

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. ***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 Tuthill Vacuum & Blower Systems KT-LP models KT-505 LP, KT-275 LP, KT-190 LP and KT-170 LP. You should be thoroughly familiar with these instructions before attempting to install, operate, or perform maintenance on these units. Consult Tuthill Vacuum & Blower Systems Service Department when problems arise that cannot be resolved after reading this manual. Always include pump nameplate information when ordering parts or components.

DESCRIPTION

Tuthill Vacuum & Blower Systems KT-LP pumps have three sets of cams and pistons driven by a common shaft. One cam and piston set is longer than the other two and the cams are set 180° apart. The dynamic forces produced by the rotation of the long cam and piston are balanced by opposing forces produced by the short cams and pistons on either side. This balancing technique developed by Kinney Vacuum virtually eliminates any pump vibration.

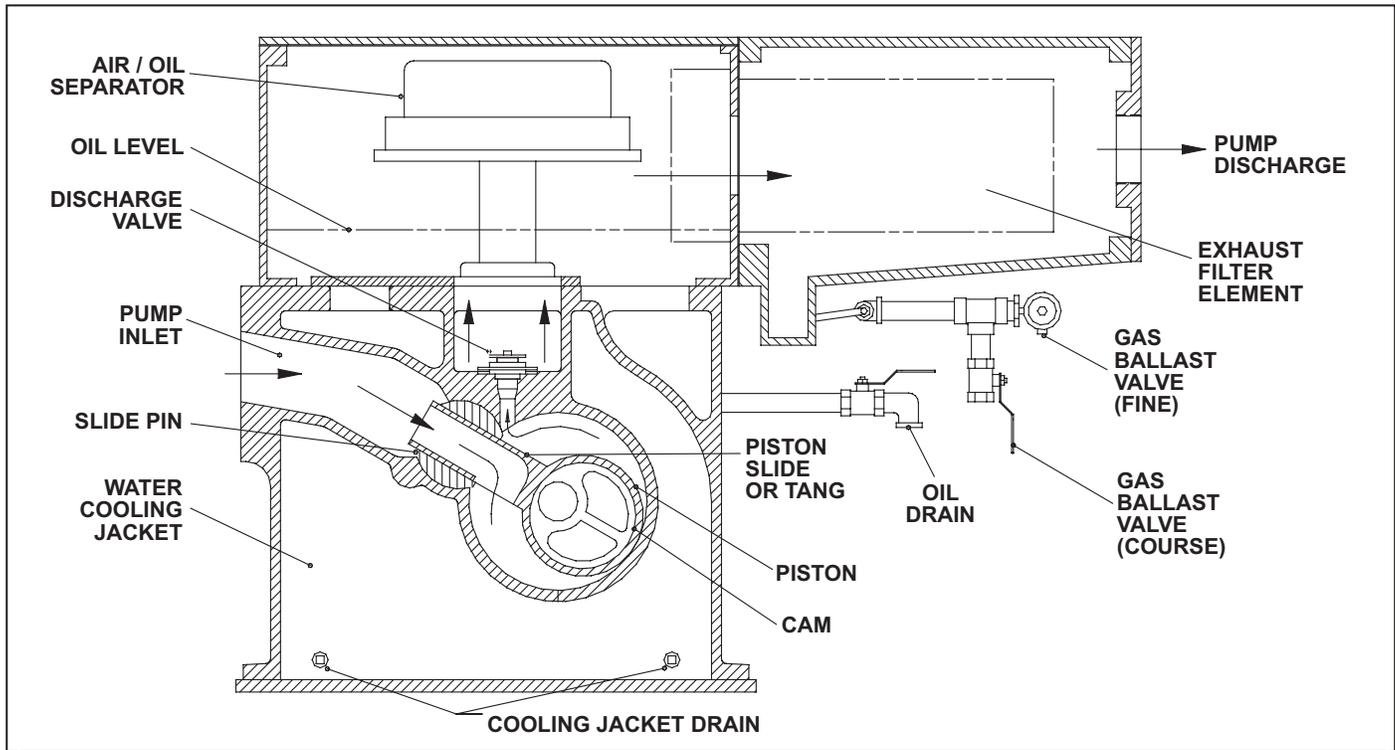


Figure 1. Cross Section of Pump

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

As the pistons rotate, gas is drawn into the pump through a common inlet. The gas is channeled through the three piston slides and into the space behind the pistons. The gas ahead of the pistons is compressed and forced out through the discharge valves. As the gas is forced through the pump, sealing oil is mixed with the discharged gas. The discharged mixture is then channeled into the separator housing where 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 is driven by a direct coupling to the vacuum pump drive shaft. All models have a channeled drive shaft with an opening on 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

UNPACKING

Carefully remove the pump from the crate and unbolt it from the skid. Use only the eyebolts attached to the pump to lift it off the skid. Inspect the pump for any damage that may have occurred during shipping. If any damage is visible, call Tuthill Vacuum & Blower Systems Customer Service Department (800-825-6937) for instructions on filing a damage claim with the freight carrier.

VIBRAMOUNT INSTALLATION

KT-LP pumps are supplied with vibramounts that enable the pumps to run quietly and vibration free. The pump can be installed on any floor that will support its weight. The pump must be installed on the vibramounts. **Do not bolt the pump to the floor.**

Lift the vacuum pump off of the ground. Attach the vibramounts with the cap screws provided and insert them through the attachment holes in the pump support frame. See Figure 2 for the correct vibramount positioning. Tighten the screw until contact is made between the top of the vibramount and the support frame. The KT-505 LP is supplied with a spacer that is mounted between the vibramount and the support frame.

FILLING THE PUMP WITH OIL



WARNING: Make sure the pump is filled with oil before running. Do not add oil while the pump is running.

If the pump is new, has been sitting idle for months, or has been completely disassembled, distribute approximately one gallon of oil into the suction port. It will be necessary to reach into the suction port with a container and pour oil directly onto the slide pins. (If possible, connect only the elbow portion of the suction manifolding to make pouring the oil into the suction port easier.) Rotate the pump by hand a minimum of three revolutions to distribute the oil throughout the pump interior.

KV-100 oil is recommended by Tuthill Vacuum & Blower Systems for use in KT-LP pumps; see the specification table on page 4 for the quantity required to fill the pump. Unscrew the oil filler cap located above the sight glass and add oil until the level reaches the top of the sight glass. The level will drop to mid-center of the sight glass. Add or drain oil as necessary to keep the oil level 3/8 inch (1 cm) up from the bottom of the sight glass while the pump is operating at its base pressure. The oil level changes with operating pressure, reaching the lowest level at blank-off conditions.



CAUTION: Overfilling the pump with oil can damage the pump. A high discharge of oil will saturate the filter elements and cause back pressure, which could increase the amperage draw on the motor.

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 permanently installed in the line.

SUCTION MANIFOLDING CONNECTION

The inlet manifolding should be sized and designed with five objectives in mind:

1. To avoid gas flow restrictions.
2. To prevent pump fluids from entering the process chamber.
3. To protect the pump from the ingestion of particulate matter.
4. To allow proper venting of the pump and suction manifold.
5. To allow freedom for the pump and ensure low vibration operation.

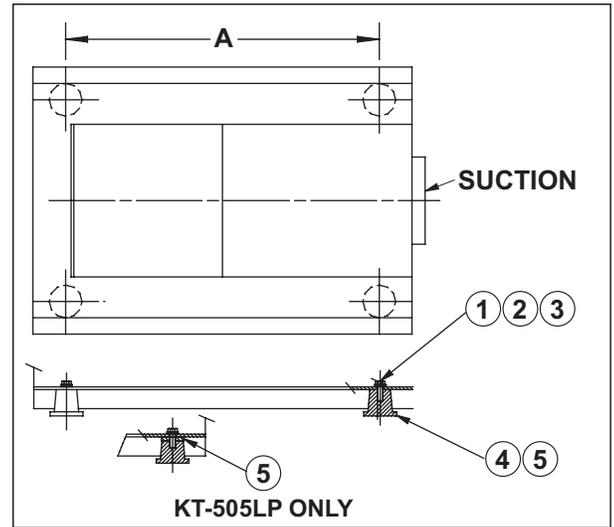


Figure 2. Vibramount Positioning

ITEM NO.	DESCRIPTION	KT-505 LP		KT-275 LP		KT-190/170 LP	
		QTY	A	QTY	A	QTY	A
1	HHCS 1/2 - 13 x 1/2 lg	4		4		4	
2	LOCKWASHER 1/2 REG SPR	4		4		4	
3	PLAIN WASHER 1/2	4		4		4	
4	VIBRAMOUNT, BLACK 250#	-	29.125"	-	32.75"	4	31.75"
	VIBRAMOUNT, RED 525#	-		4		-	
	VIBRAMOUNT, BRAY 1100#	4		-		-	
5	SPACER	4		-		-	

Oil will splash from inside the pump through the suction port; Therefore, the suction line must be designed to prevent oil from collecting there and draining back into the system or process.

Tuthill Vacuum & Blower Systems recommends an elbow and a vertical run of one or two pipe diameters from the center line of the intake port. For maximum capacity, 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. Heat exchangers, condensers or in-line filters can affect the end performance of the pump.

Make sure a flexible connection is installed in the suction manifold to provide freedom for the vibramounts. To avoid placing a strain on the vacuum piping, make sure the piping is properly aligned with the pump connections.

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 and cause damage.

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

DISCHARGE MANIFOLD CONNECTION

KT-LP pumps have an integral oil mist eliminator, which should prevent oil mist from being present in the discharge manifolding. It is recommended that the pump exhaust fumes be piped away from the pump area, such as outdoors. If this is done, the piping must be arranged to prevent line condensation that has accumulated in the pipe from returning to the pump. Install a drip leg to drain any liquids that accumulate. A flexible connector should also be fitted in the discharge line to provide freedom for the vibramounts.

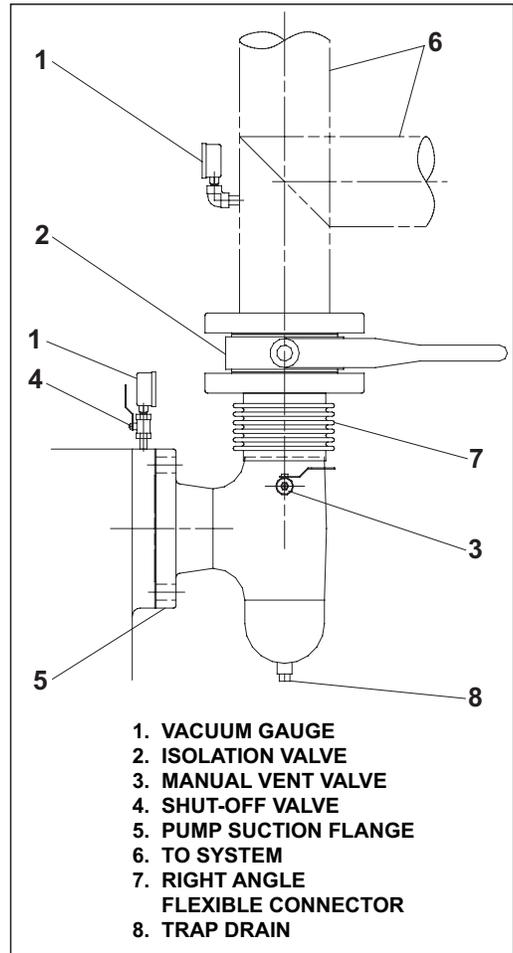


Figure 3. Cross Section of Pump

WARNING: *There should be no valves or restrictions installed on the discharge of any vacuum pump.*

It is very important that the diameter of the discharge manifolding is not less than the diameter of the pump connection. Make sure the pipe length is kept to a minimum because the conductance is inversely proportional to the length.

For very long connections it is important that the pipe diameter be increased, if necessary, to keep pressure drop, due to piping at full flow conditions less than 1 or 2 psi. This can be checked using flow charts for air. For a common connecting discharge manifold joining two or more pumps, the area of the common pipe should be equal to the sum of the areas of the individual pipes. Since the area A is proportional to the diameter squared ($A \approx D$), then $D = (d^1 + d^2 + \dots)^{1/2}$.

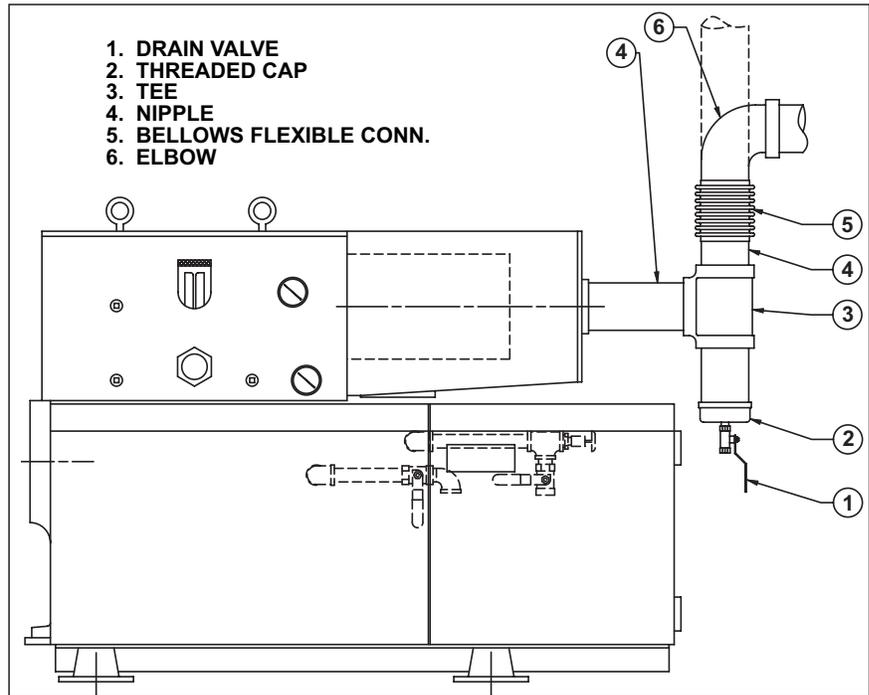


Figure 4. Flex Connector Configuration

ELECTRICAL CONNECTIONS



WARNING: Disconnect the pump from the electrical power source prior to making repairs or adjustments to any electric component of the unit. If the pump is not wired when received, wire the motor according to the wiring diagram on the motor.

Before the pump is wired, turn the pump by the hand in the correct rotation to ensure that the pump is moving freely. (Make sure the suction is open.) Momentarily jog the motor to check that the direction of rotation is clockwise when facing the pump drive shaft and sheave. If the pump rotates in the wrong direction, disconnect the power and 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. This will stop the motor or activate an alarm in the event the cooling water flow is interrupted.

INSTALLING VACUUM GAUGES

The vacuum gauge(s) 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 are total pressure and partial pressure.

1. **TOTAL PRESSURE GAUGES:** Used in many applications for system-operating functions. This gauge reads the presence of most vapors. Depending on the gauge used and the amount of condensable vapor in oil, the blank off could be 0.01 to .100 Torr. **NOTE: For test purposes, a calibrated total pressure gauge with a reference standard can be used.**
2. **PARTIAL PRESSURE GAUGES:** The McLeod gauge, used by Tuthill Vacuum & Blower Systems for the final acceptance test, is a partial pressure gauge. It indicates the partial pressure of permanent gases. It does not indicate the presence of most vapors, such as water vapor, and it is not greatly affected by vapor contamination unless the contamination pressure is very high.

All KT pumps are put through a standard production test. At the end of this test the final blank-off has to be 0.01 Torr or less (McLeod gauge).



WARNING: The McLeod gauge contains mercury and should only be used by personnel familiar with this type of gauge

COOLING WATER CONNECTION

The KT-LP pumps are water-cooled and require an external source of clean cooling water. See the pump specifications on page 4 for recommended flow rate and temperature for each model. The cylinder cooling water jacket is shipped dry. Make sure the water jacket is filled before starting the pump.



CAUTION: 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.

If an optional water flow modulating valve (water miser) is fitted, the cylinder may take 20 minutes or more to fill. For installation that requires starting at ambient temperatures lower than 60°F (16°C), electrical heaters should be installed in the water jacket. See Figure 5.

Locate the water inlet and outlet connections, which are labeled on the pump. Connect a water supply line with

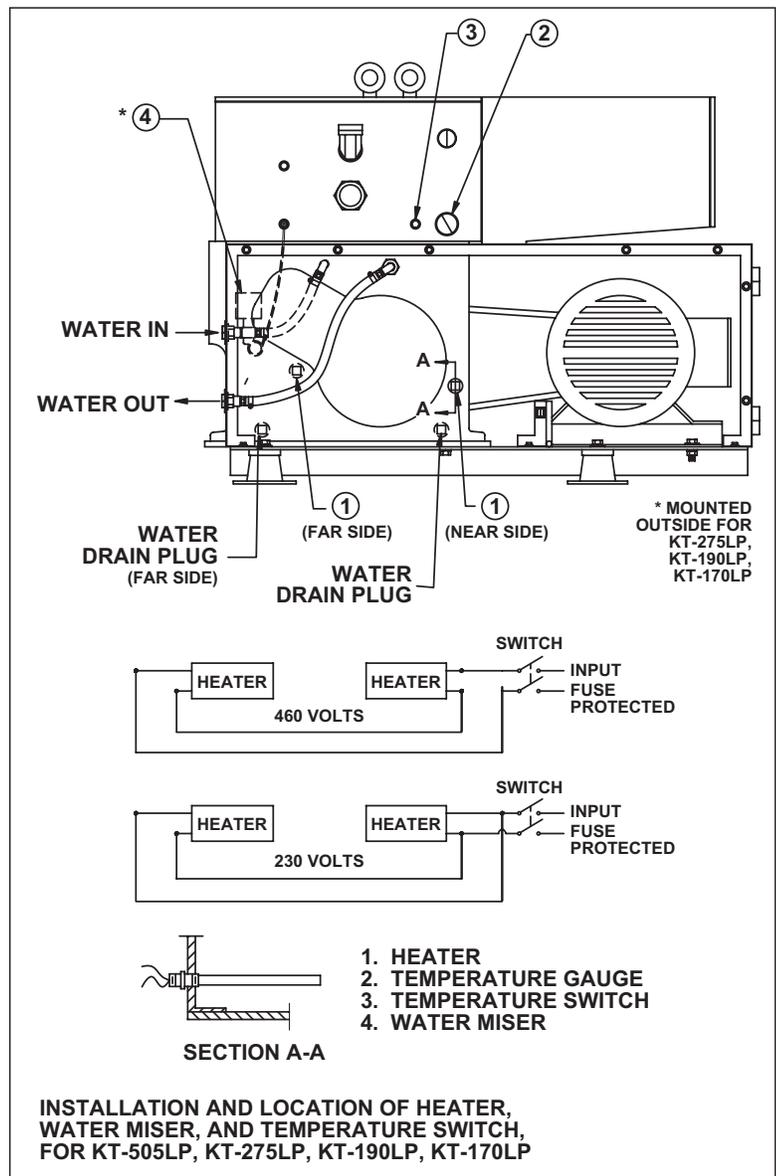


Figure 5. Water Miser and Heater Installation

an “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. When the pump is not running the water should be shut off.

