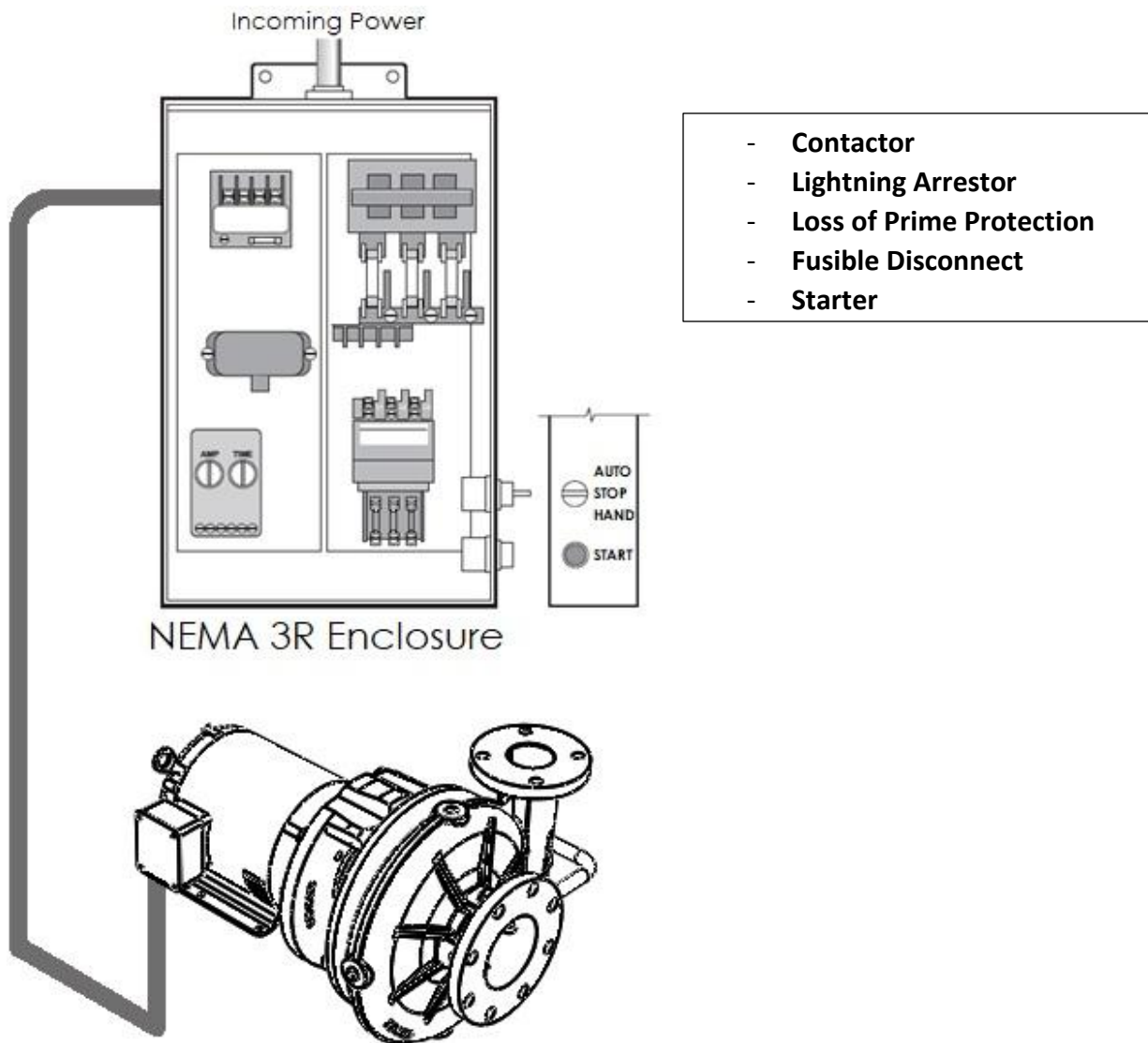
Support pipe in such a way that no force is exerted on pump connections. Check alignment as follows:

1. With the pump shut down and isolation valves closed, remove pipe flange bolts.
2. If the mating flanges come apart or shift, misalignment is present and causing pressure on the connections.
3. Adjust pipe supports until flanges mate without any force. This procedure can be performed throughout the piping system

