KINNEY®

Kinney®
Dry-Screw Vacuum Pump

Manual 1854 Rev C p/n 001854 0000

WARNING: Do Not Operate Before Reading Manual

KDP Series
OPERATOR'S MANUAL

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

Operator's Manual: Dry-Screw Vacuum Pump

800.825.6937 | www.md-kinney.com

Original Instructions

Disclaimer Statement:
All information, illustrations and specifications in this manual are based on the latest information available at the time of publishing. The illustrations used in this manual are intended as representative reference views only. Products are under a continuous improvement policy. Thus, information, illustrations and/or specifications to explain and or exemplify a product, service or maintenance improvement may be changed at any time without notice.

Product information and specifications subject to change.

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01 INTRODUCTION

CONGRATULATIONS on the purchase of a new **Kinney® KDP™** Dry-Screw Vacuum Pum. Please examine the pump for shipping damage, and if any damage is found, report it immediately to the carrier. If the pump is to be installed at a later date, make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If pump is stored outdoors, be sure to protect it from weather and corrosion.

This manual provides instructions for handling and maintaining the Kinney® KDP™ Dry-Screw Vacuum Pump. Read this manual carefully before installing, operating, or servicing the pump.

DESCRIPTION

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

The screw rotors have a specially selected profile formed by Archimedean, Quimby, and arc curves. The counterrotation 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. Because there is no oil in the pumping chamber, oil cannot mix with the discharge gases.

CONSTRUCTION

Rotor Shaft

The rotor shaft is made of high-grade spheroidal graphite cast steel. The shaft rotors have been precision-machined to numerical tolerances. After being machined, the shaft rotors have been perfectly dynamic-balanced and coated with 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 have been 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 bearings. The bearings on the expansion side are roller bearings with heavy load capacity. These bearings have been designed to withstand high-speed, heavy-load service and to preserve the clearances between gears and rotors.

Oil Level Sight Gauges

The pump has an oil level sight gauge on each side of the front-end cover. Check both sight gauges. The two readings should be equal, indicating that the pump is mounted level. During operation, oil is splashed over the bearings and mechanical seals by revolution of the gears.

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 rear 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.

Cooling Purge

If the pump has the After Cooler option, the cooling water inlet should be located on the cooler side. If atmosphere intake is impractical, cool the discharge air and recycle it.

SPECIFICATIONS

MODEL		KDP-150	KDP-300	KDP-400	KDP-800
Capacity (60 Hz)		90 CFM (150 m^3/hr)	195 CFM (330 m^3/hr)	235 CFM (400 m^3/hr)	460 CFM (800 m^3/hr)
Ultimate pressure		0.1 Torr (0.13 mbar)	0.1 Torr (0.13 mbar)	0.1 Torr (0.13 mbar)	0.05 Torr (0.067 mbar)
Motor		7.5 HP	15 HP	20 HP	30 HP
Power	50 Hz 60Hz	3.7 kW 5.5 kW	7.5 kW 11.5 kW	11.5 kW 15 kW	19 kW 22 kW
Rotational speed	50 Hz 60 Hz	2,900 RPM 3,500 RPM	2,900 RPM 3,500 RPM	2,900 RPM 3,500 RPM	2,900 RPM 3,500 RPM
Gear oil		1.4 qt (1.3 L)	1.7 qt (1.6 L)	2.1 qt (2.0 L)	3.8 qt (3.6 L)
Cooling water @ 75°F (24°C)		0.5 GPM (1.9 LPM)	1.0 GPM (3.8 LPM)	2.0 GPM (7.6 LPM)	2.6 GPM (9.8 LPM)
Suction port size		1.5 in. (40 mm)	2.0 in. (50 mm)	2.5 in. (65 mm)	4.0 in. (100 mm)
Discharge port size		1.5 in. (40 mm)	1.5 in. (40 mm)	2.0 in. (50 mm)	2.5 in. (65 mm)
Silencer port size		1.5 in. (40 mm)	1.5 in. (40 mm)	2.0 in. (50 mm)	2.5 in. (65 mm)
Weight (pump only)		484 lb (220 kg)	698 lb (317 kg)	887 lb (402 kg)	1,320 lb (600 kg)

Table 1-1

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SAFETY

GRAPHIC CONVENTIONS USED IN THIS MANUAL

The following hazard levels are referenced within this manual:

⚠ DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation that can cause damage to the engine, personal property, and/or the environment or cause the equipment to operate improperly.

NOTE: Indicates a procedure, practice, or condition that should be followed in order for the equipment to function in the manner intended.

SAFETY INSTRUCTION TAGS

⚠ 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 before operating the 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.

⚠ WARNING

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, or 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 that the pump is completely reassembled, the belt guard is properly installed, and 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. Never lift equipment attached to the 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) may cause surface temperatures as high as 220°F (104°C).

03

INSTALLATION

INSTALLATION LOCATION

Mount the pump on a flat, level surface. Use a baseplate that is rigid, solidly supported, and structurally sound. Shim under the legs where necessary so that each leg of the pump supports an equal share of the pump weight. This is necessary to prevent twisting of the pump. Make sure the feet rest evenly on the mounting surface before fastening down. Twisting or cramping the pump during mounting will cause internal contact and binding during operation, resulting in a condition called “soft foot.” See Soft Foot on page 7 for further details and preventative measures. If the pump will be installed outdoors, check the motor, V-belt, exterior paint, peripheral equipment, and other parts for outdoor service suitability.

Allow enough space surrounding the pump for access during maintenance such as disassembly, re-assembly, and periodic inspections.

FOUNDATION

Make sure the concrete foundation has an adequate pressure-bearing area to counteract the weight of the pump. Anchor the pump securely to the foundation.

PUMP INSTALLATION

1. Position the pump and center it for installation.
2. Set the pump on the foundation, and support the base plate evenly by inserting a choke liner between the pump and the foundation surface. Make sure that the bed is level and that there is space for grouting the cement mortar between the foundation surface and the bed.
3. 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 provide proper support.
4. Use a level to check that the pump assembly is level.
5. Grout the cement mortar in the space under the bed and in the anchor boltholes, and let it set. Once the mortar is hardened, tighten the nuts for the anchor bolts.

NOTE: Be sure to tighten the nuts evenly.

MANIFOLD INSTALLATION – MAIN PIPING

Clean the interior of the suction and discharge pipe to remove any rust, dust, or foreign matter.

Kinney recommends installing an expansion joint on the suction side as well as the discharge side of the pump. Properly support the piping to protect the pump from absorbing excessive load. If a silencer is provided on the discharge side, install it as closely as possible to the discharge port of the pump.

Kinney recommends installing 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 it is not possible to install the recommended non-return valve, install a gate valve instead and be sure to shut the valve before stopping the pump.

