VACUUM
EL SYSTEM

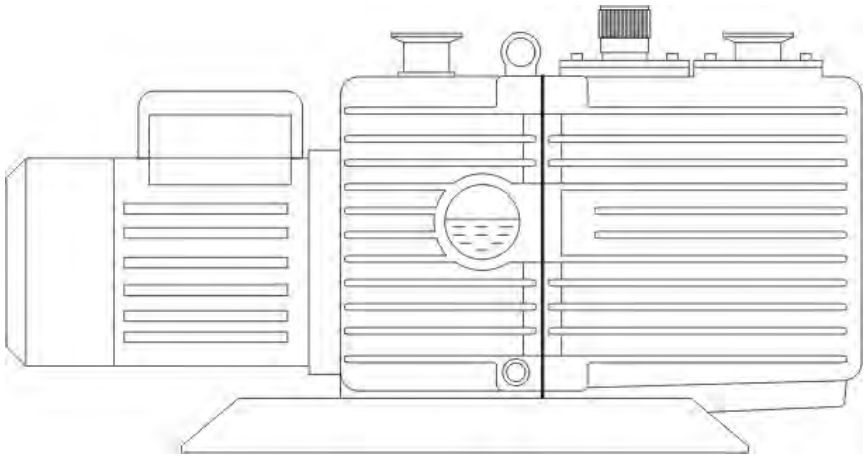
DIN EN ISO
9001:2000

Oil Rotary Vane Two-Stage Vacuum Pumps

Types

RTVP 16 A	**RTVP 16 AC**
RTVP 30 A	**RTVP 60 AC**
RTVP 60 A	**RTVP 60 AC**

OPERATING INSTRUCTIONS



Indications:

Warning: Indicates procedures that must be strictly observed to prevent hazards to persons.

Caution!

Indicates procedures that must strictly be observed to prevent damage to, or destruction of the equipment.

Caution!

We recommend that you carefully read this user's manual before you begin operation of RTVP vacuum pump. We do not bear responsibility for accidents or damages, caused by or related to product exploitation, occurred due to non-observance of hereby instructions. Our responsibility constitutes a quality repair service in case of troubleshooting, and is limited within the value of the product.

Figures:

The references to figures in the text, consist of the figure No and the position No, e.g. (1/3).

Service:

If a pump is returned to a service, indicate whether the pump is free of substances damaging to health or whether it is contaminated. If it is contaminated also indicate the nature of the hazard. Any pump, sent to a service without a "Declaration of Contamination", will be returned to the sender's address, on the account of the sender.

Disposal of waste oil

Anyone in possession of used oil is responsible for its proper disposal, in accordance with the local acting regulations.

Used oils coming from vacuum pumps must not be mixed with other substances.

Used oils from vacuum pumps (on the basis of mineral oils) having been affected by normal contamination due to oxygen from the ambient air, increases in temperature and mechanical wear, must be disposed of as used oil in accordance with the regulations.

Used oils from vacuum pumps that have been contaminated by other substances must be labelled, stored and disposed of as special waste with reference to the kind of contamination.

In many countries proof of where the oil has finally been left is required by Law and often shipping of such contaminated waste requires permission by the authorities.

When storing and disposing of used oil please observe the safety regulations that are valid in your country.

1. Description

RTVP pumps are oil-sealed rotary vane two-stage vacuum pumps. The number in the type designation (**RTVP 16, 30** and **60**) indicates the pumping speed in m^3/h, and the marks **"A"** or **"AC"** – the variant of designation – normal make **(A)** and for aggressive media **(AC).** They are highly productive at comparatively low weight and low energy cost. Application areas are industry, power engineering, electrical engineering, microelectronics, metallurgy, pharmaceutics, optics, sputtering installations and others.

RTVP pumps can pump gases and vapours and evacuate vessels or vacuum systems in the fine vacuum range.

- Pumps of standard design are **not** suitable for pumping greater than atmospheric concentrations of oxygen, hazardous gases, or extremely aggressive or corrosive media.

RTVP pumps operate through means of three-phase electric motors, having different power, depending on the pumping speed.

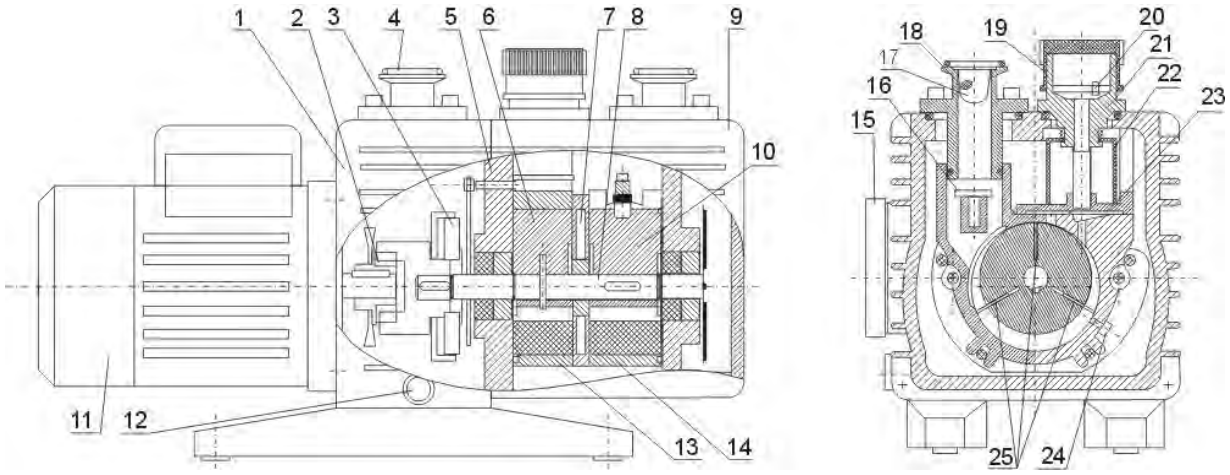
Caution!

- **RTVP 16 A and RTVP 16 AC** are also available with a single-phase motor.

The drive motor is directly flanged to the pump. The pump and motor shafts are directly connected by a flexible coupling. The bearing points of the pump module are force lubricated sliding bearings. All connections are to be found at the top of the pump. The oil-level indicator is provided with a prism for better observation of the oil level.

The pump module consists of assembly parts which are pin-fitted so as to allow easy disassembly and reassembly.

Fig.1. Sectional drawing of **RTVP**



1 Coupling housing
2 Coupling
3 Centrifugal switch
4 Exhaust port
5 Front-end plate
6 Rotor
7 Intermediate plate
8 Rotor Shaft
9 Oil reservoir
10 Rotor
11 Electrical motor
12 Oil-drain plug
13 Low-vacuum ring
14 High-vacuum ring
15 Oil-sight gauge
16 Anti-suckback valve
17 Dust trap filter
18 Intake port
19 Gas ballast valve – knob
20 Valve plate
21 Gas ballast valve
22 Demister
23 Exhaust valve
24 Oil nozzle
25 Vanes

1.1 Function

In accordance with Fig.1, the rotor (1/10), mounted eccentrically in the high vacuum ring (1/14), has three radially sliding vanes (1/25) which divide the high-vacuum stage of the pump chamber into several compartments. The volume of each compartment changes periodically with the rotation of the rotor.
As a result, gas is sucked in at the intake port (1/18). The gas passes through the dust trap filter (1/17), flows past the open anti-suckback valve (1/16) and then enters the pump chamber. In the pump chamber, the gas is passed on and compressed.The oil injected into the pump chamber is used for sealing and lubricating.

The compressed gas passes through intermediate plate (1/7), in the chamber of the low-vacuum stage, consisting of a rotor (1/6) and a low-vacuum ring (1/13). The operating principle of the two stages is identical.

From the chamber of the low-vacuum stage, the compressed gas enters the pump oil reservoir, when certain pressure through the exhaust valve (1/23) has been obtained. The oil entrained in the gas is coarsely trapped in the internal demister (1/22); there the oil is also freed of mechanical impurities. The gas leaves the pump through the exhaust port (1/4).

During compression, a controlled amount of air – the so called gas ballast – can be allowed to enter the pump chamber by opening the gas ballast valve (1/21). The gas ballast stops condensation of vapours in the pump chamber up to the limit of the water vapour tolerance. The gas ballast valve is opened and closed by turning the gas ballast knob (1/19).

