



Installation and Operating Instructions



Rotary Vane Vacuum Pumps
R 5 0010, 0012, 0016, 0021, 0160,
0400, 0502, 0630, 1000, 1600

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GENERAL

Identification

For model identification, see the nameplate mounted on the side of the exhaust box.

This manual is written to cover RA, RB and RC versions of models 0010, 0012, 0016, 0021, 0160, 0400, 0502, 0630, 1000 and 1600 with a "B" ("A" on 0010 and 0016, "S" on 0021 and no letter designation on 0012) appearing as the seventh character in the model type number. For example, it would appear as follows:

RAXXXX-BXXX-XXXX

When ordering parts, it is helpful to include the identification code stamped into the side of the cylinder as well as the serial number from the nameplate.

Example: RB0012-1029-XXXX

Operating Principles

All reference (Ref. XXX) numbers listed in the text and on illustrations throughout this manual are related to the drawings and parts list shown later in this publication.

All R 5 Series, Single Stage, Rotary Vacuum Pumps are direct-driven, air-cooled, oil-sealed, rotary vane pumps that operate as positive displacement pumps. They consist of a rotor positioned eccentrically in a cylindrical stator (see Fig. 1). The rotor has three radially sliding vanes which divide the pump chamber into three segments. The gas to be pumped enters at the inlet port, passes through the inlet screen and the open anti-suckback valve into the pump chamber. As the rotor rotates, the inlet aperture is closed, the gas is compressed and forced out through the exhaust port. This operation is repeated three times each revolution.

All R 5 series pumps are designed to handle air. Vapor in the air stream can be tolerated when the pump is operated within certain operating parameters as defined by Busch LLC Engineering (see Section 2.2 - Gas Ballast). When you desire to use the pump on an air stream that contains vapors, contact Busch LLC Engineering for operating recommendations; otherwise, the warranty could be void.

1.0 INSTALLATION

1.1 Unpacking

Inspect the box and pump carefully for any signs of damage incurred in transit. Since all pumps are ordinarily shipped FOB our factory, such damage is the normal responsibility of the carrier and should be reported to them.

Remove the nuts from the bottom of the box/crate and pull the pump out of the container, then unscrew the studs from the bottom of the rubber feet.

The inlet port of the pump is covered with a plastic cap prior to shipment to prevent dirt and other foreign material from entering the pump. Do not remove this cover until the pump is actually ready for connection to your system.

1.2 Location

The pump must be installed in a horizontal position on a level surface so that the pump is evenly supported on its rubber feet. Allow at least one foot (five feet for 0400 and larger pumps) of air space between the pump and any walls or other obstructions to the flow of cooling air.

Also, adequate ventilation must be provided for the fans on the pump and motor (i.e., do not locate the pump in a stagnant air location).

Whenever the pump is transported, be sure to drain the oil prior to shipping to avoid vane breakage when restarting the pump.

Do not tip the pump over if it is filled with oil.

Locate the pump for easy access to the oil sight glass (Ref. 83) in order to inspect and control the oil level properly. Allow clearance at the exhaust flange area to provide service access to the exhaust filters.

1.3 Power Requirements

The schematic diagram for the electrical connection is located in the junction box or on the nameplate of the pump motor.

CAUTION: On 0400/0502/0630/1000/1600 models, a switch mounted on the exhaust box side cover plate is a safety device. This switch is used to shut off the pump in the event the pump oil chamber is overheated. Wire this normally closed switch into the starter control circuit so that when the switch reaches the set point, power to the pump motor is discontinued.

The motor must be connected according to the electrical codes governing the installation. The power supply must be routed through a fused switch to protect the motor against electrical or mechanical overloads. The motor starter must be set consistent with the motor current listed on the motor nameplate.

Note: Soft starting means are required for the motors of models 1000 and 1600. Using an across-the-line type of starter could possibly cause coupling and/or pump failure.

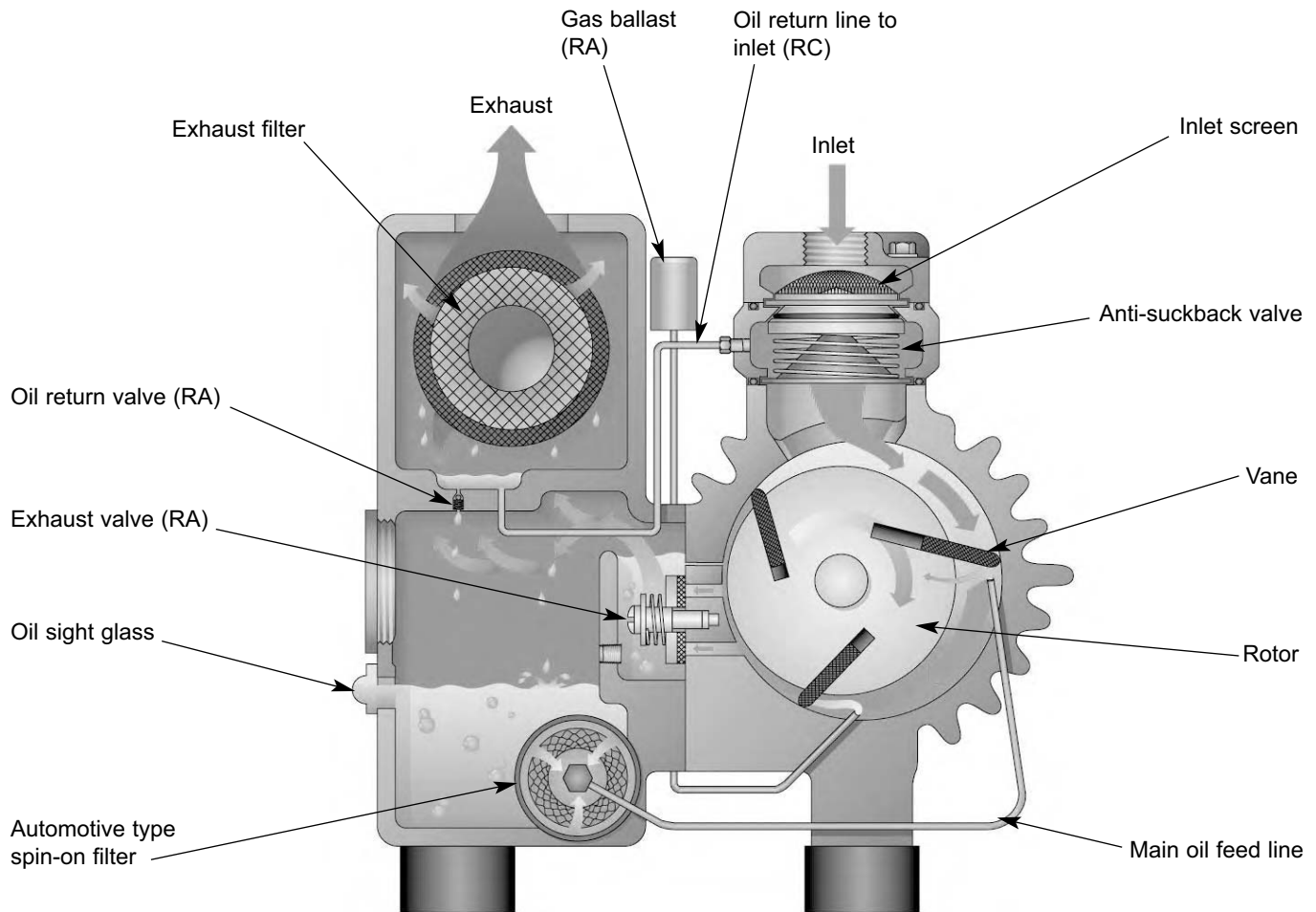


Fig. 1 - Basic R 5 Pump

If the pump is supplied with a manual motor starter, it is preset at the factory in accordance with the customer's specification. For other voltage requirements, contact the factory for motor and/or starter information.

Note: See the motor manufacturer's manual for start-up maintenance of the motor.

Correct direction of rotation is marked by an arrow on the motor fan housing and is counterclockwise when looking at the motor from the motor's fan side.

CAUTION: After the electrical connection has been made, but before the pump is filled with oil, the rotation of the motor must be checked. Open the inlet port and jog the motor briefly to make sure rotation is correct. If it runs backwards and if it is wired three phase power, reverse any two leads of the three at the power connection.

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

1.4 Vacuum Connections and Drip Legs

Use a line size to the vacuum system that is at least as large as that of the pump inlet. Smaller lines will result in lower pumping speeds than the rated values.

Install a drip leg and drain on the vertical pipe near the pump inlet. Also, when installing discharge piping, a drip leg should be installed. Drain the drip legs often to remove any condensation which may have collected.

If more than one vacuum pump or a receiver tank is connected to a common main line, each pump should have its own manual or automatic operated shut-off valve or positive action check valve. The built-in, anti-suck-back valve should not be used as a shut-off valve for the vacuum system.

CAUTION: Do not use the anti-suck-back valve as a system check valve.

Remove the plastic protective cap from the inlet port prior to connection of the pump to the system. Vertical connection of the vacuum line can be made directly to the pump inlet (Ref. 260).

Type and size of the inlet connections of the R 5 Series pumps are shown in the TECHNICAL DATA page 27.

If the gas that is pumped contains dust or other foreign solid particles, a suitable inlet filter (10 micron rating or less) should be connected to the inlet port. Consult the factory for recommendations.

1.5 Oil Filling

WARNING: Do not use hydrocarbon oils in pumps on oxygen service. See Section 2.6 - Oxygen Service Pumps.

WARNING: Keep the oil fill plug tight as pressure in the exhaust box could cause bodily injury if the plug is blown out. Do not fill/add the pump with oil through the exhaust/inlet ports as there is danger of breaking the vanes!

The pump is shipped without oil. After level installation, and after correct rotation has been established, fill the pump with the recommended vacuum oil through the oil filling port (Ref. 88), observing the "MAX" and MIN" position at the oil sight glass (Ref. 83). On pumps with two sight glasses, fill the top glass up to the 3/4 mark. Non-detergent oil should be used. Do not use detergent motor oil as additives in detergent oil will plug exhaust filter elements and shorten their life.

It is recommended that Busch R500 Series oil be used to receive the best performance from your vacuum equipment. R500 Series oil is a high quality vacuum oil that will give longer running time between oil changes, will provide better lubrication at high operating temperatures, and will prolong the life of exhaust filter elements. This oil can be obtained directly from Busch LLC in Virginia Beach, Virginia.

The strict use of Busch oils and parts from the day of purchase can extend the life of the vacuum pump.