A water pressure relief valve is fitted in the water jacket. This relief valve is set to open at 50 psig (3.5 bar). The standard cooling water flow rate is based on a water temperature of 80°F (26°C) or less. The supply temperature and operation is designed for continuous operating pressures ranging from .010 to 100 Torr. Sustained operation above 100 Torr (130 mbar) and/or long pump downs may require additional cooling. Contact Tuthill Vacuum & Blower Systems Service Department for further details.

OPERATION

GENERAL



WARNING: Do not operate the pump unless the belt guard is properly attached.



WARNING: Prolonged inhalation of oil mist or vapors is a health hazard. Do not allow the pump to discharge into a closed room or a room without adequate ventilation.



WARNING: Do not restrict the flow of gas from the pump discharge line. Back pressure within the pump could cause severe damage.



WARNING: Make sure the Safety Instructions in the front of this manual are fully understood before operating the pump.

SPECIFICATIONS TABLE

	UNIT	MODEL			
		KT-170 LP	KT-190 LP	KT-275 LP	KT-505 LP
Nominal displacement at rated RPM	CFM / m ³ /h	94 / 160	112 / 190	162 / 275	300 / 505
Motor	HP / kW	5 / 3.7	7.5 / 5.6	10 / 7.5	15 / 11
Nominal pump rotation	RPM	1150	1360	1200	870
Oil capacity (Type: KV-100)	Gallons / Liters	2.6 / 10	2.6 / 10	4.5 / 17	10 / 38
Cooling water (min.) @ 60° F (16°C)	GPM / L/min	1 / 4	1 / 4	1 / 4	1.5 / 6
Dry weight (complete assembly)	Lbs / kg	750 / 340	780 / 354	900 / 408	1870 / 848
Maximum gas ballast flow	CFM / m ³ /h	8 / 14	8 / 14	11 / 18	20 / 34
Typical blank-off pressure with 5% gas ballast	Torr / mbar	2.0 / 3.0	2.0 / 3.0	2.0 / 3.0	2.0 / 3.0
Ultimate pressure (McLeod gauge)	Torr / mbar	0.010 / 0.013	0.010 / 0.013	0.010 / 0.013	0.010 / 0.013
Typical Noise Level	dBA	71	71	72	72

PRE-START 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 water jacket 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, refer to the section, “Filling the Pump with Oil” on page 5.
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.
6. Drive belts are correctly tensioned. (See the section, “V-Belt Drive” on page 13).
7. Direction of rotation is correct (clockwise facing the pump drive shaft).

STARTING THE PUMP

1. Close inlet isolation valve (if equipped, recommended).
2. Close the vent valve (if equipped, recommended).
3. Close the gas ballast valve.

NOTE: If the pump was not vented when the pump was last stopped, the following procedure must be used:

- a. Disconnect the pump from the power source.
 - b. Remove the belt guard panel to access the drive belts.
 - c. Rotate the pump in the correct rotation by hand, using drive belts.
 - d. Rotate at least 3 full rotations.
 - e. Replace belt guard panel.
 - f. Reconnect the pump to the power source.
4. Start pump.
 5. Open and adjust the cooling water flow as shown in the specification.
 6. Maintain oil level 3/8" (1 cm) up from the bottom of the sight glass when operating at blank-off. The circulation pump (gear pump) on start-up may increase the oil pressure to 100 to 150 psi (6.9 to 10.3 bar), the check valve will open, and oil will be forced into the pump through the main line. As the oil heats up, the pressure will quickly drop to 18 to 40 psi (1.2 to 2.8 bar).
 7. Adjust the gas ballast. (See " Gas Ballast" section, below) 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.
 8. Run the pump at blank-off for 5 to 10 minutes and then with full gas ballast for 10 to 15 minutes before opening the suction of the pump to a higher air pressure. This will shorten the pump warm-up time. Oil temperature should be over 100° F before opening the pump to the process.

PROPER VENTING

The vacuum pump must be properly vented to atmosphere before the pump is turned off. Also, the suction line must be properly vented to prevent oil from migrating into the process chamber. To do this, open the suction line vent valve for at least 10 seconds before shutdown. Recommended vent valve sizes are shown in the table to the right.

KT-505 LP	1 inch
KT-275 LP	3/4 inch
KT-190/170 LP	1/2 inch

STOPPING THE PUMP

1. Close isolation valve (if equipped, recommended).
2. Open the vent valve (if equipped, recommended) while the pump is still operating.
3. Close the gas ballast valve.
4. Stop the pump

NOTE: The vent valve must be opened for at least 10 seconds before shutting down the pump. This will allow the excess oil in the pumping chamber to be transferred into the oil separator housing.

5. Shut off cooling water.
6. Close vent valve (if equipped, recommended).

NOTE: The check valve in the oil line will now be closed, preventing the oil in the separator from migrating back into the pump.

HANDLING LARGE QUANTITIES OF WATER

Using the gas ballast valve enables the vacuum pump to handle small to moderate amounts of water and other vapors in the suction gas stream.

In certain processes, water can accumulate in the sump of the pump's oil reservoir. If the water level collects too high, it could circulate through the pump. If the water or other condensate collects in the oil reservoir, the condensate should be drained before the level reaches the oil line pickup. To drain water from the pump before the pump is started, slightly open 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 on page 4. Gas ballast is used while the pump is running to prevent internal condensation of vapors such as water, alcohol or other solvents. It is also used to quiet the hydraulic noise when running the pump at blank-off conditions.

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

Continuous use of gas ballast is recommended when 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. In this case, be sure that water is not building up in the oil reservoir.

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.

NOTE: At inlet pressures above 300 Torr, oil will spit out of the open gas ballast valve. This procedure is not recommended on rapid cycle systems.

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 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 for 10 to 20 minutes (oil temperature should be about 160° to 180° F [71° to 82° C]). 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

GENERAL MAINTENANCE

Pump repair services are available at our factory in Springfield, MO, our Northeast Repair Center in the Boston, MA area and our West Coast Service Center in the Los Angeles, CA area. Call (800) 825-6937 for a location nearest you for more information.

PERIODIC MAINTENANCE

There is no fixed interval for changing the pump oil since applications vary widely. This can be determined only by experience and/or by deterioration of pump performance. At a minimum, the pump oil should be changed after each 1000 hours of operation.

At high pressures or with 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 inspect it for solid or liquid contaminants.

OIL CONTAMINATION

When the pump's performance gradually become poor after it has operated satisfactorily for some time, clean the oil by applying gas ballast, or change the oil as directed in "Changing the Oil" on page 11. A change in the color of the oil does not necessarily mean that it 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:

1. Water and solvents will lower viscosity
2. Solid accumulation will increase viscosity and feel gritty
3. Polymerization and chemical attack on oil will increase viscosity, total acid number, and color
4. Continuous operation at high inlet pressures will cause the oil to accumulate a high oxygen content

As a rule of thumb the oil should be changed if:

1. The oil feels gritty
2. Oil viscosity changes more than 100 SSU at 100°F (38°C)
3. Oil color becomes opaque
4. Oil smells burnt or acrid
5. Oil 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" on page 9. Oil filtration systems are available for filtering solids, water, and acids, continuously or periodically. Call Tuthill Vacuum & Blower Systems for more information.

CHANGING THE OIL

Stop the pump according to the procedure on page 9. Place a container under the oil drain valve and open the valve until the oil is removed from the pump.

NOTE: A small quantity of oil (sufficient to lubricate the cams and pistons upon start-up) is trapped in the cylinder. Upon start-up this oil reserve will mix with the new oil and possibly change the color of the new oil.

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 on page 8. The oil level will show above the center line of the sight gauge until the pump is started and the oil is distributed through the pump. Again, maintain an oil level of 3/8" (1 cm) up from the bottom of the sight glass at blank-off.

If water contamination was the reason for the oil change, additional gas ballast will clear the oil. If the contamination was due to solvents or varnish, additional oil changes may be needed.

NOTE: The pump is only one of the many places that water can be trapped. If water remains in the suction manifold the oil will continue to change color.

If you suspect trapped water in the suction manifold:

1. With an ambient temperature of at least 50 to 60°F (10 to 16°C) and with the manifold under vacuum, check all low spots in the line. If water is trapped in any area, the pipe will feel cool to the touch.
2. If the system is outside in a cold environment, the manifold would need disassembly.

LUBRICATING THE PUMP

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

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 of the pump internals, or foreign matter in the pump. If the pump can not be turned over freely by hand after cooling, then there is foreign matter in the pump and the inside of the pump must be cleaned. Sometimes a process-related coating of the internals can be removed by soaking the pump with the proper solvent and turning by hand. Check with Tuthill Vacuum & Blower Systems Service Department for further details.

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. Read the blank-off pressure with a thermocouple gauge.

To read the blank-off pressure, close the pump inlet by means of a vacuum valve or blank-off plate. Connect a calibrated vacuum gauge to the suction side and position the gauge tube facing downward, so that the tube will be self-draining and not become flooded and blocked by splashing pump oil. If the pump is disconnected from the process equipment, connect the elbow extending upward to the inlet flange. Bolt the blank-off plate with gauge connection to the open inlet elbow flange, or use the gauge fitting located on the pump at the inlet section.

Operate the pump for a minimum of 15 minutes and record the lowest pressure reached. Average blank-off readings are 10 to 100 microns with a thermocouple gauge.

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, such as Apiezon Q, to seal over suspected areas: joints, connection plugs and any penetrations into the vacuum area. Check the pump's ultimate vacuum performance before making permanent repairs. If gasketed connections are suspected, remake the connections. Check the shaft seal for mechanical defects, such as cracked carbon washer or hardened rubber components. Do not reuse the seal; replace it with a new one.

A helium leak detector is the most convenient to use for pinpointing leaks.

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 6, below). 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. The valves should be inspected after 2000 hours. 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 that press against a sealing disk. The disk fits against a seal forming a tight fit. The springs are maintained in place by a lift stop and the entire valve is held together by a cap screw. The valves are attached to the cylinder by screws and a hold-down plate.

To inspect the discharge valves, proceed as follows:

1. Drain oil from the pump and remove the separator housing cover.
2. Remove the mesh pad from the discharge pipe, if equipped.
3. Remove the cap screws from the valve deck cover and remove the cover.

NOTE: The gasket for this cover has a tendency to adhere to the sealing surface. To help remove this plate, tap on the pipe, which is threaded into the valve deck cover, with a mallet or a lead hammer. Do not clean at this time if part of the gasket still remains on the cylinder sealing surface after valve deck is removed.

4. The valve chamber will contain a small quantity of oil. With a small container, scoop the oil out of the valve cavity to a point below the valve seat. This will prevent any oil or dirt from getting under the valve. 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.
5. If a complete inspection is warranted, remove all the cap screws in the valve hold-down plate.



CAUTION: If anything drops into the pump (screws, etc.) the pump must be completely disassembled. Do not go on to the next step until all screws are removed from the pump.

6. Lift out the valve plates with the valves. When reassembling the valve, replace valve components in exactly the same position as before.
7. Clean the valve deck area as well as possible; any residual oil or remaining dirt will drain back into the pump.
8. Inspect the sealing surfaces for dirt or other foreign material. Check that the disk or lower valve spring has not warped (dish-shaped), as they must be flat for full contact.
9. Tuthill Vacuum & Blower Systems does not recommend that the valves be taken apart. If a more careful inspection is required, remove the cap screw holding the valve together.

NOTE: This is a special screw with a nylon insert and should be replaced if removed.

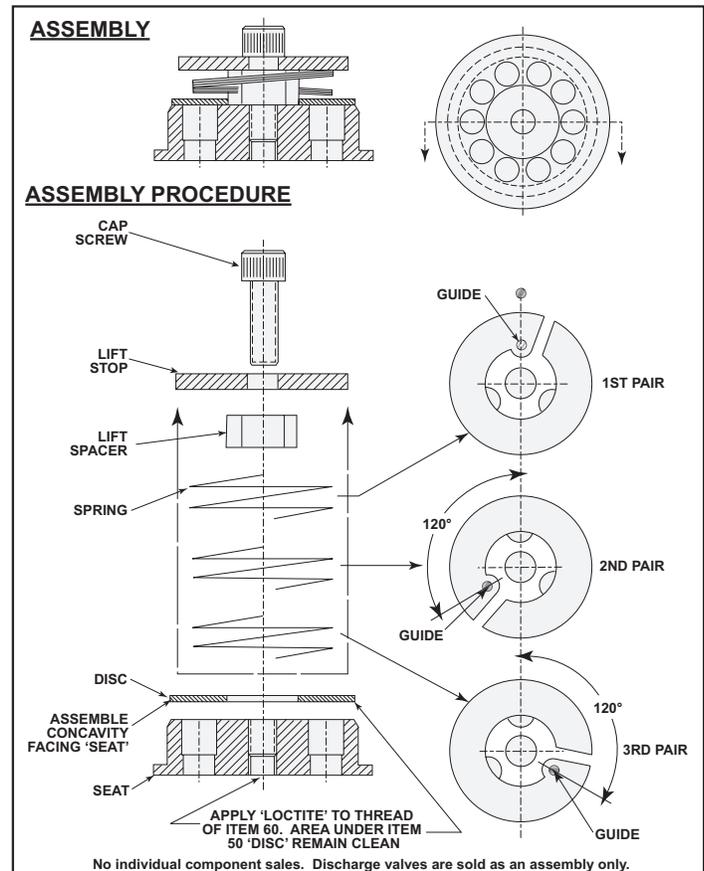


Figure 6. Discharge Valve

REINSTALLING DISCHARGE VALVES

With the damaged gasket for the valve deck still in place, cover all the open ports and remove all the oil trapped in the bolt holes.

NOTE: *If any oil remains in these holes it can prevent the screws from being fully engaged.*

Before installing the valves, use a honing stone on each valve seal to ensure flatness. With the well completely cleaned out, reinstall the valves.

1. Install the valves and the hold-down plates. This will prevent any dropped objects (screws) from getting into the pump.
2. Replace with new screws. These are special screws with a nylon insert. This part is used on all KT-LP Series pumps.
3. Tighten screws evenly to 15 ft-lb torque.
4. Check all valves to insure tightness.
5. Remove the portion of the old gasket, which is used to seal the valve deck cover, and clean out any of the gasket material that drops into the clean well.
6. Make sure the valve deck cover bolt holes are free of oil. Align the gasket and cover, temporarily install six studs or threaded rods to hold the cover in place; replace with the cap screws.
7. Install the cap screws for the valve deck cover and sequence tighten.
8. Install the separator cover with the gasket. Sequence-tighten.

SHAFT SEAL ASSEMBLY

The shaft seal should have 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 replaced. If oil that 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. Note: The pump is shipped with the shaft seal housing drain plug installed. It should be removed to allow any oil drips to be observed.

SHAFT SEAL REPLACEMENT

To replace the shaft 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 seal and bearing housing:
 - a. Remove the outboard bearing retainer nut from the shaft.
 - b. Remove the cap screws holding the bearing housing.
 - c. Use jack screws to remove the bearing housing.
4. Always replace the shaft seal and bearing if the housing has been removed and if the seal has been taken off the shaft.

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 rings, a dent, or scratches 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



WARNING: *Remove pump from power source before removing belt guards.*

Before attempting to tension the V-belt drive, it is imperative that the sheaves be properly aligned. Sheaves should be positioned to allow the belts to be placed in the grooves without rolling onto the sheaves.

