KINNEY® KT-VFP™ SERIES
Rotary Piston Vacuum Pumps

Models KT-840VFP KT-1350VFP

INSTALLATION
OPERATION
MAINTENANCE
REPAIR
MANUAL

WARNING

DO NOT OPERATE
BEFORE READING MANUAL

ISO 9001

6/2008

LEADING THE SEARCH FOR NEW SOLUTIONS

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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 ROTARY PISTON 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.

> 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, 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)

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INTRODUCTION

This manual applies to Kinney Vacuum KT Series models KT-840VFP and KT-1350VFP. You should be thoroughly familiar with these instructions before attempting to install, operate or repair this unit. Consult Tuthill Vacuum & Blower Systems when problems arise that cannot be resolved after reading this manual. Always include pump nameplate information when ordering parts or components.

SPECIFICATIONS TABLE

MODEL	UNIT	KT-840VFP	KT-1350VFP
Displacement at rated RPM	CFM / m^3/h	484 / 820	778 / 1325
Motor	HP / KW	30 / 22	40 / 30
Pump RPM	RPM	744	581
Oil Capacity	Gal / Liter	15 / 57	28 / 106
Cooling water minimum at 80° F (17° C)	GPM / l/m	2.5 / 9	3.5 / 13
Operating Weight	Lbs / Kg	3650 / 1660	4375 / 1989
Max Gas Ballast Flow	CFM / m^3/h	34 / 58	62 / 105
Typical Blank off pressure with 5% gas ballast	Torr / mBar	2 / 3	2 / 3
Ultimate Pressure (McLeod Gauge)	Torr / mBar	0.01 / 0.013	0.01 / 0.013

DESCRIPTION

The KT-Series pumps covered herein have an oil circulating pump to provide adequate lubrication at all pressures including atmosphere. The vacuum pump has three cams and pistons pumping in parallel, driven by a common shaft. The cams are positioned on the shaft so as to dynamically balance moving parts. This balancing technique applied to the Rotary Piston Principle was developed by Kinney Vacuum and virtually eliminates vibration.

Figure 1 shows a cross section of the pump with the pistons being driven by the cams and revolving within the cylinder.

Gas is drawn into the pump through a common inlet, channeled to the three piston slides and into the space behind the pistons as they rotate.

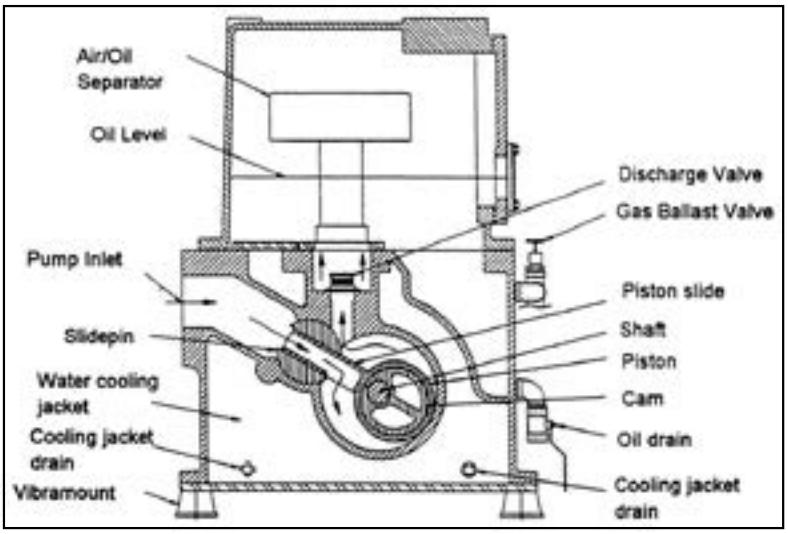


Figure 1. Typical Cross Section

The gas ahead of the pistons is compressed and forced out the discharge valves. As the gas is forced through the pump, sealing oil is mixed with the discharged gas and the discharged mixture is channeled into the separator, which is located in the reservoir, and there the gas is separated from the oil.

Sealing and lubricating oil is provided by the oil pump which is mounted on the non-drive head and driven by direct coupling to the vacuum pump drive shaft. The oil pump provides forced feed oil circulation at all operating pressures including atmosphere. All models have a channeled drive shaft with an opening at each cam to distribute oil through the pump.

Oil is taken from the reservoir at a point some distance above the reservoir bottom. This provides an area for impurities to collect for draining.

INSTALLATION

INSTALL VIBRASPRINGS

KT-840VFP & KT-1350VFP pumps are supplied with vibrasprings which enable them to run quietly and vibration free. The pump can be operated on any flat, level floor which will support its weight. The pump must be installed on the vibramounts and flexible connectors fitted in suction, discharge, water and electrical connections. It is not necessary to bolt the pump to the floor

If the studs provided are not already installed into the vibrasprings, thread the short end into the top of the mount (smaller diameter) up to the spacer portion of the stud. With the pump lifted off the ground, screw the vibrasprings into the four open threaded holes in the flanged edges of the cylinder, in line with the bottom plate/cylinder bolts, at each corner.

On the KT-1350VFP install one black spring at the belt drive end on the suction port side, one white spring at the oil mist eliminator end on the suction port side, and both gray springs on the gas ballast side. The vibrasprings may not work correctly if they are not installed in the correct locations.

Care must be taken to set the pump down squarely on the mounts when installing the pump in operating position.

SUCTION MANIFOLDING

Inlet manifolding should be sized and designed with these objectives in mind:

- To avoid gas flow restrictions
- To prevent pump fluids from entering the process chamber
- To protect the pump from the ingestion of particulate matter.
- To allow proper venting of the pump and suction manifold.

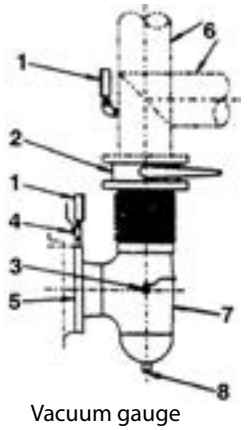
Under the normal conditions, the diameter of the manifolding should not be less than the diameter of the pump connection and the pipe length should be kept to a minimum.

Oil may splash from inside the pump through the suction port so the suction line must be designed to prevent oil from collecting there and draining back to the system or process. See Figure 2 for recommended arrangements as a guide for fabricating inlet manifolding.

A flexible connection should be installed in the suction manifold to provide freedom for vibramounts. The vacuum piping must be well aligned with the pump connections so as not to place a strain on the piping.

Provisions for gauge installation and any other drilling in the piping must be made prior to piping installation, otherwise, drilling particles entering the piping could be entrained into the pump.

A vacuum isolation valve should be installed adjacent to the suction port to be used for leak checking, shutting down the system, or blanking off the pump.



1. Vacuum gauge
2. Isolation valve
3. Air vent valve
4. Shut off valve
5. Pump suction flange
6. To system
7. Right angle flexible connector
8. Trap drain

Figure 2. Inlet Suction Elbow

PROPER VENTING

The vacuum pump must be properly vented to insure all oil is removed from the pumping chamber before the pump is turned off. Also, the suction line must be properly vented to insure oil does not migrate into the process chamber. Recommended vent valve sizes are: KT-840VFP - 1 ½ inch; KT-1350VFP - 2 inch

Vent valve must be open at least 10 seconds before the pump is turned off to remove all oil from the pumping chamber.

Before connecting the suction manifolding, distribute 4 quarts of oil over the three slide pins. This will require reaching through the suction port with a container and pouring oil directly onto the slide pins. Then rotate the pump by hand a minimum of two revolutions to distribute the oil throughout the pump interior.

During the initial operation and as long thereafter as necessary, a fine mesh screen should be installed across the inlet connection to prevent abrasive or solid particles left in the line from being sucked into the pump. This screen can be removed when particles no longer accumulate. If particles continue to accumulate, a filter should be installed in the line.

DISCHARGE MANIFOLD

KT-LP Series pumps have an integral oil mist eliminator which should prevent oil mist being present in the discharge manifolding. It may be necessary to pipe the pump exhaust fumes away from the pump area, such as out of doors. If this is done, the piping must be arranged to prevent line condensation from returning to the pump. A flexible connector should be fitted in the discharge line to provide freedom for the vibramounts.

Under the normal conditions, the diameter of the manifolding should not be less than the diameter of the pump connection and the pipe length should be kept to a minimum.

COOLING WATER

The cylinder cooling water jacket is shipped dry, with the drain plugs removed. They are tied to the pump in a small cloth bag. Replace the plugs in the positions shown in Figure 1 and fill the water jacket before starting the pump.

If an optional water flow modulating valve (Water Miser) is fitted, the cylinder may take 20 minutes or more to fill. The delay can be avoided by lifting the spring to open the valve.