For general applications, use R530 in all models covered by this manual, except for the 0021 model, which should use R580. Use R590 or R570 in pumps that are operated in high ambient temperatures (above 90°F) or high operating pressure when the oil carbonizes (turns black) before the change interval. Contact the factory for recommendations when using other oils.

The TECHNICAL DATA chart on page 27 gives the approximate quantities of oil required for each pump. The oil capacity chart should only be used as a guide, since oil capacity may be slightly lower, depending on whether the pump was filled previously, and whether all components such as oil filter, oil lines, etc., were allowed to completely drain. Use only the sight glass reading for proper level. Never overfill!

For ambient operating temperatures lower than 41°F, use Busch R580 synthetic oil. If this does not help (where the pump has difficulty starting due to high oil viscosity), contact the factory in Virginia Beach, Virginia.

Replace the oil fill plug (Ref. 88), making sure that the gasket (Ref. 89) is in place and properly seated and secured. Some pumps are equipped with an exhaust pressure gauge as an integral part of the oil fill plug.

2.0 OPERATION

2.1 START UP

Check rotation of the motor as described in Section 1.3.

Fill the pump with oil as described in Section 1.5.

Start the pump and immediately close the inlet. Run the pump for a few minutes before checking the oil level again. With the pump shut off, the oil level should be visible in the oil sight glass (Ref. 83), between the "MIN" and "MAX" mark.

On pumps with two sight glasses, with the pump shut off, the oil level should be visible in the upper oil sight glass, between the "MIN" and "MAX" mark.

Add oil, if necessary, but only add it when the pump has been shut off and the circulating oil has had sufficient time to return to the oil sump.

Note: The oil separated by the exhaust filter element forms droplets on the outside of the exhaust filter that collect at a low point in the upper half of the exhaust box. From there the collected oil is drained back to the oil sump via an oil return valve (Ref. 275), which opens on R 5 RA/RB model pumps when the pump is shut off. It is necessary to shut off the pump (all 0010-0160 RA model pumps and RB0021 model pumps) after every 8 hours of operation to allow the check valve to open. If the pump is not shut off after this time period, it is possible to starve the pump of oil since the oil is not allowed to drain back into the oil sump and/or oil droplets may be blown out of the exhaust. If the pump is operating at high pressure, it may be necessary to shut it down sooner than 8 hours. (Not applicable on 0400-1600 RA model pumps which have an oil return float valve assembly (Ref. 585) which enables the pumps to be run continuously).

On R 5 RC Series pumps, the collected oil is drawn continuously during operation of the vacuum pump to the inlet flange (Ref. 260) via the oil return line (Ref. 290). The oil return line is connected directly to the area of the exhaust box, downstream of the exhaust filter, which is at atmospheric pressure. Therefore, a constant amount of air is sucked into the pump, which is an additional reason that the R 5 RC Series Pumps do not

achieve as low a vacuum as the R 5 RA Series Vacuum Pumps. RC model pumps can run continuously without having to shut them off for the oil to drain back.

2.2 Gas Ballast

All RA Series pumps are equipped with a gas ballast valve. The gas ballast valve (Ref. 440) is located between the inlet port and the exhaust box. RA0010 and RA0016 pumps are equipped with a permanent gas ballast which cannot be shut off unless the sintered filter is removed and the orifice plugged. Pumps RA0160 thru RA1600 are equipped with an adjustable gas ballast valve.

The adjustable gas ballast valve should normally be left open. Its primary function is to prevent water vapor from condensing in the pump. Condensation causes emulsification of the oil, loss of lubricity, and possible rotor seizure.

2.3 Process Gas

The R 5 series pumps are designed to pump air and are not intended for use when water vapor is being pumped. In some applications, when the quantity of the water vapor is moderate, R 5 pumps have been used with good results. On these occasions, the pump is run until it is up to operating temperature before it is allowed to pump the process gas. The pump is also operated for a period of time off process and on air (to clear it of process gas) before it is shut down. This operating technique prevents the vapor from condensing in the pump. Before attempting to pump a gas laden with water vapor, contact Busch Engineering for advice.

2.4 Stopping Pump

To stop the pump, turn off the power. The pump has a built-in, anti-suck-back valve (Ref. 251 thru 255) to prevent the pump from rotating backwards when it is shut off.

CAUTION: Do not use the anti-suck-back valve as a check or shut-off valve for your vacuum system. Do not depend on the anti-suck-back valve to prevent pump oil from migrating through the inlet into the system when the pump is shut down.

Install an automatic operated valve (such as a check valve) in front of the pump, if more than one pump is pumping on the same line or if there is a sufficient volume of vacuum in the system to cause the pump oil to be drawn into the piping when that pump is shut down.

All R 5 Series pumps are vented internally to atmospheric pressure through venting holes that are next to the exhaust valve assembly.

2.5 Water-Cooled Pumps (optional)

Water-cooled pumps are cooled by circulating the oil through a shell-and-tube type heat exchanger. The circulation of the pump oil through the shell is created by vacuum in the pump, but the circulation of the cooling water through the tubes is thermostatically controlled. The flow rate of the cooling water is controlled by a thermostatically activated valve (see Fig. 2) that senses, through a capillary bulb mounted in the exhaust box, the pump's oil temperature as it is discharged from the compression chamber. The valve will open at its set point and close at approximately 3°F to 5°F below the set point.

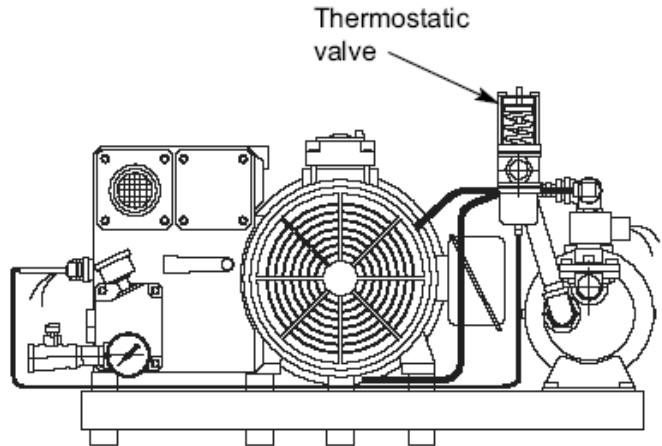


Fig. 2 - Water-cooled Pump

The valve set point is adjustable as follows:

- Rotate the valve adjustment screw counterclockwise to cause the valve to open at a higher temperature. This makes the pump run hotter.
- Rotate the valve adjustment screw clockwise to make the valve open at a lower temperature. This makes the pump run cooler.

The thermostatic valve can be manually opened by inserting a screwdriver under each side of the spring guide and prying the spring and guide upward away from the valve body.

The water cooling option can be used to cool pumps operating in high ambient temperatures, or it can be used to maintain a pump at elevated temperatures to prevent condensation inside the pump in wet applications. Contact Busch Engineering in for details.

2.6 Oxygen Service Pumps

Oxygen service pumps must be used in oxygen enriched applications that are defined as any application which has a process gas that is 25% or more oxygen. If this pump is contaminated by organic compounds, do not attempt to use it on oxygen service until it has been decontaminated.

These pumps have been manufactured, solvent washed (to remove organic contaminants) and assembled according to the latest technical standards and safety regulations. If this pump is not installed properly or not used as directed, a dangerous situation or damage might occur. It is mandatory that these operating instructions be read and understood prior to vacuum pump installation and start-up!

WARNING: This pump is filled with a special operating fluid. Do not use any other type of fluid, oil and/or grease. Use one of the following:

- Fomblin LC 250
- Tyreno Fluid 12/25V (perfluorinated polyether)
- KRYTOX® Vacuum pump fluid by Du Pont Company

If you have any questions, please phone our Customer Service Department for more information.

For overhaul/repair of oxygen service pumps, Busch LLC strongly recommends that all major repair operations be conducted at the factory. **Improper handling of repairs could result in extreme danger to personnel operating the pump.**

3.0 ROUTINE MAINTENANCE

R 5 Series pumps require very little maintenance; however, to insure optimum pump performance, the following steps are recommended.

3.1 Pump Oil

3.1.1 Oil Level

CAUTION: Do not add oil while the pump is running since hot oil vapor may escape through the oil fill port.

CAUTION: Insufficient oil quantity in the pump has the potential, under certain conditions, to lead to self-ignition of the remaining oil in the pump.

With the pump installed relatively level, make sure that there is sufficient clean oil in the pump. The oil level should be observed on a daily basis and/or after 8 hours of operation and should be replenished if it drops below the 1/4 mark on the oil sight glass on pumps with one sight glass or below the 1/4 mark on the upper oil sight glass on pumps with two sight glasses.

On RA/RB Series pumps, you must first shut the pump off in order to let the oil flow back into the oil sump prior to checking the sight glass. Allow sufficient time for the oil to drain back into the sump on RA/RB Series pumps prior to adding oil, or overfilling could result.

Oil level readings should be done only when the pump is turned off. Oil can be added to the oil fill port (Ref. 88) if the pump is shut off and the circulating oil has sufficient time to return to the oil sump. The oil might appear to be foamy, which is a normal phenomenon with aerated oil.

Under normal circumstances, it should not be necessary to add or drain oil from the pump between recommended oil changes.

A significant drop in oil level means there is an oil leak or that an exhaust filter is broken. The pump should be smoking excessively. It is normal for the oil to be foamy and light in color in an operating pump. However, if the oil is milky colored, it is an indication that water is present in the oil. Normally, by operating the pump for an extended period, with the inlet suction blanked off and the gas ballast open on RA pumps, the water will be purged from the oil. If the oil is dark colored, it is contaminated or carbonized and must be changed. Depending on the severity of the contamination, a thorough flushing may be needed. Contact the factory for flushing oil (Busch R568) and refer to Section 3.1.4.

3.1.2 Oil Type and Quantity

See Section 1.5 for details on oil type and quantity.

3.1.3 Oil and Filter Change

Oil life is dependent upon the conditions to which it is exposed. A clean, dry air stream and an oil operating temperature under 210°F are ideal conditions. When using R530 (hydrocarbon oil), it is recommended that oil changes are made every three (3) to four (4) months or 500 to 750 hours of operation, or as necessary if high heat is contaminating the oil. The use of Busch R570 or R590 synthetic oils could extend the operating hours between oil changes under ideal conditions. Oil samples should be taken regularly when exceeding the 500-750 hour recommendation.