The oil is separated from the gas in the pump in two steps (phases). First, small droplets are coalesced into large drops. Then, the large drops fall into the oil reservoir as the exhaust gas is diverted by the inner walls of the oil case. Thus a low loss of oil is obtained. This and the large usable oil reservoir ensure long intervals between oil changes even at high intake pressures.

The vacuum in the operating media is maintained by an anti-suckback valve (1/16) which is controlled via the centrifugal switch (1/3). During operation of the pump the control piston and the valve disc of the anti-suckback valve are held at the lower position by their own weight (valve open).

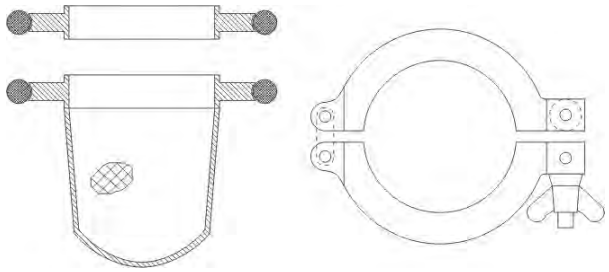
When the pump stops (because it has been switched off or because of a failure), the air pressure pushes the control piston up. Thus a connection is provided between the pump chamber, the oil reservoir and the piston of the anti-suckback valve.

Air follows in, which vents the pump chamber and forces the valve disc (1/16) against its seat. This effectively prevents backstreaming of oil or oil vapours. The anti-suckback valve (1/16) operates independently of the operating mode of the pump, i.e. also with gas ballast.

1.2 Supplied Equipment

Standard equipment supplied includes:

Pump with motor, including initial filling of N 62 , HE-200 or Shell Corena V oil,
A set of connecting elements DN 25 KF or DN 40 KF, depending on the concrete pump,
1 centering “O”ring,
1 centering “O”ring with dirt trap,
2 clamping rings.



For protection during shipment, the connection ports are each wrapped separately and placed in the pump package.

Switches, motor protection switch, mains cable etc. are not included.

1.3 Transportation

Caution!

- Pumps which are filled with operating oil must only be moved while standing in normal /operating/ position. Otherwise oil may escape. Avoid any other orientations during transport. Acceptable tilt degree - 15°.

• Check the pump for the presence of any oil leaks, since there exists the danger that someone may slip on spilt oil.

• When lifting the pump you must make use of the crane eyes provided on the pump for this purpose; also use the recommended type of lifting device.

1.4 Technical Data

Description	Measure	Model		
		RTVP 16A RTVP 16AC	**RTVP 30 A RTVP 30 AC**	**RTVP 60 A RTVP 60 AC**
Free Air Pumping *	m^3/h	20	38	76
Pumping Speed **	m^3/h	16	30	60
Ultimate remaining pressure ***				
- Gas-ballast – closed	mbar	$2{,}5x10^{-4}$	$2{,}5x10^{-4}$	$2{,}5x10^{-4}$
- Gas-ballast – open	mbar	$6{,}5\ x10^{-3}$	$6{,}5\ x10^{-3}$	$6{,}5\ x10^{-3}$
Ultimate working pressure ****				
- Gas-ballast – closed	mbar	$\leq 4x10^{-4}$	$\leq 4x10^{-4}$	$\leq 4x10^{-4}$
- Gas-ballast - open	mbar	$\leq 6{,}5\ x10^{-3}$	$\leq 6{,}5\ x10^{-3}$	$\leq 6{,}5\ x10^{-3}$
Incoming voltage (50Hz)		220V 1-PH 220V/380V 3-PH	220V/380V 3-PH	220V/380V 3-PH
Electric motor power	kW	0.55	1.1	2.2
Nominal speed, rpm	min^{-1}	1500	1500	1500
Noise level	DB(A)	58	60	66
Quantity of oil	l	1,3	3,4	4,1
Recommended oil		N62	N62	N62
Tolerance of ambient temperature	°C	12~40	12~40	12~40
Input / Output type		NW 25/ NW 25	NW 40/ NW 40	NW 40/ NW 40
Dimensions	mm	550(L) x 172(W) x 290(H)	615(L) x 242(W) x 365(H)	730(L) x 242(W) x 365(H)
Weight	kg	30	73	90

* Theoretical pumping speed.

** Pumping speed in working media, measured at specific laboratory conditions – gas, pressure, temperature, etc. This speed is variable, depending on the real operation process.

*** Lowest values of pressure (with/without gas ballast), which can be obtained at specific laboratory conditions.

**** Operational pressure values (with/without gas ballast), obtainable in real conditions, in accordance with the pump operation instructions.

All measurements of vacuum pumps parameters are done in compliance with the factory instructions.

