KINNEY® KDP™ SERIES

Dry-Screw Vacuum Pumps

Models KDP-150 KDP-330 KDP-400 KDP-800

INSTALLATION
OPERATION
MAINTENANCE
REPAIR

MANUAL

WARNING

DO NOT OPERATE
BEFORE READING MANUAL

6/2008

LEADING THE SEARCH FOR NEW SOLUTIONS

TUTHILL
Vacuum & Blower Systems

4840 West Kearney Street, P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel 417 865-8715 800 825-6937 Fax 417 865-2950
http://vacuum.tuthill.com

WARNING

DO NOT OPERATE WITHOUT BELT GUARD

CAUTION

DO NOT VALVE OR RESTRICT PUMP DISCHARGE OPENING.

USE OIL MIST ELIMINATOR WHEN OPERATING PUMP, ENSURE ADEQUATE VENTILATION WHEN DISCHARGING INDOORS

REFER TO MANUAL SAFETY INSTRUCTIONS.

NOTICE

The above safety instruction tags were permanently affixed to your pump prior to shipment.
Do not remove, paint over or obscure in any manner.

Failure to heed these warnings could result in serious bodily injury
to the personnel operating and maintaining this equipment.

SAFETY PRECAUTIONS FOR DRY VACUUM PUMPS

Please read the following safety information on this page before operating your vacuum pump.

- Do not operate the pump without the belt guard properly attached. Disconnect the pump motor from the electrical supply at the main disconnect before removing the belt guard. Replace the belt guard before reconnecting the power supply to the pump motor. Operating the pump without the belt guard properly installed exposes personnel in the vicinity of the pump to risk from rotating drive components.
- Do not operate the pump with oxygen-enriched gas (greater than 21% by volume) in the suction line, unless the pump has been prepared with an inert fluid suitable for the application and equipped with seal and start/stop purge system. Pumping oxygen-enriched gases with mineral oil or other non-inert fluids and without proper purges can cause fire or explosion in the pump, resulting in damage or serious bodily injury.
- Take precautions to avoid prolonged or excessive exposure to oil mist or process materials emanating from the discharge of the pump.
- Do not allow the pump to discharge into a closed, or inadequately ventilated room. Where process vapor contains environmentally unfriendly chemical vapor, pump discharge must be connected to the properly sized scrubber system to neutralize the harmful chemicals prior to the discharge to the atmosphere. Laws and ordinances may pertain to your local area regarding discharge of oil mist, oil vapor, chemical vapor to atmosphere. Check local laws and ordinances prior to operation of the pump with discharge to outside atmosphere.
- Do not restrict the pump discharge in any way, or place valves in the discharge line. The vacuum pump is a compressor and will generate high pressures without stalling the motor when operated at low suction pressures. Excessive pressure could cause damage or serious bodily injury.
- Disconnect the pump motor from the electrical supply at the main disconnect before disassembling or servicing the pump. Make sure pump is completely reassembled, the belt guard is properly installed, and that all fill and drain valves are installed and closed before reconnecting the power supply. Accidental starting or operation of the pump while maintenance is in progress could cause damage or serious bodily injury.
- Lift pump only by the lifting lugs supplied with the pump. DO NOT lift equipment attached to pump by the pump lifting lugs.
- Do not touch hot surfaces on the pump. In normal operation at low pressures, surface temperatures will not normally exceed 180° F (82° C). Prolonged operation at 200 Torr (267 mbar a) may cause surface temperatures as high as 220° F (104° C)

TABLE OF CONTENTS

PREFACE

This manual provides instructions for handling and maintaining the Kinney® KDP™ Dry Screw Vacuum Pump. It is strongly recommended that those who wish to operate or maintain this pump read this manual carefully before installing and operating the pump.

GENERAL

DESCRIPTION

The KDP Dry Screw Vacuum Pump discharges gas under pressure by the counter rotation of screw rotors. Power is transmitted to the main rotor shaft through a v-belt or direct drive coupling and further to the driven rotor shaft through timing gears.

The screw rotors have a specially selected profile comprising of a plurality of Archimedean, Quimby and Arc curves. The counter rotation of these rotors creates an axial flow through the pumping chamber. Due to the special profile of the screw rotors, the inlet gas is smoothly pressurized, in a single stage, against the pressurized gas on the discharge side. The two screw rotors operate freely in the pumping chamber, with a clearance maintained between the rotors and between the rotors and the casing wall. There is no oil in the pumping chamber so no oil can mix with the discharge gases.

CONSTRUCTION

ROTOR SHAFT

The rotor shaft is made of high-grade spheroidal graphite cast steel. The shaft rotors are precision machined to numerical tolerances. After machining they are perfectly dynamic balanced and coated with a number of optional materials.

TIMING GEAR

The helical timing gear pair is the most important part of the dry screw vacuum pump. It is necessary for turning the rotors so that they are kept apart at a precision tolerance. The gear tooth surfaces are heat cured, and then polished with a high precision polishing machine to lower noise and reduce gear wear.

BEARINGS

The bearings on the fixed side are double row angular contact ball bearing. On the expansion side are roller bearings with heavy load capacity. These bearings have been selected to withstand high speed, heavy load service and to assure the accurate maintaining of the clearances between gears and between rotors.

There are two Oil Level Sight Gauges, one located on each side of the front-end cover. Check both sight gauges; the reading should be the same, indicating that the pump is mounted level.

SHAFT SEAL

The shaft seals consist of a bellows-type mechanical seal assembly on the discharge side and double lip seals on the suction side. These seals prevent oil from the front end plate and grease from the read end plate from migrating into the casing. The motor side of the front-end cover/drive rotor shaft is sealed by an oil seal or optional mechanical seal.

OIL LEVEL

There are two Oil Level Sight Gauges, one located on each side of the front-end cover. Check both sight gauges; the reading should be the same, indicating that the pump is mounted level.
With the pump running, oil should be at the middle of the red dot. Maintain the level (running) between the top of the red dot and

SPECIFICATIONS					
MODEL		KDP-150	KDP-330	KDP-400	KDP-800
Capacity (60 Hz)	CFM m^3/hr	90 150	195 330	235 400	460 800
Ultimate Pressure	Torr mBar	0.1 0.13	0.1 0.13	0.1 0.13	0.05 .067
Motor	HP	7.5	15	20	30
Power	KW 50 Hz KW 60 Hz	3.7 5.5	7.5 11.5	11.5 15	19 22
Rotational Speed	50 Hz RPM 60 Hz RPM	2900 3500	2900 3500	2900 3500	2900 3500
Gear Oil	Quarts Liter	1.4 1.3	1.7 1.6	2.1 2.0	3.8 3.6
Cooling Water @ 75° F	GPM LPM	0.5 1.9	1.0 3.8	2.0 7.6	2.6 9.8
Suction Port Size	Inches mm	1.5 40	2.0 50	2.5 60	4.0 100
Discharge Port Size	Inches mm	1.5 40	1.5 40	2.0 50	2.5 65
Silencer Port Size	Inches mm	1.5 40	1.5 40	2.0 50	2.5 65
Weight (Pump Only)	Pounds Kg	484 220	698 317	887 402	1320 600

the middle of the red dot. Do not overfill! Maintain minimum level to ensure long life of bearings, gears and seals. Note: The oil level will drop from pump off condition to pump running condition. Be sure to check and establish the level with the pump running. Turn off the pump to add oil. Never attempt to add oil while the pump is running.

During operation the oil is splashed over the bearings and mechanical seals by revolution of the gears. If the oil level is too low, the gears, bearings and mechanical seals will be damaged as a result of improper lubrication. If the oil level is too high it will cause overheating.

COOLING PURGE

In case the After Cooler is provided, the cooling water inlet should be located on the cooler side. If atmosphere intake is impractical, the discharge air should be cooled and recycled. (*) After Cooler is optional.