Motor Electrical Connection

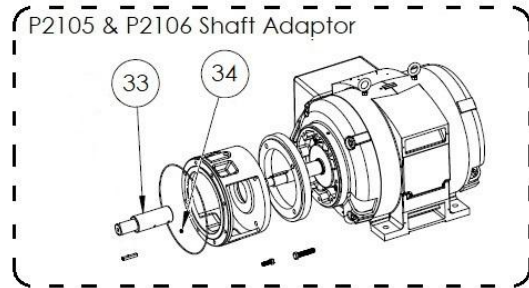
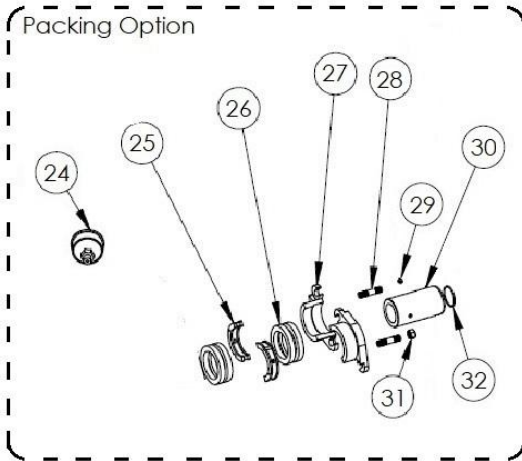
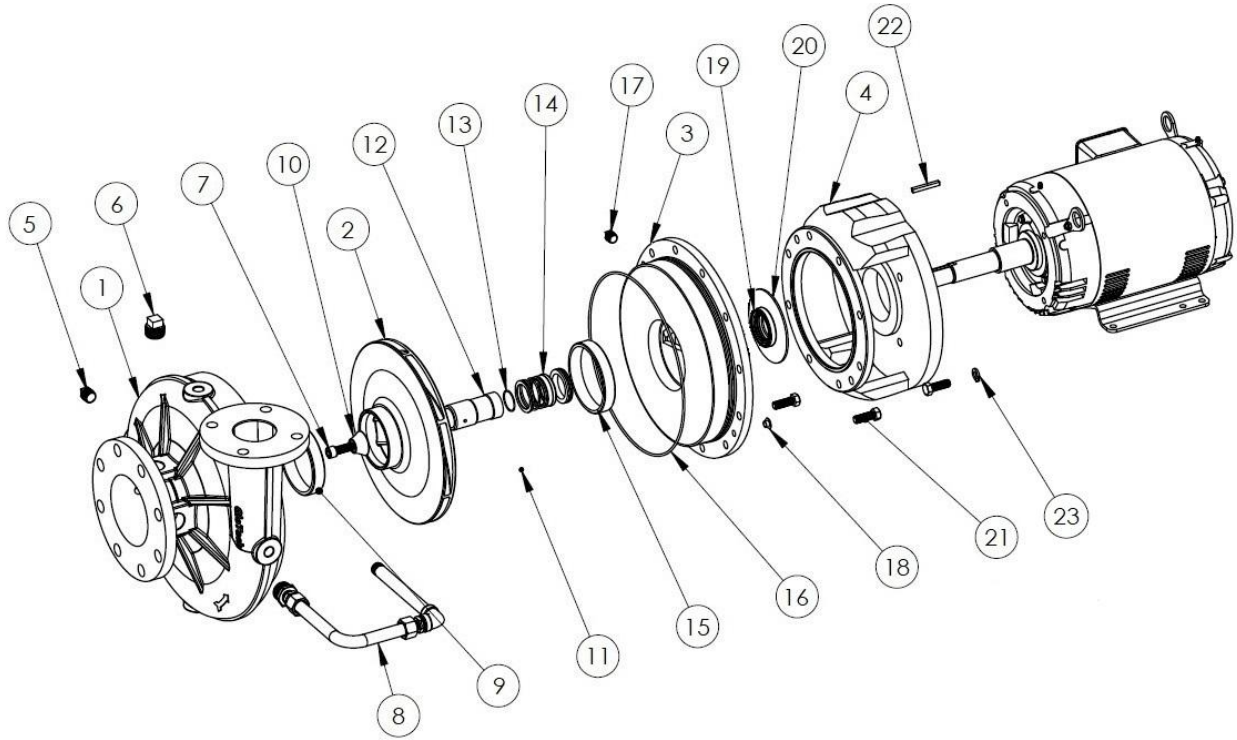
Check phase and voltage stamped on pump motor nameplate before wiring. Ensure these values agree with your electric current supply. They **MUST** be the same. If in doubt, check with your local power company.

A panel diagram with the minimum recommended components can be seen below.



HAZARDOUS VOLTAGE! Can shock, burn, or cause death. All wiring should be done by a qualified electrician. Disconnect power to pump before servicing.

Close Coupled Pump Parts Diagram

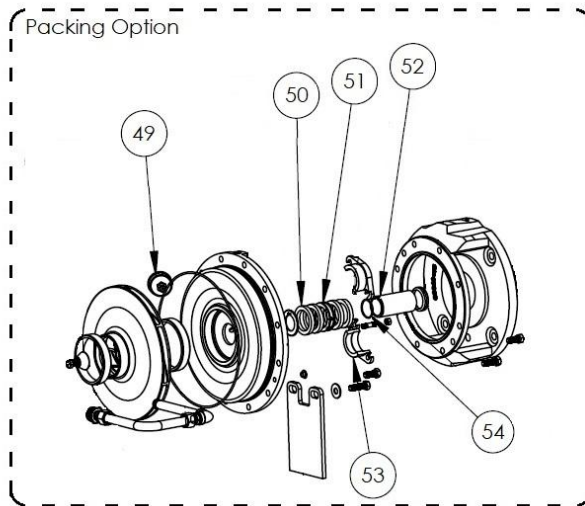
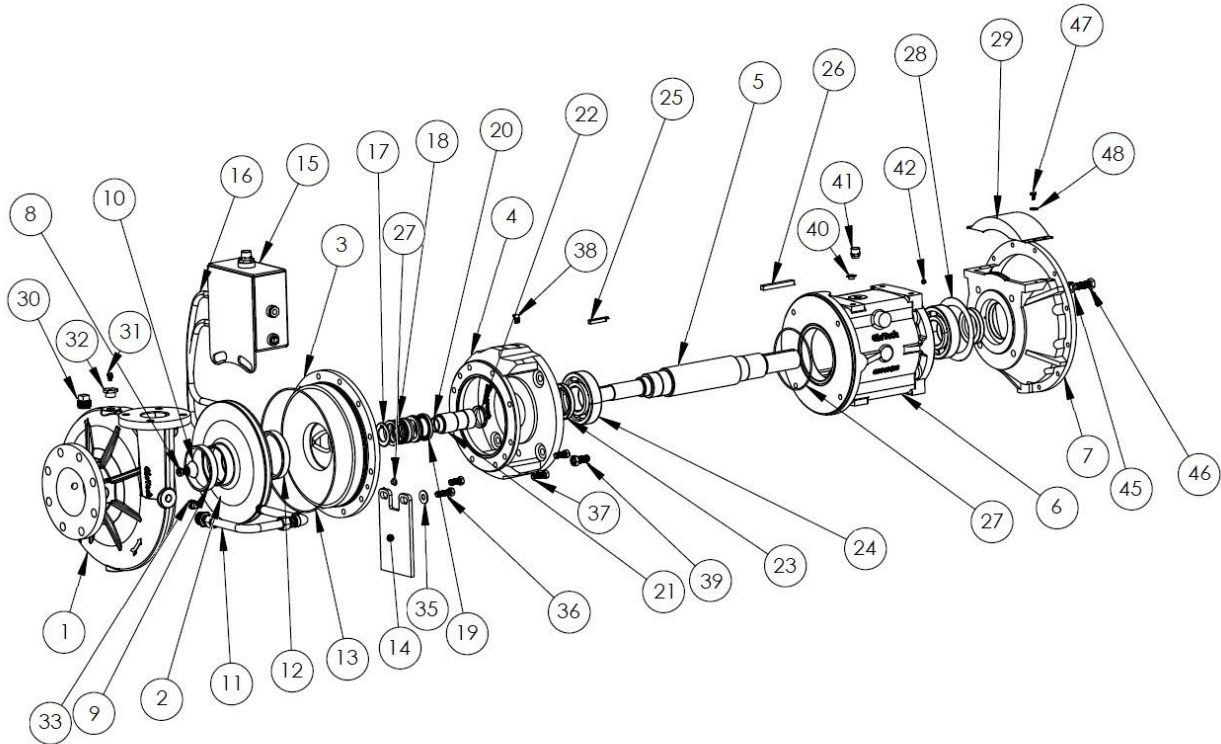