WARNING: Fill the cooling water jacket before starting the pump.

Failure to ensure that the cooling water jacket is filled before starting the pump will result in localized overheating of the pump and cause extensive damage.

For installations requiring starting at ambient temperatures lower than 60°F (16°C), electric heaters should be installed in the water jacket. See Figure 4.

WARNING: Do not allow the cooling water to freeze in the pump.

Freezing of the cooling water jacket usually results in extensive damage to the pump cylinder which cannot be repaired.

Locate the water inlet and outlet connections which are labelled on the pump. Connect a water supply line with "on-off" valve to the water inlet, and an open drain to the water outlet. The inlet line should have a flow regulating valve. If the water supply is unreliable, it is advisable to install a flow switch to stop the pump or signal when the flow is interrupted. Normally the cooling water will be off when the pump is not running.

A water pressure relief valve (item 44 of the parts list) is fitted in the water jacket. This relief valve is set to open at 50 PSIG (3.5 bar). Standard cooling water rates are for up to 80°F (26°C) supply temperature and operation within the design continuous operating pressure range of .1 to 100 mm Hga. Sustained operation above 100 torr (130 mbar) and/or long pump downs generally require larger cooling water flow rate and/or external oil heat exchanger. Larger cooling water rate increases cooling efficiency reduces heat dissipation to room and keeps oil cooler (longer oil life and less oil loss through the oil mist eliminator).

FILLING THE PUMP WITH OIL

For initial oil filling and the first filling after the pump has been disassembled, the quantity of oil to be placed in the reservoir is one gallon less than shown in the specifications. One gallon is required in the suction port as outlined in "INSTALLATION, MANIFOLDING". Use oil recommended by Tuthill Vacuum & Blower Systems and see the specifications for the quantity of oil required to fill the pump. Remove the filler plug at the top of the separator housing and add oil until the level reaches the top of the sight gauge. The level will drop to below mid-center of the gauge once the pump is operated at blank off and the oil is distributed. Add or drain oil as necessary, to keep the oil level at blank off 3/8 inch (1 cm) up from the bottom of the glass. The oil level changes with operating pressure, reaching the lowest level at blank-off.

CAUTION: Do not overfill the pump.

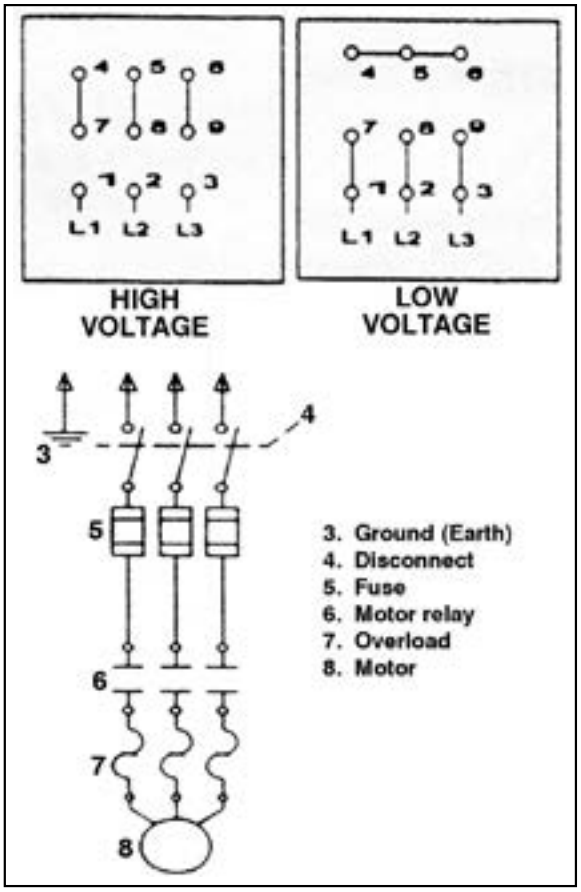


Figure 3. Typical Wiring Diagram

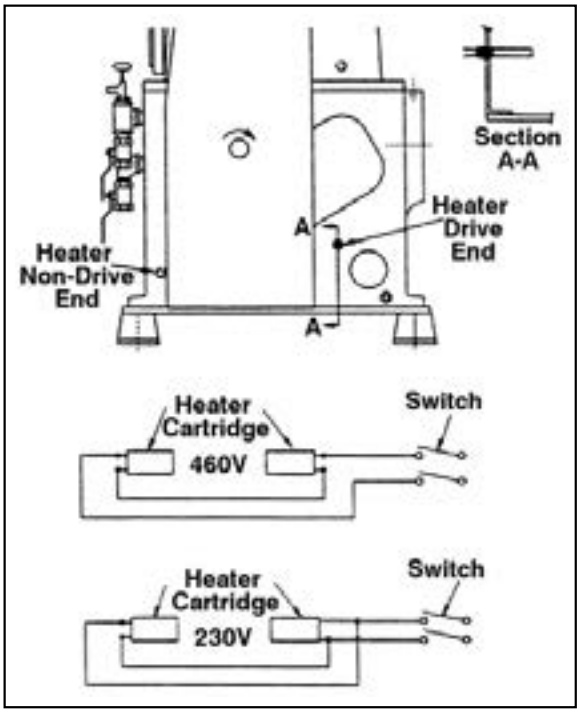


Figure 4. Heater Installation

ELECTRICAL CONNECTIONS

WARNING: Disconnect pump from source of electrical power prior to making repairs or adjustments to any electric component of the unit.

If the pump is not wired when received, wire the motor in accordance with Figure 3, which also illustrates optional controls such as system pressure switch, oil temperature and pressure switches and cooling water solenoid valve.

When wiring is completed turn the pump by hand to ensure that the pump is free to turn and then momentarily jog the motor to check that the pump rotation direction is clockwise when facing the drive end. If the pump rotates in the wrong direction reverse any two of the three motor leads. If a flow switch is provided it should be wired into the motor circuit with a relay so as to stop the motor in the event the cooling water flow is interrupted.

VACUUM GAUGES

The vacuum gauges to be installed on the pump must be selected to meet the requirements of the particular pump application. Two general types of vacuum gauges are used for the testing of vacuum equipment, total pressure such as thermistor or thermocouple gauges, and partial pressure reading McLeod gauges.

- The McLeod gauge indicates the partial pressure of permanent gasses. It does not indicate the component of pressure due to vapor such as water vapor. It is not greatly affected by vapor contamination unless the contamination pressure is quite high. It is most useful in confirming pump performance and for determining the absence or presence of leaks.
- A high thermistor or thermocouple gauge reading may indicate that the pump is contaminated or that it leaks, or both.
- A high McLeod gauge reading means that a leak is present.

OPERATION

GENERAL

WARNING: Do not operate the pump in an enclosed area unless the pump discharge is filtered or piped to open air. Prolonged inhalation of oil mist or vapors is a health hazard.

WARNING: Do not block or restrict the flow of gas from the pump discharge. Back pressure within the pump could cause severe damage. The belt guard must be properly secured to the pump at all times while the pump is running.

PRESTART CHECKS

Before starting the pump check the following items:

1. The installation has been made in accordance with the installation section of this manual.
2. The pump has been filled with oil and the cylinder has been filled with water, in accordance with the installation section of this manual.
3. If the pump has been idle for a month or more - Turn the pump by hand two or more revolutions to distribute oil internally through the pump.
4. The temperature of the pump oil is 60°F (16°C) or above. Optional pump heaters are available for installation in the cylinder water jacket.
5. Cooling water is available. Do not start the cooling water flow until the pump has operated a few minutes.
6. Drive belts are correctly tensioned. (See V-Belt Drive in Maintenance section).
7. Direction of rotation is correct.
8. Pump has been filled with oil

STARTING THE PUMP

1. Close the inlet isolation valve.
2. Close the vent valve.
   NOTE: If the pump was not vented when the pump was stopped, the following procedure must be used:
   a. Remove the power source from the pump.
   b. Remove the belt guard panel.
   c. Rotate the pump, in proper rotation, by hand using drive belts.
   d. Rotate at least 3 full rotations.
   e. Replace belt guard panel
3. Start pump
4. Open and adjust the cooling water flow as shown in the specifications.
5. Maintain oil level 3/8" up from bottom of sight when running at "Blank off." The circulating pump (Gear Pump) increases the oil pressure to 20 psi (1.4 bar), the check valve will open and oil will be forced into the pump through the main line.

6. Adjust the Gas Ballast (See the Gas Ballast section). The small gas ballast valve can be set to quiet the pump during blank off conditions and left open if an ultimate vacuum of 0.05 to 0.10 torr is acceptable.
7. Run the pump at blank off for 5-10 minutes and then with full gas ballast for 10-15 minutes before opening the suction of the pump to a higher air pressure.

