WILFLEY

DURABLE. WATERLESS SEALING. INDUSTRIAL PUMPS

EMW® SLURRY PUMP

Metallic Pump

Installation, Operation, and Maintenance Manual
IM-EMW-M

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DURABLE. WATERLESS SEALING. INDUSTRIAL PUMPS

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1.0 Considerations

It is extremely important that this entire manual be read prior to installation or operation of the pump.

Any warranty of the operating reliability and safety of the pump/unit supplied is only valid if the machine is operated in accordance with its designated use. The limits stated in the data sheet must not be exceeded under any circumstances.

Warranty is only valid when genuine Wilfley parts are used. Modifications of the pump and/or pump parts are only permitted with approval from the manufacturer. **Contact your authorized Wilfley representative for basic warranty information and before making any changes.**

A.R. Wilfley and Sons, Inc. shall not be liable for damage or delays caused by a failure to observe the instructions that are contained in this manual.

Proper pump selection should be made for applications based on conditions of service, material compatibility, solids content, fluid temperature, footprint size, as well as motor speed and energy considerations. Improper selection or improper use of pumps could risk injury or damage. For maximum safety and reliability, use only factory-supplied parts and closely follow all operating instructions and maintenance recommendations.

Every centrifugal pump has the potential to be dangerous, because of the following factors:

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

NOTE

Always coordinate repair activity with operations personnel and follow all applicable safety requirements and health safety regulations.

The following list is provided only as a guide of the types of misuse that can damage a pump and cause injury. A.R. Wilfley shall not be liable for physical injury, damage or production delays caused by a failure to comply with the instructions contained in this manual. Below are examples of misuse that will void all relevant warranties.

1. *Do not lift the pump by its case only.*
2. *Do not connect the pump to the drive system without first checking to see that the drive system is running in the correct direction.*
3. *Do not rely on the factory's alignment of the pump and the drive system. Alignment may have changed during shipment.*
4. *Do not operate a pump with the coupling guard removed. Make sure the guard fits snugly around the coupling so there are no openings.*
5. *Do not run equipment dry or start the pump without the proper prime (Casing Flooded).*
6. *Do not run a pump with the discharge valve closed or below minimum rated flow.*
7. *Do not run a pump in the reverse direction.*
8. *Do not start a pump that is "wind-milling" in the reverse direction (fluid flowing back down the discharge pipe).*
9. *Do not continue to operate a pump when there are indications that something is rubbing, binding or knocking.*
10. *Do not continue to run a pump that gives an indication of overheating.*
11. *Do not exceed the maximum allowable pressure ("Max. P. @ 38°C" as shown on pump nameplate).*
12. *Do not operate a pump that is excessively vibrating, surging, or making abnormal noise.*
13. *Do not put a cold liquid in or on a hot pump or a hot liquid in or on a cold pump.*
14. *Do not hit a pump with any object.*
15. *Do not work on a pump unless the drive system is locked out and the pump is disconnected from the drive system.*
16. *Do not examine a pump without using proper eye and face protection.*
17. *Do not stick hands, arms, legs or any other object into the discharge, suction, or any other opening of a pump.*
18. *Do not use worn or faulty parts.*
19. *Do not weld attachments to the pump.*
20. *Do not apply external heat to the pump.*

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

DANGER

DANGER – Immediate hazards that WILL result in severe personal injury or death.

WARNING

WARNING – Hazards or unsafe practices that COULD result in severe personal injury or death.

CAUTION

CAUTION - Hazards or unsafe practices that COULD result in minor personal injury, product, or property damage.

NOTE

Always coordinate repair activity with operations personnel and follow all plant safety requirements and applicable safety and health laws and regulations.

1.1 Safety Suggestions

Always follow best practices for safety—including but not limited to:

Apparel

- Insulated work gloves when handling hot bearings or using bearing heater
- Heavy work gloves when handling parts with sharp edges, especially impellers
- Safety glasses (with side shields) for eye protection, especially in machine shop areas
- Steel-toed shoes for protection when handling parts, heavy tools, etc.
- Other personal protective equipment to protect against hazardous/toxic fluids.
- Always lockout/tagout power circuits
- Ensure pump is isolated from electrical system and pressure is relieved before disassembling any pressure containing parts
- Use proper lifting and supporting equipment to prevent serious injury.
- Observe proper decontamination procedures.
- Know and follow company safety regulations.
- Never apply heat to remove impeller.
- Observe all cautions and warnings highlighted in pump instruction manual.

Maintenance

- The operator is responsible for ensuring that all maintenance, inspection, and installation work is performed by authorized and qualified personnel who understand the application.
- Work on the machine must only occur at standstill. The shutdown procedure described in this manual must be followed.
- All safety/protective devices must be re-installed and/or reactivated immediately following completion of the work.
- Please observe all instructions described in Commissioning (Section 6) before returning the machine to service.
- Always lockout or tag out power.
- Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, or disconnecting piping.
- Use proper lifting and supporting equipment to prevent serious injury.
- Observe proper decontamination procedures.
- Know and follow company safety regulations.
- Never apply heat to remove impeller.
- Observe all cautions and warnings highlighted in pump instruction manual.

2.0 Handling

Following proper transport and storage practices prevents damage to pumping units. Proper lifting and safety practices must always be observed. Caution should be taken when lifting the pump as the center of gravity is not in the physical center of the unit. Units should be secured properly on a skid or crated box.

Lifting should only be done by trained personnel using the appropriate skid assembly. Pumps and motors often have integral lifting eyes or eye bolts. These are intended for use in lifting the individual piece of equipment, not the entire assembly.

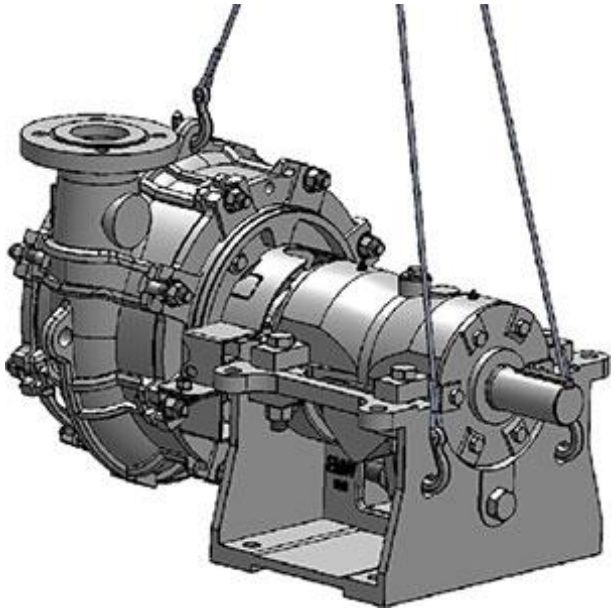
⚠WARNING

Care should be taken to ensure all lifting lines are properly installed to prevent a load shift. A load shift may result in injury, death, or property damage.

Before lifting the equipment, always be sure that the hoist and strapping method can lift the entire assembly weight.

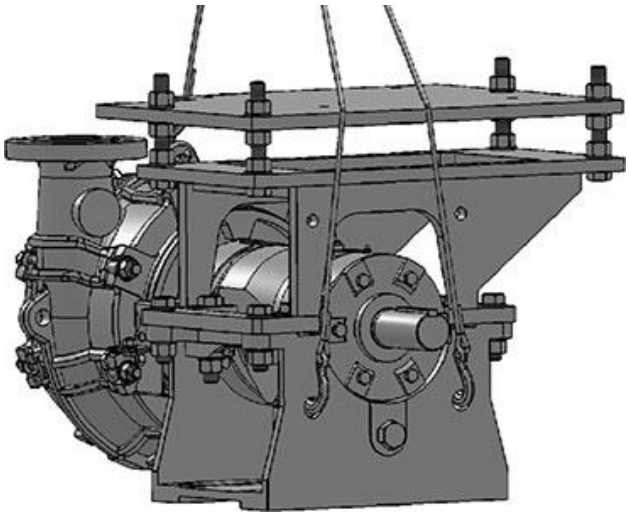
Bare Pump

Attach straps on pump case and pedestal to form a three-point lift as shown. The sling lengths should be adjusted to balance the load before lifting. **Do not use the bearing cartridge or shaft as a lift point.**



Pump and Overhead Assembly

Use the same technique as described with the bare pump. **Do not lift pump and overhead assembly with the motor mounted on the overhead.** See image shown below.



⚠CAUTION

The tapped hole in the top of the bearing cartridge is for a lifting eye used to handle the bearing cartridge assembly by itself. It is not to be used for lifting a pump.

2.1 Storage

If the pump is inoperative for a long period of time, it is recommended that the pump be flushed and thoroughly dried to minimize corrosion. It is also advisable to drain the pump interior if there is any possibility of freezing. If the pump is to be stored for more than 15 days, the pump should be rotated once a month (with lubrication) for the bearings.

Long-Term Storage

The following guidelines should be followed when the pump or parts will be idle for a period of one month or more.

Pump Storage

1. All machined metal surfaces should be coated with a suitable corrosion inhibitor to ensure the integrity of these surfaces at the time of installation.

2. All openings must be covered with suitable covers to protect against contaminants and moisture.

3. Storage of the Components and Assemblies should be kept away from all potential vibration sources. (i.e., motors, rotating pumps, engines, etc.). This is to prevent unwanted vibration and possible damage to the bearings.

4. Components and assemblies are required to be stored indoors in a dry location. Temperature range should be between 40 degrees and 100 degrees Fahrenheit. If the environment is excessively humid (more than 70%), a suitable desiccant should be used.

5. If the pump is to be stored for more than 15 days, the pump should be rotated once a month (with lubrication) for the bearings.

Individual Parts Storage

Not all parts are packaged in a suitable manner from the factory for long-term storage. To ensure satisfactory part performance, all parts must be protected from corrosion and contamination.

Motor and Seal Storage

Refer to the manufacturer's manuals for storage instructions for these items.

3.0 Installation

Inspection upon Arrival

Inspect the assembled pump upon arrival for any damage that may have occurred during shipment. Report any damage immediately to the carrier or distributor.

Leave all shipping covers attached to the pump unit until it is ready for installation. If installation is to be delayed more than 15 days, the pump shaft should be rotated by hand once every month with lubrication for care of the bearings.

To assure proper installation, supervision from an authorized Wilfley representative is recommended.

Choosing Pump Location

The following recommendations may be helpful when choosing the best location for your pump:

1. Locate the pump as close to the liquid source as practical so the suction pipe is short and direct with a minimum of elbows, fittings and valves.

2. Place the pump in a location so the unit is accessible for inspection during operation as well as for maintenance operations involving removal and disassembly.

Foundation

The foundation should be sturdy enough to absorb any vibration and to form a permanent, rigid support for the baseplate. This is important to maintain the correct alignment of the direct connected unit. A concrete foundation on a solid base is satisfactory. Foundation bolts of the proper size should be embedded in the concrete.

Alignment

Alignment of the motor and pump is necessary after the complete unit has been leveled and tightened onto the foundation. See alignment procedures

Piping

Both suction and discharge pipes should be supported independently near the pump so when the flange bolts are tightened no strain will be transmitted to the pump casing. The customer is responsible for proper suction and discharge pipe design and layout to avoid flow induced problems.

Discharge Piping

A valve should be installed in the discharge line to prevent fluid from flowing back through the pump when it is shut down. The valve should block the discharge line during maintenance.

⚠WARNING

A rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement should be provided in the piping.

Suction Piping

Care should be taken in sizing and locating suction piping to prevent cavitation. A valve should be installed in the suction line to prevent fluid from flowing into the pump when it is shut down.

To avoid NPSH and suction problems, suction pipe sizes must be at least greater than the pump suction connection. **Never** use pipe or fittings on the suction that are smaller in diameter than the pump suction size.

The ideal piping configuration should have a minimum of 10 pipe diameters between the source and the pump suction. In most cases, horizontal reducers should be eccentric and mounted with the flat side on top or up with a maximum of one pipe size reduction. Never mount eccentric reducers with the flat side down. Horizontally mounted concentric reducers should not be used if there is any possibility of entrained air in the process fluid. Vertically mounted concentric reducers are acceptable. In applications where the fluid is completely de-aerated and free of any vapor or suspended solids, concentric reducers are preferable to eccentric reducers.

Avoid the use of throttling valves and strainers in the suction line. Start-up strainers must be removed shortly after start-up. When the pump is installed below the source of supply, a valve should be installed in the suction line to isolate the pump and permit pump inspection and maintenance. However, never place a valve directly on the suction nozzle of the pump.

Packing / Seal Flush Piping

An external connection should be made at the pump so flush flow can be varied as required by valves and the pressure can be monitored. Pipe fittings and gauges must be corrosion resistant to the fluid being pumped.

⚠WARNING

Piping Forces: Take care during installation and operation to minimize pipe forces and/or moments on the pump casing.

Refer to the Hydraulic Institute Standards for centrifugal pumps for additional piping information.

3.1 Installation Alignment

Accurate alignment of the equipment must be obtained and sustained. Trouble-free operation can be accomplished by following the proper procedures.

A properly installed base plate will be leveled with shims, retained in place with anchor bolts, set in concrete, and grouted with a low shrinkage grout.

When a direct drive pump and motor is mounted to a common base plate at the factory, the coupling is installed and aligned at that time. However, coupling alignment must be verified before operating the pump and motor.

Proper coupling alignment can be verified by placing a straight edge axially across the coupling halves. The distance between the straight edge and the shaft should be the same within 0.1 mm (0.004 inches). Also, the angular distance between the coupling halves should be consistent within 0.1 mm (0.004 inches). At a minimum coupling alignment should be checked once every 90 degrees of shaft rotation (12:00, 3:00, 6:00 and 9:00).

When checking a v-belt motor connection, the parallel and offset alignment of the sheave(s) to each other must be within 1.0 mm (0.040 inches).

After connecting piping, rotate the pump drive shaft clockwise (viewed from motor end) by hand several complete revolutions to be sure there is no binding and that all parts are free. Recheck shaft alignment. If piping caused unit to be out of alignment, correct piping to relieve strain on the pump.

After making all piping connections verify pipe strains haven't altered alignment. If changes have occurred, alter piping to remove pipe strains on pump flanges.
Operate the pump for at least an hour or until it reaches final operating temperature. Shut the pump down and recheck alignment while the pump is hot. Piping thermal expansion may change the alignment. Realign the pump as necessary.

See the following table for possible alignment issues.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Unable to obtain horizontal (side to side) alignment, angular, or parallel.	Driver feet bolt bound.	Loosen pump hold down bolts and slide pump and driver until horizontal alignment is achieved.
	Baseplate not leveled properly, possibly twisted.	Determine which corner(s) of the baseplate are high or low and remove or add shims at the appropriate corner(s) and realign.
Unable obtain vertical alignment, angular, or parallel.	Baseplate not leveled properly, possibly bowed.	Determine if center of baseplate should be raised or lowered and correct by evenly adding or removing shims.

3.2 Coupling

The coupling should be installed as advised by the coupling manufacturer. If the spacer has been installed to facilitate alignment, then it must be removed prior to checking rotation. Remove

3.3 Safety Guards

⚠WARNING

Power must never be applied to the driver when the coupling guard is not installed.

Coupling guards are safety devices intended to protect workers from inherent dangers of the rotating pump shaft, motor shaft, and coupling. It is intended to prevent entry of hands, fingers, or other body parts into a point of hazard by reaching through, over, under, or around the guard.

No standard coupling guard provides complete protection from a disintegrating coupling. The coupling conforms to the U.S.A. standard ASME B15.1, “Safety Standard for Mechanical Power Transmission Apparatus.”

Never remove safety guards except for when repairs or maintenance are required. Always reinstall as the guards are intended to prevent a safety hazard by covering rotating parts from contact.

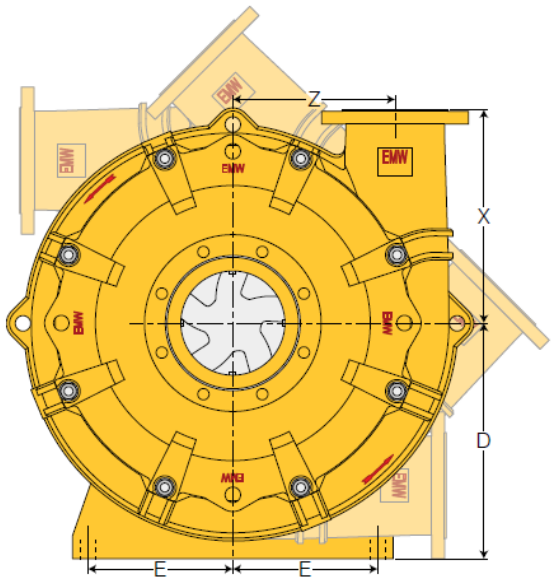
The Wilfley coupling guard conforms to the U.S.A. standard ASME B11.19, “Performance Requirements for Safeguarding.”

3.4 Rotation Check

CAUTION

A direction arrow is cast on the front of the casing. Make sure the motor rotates in the same direction before coupling the motor to the pump.

It is essential that the rotation of the motor be checked before connecting the shaft coupling. Incorrect rotation of the pump, for even a short time, can dislodge the impeller, which may cause serious damage to the pump. All Wilfley pumps turn clockwise as viewed from the motor end, or conversely, counterclockwise when viewed from the suction end



Pump with Direction of Rotation Arrow and optional case orientations

4.0 Start-Up Checks

Prior to pump operation, it is essential that the following checks be made.

- Visually check all main and auxiliary piping to ensure that all connections have been properly made.
- Check voltage, fuse, starter amperage ratings and frequency on the motor nameplate against the electrical supply characteristics.
- Visually inspect all electrical connections to the motor and control circuit.
- Check the rotation of the motor by momentarily starting the motor with motor disconnected from the pump assembly. Direction of rotation must be as shown by the arrow on the pump case and the direction of rotation plate on the top of the frame. Starting or running pump backwards will cause damage.
- Pump and motor are properly secured to the baseplate.
- All fasteners tightened to the correct torques.
- Coupling guard in place and not rubbing.
- Impeller clearance setting.
- Bearing lubrication.
- Pump instrumentation is operational.
- Pump is primed.

As a final step in preparation for operation, it is important to rotate the shaft by hand to be certain that all rotating parts move freely and that there are no foreign objects in the pump casing.

Starting

Before starting the pump, it is advisable to have the pump casing and suction line filled with liquid. It is normal to have the discharge valve momentarily closed when the pump is started since much less horsepower is required under these conditions.

DO NOT OPERATE THE PUMP IN A DEAD-HEAD (NO FLOW) CONDITION.

4.1 Ensuring Proper NPSHA

Net Positive Suction Head – Available (NPSHA) is the measure of the energy in a liquid above the vapor pressure. It is used to determine the likelihood that a fluid will vaporize in the pump. It is critical because a centrifugal pump is designed to pump a liquid, not a vapor. Vaporization in a pump will result in damage to the pump, deterioration of the generated head and possibly a complete stoppage of pumping.

Net Positive Suction Head – Required (NPSHR) is the decrease of fluid energy between the inlet of the pump and the point of lowest pressure in the pump. This decrease occurs because of friction losses and fluid accelerations in the inlet region of the pump. The value for NPSHR for the specific pump purchased is given in the pump data sheet and on the pump performance curve. For a pump to operate properly, the NPSHA must be greater than the NPSHR. Good practice dictates that this margin should be at least 3 ft (1 m) or 20%, whichever is greater.

CAUTION

Ensuring that NPSHA is larger than NPSHR by the suggested margin will greatly enhance pump performance and reliability. It will also reduce the likelihood of cavitation, which can severely damage the pump.

4.2 Starting the Pump and Adjusting Flow

1. Open the suction valve to the fully open position. It is very important to leave the suction valve open while the pump is operating. Any throttling or adjusting of flow must be done through the discharge valve. Partially closing the suction valve can create serious NPSH and pump performance problems or even severe damage.

DANGER

Never operate pump with both the suction and discharge valves closed. This could cause an explosion.

2. A standard centrifugal pump will not move liquid unless the pump is primed. A pump is said to be “primed” when the casing and the suction piping are completely void of air. Open

the discharge valve a slight amount. This will allow any entrapped air to escape and will allow the pump to prime if the suction source is above the pump. When a condition exists where the suction pressure drops below the pump's capability, it is advisable to add a low-pressure control device to shut the pump/motor down when the pressure drops below a predetermined minimum value.

3. All cooling, heating and flush lines must be started and regulated.

4. Start the driver (typically an electric motor).

5. Slowly open the discharge valve until the desired flow is reached, keeping in mind the minimum flow restrictions listed above.

DANGER

It is important that the discharge valve be opened within a short interval after starting the driver. Failure to do this could cause a dangerous build-up of heat and possibly an explosion.