CAUTION: When changing the oil and filters, it may be necessary to flush the pump to remove any build-up of degraded oil from the sumps, oil lines, radiators, etc., to ensure proper oil flow through the pump. Reduced oil flow, especially through radiators and cooling coils, can cause mechanical damage or extreme overheating, which could cause the oil vapors to ignite.

Excessive Heat

When the pump is subjected to operating conditions that will cause the oil to be heated above 235°F, the oil will carbonize and become contaminated after a relatively low number of operating hours. The higher the

temperature, the quicker the oil becomes contaminated. If the oil temperature is too severe, Busch R570 or R590 synthetic oil should be used to withstand the elevated temperatures. If synthetic oil is used, the pump should be flushed with Busch R568 oil. Auxiliary oil cooling is the most practical approach to a severe heating problem.

Contaminated Air Stream

When the air stream contains a solid and/or liquid that can contaminate the oil, it must be changed more often. If the air stream contains a small percentage of contaminants and/or they are slightly aggressive* (mild acids, etc.), synthetic oil, such as Busch R570, will resist breakdown better than the standard Busch R530. The solution is to install a filter or knock-out pot to keep the contaminants out of the pump.

*Process air streams with a large percentage of contaminants and/or more than slightly aggressive contaminants must use a once-through sealant or dry-type pump.

Oil change intervals can only be established by experience with the pump operating in the actual conditions (see previous paragraph for some of the conditions). Develop the oil change interval by periodically checking an oil sample removed from the pump. When the oil sample has become dark in color (from solids and carbonized particles) or is milky looking (from water), it is time to discard it. As mentioned before, a thorough flushing may be required.

3.1.4 Oil Flushing Procedure

Flushing is needed under certain conditions. Some pumps will be beyond flushing and will need to be overhauled.

To help determine if flushing is needed, observe the condition of the oil as it is drained from the pump. Is it black and tar like or contaminated in any way? Was the pump noisy, overheating, or was the motor overload shutting the pump off? How old is the pump and when was the last time the oil was changed?

If the above conditions exist or you don't know when the last oil change was performed further investigation is needed. Also, when changing from one oil type such as R530 to another type such as R590 or R570 it will be beneficial to flush. Although the oils are compatible, mixing a lesser grade oil such as R530 with a synthetic oil like R570 will reduce the effectiveness of the synthetic oil.

All of the oil will be removed and replaced with the flushing oil (Busch R-568), and eventually that will be replaced by whatever Busch oil is needed for your particular application. Have enough oil and oil filters on

hand for a couple of flushes. The following describes the steps in the flushing procedure:

Shut the pump off and drain all the oil from the pump and remove the access plates (Ref. 205) from the exhaust box (Ref. 075). Remove the metal baffle (Ref. 078) and take a good look at the internal walls of the oil sump. If the walls are discolored but have no build up of any kind one can proceed with the flushing. If gelled or burnt oil is clinging to the walls this material must be scraped and removed prior to flushing. Proceed by scraping and cleaning as much of the exhaust box as possible. The more debris that is removed now the more effective the flushing will be later. Re-install the metal baffle, cover and proceed with the flushing. At this point one must remember that the oil lines and oil cooler might also be plugged to a point where no amount of flushing will make a difference and a complete overhaul will be the only option. Depending on the severity of the oil contamination flushing may be a last ditch effort.

Drain all of the oil from the pump. The more contaminated oil you remove now the more effective the oil flushing will be.

Remove the oil filter (Ref. 100) and install a new one. It is recommended that you do not change the exhaust filter or filters until after the flushing to prevent contamination of any new filters.

Fill the exhaust box with the proper amount of flushing oil (Busch R-568).

If possible run the pump with the inlet closed and off of the process. Run the pump for approximately six hours, shut the pump off and drain a small sample of oil into a clear container.

Examine it. If it is clear to amber run the pump for another six hours and examine it again. If after the first six hours it is black drain it and fill again using another new oil filter.

If after the second flushing the oil still remains black the pump may have too much contaminated oil in it to flush out properly. There may be residue remaining in the lines and cooler that will not flush out. An overhaul will be necessary.

If after the second six hour period the oil still remains clear to amber in color drain it, change the oil filter and fill with the regular oil. At this point also change the exhaust filters.

Run the pump with a fresh charge of the oil to be used in your application (not R-568), and monitor the operating conditions closely. Check for noise, overheating and oil condition until a regular oil change schedule can be established.

Do not let the oil turn black. Change it before it fails. If the oil is kept in good condition the pump will last for years. If the oil starts to turn black do not hesitate to flush again. Keeping on top of the oil changes will prevent costly overhauls.

If you are just switching from one type of oil to another a single six hour flush is all that is necessary (follow the above instructions). Remember to change to a new exhaust filter or filters after the flushing and not before.

3.2 Automotive-Type Oil Filter

The 0160 - 0630 Series pumps are equipped with an automotive-type oil filter (Ref. 100). The 1000/1600 Series has two automotive-type filters. The 0010 thru 0021 are not equipped with an automotive-type oil filter. When replacing the automotive-type oil filter, use only a genuine Busch filter.

Note: Make sure to tighten the Busch oil filter securely against the aluminum sealing surface so that leaks will not occur.

3.3 Exhaust Filter

WARNING: If the gas entering this pump is a health hazard, use rubber gloves and all necessary personal protection equipment when performing the exhaust filter replacement operation.

Every nine (9) to twelve (12) months, or as necessary, replace the exhaust filter elements. The service life of the exhaust filters varies widely with pump application. It is only necessary to change the filters when the elements become clogged with foreign material or burned oil. Indications of clogged filters are smoke and oil mist coming from the pump exhaust, higher than normal motor current or oil leaking from the gas ballast valve on RA models.

A pressure gauge (Ref. 90) is supplied with your R 5 vacuum pump as part of the oil fill plug. This gauge has a green field and a red field. Pressure within the green field would indicate normal pressure. Pressure in the red field (for a continuous period of time) requires an immediate change of the exhaust filter(s).

WARNING: Wear safety glasses when installing or removing the spring retainers. The retainers can, if not secured correctly, slip off and fly out of the exhaust box.

In order to replace the filter, remove the screws retaining the exhaust port cover plate. Pull the housing off the exhaust box; set it aside. Use a slotted head screw driver to loosen the exhaust filter retaining spring (Ref. 125), then rotate and remove the spring (see Fig. 3). Pull the filter cartridge (Ref. 120) out of the exhaust box.



Fig. 3 - Removing the Filter Spring

To field test an exhaust filter element, remove it from the pump, allow it to cool, clean the sealing end (or O-ring end), and use compressed air to blow through the element. Apply approximately 3 to 6 psi (maximum allowable operating pressure across the filter).

WARNING: Do not inhale through the filter or allow your mouth to come in direct contact with the filter.

Use a clean shop rag to seal off the connection between the air hose and the filter. If you can blow through it, the element is not plugged. If plugged, discard it and install a new one. The filter cannot be cleaned successfully. Visually inspect the filter element for cracks.

Reinstall the filter elements. Make sure the open end of the element is properly seated down in its recess in the exhaust box with the O-ring (Ref. 121) correctly positioned. Retain the filter with the spring clip, tighten the tension screw until the filter is secure. Place the exhaust port gasket and cover in position on the exhaust box and retain with the cap screws.

3.4 Vacuum Inlet Filter

If the pump is equipped with a special vacuum inlet filter in applications where powder, dust or grit is present, the filter cartridge should be cleaned on a weekly basis, or as required, depending on the amount of foreign particles to which the pump is exposed.

3.5 Routine Maintenance Schedule

See the motor manufacturer's manual for the periodic motor maintenance.

Daily: Visually check oil level (see 3.1.1 and 3.1.2).

Weekly: Check oil for contamination (see 3.1.3). Inspect inlet filter (see 3.4).

Every three (3) or four (4) months, 500 to 750 hours of operation, or as necessary: See 3.1.3 and 1.5. Drain and discard oil from the hot pump. Replace the automotive-type oil filter (not applicable on the 0010, 0012, 0016 and 0021) and refill with fresh oil through the fill plug (see 3.1.2 through 3.1.3 and 3.2).

Every nine (9) to twelve (12) months, or as necessary: Replace exhaust filter elements (see 3.3).

As necessary: Check and/or clean the standard inlet screen. If the optional inlet filter is used, replace the filter material as practice determines.

The oil cooling coils (Ref. 240 on models 0012 through 0400), the oil cooler (Ref. 241 on models 0502 through 1600) and any motor or pump grill covers on all models should be inspected regularly for debris. Clean as necessary. Soiling prevents cool air intake or movement and may lead to overheating of the pump.

Drain drip legs on inlet and exhaust piping.

3.6 Overhaul Kit/Filter

An overhaul kit containing a set of gaskets and O-rings, vanes, bearings and bearing sleeves, shaft seals and taper pins, is available from the factory.

Also, a filter kit containing oil drain plug, gaskets, automotive-type oil filter (except 0010, 0012, 0016 and 0021), exhaust filter, and synthetic baffle strainer (where applicable), is available from the factory.

When ordering, please specify pump size and model (a 4-digit suffix after size), and serial number.