Fig.3 – Pumping speed characteristics of ***RTVP*** *vacuum pumps*

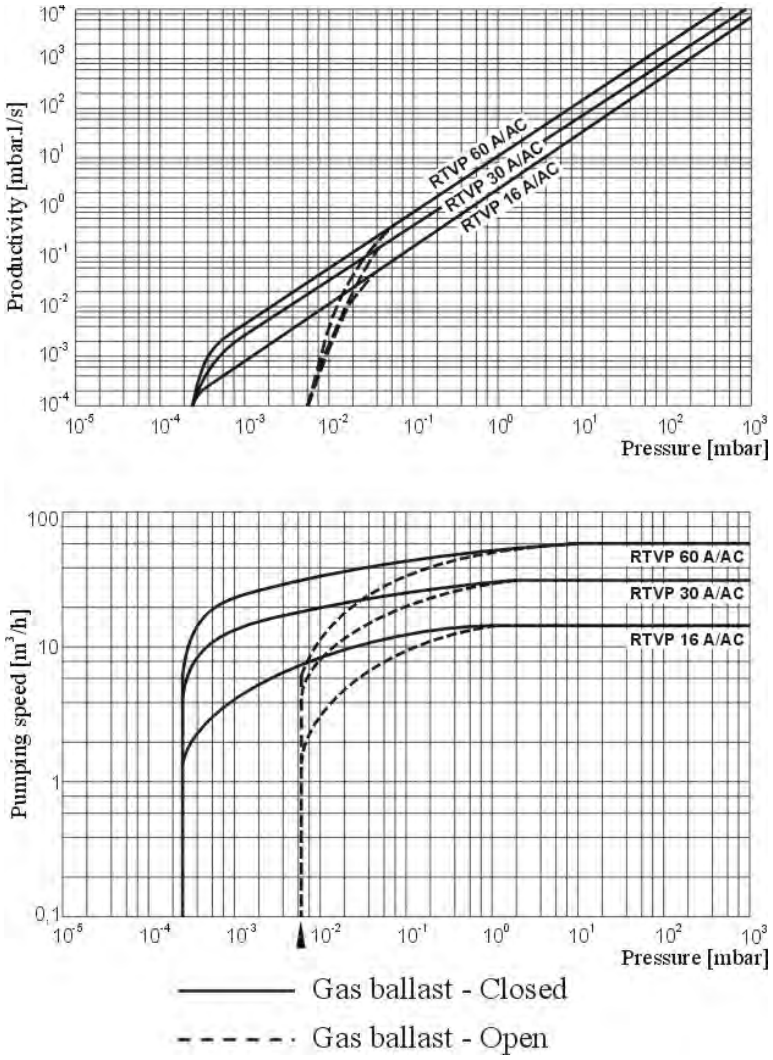


*Fig. 4 – Dimensions of **RTVP 16 A / RTVP16 AC***

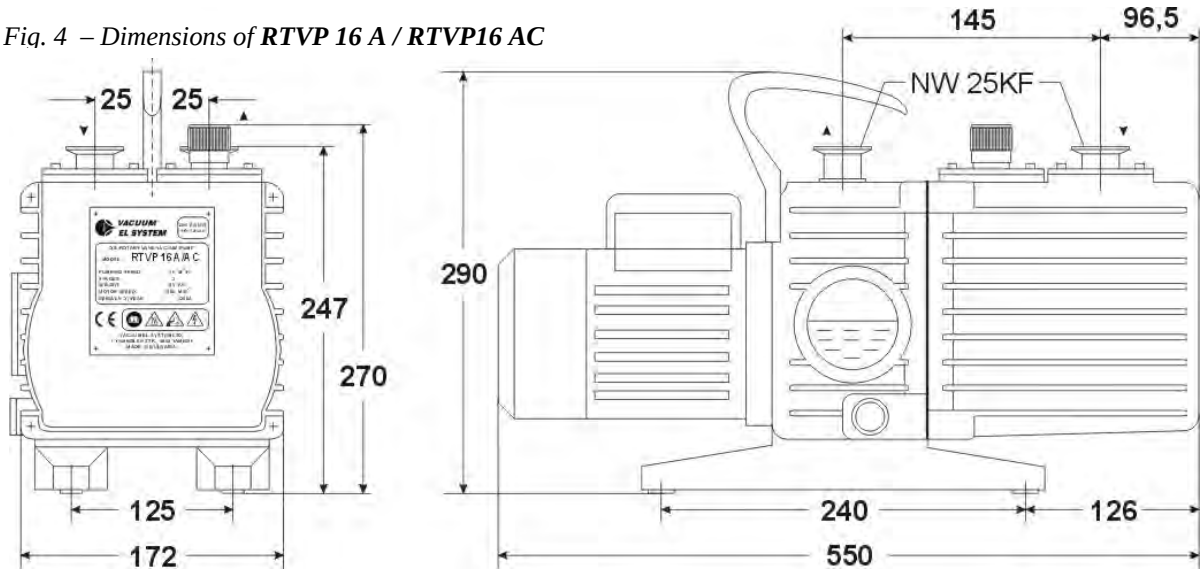


*Fig. 5 –Dimensions of **RTVP 30 A/ RTVP 30 AC***

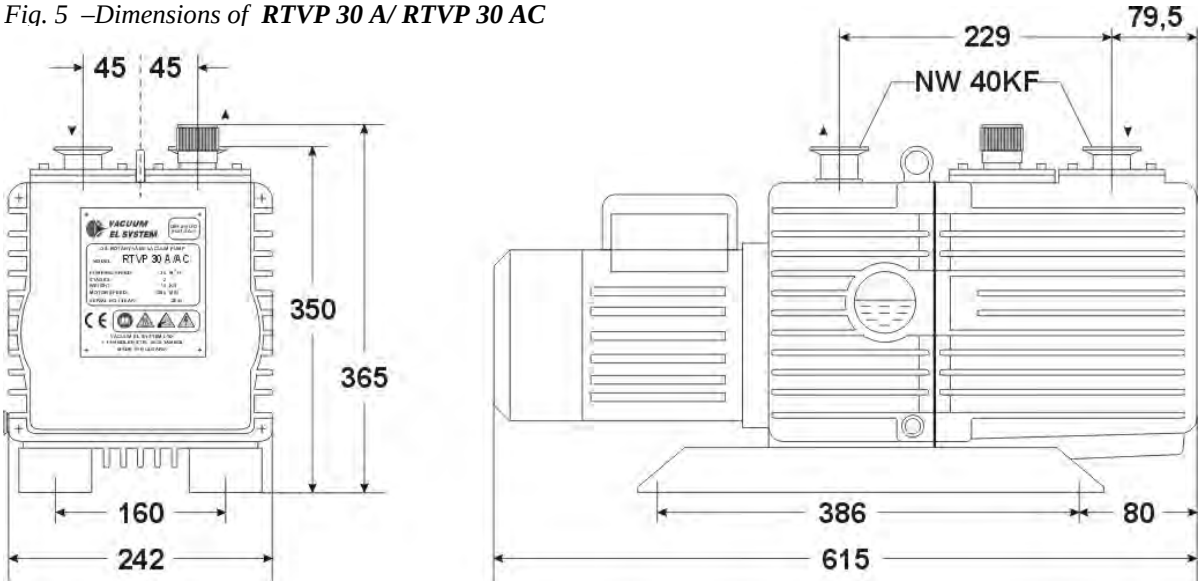
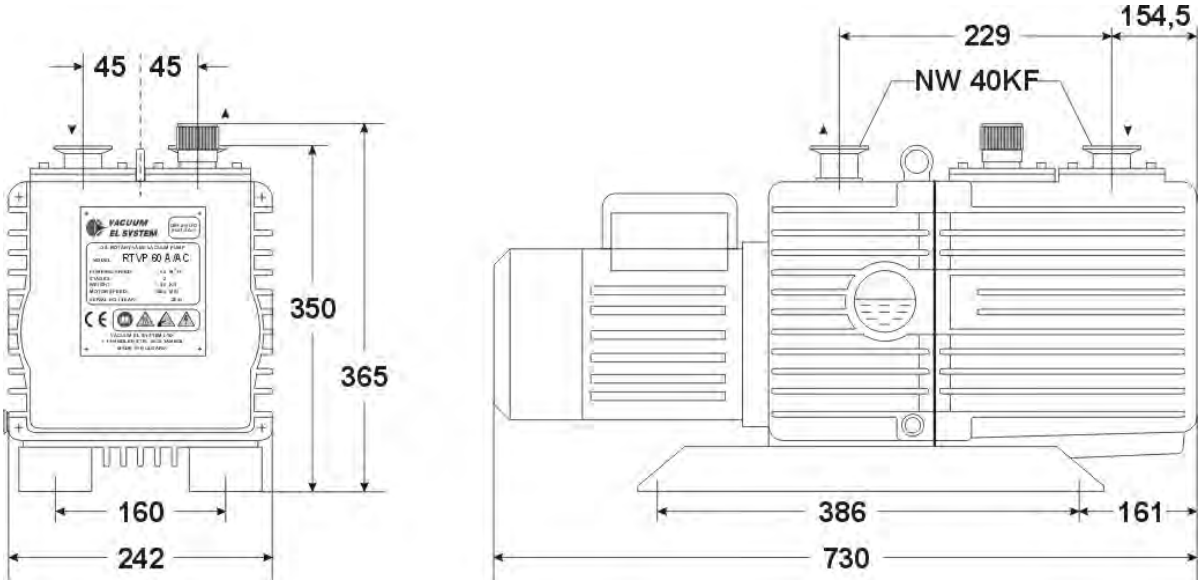


*Fig. 6 – Dimensions of **RTVP 60 A / RTVP 60 AC***



2. Vacuum Safety

2.1 Vacuum Pumps / Vacuum System Hazards

Consider all possible chemical reactions within your system. Make allowance for abnormal chemical reactions, including those, which could occur under fault conditions.

Refer to material data sheets when you assess the potential hazards, associated with your process materials.

Use dilution techniques to minimize reactions with oxidants and flammable materials.

Use manufacturers recommendations for type of lubricant in your pump when you pump oxidants and pyrophoric materials.

When you perform safety calculations, ensure that the safe working pressure for all components in the system are taken into account.

Ensure that you incorporate the correct type of pressure relief devices and that they are suitably rated for your application.

If you pump hazardous materials, you must design the system to fail to a safe condition.

Leak test systems and equipment before use.

No part of the body should be exposed to vacuum. The exposure of small areas of the body surface to the suction of a pumping system can result in tissue damage.

Exhaust hazard – Any dangerous gas substances that may be present in the system being evacuated may pass through the system into the pump and be emitted at the exhaust. Suitable precautions must be taken.

2.2 Hazardous Overpressure

Hazardous pressures may be produced if the exhaust from an automatic pump is restricted or blocked, and care should be taken at all time to prevent this.

Exhaust line manifold systems should be designed to cope with the maximum exhaust load that can occur.

Hazardous pressures may be produced in the system to be evacuated if the rotary pump is operated in the reverse sense. When a rotary pump motor requires a three-phase electrical supply, the outfit should be checked for correct rotation after main connection, before being connected to the system to be evacuated.

2.3 Pump Oil Hazards

Cleaning hazard – Suitable precautions should be taken to protect personnel, engaged in cleaning vacuum pumps from the solvents being used and from the process debris in the pump. The exact precautions to be taken will be dependent on the cleaning solvent involved and the applied process, but particular attention should be paid to the danger of inhaling solvent vapours.

Oil mist hazard – Rotary pumps are oil-sealed and discharge small quantities of oil mist when operating. In poorly ventilated areas this can lead to unacceptable concentrations of oil-vapour. Oil vapour should be kept to a minimum. It is recommended that a suitable oil mist filter is fitted to the pump or, alternatively, the exhaust should be piped away externally.

Oils, based on mineral products are only slightly to moderately irritating to the skin and eyes. Prolonged exposure of the skin to mineral oils may give rise to dermatitis.

Care should, however, be taken to avoid inhalation of vapours or mists, arising from undue heating or excessive mist generation. In the case of fluorinated compounds (e.g. Fomblin), avoid contact with excessive heat (280^{o} C), e.g. lighted cigarettes, heater elements, etc.