STOPPING THE PUMP

1. Close isolation valve.
2. Open the vent valve while the pump is still operating.
3. Close gas ballast valve.
4. Stop pump. NOTE: The vent valve must be opened for at least ten seconds before removing power from the pump. This will allow all the oil in the pumping chamber to be transferred into the oil separator housing.
5. Shut off cooling water.
6. Close vent valve.

HANDLING LARGE QUANTITIES OF WATER

Use of the gas ballast valve enables Tuthill Vacuum & Blower Systems pumps to handle small to moderate amounts of water and other vapors in the suction gas stream. See the Gas Ballast section.

For applications where the vapor load exceeds that which can be handled by the gas ballast valve, consult Tuthill Vacuum & Blower Systems about Vapor Handling Systems, which can usually be retrofitted to existing pumps.

KT-Series pumps can accumulate ¾ to 2 ½ gallons of water depending on model, in the reservoir before the water level reaches the oil line pickup where it could circulate through the pump. If water or other condensate collects in the oil reservoir the water should be drained before the level reaches the oil line pickup. To drain water from the pump crack the oil drain valve and leave it open until any water accumulation has drained out. Drain the water as often as necessary.

GAS BALLAST

The gas ballast valve is shown in Figure 1. Gas ballast is used while the pump is running, to prevent internal condensation of oil insoluble vapors such as water, alcohol or acetone and to quiet the hydraulic noise when running pump at blank-off conditions.

When gas ballast is used, the ultimate pump pressure increases, more oil mist is created in the pump discharge, and power consumption increases slightly (within the standard motor rating). Pump noise can be generally eliminated by using a small flow of gas ballast with only slight increase in ultimate pump pressure.

Continuous use of gas ballast is recommended where the process pressure requirements can be met with the gas ballast valve open; otherwise, intermittent use of gas ballast between process cycles is suggested. If use of gas ballast at neither of these times is tolerable it is advisable to run the pump, using gas ballast, when process work is not being done such as overnight.

Use the gas ballast valve as follows:

1. Continuous gas ballast. With the pump operating, open the gas ballast valve until the ultimate pressure is slightly below that needed for the process. Operate the pump in this manner continuously to aid in preventing oil contamination.
2. Intermittent gas ballast during processing. With the pump operating, fully open the gas ballast valve during periods when this will not affect the process (work preparation, recycling, etc..). This will aid in cleaning the oil.
3. Continuous gas ballast when not processing. With the pump operating, but isolated from the process, fully open the gas ballast valve. If convenient, operate the pump overnight in this manner to clean badly contaminated oil. Gas ballast will remove vapor contamination but will not remove solids such as varnish.

If it is necessary to clean the oil using gas ballast in the short period, the time needed can be estimated as follows: Open the gas ballast valve fully and operate the pump for a short period (15 to 20 minutes). Close the gas ballast valve for 1 to 2 minutes and observe the pressure change. Use the “pressure change versus time” as a rough guide to estimate the total time required to obtain the desired blank-off pressure.

MAINTENANCE

PERIODIC MAINTENANCE

There is no fixed interval for changing pump oil, since applications vary widely. This can be determined only by experience and/or by deterioration of pump performance. As a minimum, the pump oil should be changed after each six month logged period of operating.

At high pressures, or with a gas ballast flow the oil level should be higher than it is when operating at low pressures near blank off. If there are no changes in the oil level, check for obstructed oil passages. Check the condition of the oil periodically by draining a small quantity of oil into a clean container and visually inspecting it for solid or liquid contaminants. Clean strainer after oil pump (KT-840VFP and KT-1350VFP).

OIL CONTAMINATION

When the pump has operated satisfactorily for some time and then gradually the vacuum becomes poor, clean the oil by applying gas ballast, or change the oil as directed in the Changing the Oil section. A change in the color of the oil does not necessarily mean that is not satisfactory for use. On the other hand, vapors may contaminate the oil and not show any color change.

The following factors may cause the pump oil to deteriorate:
- Water and solvents will lower viscosity
- Solid accumulation will increase viscosity and "feel gritty'
- Polymerization and chemical attack on oil will increase viscosity and odor

As a "Rule of Thumb" the oil should be changed if the oil "feels gritty" or:
- Viscosity changes more than 100 SSU at 100°F (38°C).
- Oil color becomes opaque
- Smells burnt or acrid smell occurs
- Total Acid Number increases to 0.3

If oil contamination is suspected, change the oil and operate the pump for 15 to 30 minutes. Repeat this procedure as required to flush out all contaminants from the pump or operate the pump with gas ballast as explained under Gas Ballast. See gas ballast and water handling instructions under OPERATION. Oil filtration systems are available for filtering solid, water, and acids continuously or periodically.

CHANGING THE OIL

Run the pump until the oil reaches normal operating temperature 145 to 165°F, (63 to 75'C' below 100 torr (130 mbar). Stop the pump, place a container under the oil drain valve and open the valve until the oil is removed from the pump, then close the valve.

If the oil is being drained due to oil contamination it is advisable to drain the oil from the discharge valve well. The well is between the pump cylinder and separator housing, the oil trapped there can be drained by removing the pipe plug(s) from the cylinder located above the heads. On the KT-840VFP only, also remove the pipe plug level with the oil drain valve connection and near the left hand corner of the cylinder when facing the drain valve.

When the oil has drained from the pump close all drains and fill the pump with the quantity and type of oil shown in the specifications. The oil level will show above the center of the sight gauge until the pump is started and the oil is distributed through the pump.

LUBRICATING THE PUMP

The lubricating Gear Pump is mounted on the closed head and is driven directly by the vacuum pump shaft. Failure of the gear pump may be detected by deteriorating performance, noise, unusually high temperature and lower temperature of oil line tubing. The tubing should be nearly the same as the oil temperature or 145 to 165°F(63 to 75°C).

The KT-1350VFP has an oil pressure gauge that should indicate at least 20 psig.(1.4 bar). The other pumps have a plug that may be removed and a pressure gauge or switch added. Caution - these pumps do not have a bypass valve on the oil pump and pressure may exceed 150 psig (10 bar) on cold start up.

STALLING

If the pump stalls at any time, it may be due to loose belts, lack of lubrication caused by failure of the oil circulating pump, badly contaminated oil, coating build up or foreign matter in the pump or oil line strainer (KT-1350 and KT-840VFP). If the pump cannot be turned over freely by hand after cooling, there is foreign matter in the pump and the inside of the pump must be cleaned. Sometimes

a process related coating build up can be removed by soaking the pump with the proper solvent (turning by hand) - check with Tuthill Vacuum & Blower Systems. Inspecting the inside the pump is covered under "DISASSEMBLY."

PUMP LEAKS

If the pump is suspected of having an air leak, after eliminating oil contamination as the cause of poor performance, use a plastic sealing compound to seal over suspected areas, such as joints, connections plugs and any penetrations into the vacuum area and check pump blank off performance. If gasketed connections are suspected, remake the connections. Plastic sealing compound may be used to make temporary gaskets; these should not be made too thick since the material may be squeezed into the pump. Check the shaft seal for mechanical defects, such as a cracked carbon washer or hardened rubber components.

For checking leaks, a fast acting total pressure gauge used with acetone or a sensitive freon leak detector can be used. A helium leak detector is the most convenient to use if available.

CHECKING PUMP PERFORMANCE

If the processing time or the ultimate pressure becomes poor with no recent changes in the process or in system configuration, test the pump to determine if the trouble is in the pump or the connected process equipment. To check the condition of the pump, measure the blank off pressure as directed below using a McLeod gauge. If possible, also read the blank off pressure with a thermistor or thermocouple gauge.

1. To read the blank off pressure, close the pump inlet by means of a vacuum valve or blank off plate.
2. Connect a vacuum gauge to the suction side and position the gauge tube, facing downward in the higher area of the manifolding so that the tube will not become flooded and blocked by splashing pump oil. If the pump is disconnected from the process equipment, connect a 90 degree elbow, extending upward, to the inlet flange and bolt the blank off plate, with gauge connection, the open elbow flange.
3. Operate the pump for a minimum of 15 minutes and record the lowest pressure reached. Average blank off readings are 5 to 25 microns with a McLeod gauge, and 10 to 100 microns with a thermocouple gauge. The specification pressure is 10 microns, McLeod gauge reading. If the McLeod gauge reading is low and the thermocouple gauge reading is high, the pump oil is contaminated, see Oil Contamination. A high reading of both the McLeod and thermocouple gauges indicates that an air leak is present.

