



MASPORT M3

INSTRUCTIONS



www.dieselparts.com.au

1. Introduction

Congratulations on your purchase of a Masport M-Series Rotary Vane Vacuum Pump. We are delighted you have chosen to join the community of satisfied customers using Masport equipment in daily professional operations.

Masport is a leading manufacturer in the New Zealand agriculture industry and has been for over 100 years. We have always been at the forefront of agricultural markets both domestically and internationally. Our strength lies in the extensive range of reliable, durable and quality agricultural products we manufacture and market.

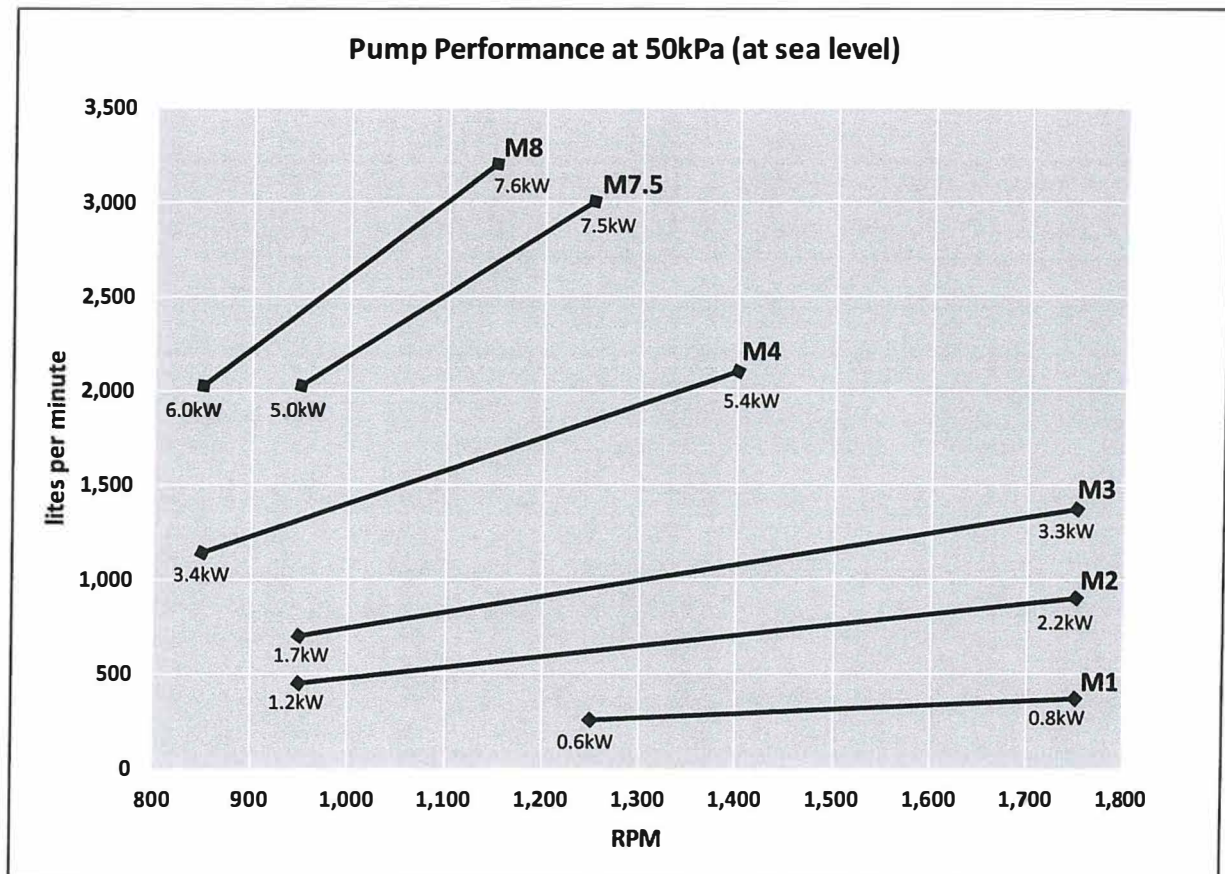
Our expert product development, manufacturing and distribution teams work to rigorous quality standards and a strict testing regime. This system ensures you receive a quality product. We have been manufacturing our vacuum pumps for more than 60 years so you can be sure of engineering excellence. We know you will have many years of reliable service from this product.

This manual provides all the information you will need to run your vacuum pump correctly to ensure a long and efficient service life.

M-Series Pump Range:

The Masport M-Series Vacuum pump is a range of robust rotary vane vacuum pumps that are a work horse in the dairy industry and have been for decades. These pumps are high quality, reliable and extremely durable products that perform exceptionally well.

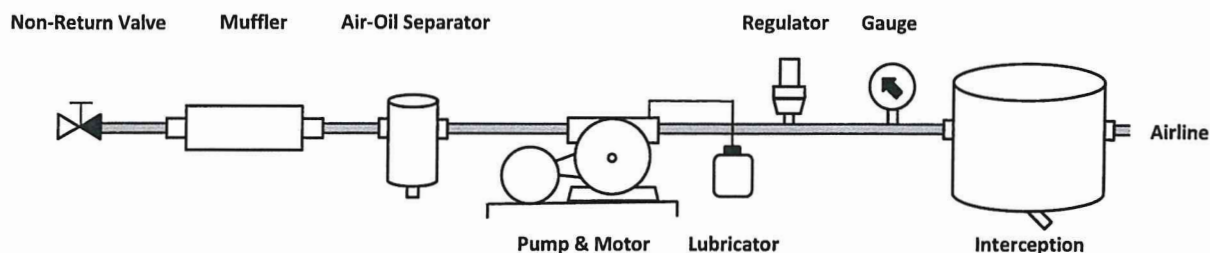
The table and chart below outlines the performance and key specifications of the M-Series Vacuum Pump Range operating at 50kPa (15"Hg) at sea level.



2. Installation Requirements

Recommended Vacuum System Setup:

The below image illustrates the recommended vacuum system setup for the M-Series Vacuum Pump Range. Each of these elements is further explained below.



Location:

- The pump must be installed in a separate, clean, dry, and well-ventilated room, away from other equipment. This will prevent the accumulation of dirt and dust building up on the casing of the pump. The build-up on the pump casing can insulate the pump, potentially causing damage due to overheating.
- Ensure that the system is installed to allow ease of service, filling of the oil reservoir, and out of major walkways.
- Note that with each 300 meters (1000 feet) of elevation above sea level the maximum attainable vacuum level drops by approximately 3.5kPa (1" Hg) that results in a loss of airflow at the recommended operating levels.

Pump Installation:

- The pump must be installed upright, with its base horizontal.
- The pump must be bolted through the four feet mounting holes to a rigid stand that in turn is to be bolted to the floor.
- All bolts used to mount the vacuum pump, motor, motor rails and stand in place should be the same size as the holes provided.
- To ensure vacuum can be reached in the optimum time check that all connections are tight, face plates and bungs are in place, and claw buttons are shut-off.

Plumbing:

- The pipe used in plumbing the pump should never be smaller than the diameter of the inlet and outlet ports. If smaller diameters are used it will cause line restrictions causing reduced airflow and the pump to potentially overheat. This will dramatically reduce the durable service life of the pump and increase operating noise levels. The minimum inside diameter of the pipes to be used on the systems are as follows:

Pump	Connections	
	Inlet Port (in)	Outlet Port (in)
M1	1"	1"
M2	1 ¼"	1 ¼"
M3	1 ½"	1 ½"
M4	2"	2"
M7.5	2"	2"
M8	3"	3"

- Keep the pipe as straight and as short as is practical. Avoid changes in pipe direction wherever possible – these restrict airflow and downgrade the performance. Where necessary use bends, not elbows.