INSTALLATION & OPERATION

INSTALLATION LOCATION

- Mount the pump on a clean, flat & level surface. Make sure that the surface is rigid. If the pump will be installed outdoors, check the motor, V-belt and other parts for outdoor service.
- There should be enough surrounding space to allow convenient maintenance such as disassembly, re-assembly, and periodic inspections, etc.

FOUNDATION

The concrete foundation should have an adequate pressure bearing area in consideration of the weight of the pump.
The pump should be securely anchored to the foundation.

INSTALLATION

- Position the pump and center it for installation.
- Set the pump on the foundation, and support the base plate equally by inserting a choke liner between the pump and the foundation surface. Insure that the bed is level and that there is space for grouting the cement mortar between the foundation surface and the bed.
- Place anchor bolts in position on the bed temporarily, set the nuts on the full head of the bolts, and leave them in the boltholes. Choke liners will help support it properly.
- Using a level, check that the pump assembly is level.
- Grout the cement mortar in the space under the bed and in the anchor boltholes, let set. Upon hardening of the mortar, tighten the nuts for the anchor bolts, taking care to do so evenly.

MANIFOLD INSTALLATION - MAIN PIPING

Clean the inside of the suction and discharge pipe so that there is no rust, dust or foreign matter.

It is advisable to install an expansion joint on the suction side as well as the discharge side of the pump. Also, provide support for the piping so that there is no excessive load imposed on the pump. If there is a silencer provided on the discharge side, make sure it is installed as near to the discharge port of the pump as possible.

It is recommended to install a non-return valve (inlet check valve supplied) on the suction or discharge port so that the pump will not rotate in reverse upon shutdown. If the installation of the non-return valve is a problem, install a gate valve instead, and be sure to shut the valve before stopping the pump.

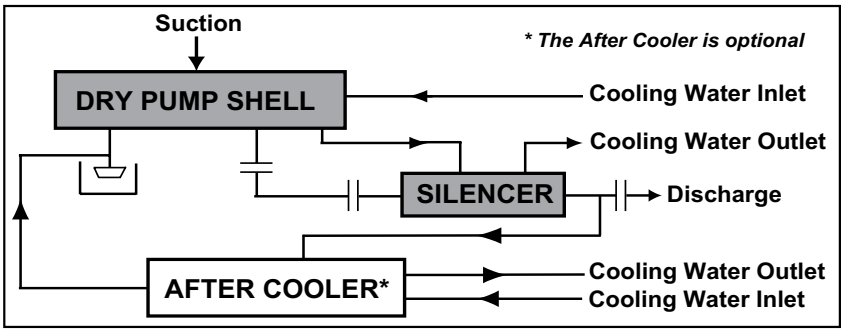


Figure 1. Standard Piping

COOLING WATER PIPING

For the KDP-Series pumps, cooling water piping is required to cool the front-end cover, front end plate, casing, rear end plate, and water-jacketed

exhaust silencer or separator. Water inlet to the pump is from the bottom on the drive end. Water outlet from the pump is from the top on the suction end. The water inlet and outlet are labeled on the pump.

NOTE: There are also water drains for fully draining the pump casing, front-end cover, front end plate and rear end plate water jackets. Water drains are not water outlets and are used only to drain the pump before moving or disassembling it.

DRIVE ASSEMBLY

V-BELT DRIVE

The belt and bearing life depends greatly on the belt tension. If the belt tension is too loose, reduction of the transmission efficiency due to belt slippage can happen. Also, fatigue and heating on the belt will occur. This can shorten the belt life considerably, and damage the bearings as a direct result of belt vibration. However, if the belt if too tight, too much tension will be applied and the strength will be lessened. It will also result in reduction of the belt life and excessive load will cause severe heat or wear of the bearing. Therefore, adjust the belt tension as shown in Figure 2.

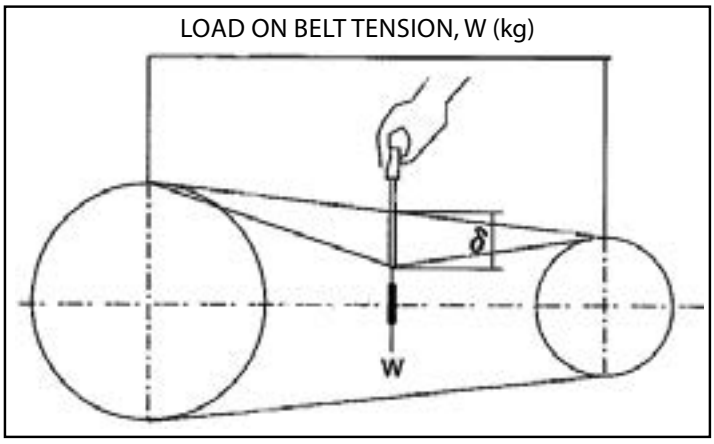


Figure 2. V-Belt Tension

BELT TENSION

Apply the load vertically at the center of "L". The belt sag at this time should be d = 0.0016 x L (mm)

TYPE	A	B	C	D	3V	5V	8V
New Belt	1.0	1.8	4.0	8.0	2.5	7.8	21.6
Re-tightening	1.3	2.5	5.5	10.0	3.7	10.4	27.6

COUPLING DRIVE

Align the coupling by using a dial gauge. The concentricity should be as shown in Figure 3.

CLASS OF MOTOR	ON SIDE OF COUPLING	CLASS OF MOTOR	AT END OF COUPLING
M180L (ML5-180L) and under	Less than 0.05 mm	M132M (ML5-132M) and under	Less than 0.10 mm
M200M (M15-200M) and above	Less than 0.08 mm	M160M (ML5-160M) and above	Less than 0.18 mm

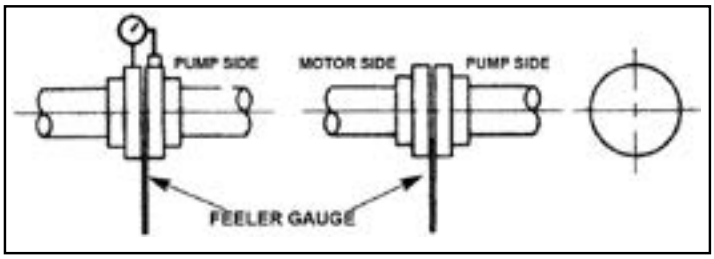


Figure 3. Coupling Alignment

PRESTART CHECKS

PIPING INSPECTION

All piping must be clean and free from dirt and debris. Do not allow welding slags and chips to be left inside the process piping.

PIPING FINAL ASSEMBLY

Check that all suction and discharge connections are properly tightened and all piping is supported. Repeat for all cooling water piping.

OIL LEVEL

Fill the oil case to the top of the red dot of the oil sight gauge. Check oil level with the pump operating (it will drop) and ensure that it is between the top and middle of the red dot. Be sure to turn off the pump before adding oil. Do not attempt to add oil with the pump running.

If the oil runs low, the gears and bearings can seize and seals can fail. If the oil is over-filled, the temperature will rise excessively, and cause noises from the gears, or can have some effect on other parts. The oil level with the pump running should be maintained between the top and middle of the red dot at all times.

COOLING WATER

Ensure that the cooling water as specified in Figure 1 is fully circulating through the pump.

STARTING THE PUMP

1. Ensure the direction of the pump rotation is correct; CW (Clock Wise) direction, looking from the motor. Pump rotational direction check can be done by jogging the pump a brief moment while checking the rotational direction of the motor fan. If the motor rotates CCW (Counter Clock Wise), correct the power cable connections and check the rotational direction again to ensure the pump rotates in correct CW direction. Pump rotational direction check shall be done with the process inlet isolation valve being open.
2. With the process inlet isolation valve being open, operate the pump for 20 to 30 minutes. At this stage, all pump operating parameters shall be checked for any abnormality, such as excessive vibration, high oil/grease temperatures, high cooling liquid discharge temperature, high process discharge temperature noise, over current draw etc. In case of observation of any abnormality, stop the pump and investigate for the cause of the abnormality. Typical causes of the abnormality come from improper lubrications and/or improper installation of the pump.
3. Upon completion of the above step, operate the pump for 2 to 3 hours under normal process load condition and check the pump operating parameters again.
4. If any abnormality is observed during the initial operation with normal process load, shutdown the pump immediately and ensure the problem is corrected prior to re-startup of the pump.