Reduced capacity

Avoid running a centrifugal pump at drastically reduced capacities or with the discharge valve closed for extended periods of time. Operating in this capacity could result in the liquid in the pump reaching its boiling point. If this occurs, the seal may be damaged, as it will have no lubrication and may score or seize to the stationary parts. It is also possible that it can create an explosive condition. If the suction valve is simultaneously closed, there is an even greater risk of a catastrophic failure.

Thermocouples may be used to safeguard against overheating by shutting down the pump at a predetermined temperature

Pump safeguards should also be used to prevent operation with a closed discharge valve. This may be accomplished by installing a bypass back to the suction source. The size of the bypass line and the required bypass flow rate is a function of the input horsepower and the allowable temperature rise.

Reduced Head

Note that when discharge head drops, the pump's flow rate usually increases rapidly. Check motor for temperature rise as this may cause an overload in flow. If flow overloading occurs, adjust the discharge valve.

Surging Condition

A rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement is recommended in the piping.

4.3 Operation to prevent Freezing

When using the pump in sub-freezing conditions especially if the pump is periodically idle, special attention should be given to the temperature. The pump should be properly drained or protected with thermal insulating devices which will keep the liquid in the pump from freezing.

4.4 Shutdown Considerations

When the pump is being shut down, the procedure should be the reverse of the start-up procedure. First, slowly close the discharge valve, shut down the driver and then close the suction valve. Remember, closing the suction valve while the pump is running is a safety hazard and could seriously damage the pump and other equipment.

5.0 General Servicing

It is recommended that the pump be inspected at regular intervals. It is also suggested that a service record be kept for the pump. A procedure for keeping accurate maintenance records is a critical part of any program to improve pump reliability. There are many variables that can contribute to pump failures. Analyzing these variables through pump maintenance records can only solve often-long term and repetitive problems.

General service and maintenance should be carried out by authorized and trained operators who are familiar with these operating instructions.

⚠WARNING

The electrical connections must be disconnected and locked out. Make sure the pump cannot be switched on accidentally.

Liquids posing health hazards must be decontaminated and disposed of ensuring that there are no risks to persons or to the environment.

5.1 Periodic Maintenance

All flow, pressure, and temperature gauges should be monitored to ensure that the pump is operating within specified limits. If the frame temperatures are monitored, this temperature generally should not exceed 71°C (160°F).

The following table contains recommended service checks that should be performed on a periodic basis.

	Initial Start-Up	Weekly	Monthly
Flow, Pressure, Temperature	X	X	
Visual	X		X
Noise Vibration	X		X
Lubricate	X	X	X

5.2 Visual Inspections

Periodic visual inspection should be made of the pump and its installation.

This inspection should include the following:

1. All mounting supports should be secure.
2. All external nuts, bolts, and fittings should be tight.
3. All suction and discharge piping should be secure.
4. All surfaces and joints should show no signs of leakage.

5.3 External Cleaning

Periodic maintenance can involve the use of high pressure sprays to remove excess dirt and debris. When using such equipment, it is essential to ensure the bearing isolators are not sprayed in order to prevent liquid penetration into the bearing frame. If this occurs, simply drain, and re-lubricate.

5.4 Grease Lubrication

Grease lubrication is standard on EMW pumps. The grease base oil may be mineral or synthetic with synthetic base oil being preferred for bearing temperatures above 93°C (200°F). The consistency should be a NLGI grade 2, with a lithium or lithium complex thickener (soap).

Bearings in pumps shipped from the factory come with the bearings pre-packed with grease. When replacing bearings, pack the bearings 100% full of grease, and fill the pump housing cavity around the bearing 30% to 50% full of grease.

Re-lubrication intervals are difficult to determine. Once intervals are established through plant practices or experiences, regular lubrication intervals should be maintained. In the absence of pre-existing practices, refer to Appendix 1 for guidelines.

5.5 Oil Lubrication

The optional oil lubrication is a less common feature of the EMW pumps. Recommended oil change interval is once every three months when used in continuous operation. Viscosity grade recommendations are listed in the following table:

ISO Grade	Temperature	
VG68	63°C to 76°C	145°F to 170°F
VG150	77°C to 92°C	171°F to 199°F
VG220	9°C to 121°C	200°F to 250°F

The bearing unit should be filled until the sight glass indicates the oil level approximately in the middle:

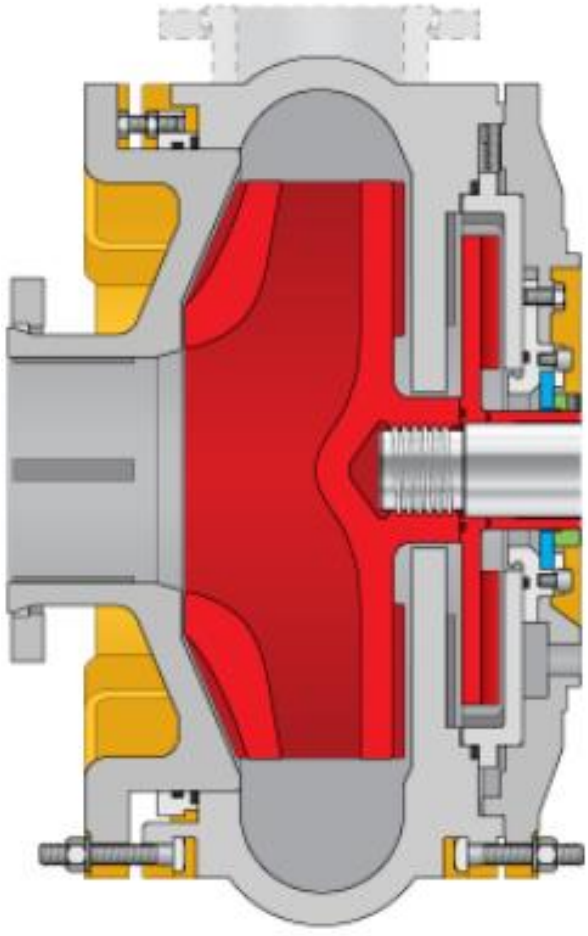
Size	Oil Level Liters (Quarts)
50 (2x2)	0.6 (0.6)
75 (3x3)	0.7 (0.8)
100 (4x3)	1.0 (1.1)
150 (6x4)	1.3 (1.4)
200 (8x6)	2.1 (2.2)
250 (10x8)	4.6 (4.8)
300 (12x10)	5.9 (6.2)
350 (14x12)	5.6 (6.0)

6.0 Pump Designation

Example: **EMW 150M 6x4**

Pump:
EMW
Suction Nozzle (in mm):
50 through 350
(See the table below)
Hydraulic Type:
Metal (M)
Rubber (R)
Imperial Size (suction x discharge):

Pump	Type	Suction mm (in)	Discharge mm (in)
50	M/R	50 (2)	50 (2)
75	M/R	75 (3)	75 (3)
100	M/R	100 (4)	75 (3)
150	M/R	150 (6)	100 (4)
200	M/R	200 (8)	150 (6)
250	M/R	250 (10)	200 (8)
300	M	300 (12)	250 (10)
350	M	350 (14)	300 (12)



6.1 EMW Slurry Pump Details

Designed as a class III heavy duty end suction slurry pump, the EMW pumping chamber, impeller and expeller are constructed with high chrome, hard iron materials. The wet end construction of the EMW pump is built to last and features components with double the thickness of comparable medium duty slurry pumps. This type of design, combined with Wilfley's proprietary MAXALLOY® 5A hard iron and rubber liners, creates the ideal slurry pump for high wear applications.

Pump Casing

The extra heavy wall thickness and special volute design extends wear life. The front of the case is open to allow inspection of or removal of the impeller from an installed pump. The casing may be rotated in 45 degree increments (90 degrees for the size 75 and 50 pumps) to accommodate a variety of discharge requirements.

Impeller

The impeller with its extra thick shrouds and vanes and wide-open flow passages for handling large objects, maintains excellent performance characteristics throughout its wear life. A closed type impeller is used with all sizes except the size 50 (2x2) pump, which uses a semi-open type impeller.

Bearing Cartridge

The shaft is constructed from high strength alloy steel, mounting paired taper roller thrust bearings and a spherical roller radial bearing protected by labyrinth isolators. The bearing cartridge assembly is designed for long life in the harshest conditions and is available with either grease or oil lubrication.

Sealing System

The seal chamber is designed for easy maintenance, equipped with large openings for all around accessibility.

The following seal systems are available.

- Dynamic Seal with expeller
- Expeller with Packing Seal
- Packing Seal
- Mechanical Seal
- Diaphragm Seal with expeller

Dynamic Seal with Expeller

The dynamic seal is a flush-less proprietary sealing solution that uses an expeller to create an air pocket to seal the pump while rotating, and a specially designed static seal that can be adjusted to open and close specifically at the application speeds and pressures.

Operating the pump at other than the specified conditions for which it was built could result in unsatisfactory performance, excessive wear, and/or premature failure. For additional information, review the Solidlock® User manual, **IM-SL.**

Expeller with Packing Seal

The expeller provides a positive hydraulic sealing arrangement when the pump is running. The packing provides a static seal when the pump is not running. The expeller will keep slurry from coming in contact with the packing when the pump is running, so abrasive wear on shaft sleeve is greatly reduced. However, the packing must be lubricated to compensate for the pumping action of the expeller, which will tend to dry out the seal chamber. Grease is the recommended lubricant for applications where the use of a liquid lubricant is undesirable. Graphite packing is standard.

Packing Seal

The Packing seal provides a simple alternative solution to either an expeller seal or mechanical seal. Graphite packing is standard. A packing flush is always recommended; however, in some applications, dry running packing (packing that is lubricated solely by the liquid being pumped) will also work.

Mechanical Seal

The EMW pump seal chamber is designed to accommodate select mechanical seals. Consult with a Wilfley Representative for mechanical seal use with the EMW Slurry pump.

Diaphragm Seal with Expeller

A flush-less diaphragm seal is possible with the EMW slurry pump. The expeller creates suction in the seal chamber that pulls open the diaphragm while rotating, and the diaphragm will push back against a rotating seal face when stopped.

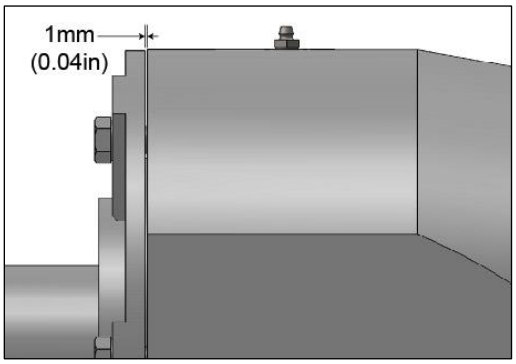
Expeller seal and dynamic seal performance is highly dependent upon suction pressure and pump rotational speed as well as properly adjusted internal clearances.

7.0 General Assembly Information

The EMW pump is metric by design. Metric fasteners are used throughout with the select exceptions. All pipe fittings use imperial National Pipe Threads (NPT). On EMW metal pumps produced in the U.S.A. the square head bolts and nuts used to assemble the case are imperial. The flat washers used with these fasteners, however, are metric. Imperial washers are too large to register correctly in the case and bracket counter bore reliefs and should not be substituted here.

In general, parts should be cleaned to remove debris, dirt, or rust inhibitor coatings. Use this opportunity to visually inspect for damage. If reconditioned or existing parts are going to be used, inspect them for wear before installing. All sealing surfaces should be inspected for cleanliness and damage. Replace any damaged fasteners with new fasteners coated with an anti-seize lubricating compound prior to using.

When bolted joints are encountered care should be taken to incrementally tighten all fasteners in a crossing pattern until metal to metal contact is achieved between the mating parts.
Exception: A gap, approximately 1 mm (0.040 inches) wide, will exist between the thrust bearing cap and the bearing cartridge when properly assembled. This bearing cap should not be over tightened.

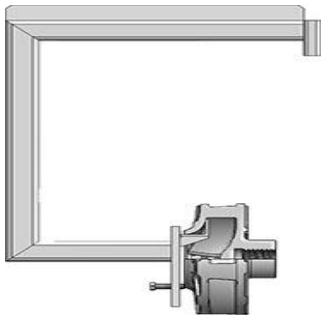


7.1 Specialized Tools

Impeller Tool

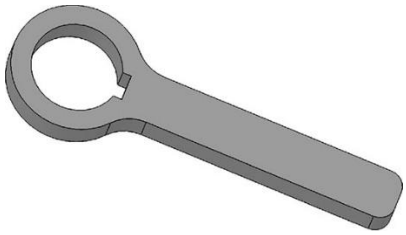
On all but the smallest size pumps, an impeller lifting fixture that registers in the eye of the impeller is

required for inserting an impeller into or removing an impeller from a case. If a crane will be used, a “C” shaped bent frame lifting fixture with a lifting point located above the impeller center of gravity when the impeller is in a horizontal position is recommended.



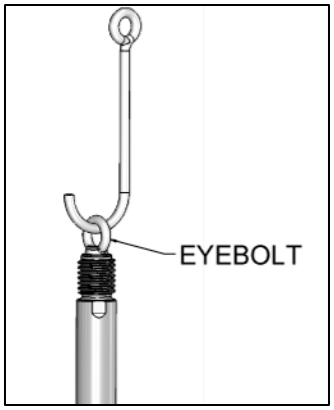
Shaft Wrench

A shaft wrench keyed to fit the drive end of the shaft is recommended for aiding with the tightening or releasing of an impeller. Contact AR Wilfley for details on this tool.



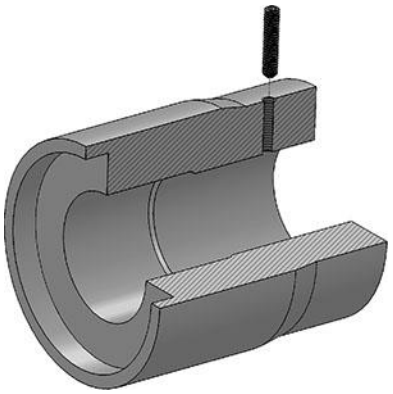
Shaft Handling Tool

A 12 mm tapped hole in the end of the shaft provides a location for a hoisting attachment such as an eyebolt to assist with vertical positioning of the shaft for insertion into or removal from a bearing cartridge.



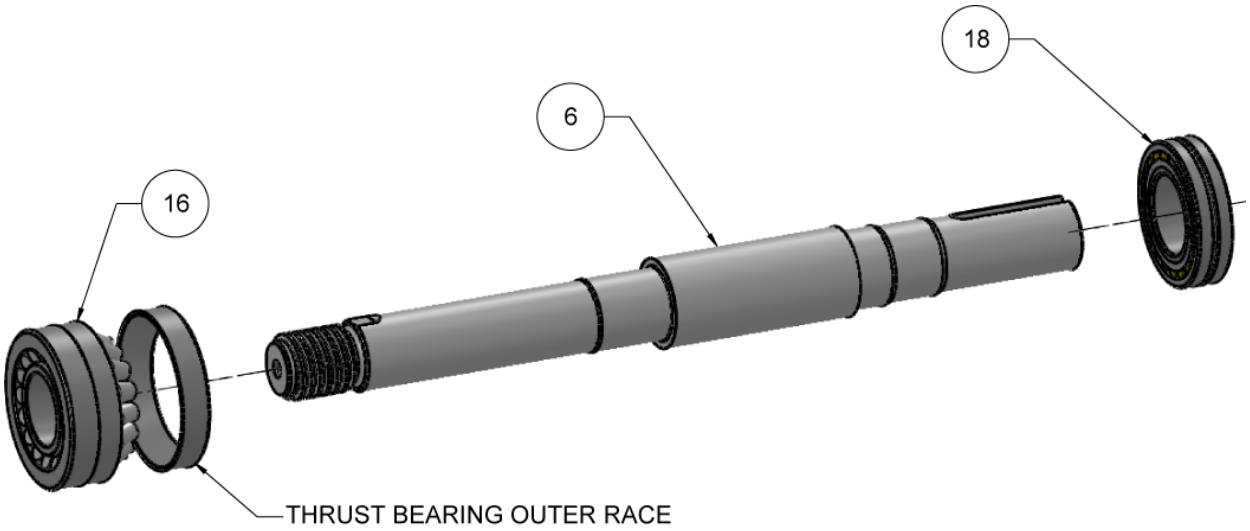
Radial Bearing Alignment Tool

A tool to align the radial bearing outer race during vertical insertion or removal of a shaft assembly into or from a bearing cartridge is required. A tool that shoulders against the radial bearing outer race, slip fits over the drive end of the shaft and is secured in the keyway by a set screw is recommended. To avoid damaging the shaft, the set screw should only be tightened against the shaft keyway flat.



8.0 Power End Assembly

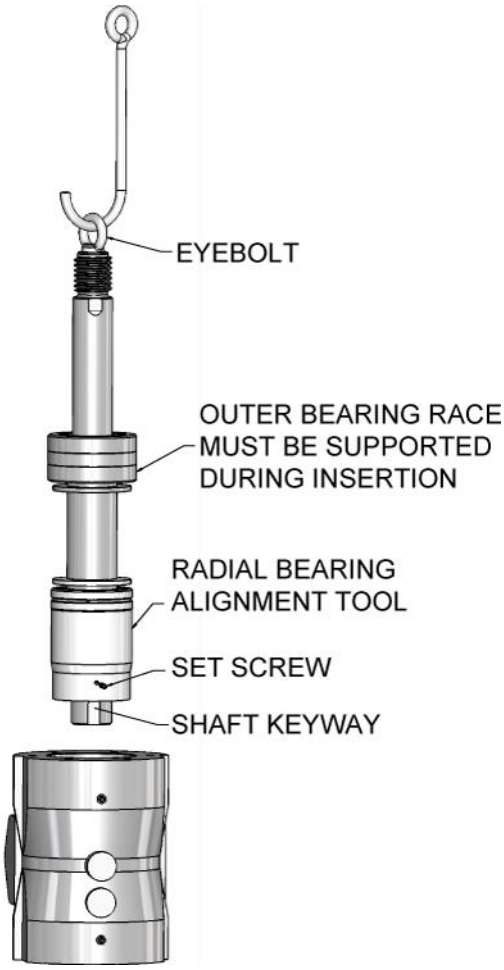
Shaft assembly. Preheat the Thrust Bearings (16) and Radial Bearing (18) onto the Shaft (6) using an induction heater. The temperature will allow the bearings to slip onto the shaft against the appropriate shoulder. Be sure that the bearings are cooled before moving on to the next step.



NOTE

The thrust bearing outer race (for the inner bearing) will have to be placed on the shaft before installing the thrust bearings. The thrust bearings are located on the threaded side of the shaft. The radial bearing is located on the keyed side of the shaft

Shaft Insertion. Next, install the shaft with bearings into the Bearing Cartridge (99). If the bearings are grease lubricated, the space directly inboard from the bearings should be packed with grease before inserting the shaft assembly into the bearing cartridge. The best way to do this is to install the assembly vertically down and into the cartridge. Use the threaded hole in the shaft and a lifting eye for safe maneuvering.



NOTES

Note the orientation and bearing fits - the side that has a lip in the bore is the thrust bearing side (the side that the shaft is inserted into). Be careful when lowering the thrust bearing into the cartridge such that the outer races are inserted squarely.

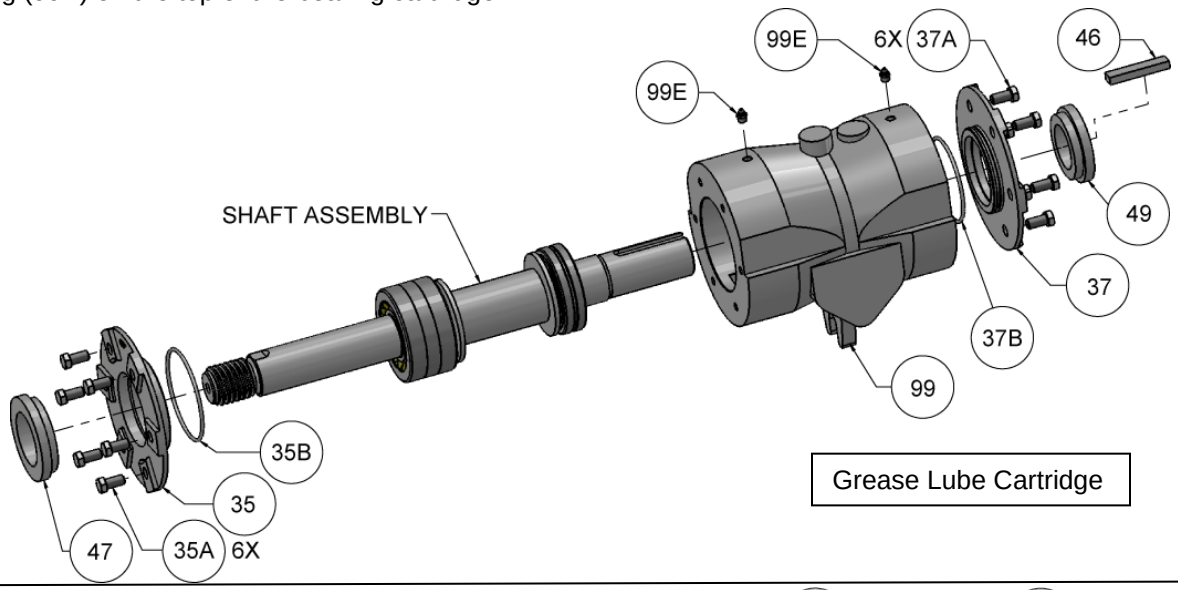
Bearing Cartridge.