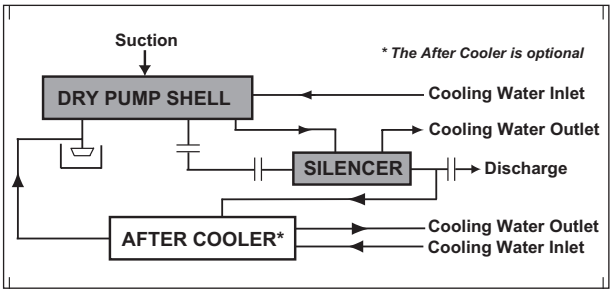


Figure 3-1 – Standard Piping

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. The water inlet to the pump is from the bottom on the drive end. The water outlet from the pump is from the top on the suction end. The water inlet and outlet are labeled on the pump.

NOTE: In addition to the water outlet, the pump also has water drains for fully draining the pump casing, front-end cover, front end plate, rear end plate, and water jackets. Water drains are not water outlets. Use the water drains 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, the transmission efficiency can be reduced due to belt slippage. Fatigue and heating on the belt will also occur. This can shorten the belt life considerably and damage the bearings.
- If the belt is too tight, too much tension will be applied and the strength will be decreased. The belt life will also be reduced, and excessive load will cause severe heat or wear of the bearing.

To maintain proper belt tension, adjust the belt tension as shown in ***Figure 3-2***.

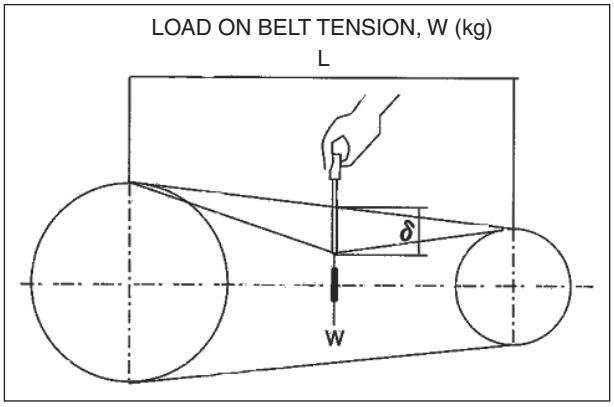


Figure 3-2 – V-Belt Tension

Belt Tension

Apply the load vertically at the center of "L" (***see Figure 3-2***). The belt sag at this time should be $\delta = 0.0016 \times L$ (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

Table 3-1

CLASS OF MOTOR	ON SIDE OF COUPLING	CLASS OF MOTOR	AT END OF COUPLING
M180L (ML5-180L) and under	Less than 0.00197 in. (0.05 mm)	M132M (ML5-132M) and under	Less than 0.00394 in. (0.10 mm)
M200M (M15-200M) and above	Less than 0.00315 in. (0.08 mm)	M160M (ML5-160M) and above	Less than 0.00709 in. (0.18 mm)

Table 3-2

Coupling Drive

Use a dial gauge to align the coupling (***see Figure 3-3*** for proper concentricity).

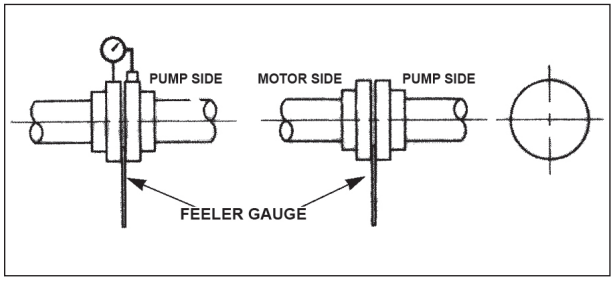


Figure 3-3 – Coupling Alignment

Soft Foot

Soft foot is a condition in which one of the pump feet does not sit flat on the base. Soft foot is usually due to irregularities in the surface to which the pump is mounted. When the bolt on the foot gets tightened, a slight distortion occurs that can affect bearing and seal life as well as cause internal contact between parts.

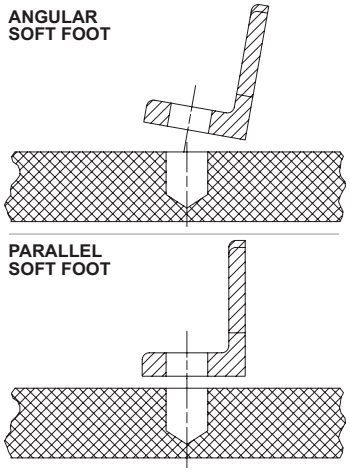


Figure 3-4 – Illustrations of Soft Foot

1. Place the pump on the base.
2. Check each foot for gaps between the foot and base (soft foot). Shim as necessary to fill the gap within 0.002 in. (0.05 mm). Figure 3-4 shows the two most common types of soft foot conditions. If either type is present at a measurement of more than 0.003 in. (0.076 mm), the pump may fail prematurely.
3. Tighten all bolts.
4. Mount a dial indicator on the base contacting one foot at 12 o'clock position.
5. Loosen the bolt on that foot. Observe indicator travel and add shims as needed to reduce "spring" to less than 0.002 in. (0.05 mm). Repeat steps 4 and 5 on the remaining feet.

04

OPERATION

PRESTART CHECKS

Piping Inspection

Make sure all piping is clean and free from dirt and debris. Remove all welding slags and chips from the interior of 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

Be sure to turn off the pump before adding oil. Never add oil with the pump running.

1. With the pump shut off, fill the oil case to the top of the red dot on the oil sight gauge.
2. Start up the pump.
3. Check the oil level. With the pump running, the oil level should be between the top and middle of the red dot on the gauge.

NOTE: The oil level on a pump that is not running will drop once the pump is started. Be sure to check and establish the level with the pump running.

NOTICE

Keep the oil level with the pump running between the top and middle of the red dot at all times. If the oil level is too low, the gears, bearings, and mechanical seals will be damaged. If the oil level is too high, the equipment will overheat.

Cooling Water

Make sure that the cooling water, as specified in ***Figure 3-1***, is fully circulating through the pump.

STARTING THE PUMP

1. Check the pump rotational direction by jogging the pump briefly, with the process inlet isolation valve open, while checking the rotational direction of the motor fan. The pump rotation direction should be CW (Clock Wise), viewed from the motor.

   If the motor rotates CCW (Counter Clock Wise), correct the power cable connections and check the rotational direction again to make sure the pump rotates in the correct CW direction.
2. With the process inlet isolation valve still open, operate the pump for 20 – 30 minutes.
3. Check all pump operating parameters for any trouble, such as excessive vibration, high oil/grease temperatures, high cooling liquid discharge temperature, high process discharge

temperature noise, and over-current draw. If any abnormal condition appears, stop the pump to investigate and correct the cause.

NOTE: Typical causes of an abnormal condition are improper lubrication or installation of the pump.

4. Operate the pump for 2 – 3 hours under normal process load conditions.
5. Check the pump operating parameters again.
6. If any abnormal condition arises during initial operation with normal process load, shut down the pump immediately and correct the abnormal condition before restarting the pump.