TRIAL RUN

Operate the pump under no load condition for about 20-30 minutes to check for any abnormal vibration or heat. In case of any abnormality, stop the operation and check the troubleshooting guide on Page 16 or call Tuthill Vacuum & Blower Systems.

Operate the pump for 2-3 hours under normal load conditions and check the temperature and motor current.

WARNING: During the operation, monitor the bearing temperature, lubricant temperature, and motor current plus the cooling water flow. Maintain the pump operation within the designated specifications.

STOPPING THE PUMP

SUCTION SHUT OFF

Close the isolation valve on the suction line.

CORROSIVE GAS INHALATION - PURGE

If any corrosive gas has been inhaled into the piping or pump, purge the pump and piping by flushing the system with a cleansing gas. Flush for 20 to 30 minutes before stopping the pump to ensure that the pump is thoroughly cleaned.

MOTOR SHUT OFF

Stop pump by turning off the motor.

STEAM FLUSHING

Oligomer, Monomer, Polymer, Resin, Etc. Ingestion – Steam Purge If any process materials have carried over into the pump and caused resistance do not attempt to rotate the pump with force. Instead flush steam inside the pump and screws with the following procedure.

Steam Pressure approx. 1 Kg/cm2G

1. Close inlet (suction) valve, open discharge valve and drain valve from exhaust silencer or separator.
2. Inject steam for 1-10 minutes through one of the purge or instrumentation ports on the inlet manifold.
3. Ensure power to the motor is disconnected, and then try to rotate the drive shaft via pulley or coupling by hand.
4. If necessary repeat the above 2-3 times.

LUBRICATION

Any lubricants used must be high-grade petroleum products that contain oxidation inhibitors, rust preventatives, extreme-pressure additives, etc.

NOTE: Do not use any lubricant, which contains any elements of water, sulfate resin or tar Turbine oil (ISO VG68) which will satisfy these requirements.

Recommended lubricants are as follows:

- Lubricant: Kinney Type AX or BP Energol THHT 68 or BP Energol THB 68
- Shell Turbo 68 Mobil DTE Heavy Medium
- Grease: Dow Corning 3451 Bearing Grease

MAINTENANCE & INSPECTION

OVERHEATING

During operation, the temperature will rise corresponding to the compression ratio due to heat of compression. However, if the temperature rise is local and the outside coating becomes scorched, it is abnormal. It may be because of interference between the rotors and casing, or the pump has sucked in some foreign material.

CAUTION: Stop the operation immediately and check for abnormalities.

ABNORMALITIES

Abnormalities can be noted as they develop by making careful checks on bearing temperatures, vibration, and noise.

INTERFERENCE

Interference between rotors or between rotor and casing can be determined by listening to any abnormal sound through a stethoscope applied against the casing.

FREEZING

In winter, or in cold regions, freezing of the cooling water could damage the water jackets. The water should be drained after the pump is shut down.

INSPECTION

DAILY INSPECTION

1. Oil Level Gauge - Ensure the level is between the high and low level specified in section. Excess or low levels of lubricant can damage gears, bearings and seals.
2. Cooling Water - Ensure that the cooling water is fully circulating through the pump at the proper flow rate.
3. Suction & Discharge Pressure - Check the suction and discharge pressures.
4. Temperature - Use a surface thermometer and inspect the surface of the grease cover and gear case.
5. Motor Amperage - Check for any increase of amperage in the motor, which can be used to determine an abnormal operating condition that can cause early failure or loss of efficiency of the pump.

MONTHLY INSPECTION

1. Check the V-belt tension.
2. Check the lubricant color (If oil color is dark, replace lubricant).
3. Check oil level. If oil disappears severely, check mechanical seals.
4. Every three months check, inspect non-drive end bearings and lubricate as needed.

BI-ANNUAL INSPECTION

1. Check piping for scale or dirt build-up.

YEARLY INSPECTION

1. Check mechanical seals.
2. Disassemble the piping on suction side to check the inner surface of rotors and casings.
3. Remove the gear case to check the gear.
4. Replace lubricant in the gear case

DRY VACUUM PUMP MAINTENANCE & INSPECTION SCHEDULE

ITEM	CHECK POINT	DAILY	MONTHLY	6 MOS.	YEARLY
Motor Amperage	Any Change? Amperage as specified?	X			
Rotation	Is the rotation smooth and direction correct?	X			
Suction & Discharge Pressure	Is the pressure as specified?	X			
Noise & Vibration	Any abnormal sound or vibration?	X			
Temperature	Any excessive oil or water temperature?	X			
Oil Level Gauge	Is oil at proper level?	X			
Water contamination on free end cover	What is the color? Has it changed to reddish brown?	X			
Cooling Water Pressure	Is the pressure as specified or too high?	X			
Oil Leaks	Any sighs of oil leaks?	X			
Reverse Cooling Filter (Cooler)	Any heat on suction pipe?	X			
Chamber Purge (Clean)	Close suction line & run for 20-30 min. while purging with N_2 or air.	X			
Belt Tension	Check V-Belt Tension		X		
Lubricant Color	Check color; if dark, replace lubricant		X		
Oil Level	If oil level drops drastically check mechanical seal.		X		
Suction & Discharge Piping	Is there any accumulated scale or dirt?			X	
Non-drive end bearings?	Inspect every 3 months and lubricate as needed.				
Mech. Seal, Oil Seal, Bearing, O-Ring, V-Belt & Packing	Inspect for damage & replace as needed.				X
Rotors & Casings	Inspect inside for rust and any damage or flaw.				X
Gear Case Lubricant	Replace			X	X
Gear	Inspect for damage				X

DISASSEMBLY

CAUTION:
- Place matching marks on all connections and fitted parts.
- Keep disassembled parts away from dust and dirt, especially the bearings.
- Do not sand blast parts that are coated (SHAFTS, PLATE GUIDES and the ends and inside of the CASING).

DISASSEMBLY PROCEDURE

1. Open the drain valves, drain cooling water from the pump.
2. Remove oil drain plug from FRONT END COVER (4) and drain oil.
3. Remove OIL LEVEL GAUGES (49), VALVES (52) and all accessories from the pump.
4. Remove SEAL ADAPTER HOUSING (25) from the FRONT END COVER.
5. Remove OIL SEAL (21) from SEAL ADAPTER HOUSING.
6. Remove FRONT END COVER
7. Remove BALL BEARING (24) from FRONT END COVER.
8. Loosen POWERLOCKS (15) and remove TIMING GEARS A (27) & B (28).
9. Remove BEARING STOPPERS A (13)& B (14)
10. Remove LOCKNUTS (17) and LOCKWASHERS (16).
11. Remove BEARING HOLDERS A(10) &B(11) from FRONT END PLATE(2).
12. Press out BALL BEARINGS (23) from BEARING HOLDERS A & B.
13. Remove SPACERS A (36) from DRIVE A (6) and DRIVEN B (7) SHAFTS. **Label SPACERS as drive side or non drive side.**
14. Remove MECHANICAL SEAL ASSY (18) from DRIVE and DRIVEN SHAFTS.
15. Remove GREASE COVERS (5) from BEARING HOLDERS (12).
16. Remove LOCKNUTS, LOCKWASHERS and BEARING PUSH SLEEVES (37).
17. Remove BEARING HOLDERS.

18. Press out ROLLER BEARINGS (22) and LIP SEALS (19) from BEARING HOLDERS.
19. Remove SLIP SLEEVES (39) and SPACERS B (38).
20. Remove FRONT END PLATE.
21. If needed, remove PLATE GUIDES A (8) and B (9) from FRONT END PLATE.
22. Remove REAR END PLATE (3) from CASING (1).
23. If needed, remove PLATE GUIDES B (9) from REAR END PLATE.
24. Carefully remove DRIVE & DRIVEN SHAFTS from CASING.
25. Remove BLIND PLATES and GASKETS for water jacket at casing and end plates.