1. Press fit the bearing isolaters (47) and (49) into the bearing caps (35) and (37) respectively.
2. Next install the o-rings (35B) into the thrust bearing cap (35), and (37A) into the radial bearing cap (37). The bearing caps are assembled onto their respective sides using hardware (35A) and (37A). If the bearings are grease lubricated, the area directly outboard from the bearings should be packed with grease prior to assembling the bearing caps. When installing the bearing caps, it may be difficult to push the o-ring over the shaft shoulder, so it is recommended to use the cap screws to pull the bearing cap evenly into place.

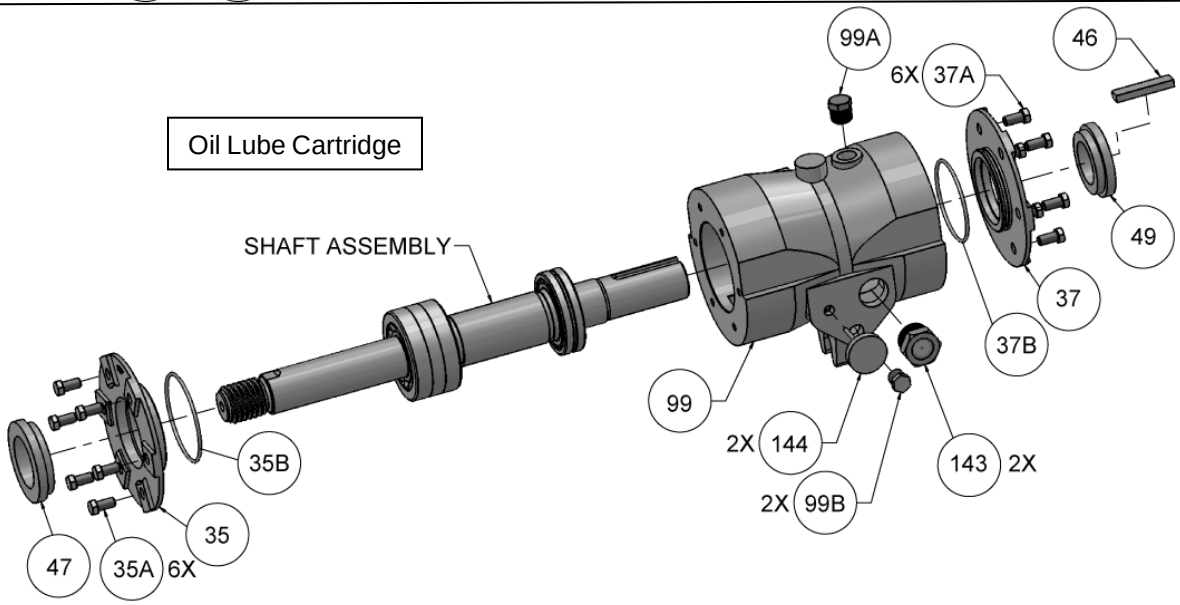
NOTE

When installing the thrust bearing cap (35), a gap of approximately 1mm (0.040 inches) will be visible between the bearing cartridge and bearing cap. The bearing cap screws (35A) and (37A) should be tightened slowly in a star pattern. Do not over tighten this bearing cap.

3. If the pump is grease lubricated, thread two grease fittings (99E) into the top of the bearing cartridge and give each bearing a shot of grease. If the pump is oil lubricated, assemble the oil drain plug (99B), oil sight glass (143), and temperature gauge (144) into the holes on the side of the cartridge, and install the oil fill plug (99A) on the top of the bearing cartridge.



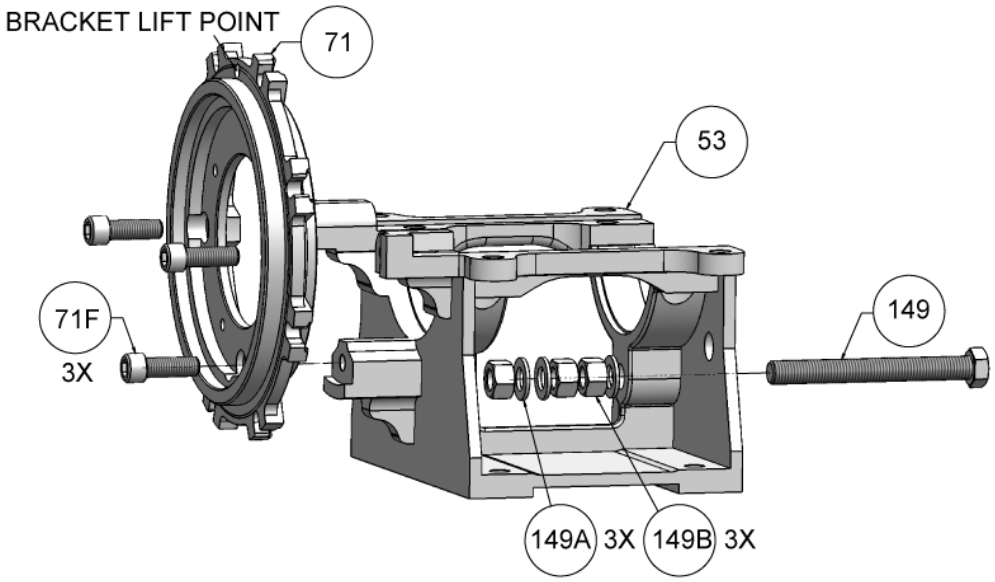
Grease Lube Cartridge



Oil Lube Cartridge

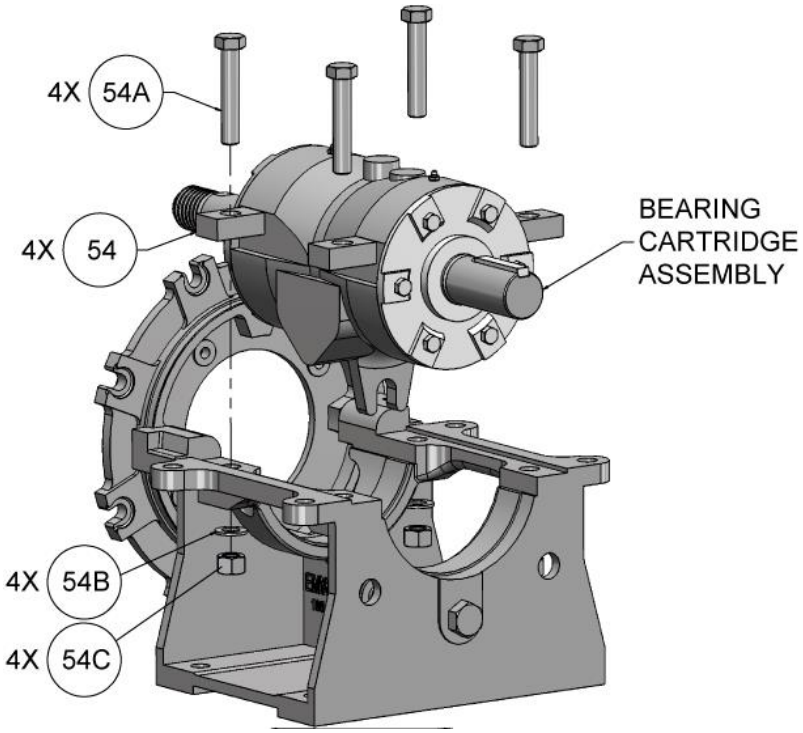
Pedestal Assembly.

1. Install the clearance adjustment bolt (149), nuts (149B), and washers (149C) into the pedestal (53).
2. Bolt the pedestal to a rigid base or structure to prevent it from tipping forward when the wet end of the pump is assembled.
3. On pumps size 100 and smaller, assemble the bracket (71) with socket head cap screws (71F). On pumps size 150 and larger, assemble the bracket (71) with hex-head screws (71F) and flat washers (71G).



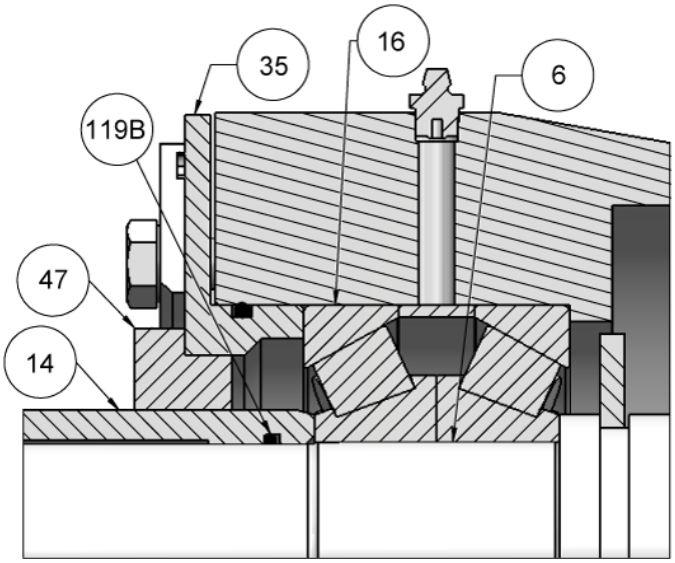
Power End Assembly.

1. Lower the bearing cartridge assembly onto the pedestal assembly making sure the threaded side of the shaft is on the side of the pedestal with the bracket (71).
2. Loosely install the bearing cartridge clamps (54) using hardware (54A), (54B), and (54C). Remove the lifting eye from the bearing cartridge and replace it with a hex cap screw and washer as this lifting eye location is not designed to lift the full pump weight.



Shaft Sleeve assembly.

1. Install the o-ring (119B) into the inner groove in the shaft sleeve (14). Slide the shaft sleeve, chamfered end first, onto the front end of the shaft (6). Lubrication of grease will help the oring to start sliding against the shaft. The sleeve will stop on contact with the bearing isolator. Be sure to push the shaft sleeve completely on, until it seats against the thrust bearing (16).



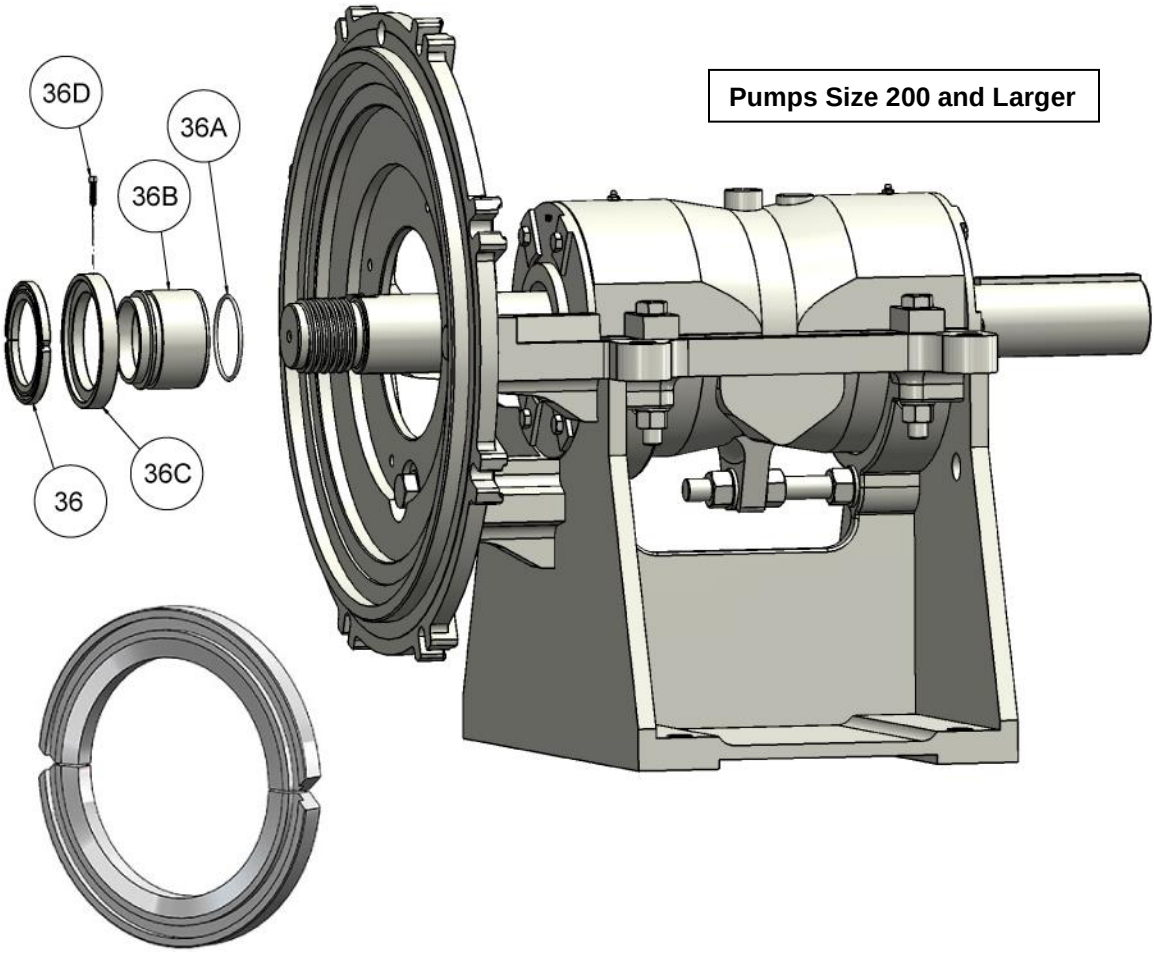
Pumps Size 150 and Smaller

Correctly installed shaft sleeve
(Shoulders against thrust bearing)

Incorrectly installed shaft sleeve
(Shoulders against thrust bearing isolator o-ring

Release Collar Sleeve Assembly.

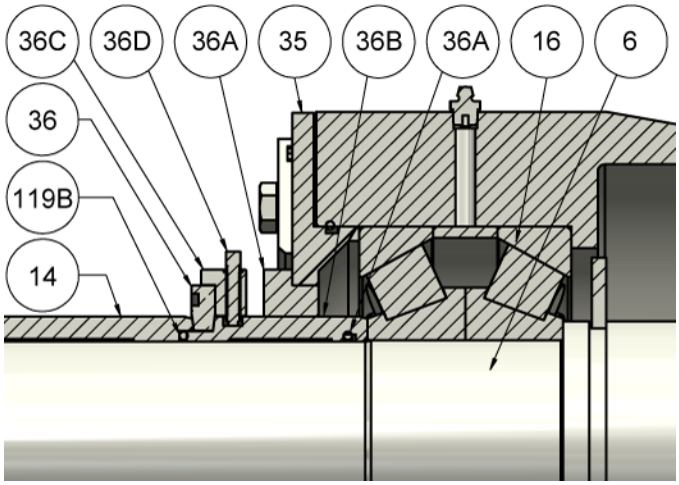
1. Install the o-ring (36A) in the inner in the release collar sleeve (36B). Slide the release collar sleeve, chamfered end first, onto the shaft (6).
2. Slide the release collar cover (36C) onto the release collar shaft sleeve past the groove and loosely install the square head set screw (36D) into the cover (36C).
3. If the release collar (36) is not already in two pieces, cut the release collar into two halves at the two scored locations and notch to 45 degrees as shown. Orient the two halves so that the O-ring grooves are facing out. Position on the shaft as shown.
4. Slide the release collar cover (36C) over the two halves of the release collar (36) and tighten the square head screw (36D) so that it bottoms out in the groove on the release collar sleeve (36B).



NOTE

The release collar is split to allow removal and reinstallation on a fully assembled pump. Removing the release collar will relieve the pressure on the impeller threads so the impeller can be removed easily after use.

To remove a release collar from a fully assembled pump, loosen the square head set screw (36D). Slide the release collar cover (36C) towards the bearing cartridge to expose the release collar (36) and use the notches in the release collar as pry points to work the collar out.



9.0 Wet End Assembly

Seal Assembly.
There are a variety of seals available for the EMW pump. Please navigate to the appropriate page in table 6-1 based on which seal is installed in your pump.

Table 6-1: Seal Assemblies by Page

Seal	Section	Page
Solidlock® Dynamic Seal	See IM-SL	19-21
Expeller with Packing	9.2	22-26
Packing	9.3	27-20
Mechanical Seal	9.4	30-33
Solidlock® Lite (Diaphragm Seal)	Contact Wilfley Representative	

9.1 Solidlock® Static Seal

The recommended seal for use in EMW slurry pumps is the Solidlock® Static seal. For applications with abrasives and some degree of solids or particulates that tend to crystalize, the Solidlock® seal is an excellent solution. The two seal faces operate as a dynamic seal in tandem with the pump's expeller.

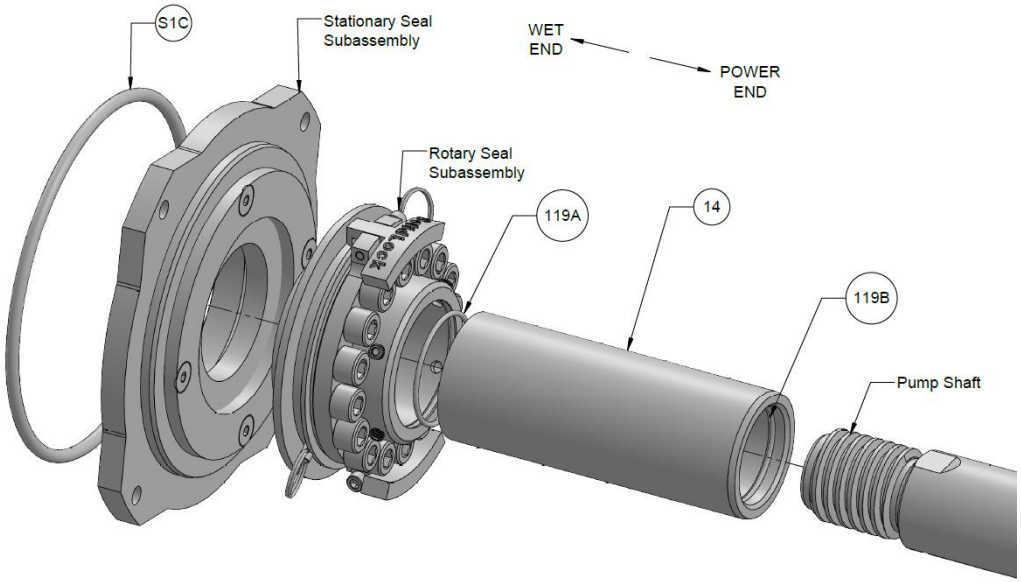
No flushing plan is required and the Solidlock® seal may operate dry without issue, such as if a tank level is dropped accidentally. The cartridge design allows the units to be installed easily as well as set in a few quick steps. An optional flushing port is also available for the flexibility of that feature.

Please review the Solidlock® Instruction manual **IM-SL** for additional detail regarding this sealing solution.

The instillation of the Solidlock® seal components consist of the expeller (4), expeller plate (71B), case plate o-ring (71C), stationary seal subassembly, stationary seal o-ring (S1C), rotary seal subassembly, stationary seal o-ring (S1C), shaft sleave (14), expeller to shaft sleave o-ring (119A), and shaft sleave o-ring (119B).

1. Install expeller to shaft sleave o-ring (119A) in grove on the shaft sleave towards the wet end. Then install o-ring (119B) in the groove inside the shaft sleave on the power end.

2. Apply the lubrication to the o-rings outlined in the Solidlock® instruction manual **IM-SL** and slide the shaft sleave on to the pump shaft till shaft sleave bottoms on the inboard bearing. Slide the Solidlock® rotary subassembly over the shaft sleave.

