

DURAVAC “RP” SERIES

Oil Lubricated, Rotary Piston Vacuum Pumps

Models RP-35 & RP-50

INSTALLATION
OPERATION

MANUAL



WARNING

**DO NOT OPERATE BEFORE
READING MANUAL**



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FORWARD

This manual contains installation, operation, maintenance and troubleshooting information for the Model RP-35 & RP-50 Rotary Piston Vacuum Pumps. Please read it in its entirety before operating the pump.

Our Rotary Piston Vacuum Pumps are designed to ensure safety when used properly. It is the responsibility of the user to follow safety-related warnings, cautions, notes and other requirements described in this manual.

Returned equipment will not be accepted by our company without prior authorization. Prior to shipping please call for a returned goods authorization number (RGA).

Our company reserves the right to cancel the warranty if the pump is disassembled without authorization, if pump fluids are used that are not compatible with the design and materials used in the manufacturer of the pump, and if unauthorized spare parts are used.

WARNING

The pumps associated with this manual use industrial systems including heavy Current/Voltage installations. Depending on the operating conditions, particularly where dangerous conditions may be present, improper handling could lead to severe personal injury or property damage.

Those responsible for safety of the installation must therefore insure that:

- ONLY QUALIFIED PERSONNEL ARE ALLOWED TO WORK ON THE MACHINE(S).
- THESE PERSONS ALWAYS HAVE AT THEIR DISPOSAL THE SUPPLIED OPERATING INSTRUCTIONS AND OTHER PRODUCT DOCUMENTATION WHEN DOING SUCH WORK, AND THEY UNDERTAKE TO FOLLOW ANY SUCH INSTRUCTIONS CONSTANTLY.
- NONQUALIFIED PERSONNEL ARE NOT PERMITTED TO WORK ON OR NEAR THE MACHINE(S).
- ALL WORK DONE ON ANY ELECTRICAL DEVICES AND ASSOCIATED EQUIPMENT (including motors, control panels, circuit panels, etc) MUST PERFORMED BY A PROPERLY TRAINED AND CERTIFIED ELECTRICIAN.
- THE WARNINGS, CAUTIONS, AND INSTRUCTIONS DISCUSSES IN THIS MANUAL CANNOT COVER ALL POSSIBLE CONDITIONS AND SITUATIONS THAT MAY OCCUR. IT MUST BE UNDERSTOOD BY THE OPERATOR THAT COMMON SENSE AND CAUTION ARE FACTORS THAT CANNOT BE BUILT INTO THIS PRODUCT, BUT MUST BE SUPPLIED BY THE OPERATOR.

SAFETY PRECAUTIONS

CAUTION: When using PVC pipe or any static enhancing material for exhaust piping, make provisions to safeguard against arcing from static electricity. Arcing can ignite oil vapor that may be present.

CAUTION: Do not operate the pump without the belt guard properly attached. Operating the pump without the belt guard secured in place exposes people in the vicinity of the pump to risk from rotating drive parts.

CAUTION: Do not operate this pump in oxygen service. Oxygen service is defined as any application which has a process gas concentration that exceeds 20%. Pumping oxygen enriched gases with mineral oil or other non-inert fluids can cause an explosion in the pump, resulting in damage or injury.

CAUTION: Take precautions to avoid prolonged or excessive exposure to oil mist or process materials from the discharge of the pump. Do not discharge the pump into a closed room or a room without adequate ventilation. Always use a discharge oil mist eliminator unless the pump discharge is vented to the open air. Venting the outlet to open air is highly recommended

CAUTION: Disconnect the pump from the electrical supply at the main disconnect before dismantling or servicing the pump.

CAUTION: Lift only with the lifting eyebolts supplied with the pump. Do not lift equipment attached to the pump with the eyebolts supplied.

CAUTION: Do not restrict the pump discharge line in any way, or place any valves in the discharge line. Excessive pressure build-up could cause damage or injury.