- All piping must be thoroughly cleaned and dried inside before starting the pump. Debris in the piping system will be drawn into the pump on start-up and can potentially cause catastrophic failure in the pump.
- It is recommended to connect a temporary filter in the pump inlet pipe to catch any swarf which may have escaped detection. Use a breathable material that will not break up and enter the pump.
- The inlet pipe should be constructed of a heavy wall section and galvanised. It is not recommended to use either thin walled stainless tube as it will emit higher noise levels, or PVC as it can breakdown over time from the heat radiated from the pump following shutdown.
- The exhaust pipe is not required to be galvanised, but should be of a heavy wall section to reduce noise and vibration. The exhaust pipe must be supported independently from the pump and should be isolated from the wall mounting brackets to avoid noise travelling through the building.
- Seal pipe threads to avoid leaks. Leaks will cause noise, create a path for contamination into the system and a reduction in reserve airflow. Teflon thread seal or Loctite 567 is recommended. Avoid anaerobic sealant that can leach unset liquid sealant into the pump.

Drive Systems:

The pump is setup to use a motor and belt configuration. It is recommended to use a motor with a RPM as close as available to the pump speed to avoid pulley reduction.

Power Requirements and RPM:

Due to the fact that the vanes of the pump are kept in contact with the cylinder by centrifugal force, it is important that the belt drive transfers the required horsepower to prevent the pump from slowing down during operation. If the drive is too small, the pump will slow and a condition call 'Vane Float' will occur. 'Vane Float' causes the vane to bounce on the cylinder wall, rather than sliding smoothly, causing premature pump wear.

For 40-50kPa (12-15"Hg) operation, the following speed and minimum motor size relationships should be followed:

Pump	Minimum RPM		Maximum RPM	
	RPM	Power (kW)	RPM	Power (kW)
M1	1,250	0.6	1,750	0.8
M2	950	1.2	1,750	2.2
M3	950	1.7	1,750	3.3
M4	850	3.4	1,400	5.4
M7.5	950	5.0	1,250	7.5
M8	850	6.0	1,150	7.6

Motor Installation:

- Ensure the motor direction is correct before connection the belts. Running the pump backwards will potentially cause catastrophic damage to the pump.
- Ensure the pump direction is aligned with the motor. The direction of operation of the pump is cast onto the pumps cylinder.
- The pump can be setup to be driven clockwise or counter clockwise. As standard the pump is setup to suit clockwise drive (as looking at the shaft of the pump). To change to counter-clockwise remove the shaft gauged and refit to the exposed shaft end.

Pulley Sizing and Installation:

The pulley diameter has a direct effect on the amount of power a belt drive is capable of transferring. In determining the correct pulley diameter, the following variables need to be considered:

- The type of belt used
- The number of belts used
- The amount of horsepower to be transferred

- The shaft speed

To ensure proper sizing, it is recommended that a qualified belt drive supplier should be consulted. Selecting the wrong size pulley can result in irreparable damage to a new pump on start-up.

When installing the pulley and belts, the following steps should be followed:

- Mount the pump pulley securely to the shaft. Ensure that it is as close as possible to the pump body and is correctly aligned. Overhung and misaligned pulleys can potentially shorten bearing life.
- The pulley and belts must be accurately aligned to prevent end-thrust on the pump rotor.
- Do not over tighten the belts(s) as this can cause belt and bearing failure. Follow standard V-belt tension recommendations.

Interception:

- Interception must be of adequate size for the pump. As a guide it is recommended to use a minimum of 24 litres per kilowatt.
- On fitment of the interceptor into the system ensure that the direction of the flow is correct. Note that the flow goes into the pump inlet.
- The interceptor should be fitted with an automatic drain. If the system floods for any reason, the pump must be stopped and the interceptor drained immediately to avoid damage to the pump.
- The interceptor should be washed out regularly to remove dry particles. If not done these dry particles can form a powder that can be carried over in the air stream causing premature wear
- An auto shut-off mechanism must be in place to avoid possible fluid carry over.

Air-Oil Separator:

Selecting the position for the separator is important to the function of the vacuum pump and vacuum system. It is recommended that the following guidelines are followed:

- The oil pipe returning to the pump from the automotive-type filter must be as short as possible and should not rise more than 450mm (18") vertically.
- The pipe from the pump to the separator should be as straight as possible. Where necessary use bends, not elbows.
- The pipe entering the separator should be straight for at least a length of eight pipe diameters. This will minimise air turbulence which can down-grade the separating action.
- There must be ready access for filling the separator with oil, and space to remove and replace the filter cartridge easily.
- The oil sight glass and the bottom drain tube should be easily visible to check the oil supply and presence of any water in the system. The drain tube must be readily accessible.
- Once having found a position to satisfy the above criteria, provide a suitable support to carry the weight of the separator – do not hang it on the pump.

Mufflers:

- When ordering the pump it is recommended to order a Muffler. The muffler will further reduce noise emissions.
- Do not fit any muffler unless it is approved by the pump manufacturer. Unsuitable mufflers can create excessive backpressure. Excessive backpressure will result over time in accelerated wear, loss of performance and increased noise.
- Ensure the muffler and exhaust line are the same size as the pumps exhaust outlet.
- A Non-Return Valve (NRV) must be installed to avoid the pump running backwards on shutdown under vacuum. Even if the system is designed to release vacuum before shutdown the NRV is still required in the event of a power cut. This needs to be installed after the muffler, and as close to the pump as possible.

- If installing an air-oil separator (i.e. Tubemiser or Oilmiser) the instructions supplied with the product must be followed carefully as their installation is critical to their operation.

Vacuum Regulator and Gauges:

- Ensure the system is fitted with a vacuum regulator to control the vacuum level. In most cases this is the only protection for the pump to avoid overheating.
- The regulator should be placed in line with the pump so that in the event of the Interceptor being activated the pump will still receive cooling air.
- The regulator should be provided with some form of air filter to prevent dirt and debris from being drawn into the pumping system.

3. Lubrication Systems

There are two type of lubrication systems available for the M-Series Rotary Vane Vacuum Pumps:

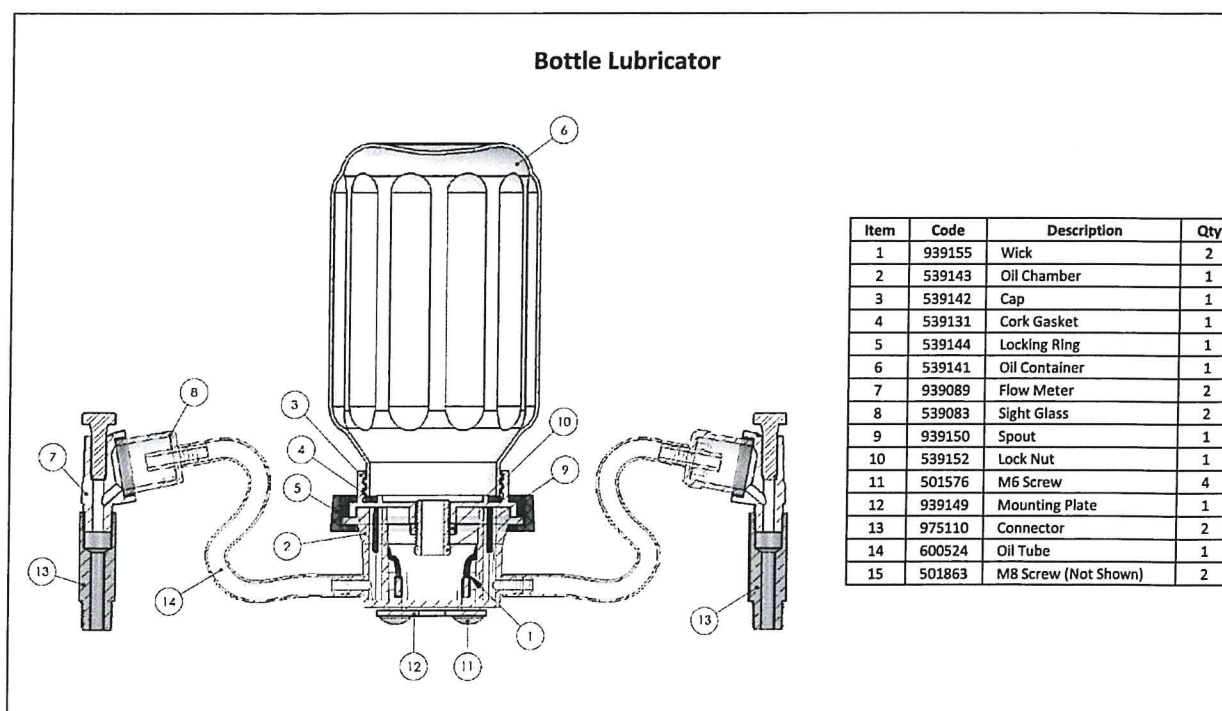
1. The Bottle Lubricator
2. The Dripper Lubricator