Close Coupled Parts Table

Item #	Part Description	Quantity	Mechanical Seal Option	Packing Option
1	Volute	1	X	X
2	Impeller	1	X	X
3	Backplate	1	X	X
4	Bracket	1	X	X
5	Pressure Check NPT Plug	Varies	X	X
6	Priming Port NPT Plug	Varies	X	X
7	Impeller Lock Screw	1	X	X
8	Balance Line Assembly	1	X	X
9	Suction Wear Ring	1	X	X
10	Impeller Washer	1	X	X
11	Shaft Sleeve Set Screw (Mechanical Seal)	2	X	
12	Shaft Sleeve (Mechanical Seal)	1	X	
13	Shaft Sleeve O-ring (Mechanical Seal)	1	X	
14	Mechanical Seal	1	X	
15	Hub Wear Ring	1	X	X
16	Backplate O-ring	1	X	X
17	Backplate NPT Plug	Varies	X	X
18	Threaded Hole Plug	2	X	X
19	Lip Seal	1	X	X
20	Deflector Ring	1	X	X
21	Cap Screw	Varies	X	X
22	Impeller Key	1	X	X
23	Split Lock Washer	Varies	X	X
24	Grease Cup	1		X
25	Lantern Ring	2		X
26	Packing Ring	4		X
27	Packing Gland	2		X
28	Threaded Rod	2		X
29	Shaft Sleeve Set Screw (Packing)	2		X
30	Shaft Sleeve (Packing)	1		X
31	Packing Gland Hex Nut	1		X
32	Shaft Sleeve O-ring (Packing)	1		X
33	Shaft Adaptor*	1	X	X
34	Shaft Adaptor Cone Set Screw*	4	X	X