Trial Run

1. Operate the pump under no load condition for 20 – 30 minutes to check for any abnormal vibration or heat. If any abnormality arises, stop operation and ***see Troubleshooting on page 19*** or call Kinney.
2. 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 Shutoff

To shut off the suction, close the isolation valve on the suction line.

Corrosive Gas Purging

If any corrosive gas gets drawn into the piping or pump, purge the pump and piping by flushing the system with a cleansing gas. To make sure that the pump is thoroughly cleaned, flush the system for 20 – 30 minutes before stopping the pump.

Motor Shutoff

To stop the pump, turn off the motor.

STEAM FLUSHING

If any process materials have been ingested into the pump and caused resistance, do not attempt to rotate the pump with force. Flush steam inside the pump and screws according to the following procedure:

1. Close the inlet (suction) valve. Open the discharge valve and drain valve from the exhaust silencer or separator.
2. Inject steam for 1 – 10 minutes through one of the purge or instrumentation ports on the inlet manifold. Steam pressure should be approximately 1 kg/cm^2G.
3. Make sure 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 steps 2 or 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 that contains any elements of water, sulfate resin, or tar turbine oil (ISO VG 68).

Recommended lubricants:

- Kinney Type AX
- BP Energol THHT 68
- BP Energol THB 68
- Shell Turbo 68
- Mobil DTE Heavy Medium

Recommended grease: Dow Corning 3451 Bearing Grease

05

MAINTENANCE AND INSPECTION

OVERHEATING

During pump operation, the temperature will rise corresponding to the compression ratio due to heat of compression. However, if the temperature rise is local and the exterior coating becomes scorched, there is an abnormality. There may be interference between the rotors and casing, or the pump may have drawn in some foreign material.

⚠ CAUTION

Stop the operation immediately and check for abnormalities.

ABNORMALITIES

Carefully check bearing temperatures, vibration, and noise. Note any abnormalities as they arise.

INTERFERENCE

To check for interference between rotors or between a rotor and casing, place a stethoscope against the casing to listen for any abnormal sounds.

FREEZING

In cold weather, the water jackets could be damaged if cooling water freezes. Drain the cooling water after the pump is shut down.

INSPECTION SCHEDULE

Daily Inspection

1. Oil Level Gauge – Make sure the level is between the high and low level specified in ***Oil Level on page 8***. Low or excessively high levels of lubricant can damage gears, bearings, and seals.
2. Cooling Water – Make sure that the cooling water is fully circulating through the pump at the proper flow rate.
3. Suction and 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 pump failure or loss of efficiency.

Monthly Inspection

1. Check the V-belt tension.
2. Check the lubricant color. If the color is dark, replace the lubricant.
3. Check the oil level. If the oil level decreases drastically, check the mechanical seals.

Every-3-Month Inspection

Inspect the non-drive end bearings, and lubricate as needed.

Bi-annual Inspection

Check the piping for scale or dirt build-up.

Yearly Inspection

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

MAINTENANCE AND INSPECTION SCHEDULE

ITEM	CHECK POINT	DAILY	MONTHLY	3 MOS.	6 MOS.	YEARLY
Motor amperage	Any change? Amperage as specified?	X				
Rotation	Is the rotation smooth and direction correct?	X				
Suction and discharge pressure	Is the pressure as specified?	X				
Noise and 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 signs of oil leaks?	X				
Reverse cooling filter (cooler)	Any heat on suction pipe?	X				
Chamber purge (clean)	Close suction line, and run for 20 – 30 minutes while purging with nitrogen 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			
Non-drive end bearings	Inspect every 3 months and lubricate as needed.			X		
Suction and discharge piping	Is there any accumulated scale or dirt?				X	
Mechanical seal, oil seal, bearing, O-ring, V-belt, and packing	Inspect for damage and replace as needed.					X
Rotors and casings	Inspect interior for rust and any damage or flaw.					X
Gear case lubricant	Replace.					X
Gear	Inspect for damage.					X

06

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).**

1. Open the drain valves. Drain the cooling water from the pump.
2. Remove the oil drain plug from the front end cover. Drain the oil.
3. Remove the oil level gauges, valves, and all accessories from the pump.
4. Remove the seal adapter housing from the front end cover.
5. Remove the oil seal from the seal adapter housing.
6. Remove the front end cover.
7. Remove the ball bearing from the front end cover.
8. Loosen the power locks. Remove timing gear A and timing gear B.
9. Remove bearing stopper A and bearing stopper B.
10. Remove the lock nuts and lock washers.
11. Remove bearing holder A and bearing holder B from the front end plate.
12. Press out the ball bearings from bearing holder A and bearing holder B.
13. Remove the spacers A from the drive shaft and driven shaft.

NOTE: Label the spacers as drive side or non-drive side.

14. Remove the mechanical seal assembly from the drive shaft and driven shaft.
15. Remove the grease covers from the bearing holders.
16. Remove the lock nuts, lock washers, and bearing push sleeves.
17. Remove the bearing holders.
18. Press out the roller bearings and lip seals from the bearing holders.
19. Remove the slip sleeves and spacers B.
20. Remove the front end plate.
21. If needed, remove plate guide A and plate guide B from the front end plate.
22. Remove the rear end plate from the casing.
23. If needed, remove plate guide B from the rear end plate.
24. Carefully remove the drive shaft and driven shaft from the casing.

25. Remove the blind plates and gaskets for the water jacket at the casing and end plates.

NOTE: Clean all parts with a suitable grade of clean solvent, and replace any worn or damaged parts with factory-approved parts. Install new bearings, seals, gaskets, and O-rings at each assembly.

07

REASSEMBLY

⚠ CAUTION

- **Check all parts for wear or damage during 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 plate guides were removed during disassembly:
   a. Insert plate guide A and plate guide B on the front end plate.
   b. Insert plate guide B on the rear end plate.
2. Place the rear end plate on a working table or pipe stand with plate guide B facing up.
3. Insert the drive shaft and driven shaft into the rear end plate, with the drive shaft to the right side.

NOTE: Keyway alignment is not necessary.

4. Place the front end plate (with plate guides facing down) onto the shafts. Discharge the port to the left side.
5. Perform reassembly from the gear (discharge) side first. Insert the mechanical seal assembly on the drive shaft and driven shaft.
6. Insert the appropriate spacer A on the drive shaft and driven shaft with the bevel facing out.
7. Insert bearing holder A and bearing holder B into the front end plate.
8. Insert the ball bearings onto the shafts and into the bearing holders.
9. Secure the ball bearings on the drive shaft and driven shaft with the lock washers and lock nuts. Bend one tab of lock washer into lock nut.
10. Put bearing stopper A and bearing stopper B on bearing holder A and bearing holder B. Secure them to the front end plate.
11. Check clearance “D” ***(see Figure 7-1)*** between the shafts and plate guides.

12. Set aside the shafts and drive end plate assembly.

13. Apply sealant on the mating face of the rear end plate. Insert O-ring into the cooling water line groove in the casing. Attach the rear end plate to the casing.