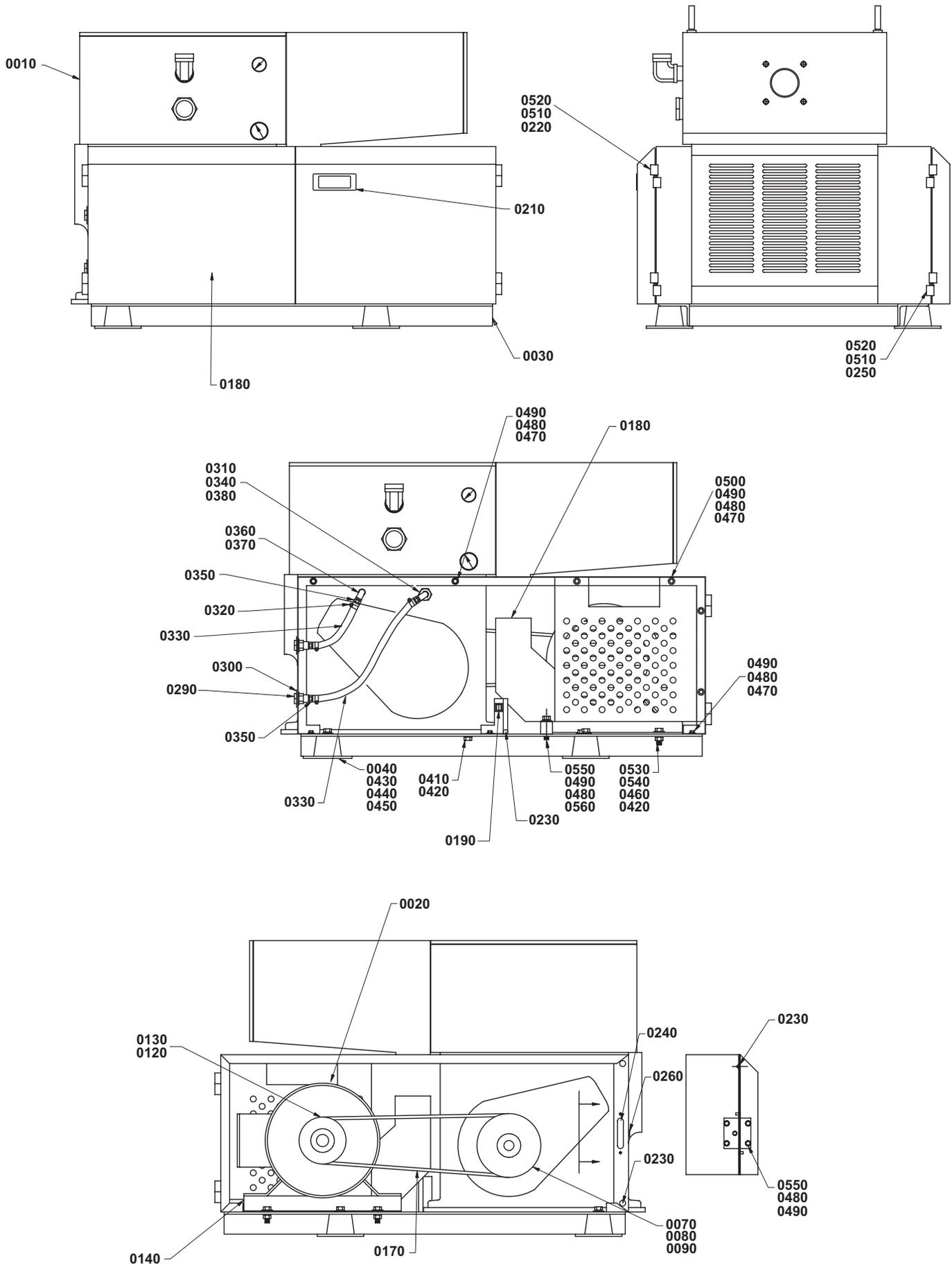
The following tensioning steps can be safely followed for all belt types, cross sections, number of belts per drive, or type of construction:

1. With belts properly in their grooves, adjust the sheaves until all slack has been taken up.
2. Turn the pump by hand each time the belts are adjusted. This can not be done with the belt guard in place.
3. After 24 to 48 hours of operation, the belts will be seated in the sheave grooves. Further tensioning is necessary as described in Step 2.

TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
System ultimate pressure excessively high	Process equipment contaminated by high vapor pressure material	Clean equipment with acetone, alcohol or ether 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 shaft seal malfunctioning	Check shaft seal per “ <i>Shaft Seal Assembly</i> ” on page 13
	Vacuum pump internal parts worn or damaged	Dismantle pump and inspect internal parts
	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 “ <i>V-Belt</i> ” drive on page 13 and “ <i>Changing the Oil</i> ” on page 11
	Foreign material or coating buildup in the 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 disassemble the pump
	Pump too cold	See “ <i>Operation</i> ” on page ___
	Foreign particles in pump	Disassemble and clean pump
Pump vibrates	Inlet or outlet connections not flexible	Use Tuthill Vacuum & Blower Systems flexible 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 pump	Add manual or automatic valve
	No isolation valve and vent valve	Add vent valve

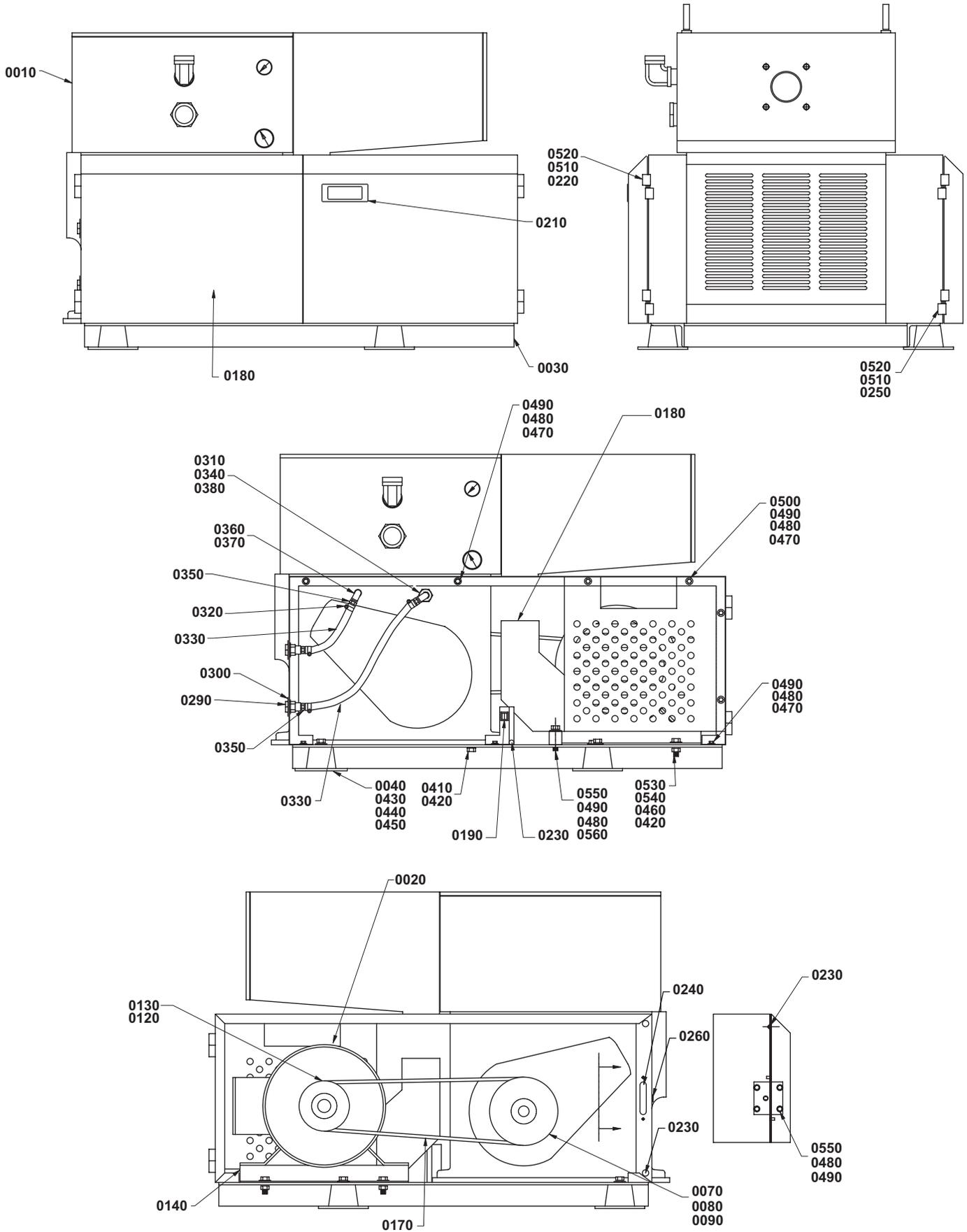
KT-170LP FINAL ASSEMBLY DRAWING



KT-170LP FINAL ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY
010	KT-100 LP W/INTERNAL OIL RESERVOIR	1
020	MOTOR TE 5 1725 184T 208/460	1
050	SHEAVE, 3-3V-5.0 (SDS)	1
060	QD BUSHING SDS 1-1/16	1
070	SLEEVE, SHEAVE SPACER	1
080	VIBRAMOUNT, BLK 250#	4
110	SHEAVE, 3-3V-3.35 (SH)	1
120	QD BUSHING SH 9/8	1
130	BASE, MOTOR FR 184	1
140	BASE BLET GUARD	1
170	V-BELT 3/3VX - 475	1
180	BELT GUARD	1
210	HEX HEAD CAP SCREW 3/8-16	4
220	LOCK WASHER 3/8 REGULAR SPRING	8
230	HEX HEAD CAP SCREW 3/8-16 X 1/2	4
240	PLAIN WASHER 3/8 ZINC COATED STEEL	4
250	HEX NUT 3/8-16 ZINC COATED STEEL	4
260	HEX HEAD CAP SCREW 1/2-13 X 1-1/2	4
270	PLAIN WASHER 1/2 ZINC COATED STEEL	4
280	LOCK WASHER 1/2 REGULAR SPRING	4
290	TRUSS HEAD SCREW 1/4-20 X 1/2	4
300	PLAIN WASHER 1/4 ZINC COATED STEEL	3
310	LOCK WASHER 1/4 REGULAR SPRING	3

KT-190 LP FINAL ASSEMBLY DRAWING

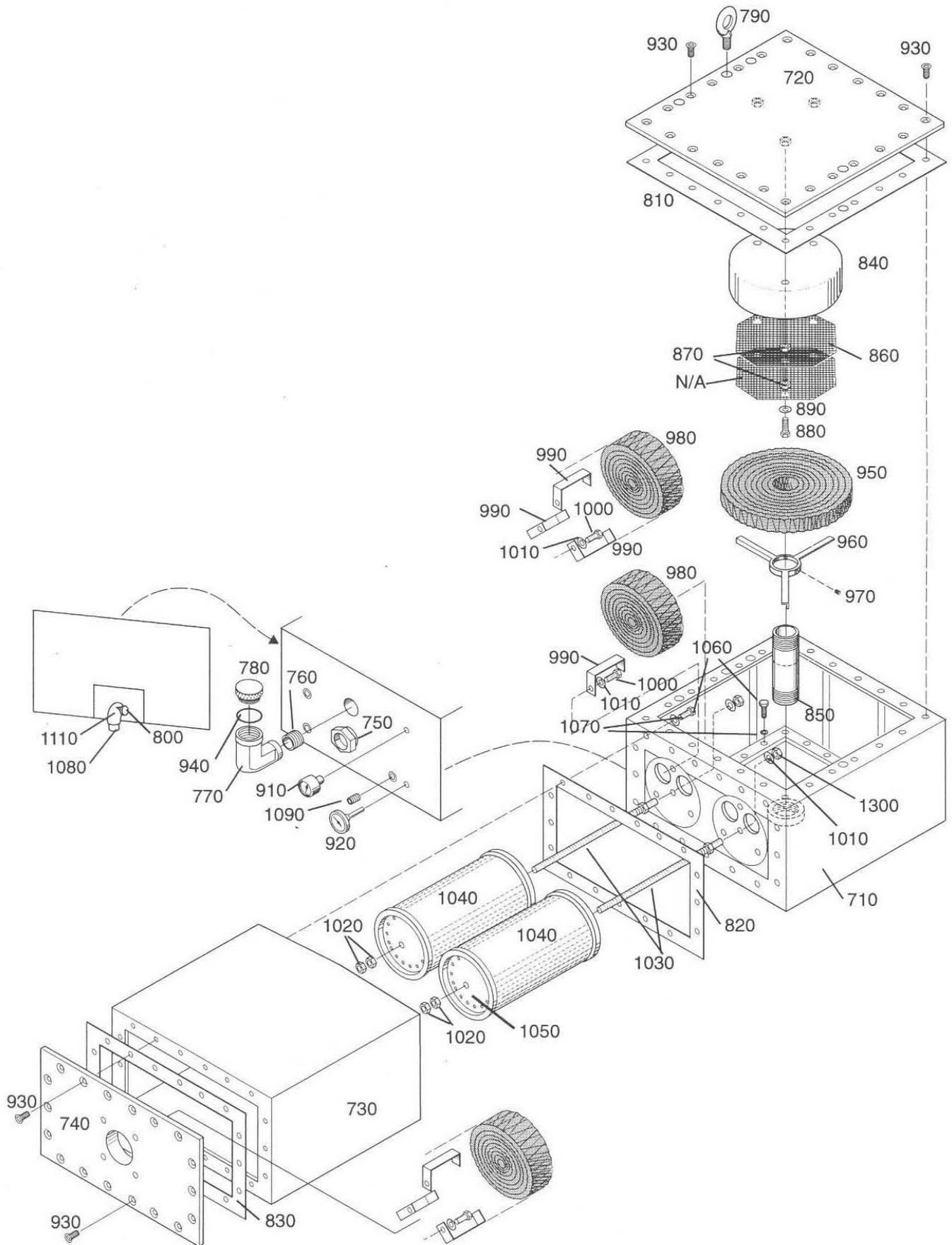


KT-190 LP FINAL ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY
010	KT-100 LP W/INT. OIL RESERVOIR	1
020	MOTOR TE 7.5 1725 213T 208/460	1
030	BASE-PANEL SET	1
040	VIBRAMOUNT, BLK 250#	4
070	SHEAVE, 2-3V-5.3 (SH)	1
080	QD BUSING -SH 17/16	1
090	SLV, SHEAVE SPACER	1
120	SHEAVE, 2-3V-4.12 (SH)	1
130	QD BUSHING SH 11/8	1
140	BASE, MTR-FR 213	1
170	V-BELT 2/3 VX-500 BAND	1
180	PANEL SET, LOCKING	1
190	PANEL LATCH	3
200	PANEL STRIKE	3
210	DOOR PULL	1
220	HINGE, LEFT HAND	2
230	DOOR SILENCER	3
240	LOCK, STD ROTOLock WITH LATCH/ RCPT	1
250	HING, RIGHT HAND	4
260	GROMMET 3/8	1
290	BULKHEAD FITTING	2
300	PLAIN WASHER 1 SAE	2
310	COUPLING, HOSE 3/8 X 3/8 NPT BRASS	3

ITEM #	DESCRIPTION	QTY
320	HOSE CLAMP 1/2	4
330	HOSE 3/8 ID, RUBBER	36
340	ELBOW 90 X 3/8 NPT MALLEABLE IRON	1
350	COUPLING HOSE 3/8 X 1/4 NPT BRASS	1
360	ELBOW 90 X 1/4 NPT MALLEABLE IRON	1
370	NIPPLE 1/4 NPT X 1-3/4 LG STEEL	1
380	NIPPLE 3/8 NPT X 2 LG STEEL	1
410	HEX HEAD CAP SCREW 3/8-16 X 1-1/2	4
420	LOCK WASHER 3/8, REGULAR SPRING	8
430	HEX HEAD CAP SCREW 1/2-13 X 1-1/2	4
440	PLAIN WASHER 1/2 , ZINC COATED STEEL	4
450	LOCK WASHER 1/2 REGULAR, SPRING	4
460	HEX NUT 3/8-16 ZINC COATED STEEL	4
470	HEX HEAD CAP SCREW 1/4-20 X 1/2	18
480	PLAIN WASHER 1/4 ZINC COATED STEEL	23
490	LOCK WASHER 1/4 REGULAR SPRING	23
500	HEX NUT 1/4-20 ZINC COATED STEEL	8
510	BINDING HEAD SCREW 10-24 X 3/8	24
520	LOCK WASHER 10 REGULAR SPRING	24
530	HEX HEAD CAP SCREW 3/8-16 X 1	4
540	PLAIN WASHER 3/8 ZINC COATED STEEL	4
550	HEX HEAD CAP SCREW 1/4-20 X 1	5
560	1/2 OD SCPRX 1/2 LGX.252 ID	1

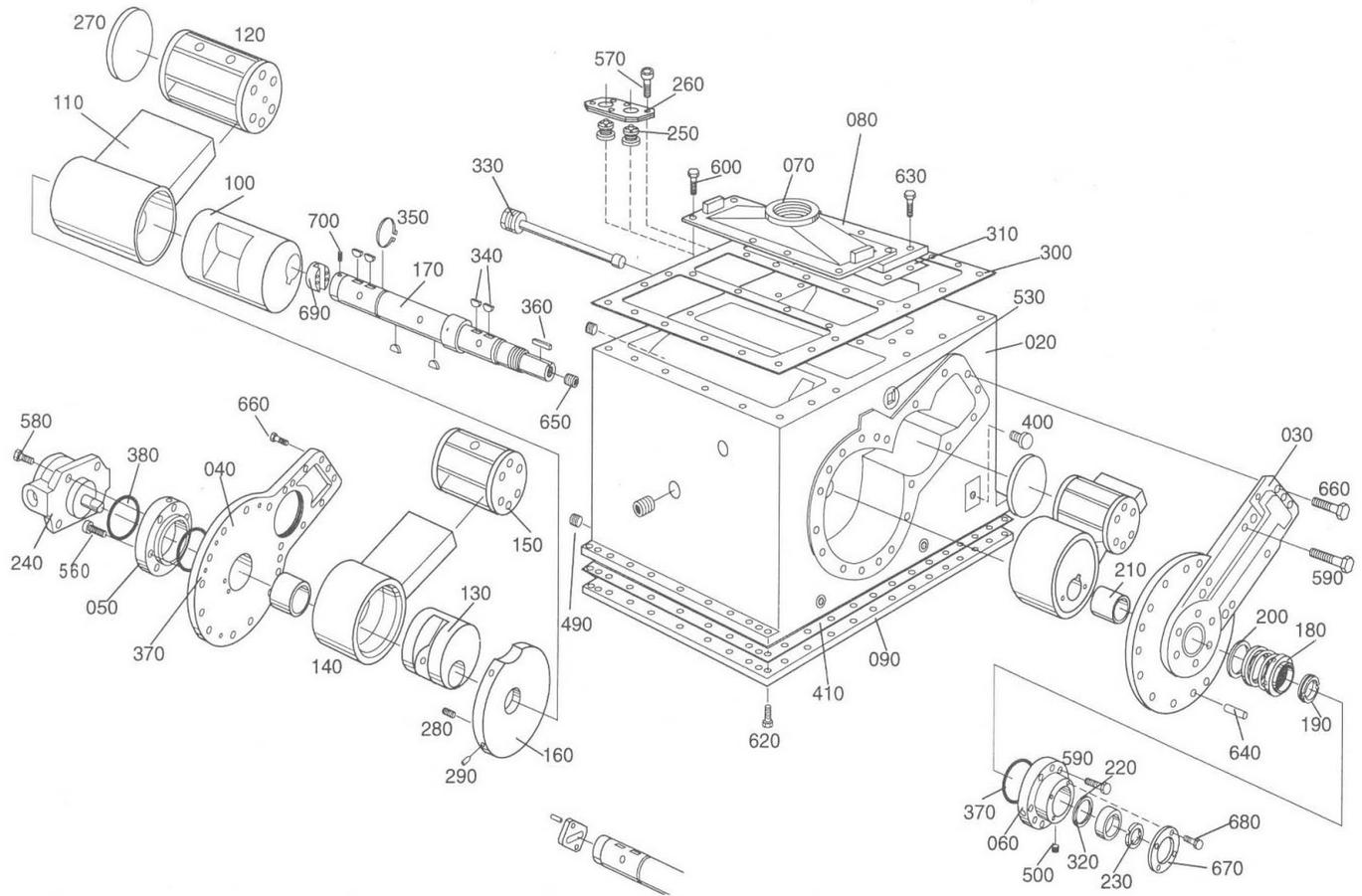
KT-170 LP & KT-190 LP UPPER ASSEMBLY DRAWING