CAUTION: Do not touch hot surfaces on the pump. In normal operation at low pressures surface temperatures will not normally exceed 180 Degree F. Prolonged operation at 200 torr may cause surface temperatures up to 220 Degree F.

TABLE OF CONTENTS

SAFETY PRECAUTIONS.....	Page 2
INTRODUCTION.....	Page 4
PERFORMANCE SPECIFICATIONS.....	Page 6
DESCRIPTIONS.....	Page 7
GENERAL INFORMATION.....	Page 8
START-UP.....	Page 10
TROUBLESHOOTING.....	Page 11
PARTS LIST & EXPLODED VIEWS.....	Page 15
WARRANTY STATEMENT.....	Page 21

PRINCIPLE OF DESIGN

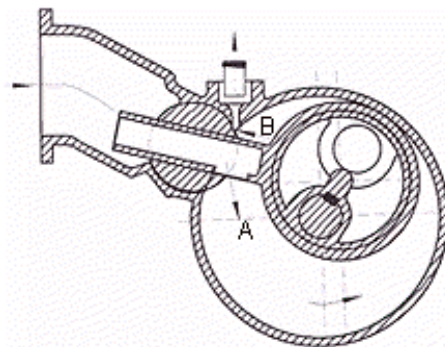
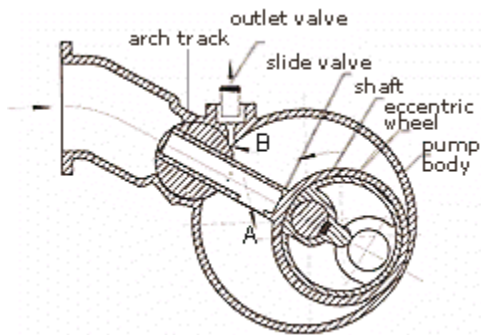
The Duravac "RP" series of pumps are of the cam (eccentric) and piston (Slide) type and are Duplex in design. Within the pump, the piston is driven by the cam. The cams are mounted 180 degrees apart on a single shaft so that centrifugal forces of the moving pistons will oppose one another. The shaft passes through the center wall separating the two pump sections and is supported by bearings in the heads at each end of the cylinder. The open head which the shaft extends, has a shaft seal set-up to prevent air leakage into the pump and an outboard bearing to handle the belt pull force.

Each piston has an integral hollow extension (called a slide) which extends through the slide pin (hinge bar). One side of the slide contains diagonal slots; as the slide passes back and forth through the slide pin, these slots are covered and uncovered to form an inlet valve. Outlet valves are over the discharge port on top of the cylinder. All working parts are precisely machined to suitable clearances for high vacuum requirements.

The covering and uncovering of the slots in the piston slide by the slide pin constitutes a mechanical inlet valve. Air or gas is admitted through these slots from the high vacuum side of the slide pin into the space between the piston and cylinder at certain parts of the cycle. As there is no spring loading, no pressure difference is required to operate this valve. The outlet (discharge) valve is opened automatically by the compression of the air or gas in the pump against atmospheric pressure, plus a slight spring pressure.

Since the success of the pump depends on its being sealed and lubricated, an oil reservoir is mounted above the pump. The sealing oil needs to be free from gases or moisture. Otherwise, the vapors will be pulled out of the oil (outgassing) and will prevent obtaining low absolute pressures.

In view A from the figures below, the piston is moving in the direction of the arrow and is rapidly creating more space into which some of the gas is admitted through the inlet port; at the same time, view B is compressing the gas previously trapped and is taking place on the opposite side of the piston. As the piston reaches the end of its compression cycle in view B, it expels all the air or gas and surplus sealing oil through the outlet valve and into the oil reservoir tank. The reservoir tank is where the oil is retained for recirculation and the air or gas being pumped is expelled out the discharge port of the reservoir.