14. Apply sealant on mating face of the casing. Insert O-ring into the cooling water line groove in the front end plate. Attach the front end plate to the casing.

15. Make sure the pump is in the horizontal position to complete the remaining reassembly.

16. Install spacers B on the drive shaft and driven shaft with the bevel facing in.

17. Insert lip seals back-to-back (2 for each bearing holder) inside bearing holders C.

18. Insert O-rings into the bearing holders.

19. Insert slip sleeves into lip seals.

20. Insert bearing holders C into the rear end plate, keeping the slip sleeves from being pushed out.

21. Grease the bearings (***see Lubrication on page 9*** for the recommended grease), and insert the bearings onto the shafts and into the bearing holders. Be sure the larger face of the inner race is facing outward to allow for expansion.

22. Insert bearing push sleeve, lock washer, and lock nut. Do not tighten the lock nuts.

23. Insert timing gear A with power lock on the drive shaft. Install timing gear B with power lock on the driven shaft. The driven gear has a shoulder on its backside. Do not tighten the power lock bolts yet.

NOTE: There are no timing marks on the gears to use for alignment. Be sure the gears butt up against the shaft shoulder.

24. Using a dial indicator with a magnetic base, put the magnetic base on the face of the front end plate and dial the indicator on the front shoulder of the driven gear as shown in ***Figure 7-2***.

25. Bring the flatness of the driven gear to 0.002 in. (0.05 mm) or less while tightening the power lock bolts to 12.5 ft-lb (17.5 N-m).

26. Set timing by setting Quimby (clearance “E” [***see Figure 7-1***]) through the suction port as shown in ***Figure 7-3***.

    a. Turning the drive shaft back and forth slightly will open and close the Quimby.

    b. Open Quimby, insert proper thickness gauge between the shafts at Quimby, and close Quimby until the shafts hold the gauge.

    c. Tighten the power lock bolts enough to hold the gear onto the shaft.

27. Using the dial indicator on the front shoulder of the drive gear, bring the flatness of the drive gear to 0.002 in. (0.05 mm) or less while tightening the power lock bolts to 12.5 ft-lb (17.5 N-m).

28. Check Quimby again to make sure it did not change.

29. At the rear end plate, tightly secure the lock nuts and bend one tab of each lock washer into lock nut.

30. Apply bearing grease (***see Lubrication on page 9*** for the recommended grease) into the bearing holders (approximately half of the space).

31. Insert O-ring on the grease covers, and attach them to the bearing holders.

32. Put O-ring in the groove of the cooling water line in the front end plate. Insert the oil paper gasket between the front end plate and front end cover. Hand-tighten the bolts.

33. Insert ball bearing on the drive shaft and into the front end cover. Tighten the bolts to secure the front end cover to the front end plate.

34. Insert O-ring on the seal adapter housing, and attach it to the front end cover.

35. Insert oil seal onto the speedi sleeve. Insert the speedi sleeve and oil seal onto the shaft and into the seal adapter housing.

36. Push in the oil seal until it stops on the shoulder inside the seal adapter housing. Then, push the end of the speedi sleeve into the end of the keyway. Be careful not to damage its outer edge.

37. Assemble the blind plates with the blind plate gaskets on the casing and plates.

38. Install the oil level gauges and all accessories.

39. Add lubrication oil through the oil inlet on the top of the front end plate until the oil level is at the top of the red mark on the oil level gauge.

NOTE: ***See Specifications on page <?>* for the proper amount of oil for each model.**

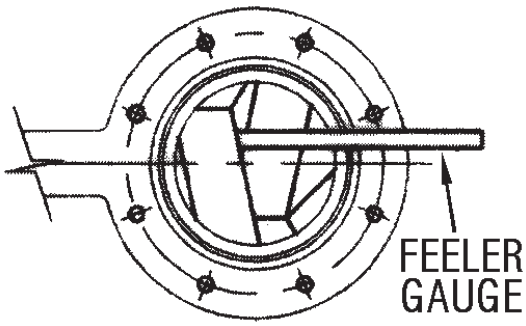


Figure 7-42 – Screw Clearance via Inlet

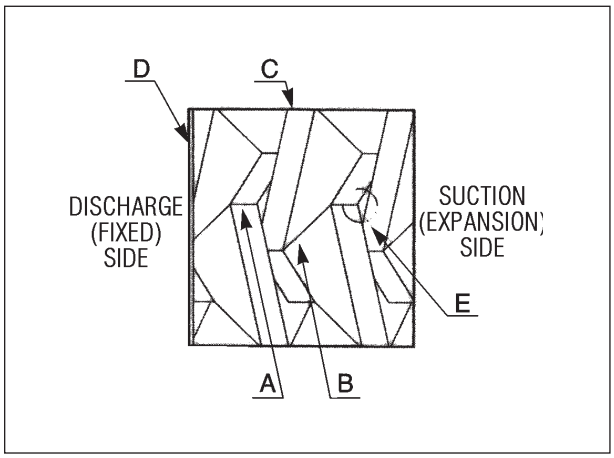


Figure 7-40 – Screw Clearance

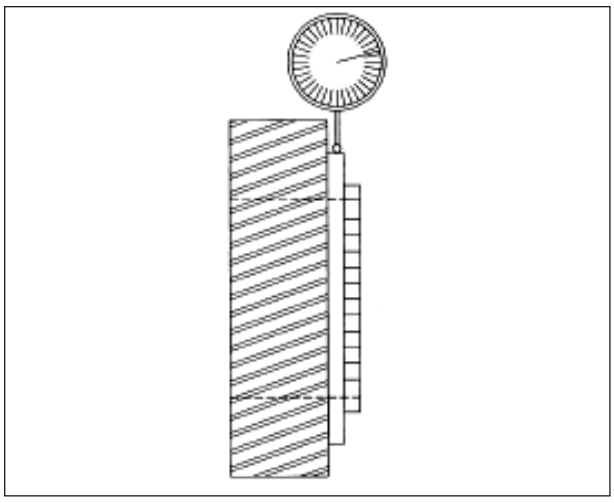


Figure 7-41 – Gear Flatness Check

SCREW CLEARANCES

See Figure 7-1 for clearances A, B, C, D, and E.