4.0 TROUBLESHOOTING

Problem	Possible Cause	Remedy
Pump does not reach "blank-off" pressure, or the pump takes too long to evacuate the system	Oil is contaminated	Shut off pump, drain oil and replace automotive-type oil filter (where applicable) when pump is cool. Flush and fill pump with new oil and take new blank off measurement after operating temperature is reached.
	Leakage in suction line	Check the piping for leaks
	Wire mesh inlet screen plugged (Ref. 261)	Clean wire mesh inlet screen. Install inlet filter if problem repeats frequently
	No oil or not enough oil in oil reservoir	Shut off pump and add necessary oil
	Automotive-type oil filter is dirty or clogged (where applicable)	Replace automotive-type oil filter, exchange oil, if necessary, and refill with fresh oil
	Inlet valve plate (Ref. 251) stuck in closed or partially open position due to contamination	Disassemble inlet valve and screen. Clean as required
	Oil tubing plugged and/or leaking	Replace, clean and/or retighten the oil fittings. Replace only with same size tubing
	Shaft seal leaking	Replace the shaft seal
	Exhaust valve (Ref. 159) is not properly seated or it is partially stuck open (RA models only)	Properly seat or loosen exhaust valve
	Vanes are blocked in the rotor or they are damaged	Free vanes or replace with new ones
	Radial clearance between the rotor and cylinder is no longer adequate.	Re-set the radial clearance
Internal parts worn or damaged	Replace worn or damaged parts	
Pump will not start	The motor does not have the correct supply voltage	Provide the correct supply voltage
	The motor starter overload settings are too low or trip level is too low	Check overload settings in motor starter for size and setting according to motor nameplate data

Problem	Possible Cause	Remedy
	A fuse is blown	Check the fuses, replace if necessary
	Connection wiring is too small or runs are too long causing too great a voltage drop	Use proper wiring size
	Pump or motor is blocked	Remove fan cover and try to turn pump and motor by hand. If frozen, remove motor from pump and check motor and pump separately. If pump is frozen, disassemble completely and remove foreign objects in the pump or replace broken vanes.
Pump starts, but labors and draws a very high current	Oil too heavy (viscosity too high) or ambient temperature below 5 degrees C (41°F)	Change to R580 vacuum oil if very cold, or warm up oil before starting the pump
	Pump runs in the wrong direction	Check for correct rotation which is counterclockwise when looking at the motor from the motor's fan side
	Pump is overfilled with oil or wrong kind of oil is used	Correct the oil level and quality per Section 1.5 and use recommended oil
	Exhaust filters in exhaust chamber are clogged and appear burned black with pump oil	Replace exhaust filters, maintain proper oil condition, oil level, and use only Busch recommended vacuum oil
	The exhaust filter is clogged due to process material	Contact the factory in Virginia Beach, Virginia for recommendations
	Loose connection in motor terminal box; not all motor coils are properly connected. Motor operates on two phases only	Check motor wiring diagram for proper hookup, especially on motors with six internal motor windings, tighten and/or replace loose connections
	Foreign particle in pump; vanes broken; bearing seizing	Remove foreign parts, and replace vanes and bearings
Pump discharges smoke at the exhaust port or expels oil droplets from the exhaust Note: An oil filling plug with pressure gauge is provided on all R 5 Series pumps, so that the pressure in front of the exhaust filters can be monitored. The green field indicates that the filters are still effective. Back pressure that causes a continuous reading in the red field requires immediate change of exhaust filters (Ref. 120).	Exhaust filter is not properly seated with O-ring (Ref. 121) or filter material is cracked	Check condition and check for proper seating of exhaust filters. Replace if necessary. Also, check filter spring clips for tightness
	Exhaust filter is clogged with foreign particles	Replace exhaust filter

Problem	Possible Cause	Remedy
	<p>The oil return valve (Ref. 275) is stuck open on RA/RB pumps. Proper function is that when blowing into check valve, it should close. When applying vacuum on it, check valve should open. (Not applicable on 0400-1600 RA series pumps, which have oil return float valve)</p>	<p>Free or replace the oil return check valve</p>
	<p>WARNING: Do not apply pressure or vacuum by mouth</p>	
	<p>If RA/RB Series vacuum pumps run continuously over 8 hours without ever being shut down, it may be possible that oil accumulates behind the exhaust box cover to the extent that oil is blown out of the exhaust with the exhaust gas. (Not applicable on 0400-1600 RA series pumps, which have oil return float valve)</p>	<p>Shut pump down during break periods or install an additional oil return line assembly. Check that oil return valve (Ref. 275) is free and drains oil back into the pump when the RA/RB Series pump is stopped</p>
	<p>Oil return line (Ref. 290) on RC Standard pump is clogged</p>	<p>Free clogged line or replace. Check that oil is being drawn out of the exhaust filter area while the vacuum pump is operating</p>
<p>Pump runs very noisily</p>	<p>Coupling insert worn</p>	<p>Replace coupling insert in motor/pump coupling</p>
	<p>Bearing noise</p>	<p>Replace bearings</p>
	<p>Vanes stuck</p>	<p>Replace vanes, Use recommended Busch oil. Change oil more frequently</p>
<p>The pump runs very hot. See Technical Data for typical oil sump temperature.</p> <p>Note: The oil temperature with a closed inlet should be approximately 185-225°F depending on pump type. At 24 in. Hg, the oil in the pump can go above 225°F. These values are taken at an ambient temperature of 68°F. The maximum recommended ambient operating temperature for an R 5 is 100°F on a continuous basis. When it is necessary to operate a pump in ambient temperatures above this limit, careful oil monitoring and/or optional water cooling is necessary. Contact the factory for details.</p>	<p>Not enough air ventilation to the pump</p>	<p>Clean motor and pump air grills. Do not install the pump in an enclosed cabinet unless a sufficient amount of cool air is supplied to the pump. On pumps with oil cooling coils, clean outside fin assembly. Bring ambient air temperature down</p>
	<p>Automotive-type oil filter (if applicable) clogged and pump does not receive enough oil</p>	<p>Change automotive oil filter</p>
	<p>Not enough oil in oil reservoir, or badly burned oil is used for pump lubrication</p>	<p>Drain and refill only with Busch recommended oil. Increase oil change intervals</p>

Problem	Possible Cause	Remedy
Pump is seized	Pump operated without oil and vanes are broken	Disassemble and exchange vanes; contact Busch LLC Service Department in Virginia Beach, Virginia for suggestions
	Pump was operated for an extended period of time in the wrong rotation	Inspect vanes and replace; contact Busch LLC Service Department in Virginia Beach, Virginia for suggestions
	Liquid carryover into the pump cylinder broke vanes while pump was running, or oil broke vanes on start-up	<p>(a) Install condensate trap on the inlet of the pump</p> <p>(b) Pump was overfilled with oil in oil reservoir. Follow oil filling procedure (see Section 1.5) and do not overfill</p> <p>(c) Built-in, anti-suck-back valve (Ref. 250 through 255) leaking while pump was shut down and vacuum was left in manifold. Clean valve seat and check that anti-suck-back valve holds vacuum on inlet when pump is shut down</p> <p>d) Two pumps or a receiver is on the same main line. Install a manual or automatic operated valve in front of each pump</p>
Automotive-type oil filter (Ref. 100) does not get warm within two to five minutes when cold pump is started (not applicable on 0010, 0012, 0016 or 0021)	Automotive-type oil filter is clogged	Replace automotive-type filter per Section 3.2 and exchange oil per Section 1.5
	Wrong automotive-type filter is used and/or oil lines and oil coolers leading to pump are clogged	Use only automotive filter as listed in Section 3.2 and blow lines free. Flush oil cooler
	Electric motor has failed and seized	Check and replace motor bearings or replace motor if windings have burned up

5.0 LIMITED STANDARD WARRANTY

Busch LLC warrants that all products furnished by it are free from defects in material and workmanship at the time of shipment for a period of 18 months from the date of shipment, or 12 months from the date of installation, whichever occurs first. Claims must be made during that period and are limited to the replacement or repair of parts claimed to be defective.

In the case of components purchased by Busch LLC, such as starters, controls, mechanical seals, motors, couplings, etc., the warranty of that manufacturer will be extended to the purchaser in lieu of any warranty by Busch LLC. The replacement of wear items including, but not limited to, seals, bearings, couplings, exhaust cover gaskets, oil drain plugs, oil fill plugs etc., made in connection with normal service are not covered by this Warranty.

The Limited Standard Warranty is valid only when the product has been properly installed, used in a normal manner, and serviced according to the operating manual. This warranty shall not extend to products that have been misused, neglected, altered, or repaired without factory authorization during the warranty period. We highly recommend the use of Busch oils and parts to achieve documented performance and efficient operation. The use of oils or parts other than Busch could limit the life expectancy of the equipment and could void any warranties if they are the cause of any damage. Operating conditions beyond our control such as improper voltage or water pressure, excessive ambient temperatures, or other conditions that would affect the performance or life of the product will also cause the warranty to become void.

Permission to return parts for warranty repair must be obtained, and all returns must be prepaid to the factory. If, after examination, the product or part is found to be defective, it will be repaired or replaced on a no-charge basis and returned, FOB the factory. If it is determined that the Warranty has not been breached by Busch LLC then the usual charges for repair or replacement will be made, FOB the factory. Parts or products that are obsolete or those made to special order are not returnable.

This Limited Standard Warranty applies only to the above and is for the period set forth. Busch LLC's maximum liability shall not, in any case, exceed the contract price for the product, part, or component claimed to be defective; and Busch LLC assumes no liability for any special, indirect, or consequential damages arising from defective equipment.

THERE ARE NO WARRANTIES IMPLIED OR EXPRESSED THAT EXTEND BEYOND THOSE CONTAINED IN THIS LIMITED STANDARD WARRANTY.