Engine Mounted Parts Diagram

**Present only on FW2105 and FW2106 models*

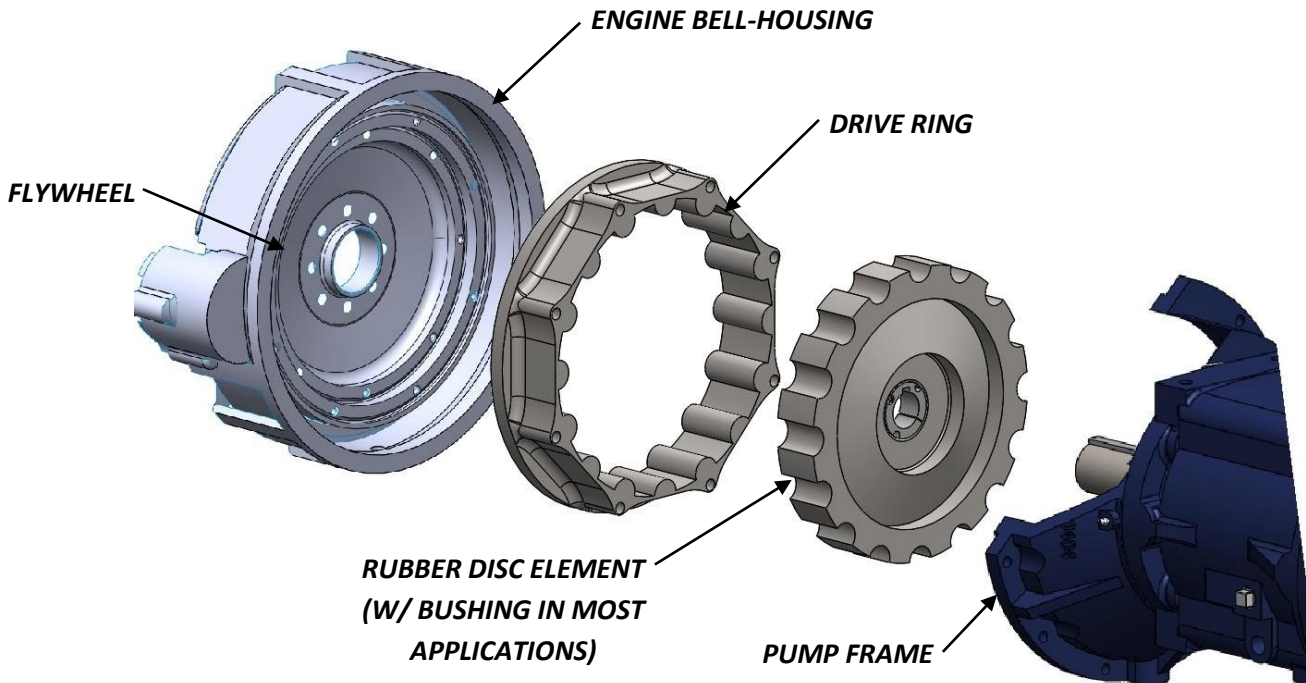


Engine Mounted Parts Table

Item #	Part Description	Quantity	Mechanical Seal Option	Packing Option
1	Volute	1	X	X
2	Impeller	1	X	X
3	Backplate	1	X	X
4	Bracket	1	X	X
5	Shaft	1	X	X
6	Frame	1	X	X
7	SAE Engine Bracket	1	X	X
8	Impeller Lock Screw	1	X	X
9	Suction Wear Ring	1	X	X
10	Impeller Washer	1	X	X
11	Balance Line Assembly	1	X	X
12	Hub Wear Ring	1	X	X
13	Backplate O-Ring	1	X	X
14	Support Plate	1	X	X
15	Oil Tank Assembly (Optional)	1	X	X
16	Hose Assembly (Optional)	2	X	X
17	Impeller Shim (If Applicable)	1	X	X
18	Mechanical Seal	1	X	
19	Backplate Lip Seal	1	X	
20	Shaft Sleeve O-Ring (Mechanical Seal)	1	X	
21	Shaft Sleeve (Mechanical Seal)	1	X	
22	Deflector Ring	1	X	X
23	Bracket Lip Seal	2	X	X
24	Deep Groove Ball Bearing	2	X	X
25	Impeller Key	1	X	X
26	Shaft Key	1	X	X
27	Frame O-Ring	1	X	X
28	Shim	Varies	X	X
29	Engine Bracket Cover	1	X	X
30	Priming Port NPT Plug	Varies	X	X
31	Vent Plug	1	X	X
32	NPT Adaptor	1	X	X
33	Pressure Check NPT Plug	Varies	X	X
34	Threaded Hole Plug	2	X	X
35	Flat Washer	2	X	X
36	Support Plate Hex Head Screw	2	X	X
37	Bracket Hex Head Screw	Varies	X	X
38	90° Grease Fitting	1	X	X
39	Hex Head Screw	4	X	X
40	Threaded Hole Plug	8	X	X
41	Breather with Splash Guard	1	X	X
42	Grease Fitting	1	X	X
43	Hex Head Screw	4	X	X
44	Flat Washer	4	X	X
45	Split Lock Washer	4	X	X
46	SAE Bracket Hex Head Screw	4	X	X
47	Engine Bracket Cover Screw	4	X	X
48	Engine Bracket Cover Washer	4	X	X
49	Grease Fitting	1		X
50	Packing Ring	4		X
51	Lantern Ring	2		X
52	Shaft Sleeve (Packing)	1		X
53	Packing Gland	2		X
54	Shaft Sleeve O-Ring (Packing)	1		X

Assembly of Pump to Engine

All 2100 series pumps can be equipped with engine-frames which are manufactured to fit the standard SAE-type flywheel and housing. For engines that do not have standard SAE flywheels and housings, some alterations may be required.



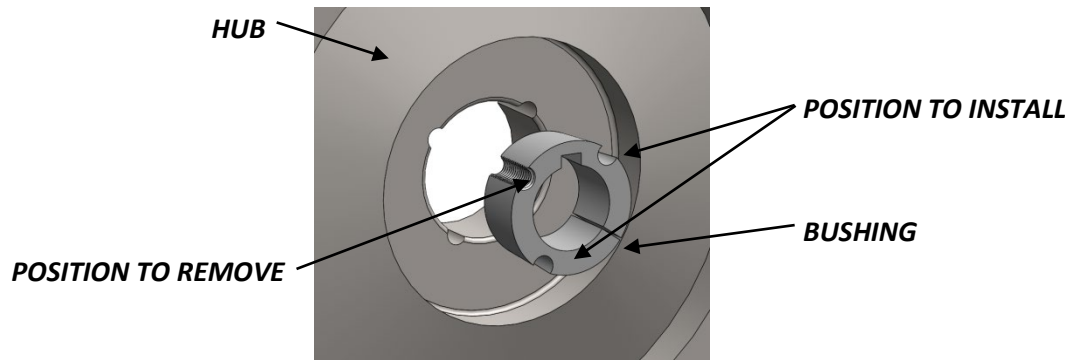
Assembly Instructions

1. Set the drive ring in place in the flywheel and bolt securely in place (bolt requirements are shown below).

Ring Gear Bolt Requirements				
Clutch Size	Bolt Size	Bolt Grade (SAE)	Bolt Torque	Number of Bolts
6.5, 7.5	5/16 – 18	5	17 Ft-lbs	6, 8
8, 10, 11.5	3/8 – 16	5	30 Ft-lbs	6, 8, 8
14	1/2 – 13	5	75 Ft-lbs	8

2. The disc element is to be placed on the pump shaft and secured. In most cases the rubber disc element will be secured to the shaft by a taper lock bushing. The bolts used should match the recommended torque as stated by the bushing supplier.


Taper Lock Bushing Instructions

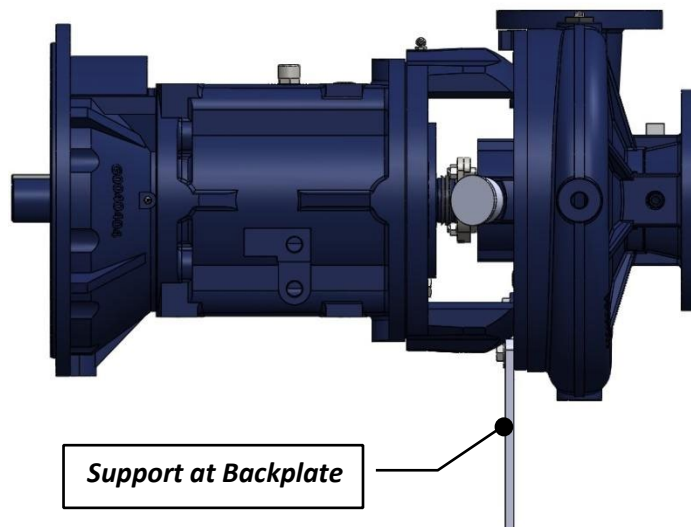


To install: The bushing is to be inserted into the hub so that the unthreaded holes in the bushing align with the threaded holes in the hub. Screws are placed in the holes and tightened. The instructions packaged with the bushing should be reviewed for complete instructions and torque values.