MODEL	A	B	C	D	E
KDP-150-M/F	0.0051 – 0.0067 in. (0.13 – 0.17 mm)	0.0071 – 0.0098 in. (0.18 – 0.25 mm)	0.0059 – 0.0079 in. (0.15 – 0.20 mm)	0.0039 – 0.0047 in. (0.10 – 0.12 mm)	0.0031 – 0.0039 in. (0.08 – 0.10 mm)
KDP-330-M/F	0.0079 – 0.0098 in. (0.20 – 0.25 mm)	0.0079 – 0.0118 in. (0.20 – 0.30 mm)	0.0079 – 0.0098 in. (0.20 – 0.25 mm)	0.0039 – 0.0059 in. (0.10 – 0.15 mm)	0.0039 – 0.0047 in. (0.10 – 0.12 mm)
KDP-400-M/F	0.0098 – 0.0118 in. (0.25 – 0.30 mm)	0.0098 – 0.0157 in. (0.25 – 0.4 mm)	0.0098 – 0.0106 in. (0.25 – 0.27 mm)	0.0047 – 0.0059 in. (0.12 – 0.15 mm)	0.0043 – 0.0051 in. (0.11 – 0.13 mm)
KDP-800-M/F	0.0110 – 0.0130 in. (0.28 – 0.33 mm)	0.0138 – 0.0197 in. (0.35 – 0.5 mm)	0.0118 – 0.0138 in. (0.30 – 0.35 mm)	0.0059 – 0.0071 in. (0.15 – 0.18 mm)	0.0043 – 0.0051 in. (0.11 – 0.13 mm)

Table 7-1

08

TROUBLESHOOTING

Although Kinney vacuum pumps are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The following chart lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
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 ratio 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.

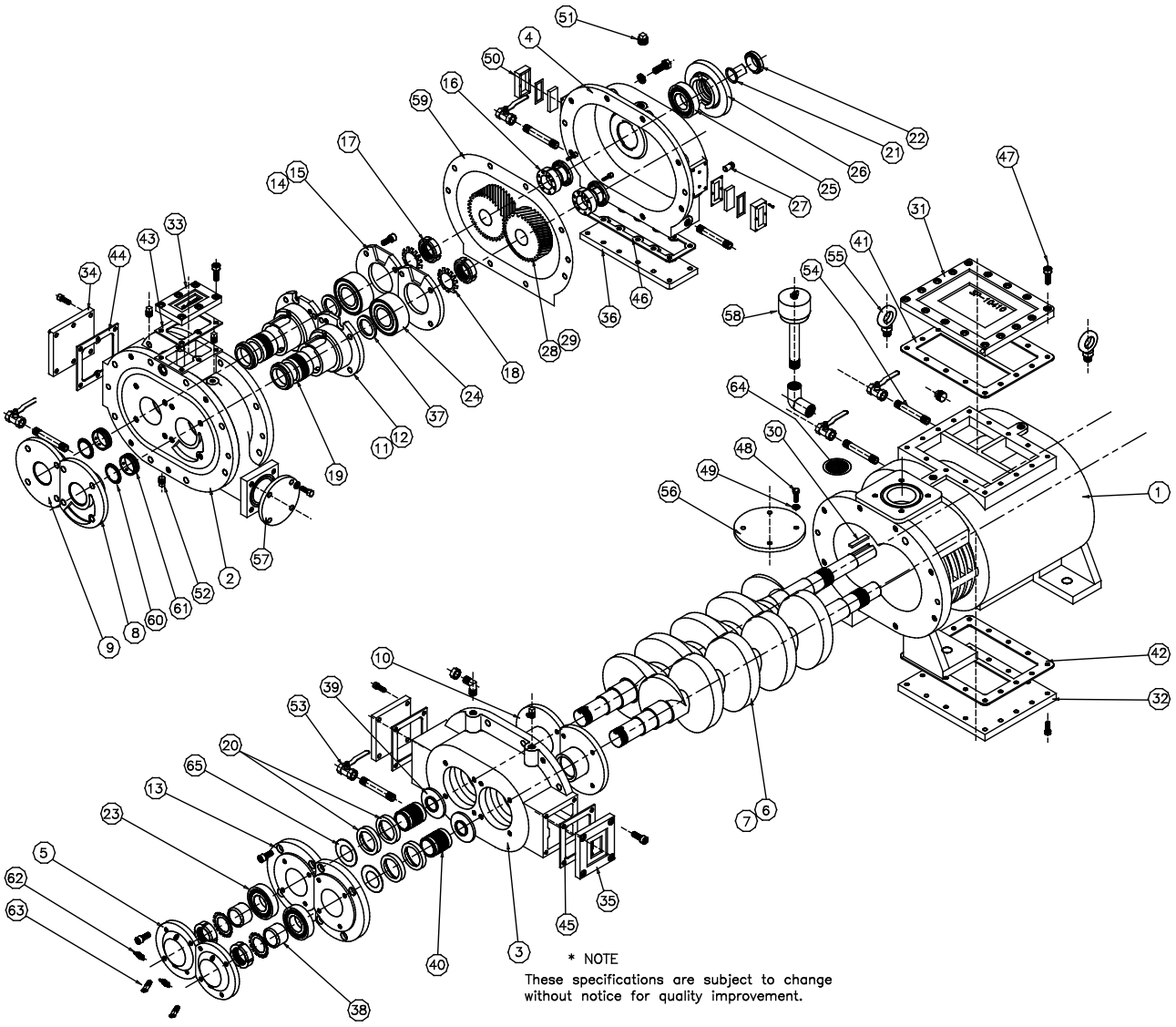
SYMPTOM	PROBABLE CAUSE	REMEDIES
Bearing or gear damage	Improper lubricant	Replace timing gears.
	Low lubricant level	Replace bearings.
	Overloading	Determine cause of damage.

Table 8-1– Common Symptoms and Remedies

NOTE: If problems are not resolved by the solutions in *Table 8-1*, please contact Kinney with the following information:

- **Model number, serial number, and application**
- **Information on piping (valves, strainers, number of bends)**
- **Description of problem encountered, frequency, etc.**