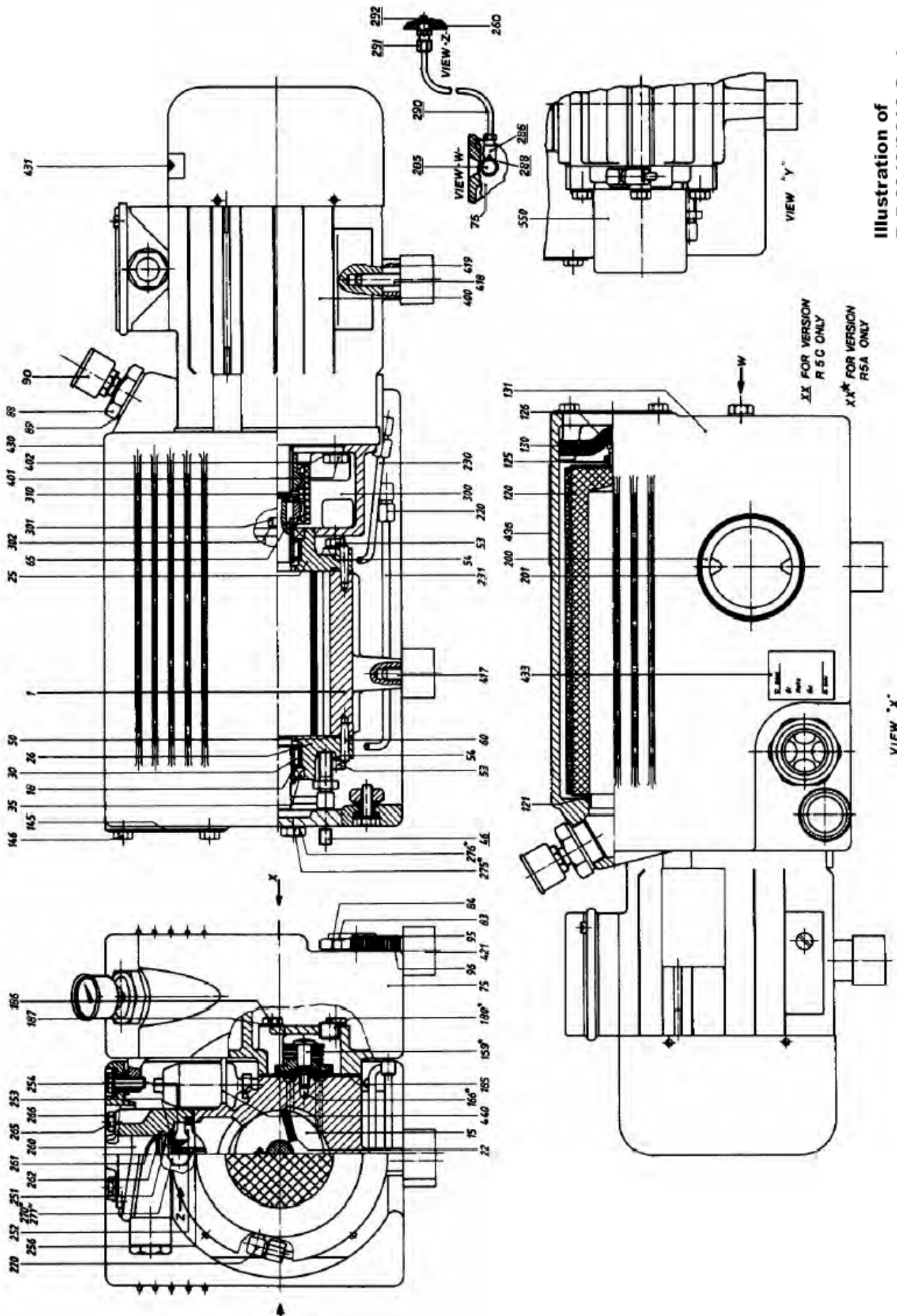
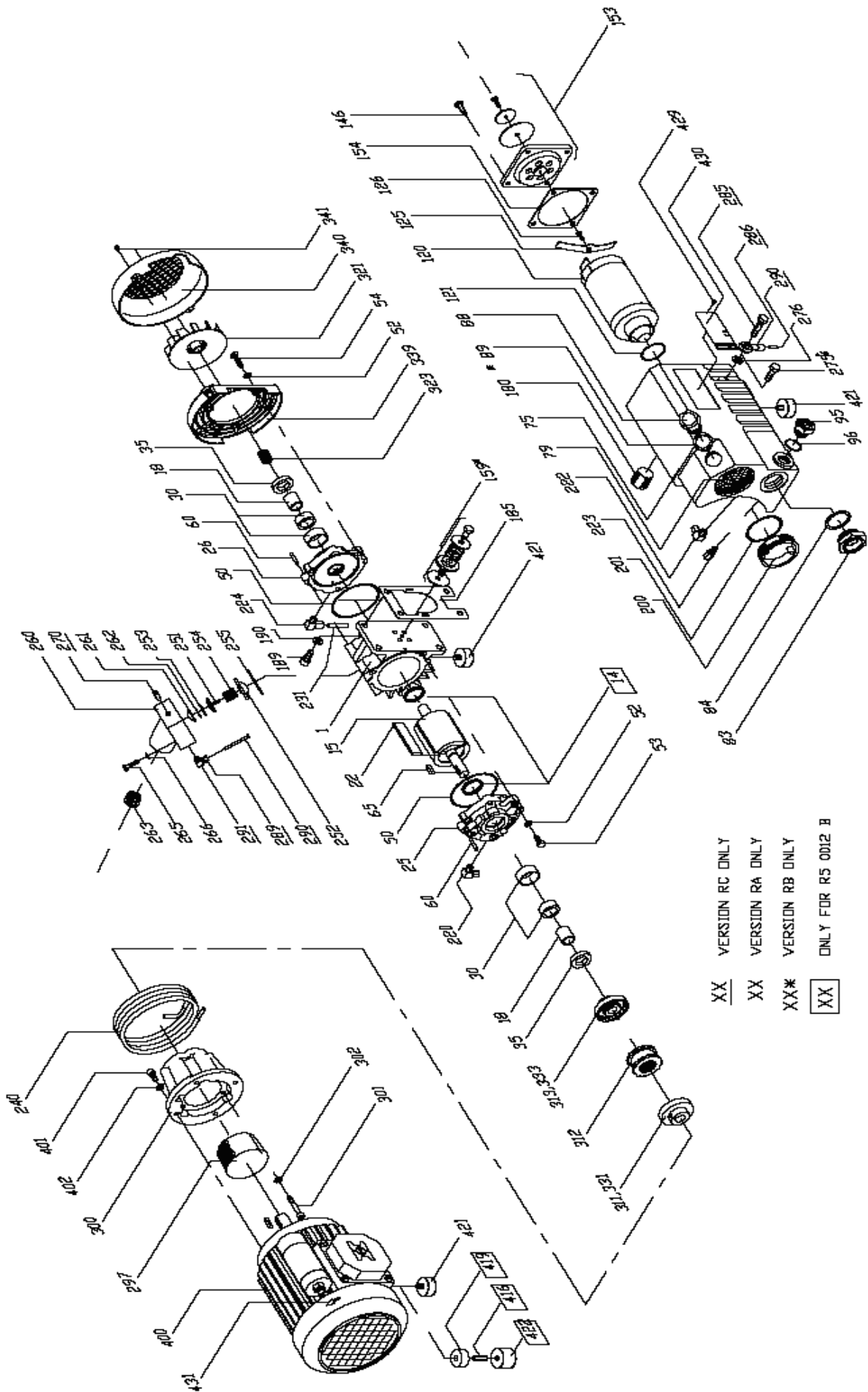


Illustration of
 R 5 0010/0016 Series

Parts List for R 5 0010/0016

Ref Description	Ref Description
001 Cylinder	285 Oil recirc. screw
015 Rotor	286 Banjo hydraulic fitting
018 Bearing sleeve	288 Ring gasket
022 Vane	290 Oil return line
025 Motor side endplate	291 Hydraulic straight fitting
026 Opp. M.S. endplate	300 Motor mounting bracket
030 Needle bearing	301 Socket head cap screw
035 Shaft seal	302 Lockwasher
046 Socket set screw	310 Coupling
047 Lockwasher	400 Motor
050 O-ring	401 Hex head cap screw
053 Hex head cap screw	402 Lockwasher
054 Lockwasher	417 Slotted set screw
056 Hex head cap nut	418 Slotted set screw
060 Tapered pin	419 Washer
065 Shaft key	421 Rubber foot
075 Exhaust box	430 Nameplate
083 Oil sight glass	431 Directional arrow
084 Ring gasket	433 Oil level label
088 Oil fill plug	436 Maintenance label
089 Ring gasket	440 Check valve for gas ballast
090 Pressure gauge	550 Cover guard
095 Oil drain plug	
096 O-ring	
120 Exhaust filter	
121 O-ring	
125 Filter spring assembly	
126 Slot chase head mach. screw	
130 Baffle strainer	
145 Cover plate exhaust screen	
146 Hex head cap screw	
159 Exhaust valve	
166 Cylindrical pin	
180 Plug	
185 Cylinder/exhaust box gasket	
186 Hex head cap screw	
187 Lockwasher	
200 Drum exhaust box plug	
201 O-ring	
220 Hydraulic elbow fitting	
230 Oil tubing	
231 Oil tubing	
251 Valve plate	
252 Valve guide	
253 O-ring	
254 Inlet check valve spring	
256 Cylinder/inlet flange gasket	
260 Inlet flange	
261 Inlet screen	
262 Retaining spring	
265 Hex head cap screw	
266 Lockwasher	
270 Plug	
271 Ring gasket	
275 Oil return valve	
276 Ring gasket	