Oil fluid spillage should be absorbed with sand, earth or mineral absorbent and disposed of in the proper manner. In the event of large spillage, steps should be taken to prevent possible pollutions.

The operating temperature of the vacuum oils should be in the order of safe operating conditions in a vacuum environment.

A hazardous condition may occur if the oil is permitted to overheat excessively (self-ignition, chemical decomposition and emission of dangerous components, etc.).

3. Operation

3.1 Unpacking of The Pump

Once the pump has been taken out of the cardboard box, in order to operate you must:

- Dismantle the metal frame, by unscrewing 6 pieces of M8 nuts, key No 13.
- Dismantle the pump from the wooden panel, by unscrewing 4 pieces of M8 nuts, key No 13.

When **lifting and/or moving** the pump you must make use of the crane eyes provided on the pump for this purpose; also use the recommended type of lifting device.

3.2 Installation

- The standard pump is not suited for installation in explosion hazard areas. When planning such an application please contact us first.

The pump must be set up on a flat, horizontal surface. The ambient temperature should not exceed +40 °C and not drop below +12 °C. The site chosen should allow adequate air circulation to cool the pump.

Caution!

- If you wish to firmly install the pump in place, insert bolts or similar connecting elements through the bore holes in the feet. Use rubber feets to act as vibration absorbers. RTVP 16A and RTVP 16 AC are equipped with rubber feet.
- When installing RTVP pump, make sure that the connections and controls are readily accessible.
- Max. tilt allowed, for the pump with possibly fitted standard accessories is 5° from the vertical. The site chosen should allow adequate air circulation to cool the pump.
- If the pump is installed on a tilt surface, the indicated oil level will be altered, and this has to be taken into consideration.

3.3 Connection to the System

Before connecting the pump, remove the shipping seals from the exhaust (1/4) and the intake (1/18) flanges.

Caution!

- Retain the shipping seals in case you need to store the pump in the future.

Connect the intake and exhaust pipes, using centering ring, “O” ring and a clamp for each ring. Placing of a filter at the intake pipe is recommendable.

Caution!

- The intake line must be clean. Deposits in the intake line may outgas and adversely affect the vacuum. The connecting flanges must be clean and undamaged.
- The cross-section of the intake and exhaust lines should be at least the same size as the connection ports of the pump. If the intake line is too narrow, it reduces the pumping speed. If the exhaust line is too narrow, overpressures may occur in the pump; this might damage the shaft seals and cause oil leaks.

The maximum pressure in the oil case must not exceed 1.5 bar. When pumping oil vapours, it is advisable to install filters /condensate traps/ on the exhaust side. Install the exhaust line with a downward slope (lower than the pump) so as to prevent condensate from flowing back into the pump. If this is not possible, insert a condensate trap.

In order to reduce the emission of oil vapours we recommend the installation of an additional exhaust filter.

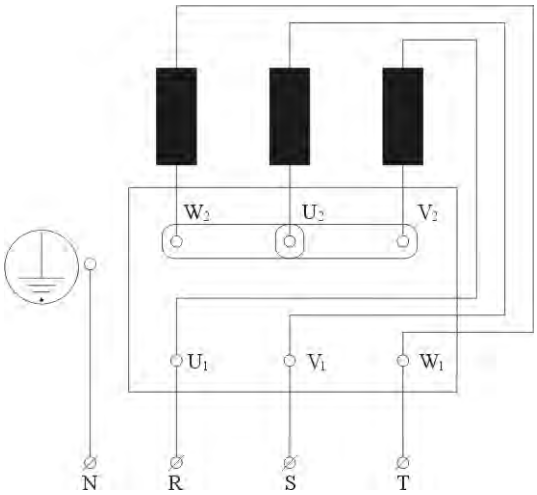
- Never operate the pump with a sealed exhaust line. There is the danger of injury.
- Before starting any work on the pump, the personnel must be informed about possible dangers first. All safety regulations must be observed.

3.4 Electrical Connection

- Before beginning with any work on the wiring, ensure that mains supply for the pump is off.
- Electrical connections must be done by a qualified electrician in accordance with the acting guidelines.

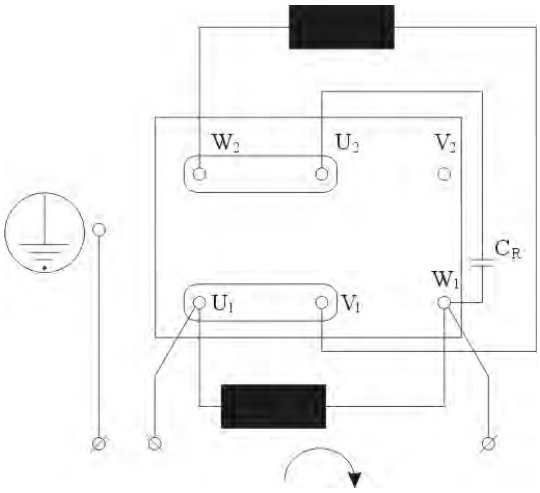
RTVP pumps are supplied without accessories for electrical connection. They must be connected via the appropriate cable, and a suitable motor protection switch. Set the switch in accordance with the rating on the motor nameplate.

Fig. 7 Connection diagram for a 3-phase motor.



- The pump is connected through a 4-wire cable, three wires are for the phase leads (R, S, and T) and the fourth is the Neutral lead, connected to the bolt, marked with sign

Fig. 8 Connection diagram of a single-phase motor.



- Refers only to RTVP 16 A and RTVP 16 AC pumps with a single-phase motor.
- The pump is connected through a 3-wire cable, two leads are connected to the terminals of the box, and the third – protective lead is connected to the bolt, marked with sign

Caution!

- After connecting the motor and after every time you alter the wiring, check the direction of rotation. To do so, briefly switch on the motor and check whether a suitable cover (e. g. a blank flange) is sucked on at the intake port. If not, interchange the two phase leads of the connection. Observe the direction arrow on the coupling housing!

3.5 Start-up

Caution!

- Each time before starting up check the oil level.

For pumps with 3-phase motors, check the direction of rotation before starting the pump for the first time and after each change in the electrical connection.

On initial start-up, after prolonged idle periods or after an oil change, the specified ultimate pressure cannot be attained until the oil is degassed. This can be done by running the pump for approx. 30 min. with the intake line closed and the gas ballast valve (1/21) open.

- Before starting the pump ensure that the pump and the fitted accessories meet the requirements of your application and that safe operation can be guaranteed.
- Avoid exposure of any part of the body to the vacuum. There is the danger of injury. Never operate the pump with an open intake port. Vacuum connections as well as oil-fill and oil-drain openings **must never be opened** during operation.
- The safety regulations which apply to the application in each case must be observed. This applies to installation, operation and during maintenance (service) as well as waste disposal and transportation.
- The standard pumps are not suited for pumping of hazardous gases or vapours.

3.5.1 Application Areas

- The pump **is not** suitable for pumping of:
  - ignitable and explosive gases or vapours
  - oxidants
  - pyrophorous gases.

Caution!

- The pumps are not suitable for pumping of liquids or very dusty media. Suitable protective devices must be installed.

3.6 Operation

RTVP pumps can pump condensable gases and vapours within the acceptable tolerance, provided that the gas ballast valve (1/21) is open and the pump has attained its operating temperature.

3.6.1. Pumping of Non-Condensable Gases

If the process contains mainly permanent gases, the pump may be operated without gas ballast, provided that the saturation vapour pressure at operating temperature is not exceeded during compression.

If the composition of the gases to be pumped is not known and if condensation in the pump cannot be ruled out, run the pump with the gas ballast valve open.

3.6.2. Pumping of Condensable Gases and Vapours

With the gas ballast valve open and at operating temperature, RTVP pumps can pump pure water vapour up to the water vapour tolerance. If the vapour pressure increases above the permissible level, the water vapour will condense in the oil of the pump.

Caution!

- During pumping, vapours may dissolve in the oil. This changes the oil properties and thus there is a risk of corrosion in the pump. Therefore, don't switch off the pump immediately after completion of the process. Instead, allow the pump to continue operating with the gas ballast valve open and the intake line closed until the oil is free of condensed vapours.

We strongly recommend operating the pump in this mode for about 30 minutes after completion of the process.

In cyclic operation, the RTVP pumps should not be switched off during the intervals between the individual working phases (power consumption is minimal when the pump is operating at ultimate pressure), but should continue to run with gas ballast valve open and intake port closed (if possible via a valve).

Once all vapours have been pumped off from a process (e.g. during drying), the gas ballast valve can be closed to improve the attainable ultimate pressure.