KDP-150 EXPLODED VIEW DRAWING

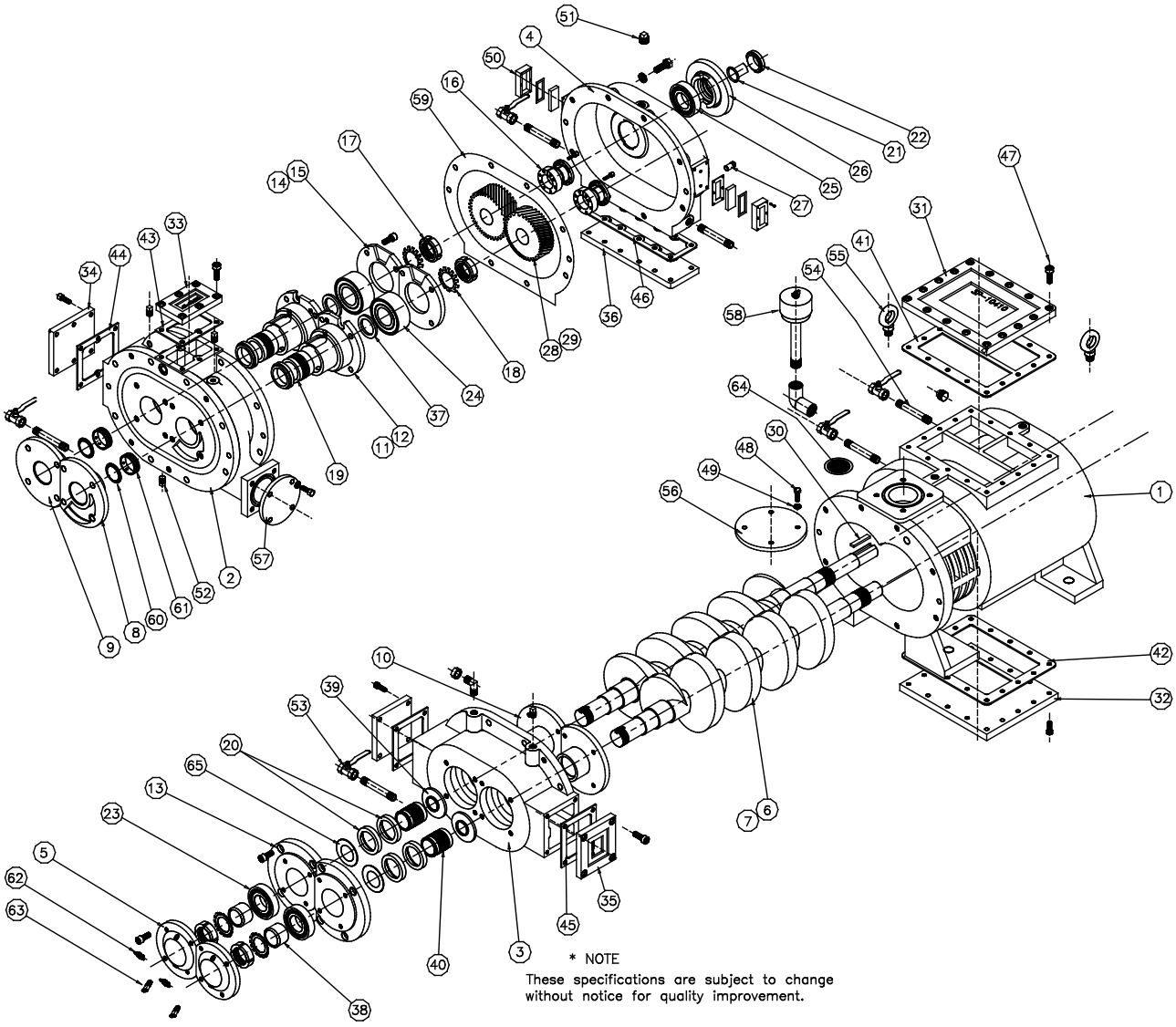


KDP-150 PARTS LIST

ITEM NO.	DESCRIPTION	QTY
1	Casing	1
2	Front End Plate	1
3	Rear End Plate	1
4	Front End Cover	1
5	Grease Cover	2
6	Driver Shaft (A)/Driver	1
7	Driver Shaft (B)	1
8	Plate Guide (A)	1
9	Plate Guide (B)	1
10	Plate Guide (C, D)	2
11	Bearing Holder (A)	1
12	Bearing Holder (B)	1
13	Bearing Holder (C)	2
14	Bearing Stopper (A)	1
15	Bearing Stopper (B)	1
16	Power Lock	2
17	Lock Nut	4
18	Lock Washer	4
19	Mech. Seal. Ass'y (A)	2
20	Lip Seal	4
21	Speedi Sleeve	1
22	Oil Seal	1
23	Roller Bearing	2
24	Ball Bearing	2
25	Ball Bearing	1
26	Seal Adapter Housing	1
27	Dowel Pin	6
28	Timing Gear (A)	1
29	Timing Gear (B)	1
30	Key-Drive Shaft	1
31	Blind Plate (A)	1
32	Blind Plate (B)	1
33	Blind Plate (C)	1

ITEM NO.	DESCRIPTION	QTY
34	Blind Plate (D)	1
35	Blind Plate (E)	1
36	Blind Plate (F)	1
37	Spacer (A)	1
38	Bearing Push Sleeve	1
39	Spacer (B)	1
40	Slip Sleeve	1
41	Blind Plate Gasket (A)	1
42	Blind Plate Gasket (B)	1
43	Blind Plate Gasket (C)	1
44	Blind Plate Gasket (D)	1
45	Blind Plate Gasket (E)	2
46	Blind Plate Gasket (F)	1
47	Socket Bolt	94
48	Hex Bolt	36
49	Spring Washer	130
50	Oil Sight Glass Ass'y	2 SET
51	Plug	4
52	Plug	4
53	Drain Valve	5
54	Nipple	6
55	Eye Bolt	2
56	Suction Cover Plate	1
57	Discharge Cover Plate	1
58	Air Filter	1
59	Gasket	1
60	Lip Seal	2
61	Lantern Ring	2
62	Grease Nipple Ass'y	2
63	Plug	2
64	Mesh Filter	1
65	R.E.P. Slinger	2