**Illustration of
 R 5 0012/0021 Series**

Parts List for R 5 0012/0021

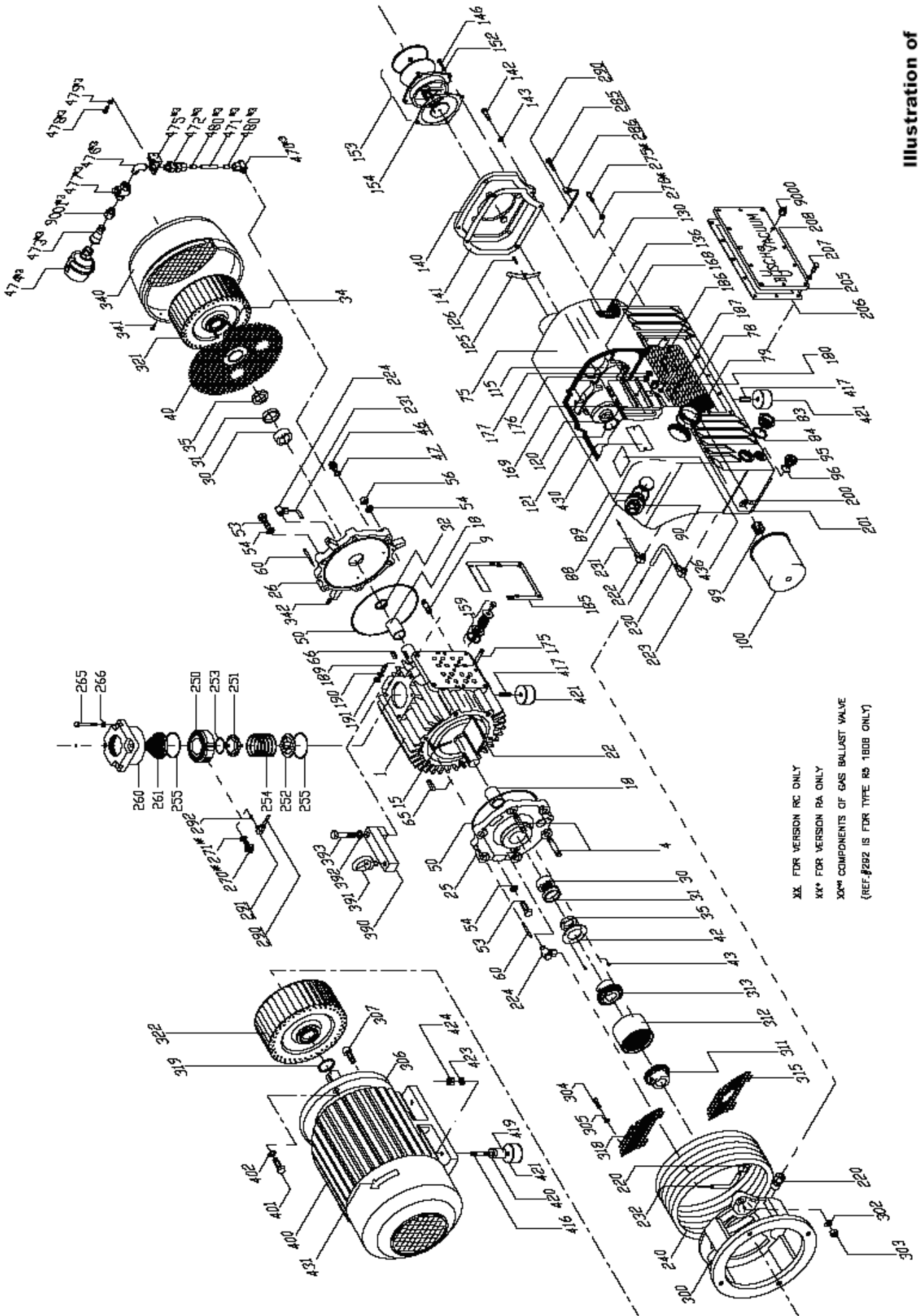
Ref Description

001 Cylinder
 014 Seal
 015 Rotor
 018 Bearing sleeve
 022 Vane
 025 Motor side endplate
 026 Opp. M.S. endplate
 030 Teflon sleeve bearing
 035 Shaft seal
 050 O-ring
 052 Lockwasher
 053 Hex head cap screw
 054 Lock washer
 060 Tapered pin
 065 Shaft key
 075 Exhaust box
 079 Demister pad
 080 Oil sight glass
 081 Ring gasket
 083 Oil sight glass
 084 Ring gasket
 088 Oil fill plug w/hole
 089 Ring gasket
 090 Pressure gauge
 095 Oil drain plug
 096 O-ring
 120 Exhaust filter
 121 O-ring
 125 Filter spring assembly
 126 Slot chs. head mach.screw
 146 Hex head cap screw
 153 Exhaust cover plate
 154 Exhaust cover gasket
 159 Exhaust valve assembly
 180 Plug
 185 Gasket
 189 Stud
 190 Lockwasher
 191 Hex head nut
 200 Drum exhaust box plug
 201 O-ring
 220 Hydraulic elbow fitting
 222 Hydraulic straight fitting
 223 Hydraulic straight fitting
 224 Hydraulic elbow fitting
 231 Oil tubing
 240 Cooling coil
 251 Valve plate
 252 Valve guide
 253 O-ring
 254 Inlet check valve spring
 255 O-ring
 260 Inlet flange
 261 Inlet screen
 262 Retaining spring
 263 Baffle strainer

Ref Description

265 Screw
 266 Lockwasher
 270 Plug
 275 Oil return valve
 276 Ring gasket
 285 Oil recirc. screw
 286 Banjo hydraulic fitting
 289 Fitting nut
 290 Oil return line tubing
 291 Hydraulic fitting
 297 Screen
 300 Motor mounting bracket
 301 Socket head cap screw
 302 Lockwasher
 311 Motor side coupling half
 312 Coupling insert
 313 Pump side coupling half
 321 Pump fan
 323 Tolerance ring
 331 Set screw
 333 Set screw
 339 Fan centering ring
 340 Pump end cover
 341 Machine screw
 400 Motor
 401 Hex head cap screw
 402 Lockwasher
 416 Stud
 417 Slotted set screw
 419 Foot spacer
 421 Rubber foot
 422 Rubber foot
 429 Screw
 430 Nameplate
 431 Directional arrow

**Illustration of
R 5 0160 Series**

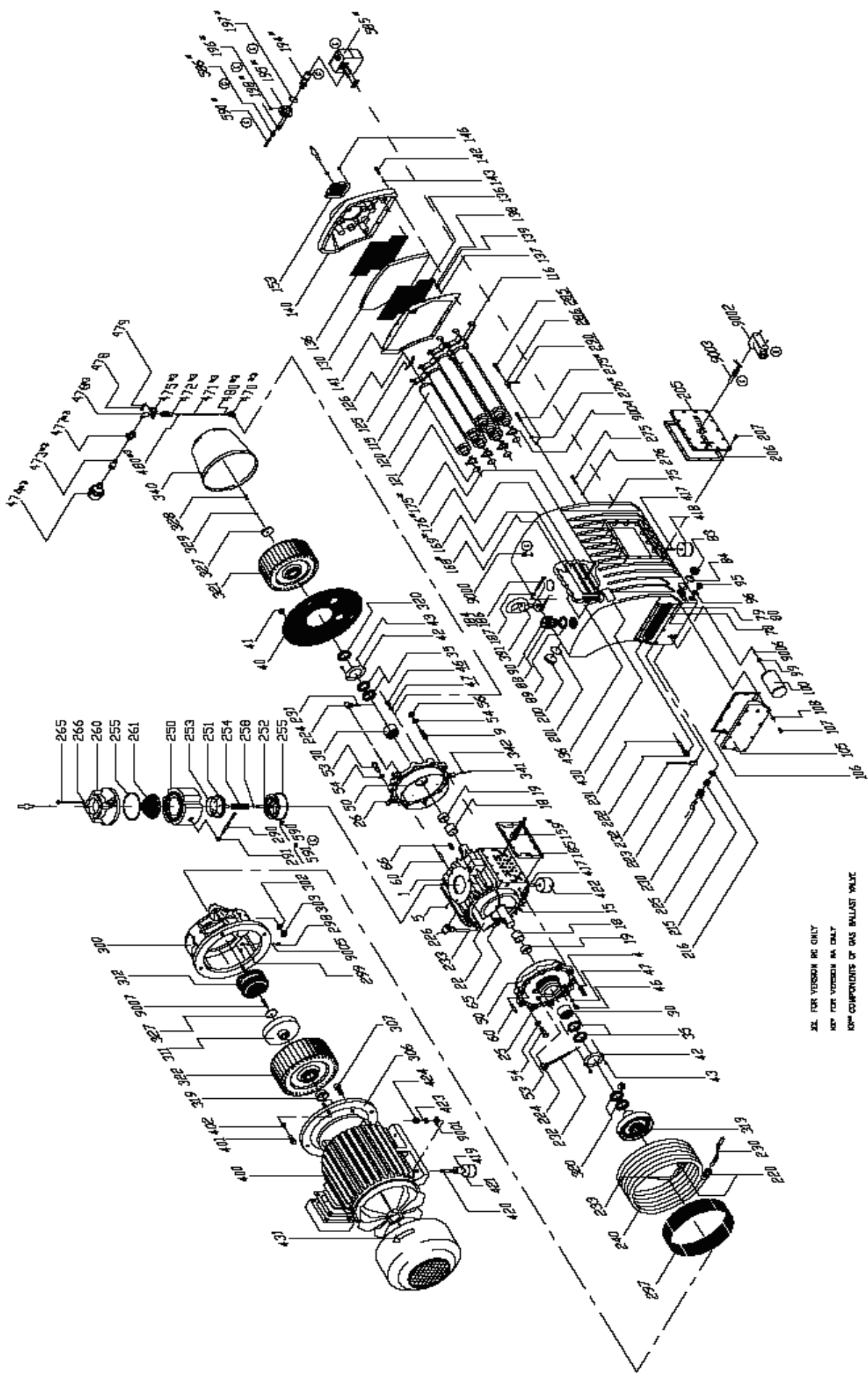


XX FOR VERSION RC ONLY
 XX* FOR VERSION RA ONLY
 XX** COMPONENTS OF GAS BALLAST VALVE
 (REF #292 IS FOR TYPE R5 1BDB ONLY)

Parts List for R 5 0160

Ref Description	Ref Description	Ref Description
001 Cylinder	176 Lockwasher	322 Motor side fan
004 Stud	177 Hex head nut	340 Fan Cover
009 Stud	180 Plug	341 Sheet metal screw
015 Rotor	185 Gasket	342 Plastic insert
018 Bearing sleeve	186 Hex head cap screw	390 Eyebolt adapter
022 Vane	187 Lockwasher	391 Eyebolt
025 Motor side endplate	189 Stud	392 Lockwasher
026 Opp. M.S. endplate	190 Lockwasher	393 Hex head cap screw
030 Needle bearing	191 Hex head nut	400 Motor
031 Endplate spacer	200 Drum exhaust box plug	401 Hex head cap screw
032 Pump spacer	201 O-ring	402 Lockwasher
034 Slotted chs hd cap screw	205 Cover side plate	416 Stud
035 Shaft seal	206 Gasket	417 Slotted set screw
040 Protective screen	207 Hex head cap screw	419 Foot spacer
042 Shaft seal retaining plate	208 Lockwasher	420 Flat washer
043 Hex head cap screw	220 Hydraulic fitting	421 Rubber foot
046 Hex head plug	222 Hydraulic fitting	423 Washer
047 Copper ring gasket	223 Hydraulic fitting	424 Hex head cap nut
050 O-ring	224 Hydraulic fitting	430 Nameplate
053 Hex head cap screw	230 Oil tubing	431 Arrow label
054 Lockwasher	231 Oil tubing	436 Maintenance label
056 Hex head cap nut	232 Oil tubing	470 Hydraulic fitting
060 Tapered pin	240 Cooling coil	471 Teflon tubing
065 Shaft key	250 Inlet flange	472 Check valve
066 Shaft key	251 Valve guide	473 Bell reducer
075 Exhaust box	252 Valve plate	474 Gas ballast filter
078 Sheet metal baffle	253 O-ring	475 Gas ballast valve bracket
079 Demister pad	254 Inlet check valve spring	476 Elbow fitting
083 Oil sight glass	255 O-ring	477 Pet cock valve
084 Ring gasket	260 Inlet flange	478 Hex head cap screw
088 Oil fill plug	261 Inlet screen	479 Lockwasher
089 Oil fill plug gasket	265 Hex head cap screw	480 Oil tube insert
090 Pressure gauge	266 Lockwasher	9000 Steel socket plug
095 Oil drain plug	270 Plug R1/8"	9001 Hydraulic adapter
096 O-ring	271 Ring gasket	
099 Nipple	275 Oil return valve	
100 Auto-type oil filter	276 Ring gasket	
115 Filter bracket	285 Oil recirc. screw	
120 Exhaust filter	286 Banjo hydraulic fitting	
121 O-ring	290 Oil return line tubing	
125 Filter spring assembly	291 Hydraulic fitting	
126 Socket head cap screw	292 Carburetor jet	
130 Baffle strainer	300 Motor mounting bracket	
136 Support for syn. frame	302 Lockwasher	
140 Exhaust cover plate	303 Hex shoulder nut	
141 Cover plate gasket	304 Socket hd machine screw	
142 Hex head cap screw	305 Flat washer	
143 Lockwasher	306 C-face adapter flange	
146 Hex head cap screw	307 Socket head screw	
152 Lockwasher	311 Motor side coupling half	
153 Exhaust silencer	312 Coupling insert	
154 Gasket	313 Pump side coupling half	
159 Exhaust valve	315 Protective screen	
168 O-ring	318 Protective screen	
169 Exh. valve cover plate	319 Spacer	
175 Stud	321 Pump shaft fan	