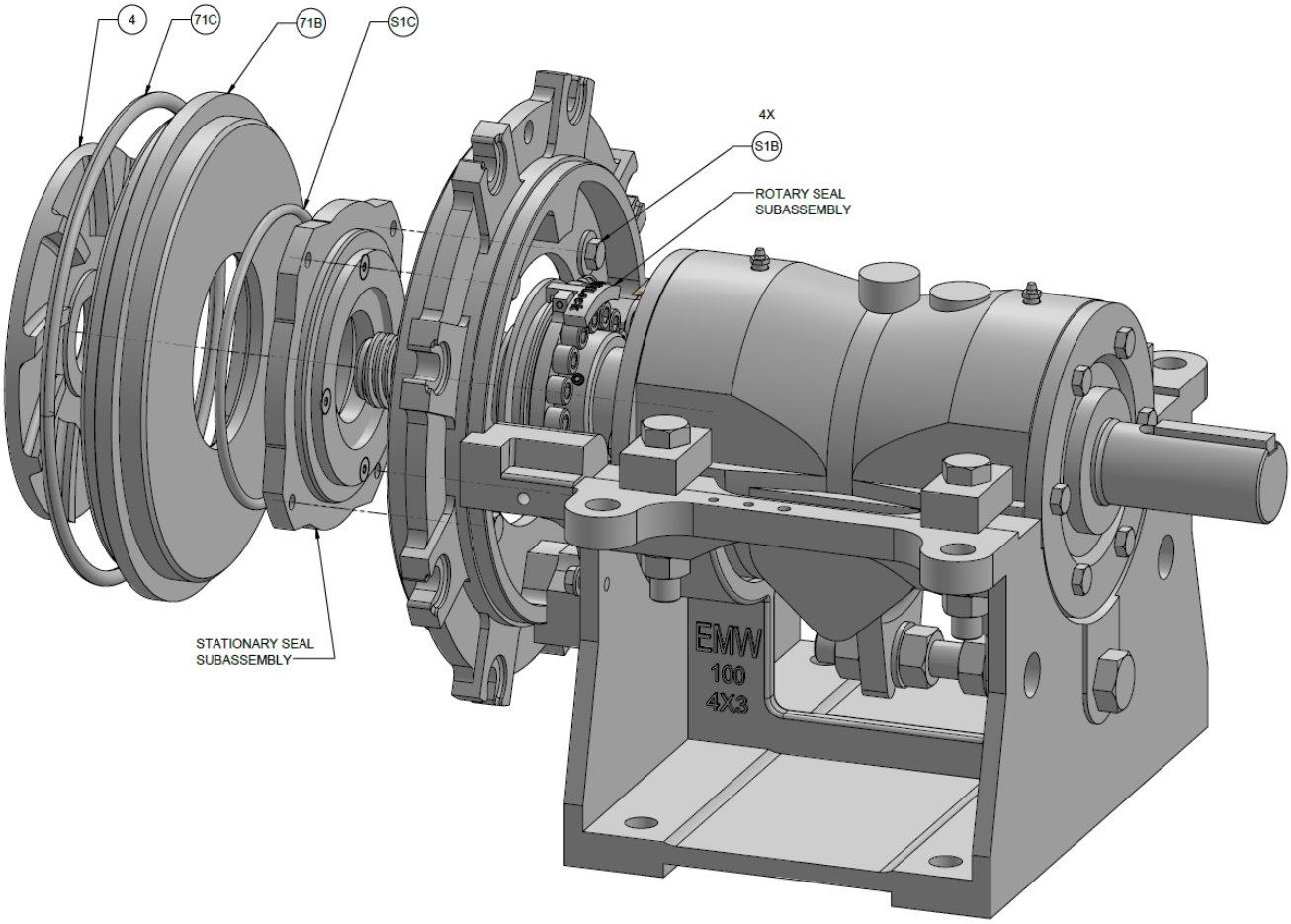


3. Install stationary seal o-ring (S1C) on to the wet end of the stationary seal. Apply lubrication to the o-ring as specified in the Solidlock® instruction manual **IM-SL.**

4. Bolt the stationary seal to the bracket using the hex head bolts (S1B).

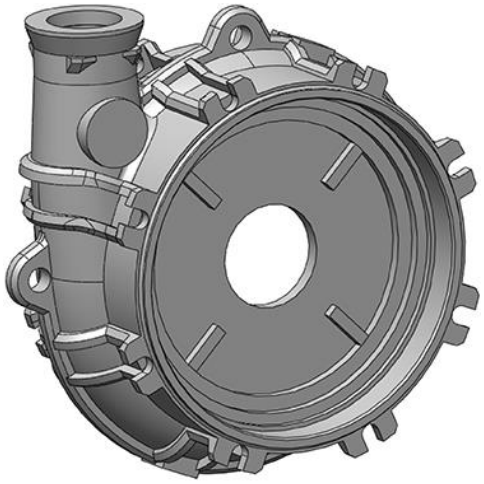
5. Install the expeller plate o-ring (71C) on to the wet end lip of the expeller plate and install expeller plate to bracket. On pumps sized 200 8x6 and larger, there is a set screw to hold the expeller plate in place.

6. Install expeller (4) on to the pump shaft. Verify that the expeller vanes are facing expeller plate, and expeller key seat is aligned with the key seat of the shaft. Install expeller till it bottoms on the pump shaft.



Case Assembly (Expeller with Solidlock®)

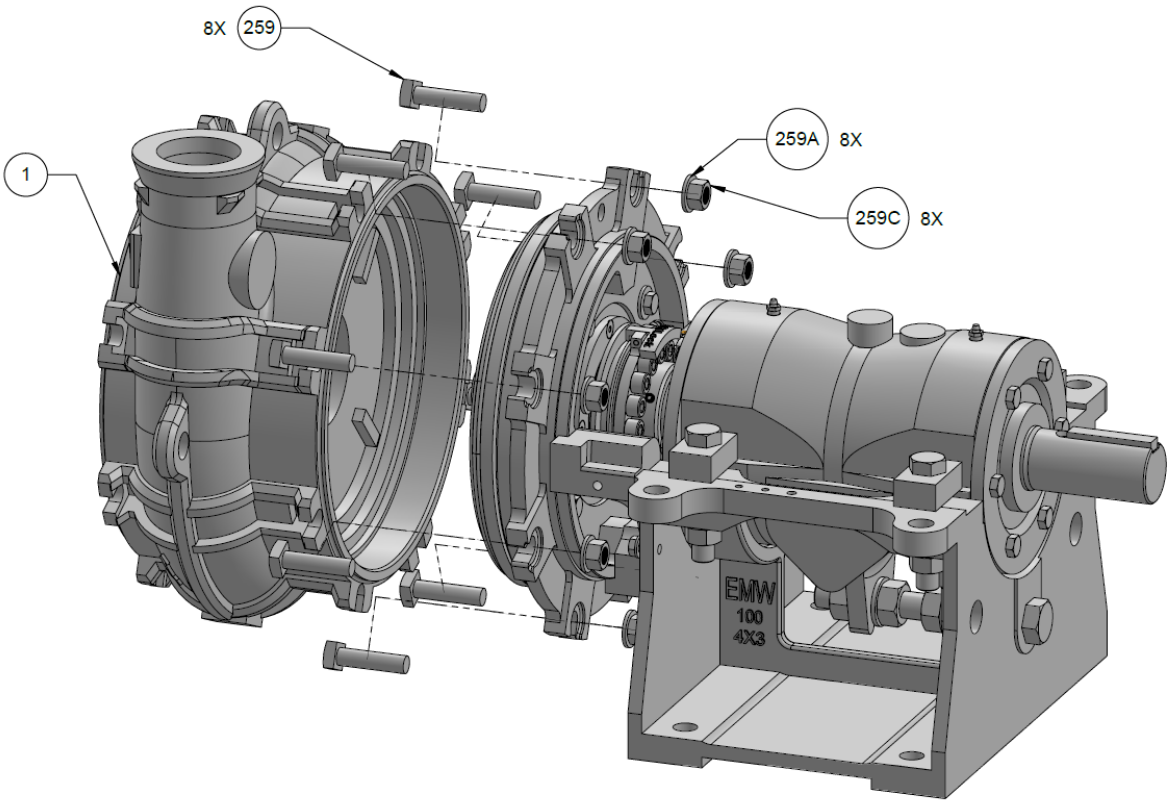
The case used with an expeller seal contains stationary vanes and a small annular opening around the shaft. The square heads of the bolts must go inside the pocket. Do not use a standard bolt head to attach the case or suction cover as they cannot properly seat and may not hold the pressure generated by the running pump.



Expeller Seal Case

The pump assembly must be attached to a structure or workbench before proceeding, otherwise the pump will tip forward when the case is assembled onto the pump.

1. Slide the case (1) on to the assembly, mounting it with hardware (259, 259A, 259C) to the bracket (71).
2. Torque nuts (259C) to 80 N-m (60 Lb-Ft).



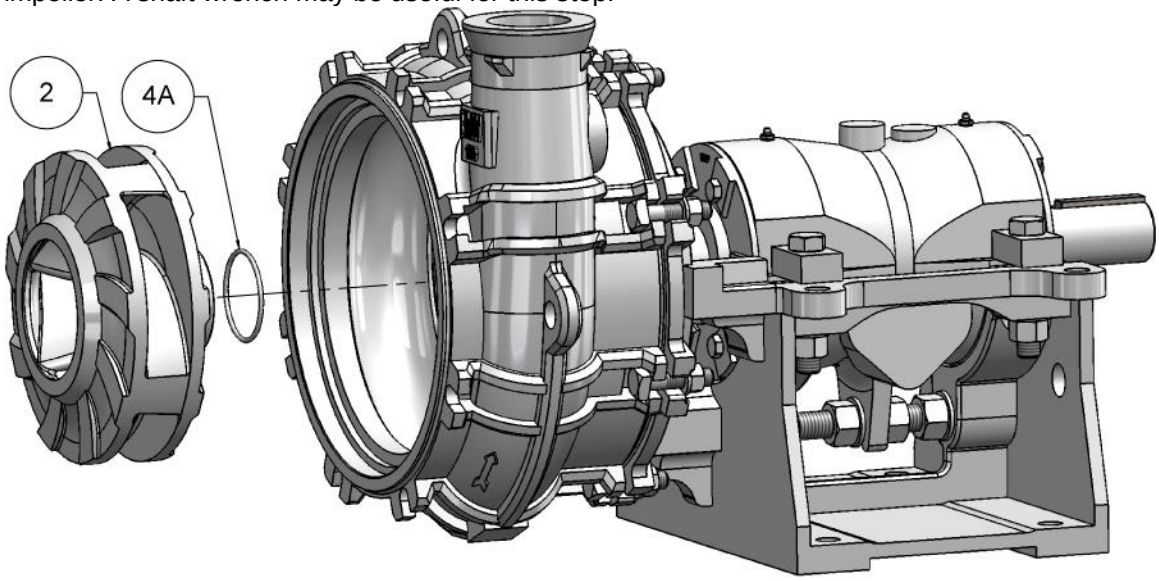
Case Assembly (Expeller Seal)

Impeller Installation – Expeller with Solidlock®.

The impeller used with an expeller seal has long pump out vanes on the backside that extend almost all the way down to the hub.

Impeller (Long back vanes shown)

1. Install the expeller o-ring (4A) into the expeller and thread the impeller (2) onto the shaft. Tighten the impeller. A shaft wrench may be useful for this step.



Impeller Installation

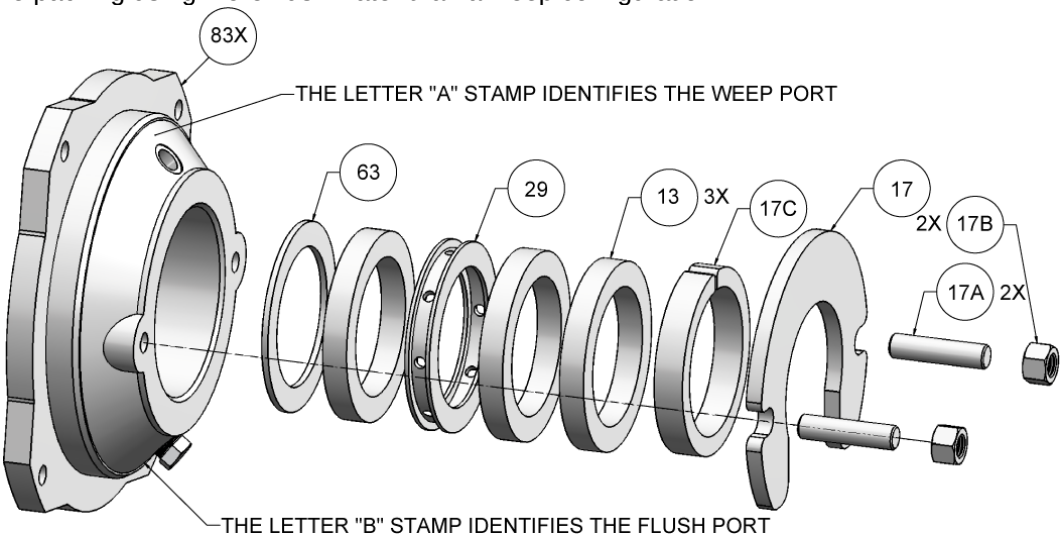
NOTE

The pump must be fully assembled before setting the Solidlock® seal. Please review the Solidlock® Instruction manual IM-SL for additional detail.

Once the Solidlock® seal has been installed, proceed to Section 9.5, Suction Cover assembly.

9.2 Expeller with Packing

The expeller seal consists of an expeller (4), which creates a dynamic seal during operation, and a packing seal, which creates a seal when the pump is stopped. On pumps size 100 (4x3) and larger, a flat section inside the expeller bore engages a flat on the shaft to prevent the expeller from slipping. The flush configuration (spacer ring, lantern ring, and three rings of packing) directs the majority of the liquid towards the seal chamber, pushing solids away from the packing using more flush water than a weep configuration.

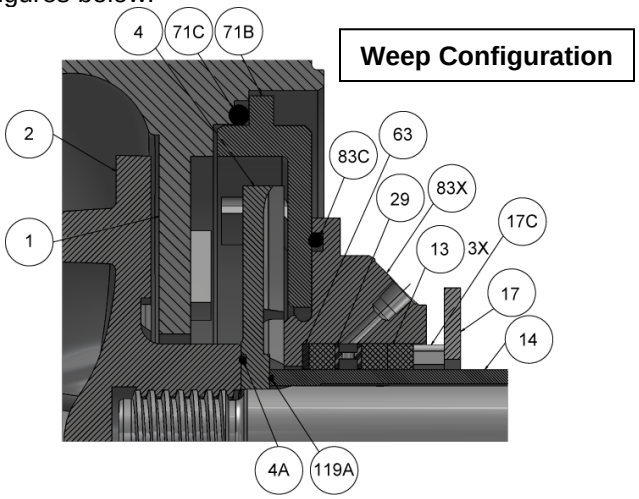


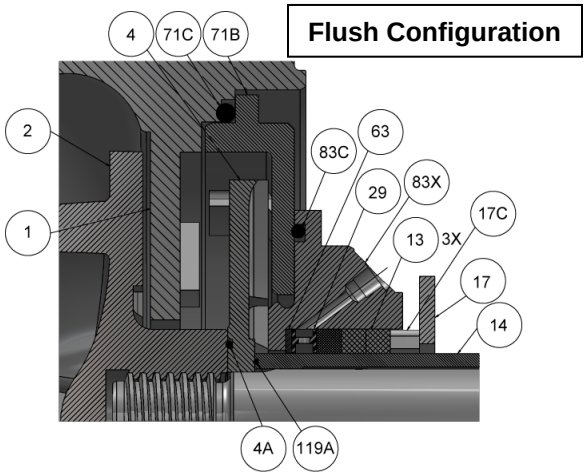
Expeller with Packing Seal Components (Weep Configuration Shown)

The packing seal consists of a stuffing box (83X) three rings of packing (13), a lantern ring (29), a spacer ring (63), a gland plate (17), a gland ring (17C), two gland studs (17A) and two gland nuts (17B). When studs (17A) are being installed, coat the stud threads with a thread locking compound when assembling. Joints of successive rings should be staggered and kept at least 90° apart. The seal housing (83X) is provided with two port configurations, weep and flush. An “A” stamp next to the port identifies the weep port while a “B” stamp next to the port identifies the flush port.

Install the spacer ring (63) into the stuffing box (83X). Then depending on the flush or weep style configuration, install the packing rings (13) and lantern ring (29). Place the gland ring (17C) on the packing, install the studs (17A), and tighten down the gland plate (17) using two nuts (17B). The nuts only need to be loosely installed for initial installation. They should be tightened after the pump is fully assembled.

To prevent a packing seal failure the packing must be lubricated during pump operation. An o-ring (71C) seals the case and expeller cover joint where another o-ring (83C) seals the expeller cover and the stuffing box joint as seen in the figures below.





Expeller with Packing Seal.

1. Install the shaft o-ring (119B) into the shaft sleeve (14) and insert the shaft sleeve onto the shaft (6) butting it up against the release collar (36).

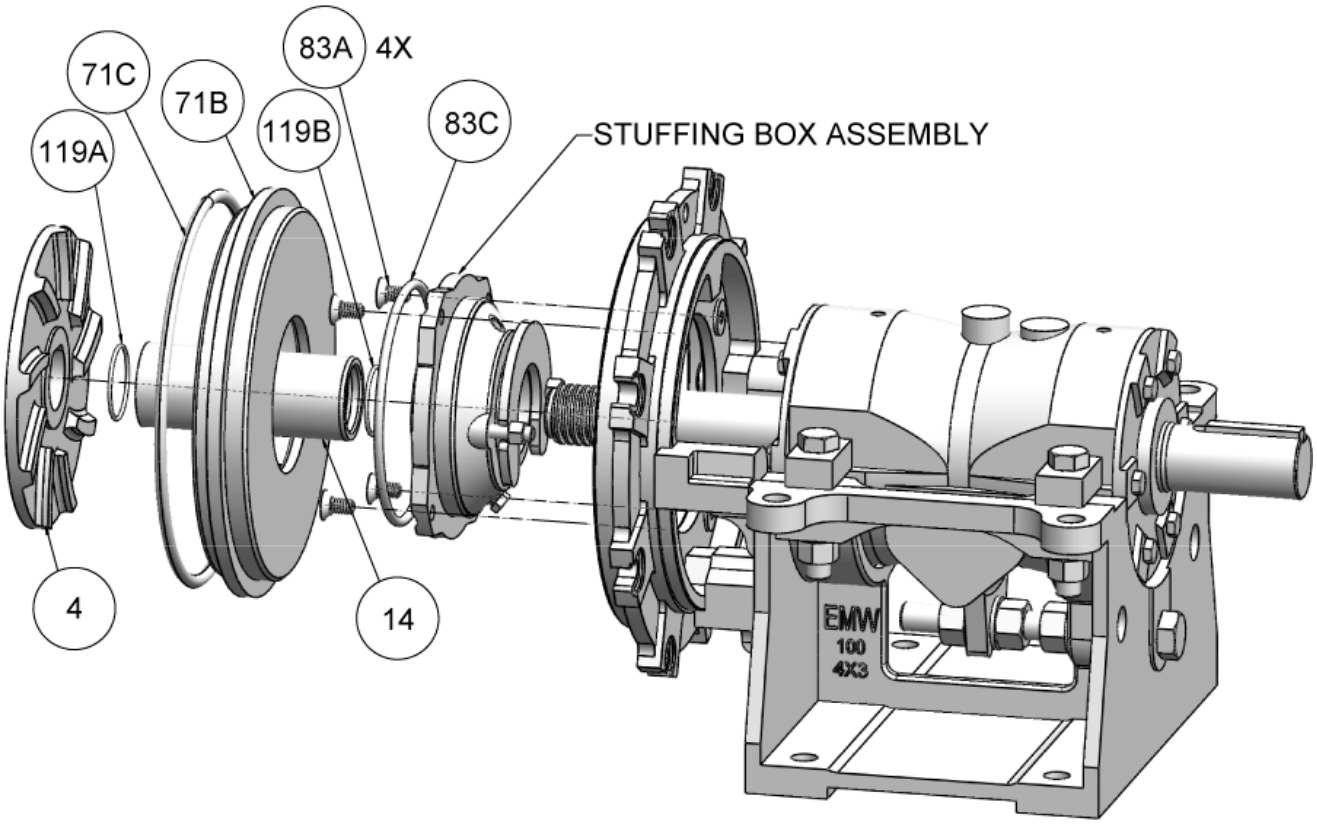
2. Take the stuffing box assembly (83X) and slide it onto the shaft sleeve (14).

3. Bolt the stuffing box to the bracket using the flat head cap screws (83A).

4. Next, place the stuffing box o-ring (83C) into the stuffing box groove and insert the expeller plate (71B) into the bracket. On pumps sized 200 8x6 and larger, there is a set screw to hold the expeller plate in place.

5. Place the expeller cover o-ring (71C) on the expeller cover.

6. Insert the shaft sleeve o-ring (119A) onto the end of the shaft sleeve (14) and but the expeller (4) up against it with the expeller vanes pointed towards the back of the pump.