Both of these options are once through lubrication systems. As the name implies, all the oil is fed into the pump only the one time and then will exhaust to outside atmosphere or to an oil catch mechanism. Once-through oil systems consist of an oil reservoir, oil flow sight assemblies and interconnecting lines.

Bottle Lubricator:

This is a two point lubrication system and is only recommended for use on the M1, M2 and M3 range of pumps.

WARNING: Use of the Bottle Lubricator on the M4, M7.5 and/or M8 range of pumps will immediately void the warranty. These pumps require three point Lubrication Systems, and as such are only offered with the Dripper Lubricator.



Assembly and Installation:

1. Remove the small plastic plugs off the top of each end cover of the pump and pour approximately 30ml (1oz) of oil down each hole.
2. Screw the Connectors (13) into the end-cover mounting holes, and then screw the Flow Meter (7) into the Connectors. Take care to not over tighten either component. The Flow Meter inlet tubes should be approximately at right angles to the shaft facing towards the inlet side of the pump.
3. Bolt the Bottle Lubricator in place checking that it sits level. As necessary, pack under the Mounting Plate (12) to achieve level.
4. Connect the Sight Glasses (8) to the Flow Meter.
5. Connect the Oil Tubes (14) between the Oil Chamber (2) and Sight Glass. Ensure that the Oil Tubes run smoothly without kinking or flattening. As necessary, cut the Oil Tube to length.
6. Soak the Wicks (1) in oil and insert in place in the wick tubes inside the Oil Chamber. Push down on the wick wire to ensure they are fully homed.
7. Fill the Oil Container (6) with the recommended oil. Ensure that the oil is always both clean and new.
8. Place the Locking Ring (5) over the neck of the Oil Container, with the printed side facing down, and screw on the Cap (3). Ensure that the Cork Gasket (4) is in place.
9. Cover the end of the Spout (9) and invert the Oil Container over the Oil Chamber. Uncover the Lubricator Spout and quickly place the Oil Container on top of the Oil Chamber. Lock in place by turning the Locking Ring anti-clockwise.
10. While the oil level is stabilising in the Oil Chamber, prime the pump by rotating the pump shaft by hand five or six times to distribute the oil internally.

CAUTION: The Bottle Lubricator relies on having a vacuum in the milking system to draw the oil through. Do not run the pump without the lid on the interceptor. It may be necessary to insert a bung in the piping to ensure sufficient vacuum to operate the Bottle Lubricator correctly.

Setting the Oil Rate:

The rate of oil supply to the pump can be checked by observing the drops falling inside each Flow Meter. This should only be finalised when the vacuum is up to full operating level and the pump has fully warmed up (i.e. after approximately 30 minutes of running). The flow rate should be adjusted to no less than the recommended drop rate shown below.

Minimum Flow Rate at Each Flow Meter

Driving Kilowatts	1.0	1.5	2.0	2.5	3.0	4.0
Driving Horsepower	1.3	2.0	2.7	3.4	4.0	5.4
Drops per Minute	5	7	9	11	12	16

It is recommended to have the oil flows exceeding the minimum rate as it will enhance protection against contamination damage.

The oil flow rate can be adjusted in two ways:

1. Varying the height of the oil in the Oil Chamber
2. Varying the amount of air drawn through each Wick

To vary the height of oil in the Oil Chamber, release the Lock Nut (10) and adjust the extension of the Lubricator Spout. To vary the amount of oil drawn through each Wick, adjust the extension of the adjusting bolt on the flow meter. If the air flow in the tubes is too great, the wicks may dry out causing the flow rate to drop.

It is recommended to first alter the level in the Oil Chamber to approximately the correct setting, and then fine tune with the adjusting bolts. Please note, it will take a while for the oil level to stabilise at its new setting after an adjustment has been made.

To start, it is recommended to have the surface of the oil approximately 3mm (0.1") below the top of the wick tubes, and the end of the adjusting bolt approximately half way across the air bleed holes.

When the system is operating correctly, there will be a gentle bubbling pool of oil in the bottom of each oil tube.

Maintenance:

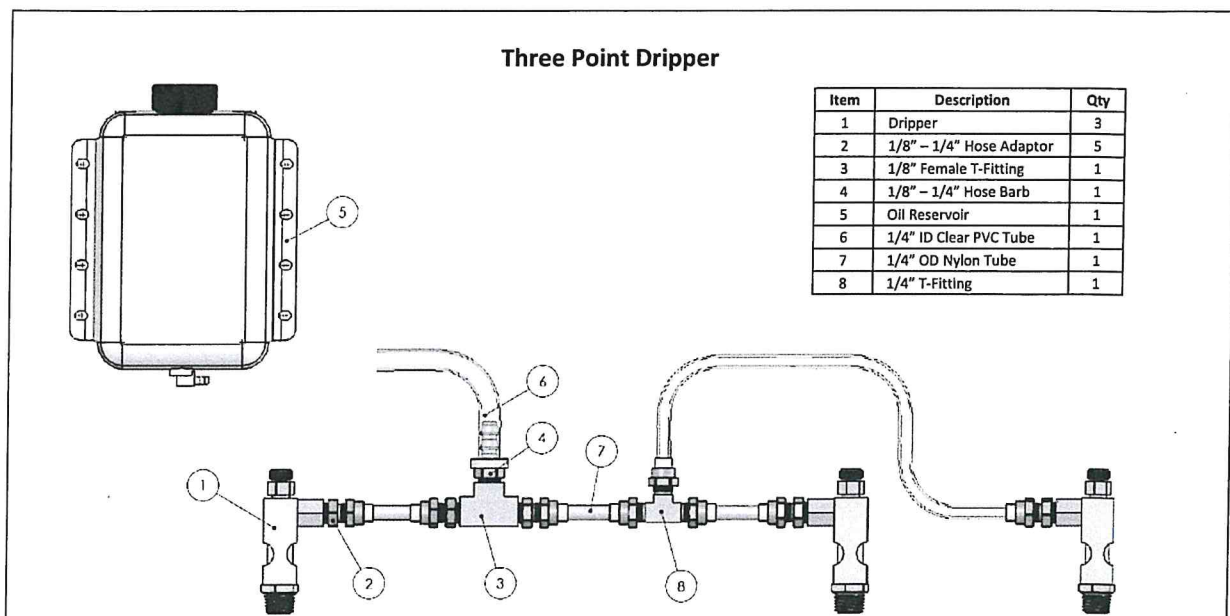
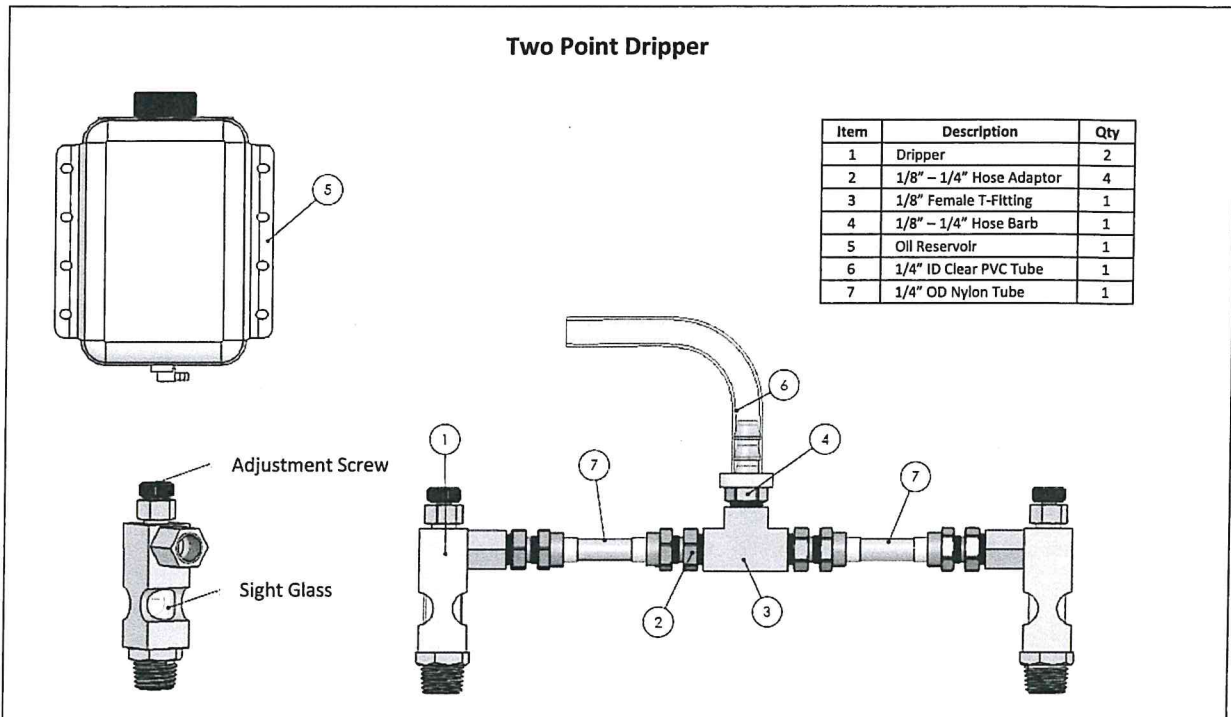
On a daily basis check the oil flow rate, and level of oil in the Oil Container. For safe operation it is recommended to refill the Oil Container when it is approximately three quarters empty. Ensure that only recommended oil is used.

The wicks should be replaced at least once a season or immediately if they become damaged or contaminated (i.e. through being waterlogged). It is advised to keep a spare set of replacement wicks on hand.

If the brand of oil or vacuum level is changed, check and adjust the oil flow rate.

Dripper Lubricator:

There are two type of Dripper Lubricators available: the Two Point Dripper; and the Three Point Dripper. The Two Point Dripper is to be used on two point oiling pumps (i.e. M1, M2 and M3) whereas the Three Point Dripper is to be used on three point oiling pumps (i.e. M4, M7.5 and M8).



Assembly and Installation:

1. Remove the small plastic plugs off the top of each end cover of the pump and pour approximately 30ml (1oz) of oil down each hole.
2. Screw in the Drippers (1) into the end-cover mounting holes (and in the case of the three point dripper into the cylinder). Take care to not over tighten them. The Dripper inlets should approximately face each other.
3. Using the fittings (2 and 8) and the smaller diameter tube (7) provided, connect the inlets to each other with the tube and have the straight run of the 1/8" Female T-fitting (3) in its centre.
4. Remote mount the Oil Reservoir (5) in an easy to access location for refilling. Ensure that it is mounted so the top of the Oil Reservoir is approximately 100mm (4") below the top point of the highest Dripper. This will stop siphoning when the pump is not in use
5. Fit the larger diameter tube (6) between the Oil Reservoir barb and the 1/8" – 1/4" Hose Barb (4)
6. Remove the lid of the Oil Reservoir and fill with the recommended oil. Replace the lid.
7. Turn the adjusting screw on top of each Dripper counter-clockwise at least five turns from the fully closed position. This will ensure adequate amounts of oil to start with.
8. Prime the pump by rotating the pumps shaft by hand five or six times to distribute the oil internally.

CAUTION: The Dripper Lubricator relies on vacuum in the plant. If there is no, or low vacuum, the vacuum pump will not receive oil. Do not run the pump for more than 20 seconds at vacuum levels lower than 20 kPa (6" Hg)

Setting the Oil Rate:

The rate of oil supply to the pump can be checked by observing the drops falling inside each Dripper through the sight glass. This should only be finalised when the vacuum is up to full operating level and the pump has fully warmed up (i.e. after approximately 30 minutes of running.) The flow rate should be adjusted to no less than the recommended drop rate shown below:

Minimum Flow Rate at Each Dripper

Driving Kilowatts	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.5	7.5
Driving Horsepower	1.3	2.0	2.7	3.4	4.0	5.4	6.7	8.7	10.0
Drops per Minute	5	7	9	11	12	16	20	26	30

It is recommended to have the oil flows exceeding the minimum rate as it will enhance protection against contamination damage.

The oil flow rate can be adjusted by turning the adjusting screw clockwise to reduce, counter-clockwise to increase. Ensure the locking gland nuts are tight to avoid Dripper adjustment while the pump is operational.

Maintenance:

On a daily basis check the oil flow rate, and level of oil in the Oil Reservoir. For safe operation it is recommended to refill the Oil Reservoir when it is approximately three quarters empty. Ensure that only recommended oil is used.

If the brand of oil or vacuum level is changed, check and adjust the oil flow rate.

Lubricant Type:

As the pump is a precision machined mechanism it is essential to use the correct oil for your particular system and application. The following oils are recommended for use with all M-Series range pumps:

- Castrol 890/68
- Shell Vacuum Pump Oil S2 R 100
- Oil company vacuum pump oil equivalents (i.e. Shell, BP, Caltex etc.)

Under no circumstances is recycled oil to be used. If in doubt over the suitability of an oil please contact your distributor or Skellerup directly for further advice.

4. General Pump Maintenance

Routine Care:

Start-Up:

- Check oil level in reservoir
- Do not run pump for more than 20 seconds with vacuum lower than 20 kPa (6" Hg)
- Ensure all connections are tight, face plates and bungs are in place, and claw buttons are shut-off

Shutdown:

- After each plant wash-up, run the pump under normal operating vacuum for five minutes to ensure an adequate internal oil film
- Turn the pump off under full vacuum and ensure that the pump does not run backwards.

Oil Reservoir:

- Clean around the top of the Oil Reservoir to remove all contaminants before removing lid
- Clean around the top of the oil drum completely – not just by the outlet
- Clean the funnel or spout to ensure there are no contaminants present
- If the Oil Container/Reservoir seems to have contaminants present, it is recommended to empty and clean. Ensure that the Oil Container/Reservoir is completely clean and dry before refilling.