3.6.3 Operating Temperature

Proper operation of the RTVP is ensured in the ambient temperature range between **12 °C to 40 °C.**

- At normal operation, the surface temperature of the oil case may exceed 80 °C, depending on the load.
- **There is the danger of receiving burns.**

3.7 Switching Off / Shutdown

Under normal circumstances, all that you need do is to electrically switch off the pump. No further measures will be required.

Caution!

- When pumping condensable media let the pump continue to operate with the gas ballast valve open and the intake line closed before switching off.
- When pumping aggressive or corrosive media, let the pump continue to operate even during long non-working intervals (e.g. overnight) with the intake line closed and the gas ballast valve open. This avoids corrosion during idle periods.

If the pump is to be shutdown for an extended period after pumping aggressive or corrosive media or if the pump has to be stored, proceed as follows:

- When pumping harmful substances, take adequate safety precautions:

.

Drain the oil.

Add clean oil until the oil-level is at the “min” mark and let the pump operate for some time. Then drain the oil and add clean oil until the oil level is at the “max.” mark (as shown in Fig.9).

Seal the connection ports. Special conservation or anticorrosion oils aren’t necessary.

Caution!

- Please also take note of the information given in Section 4.4 (storage and storage conditions).

3.7.1 Shut-Down

Through Monitoring Components

- When the pump has been switched off due to overheating sensed by the motor coil protector, the pump must only be started **manually** after the pump has cooled down to the ambient temperature and after having removed the cause first.

3.7.2 Failure of the Control System or the Mains Power

- In order to prevent the pump from running up unexpectedly after a mains power failure, the pump must be integrated in the control system in such a way that the pump can only be switched on again manually.

4. Maintenance

- Disconnect the electrical connections before disassembling the pump. Make absolutely sure that the pump cannot be accidentally started.
- If the pump has pumped harmful substances, ascertain the nature of hazard and take adequate safety measures. Observe all safety regulations.

If you send a pump for repair please observe the information provided in Section 6.

- When disposing of used oil, you must observe the applicable environmental regulations!

Due to the design concept, RTVP pumps require very little maintenance when operated under normal conditions. The work required is described in the sections below.

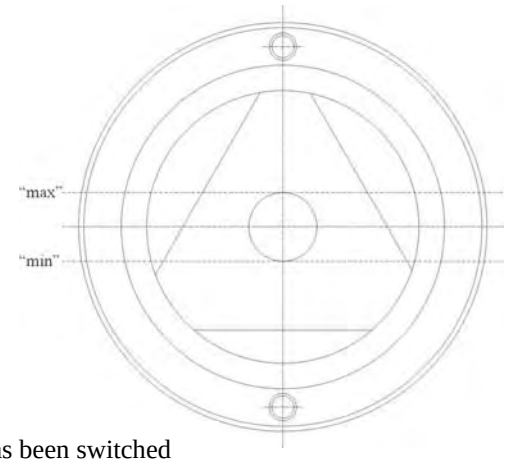
Caution!

- All work must be carried out by suitably trained personnel. Maintenance or repairs carried out incorrectly will affect the life and performance of the pump and may cause problems when filing warranty claims.
- If the pump has been used in ambient air which is much contaminated, make sure that the air circulation and the gas ballast valve are not adversely affected.
- When the RTVP has been pumping corrosive media we recommend that possibly planned maintenance work be carried out immediately in order to prevent corrosion of the pump while it is at standstill.

4.1 Checking the Oil Level

During operation of the RTVP the oil level must always remain between the marks “min” and “max” at the oil-level glass. The amount of oil must be checked and topped up as required.

Fig. 9 An oil-level indicator scheme, RTVP pumps



Caution!

- Fill in oil only after the pump has been switched off.

4.1.1 Checking the Condition of N 62, HE 200 Oil, Shell Corena V

a) Visual check

Normally the oil is clear and transparent. If the oil darkens, it should be changed.

b) Chemical check

The neutralisation number of the oil is determined according to DIN 51558. If it exceeds 2, the oil should be changed.

c) Viscosity check

If the viscosity of N 62 oil at 25 °C exceeds 300 mPas, the oil should be changed.

If gases or liquids dissolved in the oil result in a deterioration of the ultimate pressure, the oil can be degassed by allowing the pump to run for approx. 30 min. with the intake port closed and the gas ballast valve open.

When wanting to check the oil, switch off the pump first and drain out from the warm pump the required amount of oil from the oil drain plug (1/12) into a beaker or similar.

4.2 Oil Change

For proper operation of the pump, it is essential that the pump has an adequate supply of the correct and clean oil at all times.

The oil must be changed when it looks dirty or if it appears chemically or mechanically worn out.

The oil should be changed at every 2,000 operating hours or after one year. At high intake pressures and intake temperatures and/or when pumping condensable gases or vapours, the oil will have to be changed more frequently.

Further oil changes should be made before and after long-term storage of the pump.

If the oil becomes contaminated too quickly, install a dust filter and/or oil filter.

Required tool: Allen key size 8.

Caution!

- Only change the oil after the pump has been switched off and while the pump is still warm.
- If there is the danger that the operating agent may present a hazard because of the media, which have been pumped, you must ensure that all necessary safety precautions are taken.

Remove the oil-drain plug and let the used oil drain into a suitable container. When the flow of oil slows down, screw the oil-drain plug back in, briefly switch on the pump (max. 10 s) and then switch it off again.

Remove the oil-drain plug once more and drain out the remaining oil. Screw the oil-drain plug back in (check the gasket and reinstall a new one if necessary).

Remove the oil-fill plug and fill in with fresh oil. Screw the oil-fill plug back in.

The quantity of oil, needed for your pump model, can be checked at the Technical Specifications (section 1.4)

4.3 Cleaning the Dirt Trap

A wire-mesh sieve is located in the intake port of the pump to act as a dirt trap for coarse particles. It should be kept clean. For this purpose, remove the dirt trap from the intake port and rinse it in a suitable vessel with solvent. If the dirt trap is defective, replace it with a new one.

Caution!

- The cleaning intervals depend on the application. If the pump is exposed to large amounts of abrasive materials, a dust filter should be fitted into the intake line.

4.4 Storing the Pump

Caution!

- The pump should be stored in a dry place preferably within the operating temperature (12 °C - 40 °C). Before the pump is shelved it must be properly disconnected from the vacuum system, purged with dry nitrogen and the oil should be changed too. The inlets and outlets of the pump must be sealed with the shipping seals, which are provided upon delivery.
- The gas ballast switch must be set to the “closed” position.

When a pump is put into operation after it has been shelved for over one year, standard maintenance should be run on the pump and the oil should also be exchanged (see “Operation” and “Maintenance”).

4.5 Maintenance plan

- **Maintenance before switching on the system**

  - Check the oil level, change the oil if required. Oil: N 62 or special and alternative oils. Refill: only after the pump has been switched off.
  - Check the quality of the oil, change the oil if required. **Visually:** normally light and transparent, oil change is required when discolorations increase.

- **Daily maintenance**
  - Operate the pump for at least 30 minutes with gas ballast. Condensed water is thus removed from the oil.
  - Check the oil level, change the oil if required. Oil: N 62 or special and alternative oils. Refill: only after the pump has been switched off.
  - Check the quality of the oil, change the oil if required. **Visually:** normally light and transparent, oil change is required when discolorations increase.

- **6 monthly maintenance**
  - Check the oil level, change the oil if required:

    Chemically: according to DIN-51558;
    Mechanically: when dynamic viscosity at 25 °C exceeds 300 mPas; then an oil change will be required.

  - Clean the dirt trap in the intake port, change it as required. Use suitable cleaning agent and compressed air. Observe the safety regulations when using cleaning agents.

Service Maintenance of the Pump
This kind of maintenance is done only in the service, specified in the Warranty Card!