KT-170 LP & KT-190 LP UPPER ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
010	LOWER PUMP ASSY KT-100 LP	1	1020	SEAL NUT 3/8-16	4
710	SEPARATOR HOUSING	1	1030	CLAMPING ROD ASSY	2
720	COVER, SEPARATOR HOUSING	1	1040	ELEMENT, OME 60	2
730	HOUSING, OME	1	1050	CLAMP PLATE, ELEMENT	2
740	COVER, OME	1	1060	HEX HEAD CAP SCREW 5/16-18 X 1	2
750	OIL SIGHT GAUGE 2 NPT W/REFLECTOR	1	1070	LOCK WASHER 5/16 REGULAR SPRING	28
760	NIPPLE 1 NPT X 1-1/2 LG STEEL	1	1080	NIPPLE 1/4 NPT X 1-1/4 LG STEEL	1
770	FEMALE ELBOW 1 NPT PLATED STEEL	1	1090	HEX SOCKET PIPE PLUG 1/2 NPT	1
780	OIL FILL CAP	1	1100	ELBOW 90 DEGREE X 1/4 NPT STEEL	1
790	EYEBOLT	2	1110	HEX HEAD BUSHING 3/4 X 1/4 NPT	1
800	HEX SOCKET PIPE PLUG 1/4 NPT	1	1120	NIPPLE 1/4 NPT X 7/8 LG STEEL	2
810	GASKET, SEPARATOR HOUSING COVER	1	1130	VALVE, SWING CHECK 1/4 NPT BRONZE	1
820	GASKET, SEPARATOR/OME	1	1140	TEE 1/4 NPT MALLEABLE IRON	1
830	GASKET, OME DISCHARGE	1	1150	NIPPLE 1/4 NPT X 1-3/4 LG STEEL	1
840	BAFFLE	1	1160	ELBOW 90 X 1/4 NPT MALLEABLE IRON	1
850	NIPPLE 2 NPT X 5 LG STEEL	1	1170	NIPPLE 1/4 NPT X 7-1/2 LG STEEL	1
860	WIRE MESH	1	1180	HEX HEAD BUSHING 1/2 X 1/4 NPT	1
870	HEX NUT 1/2-13, ZINC COATED STEEL	3	1190	VALVE, NEEDLE 1/2 NPT, BRONZE GLOBE	1
880	HEX HEAD CAP SCREW 5/16-18 X 7/8	3	1200	3/8 OD HYDRAULIC STEEL TUBING	12"
890	PLAIN WASHER 5/16 ZINC COATED STEEL	3	1210	MALE CONNECTOR 3/8 X 1/4	1
900	HEX HEAD CAP SCREW 3/8-16 X 5/8	2	1220	FLOAT VALVE	4
910	PRESS. GA. 0-15 PSI	1	1230	GASKET, FLOAT VALVE	1
920	TEMP GAUGE 1/4 NPT	1	1240	CVRSNFTG 1/8 X M10 X 1 M WITH O-RING	1
930	FLAT, SOCKET HEAD SCREW 5/16-18 X 3/4	30	1250	MALE CONNECTOR 3/8 X 1/8	1
940	O-RING 2-220	1	1260	BUTTON HEAD SCREW 1/4-20X	4
950	UMBRELLA MESH, 150	1	1270	VALVE BALL 1/2 NPT BRASS	1
960	SPIDER, 150 MESH SUPPORT	1	1280	NIPPLE 1/2 NPT X 3-1/2 LG STEEL	1
970	HEX SOCKET SET SCREW 1/4-20 X 1/4	2	1290	STREET ELBOW 90 X 1/2 NPT	1
980	MESH PAD	3	1300	HEX NUT 3/8-16 ZINC COATED	2
990	CLIP, MESH	8	1310	HEX HEAD CAP SCREW 5/16-18 NPT	1
1000	HEX HEAD CAP SCREW /8-16 X 1-1/4	6	1320	HEX HEAD BUSHING 1/4 X 1/8 NPT STEEL	1
1010	LOCK WASHER 3/8 REGULAR, SPRING	8	1330	HEX SOCKET PIPE PLUG 3/8 NPT	1

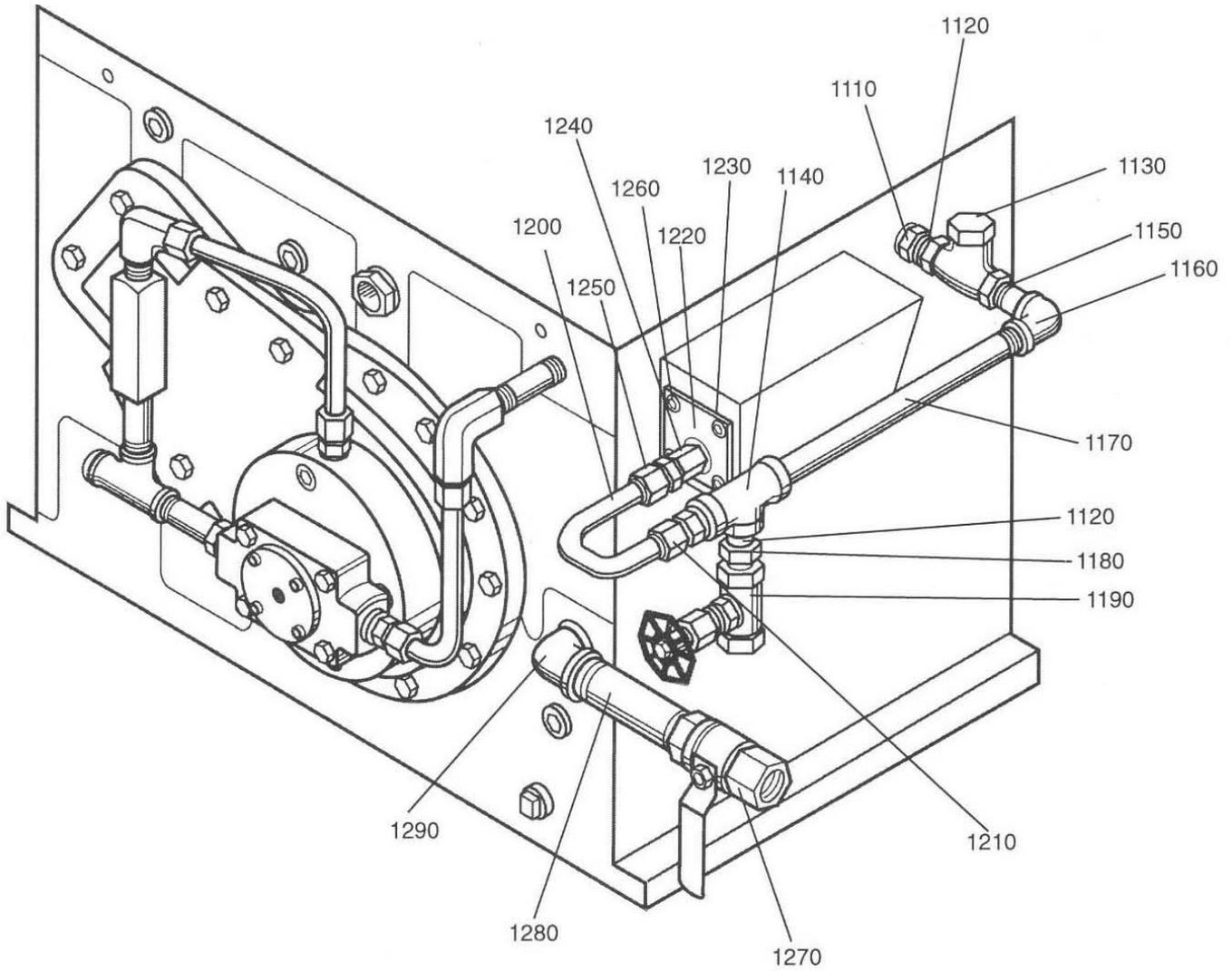
KT-170 LP & KT-190 LP LOWER ASSEMBLY DRAWING



KT-170 LP & KT-190 LP LOWER ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
020	CYLINDER	1	370	O-RING 2-232 BU-N	2
030	HEAD, OPEN END	1	380	O-RING 2-227 BU-N	1
040	HEAD, CLOSED END	1	390	VALVE, SPRING CHECK 3/8 NPT BRASS	1
050	HOUSING, OIL PUMP	1	400	VALVE, RELIEF 1/2 NPT	1
060	HOUSING, SHAFT SEAL & BEARING	1	410	GASKET BOTTOM PLATE	1
070	COVER VALVE DECK	1	420	TEE 3/8 NPT MALLEABLE IRON	1
080	TOP PLATE	1	430	MALE ELBOW 1/2 X 3/8	1
090	BOTTOM PLATE	1	440	MALE CONNECTOR 1/2 X 1/4	1
100	CAM, CENTER	1	450	MALE CONNECTOR 1/2 X 1/2	1
110	PISTON, CENTER	2	460	FEMALE ELBOW 1/2 X 3/8	1
120	SLIDEPIN, CENTER	2	470	NIPPLE 3/8 NPT X 2 LG STEEL	1
130	CAM, OUTER	2	480	NIPPLE 3/8 NPT X 3-3/4 LG STEEL	1
140	PISTON, OUTER	1	490	SQUARE HEAD PIPE PLUG 1/2 NPT	2
150	SLIDEPIN, OUTER	1	500	SQUARE HEAD PIPE PLUG 1/8 NPT	1
160	REMOVABLE WALL	1	510	NIPPLE 3/8 NPT X 2-1/2 LG STEEL	1
170	SHAFT	1	520	HEX SOCKET PIPE PLUG 1/4 NPT	5
180	SEAL HEAD ASSY, VITON 1-1/4	1	530	SQUARE SOCKET PIPE PLUG 1/2 NPT	2
190	SHAFT SEAL SEAT, CI, 1-1/4	1	540	SQUARE SOCKET PIPE PLUG 3/4 NPT	1
200	RING, SHAFT SEAL BACKUP	1	550	HEX HEAD BUSHING 1/2 X 3/8 NPT	1
210	SLEEVE BEARING 1-1/4	2	560	HEX SOCKET HEAD CAP SCREW 5/16-18	4
220	BALL BEARING, SRFS 30 MM	1	570	HEX SOCKET HEAD CAP SCREW 5/16-18	9
230	BEARING LOCKNUT N--06	1	580	HEX HEAD CAP SCREW 5/16-18 X 1-3/4	4
240	PUMP, OIL	1	590	HEX HEAD CAP SCREW 5/16-18 X 1-1/2	12
250	DISCHARGE VALVE ASSEMBLY K 1-1/2	3	600	HEX HEAD CAP SCREW 5/16-18 X 1	8
260	HOLD DOWN PLATE, DISCHARGE VALVE	3	610	1/2 OD HYDRAULIC STEEL TUBING	24
270	SPACER, SLIDEPIN	2	620	HEX HEAD CAP SCREW 3/8-16 X 1	30
280	HSSS, CENTER WALL LOCKING	3	630	HEX HEAD CAP SCREW 5/16-18 X 1	8
290	PIN, CENTERWALL LOCKING	3	640	DOWEL PIN 5/16 X 1, STEEL	4
300	GASKET CYLINDER SEPARATOR	1	650	HEX SOCKET PIPE PLUG 3/8 NPT	2
310	GASKET TOP PLATE	1	660	HEX HEAD CAP SCREW 5/16-18 X 7/8	24
320	RING, BEARING BACKUP	1	670	RETAINER PLATE, BEARING	1
330	BUSHING ASSY, WATER	1	680	HEX SOCKET HEAD CAP SCREW 1/4-20 X 5/8	4
340	KEY WOODRUFF 13	4	690	INSERT, PUMP DRIVE	1
350	RETAINING RING 1.31 EXTERNAL	3	700	HEX SOCKET SET SCREW, CUPPOINT	1
360	KEY SQUARE 1/4 X 1-3/4 DRIVE LOK	1			

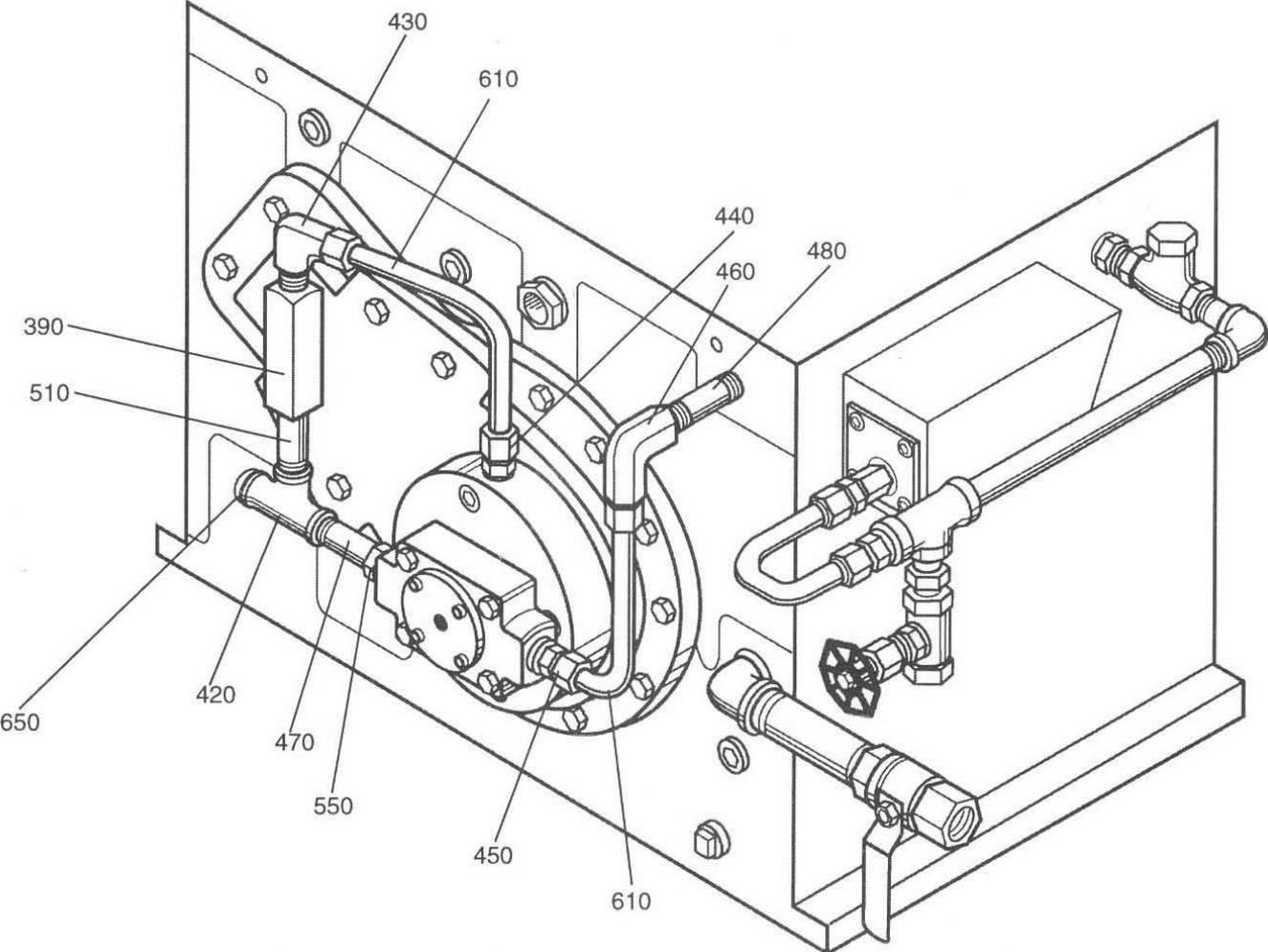
KT-170 LP & KT-190 LP UPPER ASSEMBLY PIPING DRAWING



KT-170 LP & KT-190 LP UPPER ASSEMBLY PIPING PARTS LIST

ITEM #	DESCRIPTION	QTY
1110	HEX HEAD BUSHING 3/4 X 1/4 NPT	1
1120	NIPPLE 1/4 NPT X 7/8 LG STEEL	2
1130	VALVE, SWING CHECK 1/4 NPT BRONZE	1
1140	TEE 1/4 NPT, MALLEABLE IRON	1
1150	NIPPLE 1/4 NPT X 1-3/4 LG STEEL	1
1160	ELBOW 90 X 1/4 NPT MALLEABLE IRON	1
1170	NIPPLE 1/4 NPT X 7-1/2 LG STEEL	1
1180	HEX HEAD BUSHING 1/2 X 1/4 NPT	1
1190	VALVE, NEEDLE 1/2 NPT , BRONZE GLOBE	1
1200	3/8 OD HYDRAULIC STEEL TUBING	12
1210	MALE CONNECTOR 3/8 X 1/4	1
1220	FLOAT VALVE	1
1230	GASKET, FLOAT VALVE	1
1240	CVRSNFTG 1/8 X M10X 1 M W/O-RING	1
1250	MALE CONNECTOR 3/8 X 1/8	1
1260	BUTTON HEAD SCREW 1/4-20 X	4
1270	VALVE, BALL 1/2 NPT, BRASS	1
1280	NIPPLE 1/2 NPT X 3-1/2 LG STEEL	1
1290	STREET ELBOW 90 X 1/2 NPT	1