NOTE: Clean all parts with a good grade of clean solvent and replace any worn or damaged parts with factory-approved parts. New bearings, seals, gaskets and O-Rings should be installed at each assembly.

REASSEMBLY

CAUTIONS:

- Check all parts for wear or damage during the disassembly.
- Damaged joints or fittings will impair proper operation of the pump after it is assembled. Utmost care is required for inspection of joints and fittings. If found damaged or worn, replace or repair.
- Clean bearings with light oil. Then apply lubricant. When handling bearings, always clean tools and hands.
- Use soft tissue and cleaning agent to clean dust from fittings, and apply oil. For tight fits, use of molybdenum disulfide is recommended since these fits will become hard to disassemble if they become rusted. (For tapered sections of Gear, clean the surface thoroughly with soft tissue and cleaning agent before fitting.)
- Reassemble pump VERTICALLY using a proper pipe stand or a working table with opening for ends of shafts.
- Clean all shaft journals with fine sandpaper. Be sure bearing slip sleeve easily slides onto shafts.

1. *If removed, insert PLATE GUIDE A (8) and one PLATE GUIDE B (9) on FRONT END PLATE (2) and PLATE GUIDES B (9) on REAR END PLATE (3)
2. Place REAR END PLATE (3) on working table or pipe stand with PLATE GUIDES B facing up.
3. Insert DRIVE SHAFT A (6) & DRIVEN SHAFT B (7) into rear end plate. **DRIVE SHAFT TO RIGHT SIDE** Keyway alignment is not necessary**
4. Place FRONT END PLATE (2) (with PLATE GUIDES facing down) onto shafts. DISCHARGE PORT TO LEFT SIDE.
5. The reassembly should be done from gear side. (Discharge side) first. Insert MECHANICAL SEAL ASSY (18) on drive & driven shafts.
6. Insert the appropriate SPACER A (36) on DRIVE & DRIVEN SHAFTS with bevel facing out.
7. Insert BEARING HOLDERS A (10) & B (11) into FRONT END PLATE.
8. Insert BALL BEARINGS (23) onto shafts and into BEARING HOLDERS.
9. Secure ball bearings on drive & driven shafts with LOCK WASHERS (17) & LOCKNUTS (16). Bend one tab of LOCKWASHER into LOCKNUT.
10. Put BEARING STOPPERS A (13) & B (14) on BEARING HOLDERS A & B and secure them to FRONT END PLATE.
11. Check clearance "D" between SHAFTS and PLATE GUIDES.
12. Set aside shafts and drive end plate assembly.
13. Apply sealant on mating face of REAR END PLATE, insert o-ring into cooling water line groove in CASING (1) and assemble REAR END PLATE to CASING.
14. Apply sealant on mating face of CASING and insert o-ring into cooling water line groove in FRONT END PLATE. Attach front end plate to casing.
15. Finish reassembly with the pump horizontal position.
16. Install SPACERS B (38) on drive & driven shafts with bevel facing in.
17. Insert LIP SEALS (19) back to back (2 for each bearing holder) inside the BEARING HOLDERS C (12).
18. Insert O-rings into BEARING HOLDERS.
19. Insert Slip Sleeves (39) into LIP SEALS.
20. Insert BEARING HOLDERS C into REAR END PLATE keeping SLIP SLEEVES from being pushed out.
21. Grease BEARINGS (22) and insert bearings onto shafts and into BEARING HOLDERS. Be sure larger face of the inner race is facing outwards to allow for expansion.

22. Insert BEARING PUSH SLEEVE (37), LOCKWASHER (17) and LOCKNUT (16). Do not tighten lock nuts.
23. Insert TIMING GEAR A (27) with POWER LOCK (15) on drive shaft and TIMING GEAR B (28) with POWER LOCK on DRIVEN shaft. (Note: Driven gear B has a shoulder on its backside.) Do not tighten power lock bolts at this time. ** There are no timing marks on gears to align. Be sure the gears butt up against the shaft shoulder. **
24. Use a dial indicator with a magnetic base. Put magnetic base on face of FRONT END PLATE and dial indicator on front shoulder of driven gear as shown in fig 5.
25. Bring flatness of driven gear to .002" or less while tightening power lock bolts to 17.5 n-m or 12.5 ft-lb.
26. Set timing by setting QUIMBY (clearance "E") through suction port as shown in fig 6. (a) Turning the DRIVE SHAFT back and forth slightly will open and close the QUIMBY. (b) Open QUIMBY, insert proper thickness gauge between shafts at QUIMBY and close QUIMBY until shafts hold gauge. (c) Tighten POWER LOCK bolts enough to hold gear onto shaft.
27. Using the dial indicator on front shoulder of drive gear, bring flatness of drive gear to .002" or less while tightening power lock bolts to 17.5 n-m or 12.5 ft-lb.
28. Check QUIMBY again to be sure it did not change.
29. At REAR END PLATE, tightly secure LOCK NUTS and bend one tab of each LOCKWASHER into LOCK NUT.
30. Apply bearing grease (approx. ½ of the space) into the BEARING HOLDERS.
31. Insert o-ring on GREASE COVERS (5) and attach to BEARING HOLDERS.
32. Put o-ring in groove of cooling water line in FRONT END PLATE and insert OILPAPER GASKET (58) between FRONTEND PLATE and FRONT END COVER (4). Hand tighten bolts.
33. Insert BALL BEARING (24) on DRIVE SHAFT A and into FRONT END COVER. Tighten bolts to secure FRONTEND COVER to FRONT END PLATE.
34. Insert o-ring on SEAL ADAPTER HOUSING (25) and attach to FRONT END COVER.
35. Insert OIL SEAL (21) onto SPEEDI SLEEVE (20). Insert speedi sleeve & oil seal onto shaft and into SEAL ADAPTER HOUSING.
36. OIL SEAL should be pushed in until it stops on the shoulder inside the SEAL ADAPTER HOUSING. End of SPEEDI SLEEVE should then be pushed in to the end of keyway being careful not to damage its outer edge.
37. Assemble BLIND PLATES (30-35) with BLIND PLATE GASKETS (40-45) on CASING and PLATES.
38. Install OIL LEVEL GAUGES (49) and all accessories.
39. Fill lubrication oil through oil inlet on the top of FRONT END PLATE. The oil level should be on the top of red mark in OIL LEVEL GUAGE (49). (The Oil amount for each model is listed on specification 1.3).

SCREW CLEARANCE TABLE (mm)

For reference, Clearance Table for assembling of the units is listed as follows.

MODEL	A	B	C	D	E
KDP150-M/F	0.13 - 0.17	0.18 - 0.25	0.15 - 0.20	0.10 - 0.12	0.08 - 0.10
KDP330-M/F	0.20 - 0.25	0.20 - 0.30	0.20 - 0.25	0.10 - 0.15	0.10 - 0.12
KDP400-M/F	0.25 - 0.30	0.25 - 0.4	0.25 - 0.27	0.12 - 0.15	0.11 - 0.13
KDP800-M/F	0.28 - 0.33	0.35 - 0.5	0.30 - 0.35	0.15 - 0.18	0.11 - 0.13

TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Poor Vacuum Performance	Filter screen is clogged	Clean or change screen
	Too much screw tolerance	Check tolerance
Overload on Motor	Filter screen is clogged	Clean or change inlet screen
	Ingested foreign matter	Check screw resistance Steam clean if appropriate
	Interference between screw and casing	Check screw resistance Steam clean if appropriate
Overheating	Excessive lubricant in gear box (front-end cover)	Check Oil level
	Vacuum inlet temperature is too high	Check inlet temperature
	Compression ration is too high	Check suction and discharge pressure
	Interference between rotor and casing	Determine cause of interference
	Improper or no cooling water flow	Check cooling water flow Clean cooling water lines
Knocking	Timing of screws is not correctly established	Reposition properly
	Improper Assembly	Reassemble
	Damaged gears due to overload or improper lubrication	Replace timing gears
Bearing or Gear Damage	Improper lubricant	Replace timing gears
	Low lubricant level	Replace bearings
	Overloading	Determine cause of damage

Note: If the problems are not resolved by the above actions, the cause may be located in the pump operating condition. Please contact us with the following information:

- Model Number, Serial Number, and Application
- Information on Piping (valves, strainers, number of bends)
- Description of problem encountered, frequency, etc.