- **Annual maintenance (at the client's premises)**
  - Check of the teeth edges on the coupling element for any damages;
  - Oil change;
  - Cleaning of the oil level glass;
  - Checking of the fan of the pump and the motor as well as the cooling fins on the motor for deposits
  - Measurement of pump parameters;

- **Maintenance at every two years (in service)**
  - Complete disassembly and cleaning of the pump components;
  - Checking of the individual components;
  - Oil change;
  - Change of all gaskets and seals;
  - Visual check and measurement of the vanes;

Measurement of pump parameters and functional check;

5. Troubleshooting

Fault	Possible cause	Remedy	Section*
Pump does not start	Wiring is malfunctioning. Motor protection switch incorrectly set (3-phase motors only). Operating voltage does not match motor. Motor is malfunctioning. Oil temperature is below 12 °C. Oil is too viscous.	Check and repair wiring. Set motor protection switch properly. Replace the fault element. Replace the motor. Heat the pump and pump oil or use different oil. Change the oil.	- 3.4 service service 3.6.3/4.2 4.2
Pump does not reach ultimate pressure	Measuring technique or gauge is unsuitable. External leak ** Exhaust valve is malfunctioning. Oil is unsuitable. Intake line is dirty. Pump is too small.	Use correct measuring technique and gauge. Repair the pump. Repair the valve. Change the oil (degas it, if necessary). Clean vacuum lines. Check the process data; replace the pump, if necessary.	service service service 4.2 - -
Pumping speed is too low	Dirt trap in the intake port is clogged. Exhaust filter is clogged. Connecting lines are too narrow or too long.	Clean the dirt trap; Exchange the filter element. Use adequately wide and short connecting lines.	4.3 - 3.3
After switching off pump under vacuum, pressure in system rises too fast.	System has a leak. Anti-suckback valve is malfunctioning.	Check the system. Repair the valve.	- service
Pump gets hotter than usually observed.	Cooling air supply is obstructed. Ambient temperature is too high. Process gas is too hot. Oil cycle is obstructed. Exhaust filter or exhaust line is obstructed. Exhaust valve is malfunctioning. Pump module is worn out.	Set pump up correctly. Set the vacuum system correctly. Clean or repair the oil lines and channels. Replace the exhaust filter, clean the exhaust line. Repair the valve. Replace the pump module.	3.2 4.2 service - service service
Oil in the intake line or in vacuum vessel.	Oil comes from the vacuum system. Anti-suckback valve is damaged. Sealing surfaces of anti-suckback valve are damaged or dirty.	Check the vacuum system. Clean or repair the valve. Clean or repair the intake port and the anti-suckback valve.	- service service
Oil is turbid.	Condensation.	Degas the oil or change the oil and clean the pump.	2.5.2/4.2
Pump is excessively noisy.	Oil level is much too low (oil is no longer visible). Intake pressure is too high. Coupling element is worn. Vanes or bearings are damaged.	Add oil. Lower the intake pressure. Install new coupling element. Repair pump.	4.2 - 3.6 service
Oil-level falls too fast	Oil-leak from the vacuum pump. Pump works too long at high intake pressure.	Repair the leak. Install an oil-trap at the exhaust line and/or optimize the vacuum system.	- -

* Repair information: refer to the Section in the Operation Instruction stated here.
** Bubble test: the warm pump with degassed oil is running without gas ballast and the intake blanked off. The exhaust line is led in to a vessel with water. If an evenly spaced line of bubbles appears, then the pump has an external leak.

6. Repair in Authorized Service

When you have purchased a pump, you have also received a Warranty Card, completed and sealed by the Seller. It indicates the corresponding service, which will be serving your pump in case of warranty defects and maintenance, in accordance with the plan in section 4.5.

If a pump is returned to a service for maintenance, indicate whether the pump is free of substances damaging to health or whether it is contaminated. If it is contaminated also indicate the nature of the hazard. For this you must use a form which has been prepared by us. Please make a copy and fill in the form - ***"Declaration of Contamination of Vacuum Pumps".*** This "Declaration of Contamination" is required for the protection of our personnel. Any pump, sent to a service without a "Declaration of Contamination" will be returned to the sender's address, on his account.

- The pump must be packed in such a way, that it will not be damaged during shipping and so that any contaminants are not released from the package.

7. Spare Parts

In order to ensure normal operation of the vacuum pump and to avoid any hazards, relating to its exploitation, the manufacturer recommends repair of the pump and replacement of spare parts in an authorized service only.

The authorized services have all necessary spare parts on stock and are in position to provide fast and competent assistance for the service of the product.

- In case a repair or a service maintenance is needed, please observe the instructions for transportation, maintenance and repair, pointed in sections 1.3, 4.5 and 6.

8. Warranty Conditions

We – "Vacuum El System" Ltd., herewith declare that the hereby product is made of quality materials and guarantee normal pump operation, provided that all instructions in the hereby User's Guide are observed.

Warranty period is 24 months from date of purchase.
Change of mechanical elements, including but not limited with oil, shaft seals, filters and others, made with concern to normal service maintenance, are not subject of this warranty.

This warranty will be void in case of pumps, damaged by improper transportation or non-observance of instructions for operations and storage (e.g. operated at high ambient temperature, polluted media, corrosive or explosive liquids and gases) as well as in cases, when an attempt from third persons or companies has been made to repair the malfunction.

Limitation of liabilities: Liabilities are limited to repair and renovation or replacement of the pump, at the choice of "Vacuum El System".

9. Clients Service

Each time, when you address us, in order to get service, maintenance or advise, please provide information about the model, the pump serial number and the date of purchase. Please, refer to the seller's invoice or the information plate, attached to the pump.

VACUUM EL SYSTEM	**Test Report** **No ……**	DIN EN ISO 9001:2000

1. Product:

Name:

ID No:

2. Technical parameters:

Parameter	Measure	Requirement	Measured
Ultimate operational pressure without gas-ballast	mbar	$\leq 4x10^{-4}$	
Ultimate operational pressure with gas-ballast	mbar	$\leq 6,5 . 10^{-3}$	
Pump operational temperature	^{0}C	≤ 80	
At ambient temperature	^{0}C	12 ~ 40	

Test technician: ….. …….. **Metrologist: ……..**

/St. Stoilov/ **/T. Hristov/**

CE

VACUUM EL SYSTEM

EC Declaration of Conformity

(According to Machinery Directive 98/37 EC, Annex II A)

Manufacturer: Vacuum El System Ltd.
Address: 1, Yambolen Str., 8600 Yambol, Bulgaria

Authorised Representative: Vacuum El Sys Kft.
Address: 2040 Budaörs, Fodros u. 66A, Hungary

We herewith declare that the following products complies with the basic safety and health requirements of the EC Directive by design, type and versions which are brought into circulation by us. In case of alteration of any product, not agreed upon by us, this declaration will be void.

Description of the products: Rotary vane pump
Single and two-stage

Types: RTVP- RTVP 16A; RTVP 30A; RTVP 60A

RSVP- RSVP 15; RSVP 30; RSVP 60; RSVP 90

RV – RV15, RV 30; RV 60; RV 90

Applicable EU Directives: Machine Directive (98/37/EC)
Low Voltage Directive (73/23 EEC)

Applied harmonised standards:
EN 292-1:1991
EN 292-2:1991
EN 1012-2 :1996
Pr.EN ISO 2151:2004
EN 60 204:1993

Yambol, January 2, 2006

.....

Koicho Ivanov, Director
Vacuum El System Ltd.

Budaörs, January 2, 2006

.....

Gabor Kirov, Director
Vacuum El Sys Kft.

Declaration of Contamination of Vacuum Pumps

The repair and/or service of vacuum pumps will only be carried out if a correctly completed declaration has been submitted. The manufacturer or the authorized service has the right to refuse to accept any pump without a declaration. This declaration can only be completed and signed by authorized personnel.

Vacuum pumps, which have been contaminated by biologically active or explosive substances, will not be accepted without written evidence of decontamination.

1. Description of the vacuum pump:

- model / type:
- serial No:
- invoice No:

2. Reason for return of the vacuum pump:

_____
_____
_____

3. Condition of the vacuum pump:

- has the pump been used? yes no
- what type of pump oil/liquid has been used? _____
- is the pump free from potentially harmful substances?
  yes (go to Section 5)
  no (go to Section 4)

4. Process related contamination of vacuum pump:

- toxic	yes	no
- corrosive	yes	no
- explosive	yes	no
- biological hazard	yes	no
- radioactive	yes	no
- other harmful substances	yes	no

Please, list all substances, gases and by-products, which may have come into contact with the pump.

Trade name, Product name, Manufacturer	Chemical name (or symbol)	Dangerous material class	Measures if spillage	First aid in case of human contact
1.				
2.				
3.				
4.				

5. Declaration

Undersigned _____ hereby declare that the information supplied on this form is complete and accurate. The dispatch of the contaminated vacuum pump will be in accordance with the appropriate regulations covering packaging, transportation and labeling of dangerous substances.