INTRODUCTION

PERFORMANCE SPECIFICATIONS

SPECIFICATIONS

Pump Model		RP-35	RP-50
Displacement	CFM	37	52
Ultimate Vacuum (Partial pressure)	Torr	10 microns (0.010 mm Hg)	
Motor	Hp	1.5	2
Pump Speed	RPM	400	550
Oil Capacity	Gal	2	2
Inlet connection	in.	2" Flg	2" Flg
Exhaust connection	in.	1.5" NPT	1.5" Flg
Cooling Media		AIR	AIR
Pump Weight	Lbs.	380	385

GENERAL

UNPACKING

Inspect the box and pump carefully for any signs of damage incurred in transit and report with-in 7 days of receipt. Since all our pumps are shipped F.O.B. our factory, such damage is the responsibility of the carrier and reported to them. The inlet & exhaust of the pumps are covered with plastic caps to prevent dirt and other foreign substances from entering the pump. Leave the caps in place until you are ready to pipe the pump to your equipment.

LOCATION

Install the pump in a horizontal position on a level surface so that the pump is evenly supported. Leave 12-18" of access around the pump to allow proper access for routine maintenance. Allow access to the oil sight glass in order to inspect the oil level and for easy access to change the lubricating oil and exhaust filter.

INSTALLATION

Install the pump on a suitable rigid foundation and fastened down.

Cooling:

The pumps are AIR COOLED and do not require cooling water for operation. The pumps are designed to operate up to a maximum ambient temperature of 110 Deg F.

VACUUM CONNECTION

Use a pipe size that is at least the size of the pump inlet connections. Smaller lines result in reduced pump capacity.

Pumps operating in parallel on a common main line should have a manual or automatic shut-off valve or positive acting check valve installed in the suction line of the pump.

Should the process gas contain dust or other foreign material, a suitable inline particulate filter should be connected to the inlet port.....contact US Vacuum for recommendations.

The vacuum piping should be designed to insure that no liquids such as condensate or liquid carryover from the process can reach the pump. If this possibility exists, a knock-out liquid separator should be installed.....contact US Vacuum for recommendations.

The best piping for the vacuum side of the pump is made up with flanges using neoprene gaskets or O-rings. Flanges may be welded or threaded to pipe. If threaded connections are used, use a heavy sealing compound to insure no leaks are present.

If an exhaust manifold is used, install a drip leg near the pump exhaust port and drain to prevent exhaust condensate from entering the pump exhaust box.

DISCHARGE PIPING

The discharge from the oil separator may be piped out of doors or any place convenient. In any case, be sure that the discharge line does not leave the separator vertically for any great length. This would permit the vapors to condense in the pipe, drip back into the oil reservoir tank and contaminate the pump oil.

The pump exhaust should have a horizontal run to a drop-out Tee, and then go up if necessary. Equip the Tee with a drain valve to drain off condensate from time to time as needed. Oil mist eliminator filters are available to replace the piping.

POWER REQUIREMENTS

A schematic diagram for the electric motor terminal box is located either inside the junction box cover or on the side of the motor itself. The motor must be connected according to applicable electrical codes through a fused switch in order to protect the motor against electrical or mechanical overload conditions. The overload of the motor starter must be set at a level equal to the full load motor current listed on the nameplate.

AFTER ELECTRICAL CONNECTIONS HAVE BEEN MADE, BUT PRIOR TO FILLING THE PUMP WITH OIL, THE ROTATION OF THE MOTOR SHOULD BE CHECKED. IF BACKWARD, REVERSE ANY TWO LEADS OF THE THREE AT THE POWER CONNECTION.

OIL FILLING

The pump is typically shipped without oil. After level installation and correct rotation has been established, fill the pump with recommended oil through the oil fill port. Oil level should be at the 3/4 position on the sight glass.

Non-detergent oil should be used. US Vacuum recommends US-350H vacuum pump oil which provides long running time between oil changes. In high heat applications, US-350SS is recommended

Oil capacity: RP-35/50 = 2 Gallons

CHANGE OIL EVERY 500-750 OPERATING HOURS

Check the oil for contamination on a weekly basis by shutting the pump off and draining some of the oil into a small glass or container through the oil drain port.