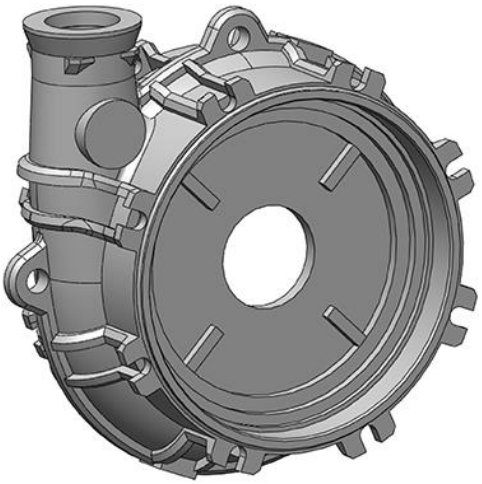
Expeller with Packing Seal – Exploded View

NOTE

The packing rings, lantern ring, and spacer ring (13), (29), and (63) can be installed and removed after the pump has been assembled, but the gland ring (17C) must be around the shaft before assembly of the wet end.

Case Assembly (Expeller with Packing Seal).

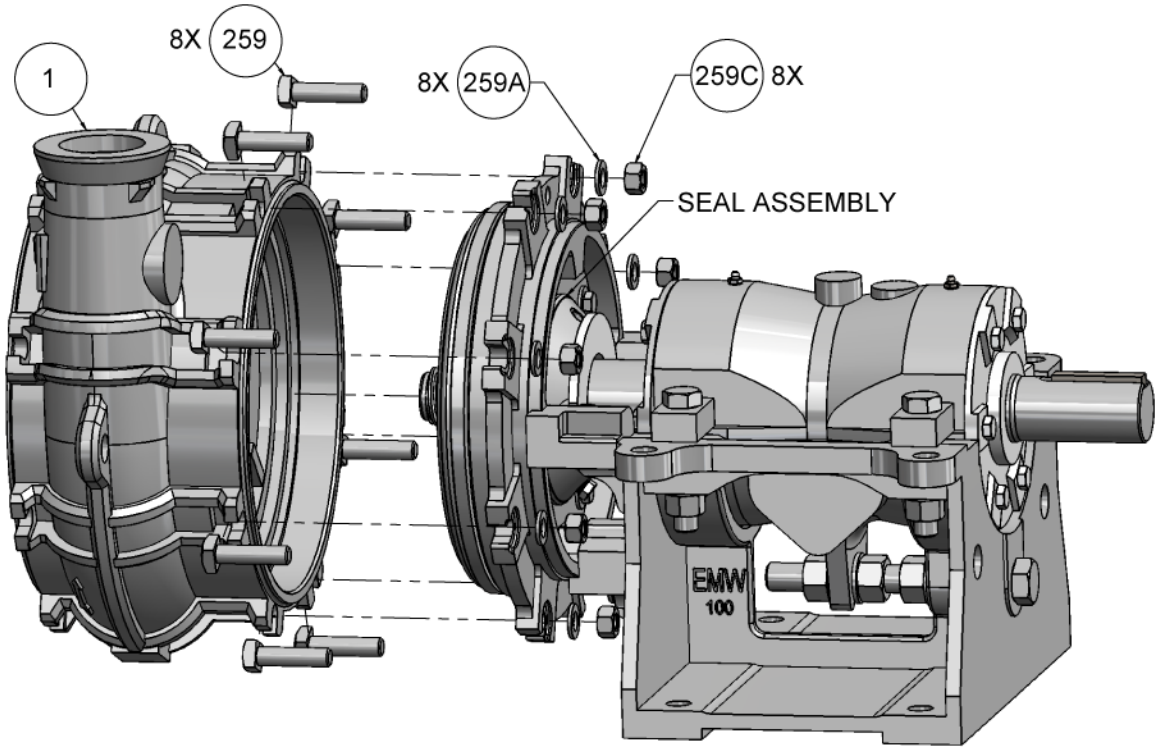
The case used with an expeller seal contains stationary vanes and a small annular opening around the shaft. The square heads of the bolts must go inside the pocket. Do not use a standard bolt head to attach the case or suction cover as they cannot properly seat and may not hold the pressure generated by the running pump.



Expeller Seal Case

The pump assembly must be attached to a structure or workbench before proceeding, otherwise the pump will tip forward when the case is assembled onto the pump.

3. Slide the case (1) on to the assembly, mounting it with hardware (259, 259A, 259C) to the bracket (71).
4. Torque nuts (259C) to 80 N-m (60 Lb-Ft).



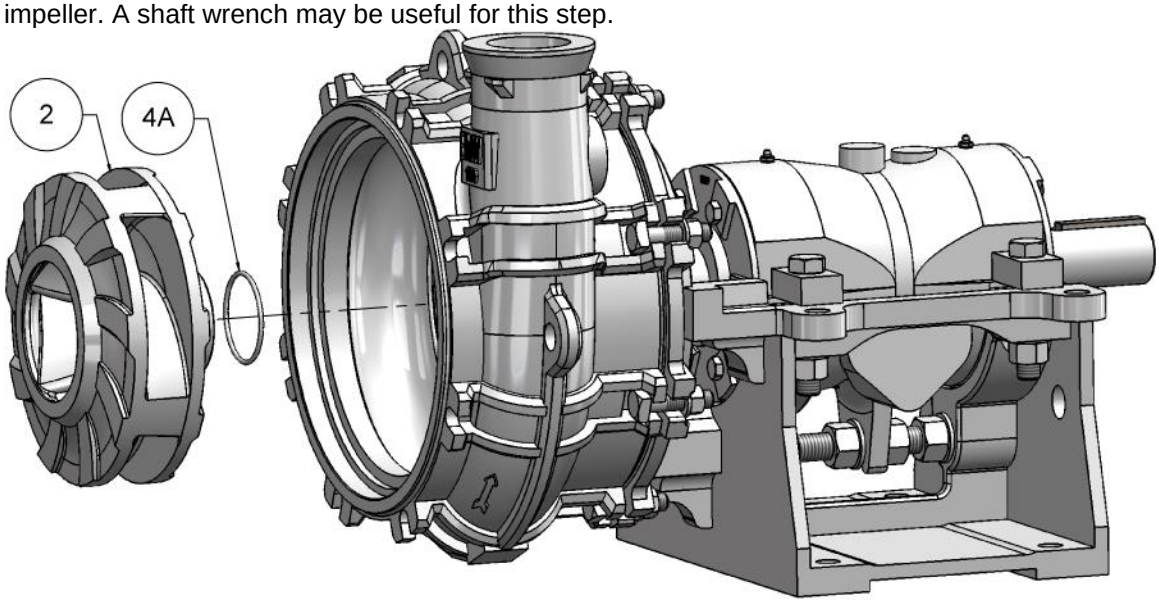
Case Assembly (Expeller Seal)

Impeller Installation – Expeller with Packing.

The impeller used with an expeller seal has long pump out vanes on the backside that extend almost all the way down to the hub.

Impeller (Long back vanes shown)

2. Install the expeller o-ring (4A) into the expeller and thread the impeller (2) onto the shaft. Tighten the impeller. A shaft wrench may be useful for this step.

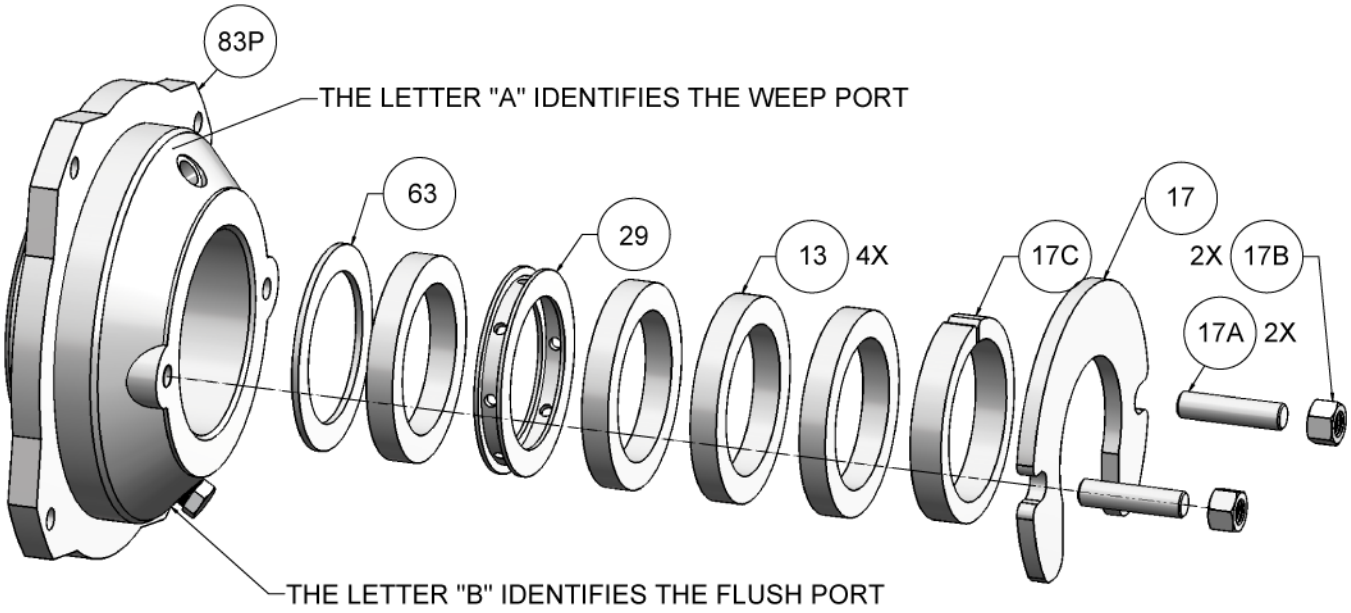


Impeller Installation

Proceed to Section 9.5, Suction Cover assembly.

9.3 Packing Seal

The packing seal creates a simple seal, both in operation and at rest using compression rings. This is the traditional seal used in slurry applications for many years, although it typically consumes significant amount of water and weeps the pump shaft/shaft sleeve. The flush configuration directs most of the liquid towards the seal chamber, pushing solids away from the packing using more flush water.

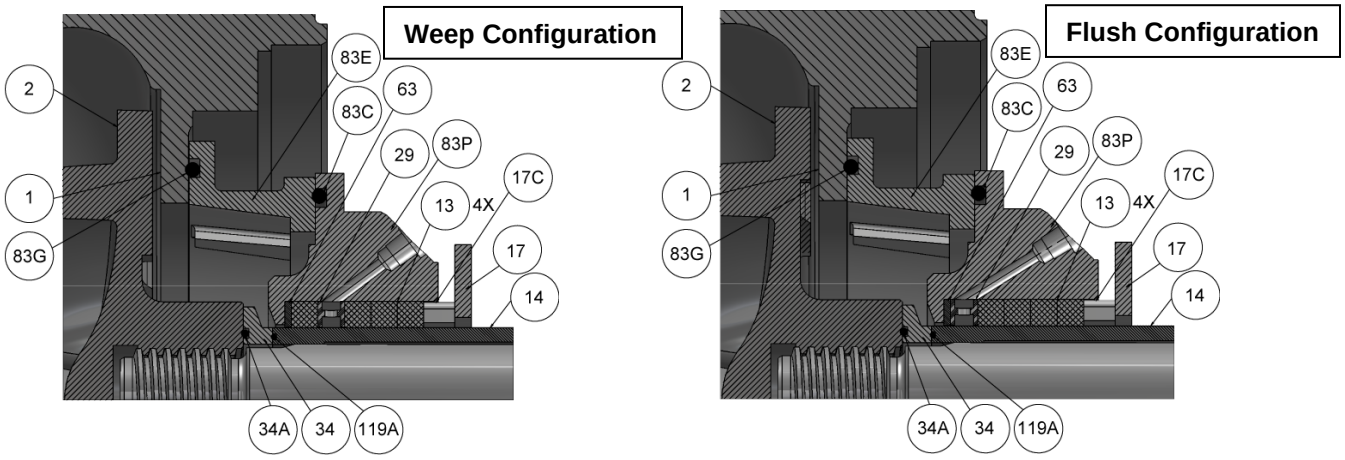


Step 6-1 - Packing Seal Components (Weep Configuration Shown)

The packing seal consists of a stuffing box (83X) four rings of packing (13), a lantern ring (29), a spacer ring (63), a gland plate (17), a gland ring (17C), two gland studs (17A) and two gland nuts (17B). When studs (17A) are being installed, coat the stud threads with a thread locking compound when assembling. Joints of successive rings should be staggered and kept at least 90° apart.

Install the spacer ring (63) into the stuffing box (83X). Then depending on the flush or weep style configuration, install the packing rings (13) and lantern ring (29). Place the gland ring (17C) on the packing, install the studs (17A), and tighten down the gland plate (17) using two nuts (17B). The nuts only need to be loosely installed for initial installation. They should be tightened after the pump is fully assembled.

The seal housing (83X) is provided with two port configurations, weep and flush. An “A” stamp next to the port identifies the weep port while a “B” stamp next to the port identifies the flush port.



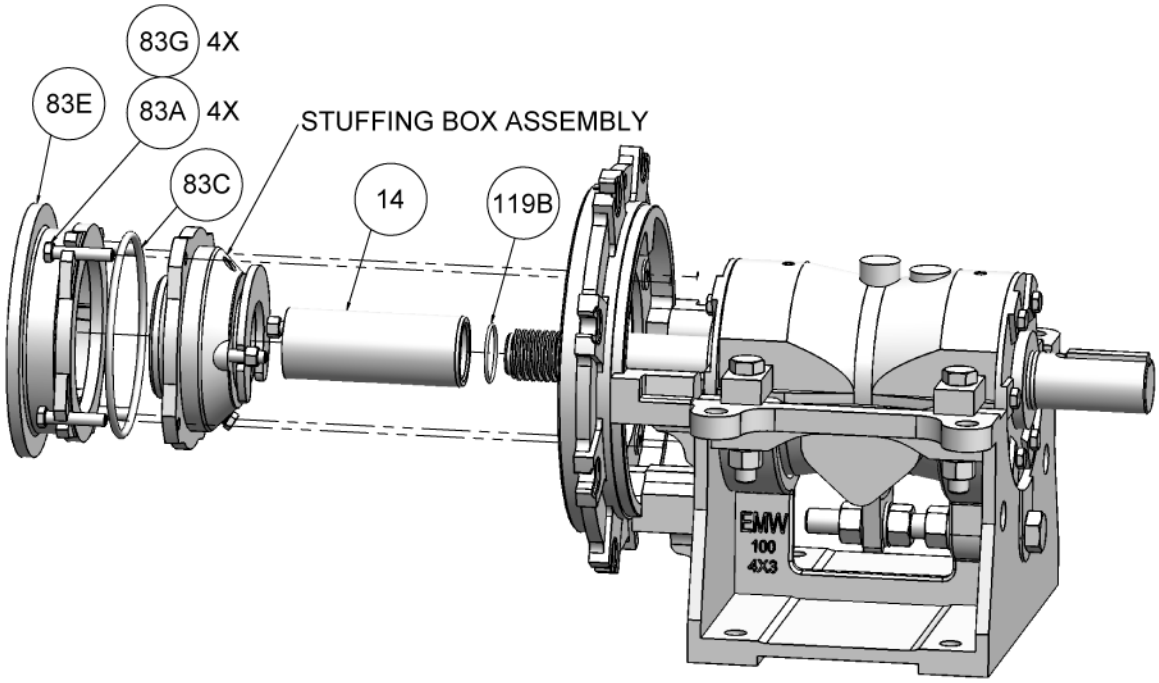
Packing Seal Installation.

1. Install the shaft o-ring (119B) into the shaft sleeve (14) and insert the shaft sleeve onto the shaft (6) butting it up against the release collar (36).

2. Take the stuffing box assembly (83P) and slide it onto the shaft sleeve.

3. Next place the stuffing box o-ring (83C) into the stuffing box groove and insert the stuffing box extension (83E) onto the stuffing box. Use the stuffing box bolts (83A) and washers (83G) to secure the stuffing box (83P) and stuffing box extension (83E) to the bracket (71).

4. Insert the shaft sleeve o-ring (119A) onto the end of the shaft sleeve (14) and butt the spacer (34) up against it.



Packing Seal – Exploded View

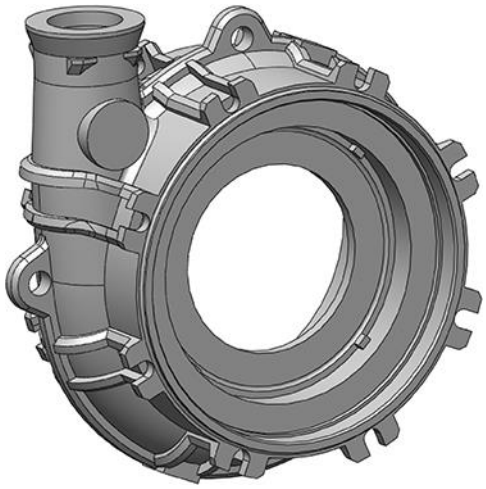
NOTE

The packing rings, lantern ring, and spacer ring (13), (29), and (63) can be installed and removed after the pump has been assembled, but the gland ring (17C) must be around the shaft before assembly of the wet end.

Proceed to Section 9.5, Suction Cover assembly.

Case Assembly - Packing Seal.

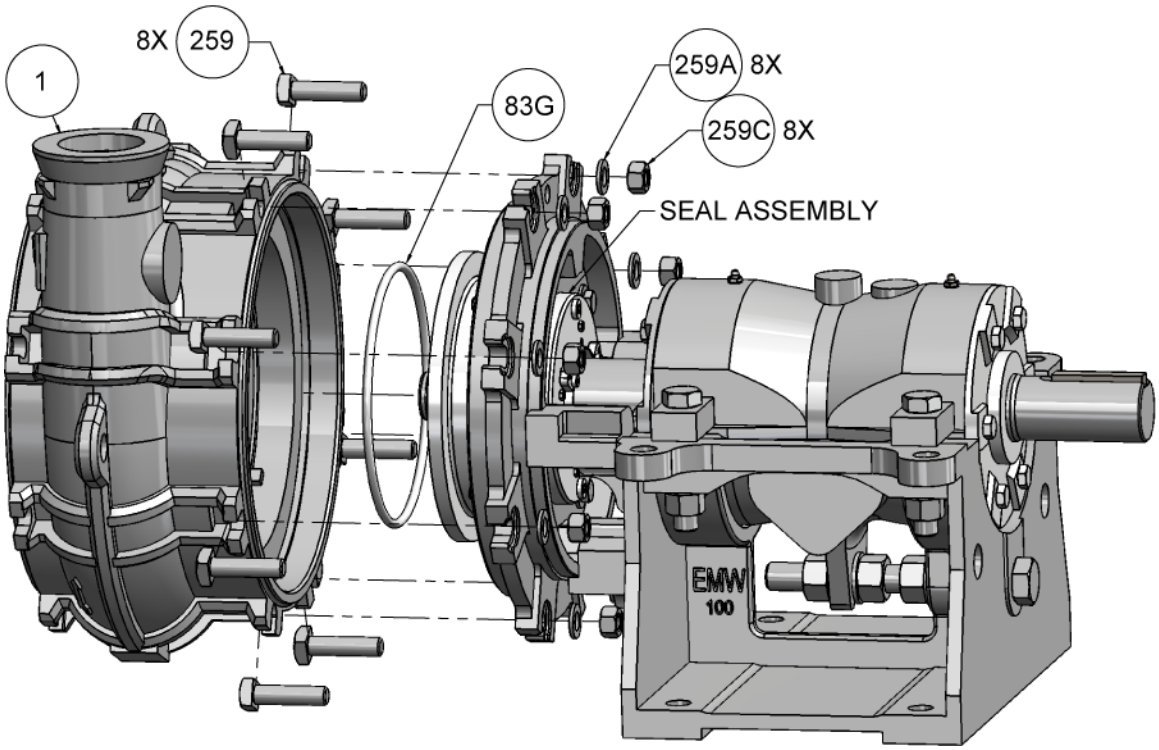
A case used with a packing seal may or may not contain static vanes and will always have a large annular opening around the shaft. Do not use a standard bolt head to attach the case or suction cover as they cannot properly seat and may not hold the pressure generated by the running pump.



Case – Packing configuration

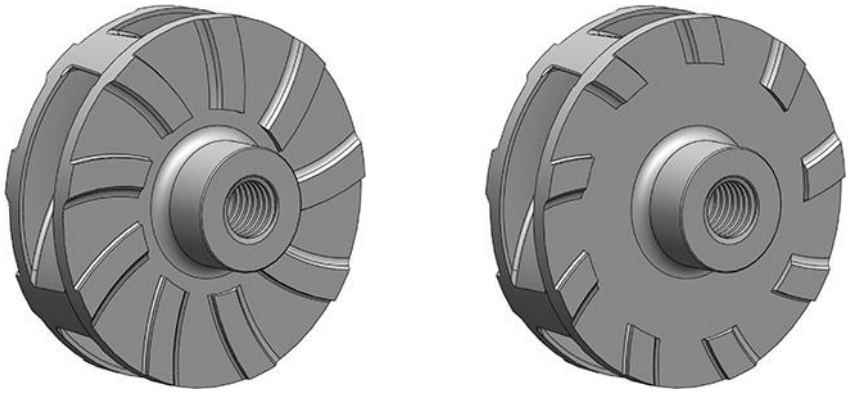
The pump assembly must be attached to a structure or workbench before proceeding, otherwise the pump will tip forward when the case is assembled onto the pump.