Name of organization or company: _____
Address: _____; Post code: _____
Tel.: _____; Fax: _____
Name: _____
Job title: _____

Date: _____ Legally binding signature: _____
(company stamp)

10. Spare Parts List

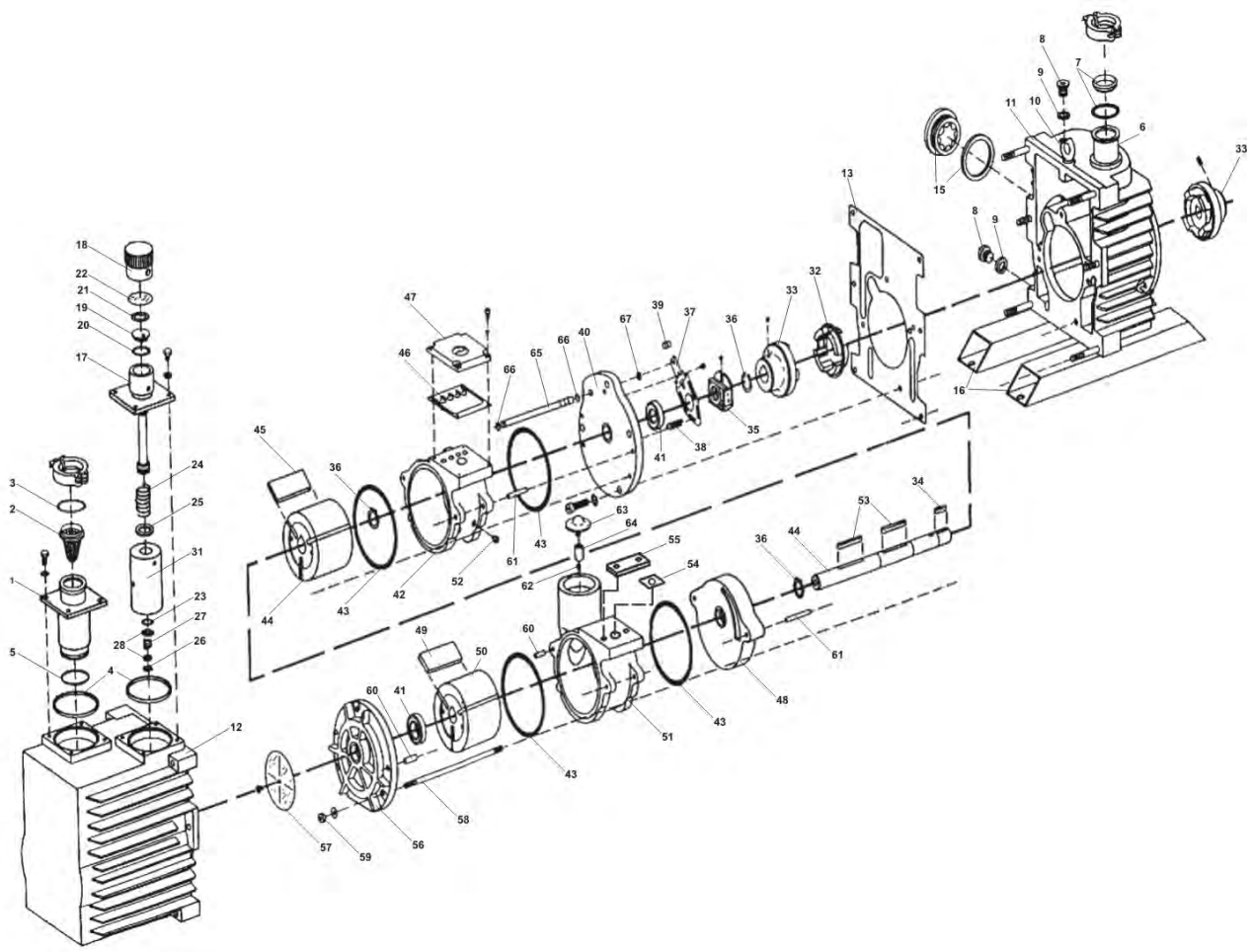


Fig.2. Detailed scheme of RTVP vacuum pump

Cat. No. VES	Pos.	Pump Model			Description	Cat.№ Leybold	Dimension	Material	Notes
		16 A	30 A	60 A					
800778	1		1	1	INTAKE TUBE	431 65 116	KF 40 x 107	Al - aly	
800779	1	1			INTAKE TUBE	433 60 119	KF 25 x 70	Al - aly	
800685	2		1	1	FILTER	411 70 121	KF 40	Steel	
800684	2	1			FILTER (Dirt trap-mesch)	411 70 206	KF 25	Steel	
802367	3	2			O-RING"	239 70 506	D 28 x 5	Viton	
802369	3		2	2	O-RING"	239 70 516	D 42 x 5	Viton	
801127	4	2			FLAT GASKET"	238 20 156	D 55 x 63	AFM	
801134	4		2	2	FLAT GASKET"	238 20 158	D 75 x 84	AFM	
801241	5	1			O-RING"	239 70 117	D 29 x 3	Viton	
801250	5		1	1	O-RING"	239 70 304	D 45 x 3	Viton	
800766	6		1	1	EXHAUST PORT	433 60 115	KF 40 x 63	Al - aly	
800767	6	1			EXHAUST PORT	433 60 117	KF 25 x 42	Al - aly	
802013	7	1			CENTERING RING	231 94 206	KF 25	Al	
802017	7		1	1	CENTERING RING	231 94 207	KF 40	Al	
802367	7a	1			O-RING"	239 70 506	D 28 x 5	Viton	
802369	7a		1	1	O-RING"	239 70 516	D 42 x 5	Viton	
801477	8	2	2	2	PLUG SCREW"	201 27 105	D 16 x 1,5	Steel	
801133	9	2	2	2	PLUG GASKET"	239 55 165	D 22 x 15,1 x 2	Viton	
801448	10		1	1	EYE BOLT	201 13 101	M 8	Steel	
800103	11		1	1	COUPLING HOUSING	331 55 139	164x242x272.5	Cast iron	
800102	11	1			COUPLING HOUSING	333 58 116	265x172,5x216,5	C Al - aly	
800113	12			1	OIL CASING	330 72 124	321.5x242x279.5	C Al - aly	
800112	12		1		OIL CASING	333 72 123	246.5x242x279.5	C Al - aly	
800111	12	1			OIL CASING	333 72 128	200,5x172,5x192,5	C Al - aly	
801135	13	1			SEAL"	238 11 126	172 x 190 x 1	Thermolit	
801136	13		1	1	SEAL"	238 11 142	242 x 270 x 1	Thermolit	
800133	14	1			HANDLE	283 02 107	106 x 120 x 32	C Al - aly	
800565	15	1	1	1	OIL LEVEL GLASS	520 40 125			
801137	15 a	1	1	1	SEAL"	520 40 125 .2	D 68 x 60 x 2	Viton	
801299	15 b	2	2	2	SEAL"	520 40 125 .3	D 43 x 50 x 2	Viton	
801303	16	4			RUBBER FOOT	279 80 308	D 20 x 16	NBR	
800602	16		2	2	BASE	461 75 107	60 x 40	Steel	
800558	17	1			GAS BALLAST VALVE STEM	351 67 206		Al-aly, St	*Not suply separately