CHECKING PROCESS EQUIPMENT

Attach a vacuum gauge (See Installation, Vacuum Gauges) to the connection on the system side of the isolation valve. For this test, the system should be clear of any process work which might give off vapors and change the reading. Run the pump to obtain the best vacuum possible with the valve open, then close the valve and observe the pressure rise. If the pressure rise is greater than desired, the leaks should be eliminated. Check the system carefully for loose joints and obvious leaks. Use a leak detector if available. The trouble can be isolated further by applying the following procedures:

Isolate each segment by valves or blank off plate at convenient locations. Pump down each segment of the process equipment individually, starting at the segment closest to the vacuum pump.

Check the lowest pressure attainable when each segment is added. If the pressure is close to that obtained previously, add the next segment. If the pressure is not, leak test the last segment.

When leak-checking process chambers, start at the air and gas inlet valves, doors, sight ports, electrical and mechanical feedthroughs, gauge tube fittings, and any other gasketed penetrations and O-ring connections. After a suspected leak has been found, cover it with plastic sealing compound, such as Apiezon Q, and check the equipment performance before sealing the leak permanently. Thus, all permanent repairs can be made at the same time.

If a leak detector is not available, use the following methods to locate leaks:

1. Cover suspected leaks with a low vapor pressure sealing compound (such as Apiezon-Q, James Biddle Company or Shell Company; or Duxseal, Mansville Corp). Do this while pumping on the equipment and monitoring the pressure. A sudden decrease in pressure indicates that a leak has been covered. Repair leaks permanently as necessary.
2. If the leak is large, causing pressures over 1 torr (1 mbar), pressurize the process equipment with one psig (70 mbar) of clean compressed air and paint a soap solution on suspected leak areas and bubbles will indicate leaks.
3. If the leak is small causing pressures less than 1 torr (1 mbar), use a fast acting medium such as acetone, alcohol, freon, or helium. Position the vacuum gauge head downstream from the suspected leak area, between the leak and pump. When the pressure has been reduced so that the gauge may be used, apply probing medium to suspected leak areas using a squirt gun or brush. If the probing fluid is directed at the leak or an area close to it, a sudden change in pressure will occur. Cover suspected leak with plastic sealing compound and continue leak checking until desired pressure is obtained.
4. If leak checking fails, disassemble and remake all demountable joints and connections using new gaskets or vacuum sealing

compound such as Loctite 515. Temporary gaskets may be fabricated from plastic sealing compound but these should not be made too thick since the material may be squeezed into the equipment.

DISCHARGE VALVES

If the cause of poor pump vacuum is not due to leaks or oil contamination, the next step is to inspect the discharge valves (see Figure 5). The discharge valves are located at the exhaust port of each chamber. They should not cause trouble unless they are mechanically damaged or are prevented from sealing properly due to foreign matter on the valve seat Under normal pump usage, the valves should be replaced annually. When the pump is operating at blank-off without gas ballast, a sharp hydraulic noise (click) indicates proper valve operation.

The poppet type valve has six flat, washer-like springs which press against a sealing disk. The disk fits against a seal forming a tight seal. The springs are maintained in place by a lift stop and the entire valve is held together by a capscrew. The valves are attached to the cylinder by means of screws and a hold-down plate.

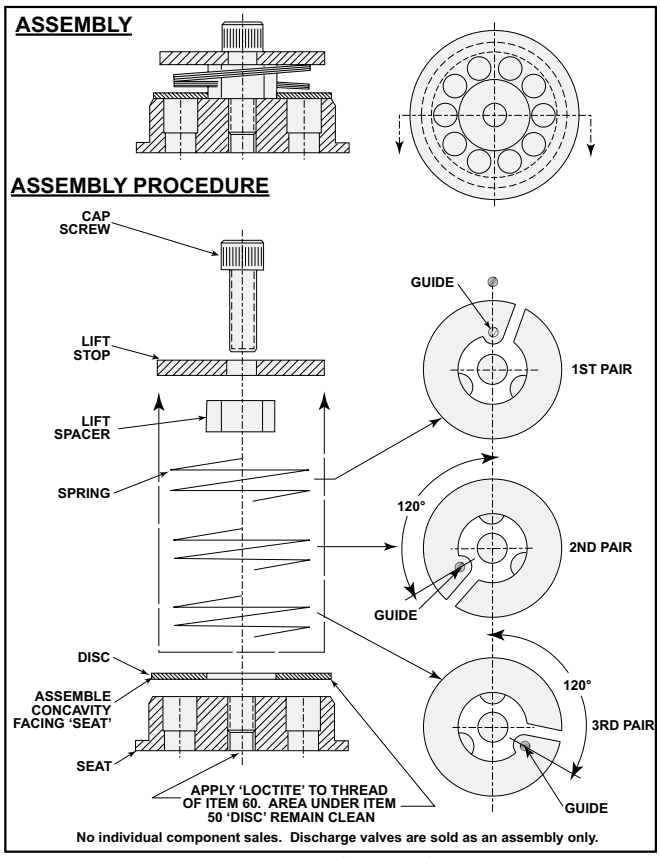


Figure 5. Discharge Valve

To inspect the discharge valves, proceed as follows:

1. Drain oil from the pump and remove the separator housing cover.
2. Unscrew the air/oil separator from the top of the valve deck cover.
3. Remove the capscrew ive, scoop the oil out of the valve cavity with a small container. Remove cap screws in valve hold down plates and lift out valve plates with valves. NOTE: Absence of oil in this chamber is an indicator of discharge valve leakage.
4. Inspect the valves by snapping the valve disk or lower valve spring away from the valve seat to check for spring tension and mechanical defects. Inspect the sealing surfaces for dirt or other foreign material. Check that the disk or lower valve spring has not warped (dish shape) as they must be flat for full contact. If a more careful inspection is required, remove the cap screw(s) holding the valve together. When reassembling the valve, replace valve components in exactly the same position as before.

SHAFT SEAL ASSEMBLY

Under normal conditions, the shaft seal has a long trouble-free life. It may become worn or scratched on the sealing face by dirty sealing oil which also lubricates the shaft seal, or it may be damaged by excessive heat due to poor lubrication.

If oil drips from the shaft seal and bearing housing, it is an indication that the shaft seal should be inspected, and replaced as necessary. The drain plug of the shaft seal and bearing housing should be removed as long as oil is leaking past the shaft seal. If oil, which has leaked from the shaft seal, is allowed to drain through the bearing it will wash the grease from the bearing and cause it to fail.

To inspect the seal, proceed as follows:

1. Remove the pump panels and belts.
2. Remove the pump pulley and drive key from the shaft.
3. Remove the shaft bearing and housing. (a) Remove the outboard bearing retainer nut from the shaft. (b) Remove the capscrews holding the bearing housing and remove it.
4. Inspect the face of the running surface for dirt, scratches, or grooves which might cause leaks into the pump. A smooth shining carbon face indicates a good seal. A crease across the sealing ring, a dent, or scratch in the running face makes a direct leak through the seal. Cracks or hardening of the rubber parts indicate that they were exposed to excessive operating temperatures and need replacement.

V-BELT DRIVE

Before attempting to tension the V-belt drive it is imperative that the sheaves be properly aligned. V-belts should be replaced in sets and the sheaves should be positioned so as to allow the belts to be placed in the grooves without rolling them onto the sheaves. The following tensioning steps can be safely followed for all belt types, cross sections, number of belts per drive, or type of construction.

1. With belts properly in their grooves adjust the sheaves until all slack has been taken up.
2. Start the drive and continue to tension the V-belt(s) until only a slight bow on the slack side of the drive appears while operating under load conditions.
3. After 24 to 48 hours of operation the belts will seat themselves in the sheave grooves. Further tensioning is then necessary as described in Step 2.

The belts should not slip if they are correctly adjusted and the correct starting procedure is used. A screeching noise at start-up may indicate the belts are too loose. Belt dressing should not be used on V-belts. Sheaves and V-belts should remain free of oil and grease. Tension should be removed from belts if the drive is to be inactive for an extended period of time.

OIL MIST ELIMINATORS

KT-VFP Series KT Pumps are supplied with integral, dual element, high efficiency oil mist eliminators. The KT-840VFP and KT-1350VFP have a vertically attached OME housing and elements.

The KT-840VFP and KT-1350VFP use a Suckback Kit, which uses an external flexible tube connected from the upper box of the OME to the metering valve of the gas ballast assembly to return oil dropout from the filters to the pump.

If any of these pumps are to be run, for extended periods of time, at pressures above 150 torr, consult the factory for High Pressure Oil Suckback Kits. These Kits allow oil to be returned directly to the pump suction.