Oil life is dependent upon the condition to which it is exposed. The oil must be changed after the first 100 hours of initial operation. After the initial oil change, and when using US350-H, it is recommended that the oil changes are made every three (3) or four (4) months or 500-750 hours of operation, or as necessary if high heat is contaminating the oil.

To change the pump oil, the pump must be switched off and ventilated to reach atmospheric pressure. Open the oil drain valve and drain the oil. Dispose of the oil in compliance with local or national regulations. When oil stops draining, replace the oil drain plug.

Start the pump again for a few seconds. Stop the pump once again, and then reopen the oil drain valve and discharge any remaining oil. Refill with new oil.

EXCESSIVE HEAT:

When the pump is subjected to operating conditions that will cause the oil to be heated above 200 Deg F, the oil will carbonize and become contaminated after a relatively low number of operating hours if standard hydrocarbon oil is used. The higher the temperature, the quicker the oil becomes contaminated and thermally breaks down. In these type of high heat applications, US350SS oil is recommended.

CONTAMINATED AIR STREAM

When the air stream contains solids and/or liquids that may contaminate the oil, the oil must be changed more often. If the air stream contains a small percentage of particulate matter, the solution is to install a pre-filter or knock-out pot to keep the contaminants out of the pump.

START-UP

- 1) Be sure the suction lines are free of foreign matter and perfectly tight. Use inlet protection screens or drop-out traps on new installations where large welded piping is employed.
- 2) Make sure the pump discharge is not obstructed
- 3) Check the oil level and adjust if necessary
- 4) Ensure that the oil line solenoid is wired correctly
- 5) Check for correct rotation of the pump.
- 6) Ensure the suction line is not under vacuum (at atmospheric pressure)
- 7) Close the vent valve if one is used
- 8) Start the pump
- 9) Adjust gas ballast as required

STOPPING THE PUMP

To stop the pump:

- 1) Close the isolation valve in the suction line
- 2) Vent the pump to atmosphere thru vent valve or gas ballast valve
- 3) Stop the pump

NOTE: Venting the pump prior to shutdown returns the lubricating oil in the pumping chamber back to the oil reservoir and prevents the pump from rotating backwards. Failure to follow proper shutdown Procedures can result in both hydraulic and vacuum locking the pump and possibly causing pump damage.

GAS BALLAST

The gas ballast valve is a manual valve located on the non-drive endplate and marked with a RED handle. The valve introduces atmospheric air into the pumping chamber to aid in removing condensable vapor contaminants from the vacuum pump oil. Vapor contaminants in the pump oil can dramatically impair the pump performance by vaporizing during the low pressure section of the pumping cycle thereby preventing gas from being drawn into the pump.

Isolate the pump from the system and fully open the gas ballast valve and run the pump overnight. If this is not possible, partially open the valve during operation and run until oil is clean.

SOLENOID VALVE

The solenoid valve feeds oil from the upper oil reservoir to the pumping cylinder via an oil line feeding each endplate. The solenoid is N.C. (normally closed) and is used to keep oil in the upper reservoir from draining into the pump cylinder when the pump is not in operation, thereby preventing oil from filling up the cylinder. Restarting the pump with the cylinder filled with oil can cause hydraulic lock and damage to the pump.

Make sure to check the voltage requirements on the solenoid and that it is wired accordingly. Low or incorrect voltage will cause the valve not to open and lead to a loss of oil lubrication to the pump causing Severe damage to the pump. Hot smell or smoke from the solenoid is cause for investigation. Do not energize the coil when it is removed from the valve body, this will cause the coil to fail.

Foreign matter will cause the valve to stick, jam or leak. Any solenoid valve should be cleaned periodically. Solenoid valves should be cleaned when the oil is changed due to contamination by foreign matter. Solenoids are designed for use in relatively dry locations and in temperatures up to 115 Degree F. Weather-proof and special purpose solenoids are available. There is always a slight hum when the solenoid is working; a slight click will be heard when the solenoid opens properly as the core hits the plug at the top of the core tube.