1. Slide the case (1) on to the assembly, mounting it with hardware (259, 259A, 259C) to the bracket (71).
2. Torque nuts (259C) to 80 N-m (60 Lb-Ft).



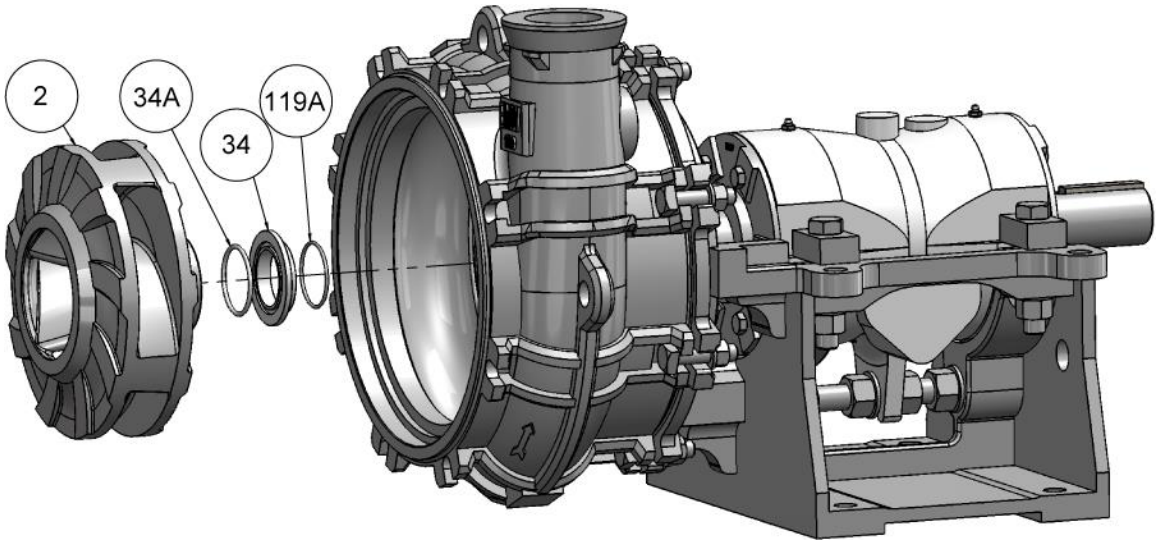
Case Assembly – Packing Seal

Impeller Installation - Packing Seal.
Impeller with either with long backside pump out vanes or optional short pump out vanes may be used with an EMW pump with packing seal.



Impeller Options

1. Install the shaft sleeve O-ring (119A) into the shaft sleeve (14) and slide the spacer sleeve (34) onto the shaft (6).
2. Install the spacer sleeve o-ring (34A) into the spacer sleeve (34) and thread the impeller (2) onto the shaft. Tighten the impeller. A shaft wrench may be useful for this step.

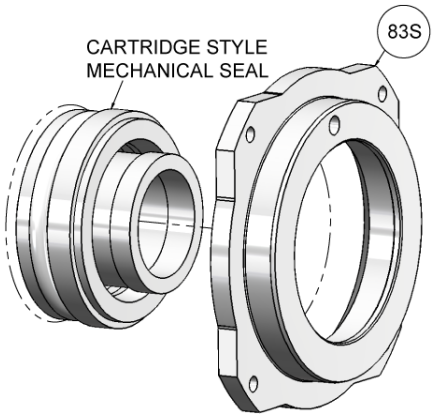


Impeller Installation – Packing Seal

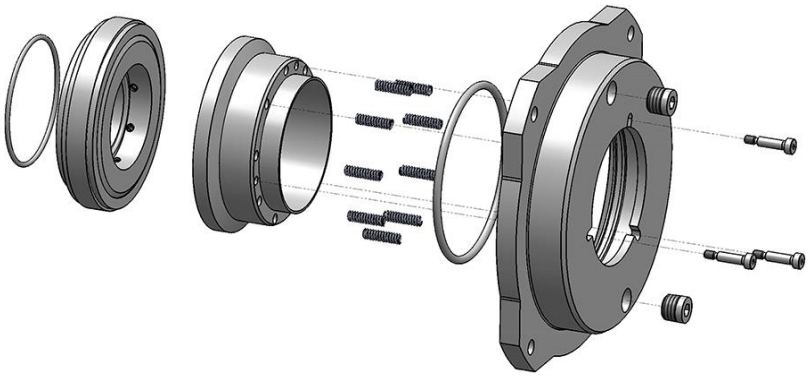
Proceed to Section 9.5, Suction Cover assembly.

9.4 Mechanical Seal

In EMW pumps, the seal chamber space allows for mounting a variety of mechanical seals, including single mechanical and double mechanical seals. This selection is optimal in applications where the suction pressure may be very high, or the customer is interested in a specific seal for inventory purposes. Wilfley representatives likely will discourage this seal selection because of the superior performance and durability of the Solidlock® seal. Once grit or particulates of a slurry make their way to the seal faces, the life of mechanical seal will be compromised.



Cartridge Style Mechanical Seal



Semi-Cartridge Style Mechanical Seal

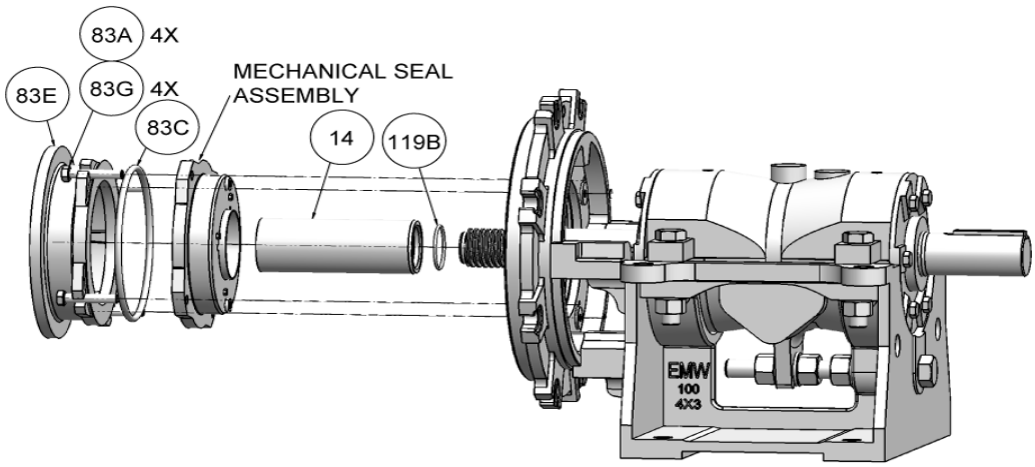
When a cartridge seal is employed, the same spacer sleeve (34) used with a packing seal is used. Semi-cartridge style seals (component seals) may also be installed. The semi-cartridge mechanical seal shown incorporates the seal gland into the stuffing box and the rotary seal face replaces the spacer sleeve. This type of seal generally requires less radial space than a cartridge style seal.

NOTE

The stuffing box extension (83E) in a mechanical seal pump is the same one used with a packing seal pump.

Mechanical Seals.

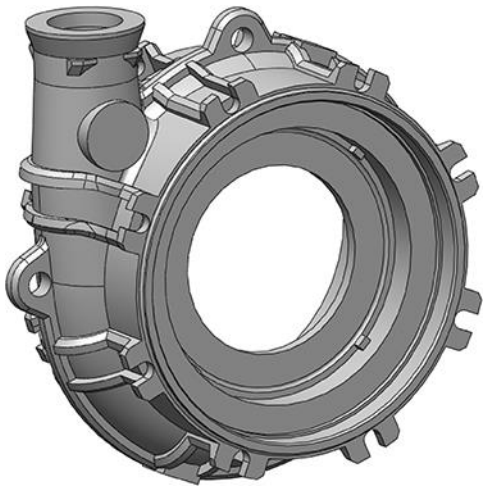
1. Install the seal assembly (89) into the stuffing box (83). The shaft sleeve (14) and o-ring (119B) can be installed on the shaft before installing the seal assembly or it can be inserted into the seal assembly and slid onto the shaft when the stuffing box is assembled to the bracket. Use lubrication if necessary.
2. Install the o-ring (83C) in the stuffing box and assemble the stuffing box extension (83E) with hardware (83A, 83G) to the stuffing box and bracket.



Mechanical Seal Installation

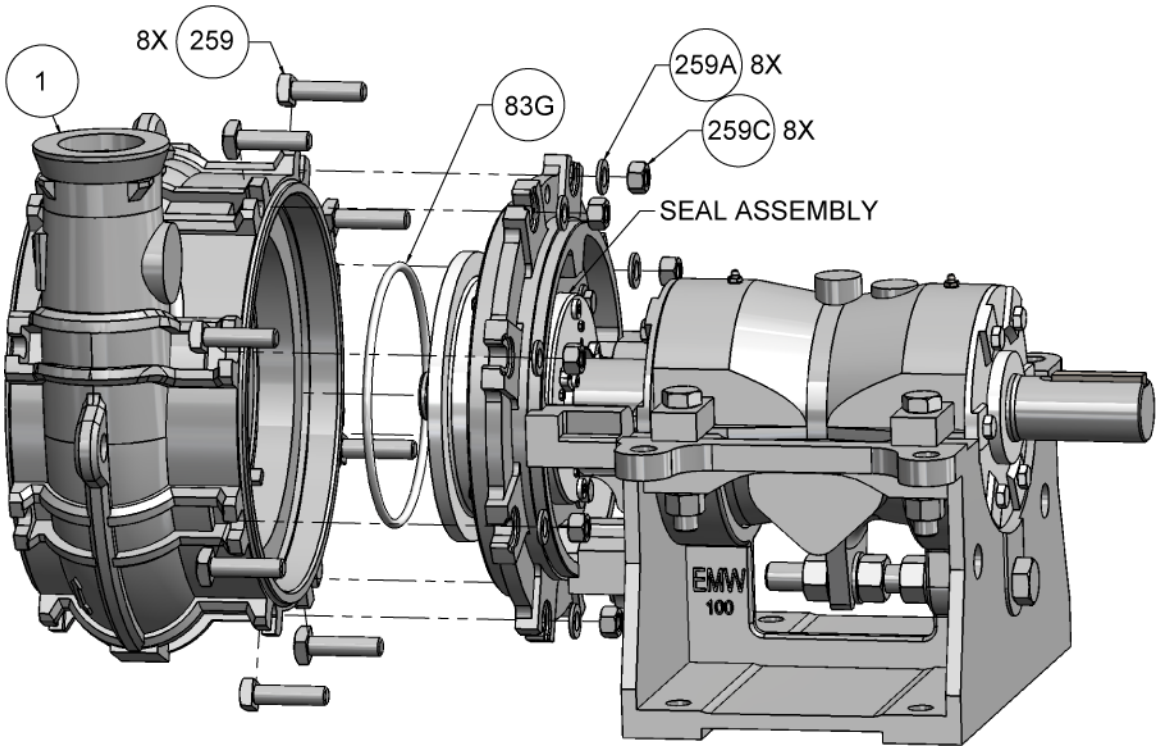
Case Assembly - Mechanical Seal.

A case used with a mechanical seal may or may not have static vanes and will usually have a large annular opening around the shaft. However, some mechanical seals perform better when the case contains a small annular opening around the shaft. For those seals, cases with a small annular opening, similar to a case used with an expeller seal, will be supplied.



Case – Mechanical Seal Configuration

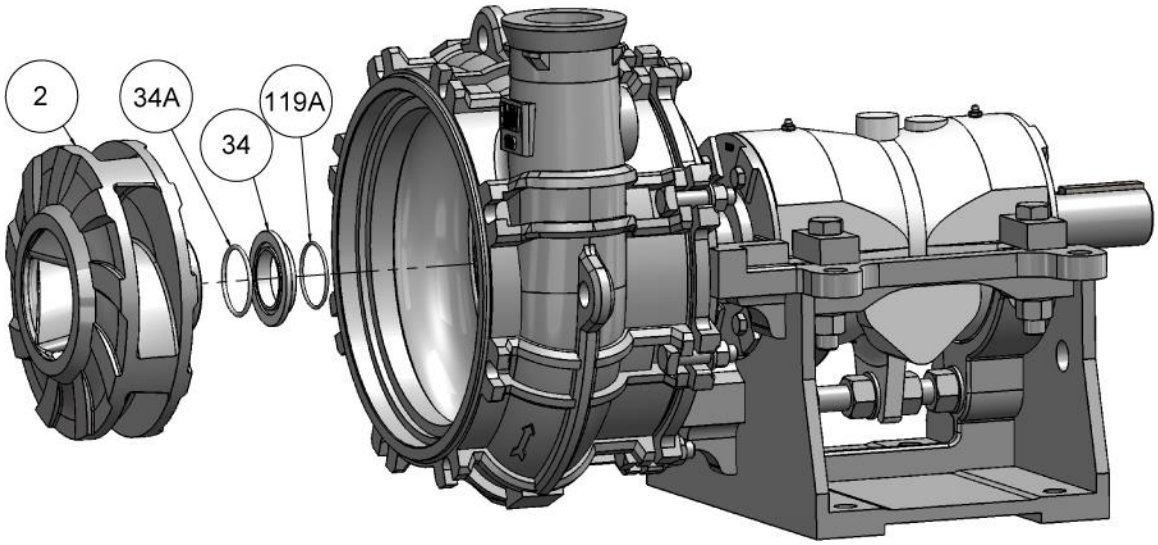
1. Install the stuffing box extension o-ring (83G) into the stuffing box extension.
2. Assemble the case with hardware (259, 259A, 259C) to the bracket, torque nuts (259C) to 80 N-m (60 Lb-Ft).



Case Assembly – Mechanical Seal

Impeller Installation - Cartridge Style Mechanical Seal.
Only an impeller with short backside pump out vanes can be used with a mechanical seal pump. Do not use an impeller with long backside pump out vanes in a mechanical seal pump because it can reduce the stuffing box pressure to a level low enough to damage the mechanical seal.

1. Install the shaft sleeve o-ring (119A) into the shaft sleeve (14) and slide the spacer sleeve (34) onto the shaft (6). Lubrication may be helpful.
2. Install the spacer sleeve o-ring (34A) into the spacer sleeve (34) and thread the impeller (2) onto the shaft.
3. Tighten the impeller. A shaft wrench may be useful.
4. Do not set the mechanical seal until clearances have been set on the pump.

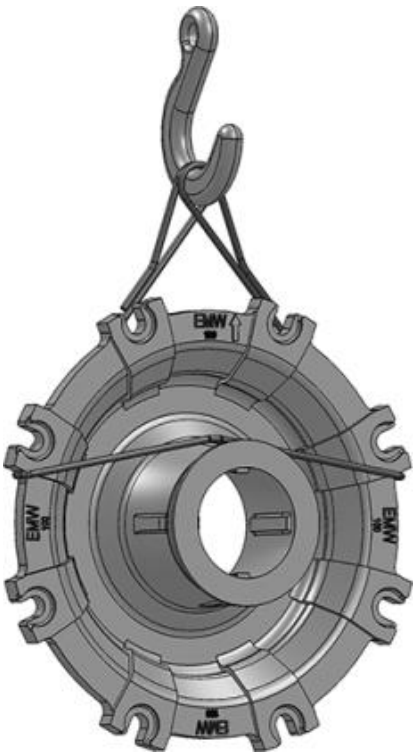


Impeller Assembly – Mechanical Seal

⚠CAUTION

Do not use an impeller with long backside pump out vanes in a mechanical seal pump because it can reduce the stuffing box pressure to a level low enough to damage the mechanical seal.

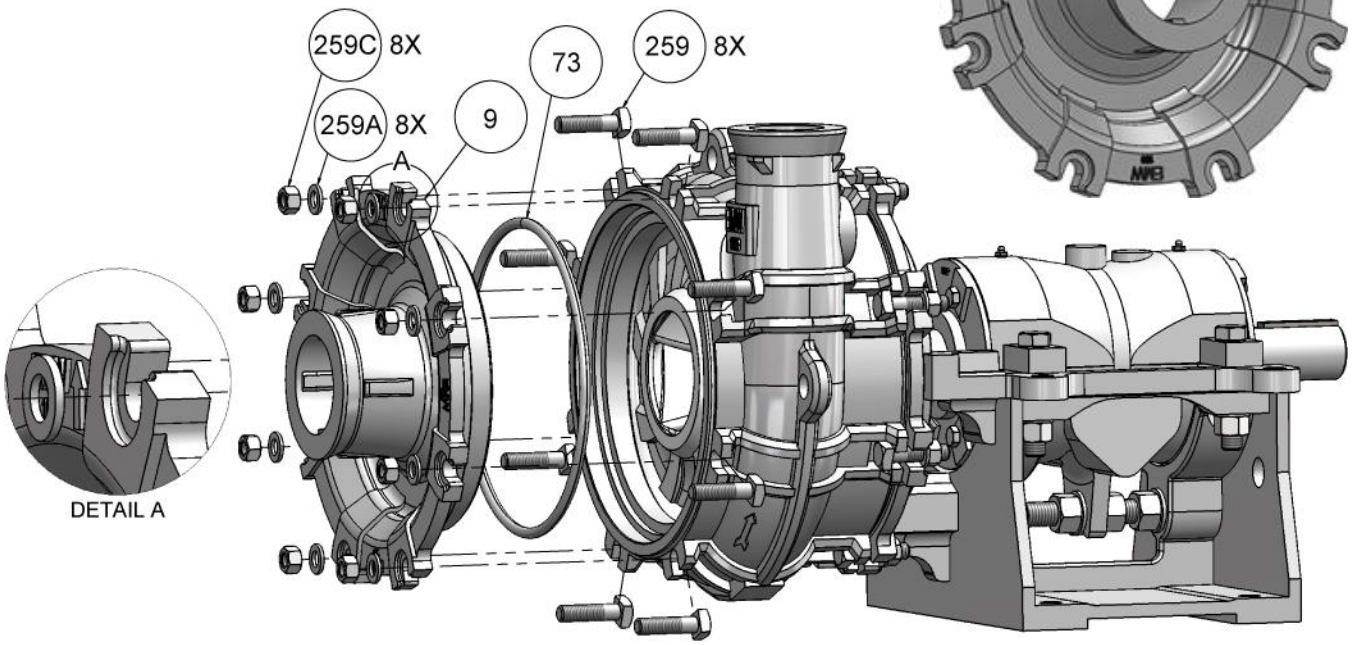
9.5 Suction Cover Assembly – Up to Size 150



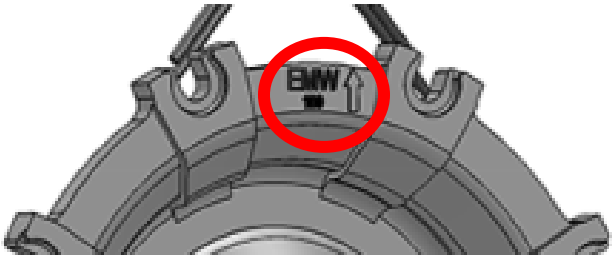
Suction covers on pumps smaller than 150M (6x4) can be hand lifted into position or hoisted with a sling arrangement.

Suction Cover Assembly - (Pumps Size 150 and Smaller).

1. Slide the suction cover o-ring (73) onto the suction cover (9).
2. Maneuver the cover to the case (1) and tighten with hardware (259, 259A, 259C). Tighten nuts (259C).



The arrow on the suction cover of the metal pump serves as position marker. Should an eccentric wear pattern develop, part life can be extended by clocking the suction cover to a new position. The arrow then provides a visual reference point identifying the clocking position. The arrow on the suction cover on factory supplied pumps will point upwards at the 12:00 position. When a new replacement is installed, the arrow should point upwards at the 12:00 position.