Pump Flushing:

To eliminate the build-up of foreign material on the inner working surface of the pump and enhance the pumps life the pump should be flushed with oil. This should occur every three months, or if carryover into the pump has been detected. To flush, increase the flow rate on the lubrication system (drippers 1-2 drops per second, bottle lubricator at maximum) and run the pump at this increased oiling rate for 10 minutes. Once complete reset the lubrication system back to the required oiling rate.

End of Season:

If the pump will be sitting idle for more than a week, pour approximately 60ml (2oz) of oil down each lubricator hole and into the pump air intake. Rotate the pump shaft slowly by hand to distribute the oil internally.

Liquid in the Pump:

In the event that liquids enter the pump contact your distributor or Skellerup directly.

5. Field Servicing – Pump Rebuilding

The following instructions are written, assuming that the pump being serviced, has been removed from the base it was mounted on. It is possible to carry out installation of the parts kit with the pump mounted, but for best results it is recommended that it is removed from the stand.

Rebuild Parts Kits:

The Rebuild Kits contain all the necessary components to rebuild or service your pump. All Rebuild Kits contain the following items:

- Vane Pack
- Bearings
- Bearing Spacers (where fitted)
- Oil Seals
- End Cover Shim Gaskets
- Flange Gaskets
- End Cover O-Rings (where fitted)

The Rebuild Kit to use on each M-Series Vacuum Pump model are as follows:

Pump	Parts Kit Number
M1	14631
M2	14609
M3	14610
M4	14632
M5	14626
M7.5	14621
M8	14633

Replacement Part Kits are available from your distributor or Skellerup directly.

Disassembly:

Tool Requirements:

The following tools, equipment and materials are required to properly service the pump:

- Ratchet
- Sockets
- Torque wrench (up to 25 ft. lbs.)
- Bearing puller
- Rubber headed mallet
- Ball peen hammer
- Small centre punch
- Gasket scraper or putty knife
- Parts washing pan and brush
- Solvent
- Oil seal driver
- Flat metal file
- 400 grit wet/dry sandpaper
- Bearing press or tubing the diameter of the bearing inner race
- Valve lapping compound
- Small container of grease vacuum pump lubricant

Preparation:

- Prior to disassembly the first step is to mark the pump parts. This is to ensure that they can be reassembled to the same mating surfacing they were originally attached to. It is recommended to use the centre punch and ball peen hammer to place a mark on one of the end covers, the corresponding side of the cylinder and the end of the rotor shaft.
- The rotor of the pump is offset to the top of the cylinder. Therefore it is recommended for ease of service to have the pump turned upside down. This will prevent the rotor from dropping onto the cylinder bore when it is removed. If the rotor is dropped in the cylinder, damage will potentially occur to the rotor or cylinder.

End Cover Removal:

- Remove the bolts around the perimeter of one of the end covers.
- The end cover can be removed by tapping the extended removal bosses cast into the perimeter of the end cover with a rubber mallet.
- As necessary use the rubber mallet to drive the rotor shaft back towards the end cover that is still bolted on to free the end cover from the bearing. Under no circumstances should the end cover be pried or hammered off of the cylinder as this will potentially result in damage to the sealing surfaces.
- The end clearance is adjusted by means of colour coded paper Shim Gaskets between the end cover and the cylinder. Make note of the colour and quantity of any Shim Gaskets when removing the end cover. The matching quantity and colour will need to be used on reassembly.

Vane and Rotor Assembly Removal:

With one of the end covers removed the rotor assembly and vanes can be pulled out of the cylinder. Once removed, the remaining end cover can be removed by following the same procedure detailed above.

Parts Inspection, Cleaning and Replacement:

Vane Wear Check:

- The pump should be inspected for vane wear at least once a year after the first two seasons of use. If the vane wear is not monitored, they can become too short causing excessive rotor and cylinder wear and eventually result in vane breakage.
- Measure the vanes to see if they are within the usable limit. If they are not they should be discarded and replaced. The vanes should be replaced when their height is below the usable limit detailed in the table below:

Pump	Vane Usable Height	
	mm	inches
M1	>36.5	>1.43
M2	>42.5	>1.67
M3	>42.5	>1.67
M4	>59.5	>2.34
M5	>60.0	>2.36
M7.5	>60.0	>2.36
M8	>74.5	>3.13

- Inspect the sides of the vanes to see if they are bent, out of parallel or worn to a concave shape on one side. Either of these conditions require part replacement. These characteristics could indicate foreign material caught alongside the vane, a burr in the edge of the rotor slot or improper lubrication. Each of these possible causes should be investigated and corrected before the pump is reinstalled.
- Inspect the edge of the vane that contacts the cylinder for frayed edges. If detected this requires part replacement. Frayed edges can indicate improper lubrication or that the pump has been operated for extended periods of time beyond its rated limits. Each of these possible causes should be investigated and corrected before the pump is reinstalled.

Bearing and Spacer Inspection:

- It is difficult to visually determine the condition of a bearing. If there is obvious damage, such as, discoloration or bluing of the bearing or the bearing race, the bearing and spacer should be replaced. If there is no discoloration, and minimal amount of carbon or oil build-up on the bearing cage, it can probably be cleaned in solvent, blown off with an air hose, oiled and reused. However, there is no guarantee that the bearing is not damaged, and with the pump disassembled, it is recommended to replace them.
- The outer circumference of the spacer should be inspected for signs of contact with the bore of the End Cover bearing housing. If there has been contact, it could be a sign that the bearing is worn and needs to be replaced.

Bearing and Spacer Removal:

- For all pumps, before removing the bearing and spacer (where fitted) any burrs on the shaft should be removed with a flat file. Once the shaft is free of burrs, the bearing and spacer can be pulled by means of a bearing puller.
- The spacers are not reusable, and must be replaced once removed.
- For the M8, the bearing can be simply removed from the end cover retainer.
- Do not install new bearings and Spacers at this time. Follow the Rotor Inspection and Cleaning instructions first.

Rotor Inspection and Cleaning:

- Inspect the rotor carefully for any cracks - especially if disassembly was due to pump seizure. Any cracks in the rotor will require replacement of the part, or considering the cost possibly the complete pump.
- With the bearings and spacers removed lightly file with a flat file along all edges of the vane slots to remove any burrs or nicks that may have occurred from either contact or from foreign material.
- Once all the burrs are removed, the ends and diameter of the rotor should be gone over lightly with 400 grit wet/dry sandpaper to remove any carbon or varnish deposits left by the oil.
- Once complete the rotor can be cleaned in solvent, and blown off with an air hose and set aside.

Bearing and Spacer Replacement:

- The spacer must be installed in the correct orientation. Ensure that the spacer is installed on the rotor shaft with the larger bore diameter facing towards the rotor. Incorrect installation of the spacer will potentially cause bearing failure and damage to the pump.
- Providing the rotor is in a usable condition and has been properly cleaned the new bearings and spacers can be pressed onto the shaft using a bearing press. When pressing them on ensure the pressure is only applied to the bearing inner race.
- If a bearing press is unavailable a length of pipe can be used to drive the bearing onto the shaft. If this method is used ensure that the pipe diameter is equal to the bearing inner race, and any dirt or pipe scale is removed before use to prevent contaminating.