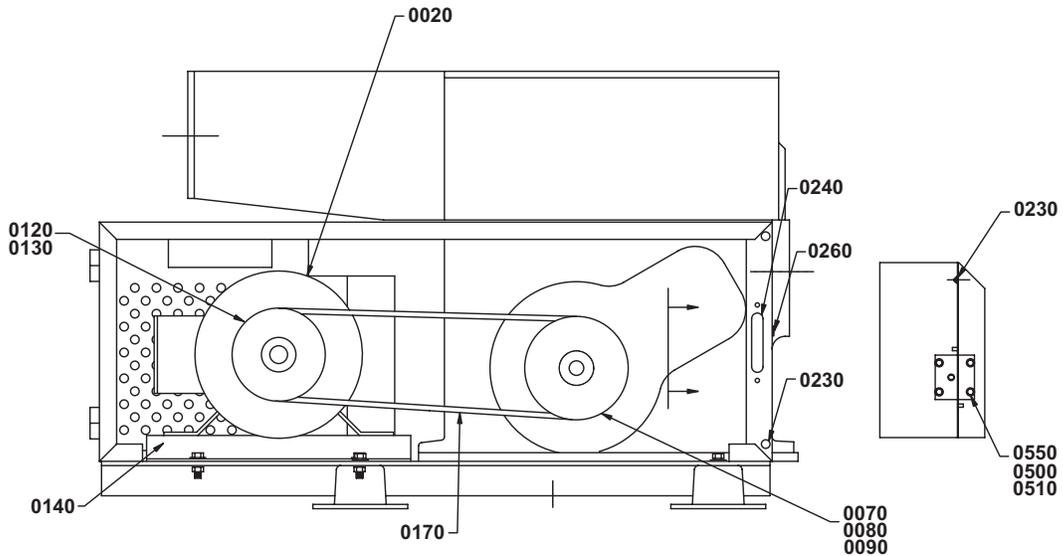
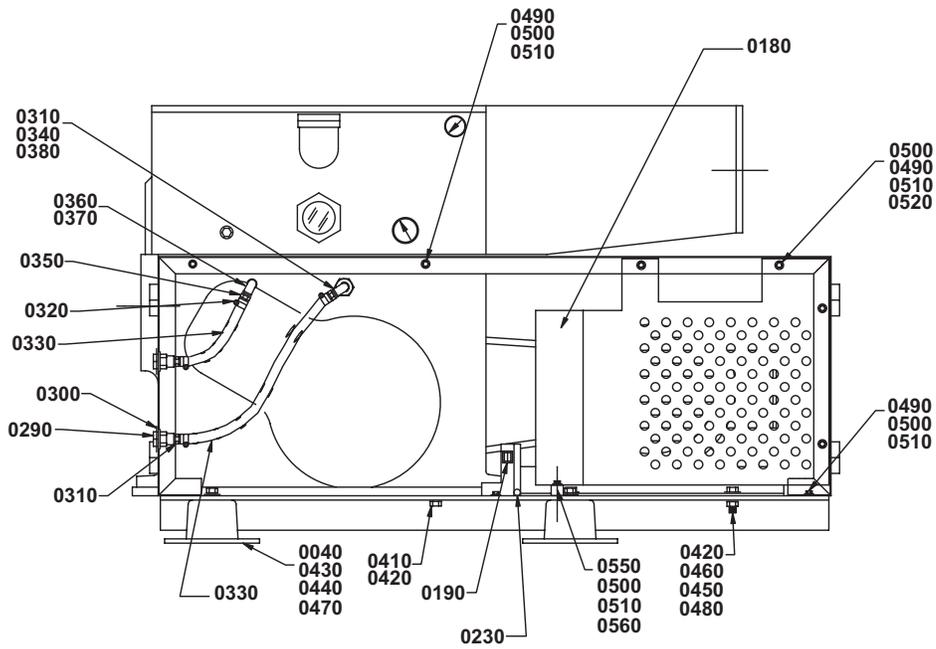
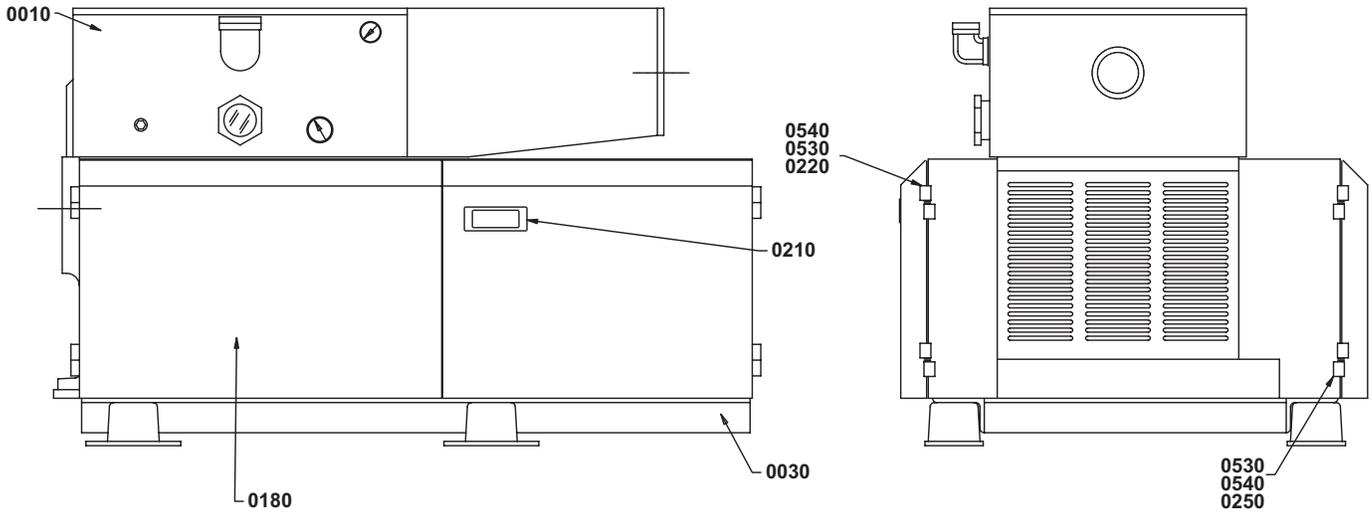
KT-170 LP & KT-190 LP LOWER ASSEMBLY PIPING DRAWING



KT-170 LP & KT-190 LP LOWER ASSEMBLY PIPING PARTS LIST

ITEM #	DESCRIPTION	QTY
390	VALVE, SPRING CHECK 3/8 NPT BRASS	1
400	VALVE, RELIEF 1/2 NPT	1
410	GASKET BOTTOM PLATE	1
420	TEE 3/8 NPT MALLEABLE IRON	1
430	MALE ELBOW 1/2 X 3/8	1
440	MALE CONNECTOR 1/2 X 1/4	1
450	MALE CONNECTOR 1/2 X 1/2	1
460	FEMALE ELBOW 1/2 X 3/8	1
470	NIPPLE 3/8 NPT X 2 LG STEEL	1
480	NIPPLE 3/8 NPT X 3-3/4 LG STEEL	1
490	SQUARE HEAD PIPE PLUG 1/2 NPT	2
500	SQUARE HEAD PIPE PLUG 1/2 NPT	1
510	NIPPLE 3/8 NPT X 2-1/2 LG STEEL	1
520	HEX SOCKET PIPE PLUG 1/4 NPT	5
530	SQUARE SOCKET PIPE PLUG 1/2 NPT	2
540	SQUARE SOCKET PIPE PLUG 3/4 NPT	1
550	HEX HEAD BUSHING 1/2 X 3/8 NPT	1
560	HEX SOCKET HEAD CAP SCREW 5/16-18 X 2	4
570	HEX SOCKET HEAD CAP SCREW 5/16 - 18 X 3/4	9
580	HEX HEAD CAP SCREW 5/16-18 X 1-3/4	4
590	HEX HEAD CAP SCREW 5/16-18 X 1-1/2	12
600	HEX HEAD CAP SCREW 5/16-18 X 1	8
610	1/2 OD HYDRAULIC STEEL TUBING	24
620	HEX HEAD CAP SCREW 3/8-16 X 1	30
630	HEX HEAD CAP SCREW 5/16-18 X 1	8
640	DOWEL PIN 5/16 X 1, STEEL	4
650	HEX SOCKET PIPE PLUG 3/8 NPT	2

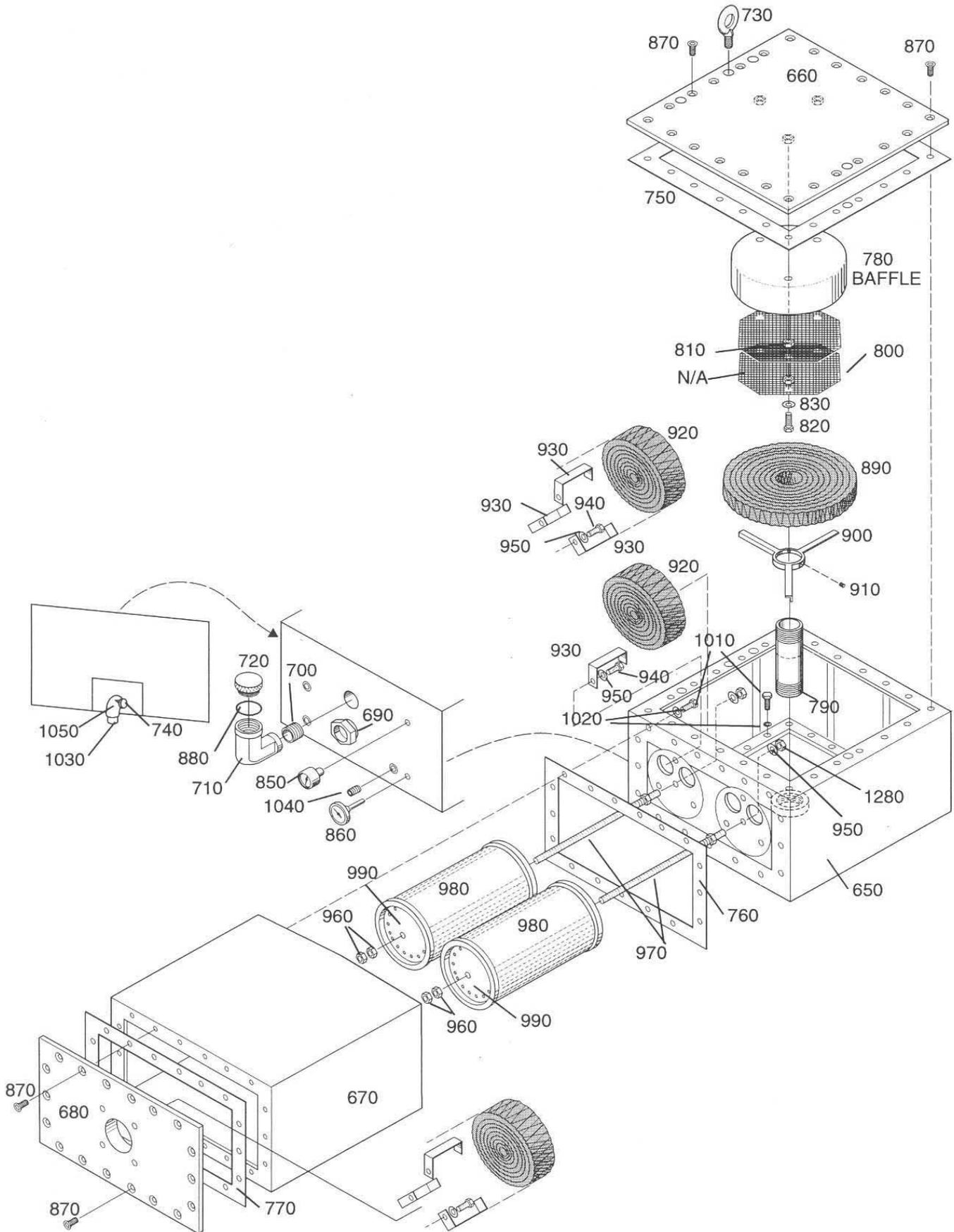
KT-275 LP FINAL ASSEMBLY DRAWING



KT-275 LP FINAL ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
010	KT - 275 LP	1	320	HOSE CLAMP 1/2	4
020	MOTOR TE 10 1725 215T 208/460	1	330	HOSE 3/8 ID, RUBBER	36
030	BASE	1	340	ELBOW 90 X 3/8 NPT MALLEABLE IRON	1
040	VIBRAMOUNT, RED 525#	4	350	COUPLING, HOSE 3/8 X 1/4 NPT BRASS	1
070	SHEAVE, 3-3V-6.0 (SDS)	1	360	ELBOW 90 X 1/4 NPT MALLEABLE IRON	1
080	QD BUSHING SDS 1 - 1/16	1	370	NIPPLE 1/4 NPT X 1-3/4 LG STEEL	1
090	SLEEVE, SHEAVE SPACER	1	380	NIPPLE 3/8 NPT X 2 LG STEEL	1
120	SHEAVE, 3-3V - 4.12 (SH)	1	410	HEX HEAD CAP SCREW — 3/8 X 1-1/2	4
130	QD BUSHING SH 11/8	1	420	LOCKWASHER 3/8, REGULAR SPRING	8
140	BASE, MOTOR - FR 215	1	430	HEX HEAD CAP SCREW — 1/2-13 X 1-1/2	4
170	V-BELT 3/3VX - 530	1	440	PLAIN WASHER 1/2, ZINC COATED STEEL	4
180	PANEL SET, LOCKING	1	450	HEX HEAD CAP SCREW 3/8-16 X 1	4
190	PANEL LATCH	3	460	PLAIN WASHER 3/8 ZINC COATED STEEL	4
200	PANEL STRIKE	3	470	LOCK WASHER 1/2 REGULAR, SPRING	4
210	DOOR PULL	1	480	HEX NUT 3/8-16, ZINC COATED STEEL	4
220	HINGE, LEFT HAND	2	490	HEX HEAD CAP SCREW 1/4-20 X 1/2	18
230	DOOR SILENCER	3	500	PLAIN WASHER 1/4, ZINC COATED STEEL	23
240	LOCK, STD ROTOLOCK W/LATCH/RCPT	1	510	LOCK WASHER 1/4, REGULAR SPRING	22
250	HING, RIGHT HAND	4	520	HEX NUT 1/4-20, ZINC COATED STEEL	8
260	GROMMET 3/8	1	530	BINDING HEAD SCREW 10-24 X 3/8	24
290	BULKHEAD FITTING	2	540	LOCK WASHER 10 REGULAR SPRING	24
300	PLAIN WASHER 1 SAE	2	550	HEX HEAD CAP SCREW 1/4-20 X 1	5
310	COUPLING, HOSE 3/8 X 3/8 NPT BRASS	3	560	1/2 OD SPCR X 1/2 LGX.252 ID	1