**Illustration of
R 5 0400 Series**



SEE FOR VERSION RC ONLY
SEE FOR VERSION RA ONLY
KAWA Components of GAS INJECTION VALVE

Parts List for R 5 0400

Ref Description	Ref Description	Ref Description
001 Cylinder	143 Lockwasher	312 Coupling insert
004 Stud	146 Hex head cap screw	313 Pump side coupling half
005 Set screw	153 Cover plate exhaust screen	319 Spacer
009 Stud	159 Exhaust valve	320 Fan and coupling spacer
015 Rotor	168 O-ring	321 Pump shaft fan
018 Bearing sleeve	169 Exh. valve cover plate	322 Motor side fan
019 Shaft seal sleeve	175 Hex head cap screw	327 Locking disk
022 Vane	176 Lockwasher	328 Socket head cap screw
025 Motor side endplate	184 Socket head cap screw	329 Lockwasher
026 Opp. M.S. endplate	185 Cylinder/Exhaust box gasket	340 Fan Cover
030 Needle bearing	186 Hex head cap screw	341 Sheet metal screw
035 Shaft seal	187 Lockwasher	342 Plastic insert
040 Protective screen	200 Drum exhaust box plug	391 Eyebolt
041 Hex head nut	201 O-ring	400 Motor
042 Shaft seal support ring	205 Cover side plate	401 Hex head cap screw
043 Hex head cap screw	206 Gasket	402 Lockwasher
046 Hex head plug	207 Hex head cap screw	417 Slotted set screw
047 Copper ring gasket	215 Reducing nipple	418 Rubber foot
050 O-ring	216 Ring gasket	419 Foot spacer
053 Hex head cap screw	220 Hydraulic fitting	420 Stud
054 Lockwasher	222 Hydraulic elbow fitting	421 Rubber foot
056 Hex head cap nut	223 Hydraulic elbow fitting	422 Rubber foot
060 Tapered pin	224 Hydraulic banjo fitting	423 Lockwasher
065 Shaft key	225 Hydraulic straight fitting	424 Hex head cap nut
066 Shaft key	226 Hydraulic banjo fitting	430 Nameplate
075 Exhaust box	230 Oil tubing	431 Arrow label
078 Sheet metal baffle	231 Oil tubing	436 Maintenance label
079 Demister pad	232 Oil tubing	470 Hydraulic banjo fitting
080 Perforated sheet metal	233 Oil tubing	471 Teflon tubing
083 Oil sight glass	240 Cooling coil	472 Check valve
084 Ring gasket	250 Inlet flange	473 Bell reducer
088 Oil fill plug	251 Valve plate	474 Gas ballast filter
089 Oil fill plug gasket	252 Valve inlet guide	475 Gas ballast valve bracket
090 Pressure gauge	253 O-ring	476 Elbow fitting
095 Oil drain plug	254 Inlet check valve spring	477 Pet cock valve
096 O-ring	255 O-ring	478 Hex head cap screw
099 Nipple	258 Ball, Viton	479 Lockwasher
100 Auto-type oil filter	260 Inlet flange	480 Oil tube insert
105 Cover plate	261 Inlet screen	9000 Steel socket plug
106 Cover plate gasket	265 Hex head cap screw	9001 Flat washer
107 Socket head cap screw	266 Lockwasher	9002 Entrance elbow connector
108 Lockwasher	275 Oil return valve	9003 Fenwal temperature switch
115 Filter bracket	276 Ring gasket	9004 Grounding washer
116 Filter bracket	285 Oil recirc. screw	9005 Plain washer
120 Exhaust filter	286 Banjo hydraulic fitting	9006 Socket head cap screw
121 O-ring	290 Oil return line tubing	9007 Hex head cap screw
125 Filter spring assembly	291 Hydraulic elbow fitting	
126 Socket head cap screw	297 Screen	
130 Baffle strainer	298 Slot chs. head screw	
136 Perf. sheet metal screen	299 Rivet	
137 Hex head cap screw	300 Motor mounting bracket	
138 Flat washer	302 Lockwasher	
139 Lockwasher	303 Hex shoulder nut	
140 Exhaust cover plate	306 C-face adapter flange	
141 Cover plate gasket	307 Socket head screw	
142 Hex head cap screw	311 Motor side coupling half	

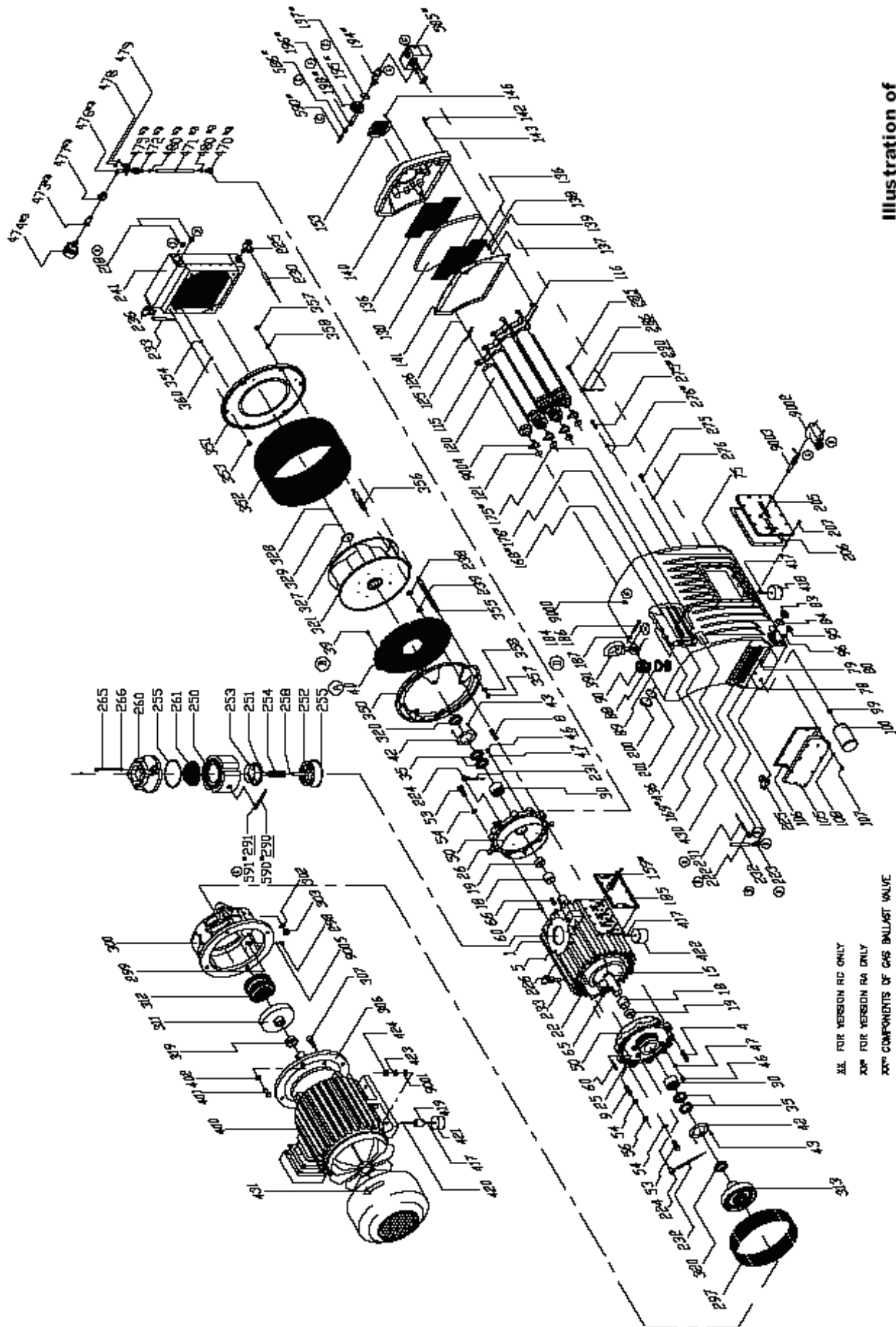
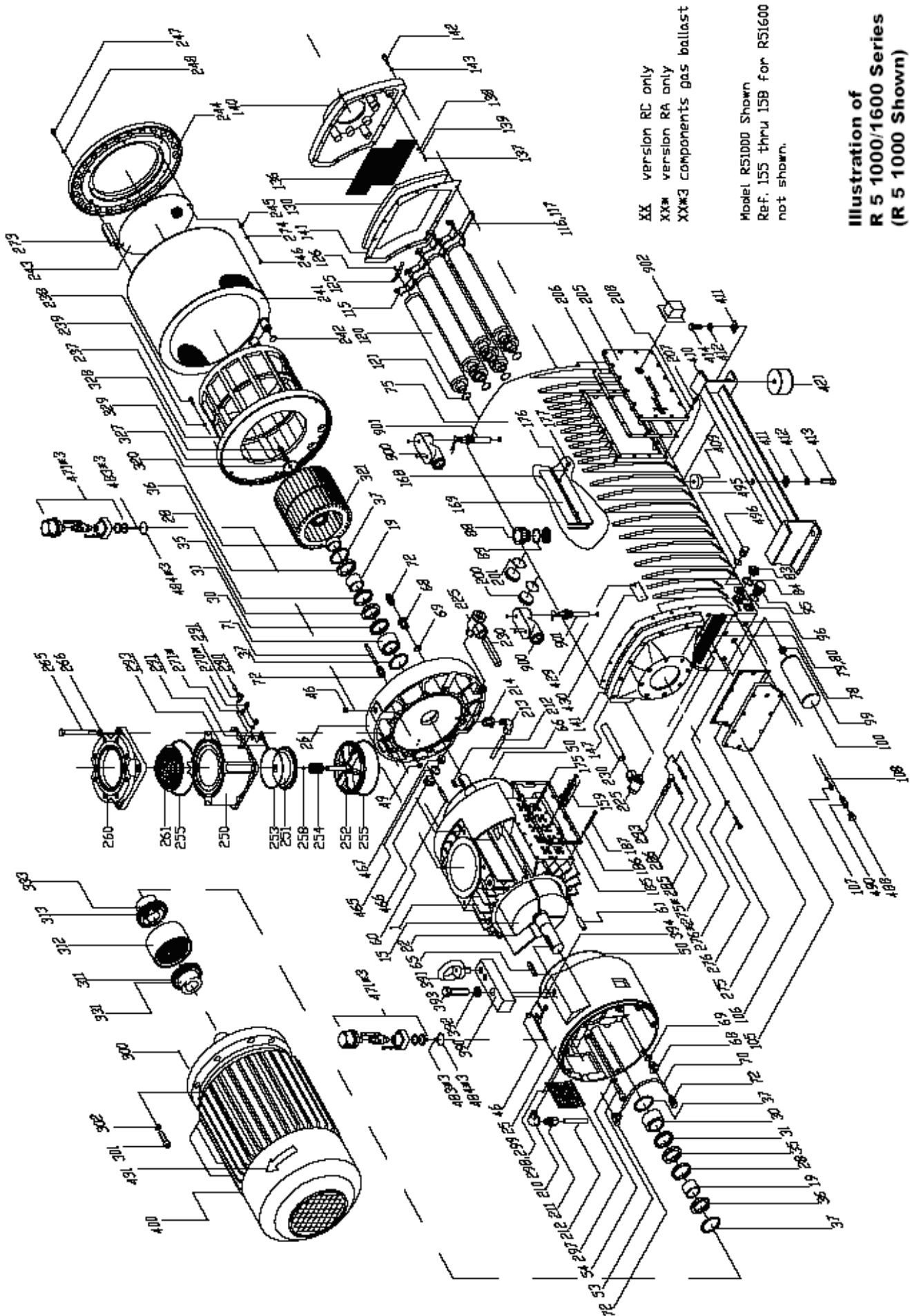