End Cover Inspection and Cleaning:

- Each of the end covers should be inspected for surface damage from rotor-to-end cover contact and the bearing housing inspected for signs of spacer-to-bore contact.
- If the end covers have been damaged by rotor-to-end cover contact and there are grooves worn in more than .005" deep, the face should be resurfaced. If there is no damage, or the damage is minor, the face of the end cover should be wiped clean with solvent and then lapped with the lapping compound against the other end cover. Once complete the covers should be wiped, cleaned, and dried off with an air hose to remove any traces of lapping compound that could cause damage during assembly or start-up.
- If the bearing housing bore is damaged, it can be cleaned up with a small file or 400 grit wet/dry sandpaper to remove any burrs. If either of the bearings had seized and spun in the housing, the fit should be checked with a new bearing, to ensure that there is not excessive clearance.

Oil Seal Replacement:

- If the oil seals are being replaced, they can be removed by inserting a screwdriver or punch through the shaft bore of the end cover on the oil seal.
- The oil seal must be installed in the correct orientation. Ensure that the oil seal is installed with the spring side of the seal facing into the bearing bore of the end cover (or bearing retainer on the M8). Incorrect installation of the oil seal will potentially result in oil leaks around the shaft and bearing failure.
- The oil seal should be pressed into the seal bore on the end cover using a seal press or a flat round disc approximately the same outside diameter as the oil seal. Care must be taken to press the oil seal into the bore evenly to prevent damage.

Cylinder Inspection and Cleaning:

- Prior to inspection, the cylinder should be cleaned inside and out to allow a more thorough inspection. Special attention should be given to the areas inside the intake and exhaust ports of the cylinder.
- If there is a sizable build-up of oil sludge in the exhaust port, the type of lubricant used in the unit should be reconsidered upon installation of the repaired pump.

- If foreign material is built up in the intake porting, the tank and filter systems should be checked for possible malfunctions.
- Inspect the interior of the cylinder for cracks and deep gouges around the circumference and corrugation across the length of the bore. Cracks in the housing will require part replacement, or considering the cost possibly the complete pump.
- The detection of corrugation or gouges across the length of the cylinder can indicate inadequate horsepower transfer, operation below minimum recommended speeds, foreign material sticking the vanes in their slots, or operation beyond recommended vacuum limits. Each of these possible causes should be investigated and corrected before the pump is reinstalled.
- If the corrugation or gouges are more than .005" deep, then the cylinder should be bored, honed and the seal gap clearance reset. As a guide it is recommended that if corrugations or gouges can be felt when a finger is run over them then it is necessary to have the cylinder bored.
- Once complete the cylinder can be cleaned in solvent, and blown off with an air hose and set aside.

Reassembly:

Installing the First End Cover:

- The area to be used for reassembly should be thoroughly cleaned to prevent contamination during the reassembly process.
- Place the cylinder upside down on the assembly table and find the reference marks made before disassembly to determine the correct end cover for that end of the pump.
- Spread a small amount of oil around the cylinder face to hold the end cover Shim Gaskets in place.
- Place the new end cover Shim Gaskets (the correct quantity and colour that were removed during the disassembly process) over the dowel pins and onto the oiled face of the cylinder.
- Fit the end cover over the end of the shaft. Use caution when installing the end cover to ensure the oil seal is not damaged by the shaft keyway.
- Align the end cover dowel pin holes with the dowel pins in the cylinder face. Drive the cover on evenly with a rubber mallet working from side-to-side to prevent bending the dowel pins or distorting the holes in the end cover.
- Install the end cover retaining bolts and torque them to 33 Nm (25 ft./lbs.). When tightening work across the cover, alternating from one side to the other to ensure even pressure on the gasket.

Installing the Rotor Assembly:

- Spread a small amount of grease inside the end cover oil seal to prevent dry running on initial start-up.
- Spread vacuum pump oil around the cylinder bore to avoid damage to the rotor and cylinder bore when refitting the rotor.
- Inspect the ends of the rotor shaft, to find the reference mark made during disassembly to ensure correct rotor-end cover-cylinder relationships. Once determined slip the rotor assembly into the cylinder and the bearing into the end cover bore. The bearing should slip in the cover house easily with only a slight tap with a rubber mallet. If the fit is extremely tight, the end cover bore should be examined for burrs and cleaned up. The bearing must be free to move slightly in and out of the cover bore without extreme force or damage to the pump will potentially occur.

Installing Vanes:

- The vanes must be installed in the correct orientation. For the M2, M3, M7.5 and M8 range pumps install the vanes with radiused edge in contact with the cylinder wall
- The M1 and M4 range pumps have Vanes with an offset bevel. Install the vanes in these pumps with the bevelled edge in contact with the cylinder wall and the leading edge facing in the direction of rotation.

- Place the vanes in the vane slots and press them all the way in. Ensure that the corners next to the bearing space do not catch.

Installing the Second End Cover:

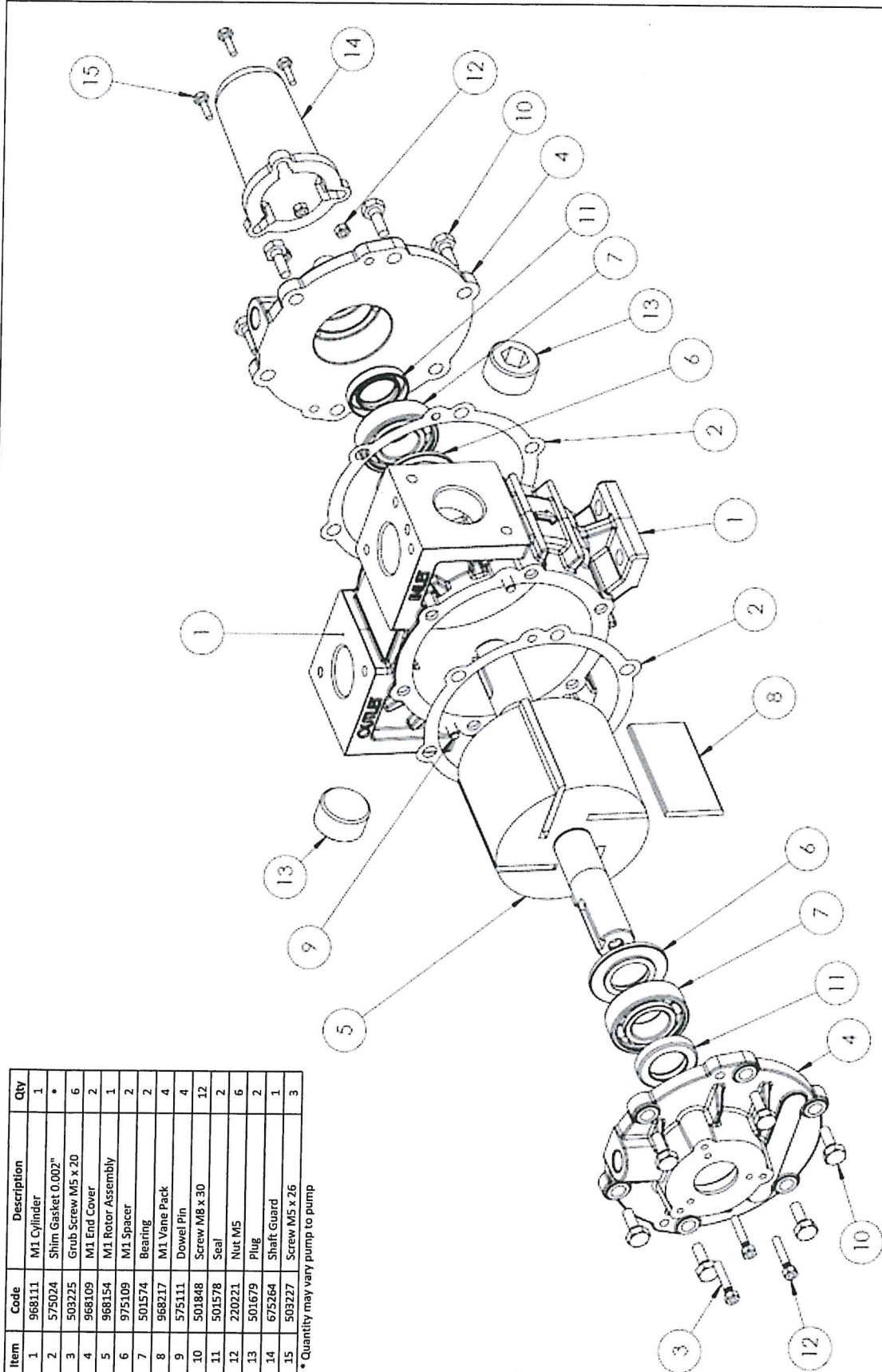
- Fit the second end cover over the shaft and the bearing bore over the Bearing. Use caution when installing the end cover to ensure the oil seal is not damaged by the shaft keyway.
- Lift the end cover and rotor assembly to align the dowel pins in the cylinder face and the end cover dowel pin holes. This procedure sets the seal gap between the rotor and the cylinder bore.
- Once the pins are aligned, the cover can be driven against the cylinder face with a rubber mallet.
- The end cover bolts can now be installed following the same procedure as detailed above.
- Rotate the pump shaft by hand. If all is correct the rotor should turn freely at this point. If it does not, either one of the vanes is in crooked and caught on a bearing spacer or the rotor is jammed against one of the covers due to a bearing sticking in the housing. Before disassembling, strike the end of the rotor shaft with a rubber mallet and check for free rotation. It is possible for a bearing to become slightly stuck in the bore, or the rotor is tight against an end cover and will not turn due to lack of lubrication. If this does not cure the problem, disassemble the pump following the procedure for End Cover Removal detailed above.