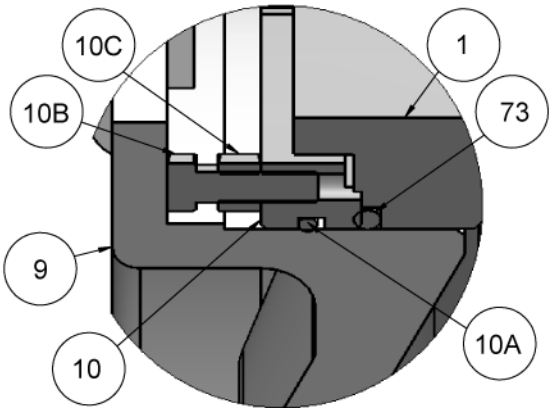


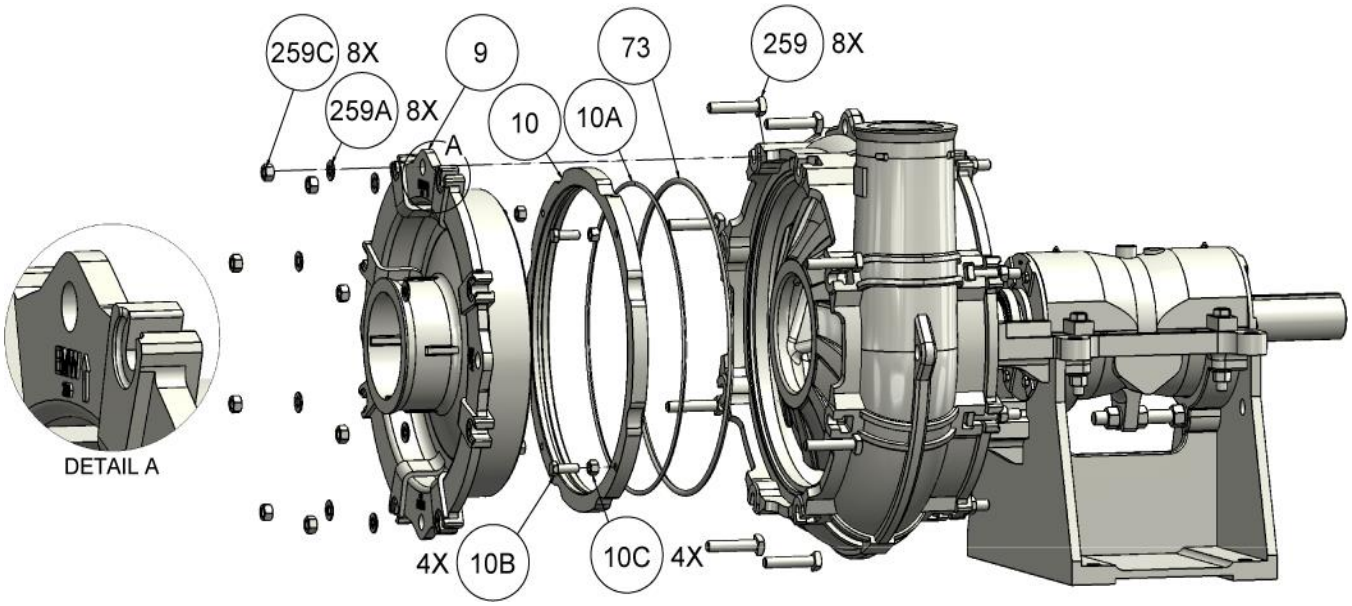
9.6 Suction Cover Assembly - Pumps Size 200 and Larger

Suction covers for the 200M size pumps and larger are equipped with lifting eyes to aid in handling. Use a hook to maneuver the part into position. For pumps that utilize an expeller, this step is required.

Suction Cover Assembly.

1. Install the bushing o-ring (10A) and hardware (10B, 10C) into the case bushing (10).
2. Slide the case bushing with hardware onto the adjustable suction cover (9).
3. Slide the suction cover o-ring (73) onto the adjustable suction cover.

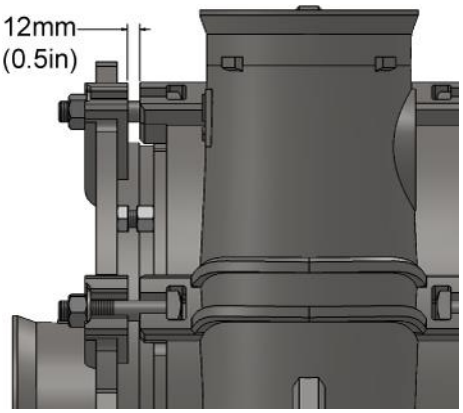




The arrow on the suction cover of the metal pump serves as position marker. Should an eccentric wear pattern develop, part life can be extended by clocking the suction cover to a new position. The arrow then provides a visual reference point identifying the clocking position. The arrow on the suction cover on factory supplied pumps will point upwards at the 12:00 position. When a new replacement is installed, the arrow should point upwards at the 12:00 position.


DETAIL A

Suction Cover Gap Setting.



1. Loosely assemble the adjustable suction cover (9) to the case (1) with hardware (259, 259A, 259C) leaving a 12 mm (0.5 inch) gap between the adjustable suction cover and the case as shown.

2. **Solidlock® Seal –** Set the seal by tightening set screws as described in Solidlock® manual, **IM-SL**.

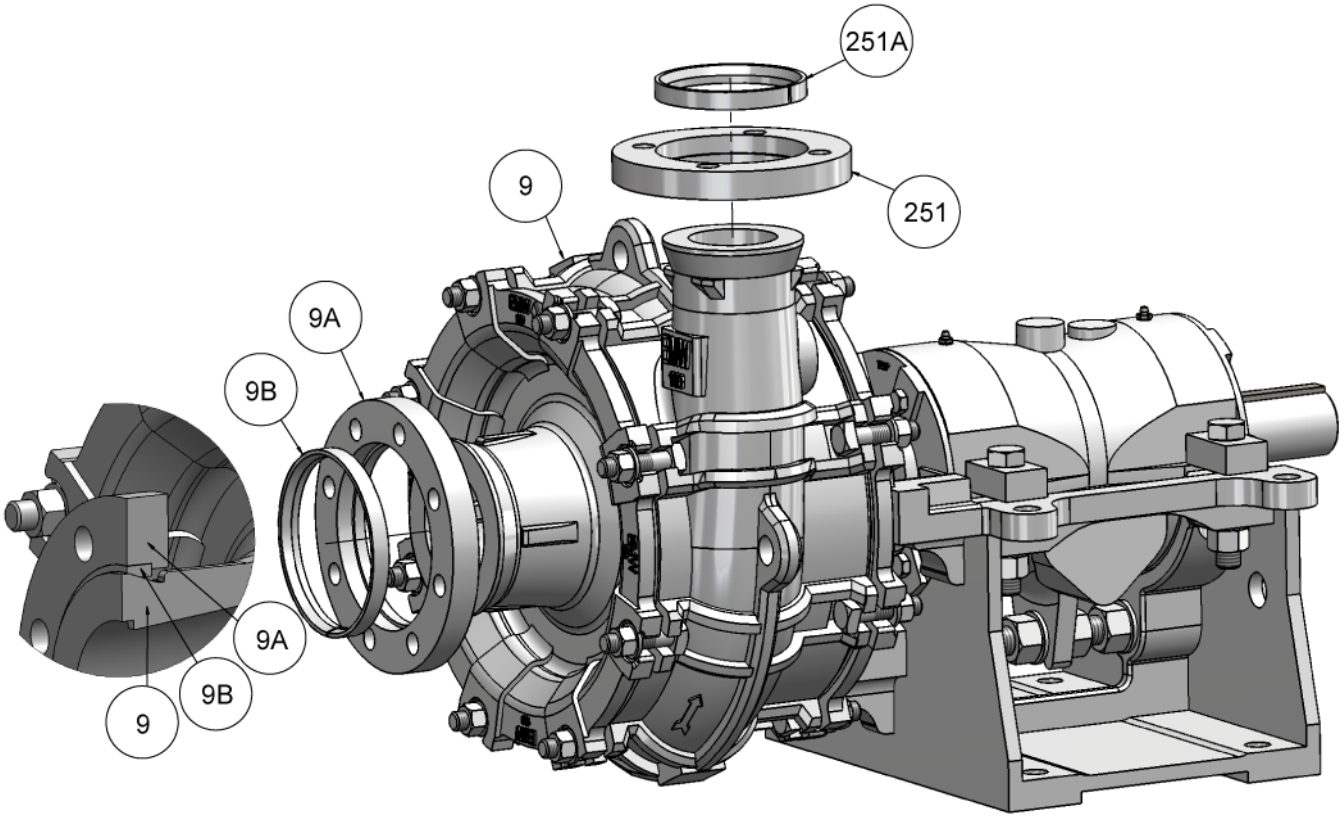
   Expeller with Packing – Make sure the packing gland nuts (17B), shown in step 6, are only finger tight. These nuts will be tightened as needed when the pump is installed and running.

   Packing – Make sure the packing gland nuts (17B) are only finger tight. These nuts will be tightened as needed when the pump is installed and running.

   Mechanical Seal – Set the mechanical seal per the manufacturer's instructions.

9.7 Flange Assembly

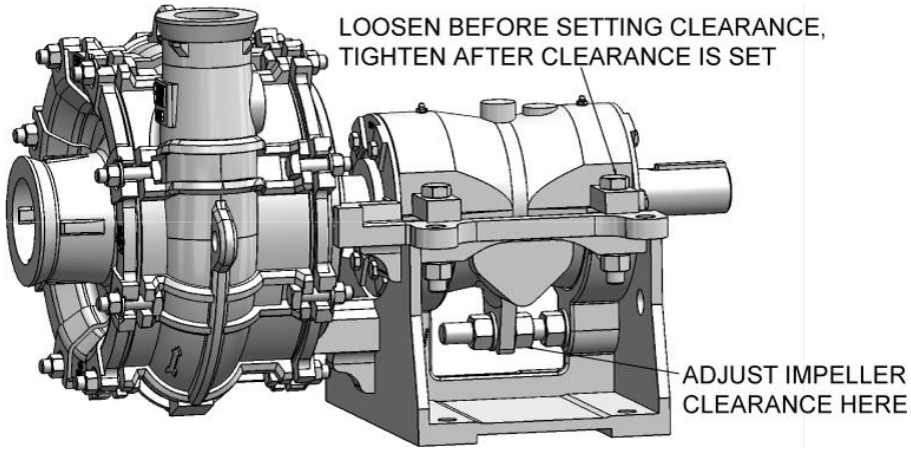
1. Slip fit the suction flange (9A) over the neck on the suction cover (9) and the discharge flange (251) over the neck on the case (1).
2. Pry open the suction flange split ring (9B) and slide it over the neck on suction cover to rest on the cone taper.
3. Pull the suction flange back against the split ring to seat it. Repeat the above assembly sequence to install the discharge flange split ring (251A) and seat the discharge flange.



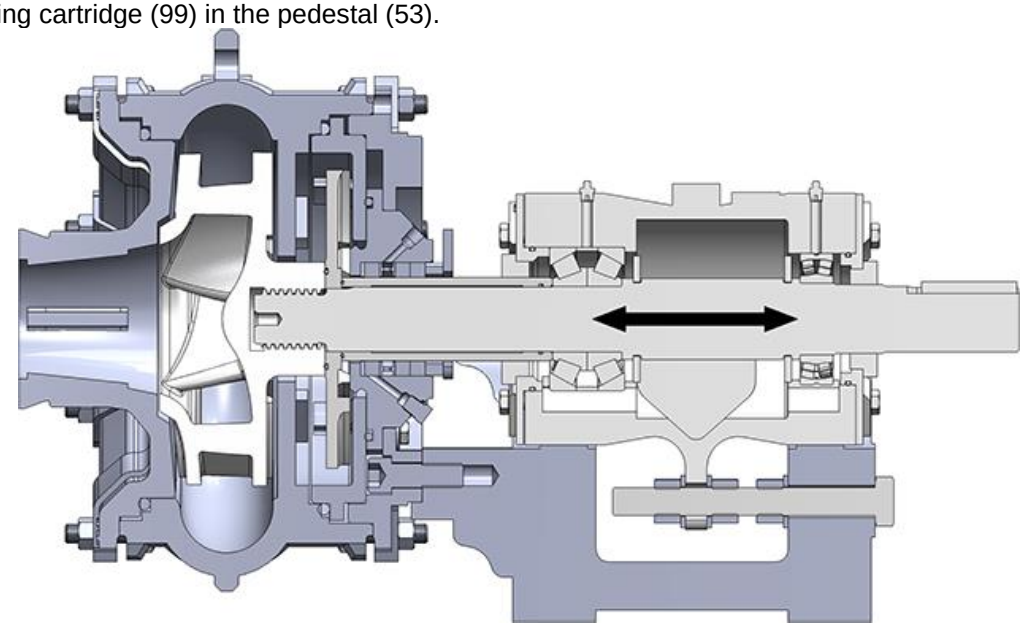
Flange Installation

10.1 Setting Clearances - Size 150 and Smaller

On pumps size 150 and smaller, the impeller running clearance is controlled by adjusting the bearing cartridge position on the pedestal. While this adjustment is primarily intended for controlling the impeller running, this adjustment may be employed to move the bearing cartridge backwards, thus reducing the expeller running clearance. However, be aware that tightening the expeller running clearance will shorten the life of the pump due to an increase in the wear at the impeller with increased running clearances. A loss of performance may also result.



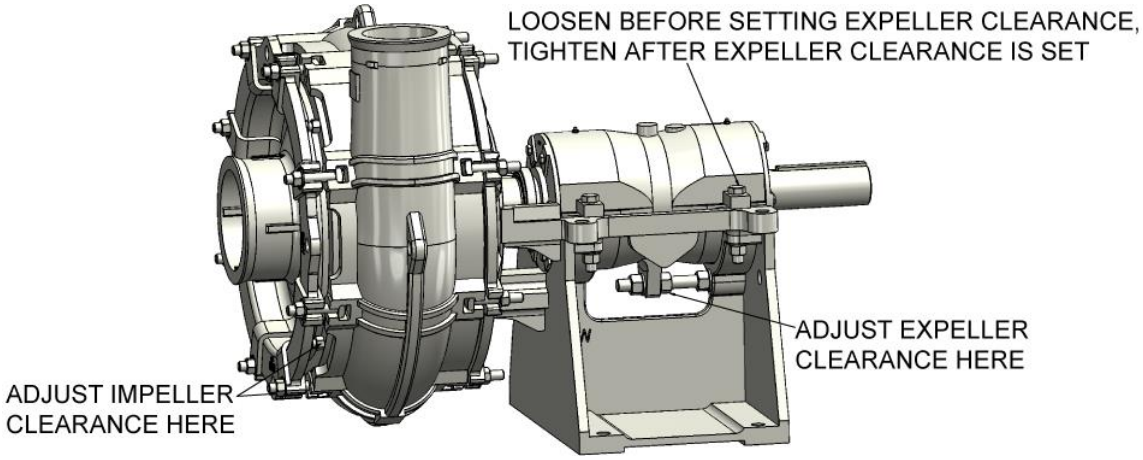
1. To set the impeller running clearance, first ensure the bearing cartridge clamp bolts are loose, then loosen the hex nuts (149B) on the bearing cartridge adjustment screw (149) located underneath the bearing cartridge (99) in the pedestal (53).

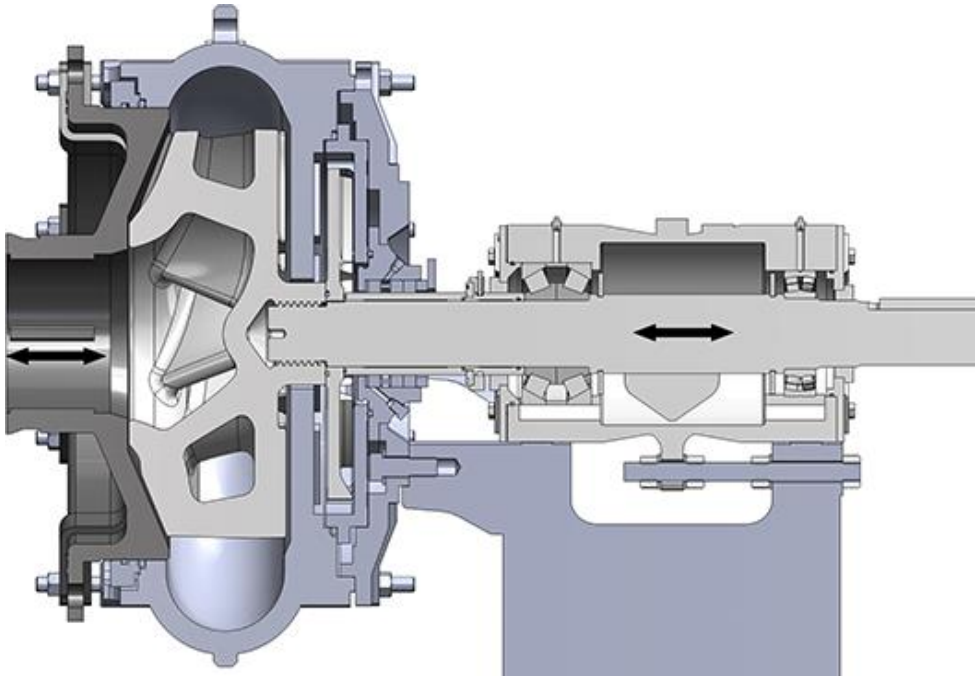


2. Move the bearing cartridge forward (left) using the outboard hex nut against the bearing cartridge adjustment screw until the impeller (2) contacts the suction cover (9).
3. While making this adjustment slowly rotate the shaft (6) in a clockwise direction, as viewed from the back of the pump. Contact of the rotating parts with be audible and felt through the shaft.
4. When contact occurs, loosen the outboard hex nut from the adjustment screw so the assembly can move the opposite direction. Tighten the inboard nut approximately 60 degrees (one hex flat) to slowly increase the running clearance of the impeller. The clearance should be approximately 0.5 mm (0.02 inches) from the front. A dial indicator may be used to measure this clearance accurately.
5. Once the impeller is positioned properly, tighten both nuts to secure the bearing cartridge from moving axially.
6. Verify the shaft turns freely before tightening the bearing cartridge clamp bolts.

10.2 Setting Clearances - Size 200 and Larger

On pumps size 200M (8x6) and larger, two adjustments are available which allows the user to control both the impeller and expeller running clearance for optimum performance and wear settings.





1. To set the impeller running clearance, first ensure the bearing cartridge clamp bolts are loose so the assembly is free to move. Loosen the hex nuts (149B) on the bearing cartridge adjustment screw (149) located underneath the bearing cartridge (99) of the pedestal (53).

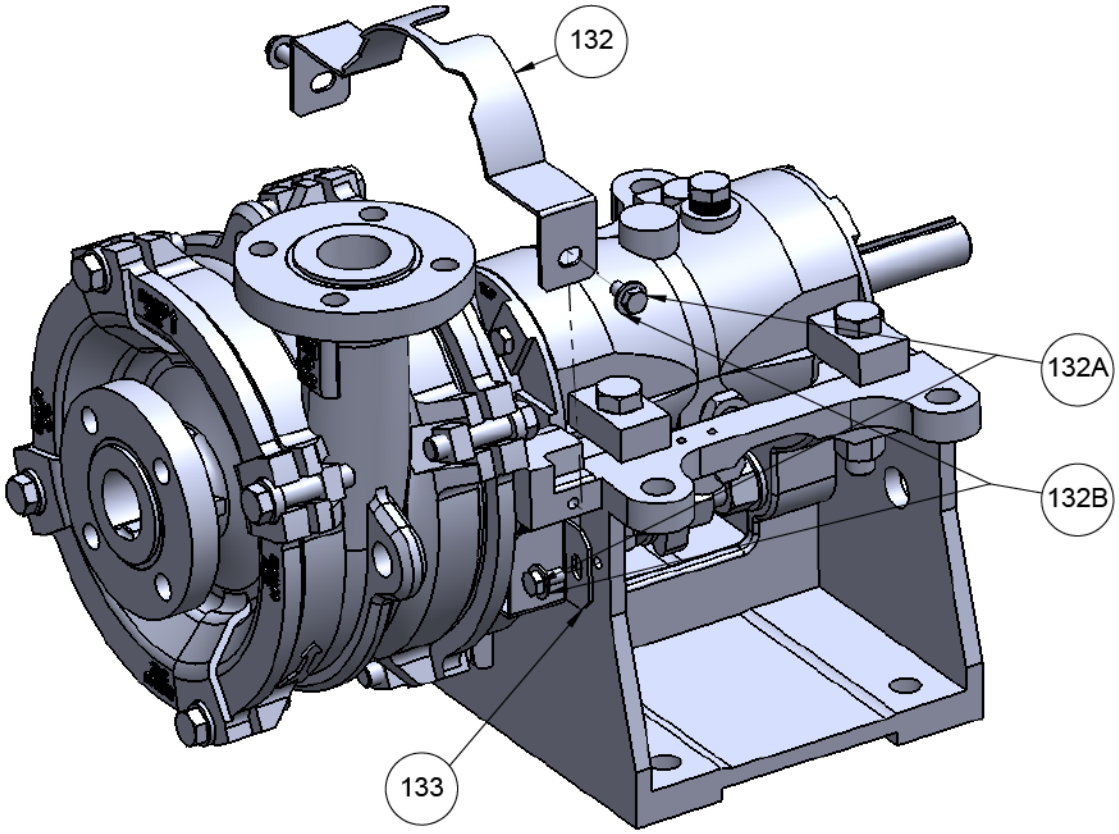
2. Move the bearing cartridge backwards by tightening the inboard hex nut against the bearing cartridge until the expeller (4) contacts the expeller cover (71B). While making this adjustment, slowly rotate the shaft (6) to listen for rubbing. Then loosen the nut again to allow for frame travel.