KDP-330 EXPLODED VIEW DRAWING

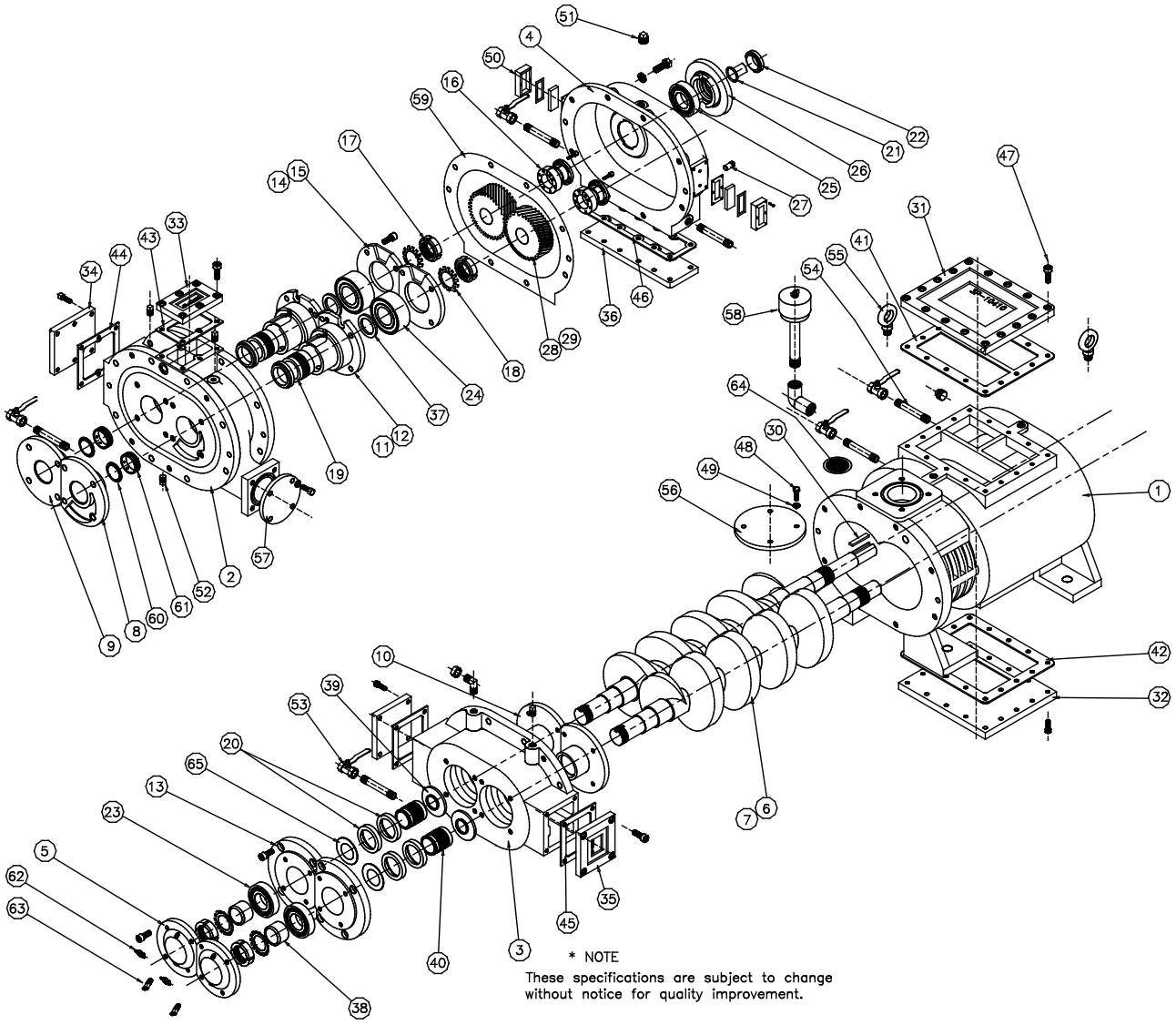


KDP-330 PARTS LIST

ITEM NO.	DESCRIPTION	QTY
1	Casing	1
2	Front End Plate	1
3	Rear End Plate	1
4	Front End Cover	1
5	Grease Cover	2
6	Driver Shaft (A)/Driver	1
7	Driver Shaft (B)	1
8	Plate Guide (A)	1
9	Plate Guide (B)	1
10	Plate Guide (C, D)	2
11	Bearing Holder (A)	1
12	Bearing Holder (B)	1
13	Bearing Holder (C)	2
14	Bearing Stopper (A)	1
15	Bearing Stopper (B)	1
16	Power Lock	2
17	Lock Nut	4
18	Lock Washer	4
19	Mech. Seal. Ass'y (A)	2
20	Lip Seal	4
21	Speedi Sleeve	1
22	Oil Seal	1
23	Roller Bearing	2
24	Ball Bearing	2
25	Ball Bearing	1
26	Seal Adapter Housing	1
27	Dowel Pin	6
28	Timing Gear (A)	1
29	Timing Gear (B)	1
30	Key-Drive Shaft	1
31	Blind Plate (A)	1
32	Blind Plate (B)	1
33	Blind Plate (C)	1

ITEM NO.	DESCRIPTION	QTY
34	Blind Plate (D)	1
35	Blind Plate (E)	1
36	Blind Plate (F)	1
37	Spacer (A)	1
38	Bearing Push Sleeve	1
39	Spacer (B)	1
40	Slip Sleeve	1
41	Blind Plate Gasket (A)	1
42	Blind Plate Gasket (B)	1
43	Blind Plate Gasket (C)	1
44	Blind Plate Gasket (D)	1
45	Blind Plate Gasket (E)	2
46	Blind Plate Gasket (F)	1
47	Socket Bolt	94
48	Hex Bolt	36
49	Spring Washer	130
50	Oil Sight Glass Ass'y	2 SET
51	Plug	4
52	Plug	4
53	Drain Valve	5
54	Nipple	6
55	Eye Bolt	2
56	Suction Cover Plate	1
57	Discharge Cover Plate	1
58	Air Filter	1
59	Gasket	1
60	Lip Seal	2
61	Lantern Ring	2
62	Grease Nipple Ass'y	2
63	Plug	2
64	Mesh Filter	1
65	R.E.P. Slinger	2