BELT GUARD LOCK

The vacuum pumps are supplied with a hinged and locked belt guard section for ease of maintenance when changing a drive belt or checking the belt tension. The cam type lock is operated with a 5/16" or 8mm hex wrench inserted through the grommet in the guard, on the suction side of the pump. Rotate the wrench in a counterclockwise direction to release the lock. The door may then be opened. The door section may be lifted off the hinges if necessary. When closing the door be sure that the alignment pins go into their mating holes which are just above and below the lock mechanism. Rotate the hex wrench in a clockwise direction to engage the lock and secure the door. Leave a slight gap [approx. 1/8" between the sections. Remove the hex key before starting the pump.

CAUTION: Do Not open the belt guard while the pump is operating, or operate the pump without the door section in place and locked.

PANEL REMOVAL AND INSTALLATION

The LP KT-LP Series Pumps are supplied with panels to cover the drive and non-drive sides of the pump, as well as a hinged door to allow access to the oil drain valve and the gas ballast valves. The panels are secured with snap type fasteners to allow removal for access to the drive belts and the pump itself. To remove a panel, grasp it at its lower sides and pull out to release the lower catches, then slide your grip the sides and pull out at the top to release the upper catches. To attach a panel, align the strikes to the center of the latches at the top of the panel and push in firmly to engage. Swing the lower part of the panel into position and push in to engage.

CAUTION: Do Not remove the drive side panel while the pump is operating, or operate the pump without the drive side panel in place.

DISMANTLING & REASSEMBLING

DISMANTLING

The following steps are for complete disassembly of the pump, however the pump should be disassembled only to the extent necessary for servicing. Refer to the illustrations and parts list as needed. Note that the open head is the head through which the shaft extends, and closed head is head on which the oil pump is mounted.

1. Disconnect all manifolding, water lines, and electrical connections and drain the oil.
2. Remove the belt guard and belts.
3. Remove the oil lines from both ends.
4. Remove the sheave from the motor and the motor from the top of the pump.
5. Remove the pump sheave and drive key.
6. Remove the oil sight gauge from the separator cover. Remove the separator cover from the separator.
7. Unscrew the air/oil separator assembly. Remove the valve cover from the cylinder.
8. Remove the discharge valves. If valves are disassembled, careful note should be made for proper reassembly.
9. Remove the separator housing and gasket from the cylinder.

CAUTION: The separator housing has threaded holes to receive eye bolts for lifting the pump. When the separator housing is removed, do not attempt to lift the pump cylinder by using the gas ballast or oil drain piping to attach or support rigging for hoisting the cylinder.

10. Remove the bearing, housing and stationary parts of the shaft seal.
11. Unscrew the retainer nut from the shaft.
12. Remove the cap screws from the housing.
13. Remove the rotating part of the shaft seal.
14. Remove the oil pump and housing from the closed head. Remove the closed head using two securing bolts as jackscrews to break the seal between head and cylinder after all securing screws are removed. Press the sleeve bearing from the head.
15. Withdraw the slide-pin, piston and cam.
16. Remove the retaining ring from the shaft. Loosen the socket head self-locking screws in the removable wall to release the pins securing the wall to the cylinder. Remove the wall, being careful not to cock it as it is removed.
17. Withdraw the piston, slide-pin and piston.
18. Remove the open head following the same procedure as removing the closed head and press the bearing from the head.
19. Withdraw the piston, slide-pin and cam.
20. The shaft and center cam can be taken out the closed head end of the pump. Press the center cam from the shaft.

REASSEMBLY

Thoroughly clean all parts and remove harmful rough or sharp areas before reassembling. Do not use solvents such as kerosene or carbon tetrachloride for cleaning unless facilities are available to evaporate them by vapor degreasing or washing with acetone or alcohol. When reassembling, all parts must be coated with vacuum oil.

1. Place keys in the shaft grooves and press center cam on shaft until it Is against the shaft shoulder. It may be desirable to heat the cam in vacuum oil to approximately 300°F (150°C) for easier assembly.
2. Temporarily mount open head (with sleeve bearing pressed in) using two dowel pins for alignment and secure with three capscrews. This will support shaft when assembling closed head end of pump.
3. From the closed head side, move the shaft through the hole in the stationary wall until the center cam is against the wall.
4. Place the slide-pin over the slide on the center piston with the flat edges of the slide-pin toward the piston and with the cap end to the left when facing the inlet ports.
5. With the piston port facing downward, insert the piston and slide-pin into the cylinder.

CAUTION: If the inlet ports on the piston face the wrong way the piston can not pump.

6. Carefully clean the removable wall seating shoulder. Insert the beveled ends of the dowel pins into the outside edge of the floating wall. If necessary, use vacuum grease to hold the pins in the holes. Slide the removable wall into the cylinder from the closed head side with the crescent shaped cutout in the wall oriented to fit around the slide-pin. Place two pieces of .005 inch (.127 mm) shim stock at the ends of the cutout between the slide-pin and removable wall. Screw new lock screws into the removable wall and with the wall firmly against the cylinder shoulder, tighten the socket head set screws to drive the dowel pins out against the cylinder to secure the wall in place. When tightening the center wall set screws, do not exceed a torque of 90 in-lbs as damage to the cylinder may result. Remove the two pieces of shim stock.

CAUTION: Lock screws in the removable wall should not be reused.

7. Place the retaining ring on the shaft. Insert the cam keys in the shaft grooves and tap the outer cam onto the shaft with the threaded holes of the cam outward.

8. Place the closed head slide-pin on the piston slide with the flat edge toward the piston. With the inlet ports facing down, insert the piston and pin into the cylinder.
9. Press the sleeve, bearing into the closed head. Apply a thin coat of Loctite 515 or equal, sealing compound to the sealing surfaces of the head and cylinder. Insert the two dowel pins into the cylinder and install the closed head. Tighten cap screws evenly.

CAUTION: Sealing compound must be used sparingly to prevent squeezing it into the pump when tightening heads. Allow compound to become tacky before installing heads.

10. Place the cam keys in the shaft grooves and tap the outer cam onto the shaft with the threaded holes of the cam outward.
11. Place the open head slide-pin on the piston slide with the flat edge toward the piston and insert the piston and pin into the cylinder with the inlet ports of the piston facing down.
12. Install the open head the same as the closed head.
13. Slip the backup ring on the shaft and install the rotating part of the shaft seal.
14. Press the stationary part of the shaft seal in the bearing housing and install the bearing housing. Install the bearing on the shaft and into the housing and replace the lock nut on the shaft.
15. Install discharge valves. Replace the valve deck cover and air/oil baffle assembly.
16. Install the separator housing and gasket.
17. Replace the oil sight gauge and replace the separator housing cover and gasket.
18. Replace the housing and oil circulating pump. Replace all oil lines and components.
19. Replace the motor and sheaves.
20. Replace and tension the V-belts and install the belt guard.
21. Reach through the suction port and pour 4 quarts (2 litres) of oil on the slide-pins and finish filling the pump with oil
22. Connect the electrical, water and manifolding connections to the pump.
23. Run the pump and test that the pump can obtain satisfactory ultimate pressure.

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	REMEDY
System ultimate pressure excessively high	Process equipment contaminated by high vapor pressure material	(a) Clean equipment with acetone,alcohol or ether (b) Pump down with vacuum pump overnight
	Process equipment or pump leaks.	Leak check process equipment, repair leaks as necessary
	Oil flow restricted, oil level should change with pump pressure	Correct oil flow. Remove restrictions.
	Vacuum pump oil contaminated	Change pump oil. See CHANGING PUMP OIL, and OIL CONTAMINATION
	Discharge valve malfunctioning	Check valves per DISCHARGE VALVES
	Vacuum pump shaft seal malfunctioning	Check shaft seal per SHAFT SEAL
	Vacuum pump internal parts worn or damaged	Dismantle pump and inspect internal parts. See DISASSEMBLY
	Hydraulic noise of pump discharge	Open gas ballast valve
Pump stalls	Electric power loss	Check power at motor
	Belts slipping. Pump malfunctioning.Pump oil contaminated or pump is not sufficiently lubricated.	See INSTALLATION, V-BELT DRIVE,and CHANGING THE OIL.
	Foreign material or coating build up inthe pump	Clean the pump
	Pump discharge line is blocked	Clear pump discharge line. Check oil mist eliminator for blockage.
Pump will not start	Electrical Failure	Check for power at motor, Check motor start controls and motor.
	Pump flooded with oil	Clear oil from pump by turning pump over by hand, or disassembling pump. Verify that vent and discharge valves are fuctioning properly
	Pump too cold	See OPERATION, GENERAL
	Foreign particles in pump	Disassemble and clean pump.
Pump vibrates	Inlet or outlet connections not flexible	Use Tuthill Vacuum & Blower Systems connectors or more flexible connectors
	Vibration mounts incorrect or not positioned properly	Check to ensure that vibration mounts are correctly installed
Oil in pump inlet piping	Piping at incorrect level	Add inlet elbow
	Gas ballast valve left open when stopping the pump	Add manual or automatic valve
	No isolation valve and vent valve	Add vent valve