To remove: Screws should be removed and a single screw should be placed in the threaded hole in the bushing. The screw should be tightened which will force the bushing and hub apart

3. With hoist or block and tackle, the pump should be maneuvered into place on the engine, be careful to mesh the rubber disc element in the drive ring properly

4.  All engine-driven pumps **MUST** be supported, and alignment must be assured before bolting the frame to the engine flywheel housing. Piping must be properly supported. The pump is not intended to carry piping loads.



NOTE: Customers can use the support plate provided with the pump or use one of their own.

FAILURE TO PROVIDE PROPER SUPPORT WILL VOID THE WARRANTY!

5. Bolt the pump and frame securely to engine bell-housing (bolt requirements are shown below) double check the location of the rubber disc element in the drive ring and adjust if necessary.

Engine Bell-Housing Bolt Requirements				
Clutch Size	Bolt Size	Bolt Grade (SAE)	Bolt Torque	Number of Bolts
1	7/16 – 14	5	50 Ft-lbs	12
2, 3, 4	3/8 – 16	5	30 Ft-lbs	12

Assembly of Pump to Motor

Assembly Instructions

1. Perform pre-assembly installations of shaft and sealing components. Install lip seal and O-ring into backplate. Apply grease onto O-ring and slide the O-ring into shaft sleeve. If stub shaft is present (FW2105/FW2106) install stub shaft directly to motor.
2. Note the alignment of the balancing line holes. Install the motor bracket to the motor using cap screws and split lock washers. Slide deflector ring over motor shaft, push to end. Slide the shaft sleeve onto the motor shaft, avoiding displacement of the O-ring.
3. Apply threadlocker onto cup-point set screws. Mount set screws into shaft sleeve and tighten. Confirm shaft sleeve alignment with keyway, if applicable. The backplate can then be installed, by mounting to the bracket with cap screws.
4. For mechanical seal configuration, insert mechanical seal stationary ring into backplate. Slide mechanical seal over motor shaft, pushing all the way to the end.
5. For packing configuration, the packing rings are preinstalled into the backplate. Hand tighten packing gland nuts. Do NOT use a wrench. Rotate shaft by hand to make sure that it turns freely
6. Insert impeller key onto motor shaft.
7. Install impeller, aligning the impeller key with impeller keyway. Apply threadlocker to impeller lock screw. Install impeller washer and impeller lock screw, tighten down securely.
8. Install volute, using cap screws to mount, align the volute NPT side with backplate NPT side for balance line installation.
9. Assemble balancing line and install between volute and backplate.

Torsional Vibration

All responsibility for torsional vibration analysis is assigned to the packager. Specialized consulting offices or engine manufacturers can provide this service. FloWise does not assume responsibility of torsional vibration problems of pump-engine units assembled by others. Problems due to torsional vibration are not warrantable.

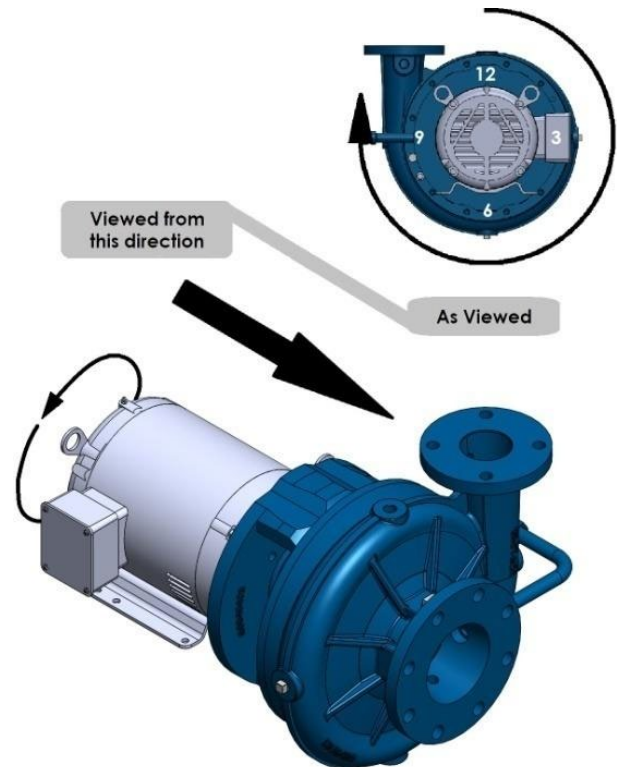
Startup Checklist



BEFORE THE START UP OF ANY PUMP, A CAREFUL CHECK MUST BE MADE TO ENSURE THAT ALL IS IN ORDER!

1. Reread all instructions and verify for compliance on each item
2. Ensure that:

- a. All gasketed joints and fasteners are properly tightened
- b. Belts and couplings are properly adjusted, guards are in place, and shafts are aligned
- c. All supports and thrust blocks are adequate
- d. The pump and/or baseplate is bolted securely to a solid foundation
- e. There are no piping loads on the pump casing, discharge piping or support suction
- f. Piping is clean and free of obstructions and debris
- g. All joints are secured and any gaskets are in place
- h. All electrical connections and electrical equipment are installed by a qualified and licensed electrical contractor
- i. The pump rotates freely by hand; the pump rotational direction should be verified with very short on/off power pulses on the start switch
- j. Pumps with mechanical seal must not run dry unless equipped with oil dry run system



3. Valves

Check all valves for proper position. If the system has a discharge gate valve, start with the valve closed. The speed of opening depends upon the size and length of your discharge pipe and capacity of the pump. The valve should not be more than $\frac{1}{4}$ open until the line is filled. This procedure's purpose is to reduce the possibility of a water hammer or shock if filling is too rapid.