Illustration of
 R 5 0502/0630 Series
 (R 5 0630 Shown)

XXL FOR VERSION RC ONLY
 XXM FOR VERSION RA ONLY
 XXX COMPONENTS OF GAS BALLAST VALUE

Parts List for R 5 0502/0630

Ref Description	Ref Description	Ref Description
001 Cylinder	141 Cover plate gasket	313 Pump side coupling half
004 Stud	142 Hex head cap screw	319 Spacer
005 Set screw	143 Lockwasher	320 Fan and coupling spacer
008 Stud	146 Hex head cap screw	321 Pump shaft fan
009 Stud	153 Cover plate exhaust screen	327 Locking disk
015 Rotor	159 Exhaust valve	328 Socket head cap screw
018 Bearing sleeve	168 O-ring	329 Lockwasher
019 Shaft seal sleeve	169 Exh. valve cover plate	350 Centering ring
022 Vane	175 Hex head cap screw	351 Centering ring
025 Motor side endplate	176 Lockwasher	352 Fan guard
026 Opp. M.S. endplate	184 Socket head cap screw	353 Hex head cap screw
030 Needle bearing	185 Cylinder/Exhaust box gasket	354 Hex head nut
035 Shaft seal	186 Hex head cap screw	355 Distance bolt
039 Socket head mach. screw	187 Lockwasher	356 Mounting bolt
040 Protective screen	200 Drum exhaust box plug	357 Hex nut
041 Hex head nut	201 O-ring	358 Lockwasher
042 Shaft seal support ring	205 Cover side plate	360 Lockwasher
043 Hex head cap screw	206 Gasket	391 Eyebolt
046 Hex head plug	207 Hex head cap screw	400 Motor
047 Copper ring gasket	222 Hydraulic elbow fitting	401 Hex head cap screw
050 O-ring	223 Hydraulic elbow fitting	417 Slotted set screw
053 Hex head cap screw	224 Hydraulic banjo fitting	418 Rubber foot
054 Lockwasher	225 Hydraulic straight fitting	419 Foot spacer
056 Hex head cap nut	226 Hydraulic banjo fitting	420 Stud
060 Tapered pin	230 Oil tubing	421 Rubber foot
065 Shaft key	231 Oil tubing	422 Rubber foot
066 Shaft key	232 Oil tubing	423 Lockwasher
075 Exhaust box	233 Oil tubing	424 Hex head cap nut
078 Sheet metal baffle	236 Hydraulic fitting	430 Nameplate
079 Demister pad	238 Hex head nut	431 Arrow label
080 Perforated sheet metal	239 Lockwasher	436 Maintenance label
083 Oil sight glass	241 Oil cooler	470 Hydraulic banjo fitting
084 Ring gasket	250 Inlet flange	471 Teflon tubing
088 Oil fill plug	251 Valve plate	472 Check valve
089 Oil fill plug gasket	252 Valve inlet guide	473 Bell reducer
090 Pressure gauge	253 O-ring	474 Gas ballast filter
095 Oil drain plug	254 Inlet check valve spring	475 Gas ballast valve bracket
096 O-ring	255 O-ring	476 Elbow fitting
099 Nipple	258 Ball, Viton	477 Pet cock valve
100 Auto-type oil filter	260 Inlet flange	478 Hex head cap screw
105 Cover plate	261 Inlet screen	479 Lockwasher
106 Cover plate gasket	265 Hex head cap screw	480 Oil tube insert
107 Socket head cap screw	266 Lockwasher	585 Oil return float valve kit
108 Lockwasher	285 Oil recirc. screw	586 Hydraulic fitting
115 Filter bracket	286 Banjo hydraulic fitting	591 Hydraulic fitting
116 Filter bracket	290 Oil return line tubing	9000 Steel socket plug
120 Exhaust filter	297 Screen	9001 Flat washer
121 O-ring	298 Slot chs head screw	9002 Entrance elbow connector
125 Filter spring assembly	299 Rivet	9003 Fenwal temperature switch
126 Socket head cap screw	300 Motor mounting bracket	9004 Grounding washer
130 Baffle strainer	302 Lockwasher	9005 Plain washer
136 Perf. sheet metal screen	303 Hex shoulder nut	9006 Socket head cap screw
137 Hex head cap screw	306 C-face adapter flange	9007 Hex head cap screw
138 Flat washer	307 Socket head screw	
139 Lockwasher	311 Motor side coupling half	
140 Exhaust cover plate	312 Coupling insert	



XX version RC only
 XX* version RA only
 XX*3 components gas ballast

Model R51000 Shown
 Ref. 155 thru 158 for R51600
 not shown.

**Illustration of
 R 5 1000/1600 Series
 (R 5 1000 Shown)**

Parts List for R 5 1000/1600

Ref Description	Ref Description	Ref Description
001 Cylinder	142 Socket head cap screw	291 Elbow assembly kit
015 Rotor	143 Lockwasher	293 Oil steel tubing
019 Shaft seal sleeve	147 Exhaust cover plate	297 Screen
022 Vane	159 Exhaust valve	298 Sheet metal screw
025 Motor side endplate	168 O-ring	299 Sheet metal nut
026 Opp. M.S. endplate	169 Exh. valve cover plate	300 Motor mounting adapter
028 End plate spacer	175 Stud	301 Socket head cap screw
030 Needle bearing	176 Lockwasher	302 Lockwasher
031 Endplate spacer	177 Hex head nut	311 Motor side coupling half
035 Shaft seal	185 Cylinder/exhaust box gasket	312 Coupling insert
036 Shaft seal	186 Hex head cap screw	313 Pump side coupling half
037 Retaining ring	187 Lockwasher	320 Distance spacer
046 Hex head plug	200 Drum exhaust box plug	321 Cooling fan
049 O-ring	201 O-ring	327 Retaining disk
050 O-ring	205 Cover plate	328 Hex head cap screw
053 Hex head cap screw	206 Cover plate gasket	329 Lockwasher
054 Lockwasher	207 Hex head cap screw	331 Socket set screw
060 Tapered pin	208 Lockwasher	333 Socket set screw
061 Cylindrical pin	210 Elbow pipe fitting	390 Eyebolt adapter
065 Shaft key	211 Hydraulic straight fitting	391 Eyebolt
066 Shaft key	212 Oil tubing	392 Lockwasher
068 Connect piece for hyd. fitting	213 Hydraulic elbow fitting	393 Hex head cap screw
069 O-ring	214 Reducer bushing	394 Alignment pin
070 Gas ballast line, A-side	225 Hydraulic banjo fitting	400 Motor
071 Gas ballast line, B-side	230 Oil tubing	401 Hex head cap screw
072 Hydraulic fitting	237 Cooler guide	402 Lockwasher
075 Exhaust box	238 Socket head cap screw	409 Spacer
078 Sheet metal baffle	239 Lockwasher	410 Frame
079 Demister pad	241 Oil cooler	411 Washer
080 Perforated sheet metal	242 O-ring	412 Lockwasher
083 Oil sight glass	243 Fan guard	413 Hex head cap screw
084 Ring gasket	244 Cooler front cover	414 Hex head cap screw
088 Oil fill plug	245 Flat washer	421 Rubber foot
089 Oil fill plug gasket	246 Hex head cap screw	429 Sheet metal screw
096 O-ring	247 Socket head cap screw	430 Nameplate
099 Nipple	248 Lockwasher	431 Arrow label
100 Auto-type oil filter	250 Inlet flange	465 Ring gasket
105 Cover plate	251 Valve plate	466 Plug
106 Cover plate gasket	252 Valve inlet guide	467 Bypass plug
107 Socket head cap screw	253 O-ring	471 Gas ballast valve assembly
108 Lockwasher	254 Inlet check valve spring	483 Ring gasket
115 Filter bracket	255 O-ring	484 O-ring
116 Filter bracket	258 Ball	488 Socket head plug
117 Filter bracket	260 Inlet flange	490 Nipple
120 Exhaust filter	261 Inlet screen	495 O-ring
121 O-ring	265 Hex head cap screw	496 Float switch
125 Filter spring assembly	266 Lockwasher	498 Socket head cap screw
126 Socket head cap screw	270 Plug	499 Lockwasher
129 Baffle strainer, A side	271 Ring gasket	900 Elbow connector
130 Baffle strainer, B side	273 Distance bolt	901 Temperature switch
136 Perf. sheet metal screen	274 Lockwasher	902 Temperature switch
137 Slot chase head screw	275 Oil return valve	
138 Flat washer	276 Ring gasket	
139 Flat washer	285 Oil recirc. screw	
140 Exhaust cover plate	286 Hydraulic banjo fitting	
141 Cover plate gasket	290 Oil return tubing	

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