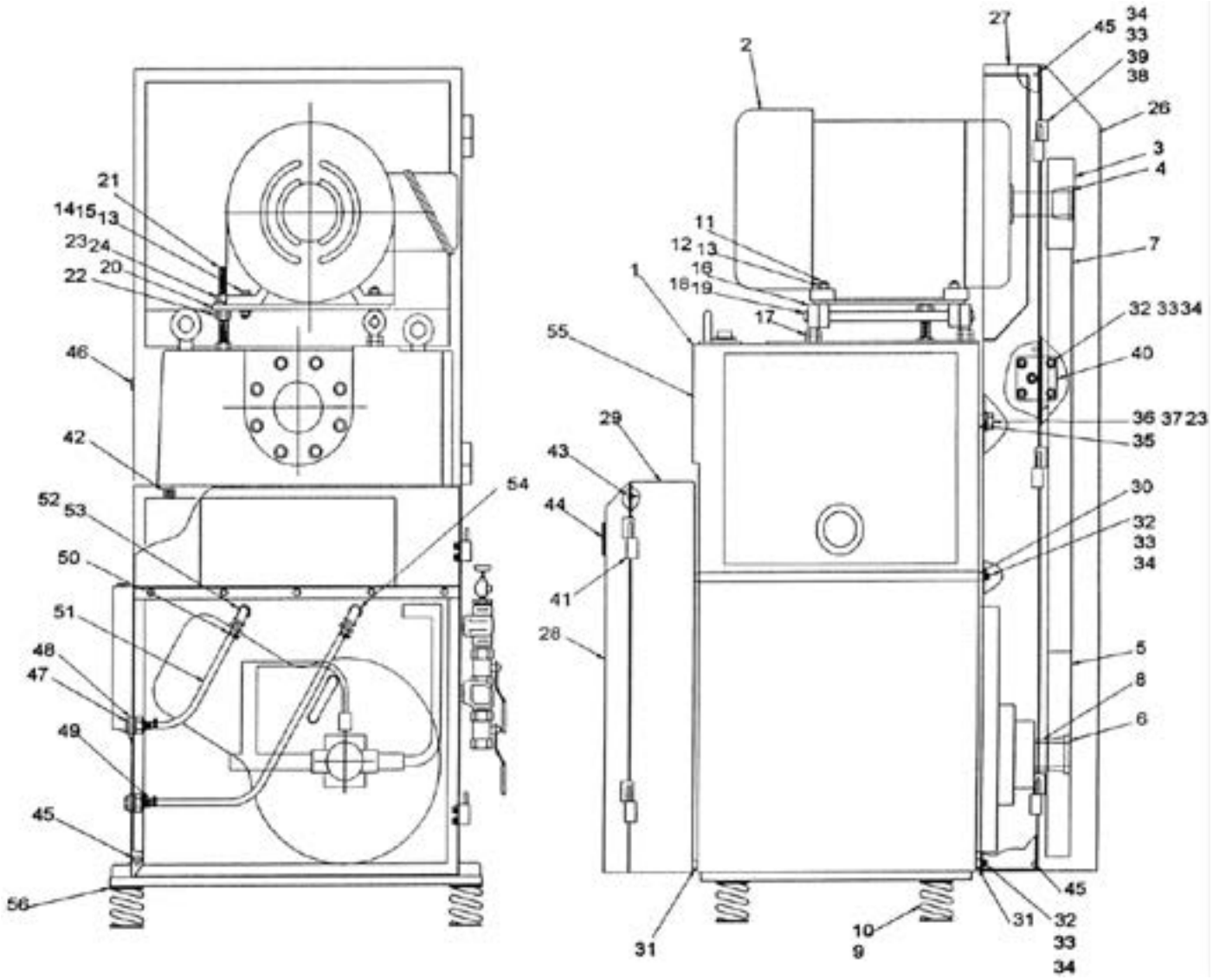
REPLACEMENT PARTS

Replacement parts for the KT Series version pumps used with standard hydrocarbon vacuum pump oil are shown on the following pages. Some parts such as pistons and cams may be used in several models of pump, and individual item numbers may have a description which includes other model numbers.

Many pumps are ordered and equipped with special modifications and accessories, or adaptations for special fluids. Therefore when ordering spare parts the pump model and nameplate serial number must always be provided to insure verification and shipment of the correct parts.