4. For Stuffing Box With Packing

When first starting the pump, there should be leakage. If the packing is too loose, air will suck in around the packing and the pump will not prime. After the pump is primed, back off on packing gland nuts to free leakage. Several minutes later, gradually and evenly tighten packing gland nuts until leakage is reduced to a trickle. Do not attempt to shut off all the leakage – packing pumps must leak to lubricate the packing.

For Stuffing Box with Mechanical Seal

Read and comply with all seal instructions within the manual. During shipment seals may be jolted, which could result in leakage. However, any leak should stop after a small period of operation.

5. Instructions for Pumps with Balance Lines and Wear Rings

Wear rings and balance lines are crucial for a successful pump operation. They perform two important functions. First, they relieve the pressure at the stuffing box. Second, they lessen axial thrust loads. Balance lines should be kept free of obstructions and they should be replaced if they are pinched, bent, or corroded. Wear rings should be replaced if the clearance has increased to about .030" per side.

6. Motors

Check the power supply voltage, temperature, amperage, and RPM with the motor nameplate. Review item 2(i) with respect to rotation and page 9 for recommended panel components.

NOTE: Large motors must not be started and stopped more than five times per hour.



Whether placed inside or outside, the motor should be mounted on a base which is four to six inches higher than the surrounding floor level.

7. Bearing Frames

In general, the considerations for a bearing frame are identical to that of electric motors. If the pump is used in winter, provisions must be made for protection of the pump and piping from freezing. A heater can be added if necessary. If the pump is not used in the winter, the volute should be completely drained to prevent damage.



Never operate electric motors or pump equipment without all protective covers, screens and guards properly in place. Before disconnecting any electrical wiring, shut off the main switch and lock it out.

8. Check to make sure the suction screens are in place. A suction screen or strainer should have a free opening with a minimum of at least three times the area of the suction pipe.
9. Start the driver. If the pump is primed or filled with liquid, the pumping will start instantly.

Centrifugal Pump Priming

A centrifugal pump is primed when all the internal passages of the pump are filled with the liquid to be pumped. Do not operate any FW2100 pump without the pump being properly primed. When the pump is primed and the unit is started, the pumpage will start to flow immediately. If it does not, recheck the system for complete prime and possible air leaks. Correct any problems and restart.



If the pumpage does not start immediately, no amount of additional pumping will solve the problem



Do not allow compressed air to pressurize the pump or vent-off compressed air through the pump as this may damage the pump or cause serious personal injury

Pump End Disassembly and Reassembly

Disassembly

1. Volute Removal

Remove the balance line. Make sure the volute is supported so that it doesn't fall onto the impeller. Remove all cap screws holding the volute to the backplate. Insert two of these cap screws into the tapped holes on the backplate. Tighten the cap screws to jack the volute free of the backplate, exposing the impeller. Remove the volute.

2. Impeller Removal

Impeller lock screws are always right hand socket head cap screws. Lock screws are installed with threadlocker, which may inhibit removal. Remove the impeller lock screw by breaker bar. Do not remove by impact wrench. Apply consistent and even torque to break the lock screw loose. Allen head tools used to remove the lock screw should be in excellent condition. If breaker bar will not loosen impeller lock screw, heat can be applied to the lock screw for 2-4 minutes, loosening the threadlocker. Do not exceed 400F.



Serious burn injury is possible when applying heat. Allow the lock screw to cool before removing it. Discard the lock screw; under emergency conditions this may not be possible. A new lock screw should be used whenever possible. Remove the impeller washer

Space wedges in pairs 180° apart between impeller and backplate. Ensure that the wedges are placed along the impeller vanes. Tap opposed wedges simultaneously to force off the impeller. Use extreme care to avoid damage to impeller, shaft and bearings. Completely remove the impeller and impeller key.

An alternative method is as follows. Install a bolt or cap screw in the shaft thread to protect the threads. Attach an impeller puller to the backplate and snug up the nuts on the rods so that the puller is against the impeller. Loosen the packing gland nuts. Remove the cap screw between bracket and backplate. Tighten the center rod to jack the backplate and impeller off the shaft.

3. Backplate Removal

If necessary, remove the grease cup. Loosen the packing gland nuts. Unbolt and remove the backplate from the pump bracket.

4. Sleeve Removal

If replacement is needed, remove the sleeve. Using new packing against a worn sleeve will give substandard service. Unthread cup-point screws and slide the old shaft sleeve off. If needed, use a standard gear puller to get the sleeve puller and sleeve off the shaft.

5. Wear Ring Removal

For pumps that have a suction spool, the suction wear ring can be removed by removing the suction spool from the volute and driving the wear ring out with a piece of wood and a hammer. Otherwise, the suction wear ring can be removed by drilling the ring longitudinally in three places to relieve compression and collapsing the three sections together. Great care must be used not to drill into the volute. Better control is obtained if small pilot holes are first drilled and then enlarged to "cut" the ring. This identical technique is used to remove the hub wear ring.

Reassembly

1. Sleeve Installation

Slide the new sleeve on the shaft. Apply threadlocker on cup-point set screws, mount set screws and tighten securely. If applicable, check shaft sleeve keyway and shaft keyway alignment before proceeding

2. Wear Ring Installation

The wear rings may be pressed in, or driven in using a mallet with a rubber or plastic head. Do not use a metal hammer directly on the wear ring as this will result in wear ring damage. If a metal hammer is all you have, use a block of wood between the hammer and wear ring.

3. Packing and Backplate Installation

Remove the packing gland and pull out the old packing. Note the position of the lantern ring, if one is present. Insert an extra sleeve in the stuffing box ring by ring. Make sure that each ring is cut square on a mandrel of correct size. Insert each ring of packing independently, pushing it squarely into the box. Successive rings of packing should be rotated so the points are 90° apart. Push all the way down and tap lightly.