MAINTENANCE

Periodic Maintenance

- DAILY: Visually check oil level in sight glass & color, oil flow through the solenoid & oil lines
- Weekly: Check inlet filter
- Every 3 Months/ 500-750 hours– Change oil
- 3000 Hours– Change exhaust filter.
- Replace V-belt and Discharge valves
- 10,000– Replace bearings and seals. This is to be done by specially trained service personnel.

US Vacuum Pumps LLC is not liable for operational failure due to mistakes made by non-US Vacuum personnel during the installation/operation or the utilization of non-US Vacuum parts . Maintenance intervals may be changed according to operating conditions.

SPARE PARTS

Oil

Type US-350H

Available in Quart, Gallon, 5-gallon pail, 55-gallon drum

Under vacuum conditions lubricating oils, especially those with additives, may behave quite differently than expected. Additives may adversely affect the attainable ultimate pressure and may react with the gas media being pumped.

For these reasons please understand that we must make our warranty commitment dependent on the use of oils which have been qualified by us. Damages caused by the use of not suitably qualified lubricating oils are not covered by our warranty.


Repair kits

RP-35: Pt#RKIT-RP35


RP-50: Pt#RKIT-RP50

Repair Kit includes bearings, shaft seals, gaskets, o-rings, discharge valves & misc. hardware

Vacuum Pump Oil	
Tested to high vacuum levels, this oil meets rigid requirements for vapor pressure, stability & viscosity	
Size	Cat. No
Quart	US-350H-32
Gallon	US-350H-128
5 Gallon	US-350H-5
55 Gallon	US-350H-55



Oil Mist exhaust Filter	
Used to eliminate (99%) of the oil mist from the pump discharge. High efficiency coalescing technology	
Pump Model	Cat. No
RP-35	VFSG848150
RP-50	VFSG3848150



TROUBLESHOOTING

TROUBLE

The pump does not reach “blank-off” pressure or takes too long to evacuate the system.

Possible cause: Contaminated oil is the most common cause of not reaching ultimate pressure.

Remedy: Shut off the pump, after the operating temperature has been reached, drain the warm oil from the pump and change the automotive type oil filter (where applicable), if necessary. Flush and fill the pump with new oil and take a new “blank off” measurement after operating temperature is reached (20-30 minutes).

Possible cause: The vacuum system or vacuum piping is not leak tight.

Remedy: Check the hose and pipe connections for possible leak.

Possible cause: Inlet filter element is plugged.

Remedy: Clean filter. Install a new filter element if the problem repeats frequently.

Possible cause: No oil or not enough oil in the oil reservoir.

Remedy: Shut off the pump, add the necessary oil, or if oil seems contaminated, drain the balance of the oil from the pump, exchange oil filter and refill with fresh oil. Flush if necessary.

Possible cause: Solenoid valve clogged.

Remedy: Clean or replace if necessary.

Possible cause: If used, the inlet check valve or automatic isolation valve is not opening or closing properly due to contamination.

Remedy: Disassemble and clean if necessary.

Possible cause: Oil tubing fittings are loose and leaking.

Remedy: Replace or retighten the oil fittings or oil tubing.

Possible cause: Shaft seal is leaking.

Remedy: Replace the shaft seal.

Possible cause: Exhaust valve is not properly seated or it's partially stuck open.

Remedy: Contact U.S. Vacuum for instructions.

Possible cause: The radial clearance between rotor and cylinder is no longer adequate.

Remedy: Contact U.S. Vacuum for instructions.

Possible cause: The internal parts are worn or damaged.

Remedy: Contact U.S. Vacuum for instructions.

Possible cause: Oil tubing fittings are loose and leaking.

TROUBLE

The pump will not start

Possible cause: The motor does not have the proper supply voltage or is overloaded; the motor starter overload settings are too low or are at the wrong setting; fuses burned; or the wire is too small or too long; causing a voltage drop at the pump.