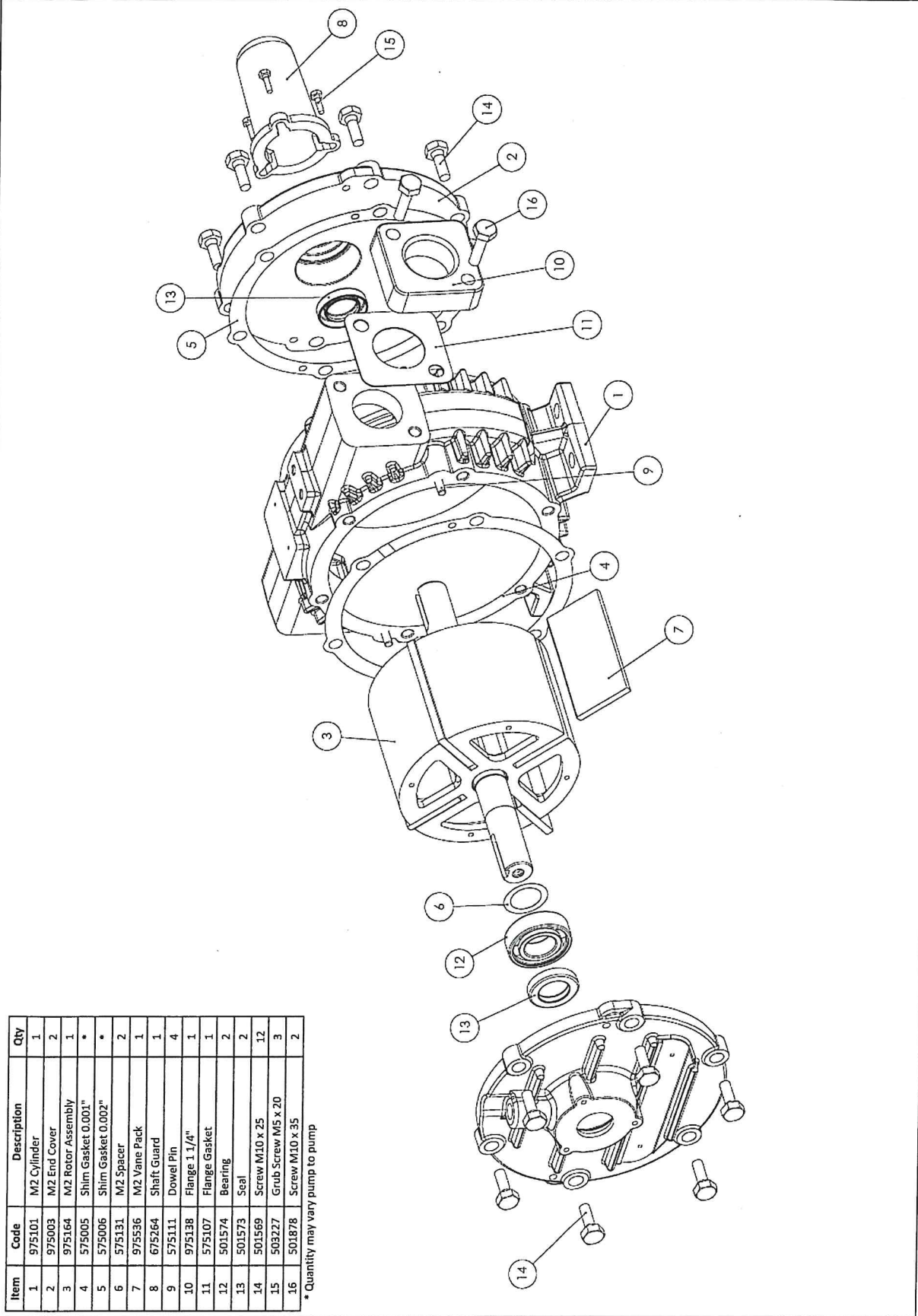
Pre-Installation Lubrication:

- To prevent damage to the pump on initial start-up pour 30ml (1oz) of pump lubricant down each of the holes at the top of the end covers and into the intake on the cylinder.
- Rotate the pumps shaft by hand five or six times to distribute the oil internally.
- The pump is now serviced and is ready to reinstall!