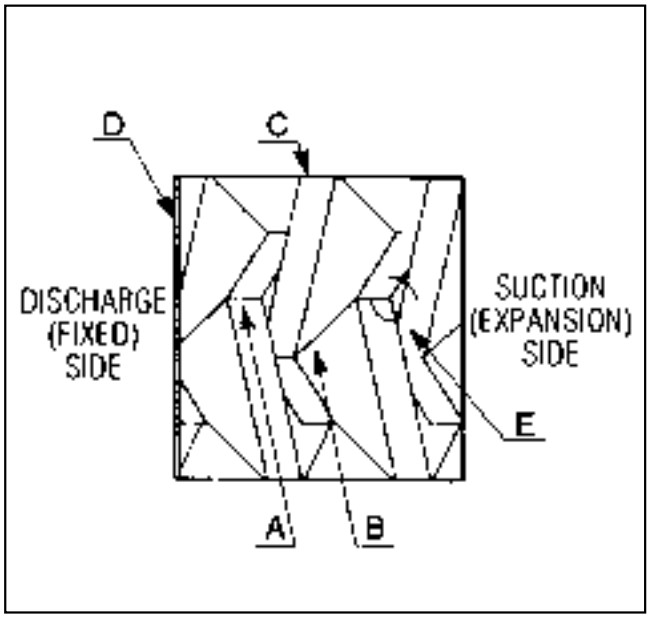


Figure 4. Screw Clearance Diagram

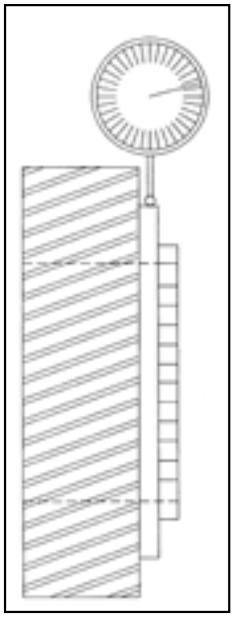


Figure 5. Gear Flatness Check

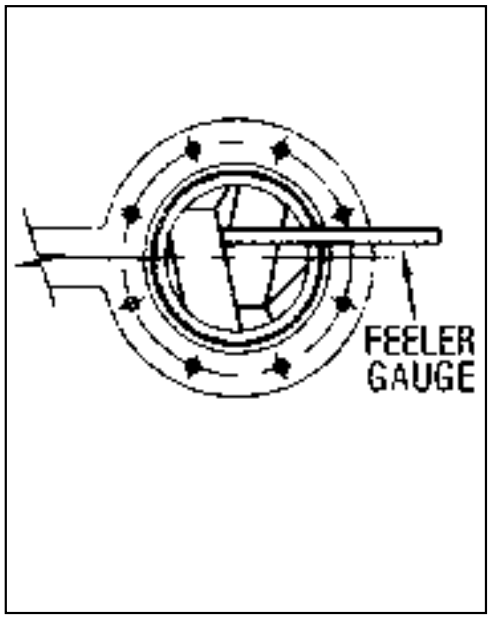
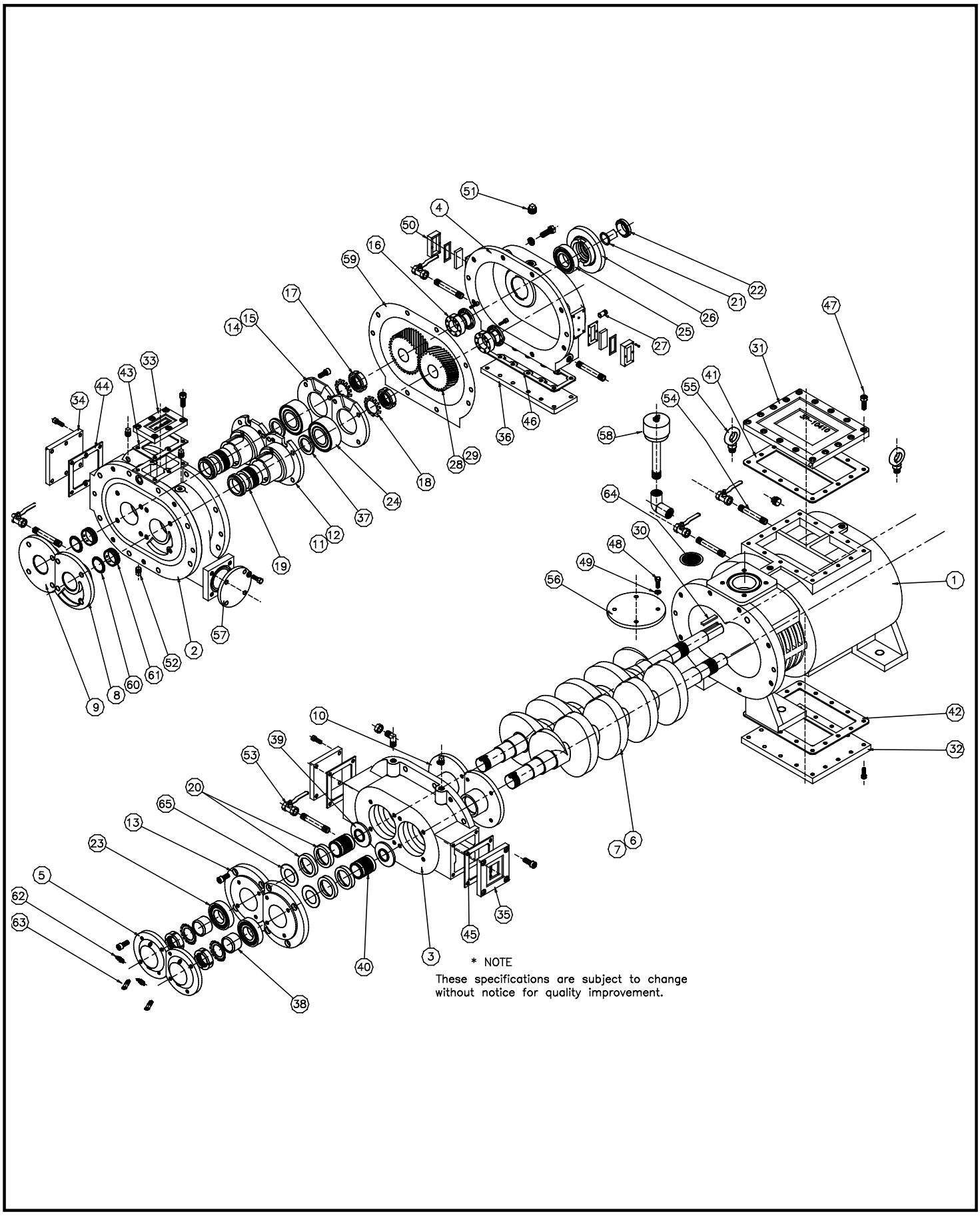


Figure 6. Screw Clearance via Inlet

NOTES:

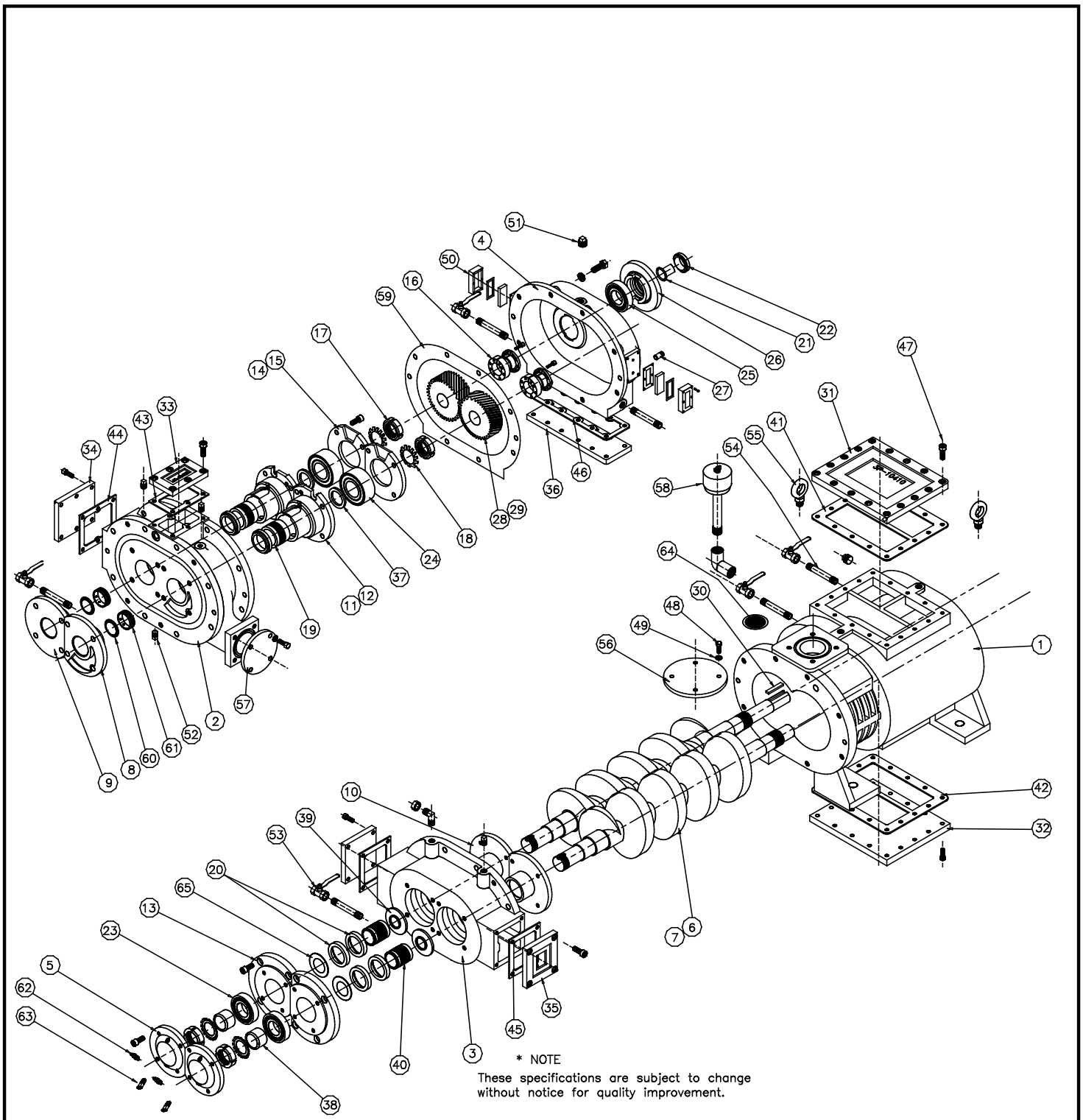
KDP 150 EXPLODED VIEW



KDP 150 PARTS LIST

ITEM NO.	DESCRIPTION	QTY	ITEM NO.	DESCRIPTION	QTY
1	CASING	1	34	BLIND PLATE (D)	1
2	FRONT END PLATE	1	35	BLIND PLATE (E)	1
3	REAR END PLATE	1	36	BLIND PLATE (F)	1
4	FRONT END COVER	1	37	SPACER (A)	1
5	GREASE COVER	2	38	BEARING PUSH SLEEVE	1
6	DRIVER SHAFT (A)/DRIVER	1	39	SPACER (B)	1
7	DRIVER SHAFT (B)	1	40	SLIP SLEEVE	1
8	PLATE GUIDE (A)	1	41	BLIND PLATE GASKET (A)	1
9	PLATE GUIDE (B)	1	42	BLIND PLATE GASKET (B)	1
10	PLATE GUIDE (C, D)	2	43	BLIND PLATE GASKET (C)	1
11	BEARING HOLDER (A)	1	44	BLIND PLATE GASKET (D)	1
12	BEARING HOLDER (B)	1	45	BLIND PLATE GASKET (E)	2
13	BEARING HOLDER (C)	2	46	BLIND PLATE GASKET (F)	1
14	BEARING STOPPER (A)	1	47	SOCKET BOLT	94
15	BEARING STOPPER (B)	1	48	HEX BOLT	36
16	POWER LOCK	2	49	SPRING WASHER	130
17	LOCK NUT	4	50	OIL SIGHT GLASS ASS'Y	2 SET
18	LOCK WASHER	4	51	PLUG	4
19	MECH. SEAL. ASS'Y (A)	2	52	PLUG	4
20	LIP SEAL	4	53	DRAIN VALVE	5
21	SPEEDI SLEEVE	1	54	NIPPLE	6
22	OIL SEAL	1	55	EYE BOLT	2
23	ROLLER BEARING	2	56	SUCTION COVER PLATE	1
24	BALL BEARING	2	57	DISCHARGE COVER PLATE	1
25	BALL BEARING	1	58	AIR FILTER	1
26	SEAL ADAPTER HOUSING	1	59	GASKET	1
27	DOWER PIN	6	60	LIP SEAL	2
28	TIMING GEAR (A)	1	61	LANTERN RING	2
29	TIMING GEAR (B)	1	62	GREASE NIPPLE ASS'Y	2
30	KEY-DRIVE SHAFT	1	63	PLUG	2
31	BLIND PLATE (A)	1	64	MESH FILTER	1
32	BLIND PLATE (B)	1	65	R.E.P. SLINGER	2
33	BLIND PLATE (C)	1			