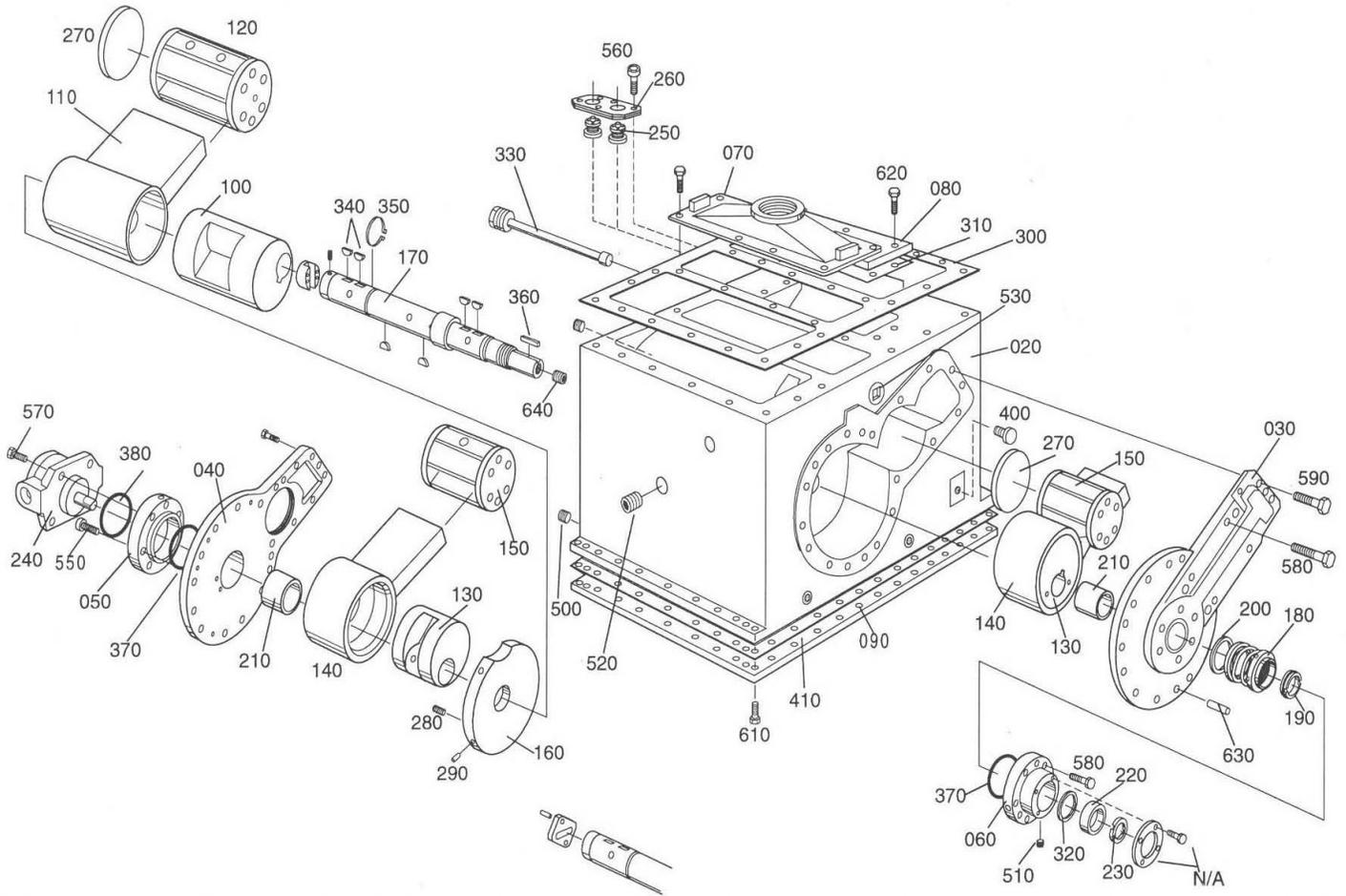
KT-275 LP UPPER ASSEMBLY DRAWING



KT-275 LP UPPER ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
010	Lower Pump Assy	1	990	Clamp Plate, Element	2
650	Separator Housing	1	1000	Union 1/4 NPT Malleable Iron	1
660	Cover, Separator Housing	1	1010	Hex Head Cap Screw 5/16-18 x 1	32
670	Housing, OME	1	1020	Lock Washer 5/16, Regular Spring	32
680	Cover, OME	1	1030	Nipple 1/4 NPT x 1-1/4 LG Steel	1
690	Oil Sight Gauge 2 NPT w/Reflector	1	1040	Hex Socket Pip Plug 1/2 NPT	1
700	Nipple 1 NPT x 1-1/2 LG Steel	1	1050	Elbow 90 Degree x 1/4 NPT, Steel	1
710	F ELB 1 NPT PLTD STL	1	1060	Hex Head Bushing 3/4 x 1/4 NPT	1
720	Oil Fill Cap	1	1070	Nipple 1/4 NPT x 7/8 LG Steel	3
730	Eye Bolt	2	1080	Valve, Swing Check 1/4 NPT Bronze	1
740	Hex Socket Pipe Plug 1/4 NPT	1	1090	Tee 1/4 NPT, Malleable Iron	2
750	Gasket, Separator Housing Cover	1	1100	Nipple 1/4 NPT x 10-1/2 LG Steel	1
760	Gasket, Separator/OME	1	1110	Nipple 1/4 NPT x 4 LG Steel	1
770	Gasket, OME Discharge	1	1120	Pipe Support	1
780	Baffle	1	1130	Hex Socket Set Screw — 10-32 x 3/16	2
790	Nipple 2 NPT x 5 LG Steel	1	1140	3/8 OD Hydraulic Steel Tubing	12
800	Wire Mesh	1	1150	Male Connector 3/8 x 1/8	1
810	Hex Nut 1/2-13, Zinc Coated Steel	3	1160	Male Connector 3/8 x 1/4	1
820	Hex Head Cap Screw — 5/16-18 x 7/8	3	1170	HSG, FLT Valve	1
830	Plain Washer 5/16, Zinc Coated Steel	3	1180	Float Valve	1
840	Hex Head Cap Screw 3/8-16 x 5/8	2	1190	Gasket, Float Valve	1
850	Press. GA. 0-15 PSI	1	1200	CVRSNFTG 1/8 x M10 x 1 M — w/O-Ring	1
860	Temp Gauge 1/4 NPT	1	1210	Button Head Screw 1/4-20 x 1/2	4
870	Flat, Socket Head Screw — 5/16-18 x 3/4	30	1220	Hex Socket Pipe Plug 1/4 NPT	1
880	O-Ring 2-220	1	1230	Valve, Ball 1/2 NPT, Bras	1
890	Umbrella Mesh, 150	1	1240	Nipple 1/2 NPT x 3-1/2 LG Steel	1
900	Spider, 150 Mesh Support	1	1250	Street Elbow 90 x 1/2 NPT	1
910	Hex Socket Set Screw 1/4-20 x 1/4	2	1260	Valve, Angle 1/8 MNPT, Brass	1
920	Mesh Pad	3	1270	Valve, Ball 1/4 NPT, Bronze	1
930	Clip, Mesh	8	1280	Hex Nut, 3/8-16, Zinc Coated	2
940	Hex HEad Cap Screw — 3/8-16 x 1-1/4	6	1290	Hex Head Cap Screw — 5/16-18 x 3	1
950	Lock Washer 3/8, Regular, Spring	8	1300	Nipple 1/4 NPT x 2-1/2 LG Steel	1
960	Seal Nut 3/8-16	4	1310	Hex Head Busing 1/4 x 1/8 NP Steel	2
970	Clamping Rod Assy	2	1320	Hex Socket Pipe Plug 3/8 NPT	1
980	Element, OME 75	2			

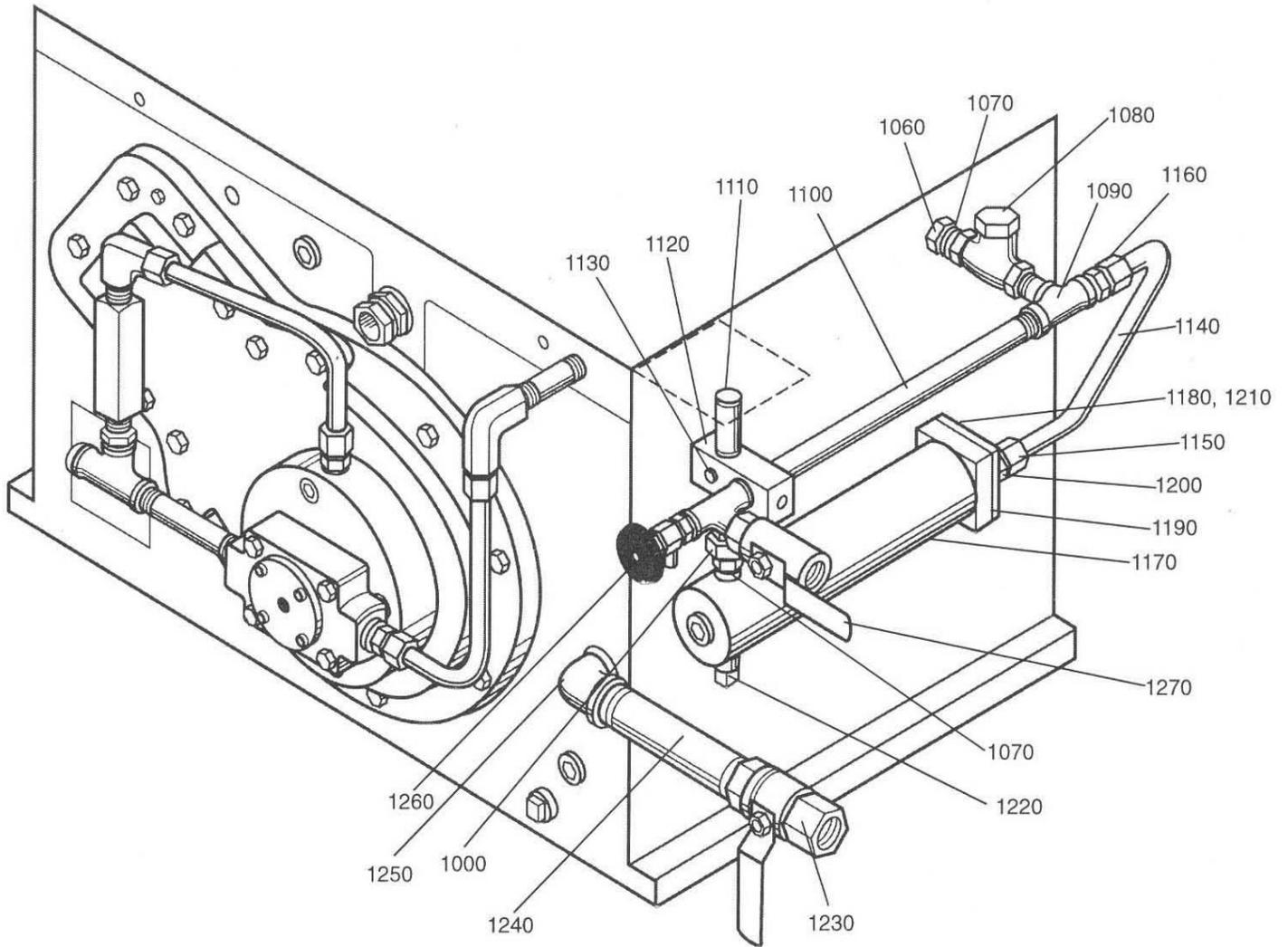
KT-275 LP LOWER ASSEMBLY DRAWING



KT-275 LP LOWER ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
020	Cylinder	1	340	Key Woodruff 13	6
030	Head, Open End	1	350	Retaining Ring 1.37 External	1
040	Head, Closed End	1	360	Key Square 1/4 x 1-3/4 — Drive Lok	1
050	Housing, Oil Pump	1	370	O-Ring 2-232 BU-N	2
060	Housing, Bearing & Shaft Seal	1	380	O-Ring 2-227 BU-N	1
070	Cover Valve Deck	1	390	Valve, Spring check 3/8 — NPT Brass	1
080	Cover, Top	1	400	Valve, Relief 1/2 NPT	1
090	Cover, Bottom	1	410	Gasket Bottom Plate	1
100	Cam, Center	1	420	Male Elbow 1/2 x 3/8	1
110	Piston, Center	1	430	Male Connector 1/2 x 1/4	1
120	Slidepin, Center	1	440	Male Connector 1/2 x 1/2	1
130	Cam, Outer	2	450	Female Elbow 1/2 x 3/8	1
140	Piston, Outer	2	460	Tee 1/2 NPT Malleable Iron	1
150	Slidepin, Outer	2	470	Nipple 1/2 NPT x 4 LG Steel	1
160	Removable Wall	1	480	Nipple 3/8 NPT x 1-1/4 LG Steel	1
170	Shaft & Coupling Assembly	1	490	Nipple 3/8 NPT x 2-3/4 LG Steel	1
180	Seal Head Assy, Buna, 1 - 1/4	1	500	Square Head Pipe Plug 1/2 NPT	2
190	Shaft Seal Seat, C1, 1-1/4	1	510	Square Head Pipe Plug 1/8 — NPT Steel	2
200	Ring, SS Backup	1	520	Square Socket Pipe Plug 1/2 NPT	2
210	Sleeve Bearing 1-1/4	2	530	Square Socket Pipe Plug 1 NPT CI	1
220	Ball Bearing, SRFS 30 MM	1	540	Hex Head Bushing 1/2 x 3/8 NPT	1
230	Bearing Lock Nut N-06	1	550	Hex Socket Head Cap Screw — 5/16-18 x 1-1/2	4
240	Pump, Oil	1	560	Hex Socket Head Cap Screw — 5/16-18 x 3/4	12
250	Discharge Valve Assembly K 1-1/2	4	570	Hex Head Cap Screw — 5/16-18 x 1-3/4	4
260	Holddown Plate, Discharge Valve	4	580	Hex Head Cap Screw — 5/16-18 x 1-1/2	16
270	Spacer, Slide Pin	2	590	Hex Head Cap Screw 5/16-18 x 1	28
280	HSSS, Center Wall Locking	3	600	1/2 OD Hydraulic Steel Tubing	24
290	Pin, Centerwall Locking	3	610	Hex Head Cap Screw 3/8-16 x 1	36
300	Gasket, Cylinder Separator	1	620	Hex Head Cap Screw 5/16-18 x 1	12
310	Gasket Top Plate	1	630	Dowel Pin 3/8 x 1-1/4, Steel	4
320	Ring, Bearing Backup	1	640	Hex Socket Pipe Plug 3/8 NPT	2
330	Busing Assy, Water	1			

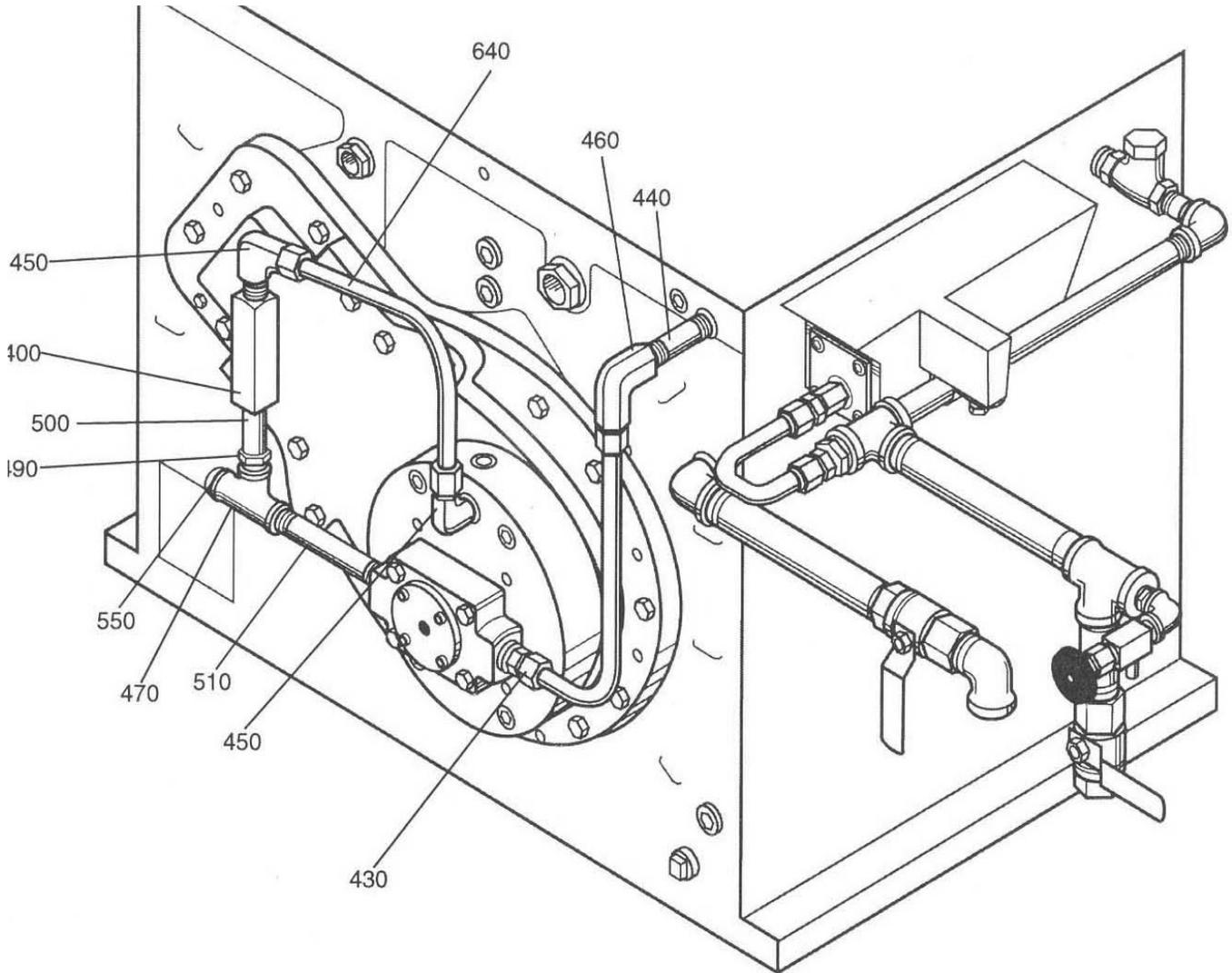
KT-275 LP UPPER ASSEMBLY PIPING DRAWING



KT-275 LP UPPER ASSEMBLY PIPING PARTS LIST

ITEM #	DESCRIPTION	QTY
1000	UNION 1/4 NPT MALLEABLE IRON	1
1010	HEX HEAD CAP SCREW 5/16-18 X 1	32
1020	LOCK WASHER 5/16, REGULAR, SPRING	32
1030	NIPPLE 1/4 NPT X 1-1/4 LG STEEL	1
1040	HEX SOCKET PIPE PLUG 1/2 NPT	1
1050	ELBOW 90 DEGREE X 1/4 NPT, STEEL	1
1060	HEX HEAD BUSING 3/4 X 1/4 NPT	1
1070	NIPPLE 1/4 NPT X 7/8 LG STEEL	3
1080	VALVE, SWING CHECK 1/4 NPT BRONZE	1
1090	TEE 1/4 NPT, MALLEABLE IRON	2
1100	NIPPLE 1/4 NPT X 10-1/2 LG STEEL	1
1110	NIPPLE 1/4 NPT X 4 LG STEEL	1
1120	PIPE SUPPORT	1
1130	HEX SOCKET SET SCREW 10-32 X 3/16	2
1140	3/8 OD HYDRAULIC STEEL TUBING	12"
1150	MALE CONNECTOR 3/8 X 1/8	1
1160	MALE CONNECTOR 3/8 X 1/4	1
1170	HSG, FLT VALVE	1
1180	FLOAT VALVE	1
1190	GASKET, FLOAT VALVE	1
1200	CVRSNFTG 1/8 X M10 X 1M WITH O-RING	1
1210	BUTTON HEAD SCREW 1/4-20 X 1/2	4
1220	HEX SOCKET PIPE PLUG 1/4 NPT	1
1230	VALVE, BALL 1/2 NPT, BRASS	1
1240	NIPPLE 1/2 NPT X 3-1/2 LG STEEL	1
1250	STREET ELBOW 90 X 1/2 NPT	1
1260	VALVE, ANGLE 1/8 MNPT, BRASS	1
1270	VALVE, BALL 1/4 NPT, BRONZE	1