KDP-400 EXPLODED VIEW DRAWING

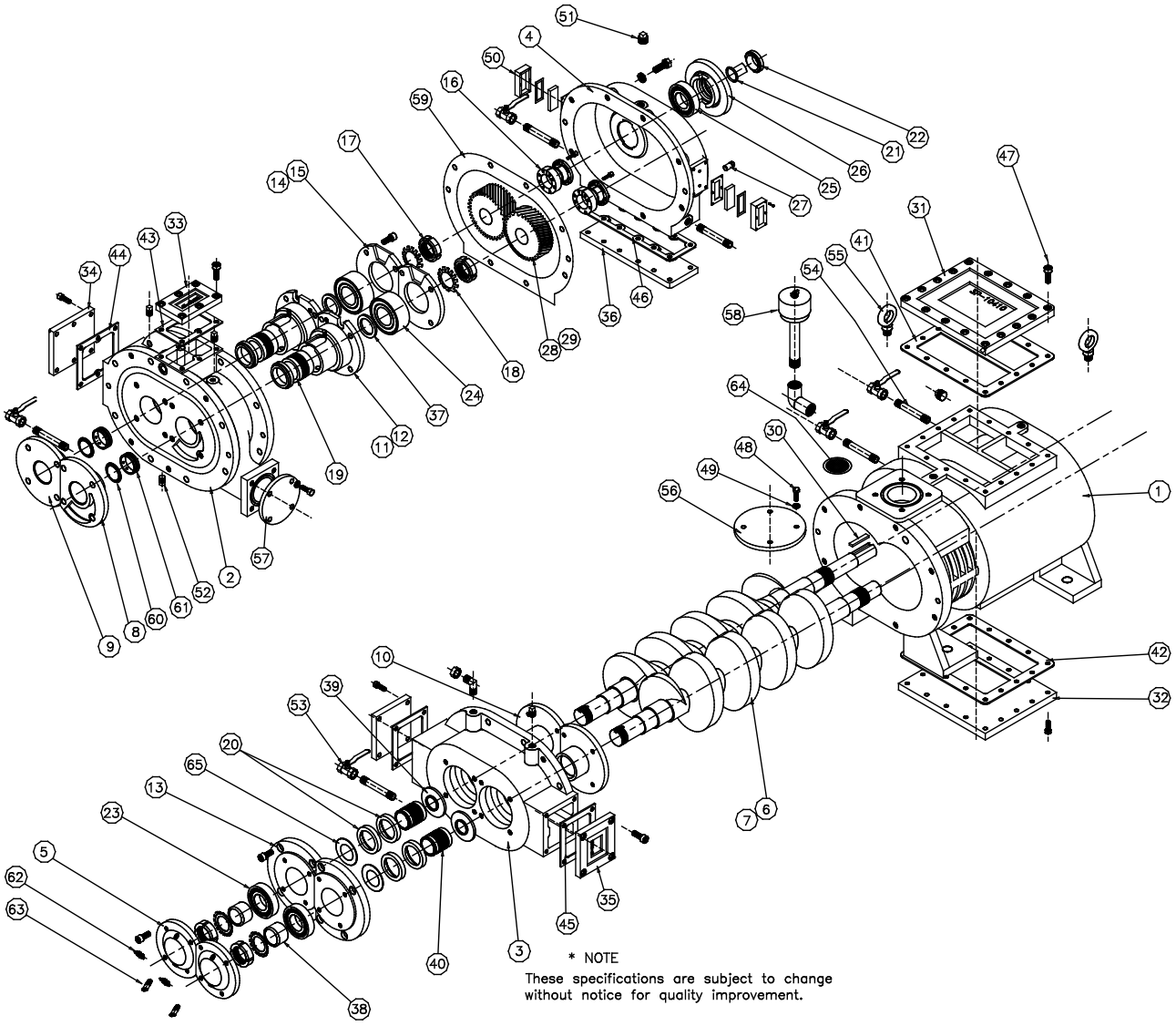


KDP-400 PARTS LIST

ITEM NO.	DESCRIPTION	QTY
1	Casing	1
2	Front End Plate	1
3	Rear End Plate	1
4	Front End Cover	1
5	Grease Cover	2
6	Driver Shaft (A)/Driver	1
7	Driver Shaft (B)	1
8	Plate Guide (A)	1
9	Plate Guide (B)	1
10	Plate Guide (C, D)	2
11	Bearing Holder (A)	1
12	Bearing Holder (B)	1
13	Bearing Holder (C)	2
14	Bearing Stopper (A)	1
15	Bearing Stopper (B)	1
16	Power Lock	2
17	Lock Nut	4
18	Lock Washer	4
19	Mech. Seal. Ass'y (A)	2
20	Lip Seal	4
21	Speedi Sleeve	1
22	Oil Seal	1
23	Roller Bearing	2
24	Ball Bearing	2
25	Ball Bearing	1
26	Seal Adapter Housing	1
27	Dowel Pin	6
28	Timing Gear (A)	1
29	Timing Gear (B)	1
30	Key-Drive Shaft	1
31	Blind Plate (A)	1
32	Blind Plate (B)	1
33	Blind Plate (C)	1

ITEM NO.	DESCRIPTION	QTY
34	Blind Plate (D)	1
35	Blind Plate (E)	2
36	Blind Plate (F)	1
37	Spacer (A)	2
38	Bearing Push Sleeve	2
39	Spacer (B)	2
40	Slip Sleeve	2
41	Blind Plate Gasket (A)	1
42	Blind Plate Gasket (B)	1
43	Blind Plate Gasket (C)	1
44	Blind Plate Gasket (D)	1
45	Blind Plate Gasket (E)	2
46	Blind Plate Gasket (F)	1
47	Socket Bolt	94
48	Hex Bolt	36
49	Spring Washer	130
50	Oil Sight Glass Ass'y	2 SET
51	Plug	4
52	Plug	4
53	Drain Valve	5
54	Nipple	6
55	Eye Bolt	2
56	Suction Cover Plate	1
57	Discharge Cover Plate	1
58	Air Filter	1
59	Gasket	1
60	Lip Seal	2
61	Lantern Ring	2
62	Grease Nipple Ass'y	2
63	Plug	2
64	Mesh Filter	1
65	R.E.P. Slinger	2

KDP-800 EXPLODED VIEW DRAWING



KDP-800 PARTS LIST

ITEM NO.	DESCRIPTION	QTY
1	Casing	1
2	Front End Plate	1
3	Rear End Plate	1
4	Front End Cover	1
5	Grease Cover	2
6	Driver Shaft (A)/Driver	1
7	Driver Shaft (B)	1
8	Plate Guide (A)	1
9	Plate Guide (B)	1
10	Plate Guide (C, D)	2
11	Bearing Holder (A)	1
12	Bearing Holder (B)	1
13	Bearing Holder (C)	2
14	Bearing Stopper (A)	1
15	Bearing Stopper (B)	1
16	Power Lock	2
17	Lock Nut	4
18	Lock Washer	4
19	Mech. Seal. Ass'y (A)	2
20	Lip Seal	4
21	Speedi Sleeve	1
22	Oil Seal	1
23	Roller Bearing	2
24	Ball Bearing	2
25	Ball Bearing	1
26	Seal Adapter Housing	1
27	Dowel Pin	6
28	Timing Gear (A)	1
29	Timing Gear (B)	1
30	Key-Drive Shaft	1
31	Blind Plate (A)	1
32	Blind Plate (B)	1
33	Blind Plate (C)	1

ITEM NO.	DESCRIPTION	QTY
34	Blind Plate (D)	1
35	Blind Plate (E)	2
36	Blind Plate (F)	1
37	Spacer (A)	2
38	Bearing Push Sleeve	2
39	Spacer (B)	2
40	Slip Sleeve	2
41	Blind Plate Gasket (A)	1
42	Blind Plate Gasket (B)	1
43	Blind Plate Gasket (C)	1
44	Blind Plate Gasket (D)	1
45	Blind Plate Gasket (E)	2
46	Blind Plate Gasket (F)	1
47	Socket Bolt	94
48	Hex Bolt	36
49	Spring Washer	130
50	Oil Sight Glass Ass'y	2 SET
51	Plug	4
52	Plug	4
53	Drain Valve	5
54	Nipple	6
55	Eye Bolt	2
56	Suction Cover Plate	1
57	Discharge Cover Plate	1
58	Air Filter	1
59	Gasket	1
60	Lip Seal	2
61	Lantern Ring	2
62	Grease Nipple Ass'y	2
63	Plug	2
64	Mesh Filter	1
65	R.E.P. Slinger	2

WARRANTY – VACUUM PRODUCTS

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Kinney (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 (Non-Piston Pumps)	15 months after date of shipment or 12 months after initial startup date, whichever occurs first
New (Piston Pumps)	30 months after date of shipment, on all units sold after June 1, 2014.
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.

June, 2014

OPERATING DATA FORM / PRODUCT REGISTRATION

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 vacuum booster, vacuum pump or the system. This information is also helpful when ordering spare parts.

Model No. _____ V-Belt Size _____ Length _____

Serial No. _____ Type of Lubrication _____

Startup Date _____ _____

Pump RPM _____ Operating Vacuum _____

Pump Sheave Diameter _____ Any other Special Accessories Supplied or in use:

Motor Sheave Diameter _____ _____

Motor RPM _____ HP _____ _____

NOTES: _____

IMPORTANT

All vacuum boosters and vacuum pumps manufactured by Kinney 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. You may also register your product online at www.md-kinney.com or contact Customer Service.

KINNEY®

For Service & Repair, Technical Support, or Product Sales contact:

Kinney
4840 West Kearney Street
Springfield, Missouri USA 65803-8702
O 417.865.8715 800.825.6937
F 417.865.2950
www.md-kinney.com

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