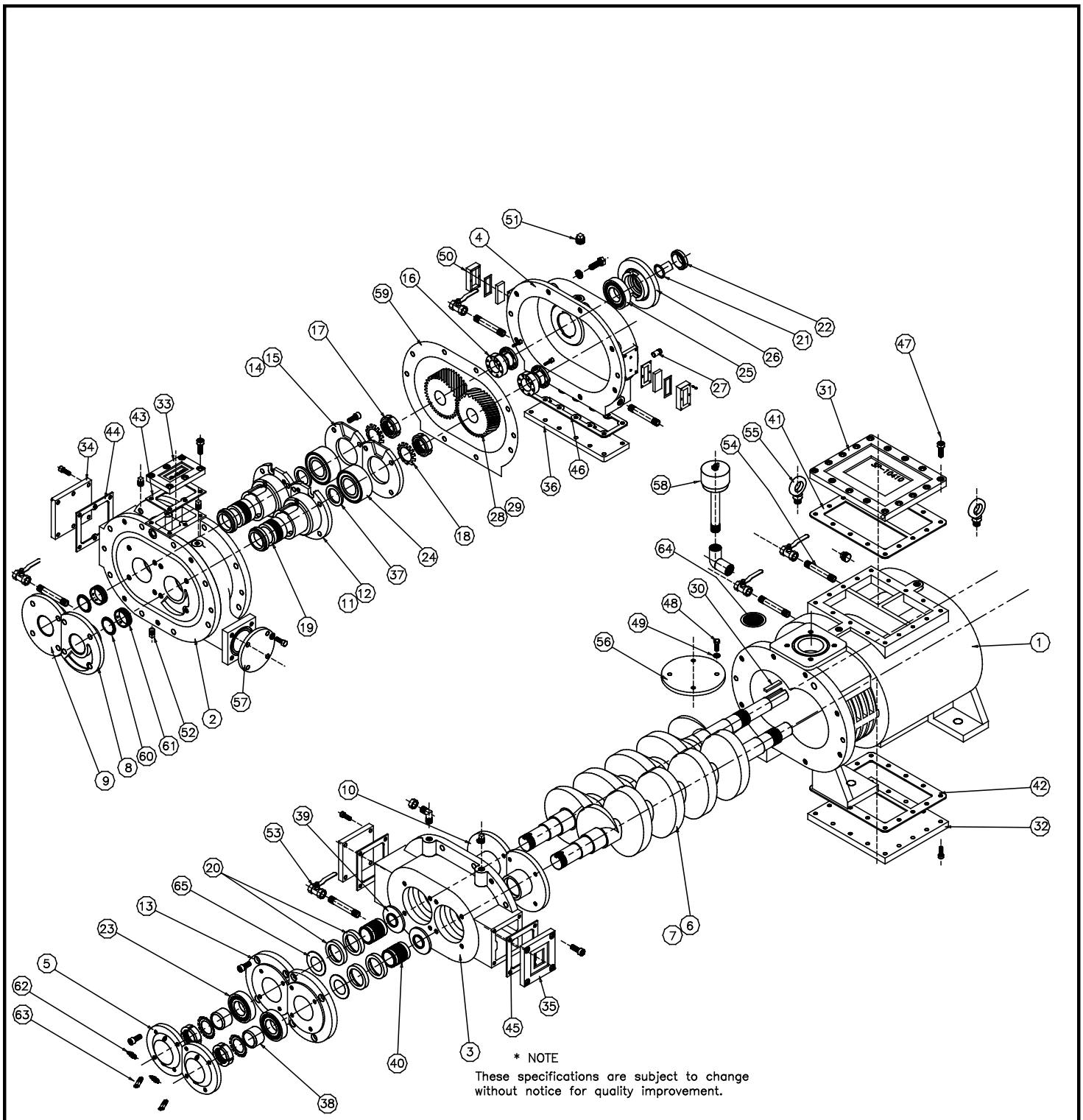
KDP 330 EXPLODED VIEW



KDP 330 PARTS LIST

ITEM NO.	DESCRIPTION	QTY	ITEM NO.	DESCRIPTION	QTY
1	CASING	1	34	BLIND PLATE (D)	1
2	FRONT END PLATE	1	35	BLIND PLATE (E)	1
3	REAR END PLATE	1	36	BLIND PLATE (F)	1
4	FRONT END COVER	1	37	SPACER (A)	1
5	GREASE COVER	2	38	BEARING PUSH SLEEVE	1
6	DRIVER SHAFT (A)/DRIVER	1	39	SPACER (B)	1
7	DRIVER SHAFT (B)	1	40	SLIP SLEEVE	1
8	PLATE GUIDE (A)	1	41	BLIND PLATE GASKET (A)	1
9	PLATE GUIDE (B)	1	42	BLIND PLATE GASKET (B)	1
10	PLATE GUIDE (C, D)	2	43	BLIND PLATE GASKET (C)	1
11	BEARING HOLDER (A)	1	44	BLIND PLATE GASKET (D)	1
12	BEARING HOLDER (B)	1	45	BLIND PLATE GASKET (E)	2
13	BEARING HOLDER (C)	2	46	BLIND PLATE GASKET (F)	1
14	BEARING STOPPER (A)	1	47	SOCKET BOLT	94
15	BEARING STOPPER (B)	1	48	HEX BOLT	36
16	POWER LOCK	2	49	SPRING WASHER	130
17	LOCK NUT	4	50	OIL SIGHT GLASS ASS'Y	2 SET
18	LOCK WASHER	4	51	PLUG	4
19	MECH. SEAL. ASS'Y (A)	2	52	PLUG	4
20	LIP SEAL	4	53	DRAIN VALVE	5
21	SPEEDI SLEEVE	1	54	NIPPLE	6
22	OIL SEAL	1	55	EYE BOLT	2
23	ROLLER BEARING	2	56	SUCTION COVER PLATE	1
24	BALL BEARING	2	57	DISCHARGE COVER PLATE	1
25	BALL BEARING	1	58	AIR FILTER	1
26	SEAL ADAPTER HOUSING	1	59	GASKET	1
27	DOWER PIN	6	60	LIP SEAL	2
28	TIMING GEAR (A)	1	61	LANTERN RING	2
29	TIMING GEAR (B)	1	62	GREASE NIPPLE ASS'Y	2
30	KEY-DRIVE SHAFT	1	63	PLUG	2
31	BLIND PLATE (A)	1	64	MESH FILTER	1
32	BLIND PLATE (B)	1	65	R.E.P. SLINGER	2
33	BLIND PLATE (C)	1			