NOTES

KT-840VFP & KT-1350VFP FINAL PUMP ASSEMBLY



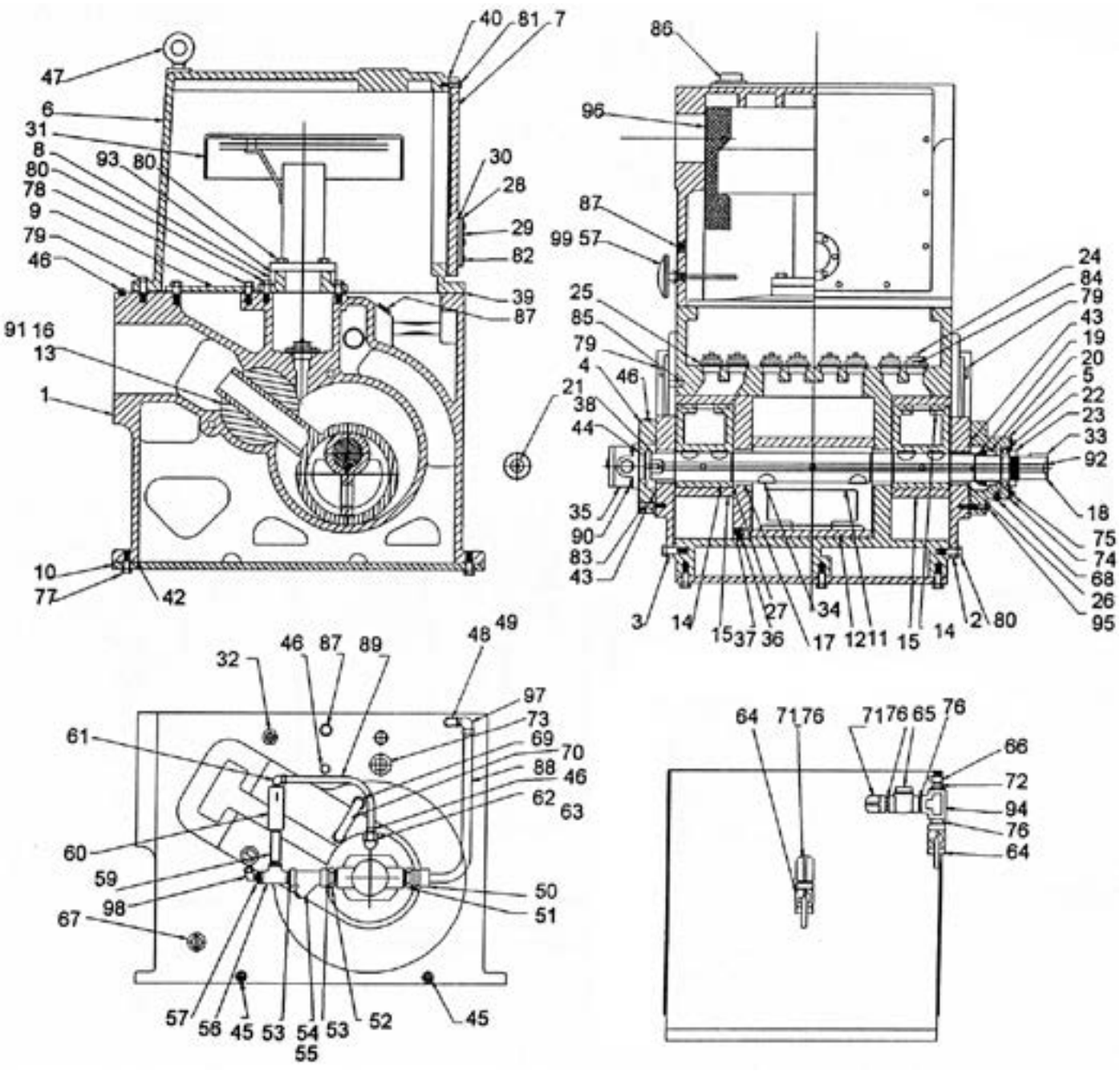
KT-840VFP FINAL PUMP ASSEMBLY

ITEM #	DESCRIPTION	QTY
1	T0500D PRODUCTION ASSY	1
2	MOT TE 30 1725 286T 230/460	1
3	SHV, 3-B-6.6-0	1
4	QD BSHG-SD-15/8	1
5	SHV,3-B-1 6.0-0	1
6	QD BSHG-SK-15/8	1
7	V-BELT 3/BX-120 BAND	1
8	SLV,SHV SPR	1
9	VIBSPR, BLUE	4
10	STUD 12-13X2	4
11	ROD END - MOTOR	2
12	HNUT,JAM 1/2-20	2
13	LKW 12REG SPR	4
14	HHCS12-13-6/4	2
16	ROD END 3/4M	2
17	NUT,JAM 3/4-16, ZINC COATED ST	4
18	HINGE PIN	1
19	RINGRTNG.75EXT	2
20	MOTOR HINGE PLATE	1
21	HHCS3/4-10-6	1
22	HNUT,JAM 3/4-10	2
23	LKW 3/4REG SPR	1
24	HEXNUT 3/4-10	1
25	PANEL SET	1
30	SPACER BAR - KT840	2
31	12" OD SPCRXI2" LGX.252 ID	4
32	HHCS1/4-20-1	18
33	PLW ¼	38
34	LKW 1/4REG SPR	38
36	HHCS 3/4-16X1-1/2 LG	2
37	PLW ¾	2
38	HINGE, OFFSET, RH	3
39	HHCS1 /4-20-1 /2	20
40	LOCK, STD ROTOLOCK W/LCH/RCPT	1
41	HINGE, OFFSET, LH	2
42	PANEL LATCH	1
43	PANEL STRIKE	1
44	DOOR PULL	1
45	DOOR SILENCER	3
46	GROMMET 3/8"	1
47	BULKHEAD FITTING	2
48	WASHER SAE 2" O.D.	2
49	CPLG,H3/8X3/8PT	4
50	HOSE CLP ½	4
51	HOSE 3/8 ID	36 IN.
52	ELB, 90 X 3/8	2
53	NIP 3/8 X 1-1/2	2
54	HHBSHG1/2X3/8	1
56	ENDPL,VIBRMT850	1

KT-1350VFP FINAL PUMP ASSEMBLY

ITEM #	DESCRIPTION	QTY
1	T0850D PRODUCTION ASSY X	1
2	MOT TE 40 1725 324T 230/460	1
3	SHV, 3-5V-7.1 -0	1
4	QD BSHG-SF-17/8	1
5	SHV,3-SV-21.2-0	1
7	V-BELT 3/5VX-1400 BAND	1
8	SLEEVE, LOCKNUT RETAINER	1
9	VIBSPR,BLACK	1
9	VIBSPR, WHITE	1
9	VIBSPR, GRAY	2
10	STUD 1/2-13X2	4
11	ROD END - MOTOR	2
12	HNUT 5/8-18	2
13	LKW 5/BREG SPR	4
14	HHCSS/8-11-7/4	2
16	PILLOW BLOCK	2
17	SHCS12-13-2	4
18	HINGE PIN	1
19	RINGRTNG.75EXT	2
20	HINGE,PLATE	1
21	HHCS3/4-10-6	1
22	HNUT,JAM 3/4-10	2
23	LKW 3/4REG SPR	1
24	HEXNUT 3/4-10	1
25	PANEL SET - KT1350	1
30	SPACER BAR - KT1350	2
31	1R" OD SPCRXI2" LGX.252 ID	4
32	HHCS1/4-20-1	21
33	PLW 1/4	38
34	LKW 1/4REG SPR	38
36	HHCS 3/4-16X1-1/2 LG	2
37	PLW 3/4	2
38	HINGE, OFFSET, RH	3
39	HHCS1/4-20-12	20
40	LOCK, STD ROTOLOCK W/LCH/RCPT	1
41	HINGE, OFFSET, LH	2
42	PANEL LATCH	2
43	PANEL STRIKE	2
44	DOOR PULL	1
45	DOOR SILENCER	3
46	GROMMET 3/8"	1
47	BULKHEAD FITTING	2
48	WASHER SAE 2" O.D.	2
49	CPLG,H3/8X3/8PT	4
50	HOSE CLP 1/2	4
51	HOSE 3/8 ID	48 IN.
52	ELB, 90 X 3/8	2
53	NIP 3/8 X 1-1/2	2
54	HHBSHG12X3/8	1