If the pump has a lantern ring and grease cup for lubricating the packing, the grease cup will contain “Insoluble pump and packing lubricant”. This compound reduces friction and prolongs the life of the graphite packing. Standard multi-purpose grease is not to be used. It will wash out the graphite particles, increasing friction and heat. Refill the grease cup with “insoluble pump and packing lubricant” as required. Apply a liberal coating of this compound to all surfaces of the packing before installing each ring. Replace the backplate and grease cup. Replace the packing gland and nuts.

4. Impeller and Lock Screw Installation

(Use only new high quality lock screws) Replace the impeller key. Before installing the lock screw make sure that the impeller, impeller washer, and lock screw are all clean and dry.

NOTE: Do not apply any lubricant to any surface in an attempt to facilitate installation. Lubrication will cause the lock screw to suffer failure or damage from overstress.

Determine the size of the lock screw and note the required installation torque from the table below. Apply threadlocker to both the lock screw and shaft threads. Install the lock screw through the impeller washer, impeller and into the shaft, with the appropriate torque from the table below. Verify that the actual torque value matches the requirement from the table.

Impeller Lock Screw Size	Required Torque
.38-16UNC	20 Ft-lbs
.50-13 UNC	40 Ft-lbs
.62-11 UNC	90 Ft-lbs
.75-10 UNC	135 Ft-lbs
1.00-8 UNC	265 Ft-lbs
1.12-7 UNC	360 Ft-lbs
1.25-7 UNC	510 Ft-lbs
1.50-6 UNC	875-lbs

5. Volute Installation

Place a new o-ring on the backplate. For emergency use, the old o-ring can be used if it is in good conditions. Slide the volute carefully over the impeller and backplate register. Install the cap screws. Reconnect the balance line.

Frame Disassembly and Reassembly

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Disassembly

1. Remove the deflectors from the shaft.
2. Remove the drive end shaft key.
3. Remove the cap screws from the engine bracket.
NOTE: If the lip seals are to be saved the shaft should be cleared of burrs or sharp protrusions that would cut the seal. If the lip seals are removed from the brackets they should be replaced.
4. Slide the engine bracket off the shaft. Remove the cap screws from the pump bracket. Slide the pump bracket off the shaft.
5. The shaft and bearings can now be removed by pressing on the drive end of the shaft.
6. Remove the bearings from the shaft with a bearing puller. If the bearings are to be saved, keep them absolutely clean. If contaminated, wash only in clean fluid.



Never hammer the shaft or parts attached to the shaft or you will ruin both the shaft and the bearings

Reassembly

1. Press the drive end and pump end bearing onto the shaft. Pressure should be applied to the inner race only. The bearings must be up against the shaft shoulder.
2. Press the shaft into the frame through the drive end until the pump end bearing is approximately flush with the pump end of the frame.
3. Install the lip seal in the pump bracket as shown on the parts diagram. Slide the pump bracket over the shaft, taking care not to damage or fold the lip seal. Install and tighten the cap screws.
4. Install the lip seal in the engine bracket as shown on the parts diagram. Reinstall the shims in the drive end of the frame (if present when disassembled). If new shaft, bearings, frame, or engine bracket are being installed, insert shims to maintain 0.007" to 0.012" shaft endplay. Slide the engine bracket over the shaft. Install and tighten the cap screws.
5. Install the deflectors and lubricate per the instructions following this section.

Grease Frame Lubrication Instruction

Bearings in all frames are greased at the factory prior to shipment.

Lubrication requirements will vary with load, power, ambient temperatures, speed, seasonal or continuous operation, exposure to contamination and moisture, and other factors. The brief recommendations which follow are general in nature and must be coupled with good judgment and consideration of the application conditions. For regreasing periods, refer to the table below. When adding grease be sure the grease and fittings are completely clean.

Grease used for these bearings should be equivalent to one of the following manufacturers' products:

- G.E Long Life Grease No. D682C5
- Mobil Mobilux No. EP2
- Shell Gadus S2 V220 2
- Texaco Multifak AFB 2

To lubricate frame bearings, remove plastic cover from Zerk fittings and be sure the fitting and end of grease gun are clean. Use a hand-operated grease gun only and pump a small amount of grease into each bearing cavity. The surplus grease will go through the bearing and into the center part of the frame.