6. Pump Exploded Views

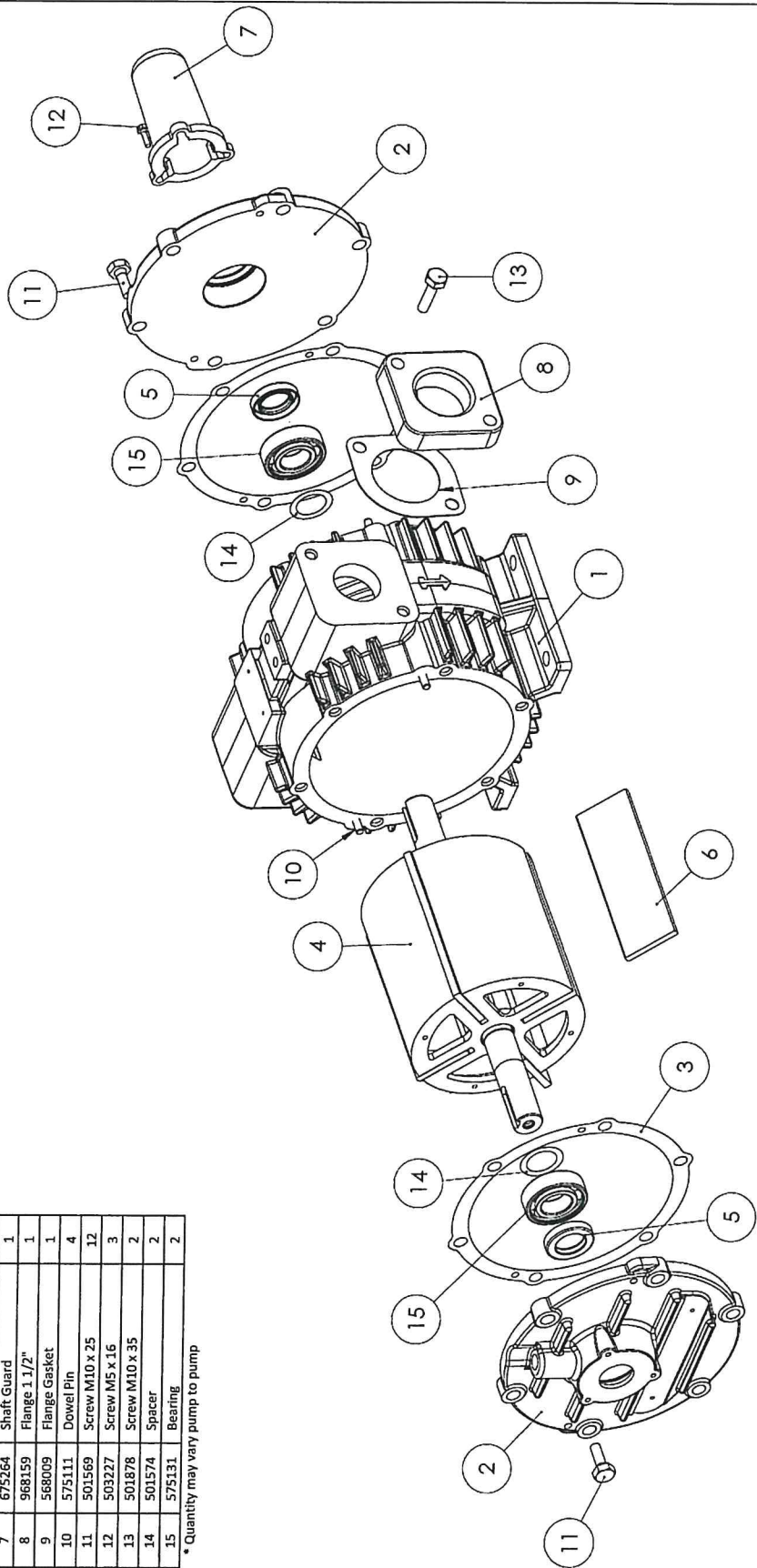
M1

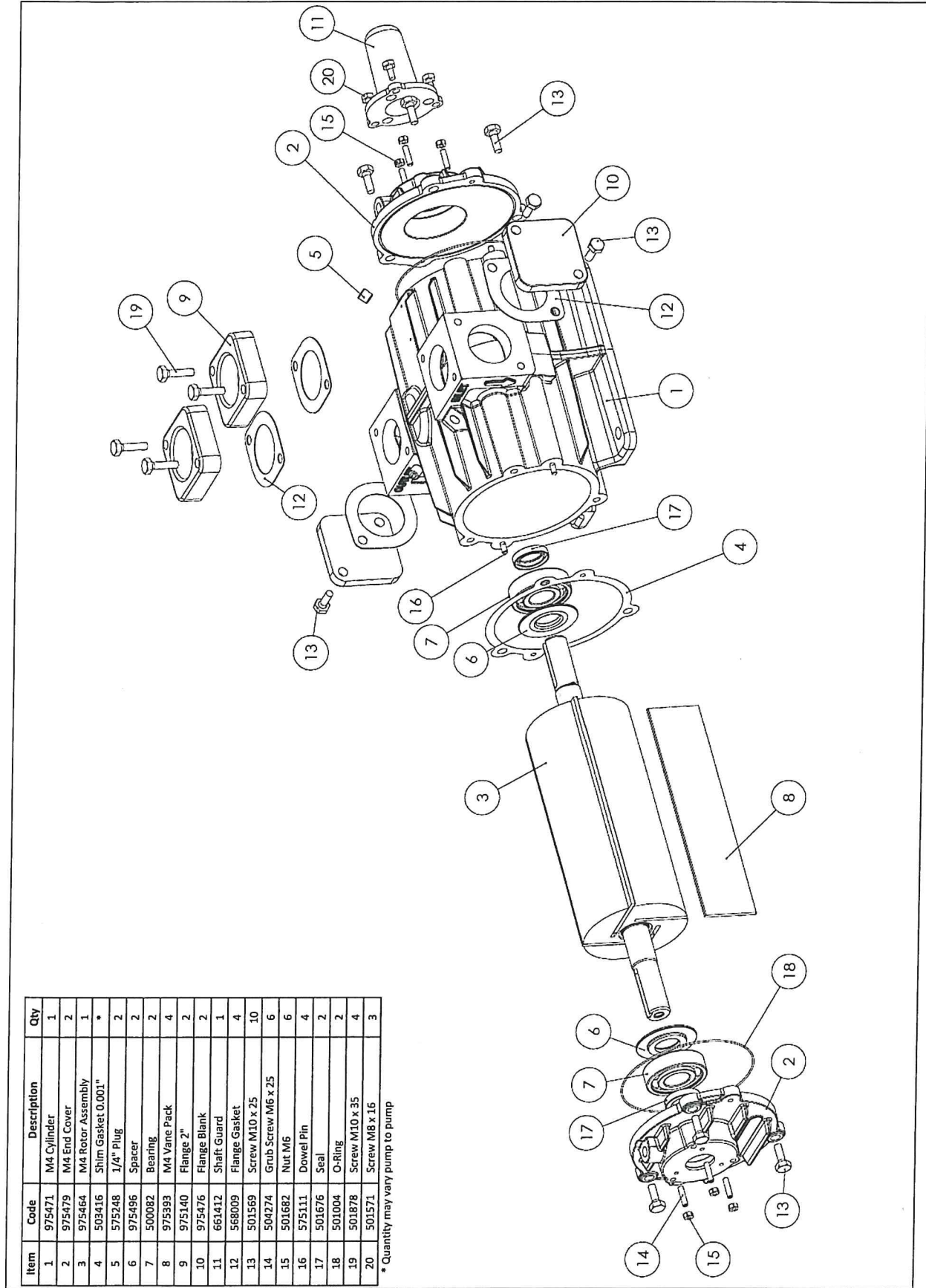




Item	Code	Description	Qty
1	975201	M3 Cylinder	1
2	975003	M3 End Cover	*
3	575005	Shim Gasket 0.001"	*
4	975252	M3 Rotor Assembly	1
5	501573	Seal	2
6	968236	M3 Vane Pack	1
7	675264	Shaft Guard	1
8	968159	Flange 1 1/2"	1
9	568009	Flange Gasket	1
10	575111	Dowel Pin	4
11	501569	Screw M10 x 25	12
12	503227	Screw M5 x 16	3
13	501878	Screw M10 x 35	2
14	501574	Spacer	2
15	575131	Bearing	2

* Quantity may vary pump to pump





M7.5

Item	Code	Description	Qty
1	975389	M7.5 Cylinder	1
2	975244	M7.5 Rotor Assembly	1
3	542009	Shim Gasket 0.002"	*
4	975337	M7.5 End Cover	2
5	501579	Seal	2
6	975539	M7.5 Vane Pack	1
7	501569	Screw M10 x 25	18
8	975140	Flange 2"	1
9	568009	Flange Gasket	2
10	661412	Shaft Guard	1
11	501571	Screw M8 x 16	3
12	502258	Dowel Pin	4
13	975631	Flange 1/4"	1
14	501584	Screw M10 x 40	2
15	503416	Plug 1/4"	3
16	975309	Spacer	2
17	500082	Bearing	2

* Quantity may vary pump to pump