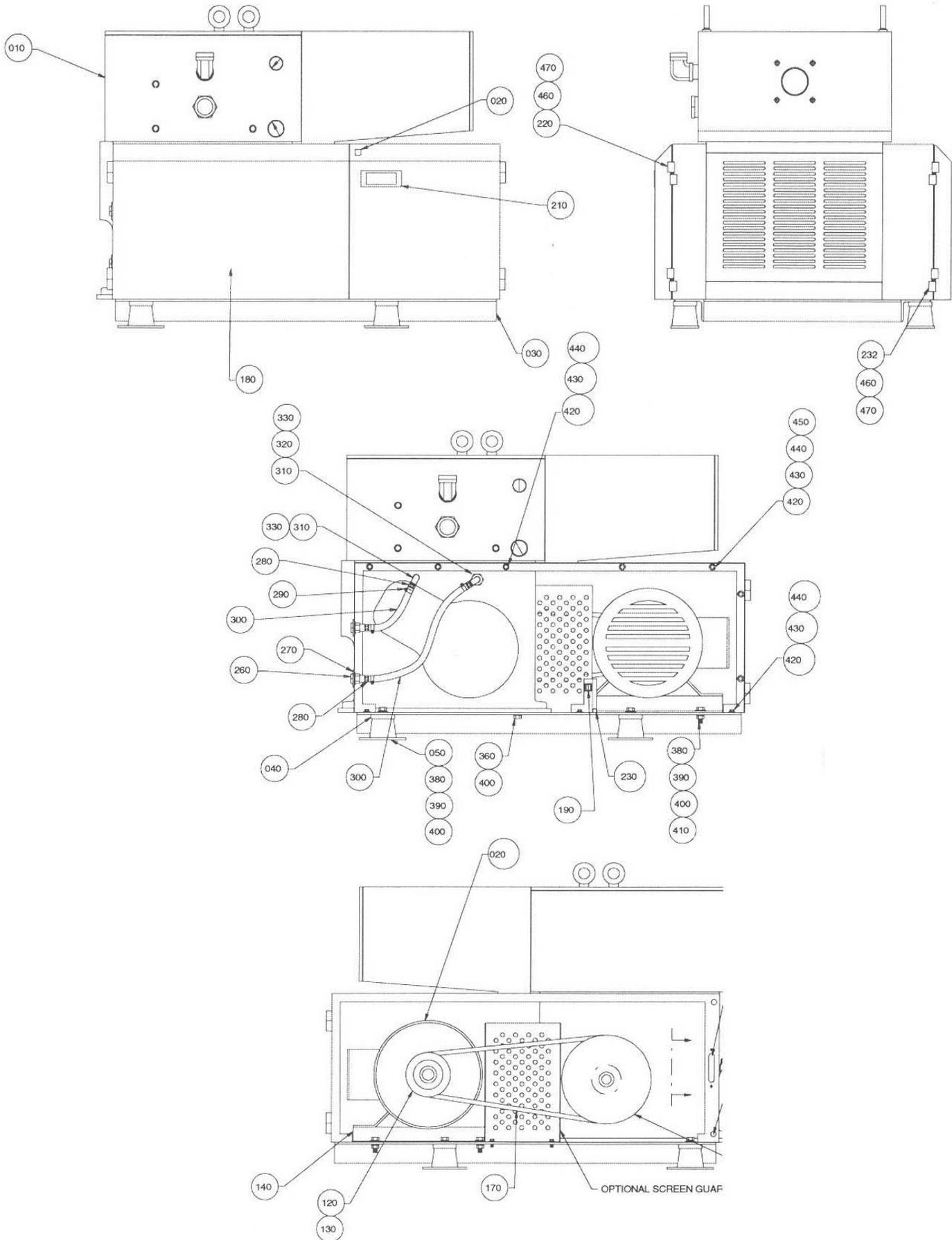
KT-275 LP LOWER ASSEMBLY PIPING DRAWING



KT-275 LP LOWER ASSEMBLY PIPING PARTS LIST

ITEM #	DESCRIPTION	QTY
390	VALVE, SPRING CHECK 3/8 NPT BRASS	1
400	VALVE, RELIEF 1/2 NPT	1
410	GASKET BOTTOM PLATE	1
420	MALE ELBOW 1/2 X 3/8	1
430	MALE CONNECTOR 1/2 X 1/4	1
440	MALE CONNECTOR 1/2 X 1/2	1
450	FEMALE ELBOW 1/2 X 3/8	1
460	TEE 1/2 NPT MALLEABLE IRON	1
470	NIPPLE 1/2 NPT X 4 LG STEEL	1
480	NIPPLE 3/8 NPT X 1-1/4 LG STEEL	1
490	NIPPLE 3/8 NPT X 2-3/4 LG STEEL	1
500	SQUARE HEAD PIPE PLUG 1/2 NPT	2
510	SQUARE HEAD PIPE PLUG 1/8 NPT STEEL	2
520	SQUARE SOCKET PIPE PLUG 1/2 NPT	2
530	SQUARE SOCKET PIPE PLUG 1 NPT CI	1
540	HEX HEAD BUSING 1/2 X 3/8 NPT	1
550	HEX SOCKET HEAD CAP SCREW 5/16-18 X 1-1/2	4
560	HEX SOCKET HEAD CAP SCREW 5/16-18 X 3/4	12
570	HEX HEAD CAP SCREW 5/16-18 X 1-3/4	4
580	HEX HEAD CAP SCREW 5/16-18 X 1-1/2	16
590	HEX HEAD CAP SCREW 5/16-18 X 1	28
600	1/2 OD HYDRAULIC STEEL TUBING	24

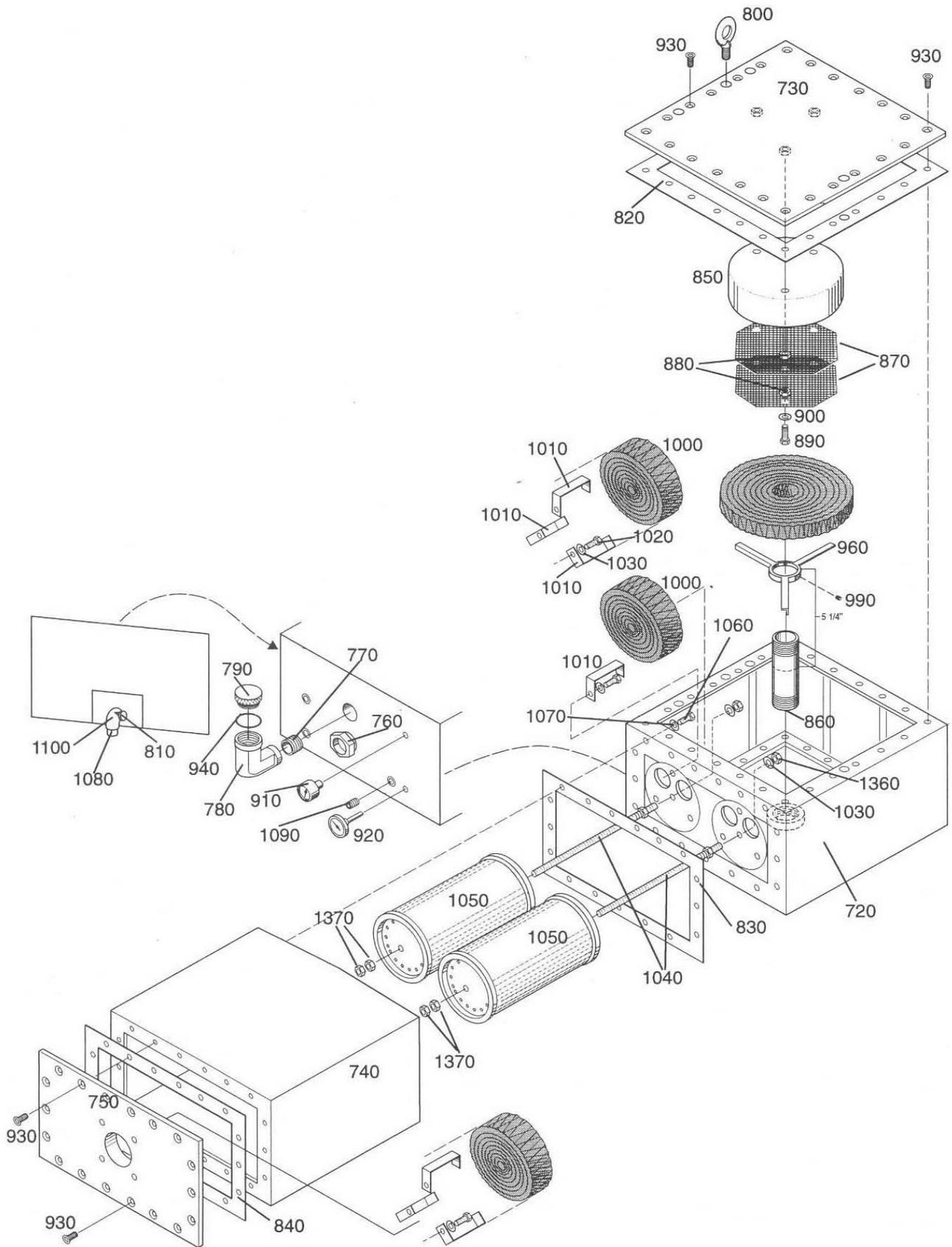
KT-505 LP FINAL ASSEMBLY DRAWING



KT-505 LP FINAL ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
010	KT-505 LP PUMP ASSY/CAST HOUSINGS	1	260	BULKHEAD FITTING	2
020	MOTOR TE 15 1725 254T 230/460	1	270	PLAIN WASHER 1 SAE	2
030	BASE	1	280	COUPLING, HOSE 3/8 X 3/8 NPT BRASS	4
040	SPACER, MOUNTING KT-505 LP	4	290	HOSE CLAMP 1/2	4
050	VIBRAMOUNT, GRAY 1100# RD	4	300	HOSE 3/8 ID, RUBBER	36
080	SHEAVE, 4-3V-10.6 (SK)	1	310	ELBOW 90 X 3/8 NPT MALLEABLE IRON	2
090	QD BUSHING - SK - 1 - 5/8	1	320	HEX HEAD BUSHING 1/2 X 3/8 NPT	1
120	SHEAVE, 4 - 3V - 5.3 (SDS)	1	330	NIPPLE 3/8 NPT X 1 - 1/2 LG STEEL	2
130	QD BUSHING - SDS - 13/8	1	360	HEX HEAD CAP SCREW 1/2 - 13 X 1 - 1/2	4
140	BASE, MTR FR 254	1	370	HEX HEAD CAP SCREW 1/4 - 20 X 1	4
170	V-BELT 4/3VX - 670 BAND	1	380	HEX HEAD CAP SCREW 1/2 - 13 X 1 - 1/2	8
180	PANEL SET, LOCKING	1	390	PLAIN WASHER 1/2, ZINC COATED STEEL	8
190	PANEL LATCH	3	400	LOCK WASHER 1/2, REGULAR, SPRING	12
200	PANEL STRIKE	3	410	HEXNUT 1/2 - 13, ZINC COATED STEEL	4
210	DOOR PULL	1	420	HEX HEAD CAP SCREW 1/4 - 20 X 1/2	24
220	HINGE, LEFT HAND	2	430	PLAIN WASHER 1/4, ZINC COATED STEEL	28
230	DOOR SILENCER	3	440	LOCK WASHER 1/4, REGUALER SPRING	28
231	LOCK, STD ROTOLOCK W/LATCH/RCPT	1	450	HEXNUT 1/4 - 20, ZINC COATED STEEL	8
232	HING, RIGHT HAND	4	460	BINDING HEAD SCREW 10 - 24 X 3/8	24
233	GROMMET 3/8	1	470	LOCK WASHER 10 REGULAR SPRING	24

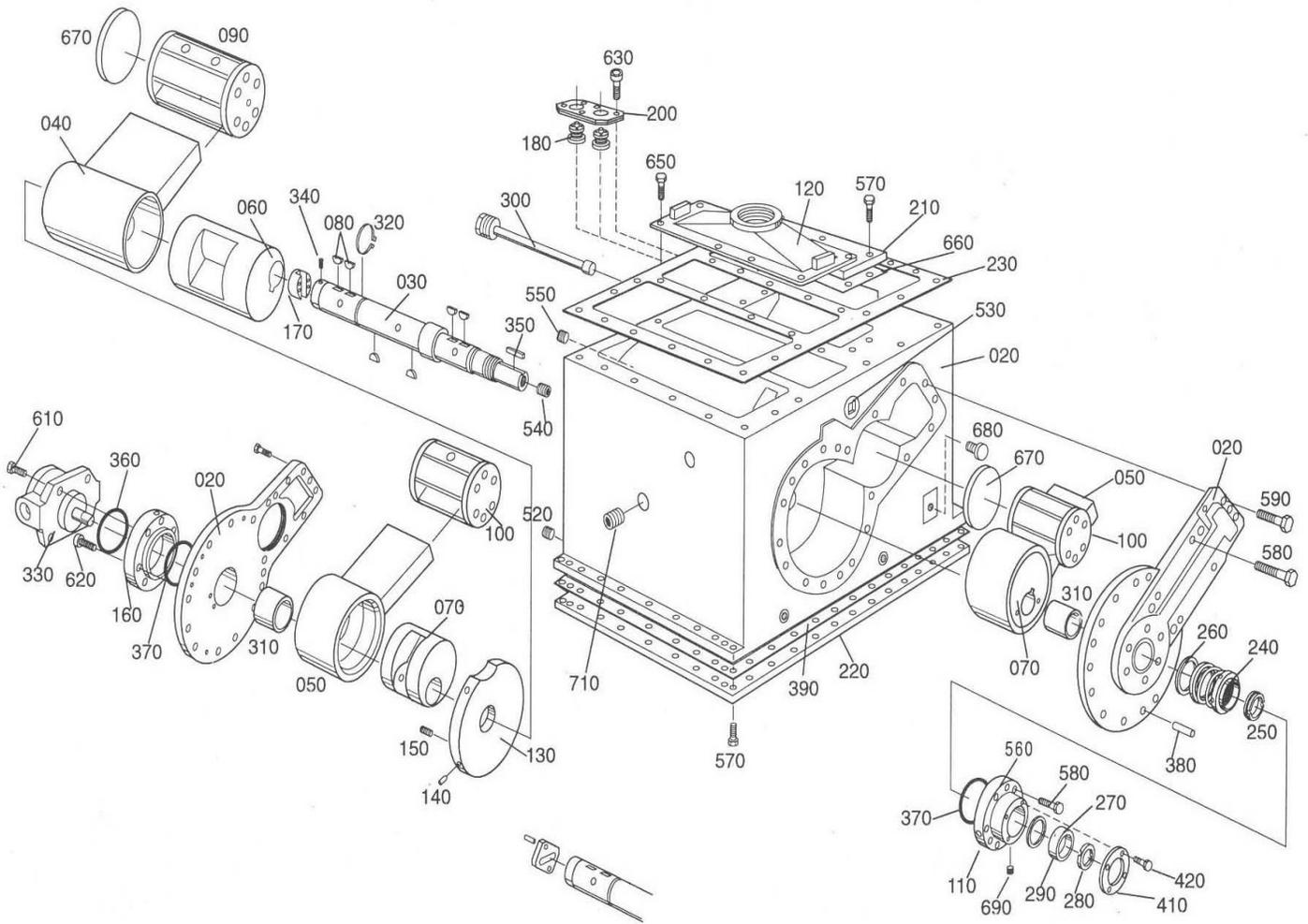
KT-505 LP UPPER ASSEMBLY DRAWING



KT-505 LP UPPER ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY	ITEM #	DESCRIPTION	QTY
010	LOWER PUMP ASSY	1	1050	ELEMENT, OME 190 CFM	2
720	SEPARATOR HOUSING	1	1060	HEX HEAD CAP SCREW 5/16-18 X 1	17
730	COVER, SEPARATOR HOUSING	1	1070	LOCKWASHER 5/16, REGULAR, SPRING	17
740	HOUSING, OME	1	1080	NIPPLE 1/4 NPT X 1 - 1/4 LG STEEL	1
750	COVER, OME	1	1090	HEX SOCKET PIPE PLUG 1/2 NPT	3
760	OIL SIGHT GAUGE 2 NPT W/REFLECTOR	1	1100	ELBOW 90 DEGREE X 1/4 NPT, STEEL	1
770	NIPPLE 1 - 1/4 NPT X 1 - 5/8 LG, STEEL	1	1110	HEX HEAD BUSHING 3/4 X 1/4 NPT	2
780	F ELB 1 - 1/4 NPT PLTD STL	1	1120	NIPPLE 3/4 NPT X 3 LG STEEL	1
790	OIL FILL CAP	1	1130	NIPPLE 3/4 NPT X 1- 3/8 LG STEEL	1
800	EYEBOLT	2	1140	VALVE, SWING CHECK 3/4 NPT, BRONZE	1
810	HEX SOCKET PIP PLUG 1/4 NPT	2	1150	TEE 3/4 NPT MALLEABLE IRON	2
820	GASKET, SEPARATOR HOUSING COVER	1	1160	NIPPLE 3/4 NPT X 12 - 1/2 LG STEEL	1
830	GASKET, SEPARATOR/OME	1	1170	HEX SOCKET PIPE PLUG 3/8 NPT	1
840	GASKET, OME COVER	1	1180	3/8 OD HYDRAULIC STEEL TUBING	12"
850	UMBRELLA, OIL BAFFLE	1	1190	MALE CONNECTOR 3/8 X 1/4	1
860	NIPPLE 2 - 1/2 NPT X 8 - 1/2 LG, STEEL	1	1200	PIP CALMP MOD. KT - 505 LP	1
870	WIRE MESH	2	1210	FLOAT VALVE	1
880	HEXNUT 1/2 - 13, ZINC COATED STEEL	6	1220	GASKET, FLOAT VALVE	1
890	HEX HEAD CAP SCREW 5/16 - 18 X 1 - 1/2	3	1230	CVRSNFTG 1/8 X M10 X 1 M W/O-RING	1
900	PLAIN WASHER 5/16, ZINC COATED STEEL	3	1240	MALE CONNECTOR 3/8 X 1/8	1
910	PRESS. GA. 0 - 15 PSI	1	1250	BUTTON HEAD SCREW 1/4 - 20 X 1/2	4
920	TEMP GAUGE 1/4 NPT	1	1260	ELBOW 90 X 3/4 NPT MALLEABLE IRON	2
930	FLAT, SOCKET HEAD SCREW 5/16 - 18 X	42	1270	NIPPLE 3/4 NPT X 8 LG STEEL	1
940	O-RING 2-223	1	1280	STREET ELBOW 90 X 3/4 NPT	2
950	UMBRELLA MESH, 300	1	1290	VALVE, ANGLE 1/8 MNPT, BRASS	1
960	SPIDER, 300 MESH SUPPORT	1	1300	VALVE, BALL 3/4 NPT, BRAS	2
970	HEX HEAD CAP SCREW 1/2 - 13 X 1 - 1/4	20	1310	NIPPLE 3/4 NPT X 7 LG, STEEL	1
980	LOCK WASHER 1/2 REGULAR, SPRING	20	1320	TEE 3/4 NPT MALLEABLE IRON	1
990	HEX SOCKET SET SCREW 1/4 - 20 X 1/4	2	1330	NIPPLE 3/4 NPTX2-1/2 LG STEEL	1
1000	MESH PAD	2	1340	STEET ELBOW 90 X 1/4 NPT	1
1010	CLIP MESH	6	1350	HEX HEAD BUSHING 1/4X1/8 NPT, STEEL	2
1020	HEX HEAD CAP SCREW 3/8-16X1 1/4	6	1360	ELASTIC STOP NUT, 3/8-16, ZINC COATED	2
1030	LOCKWASHER 3/8, REGULAR, SPRING	8	1370	SEALNUT 3/8 - 16	4
1040	CLAMPING ROD ASSY	2			