Remedy: Check correct supply voltage; check overload settings in motor starter for size and setting according to motor nameplate data; check fuses; and install proper size wire. If ambient temperature is high, use larger overloads or adjust settings 5% above nominal motor nameplate value.

Possible cause: The pump or motor is blocked.

Remedy: Remove the belt guard (disconnect power first) and try to turn the pump and motor over by hand. If frozen, remove the motor from the pump and check the motor and pump separately. If the pump is frozen, contact U.S. Vacuum for instructions.

TROUBLE

The pump starts, but labors and draws a very high current.

Possible cause: The oil is too heavy (viscosity too high) or the ambient temperature is below 41 Deg F.

Remedy: Warm up the oil before filling.

Possible cause: Pump is running in the wrong direction.

Remedy: Check for correct rotation which is counterclockwise when looking at the motor from the motor fan side. Reverse any two leads on the motor to change the direction of rotation

Possible cause: The pump is overfilled with oil or the wrong kind of oil is used.

Remedy: Correct the oil level and quality. Use recommended oil.

Possible cause: Exhaust filter element is clogged and appears burned with pump oil.

Remedy: Replace exhaust filters, maintain proper oil condition, oil level and use only U.S. Vacuum oil & filters.

Possible cause: Foreign particles, varnish or sludge in the pump.

Remedy: Disassemble and clean as required

TROUBLE

Pump smokes at the exhaust side or expels oil droplets from the exhaust

Possible cause: No exhaust filter in place

Remedy: Install exhaust filter

Possible cause: The exhaust filter is not properly seated with the o-ring in filter base or filter material is cracked.

Remedy: Exhaust filter not properly seated with o-ring, replace if necessary. Check element and secure

Possible cause: The exhaust filter is clogged with foreign particles.

Remedy: Replace the exhaust filter.

TROUBLE

Pump runs very noisily.

Possible cause: Discharge valves clicking.

Remedy: Open gas ballast valve

Possible cause: Bearing noise.

Remedy: Contact U.S. Vacuum for instructions.

Possible cause: Piston or cam wear

Remedy: Contact U.S. Vacuum for instructions. Use only recommended U.S. Vacuum oil and change more frequently.

TROUBLE

Pump runs hot

Note: The oil temperature with closed inlet should be approximately 140-180 Deg F depending on pump type. At 24"Hg the oil in the pump can go above 200 Deg F. with cooling water at 50-70 deg F.

Possible cause: Water temperature or flow inadequate

Remedy: Increase water flow to the pump and/of reduce cooling water temperature.

Check that the water jacket is not clogged with mineral deposits or scale. Clean is necessary

TROUBLE

Pump is seized

Possible cause: The pump operated without oil (faulty solenoid).

Remedy: Contact U.S. Vacuum for instructions.

Possible cause: The pump operated for an extended period of time in the wrong direction.

Remedy: Inspect. Contact U.S. Vacuum for instructions.

Possible cause: Liquid carryover into the pump cylinder broke valves or pistons.

Remedy: Install condensate trap on the inlet of the pump.