KT-840VFP & KT-1350VFP MAIN PUMP ASSEMBLY

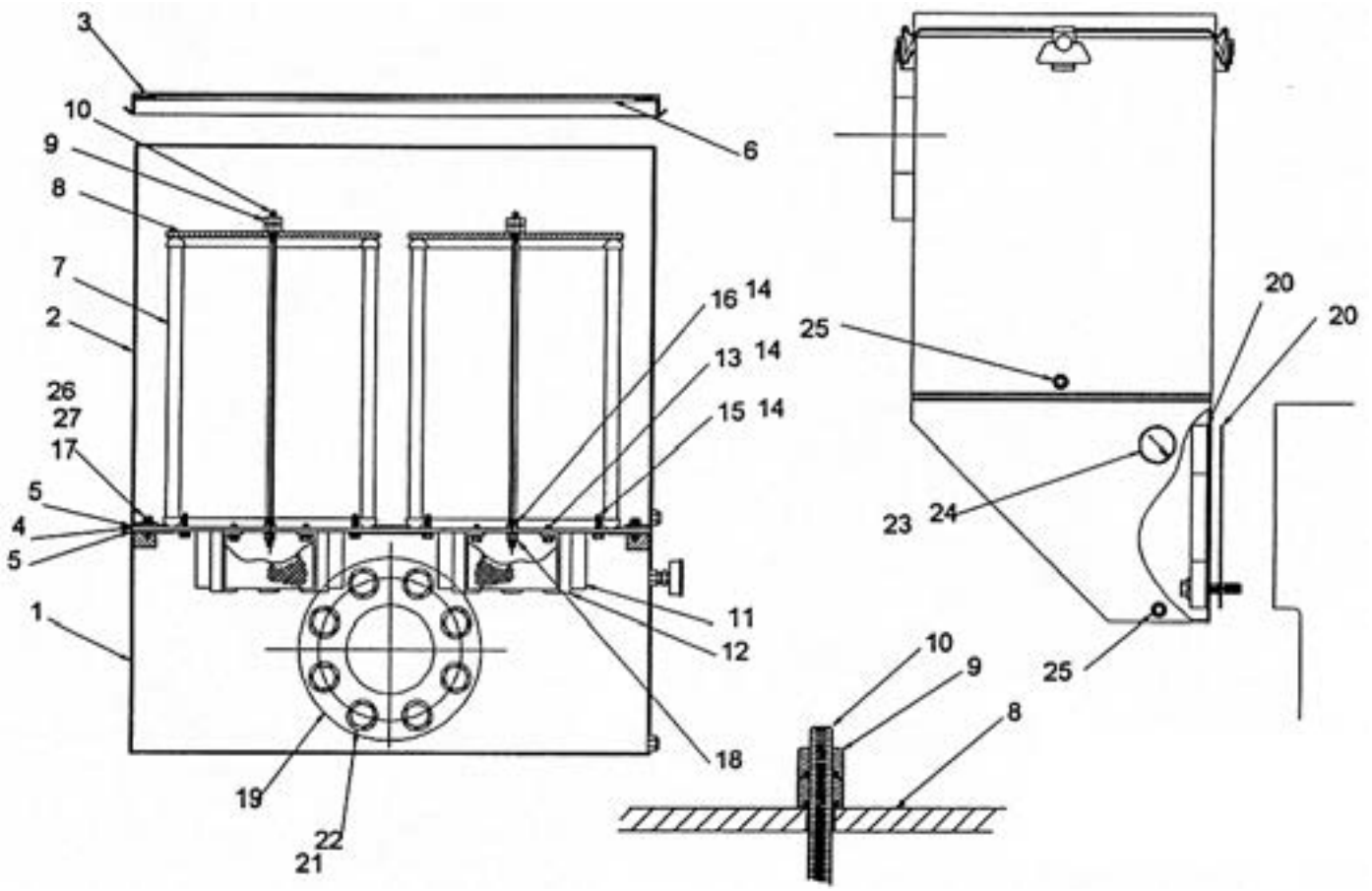


KT-840VFP MAIN PUMP ASSEMBLY

ITEM #	DESCRIPTION	QTY
1	CYL/HD SUB-ASSY - T00500	1
4	HOUSING, OIL PUMP T00300	1
5	HOUSING, SS & BRG T0500D	1
6	SEPARATOR HSG - T00500	1
7	COVER,SEP HSG - T00500	1
8	COVER,VLV DECK - T00500	1
9	TOP PLATE - T00500	1
10	BOTTOM PLATE - T00500	1
11	CAM,CENTER - T00500	1
12	PISTON, CTR (QPQ) - T00500	1
13	SUDEPIN,CTR (QPQ) - T00500	1
14	CAM,OUTER - T00500	2
15	PISTON, OTR (QPQ) T00500	2
16	SLIDEPIN,OUTER - T00600	2
17	REMOVABLE WALL - T00500	1
18	SHAFT - T00500D	1
19	SHDB ASSY, 2-1/8	1
20	SEAT,SSCI,2-1/8	1
21	INSERT, PUMP DRIVE	1
22	BBRG,SRFS 50MM	1
23	BRG LKNUT N-10	1
24	DV ASSY K 1-1L2	8
25	HOLDDOWN PLATE, DIS VLV T00300	4
26	SLV BRG 2-1/8	2
27	RINGRTNG2.50EXT	1
28	SIGHT GLASS (PLEXIGLASS)	1
29	RING, SIGHT GLASS	1
30	GASKET, SIGHT GLASS	1
31	OIL BAFFLE ASSY	1
32	BUSHING ASSY - T00500	1
33	KEY,SQ 12X32	1
34	KEY,WDF 29	6
35	PUMP,GEAR #2 - T00500	1
36	PIN, CENTERWALL LOCKING - T00500	5
37	HSSS, CENTER WALL LOCKING	5
38	HSSS 5/16-18 X 3/8 (W/PELLET)	1
39	GASKET,CYL-SEP - T00500	1
40	GASKET,SEP COV - T00500	1
41	GASKET, TOP PL - T00500	1
42	GASKET,BTM PL - T00500	1
43	O-RING2-245BU-N	2
44	O-RING2-227BU-N	1
45	PPG,SQH 1L2	2
46	PPG,HEXS 1/4	3
47	EYEBOLT	2
48	NIP 3/4 X 3-1/2	1
49	ELB, 90 X 3/4	1
50	M CONN 3/4 X 3/4	1
51	HHBSHGIX3/4	1
52	HHBSHG1X12	1
53	NIP 1/2 X 1-1/8	2
54	Y-STR 1/2	1
55	PPG,SQH 3/8	1
56	TEE 1L2	1
57	HHBSHGI/2X1/4	2
58	PRESS GAGE 0-160 PSIG	1
59	NIP 1/2 X 3-12	1
60	VLV, SPRCHI/2NPT	1
61	MELB1I2X1/2	1
62	F ELB 12 X 3/8	1
63	NIP 3/8X1	1
64	VLV BALL 1 NPT	2
65	VLV,SWCH INPT	1
66	VLV,ANG1/8MNPT	1
67	VLV,REL1L2NPT50	1

KT-1350VFP MAIN PUMP ASSEMBLY

ITEM #	DESCRIPTION	QTY
1	CYLMD SUB-ASSY - T00850	1
4	HOUSING ,OIL PUMP - T00850	1
5	HOUSING, SS & BRG - T0850D	1
6	SEPARATOR HSG - T00850	1
7	COVER,SEP HSG - T00850	1
8	COVER,VLV DECK - T00850	1
9	TOP PLATE - T00850	1
10	BOTTOM PLATE - T00850	1
11	CAM, CENTER - T00850	1
12	PISTON,CENTER - T00850	1
13	SLIDEPIN,CENTER - T00850	1
14	CAM, OUTER - T00850	2
15	PISTON,OUTER - T00850	2
16	SLIDEPIN,OUTER - T00850	2
17	REMOVABLE WALL - T00850	1
18	SHAFT/DRIVE SHAFT ASSY	1
19	SHDB ASSY, 2-12	1
20	SEAT,SSCI,2-1/2	1
22	BBRG,SRFS 55MM	1
23	BRG LKNUT N-11	1
24	DV ASSY K 1-112	12
25	HLDN PL,DIS VLV - T00850	4
26	SLV BRG 2-1/2	2
27	RINGRTNG2.75EXT	1
28	SIGHT GLASS (PLEXIGLASS)	1
29	RING, SIGHT GLASS	1
30	GASKET, SIGHT GLASS	1
31	OIL BAFFLE ASSY - KT850D	1
32	BUSHING ASSY - T00850	1
33	KEY, SO 1/2 X 2-1/2	1
34	KEY,WDF T	6
35	GEAR PUMP - T00850	1
36	PIN, CENTERWALL LOCKING - T00500	5
37	HSSS, CENTER WALL LOCKING	5
39	GASKET,CYL-SEP - T00850	1
40	GASKET,SEP COV - T00850	1
41	GASKET,TOP PL - T00850	1
42	GASKET,BTM PL - T00850	1
43	O-RING2-245BU-N	2
44	GASKET, OIL PUMP - T00850	1
45	PPG,SQH 1/2	2
46	PPG,HEXS 1/4	2
47	EYEBOLT	2
48	NIP 3/4 X 5-1/2	1
49	ELB, 90 X 3/4	1
50	M CONN 314 X 3/4	1
51	HHBSHGIX3/4	1
52	HHBSHG1X12	1
53	NIP 12 X 1-1/8	2
54	Y-STR 1/2	1
55	PPG,SQH 3/8	1
56	TEE 12	1
57	HHBSHG12X1/4	2
58	PRESS GAGE 0-160 PSIG	1
59	NIP 12 X 5-3/4	1
60	VLV,SPRCHI2NPT	1
61	TEE, MB 12 X 12	1
62	F ELB 12 X 3L8	1
63	NIP 3/8 X 6	1
64	VLV,BALL5/4NPT	2
65	VLV,SWCH 5/4NPT	1
66	VLV,ANG1/8MNPT	1
67	VLV,RELI2NPT50	1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KT-840VFP OIL MIST ELIMINATOR

ITEM #	DESCRIPTION	QTY
1	HOUSING SET, OME	1
4	FILTER PLATE, OME	1
5	GSKT, UPPER/LOWER UNIT	2
6	GSKT SET, OME COVR	1
7	EL.EM, OME 325	2
8	CLAMPING PLATE, FLTR ELEM	2
9	SEALNUT 3/8-16	4
10	SUPPORT ROD, OME FLTR	2
11	MESH PAD	2
12	CLIP, MESH	6
13	HHCS3/8-16-5/8	6
14	LKW 3/BREG SPR	14
15	HHCS3/8-1 &1	6
16	HNUT 3/8-16	2
17	PLW 5/16	22
18	ELASTIC STOP NUT 3/8-16	2
19	FLG, S/O 4	1
20	FULL FACE GASKET 4”	2
21	HHCS5/8-11-2	8
22	LKW S/BREG SPR	8
23	PRESS. GA. 0-15 PSI	1
24	HHBSHGI/4X1/8	1
25	PPG,HEXS 1/4	2
26	HHCSS/16-18-1	22
27	LKW 5/16REG SPR	22

KT-1350VFP OIL MIST ELIMINATOR

ITEM #	DESCRIPTION	QTY
1	HOUSING SET, OME - KT1350	1
4	FILTER PLATE, OME	1
5	GSKT, UPPER/LOWER UNIT	2
6	GSKT SET, OME COVR	1
7	ELEM, OME 475	2
8	CLAMPING PLATE, FLTR ELEM	2
9	SEALNUT 3/8-16	4
10	SUPPORT ROD, OME FLTR - KT1350	2
11	MESH PAD	2
12	CLIP, MESH	6
13	HHCS3/8-16-5/8	6
14	LKW 3/8REG SPR	14
15	HHCS3/8-16-1	6
16	HNUT 3/8-16	2
17	PLW 5/16	22
18	ELASTIC STOP NUT 3/8-16	2
19	FLG, S/O 5	1
20	FULL FACE GASKET 5”	2
21	HHCS3/4-10-2	8
22	LKW 3/4REG SPR	8
23	PRESS. GA. 0-15 PSI	1
24	HHBSHG3/8X1/8	1
25	PPG,HEXS 3/8	2
26	HHCS5/16-18-1	22
27	LKW 5/16REG SPR	22

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

Model No. _____

Serial No. _____

Startup Date _____

Pump RPM _____

Pump Sheave Diameter: _____

Motor Sheave Diameter: _____

Motor RPM _____ HP _____

V-Belt Size: _____ Length: _____

Type of Lubrication: _____

_____

Operating Vacuum _____

Any other special accessories supplied or in use:

_____

_____

NOTES: _____

_____

_____

_____

_____

_____

IMPORTANT

All KINNEY® vacuum pumps and systems 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 ☐
Vacuum Coating ☐
Pharmaceutical ☐
Semiconductor/Electronics ☐
Food/Meat Packing ☐
Gas/Petrochemical ☐
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