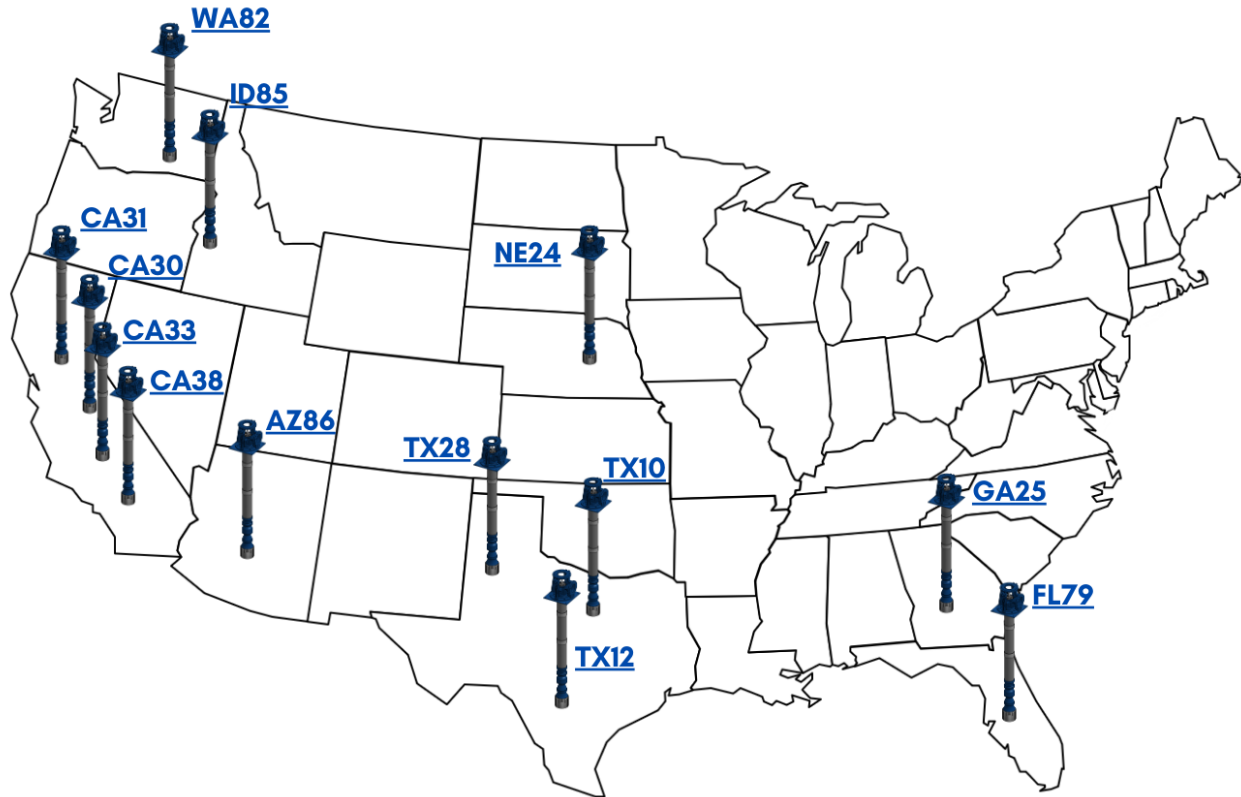
For regreasing periods and approximate quantity, determine frame size (located on serial number plate) and refer to table below.

Recommended Regreasing Periods for Frames		
Frame Size	16	18
Total Running Time	1500 Hours	1000 Hours
8-Hour Day Service	27 Weeks	18 Weeks
24-Hour Day Service	9 Weeks	6 Weeks
Approximate Amount of Grease per Line Fitting	1.25 Cubic Inch	2 Cubic Inches
Approximately (Grease Gun Hand Operated)	6 Pumps	12 Pumps

Pump Troubleshooting Guide

Symptoms	Causes	Corrections
1. Failure to Pump	A. Pump not properly primed	A. Prime pump correctly
	B. Pump running too slow or system too high	B. Consult FloWise Engineering
	C. Not enough head to open check valve	C. Consult FloWise Engineering
	D. Air leak in suction piping	D. Check and rework suction line
	E. Plugged suction pipe or impeller vanes	E. Unplug suction
	F. Suction pipe high point above impeller eye	F. Rework suction piping
	G. Suction lift too high	G. Consult FloWise Engineering
2. Reduced Performance	A. Air pockets or small air leaks in suction line	A. Locate and correct
	B. Obstruction in suction line or impeller	B. Remove obstruction
	C. Insufficient submergence of suction pipe	C. Consult FloWise Engineering
	D. Excessively worn impeller or wear ring	D. Replace impeller and/or wear ring
	E. Too high a suction lift	E. Consult FloWise Engineering
	F. Wrong direction of rotation	F. See start-up instructions
	G. Missing wear ring(s)	G. Install wear ring(s)
3. Driver Overloaded	A. Speed higher than planned	A. Reduce speed
	B. Pump runs out on curve/ system incorrect	B. Change system head
	C. Liquid specific gravity too high	C. Consult FloWise Engineering
	D. Liquid handled of greater viscosity than water	D. Consult FloWise Engineering
	E. Too large an impeller diameter	E. Trim impeller
	F. Low voltage	F. Consult power company
	G. Piping stress at flanges/ pump in bind	G. Support piping properly
	H. Packing too tight	H. Loosen packing gland nuts
4. Excessive Noise	A. Misalignment	A. Align all rotating parts
	B. Cavitation (excessive suction lift)	B. Consult FloWise Engineering
	C. Cavitation (improper suction design)	C. Correct suction piping
	D. Material lodged in impeller	D. Dislodge
	E. Worn bearings	E. Replace bearings
	F. Impeller screw loose or broken	F. Replace
	G. Wrong direction of rotation	G. See start-up instructions
5. Excessive Vibration	A. Misalignment	A. Align correctly
	B. Unbalanced Components	B. Re-balance components
	C. Bent Shaft	C. Replace shaft
	D. Structural (rigidity/ soft foot)	D. Correct bolting/ shim properly

Symptoms	Possible Causes	Solution
6. Premature Bearing Failure	A. Balance line plugged or pinched	A. Unplug or replace
	B. Worn wear rings	B. Replace
	C. Misalignment	C. Align all rotating parts
	D. Suction or discharge pipe not properly supported	D. Correct supports
	E. Bent shaft	E. Replace shaft
	F. Water or contaminants entering bearings	F. Protect pump from environment
	G. Lubrication to bearings not adequate	G. See lubrication instructions (IOM Manual)
	H. Wrong type of lubrication	H. See lubrication instructions (IOM Manual)
	I. Excessive belt loads	I. Consult FloWise Engineering
7. Electric Motor Failure	A. High or low voltage	A. Check voltage with voltage meter and consult power co.
	B. High or low voltage	B. Monitor voltage and consult power co.
	C. Poor electric connection	C. Turn power off, clean and check connections
	D. Overloads	D. Check amperage; do not exceed nameplate full load amperage
	E. Bearing failure	E. Change bearings in motor
	F. Cooling vent plugged (leaves, dirt, etc.)	F. Clean vent/ install proper screens
	G. Water in motor	G. Protect pump from environment
8. Rapid Wear on Coupling Cushion	A. Misalignment	A. Align all rotating parts
	B. Bent shaft	B. Replace shaft
	C. Wrong elastomer	C. Change elastomer/ Consult FloWise Engineering



Our pumps are available through the largest network of 13 warehouses / build centers across the country and backed with the legendary service of Preferred Pump.

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