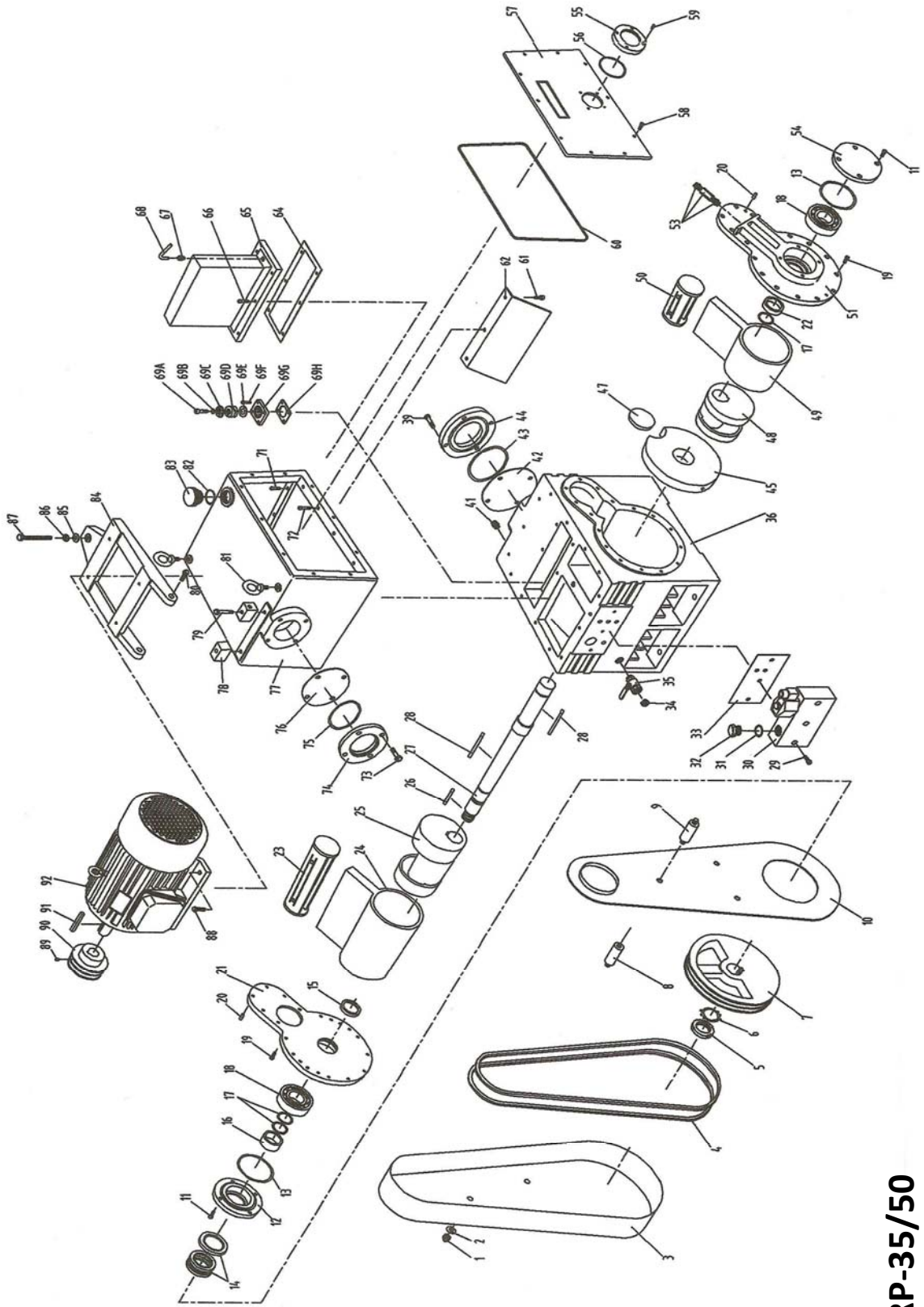
TROUBLE

Oil disappears in oil sight glass

Possible cause: Oil is sitting in the cylinder or oil mist filter.

Remedy: Vent pump prior to shutdown. Install oil suckback line on oil mist filter to return collected oil from the discharge filter to the pump

END



**RP-35/50
EXPLODED VIEW**

MODEL RP-35/50
Parts List

WARRANTY– VACUUM PRODUCTS

Subject to terms and conditions hereinafter set forth and set forth in General Terms of Sale, US Vacuum Pumps LLC (the seller) warrants products of its manufacturer, when shipped, and its work (including installation & start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to sellers 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 of 12 months. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation.

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 (motor) will 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 by seller. Unless done with prior written consent of seller, any repairs, alterations or disassembly of sellers equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for seller's inspection and returned to sellers Ex-works point upon request.

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

After buyers 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 materials or those which may lead to a 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 repairs by others in such manner as in sellers judgment affects the product materially and adversely shall void this warranty.

No employee or representative of seller other than an officer of US Vacuum Pumps LLC 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.

In no event shall buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within (1) year after the cause of action has occurred.

NOTES