3. Adjust the bearing cartridge forward by tightening the outboard hex nut. Make sure that the impeller does not contact the suction cover during this adjustment-- you may have to loosen the suction cover bolts to allow this movement.
4. Next, tighten the case bolts to draw the suction cover inwards until it contacts the impeller.
5. Tighten the four jack bolts located on the case bushing to bring it up against the suction cover (9) and use the hex nuts (10C) to lock the jack bolts (10B) in place.
6. Verify the impeller is not seized in place as a result of setting the jack bolts. Snug the hex nuts on the eight case bolts to hold the suction cover in place.
7. Once again, verify the impeller has not become seized, then, tighten the case nuts (259C).
8. Loosen the outboard hex nut on the bearing cartridge adjustment screw. Tighten the inboard nut approximately 60 degrees (one hex flat) to slowly increase the running clearance of the impeller. The clearance should be approximately 0.5 mm (0.02 inches) from the front. A dial indicator may be used to measure this clearance accurately.
9. Tighten both hex nuts to secure the bearing cartridge in place. Verify free shaft rotation.

10.3 Seal Guard Assembly

Guard Assembly.

1. Install Upper and Lower Seal Guards (132) (133) around seal cavity.
2. Tighten hardware (132A) and (132B) to the pedestal (53).



Seal Guard Installation

10.4 Wear Adjustment

As previously described, the suction cover can be rotated to compensate for uneven wear on all EMW pumps. A careful inspection of the suction cover will clarify if the part is acceptable to be reused in a new orientation, or if replacement is necessary.

The impeller running clearance in pumps sizes 150 and smaller is controlled by an adjustment bolt located under the bearing cartridge. This allows the shaft, impeller and expeller to be adjusted together for optimum operating clearances. If wear occurs, the impeller should be readjusted to approximately 0.5 mm (0.02 inches) from the front of the suction cover. BE cautious and realize a impeller with wear will generate less head, consume more power, and likely have a high propensity to leak through the dynamic seal if so equipped.

⚠CAUTION

Never adjust the clearance while the pump is running.

On pumps sizes 200 and larger, two adjustment features are provided. In addition to the adjustment bolt on the bearing cartridge, the suction cover is also adjustable. These features allow control of both the impeller and expeller running clearances. See section 10.2 for additional detail.

10.5 Disassembly Notes

Impeller Replacement.
Removal of the impeller first requires removal of the suction cover. Access to the discharge nozzle on the case is also required, as it will be necessary to insert a bar into the discharge neck to contact the impeller and prevent it from rotating as it is unthreaded from the shaft.

⚠CAUTION

On all but the smallest pumps, a lifting fixture to support the weight of the impeller at the impeller eye during this operation is necessary.

During normal operation, the impeller is tightened by running torque. On pumps size 150 and smaller, a shock force applied to a keyed shaft wrench located on the drive end of the shaft should provide the force necessary to break free the impeller.

On pumps size 200 and larger, a sacrificial brass release collar (shown) is provided to relieve the impeller thread load. Prying loose the pieces will relieve the impeller load and allow removal. A groove in the release collar sleeve provides a location for a screwdriver blade, lightly tapping the screw driver with a hammer to move the release collar along the shaft will aid with disassembly of the release collar.

Release Collar

NOTE

Care should be taken to prevent marring of the shaft or shaft keyway when using a shaft wrench.

Lock Out.
Any work on non-pump equipment shall be governed by the specifications and regulations of the manufacturer. Ensure that lockout tags are in place. Do not apply heat to impeller hub or nose.

Bearing Cartridge.
The bearing cartridge fork allows the bearing cartridge to be easily disassembled from the pedestal. Flats on the bearing cartridge provide accessibility to the bearing caps for application of force to aid in removal of the bearing caps.

Flanges.
Flanges are separate parts supplied with either ANSI 150 lb or ISO PN 16 connections. On the EMW metal pumps, the discharge and suction flanges are loose parts so that either an ISO class PN16 or ANSI class 150 lb flange connection can be made. On rubber lined pumps, as a standard, the case shell suction and discharge flange connections are PN16 metric thread tapped holes. ANSI class 150 lb flange connections are available on rubber lined pumps by special request.

Tabs located on the case and suction cover directly behind the cone where the flange seats provide a bearing surface that aid with separation of the flange from the split ring. The flange clears the tabs while the split ring does not. With the flange assembly resting on the tabs, application of a sharp blow to the flange should separate the two pieces. With the aid of a screw driver, prying open the split ring makes it possible to slip it over the cone. Following that, the flange itself can be lifted free of the part.

10.6 Spare Parts

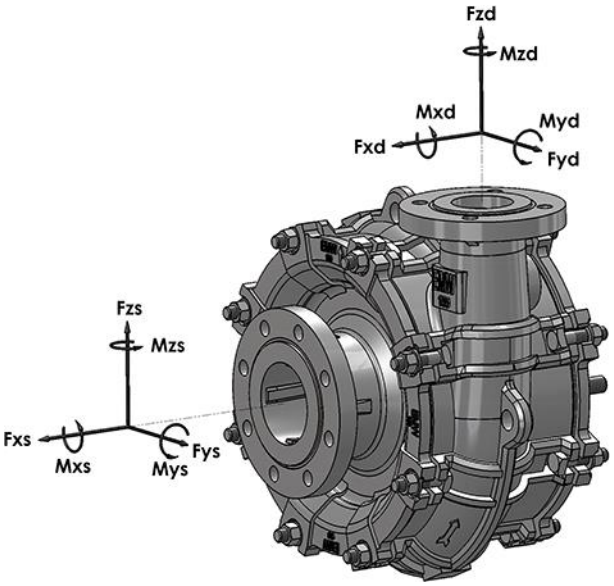
Ordering parts may be accomplished by providing two pieces of information. Using the pump serial number and the item reference number, the exact part material and part number may be identified by AR Wilfley. When ordering, provide as much of the following as possible.

- Part numbers
- Size and model of pump
- Provide serial number

Whenever a pump is rebuilt, all o-rings and gaskets should be replaced. On pumps size 200 and larger, the release collar is a sacrificial component which must be replaced every time a pump is rebuilt.

11.0 Forces and Moments

Forces and moments only apply to static pipelines due to loads based on operation and temperature change. The values are applicable when pump is installed on a grouted and even foundation.



Note: Discharge nozzle coordinate system always moves with nozzle angle, Fz always moves in direction of flow.

BRANCH SIZE	Discharge						Suction					
	F_{Xd} (N)	F_{Yd} (N)	F_{Zd} (N)	M_{Xd} (N-m)	M_{Yd} (N-m)	M_{Zd} (N-m)	F_{Xs} (N)	F_{Ys} (N)	F_{Zs} (N)	M_{Xs} (N-m)	M_{Ys} (N-m)	M_{Zs} (N-m)
50	7110	5690	14450	3570	3570	5420	14450	7110	5690	5420	3570	3570
75	7840	6270	15180	3930	3930	5960	15180	7840	6270	5960	3930	3930
100	8590	6890	15930	4290	4290	6500	15930	8590	6890	6500	4290	4290
150	10110	8090	17450	4990	4990	7570	17450	10110	8090	7570	4990	4990
200	11700	9340	19040	5690	5690	8620	19040	11700	9340	8620	5690	5690
250	13390	10710	20730	6380	6380	9670	20730	13390	10710	9670	6380	6380
300	15230	12180	22560	7070	7070	10710	22560	15230	12180	10710	7070	7070
350	17300	13830	24640	7740	7740	11730	24640	17300	13830	11730	7740	7740

BRANCH SIZE	Discharge						Suction					
	F_{Xd} (lb)	F_{Yd} (lb)	F_{Zd} (lb)	M_{Xd} (ft-lb)	M_{Yd} (ft-lb)	M_{Zd} (ft-lb)	F_{Xs} (lb)	F_{Ys} (lb)	F_{Zs} (lb)	M_{Xs} (ft-lb)	M_{Ys} (ft-lb)	M_{Zs} (ft-lb)
2	1600	1280	3250	2640	2640	4000	3250	1600	1280	4000	2640	2640
3	1760	1410	3410	2900	2900	4390	3410	1760	1410	4390	2900	2900
4	1930	1550	3580	3160	3160	4790	3580	1930	1550	4790	3160	3160
6	2270	1820	3920	3680	3680	5580	3920	2270	1820	5580	3680	3680
8	2630	2100	4280	4200	4200	6360	4280	2630	2100	6360	4200	4200
10	3010	2410	4660	4700	4700	7130	4660	3010	2410	7130	4700	4700
12	3420	2740	5070	5210	5210	7900	5070	3420	2740	7900	5210	5210
14	3890	3110	5540	5710	5710	8650	5540	3890	3110	8650	5710	5710

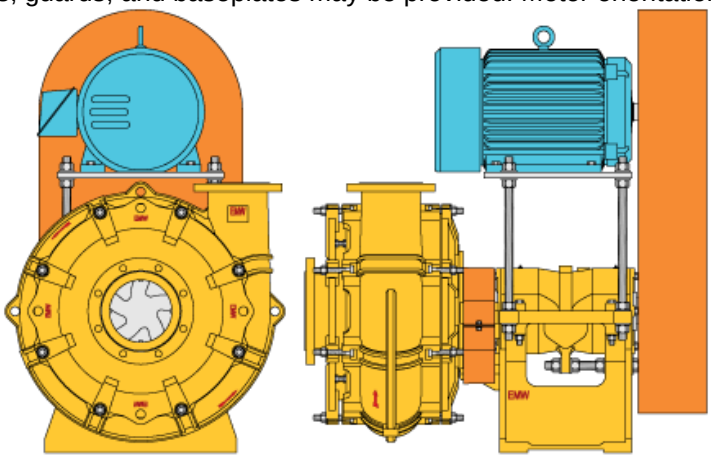
11.1 Noise Levels

When running the pump within the normal limits of operation and on clear liquids, the sound pressure level for the pump alone does not exceed 80 dBa. Coarse solids, froth, or cavitation conditions can increase noise levels.

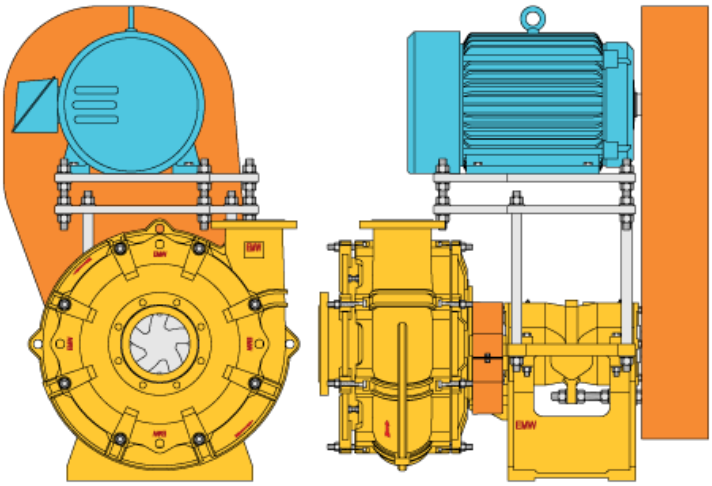
Sound pressure levels from motors, gear reducers, and belt driven units must be added.

11.2 Accessories

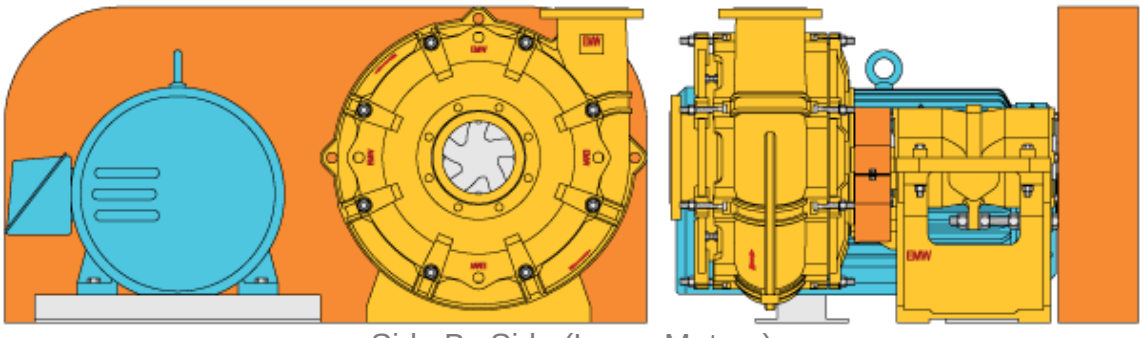
Couplings, sheaves, v-belts, guards, and baseplates may be provided. Motor orientation is shown.



Inline Overhead (Small Motors)



Offset Overhead (Medium Motors)



Side By Side (Large Motors)

11.3 Torque Values (unless otherwise specified)

METRIC Class 8.8 (N-m)			SAE Grade 5 (Lb-Ft)		
Bolt Size	Thread Pitch	Torque	Bolt Size	Thread Pitch	Torque
6	1	10	1/4	20	7
8	1.25	14	5/16	18	10
10	1.5	23	3/8	16	17
12	1.75	54	1/2	13	40
14	2	80			
16	2	108	5/8	8	80
18	2.5	128			
20	2.5	162	3/4	7	120
22	2.5	216	7/8	7	160
24	3	270	1	6	200
27	3	324	1-1/8	10	240
30	3.5	378	1-1/4	11	280
33	3.5	432	1-3/8	9	320
36	4	486	1-1/2	9	360

11.4 Case/Suction Cover Hardware Torque Values

Pump Size	Fastener Size	Torque (N-m)	Torque (Lb-Ft)
50 (2x2)	M16	80	60
75 (3x3)	M16	80	60
100 (4x3)	M16	100	75
150 (6x4)	M20	150	110
200 (8x6)	M20	150	110
250 (10x8)	M24	250	185
300 (12x10)	M24	250	185
350 (14x12)	M24	250	185

12.0 Troubleshooting

SYMPTOMS													
Pump sump tank overflows	Pump overheats or seizes	Reduced bearing life	Excessive pump vibration or noise	Reduced packing life	Stuffing box leakage	Excessive motor power draw	Pump loses prime	Low discharge pressure	Low capacity	Loss of discharge pressure	Pump surges	Excessive wear on wetted parts	POSSIBLE CAUSES
■	■									■			Pump not primed
			■				■		■	■	■		Pump or suction pipe not completely filled with liquid
			■				■		■	■			Suction lift too high
	■		■						■	■	■	■	Insufficient NPSH
							■		■	■	■		Air pocket in suction line
							■		■		■		Air leaks in suction line
							■		■				Air leaks into pump through stuffing box
■			■				■		■	■	■		Obstructed suction line
■			■				■		■	■			Suction pipe diameter too small or excessive losses in suction pipe
				■	■								Suction head too high for expeller
												■	Suction liquid velocity too high
■								■	■	■			Pump speed too low
			■			■			■		■	■	Pump speed too high
■						■		■	■	■			Impeller running backwards
■						■		■	■	■			System head higher than design
						■							System head lower than design
								■	■	■		■	Material incompatible with liquid being pumped
■						■							Liquid specific gravity different from design
	■	■	■								■	■	Unstable flow into pump sump tank
	■		■										Low capacity operation
■							■	■	■	■	■		Entrained air in pump or frothy conditions
■			■				■	■	■	■	■		Improperly installed piping
	■	■	■	■	■	■							Misalignment of motor to pump
			■										Non-rigid foundation
		■	■	■	■	■							Bent shaft
	■	■	■			■						■	Rotating parts rubbing on stationary parts
	■	■	■	■									Worn bearings
■			■					■	■	■			Worn or damaged impeller
				■	■	■							Worn or scorned shaft sleeve
				■	■	■							Improperly installed packing
				■	■	■							Packing not suitable for operating conditions
		■			■								Faulty mechanical seal
	■	■	■	■	■								Excessive shaft runout
	■	■	■	■	■								Unbalanced impeller
				■		■							Packing gland too tight
■		■	■				■	■	■	■			Obstructed impeller hydraulic passage
	■	■	■										Excessive thrust load
	■	■	■										Excessive bearing lubrication
	■	■	■										Insufficient bearing lubrication
	■	■	■										Improperly installed bearings
		■	■										Dirt in bearing housing
		■	■										Moisture in bearing housing
	■	■											Faulty bearing isolator
				■	■								Worn expeller or excessive product buildup between expeller vanes
				■	■								Excessive clearance between stuffing box and shaft sleeve
			■										Loose pedestal clamp screws
	■	■											Excessive V-belt tension

13.0 Revision History

Revision	Description	Date
4	• Updated Logo and branding	Sep. 2014
5	• Updated wording and reorganized sections 1-5. Safety, lifting, assembly. Revision table added.	August 2020
6	• Updated Solidlock Assembly	May 2021

Appendix 1

Bearing Operating Temperature Range 63°C to 76°C (145°F to 170°F)

Pump	Lubrication Amount		Lubrication Interval Based On Pump Run Time		
	Thrust	Radial	8 hrs/day	16 hrs/day	24 hrs/day
50 (2x2)	7 g (0.2 oz)	3g (0.1 oz)	2300 hrs	1100 hrs	800 hrs
75 (3x3)	11 g (0.4 oz)	4 g (0.1 oz)	1500 hrs	700 hrs	500 hrs
100 (4x3)	15 g (0.5 oz)	6 g (0.2 oz)	1200 hrs	600 hrs	400 hrs
150 (6x4)	23 g (0.8 oz)	8 g (0.3 oz)	1700 hrs	900 hrs	600 hrs
200 (8x6)	32 g (1.1 oz)	13 g (0.5 oz)	2300 hrs	1100 hrs	800 hrs
250 (10x8)	40 g (1.4 oz)	17 g (0.6 oz)	2500 hrs	1300 hrs	800 hrs
300 (12x10)	60 g (2.1 oz)	21 g (0.8 oz)	2700 hrs	1300 hrs	900 hrs
350 (14x12)	71 g (2.5 oz)	29 g (1.0 oz)	3500 hrs	1800 hrs	1200 hrs

Bearing Operating Temperature Range 77°C to 92°C (171°F to 199°F)

Pump	Lubrication Amount		Lubrication Interval Based On Pump Run Time		
	Thrust	Radial	8 hrs/day	16 hrs/day	24 hrs/day
50 (2x2)	7 g (0.2 oz)	3g (0.1 oz)	1100 hrs	600 hrs	400 hrs
75 (3x3)	11 g (0.4 oz)	4 g (0.1 oz)	700 hrs	400 hrs	200 hrs
100 (4x3)	15 g (0.5 oz)	6 g (0.2 oz)	600 hrs	300 hrs	200 hrs
150 (6x4)	23 g (0.8 oz)	8 g (0.3 oz)	900 hrs	400 hrs	300 hrsd
200 (8x6)	32 g (1.1 oz)	13 g (0.5 oz)	1100 hrs	600 hrs	400 hrs
250 (10x8)	40 g (1.4 oz)	17 g (0.6 oz)	1300 hrs	600 hrs	400 hrs
300 (12x10)	60 g (2.1 oz)	21 g (0.8 oz)	1300 hrs	700 hrs	400 hrs
350 (14x12)	71 g (2.5 oz)	29 g (1.0 oz)	1800 hrs	900 hrs	600 hrs

Bearing Operating Temperature Range 93°C to 121°C (200°F to 250°F)

Pump	Lubrication Amount		Lubrication Interval Based On Pump Run Time		
	Thrust	Radial	8 hrs/day	16 hrs/day	24 hrs/day
50 (2x2)	7 g (0.2 oz)	3g (0.1 oz)	600 hrs	300 hrs	200 hrs
75 (3x3)	11 g (0.4 oz)	4 g (0.1 oz)	400 hrs	200 hrs	100 hrs
100 (4x3)	15 g (0.5 oz)	6 g (0.2 oz)	300 hrs	200 hrs	100 hrs
150 (6x4)	23 g (0.8 oz)	8 g (0.3 oz)	400 hrs	200 hrs	100 hrs
200 (8x6)	32 g (1.1 oz)	13 g (0.5 oz)	600 hrs	300 hrs	200 hrs
250 (10x8)	40 g (1.4 oz)	17 g (0.6 oz)	600 hrs	300 hrs	200 hrs
300 (12x10)	60 g (2.1 oz)	21 g (0.8 oz)	700 hrs	300 hrs	200 hrs
350 (14x12)	71 g (2.5 oz)	29 g (1.0 oz)	900 hrs	400 hrs	200 hrs