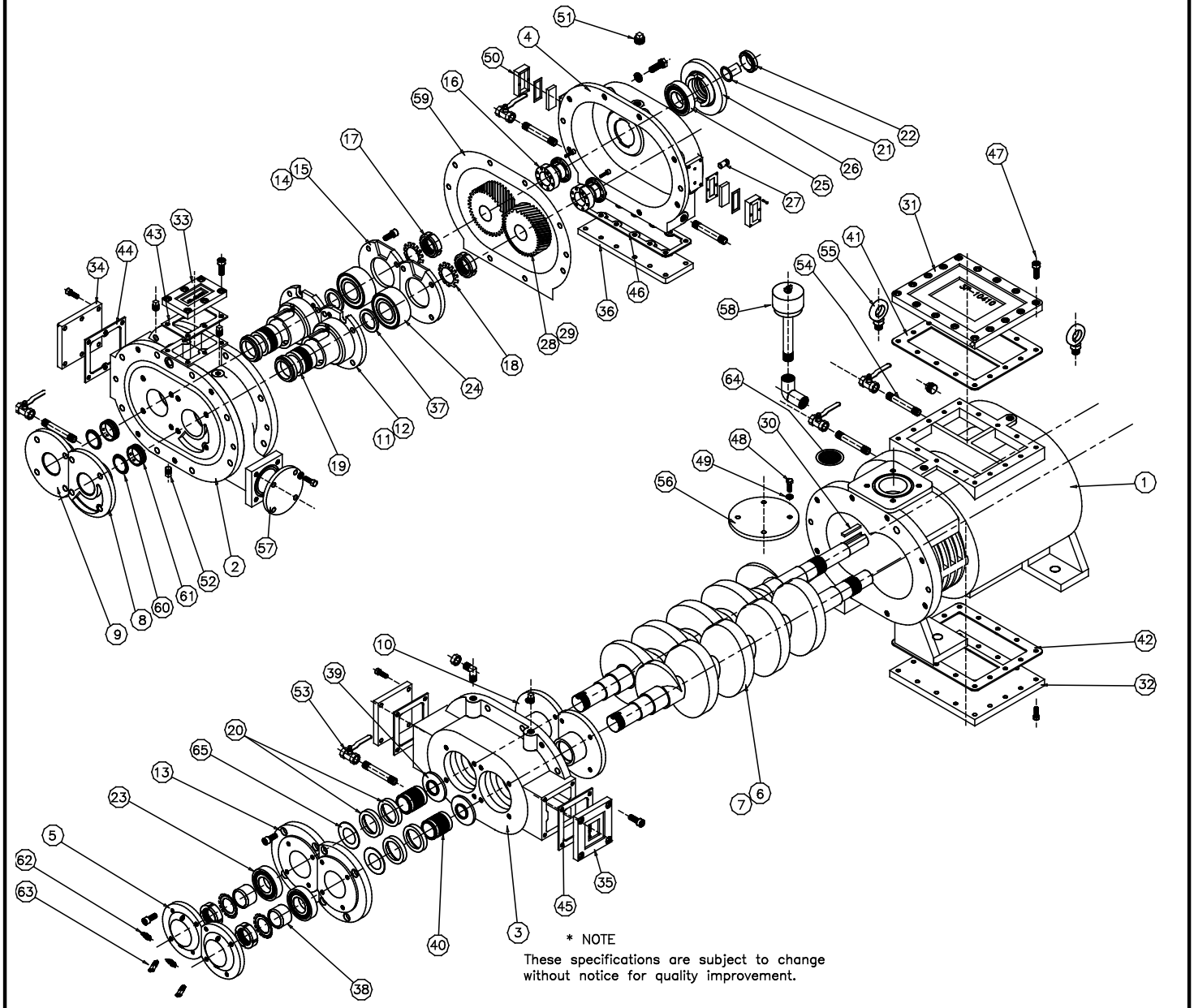
KDP 400 EXPLODED VIEW



KDP 400 PARTS LIST

ITEM NO.	DESCRIPTION	QTY	ITEM NO.	DESCRIPTION	QTY
1	CASING	1	34	BLIND PLATE (D)	1
2	FRONT END PLATE	1	35	BLIND PLATE (E)	2
3	REAR END PLATE	1	36	BLIND PLATE (F)	1
4	FRONT END COVER	1	37	SPACER (A)	2
5	GREASE COVER	2	38	BEARING PUSH SLEEVE	2
6	DRIVER SHAFT (A)/DRIVER	1	39	SPACER (B)	2
7	DRIVER SHAFT (B)	1	40	SLIP SLEEVE	2
8	PLATE GUIDE (A)	1	41	BLIND PLATE GASKET (A)	1
9	PLATE GUIDE (B)	1	42	BLIND PLATE GASKET (B)	1
10	PLATE GUIDE (C, D)	2	43	BLIND PLATE GASKET (C)	1
11	BEARING HOLDER (A)	1	44	BLIND PLATE GASKET (D)	1
12	BEARING HOLDER (B)	1	45	BLIND PLATE GASKET (E)	2
13	BEARING HOLDER (C)	2	46	BLIND PLATE GASKET (F)	1
14	BEARING STOPPER (A)	1	47	SOCKET BOLT	94
15	BEARING STOPPER (B)	1	48	HEX BOLT	36
16	POWER LOCK	2	49	SPRING WASHER	130
17	LOCK NUT	4	50	OIL SIGHT GLASS ASS'Y	2 SET
18	LOCK WASHER	4	51	PLUG	4
19	MECH. SEAL. ASS'Y (A)	2	52	PLUG	4
20	LIP SEAL	4	53	DRAIN VALVE	5
21	SPEEDI SLEEVE	1	54	NIPPLE	6
22	OIL SEAL	1	55	EYE BOLT	2
23	ROLLER BEARING	2	56	SUCTION COVER PLATE	1
24	BALL BEARING	2	57	DISCHARGE COVER PLATE	1
25	BALL BEARING	1	58	AIR FILTER	1
26	SEAL ADAPTER HOUSING	1	59	GASKET	1
27	DOWER PIN	6	60	LIP SEAL	2
28	TIMING GEAR (A)	1	61	LANTERN RING	2
29	TIMING GEAR (B)	1	62	GREASE NIPPLE ASS'Y	2
30	KEY-DRIVE SHAFT	1	63	PLUG	2
31	BLIND PLATE (A)	1	64	MESH FILTER	1
32	BLIND PLATE (B)	1	65	R.E.P. SLINGER	2
33	BLIND PLATE (C)	1			

KDP 800 EXPLODED VIEW



KDP 800 PARTS LIST

ITEM NO.	DESCRIPTION	QTY	ITEM NO.	DESCRIPTION	QTY
1	CASING	1	34	BLIND PLATE (D)	1
2	FRONT END PLATE	1	35	BLIND PLATE (E)	2
3	REAR END PLATE	1	36	BLIND PLATE (F)	1
4	FRONT END COVER	1	37	SPACER (A)	2
5	GREASE COVER	2	38	BEARING PUSH SLEEVE	2
6	DRIVER SHAFT (A)/DRIVER	1	39	SPACER (B)	2
7	DRIVER SHAFT (B)	1	40	SLIP SLEEVE	2
8	PLATE GUIDE (A)	1	41	BLIND PLATE GASKET (A)	1
9	PLATE GUIDE (B)	1	42	BLIND PLATE GASKET (B)	1
10	PLATE GUIDE (C, D)	2	43	BLIND PLATE GASKET (C)	1
11	BEARING HOLDER (A)	1	44	BLIND PLATE GASKET (D)	1
12	BEARING HOLDER (B)	1	45	BLIND PLATE GASKET (E)	2
13	BEARING HOLDER (C)	2	46	BLIND PLATE GASKET (F)	1
14	BEARING STOPPER (A)	1	47	SOCKET BOLT	94
15	BEARING STOPPER (B)	1	48	HEX BOLT	36
16	POWER LOCK	2	49	SPRING WASHER	130
17	LOCK NUT	4	50	OIL SIGHT GLASS ASS'Y	2 SET
18	LOCK WASHER	4	51	PLUG	4
19	MECH. SEAL. ASS'Y (A)	2	52	PLUG	4
20	LIP SEAL	4	53	DRAIN VALVE	5
21	SPEEDI SLEEVE	1	54	NIPPLE	6
22	OIL SEAL	1	55	EYE BOLT	2
23	ROLLER BEARING	2	56	SUCTION COVER PLATE	1
24	BALL BEARING	2	57	DISCHARGE COVER PLATE	1
25	BALL BEARING	1	58	AIR FILTER	1
26	SEAL ADAPTER HOUSING	1	59	GASKET	1
27	DOWER PIN	6	60	LIP SEAL	2
28	TIMING GEAR (A)	1	61	LANTERN RING	2
29	TIMING GEAR (B)	1	62	GREASE NIPPLE ASS'Y	2
30	KEY-DRIVE SHAFT	1	63	PLUG	2
31	BLIND PLATE (A)	1	64	MESH FILTER	1
32	BLIND PLATE (B)	1	65	R.E.P. SLINGER	2
33	BLIND PLATE (C)	1			

WARRANTY – VACUUM PRODUCTS

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Vacuum & Blower Systems (the seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation).

Product Type	Warranty Duration
New	15 months after date of shipment or 12 months after initial startup date, whichever occurs first
Repair	6 months after date of shipment or remaining warranty period, whichever is greater
Remanufactured	9 months after date of shipment or 6 months after initial startup date, whichever occurs first

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

January, 2002

OPERATING DATA

It is to the user's advantage to have the requested data filled in below and available in the event a problem should develop in the blower or the system. This information is also helpful when ordering spare parts.

Model No. _____

Serial No. _____ Type of Lubrication: _____

Startup Date _____ _____

Pump RPM _____ Operating Vacuum _____

Motor RPM _____ HP _____ Any other special accessories supplied or in use:

_____

NOTES: _____

_____

_____

_____

_____

_____

_____

_____

IMPORTANT

All KINNEY® vacuum pumps manufactured by Tuthill Vacuum & Blower Systems are date coded at time of shipment. In order to assure you of the full benefits of the product warranty, please complete, tear out and return the product registration card below, or you can visit our product registration web page at:

http://vacuum.tuthill.com/product_registration

IMPORTANT

All KINNEY® vacuum pumps manufactured by Tuthill Vacuum & Blower Systems are date coded at time of shipment. In order to assure you of the full benefits of the product warranty, please complete, tear out and return this product registration card.

Company _____

Location _____

City State/Province ZIP/Postal Code Country

Telephone : ( )_____

E-mail: _____

Model: _____

Serial Number: _____

Date of Purchase: _____

Date of Startup: _____

PLEASE CHECK ONE

Vacuum Furnace	o
Vacuum Coating	o
Pharmaceutical	o
Semiconductor/Electronics	o
Food/Meat Packing	o
Gas/Petrochemical	o
Other _____	

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 2912 SPRINGFIELD MO

POSTAGE WILL BE PAID BY ADDRESSEE

ATTN. CUSTOMER SERVICE – VACUUM PRODUCTS
TUTHILL VACUUM & BLOWER SYSTEMS
PO BOX 2877
SPRINGFIELD MO 65890-2150