KT-505 LP LOWER ASSEMBLY DRAWING

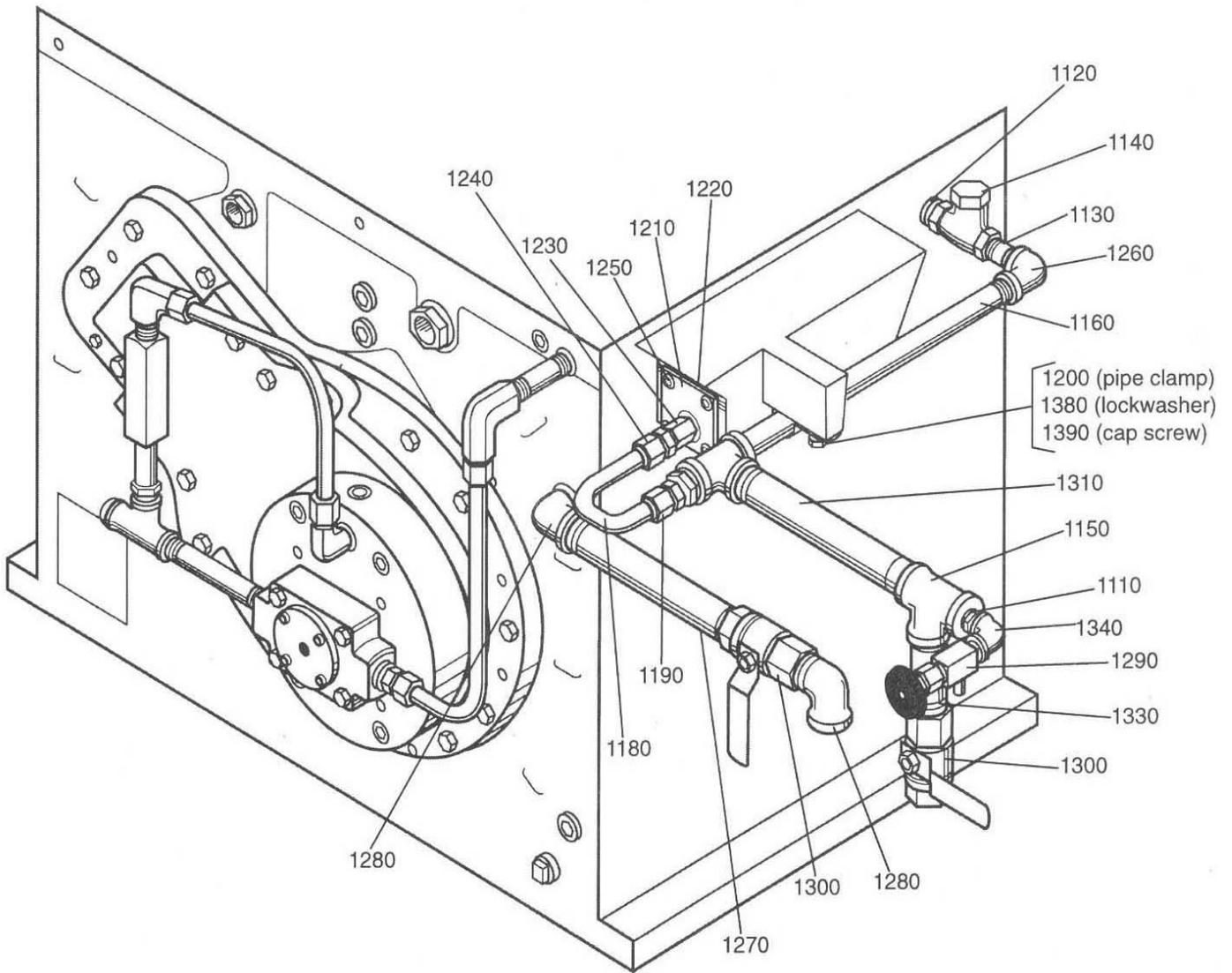


KT-505 LP LOWER ASSEMBLY PARTS LIST

ITEM #	DESCRIPTION	QTY
020	CYL/HD SUB ASSY	1
030	SHAFT	1
040	PISTON, CENTER	1
050	PISTON, OUTER	2
060	CAM, CENTER	1
070	CAM, OUTER	2
080	KEY WOODRUFF 24	6
090	SLIDEPIN, CENTER	1
100	SLIDEPIN, OUTER	2
110	HSG, BEARING & SHAFT SEAL	1
120	COVER, VALVE DECK	1
130	REMOVALBE WALL	1
140	PIN, CENTERWALL LOCKING	3
150	HSSS, CENTER WALL LOCKING	3
160	HOUSING, OIL PUMP	1
170	INSERT, PUMP DRIVE	1
180	DISCHARGE VALVE ASSEMBLY K 1-1/2	7
190	HOLDDOWN PLATE, DISCHARGE VALVE	3
200	HOLDDOWN PLATE, DISCHARGE VALVE	2
210	TOP PLATE	1
220	BOTTOM PLATE	1
230	GASKET, CYLINDER-SEPARATOR	1
240	SEAL HEAD ASSY, BUNA, 1 - 7/8	1
250	SHAFT SEAL SEAT, C1, 1-7/8	1
260	RING, SS BACKUP	1
270	BALL BEARING, SRFS 45 MM	1
280	BEARING LOCKNUT N-09	1
290	RING, BEARING BACKUP	1
300	BUSHING ASSY, WATER	1
310	SLEEVE BEARING 1-7/8	2
320	RETAINING RING 2.00 EXTERNAL	1
330	PUMP, OIL	1
340	HEX SOCKET SET SCREW	1
350	KEY SQUARE 3/8 X 1-1/2 DRIVE LOK	1
360	O-RING 2 - 227 BU-N	1

ITEM #	DESCRIPTION	QTY
370	O-RING 2 - 245 BU-N	2
380	DOWEL PIN 3/8 X 1 - 1/4, STEEL	4
380	GASKET, BOTTOM PLATE	1
400	VALVE, SPRING CHECK 3/8 NPT BRASS	1
410	BEARING CLAMP RING	1
420	FLAT, SOCKET HEAD SCREW 5/16 - 18 X	4
430	MALE CONNECTOR 1/2 X 1/2	1
440	NIPPLE 3/8 NPT X 3 - 1/4 LG STEEL	1
450	MALE ELBOW 1/2 X 3/8	2
460	FEMALE ELBOW 1/2 X 3/8	1
470	TEE 1/2 NPT MALLEABLE IRON	1
480	HEX HEAD BUSHING 1 X 1/2 NPT	1
490	HEX HEAD BUSHING 1/2 X 3/8 NPT	1
500	NIPPLE 3/8 NPT X 2 - 1/2 LG STEEL	1
510	NIPPLE 1/2 NPT X 3 - 1/2 LG STEEL	1
520	SQUARE HEAD PIPE PLUG 3/8 NPT	2
530	SQUARE SOCKET PIPE PLUG 1 NPT CI	1
540	HEX SOCKET PIPE PLUG 3/8 NPT	3
550	HEX SOCKET PIPE PLUG 1/2 NPT	4
560	HEX SOCKET PIPE PLUG 1/4 NPT	3
570	HEX HEAD CAP SCREW 1/2-13X1-1/4	34
580	HEX HEAD CAP SCREW 3/8-16X1-3/4	16
590	HEX HEAD CAP SCREW 3/8-16X1-1/4	16
600	HEX HEAD CAP SCREW 5/16-18X1-1/4	14
610	HEX HEAD CAP SCREW 5/16-18X 1-3/4	4
620	HEX SOCKET HEAD CAPSCREW 3/8-16X1-	6
630	HEX SOCKET HEAD CAP SCREW 3/8-	21
640	1/2 OD HYDRAULIC STELL TUBING	36
650	HEX HEAD CAP SCREW 1/2-13X1-1/4	10
660	GASKET, CYLINDER WATER JACKET	1
670	SPACER, SLIDE PIN	2
680	VALVE, RELIEF 1/2 NPT	1
690	SQUARE HEAD PIPE PLUG 1/8 NPT	1
700	SQUARE SOCKET PIPE PLUG 1/2 NPT	2
710	SQUARE SOCKET PIPE PLUG 3/4 NPT	1

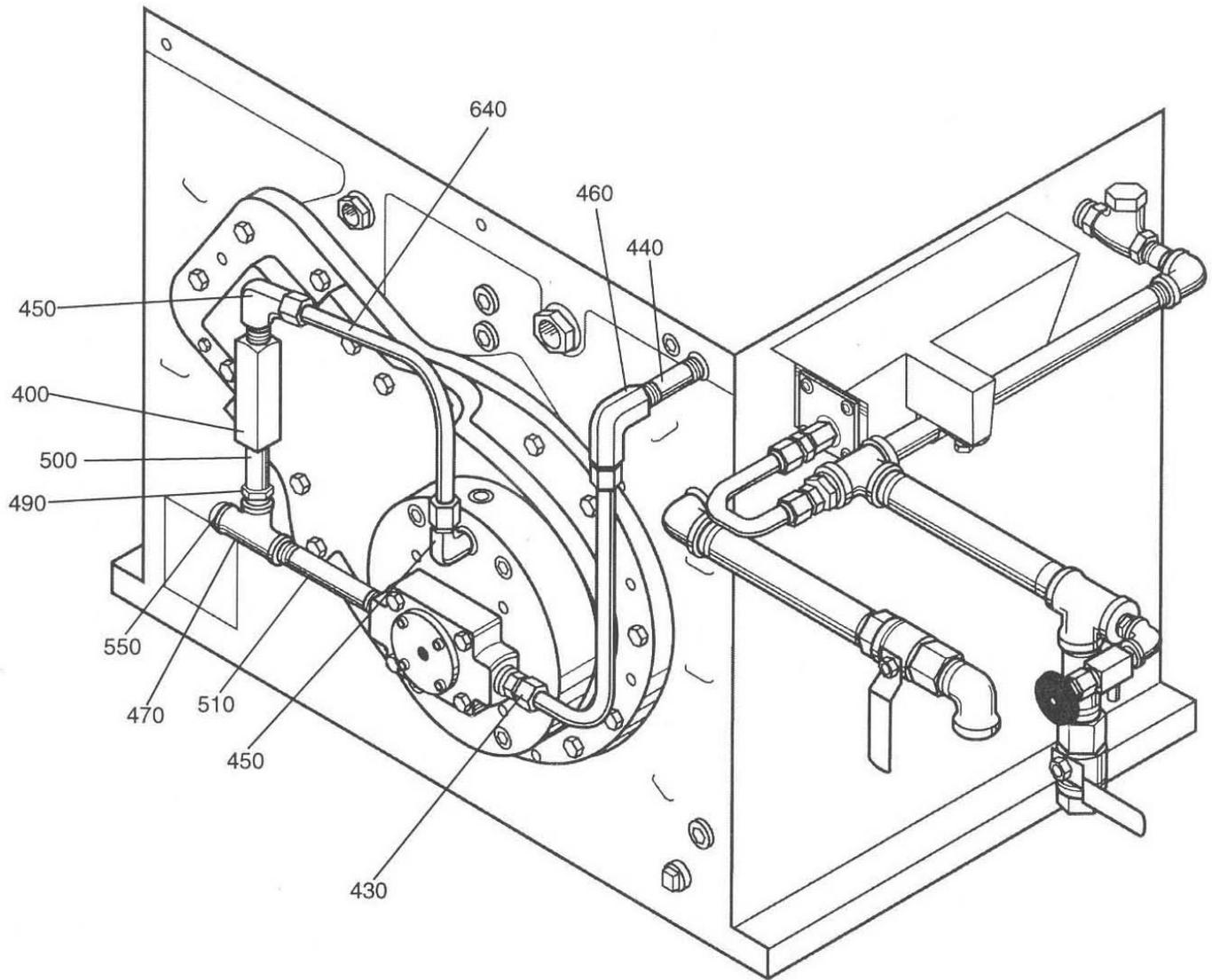
KT-505 LP UPPER ASSEMBLY PIPING DRAWING



KT-505 LP UPPER ASSEMBLY PIPING PARTS LIST

ITEM #	DESCRIPTION	QTY
1110	HEX HEAD BUSING 3/4 X 1/4 NPT	2
1120	NIPPLE 3/4 NPT X 3 LG STEEL	1
1130	NIPPLE 3/4 NPT X 1 - 3/8 LG STEEL	1
1140	VALVE, SWING CHECK 3/4 NPT, BRONZE	1
1150	TEE 3/4 NPT MALLEABLE IRON	2
1160	NIPPLE 3/4 NPT X 12 - 1/2 LG STEEL	1
1170	HEX SOCKET PIPE PLUG 3/8 NPT	1
1180	3/8 OD HYDRAULIC STEEL TUBING	12"
1190	MALE CONNECTOR 3/8 X 1/4	1
1200	PIPE CLAMP MOD. KT -505 LP	1
1210	FLOAT VALVE	1
1220	GASKET, FLOAT VALVE	1
1230	CVRSNFTG 1/8 X M10 X 1 M W/O-ING	1
1240	MALE CONNECTOR 3/8 X 1/8	1
1250	BUTTON HEAD SCREW 1/4 - 20 X 1/2	4
1260	ELBOW 90 X 3/4 NPT MALLEABLE IRON	2
1270	NIPPLE 3/4 NPT X 8 LG STEEL	1
1280	STREET ELBOW 90 X 3/4 NPT	2
1290	VALVE, ANGLE 1/8 MNPT, BRASS	1
1300	VALVE, BALL 3/4 NPT, BRAS	2
1310	NIPPLE 3/4 NPT X 7 LG, STEEL	1
1320	TEE 3/4 NPT MALLEABLE IRON	1
1330	NIPPLE 3.4 NPT X 2 - 1/2 LG STEEL	1
1340	STREET ELBOW 90 X 1/4 NPT	1
1350	HEX HEAD BUSHING 1/4 X 1/8 NPT, STEEL	2
1360	ELASTIC STOP NUT, 3/8-16, ZINC COATED	2
1370	SEAL NUT 3/8 - 16	4
1380	HEX HEAD CAP SCREW 1/4 - 20 X 5/8	1
1390	LOCK WASHER 1/4 REG. SPRING	1

KT-505 LP LOWER ASSEMBLY PIPING DRAWING



KT-505 LP LOWER ASSEMBLY PIPING PARTS LIST

ITEM #	DESCRIPTION	QTY
430	MALE CONNECTOR 1/2 X 1/2	1
440	NIPPLE 3/8 NPT X 3-1/4 LG STEEL	1
450	MALE ELBOW 1/2 X 3/8	2
460	FEMALE ELBOW 1/2 X 3/8	1
470	TEE 1/2 NPT MALLEABLE IRON	1
480	HEX HEAD BUSHING 1 X 1/2 NPT	1
490	HEX HEAD BUSHING 1/2 X 3/8 NPT	1
500	NIPPLE 3/8 NPT X 2 - 1/2 LG STEEL	1
510	NIPPLE 1/2 NPT X 3 - 1/2 LG STEEL	1
520	SQUARE HEAD PIPE PLUG 1/2 NPT	2
530	SQUARE SOCKET PIPE PLUG 1 NPT CI	1
540	HEX SOCKET PIPE PLUG 3/8 NPT	3
550	HEX SOCKET PIPE PLUG 1/2 NPT	4
560	HEX SOCKET PIPE PLUG 1/4 NPT	3
570	HEX HEAD CAP SCREW — 1/2 - 13 X 1-1/4	34
580	HEX HEAD CAP SCREW — 3/8 - 16 X 1 - 3/4	18
590	HEX HEAD CAP SCREW — 3/8 - 16 X 1 - 1/4	16
600	HEX HEAD CAP SCREW — 5/16 - 18 X 1 - 1/4	14
610	HEX HEAD CAP SCREW — 5/16 - 18 / 1-3/4	4
620	HEX SOCKET HEAD CAP SCREW — 3/8 - 16 X 1 - 1/2	6
630	HEX SOCKET HEAD CAP SCREW — 3/8 - 18 X 3/4	21
640	1/2 OD HYDRAULIC STEEL TUBING	36

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. _____ 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 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://www.tuthillvacuumblower.com/index.cfm/contact-us/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	<input type="checkbox"/>
Vacuum Coating	<input type="checkbox"/>
Pharmaceutical	<input type="checkbox"/>
Semiconductor/Electronics	<input type="checkbox"/>
Food/Meat Packing	<input type="checkbox"/>
Gas/Petrochemical	<input type="checkbox"/>
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