Cat. No. VES	Pos.	Pump Model			Description	Cat.№ Leybold	Dimension	Material	Notes
		16 A	30 A	60 A					
800555	17		1	1	GAS BALLAST VALVE STEM	351 67 207		Al-aly, St	
801109	18	1	1	1	CAP	349 75 105	D 50 x 40	NBR	
801132	19	1	1	1	VALVE gas ballast(Assy)	350 20 158	D 31,7 x 6	Termoplast	
801237	20	1	1	1	O-RING"	239 70 436	D 27 x 2,5	Viton	
800711	21	1	1	1	RETAINING WASHER	221 49 207	D 19,5 x 33 x 0,9	Steel	
800701	22	1	1	1	STIFFENING DISK	222 04 107	D 40 x 0,5	Brass	
801225	23		1	1	O-RING"	239 70 147	D 16 x 2,5	Viton	
801255	23	1			O-RING"	239 70 148	D 5 x 2	Viton	
801402	24		1	1	SPRING (FILTER)	221 62 142	D 25,2 x 38	Steel	
801400	24	1			SPRING (FILTER)	221 62 143	D 20 x 35	Steel	
801139	25		1	1	FLAT CASKET (gas ballast)"	239 25 225	D 30 x 18 x 1	Viton	
801138	25	1			FLAT CASKET"	239 25 226	D 30 x 16 x 1	Viton	
801425	26		1	1	RETAINING RING	231 04 104	15 x 1	Steel	
801401	27		1	1	SPRING (GAS BALLAST)^	221 62 140	D 15 x 11,5	Steel	
801130	28		1	1	VALVE PLATE (gas ballast)"	401 64 117	D 14,8 x 0,2	Steel	
800702	29	1			COVER	341 01 109	D 46 x 1,5	Al	не са в/у фиг.1
801433	30	1			RETAINING RING	231 03 106	17 x 1	Steel	не са в/у фиг.1
801142	31	1			OIL FILTER	390 26 117	D 42 x 55	Stainless steel	
800662	31		1	1	OIL SEPARATOR	411 12 108	D 60 x 90	Stainless steel	
801302	32		1	1	COUPLING ELEMENT"	570 42 113-3	D 75 x 20	Buna	
801300	32	1			COUPLING ELEMENT"	570 42 129.4	D 50 x 15	Buna	
802517	33			1	COUPLING COMPLETE	570 42 112	D 82 x 83	Cast iron/Buna	
802516	33		1		COUPLING COMPLETE	570 42 113	D 82 x 83	Cast iron/Buna	
802515	33	1			COUPLING COMPLETE(pos 32& pos.33)	570 42 129	D 58 x 61	Cast iron/Buna	
800200	33a	1			COUPLING ELEMENT (pump side)			Cast iron	
800201	33a		1	1	COUPLING ELEMENT (pump side)			Cast iron	
800204	33b	1			COUPLING ELEMENT (motor side)			Cast iron	
800203	33b		1		COUPLING ELEMENT (motor side)			Cast iron	
800202	33b			1	COUPLING ELEMENT (motor side)			Cast iron	
800740	34	1			KEY (COUPLING)	221 16 151	5 x 5 x 18	Steel	
800742	34		1	1	KEY (COUPLING)	221 16 179	6 x 6 x 22	Steel	
801126	35	1			CENTRIFUGAL SWITCH	500 36 128	D 70 x 27	Brs,Steel	
801125	35		1	1	CENTRIFUGAL SWITCH	500 36 147	D 60 x 26	Brs,Steel	

Cat. No. VES	Pos.	Pump Model			Description	Cat.№ Leybold	Dimension	Material	Notes
		16 A	30 A	60 A					
801421	36	1			RETAINING RING	231 03 104	D 15 x 1	Steel	
801426	36		3	3	RETAINING RING^	231 03 111	D 22 x 1,2	Steel	
800588	37		1	1	LEVER	281 53 101	109 x 40 x 1	St St	
800589	37	1			LEVER	281 53 102	88 x 40 x 1	StSt	
801399	38	1	1	1	SPRING (LEVER)	221 62 141	D 8,5 x 23	Steel	
801140	39	1	1	1	SEAL (LEVER)"	239 73 131	D 9 x 11	Viton	
800165	40	1			FRONT END PLATE	301 51 137	D 15 x 23	Cast iron, Brz	
800168	40		1	1	FRONT END PLATE	301 51 140	D 22 x 27	Cast iron, Brz	
801291	41		2	2	RADIAL SHAFT SEAL"	239 53 110	D 22 x 40 x 7	Viton	
801288	41	2			RADIAL SHAFT SEAL"	239 53 142	D 15 x 32 x 7	Viton	
800191	42		1	1	SECOND STAGE PUMP CYLINDER	231 58 122	D 118,5 x 75	Cast iron	
800190	42	1			SECOND STAGE PUMP CYLINDER	231 58 124	D 79 x 45	Cast iron	
801258	43	4			O-RING"	239 70 156	D 86 x 2	Viton	
801222	43		4	4	O-RING"	239 70 411	D 122 x 3	Viton	
802510	44	1			ROTOR(2ND STAGE) WITH SHAFT	481 21 239	D68x228	CI,St	
802511	44		1		ROTOR WITH SHAFT	481 21 240	D101x290	CI,St	
802512	44			1	ROTOR WITH SHAFT	481 21 241	101x365	CI,St	
800508	44a	1			SHAFT (2nd stage)	401 27 292.2	D 15 x 228	Steel	
800509	44a		1		SHAFT(2nd stage)	401 57 294.2	D 22 x 290	Steel	
800510	44a			1	SHAFT (2nd stage)	401 57 296.2	D 22 x 365	Steel	
800627	44b		1	1	ROTOR (2nd stage)W/Oshaft	321 66 119	D 101 x 75	Cast iron	
800640	44b	1			ROTOR (2nd stage) W/Oshaft	321 66 121	D 68 x 45	Cast iron	
801147	45		3	3	VANE^	411 55 116	32,5 x 75 x 4,5	Incutex	
801148	45	3			VANE	411 55 155	22 x 45 x 4,5	X-Ion	
801119	46		1	1	VALVE PLATE (normal)^	401 64 114	75 x 82 x 0,2	Stainless steel	
801117	46	1			VALVE PLATE (normal)"	401 64 116	63 x 45 x 0,1	Stainless steel	
801120	46		1	1	VALVE PLATE (corrosive)"	401 64 124	75 x 82 x 0,2	Gold plated	Only for models AC
801121	46	1			VALVE PLATE (corrosive)"	401 64 125	63 x 45 x 0,1	Gold plated	Only for models AC
801116	47		1	1	VALVE STOP	373 58 106	80 x 74,5 x 12	Al - aly	
801115	47	1			VALVE STOP	373 58 107	63 x 45 x 9	Black plastic	
800149	48	1			INTERMEDIATE PLATE(Center bearing)	261 51 131	D 15 x 15	Cast iron, Brz	
800150	48		1	1	INTERMEDIATE PLATE	261 51 135	D 30 x 22	Cast iron, Brz	
801146	49			3	VANE^	411 55 115	32,5 x 150 x 4,5	Incutex	

Cat. No. VES	Pos.	Pump Model			Description	Cat.№ Leybold	Dimension	Material	Notes
		16 A	30 A	60 A					
801147	49		3		VANE^	411 55 116	32,5 x 75 x 4,5	Incutex	
801145	49	3			VANE^	411 55 154	22 x 90 x 4,5	X-Ion	
800627	50		1		ROTOR, HV STAGE	321 66 119	D 101 x 75	Cast iron	
800628	50			1	ROTOR, HV STAGE(1 stage)	321 66 120	D 101 x 150	Cast iron	
800635	50	1			ROTOR, HV STAGE	321 66 122	D 68 x 90	Cast iron	
800179	51			1	PUMP CYLINDER, HV STAGE	231 65 107	D 118,5 x 150	Cast iron	
800180	51		1		PUMP CYLINDER, HV STAGE	231 65 118	D 118,5 x 75	Cast iron	
800181	51	1			PUMP CYLINDER, HV(1st) STAGE	231 65 122	D 79 x 90	Cast iron	
801106	52	1			OIL NOZZLE	392 25 113	0.8	Brass	
801107	52		2	2	OIL NOZZLE	392 25 124	1.5	Brass	
800744	53	1			KEY ROTOR	221 16 156	5 x 5 x 28	Steel	
800743	53		2	2	KEY ROTOR	221 16 188	6 x 6 x 50	Steel	
801111	54	1			VALVE PLATE "	400 50 135	16 x 16 x 5	Steel/Viton	
801113	54			2	VALVE PLATE"	400 50 138	25 x 25 x 5	Steel/Viton	
800590	55	1			RETAINING BRACKET	491 60 107	40 x 10 x 8	Steel	не са в/у фиг.1
800591	55			2	RETAINING BRACKET	491 60 111	52 x 4 x 4	Steel	не са в/у фиг.1
800136	56	1			REAR END PLATE	351 55 130	D 15 x 17	Cast iron, Brz	
800139	56		1	1	REAR END PLATE	351 55 132	D 22 x 26	Cast iron, Brz	
800506	57	1	1	1	DISK OIL SLINGER	451 74 335	D 85 x 2,1	Steel	
800727	58		3		THREADED STUD	201 52 106	D 8 x 218	Steel	
800728	58			3	THREADED STUD	201 52 108	D 8 x 293	Steel	
800729	58	4			THREADED STUD	201 52 110	D 6 x 178	Steel	
801371	59	4			HEXAGON NUT	211 01 312	D 6	Steel	
801372	59		3	3	HEXAGON NUT	211 01 314	D 8	Steel	
800747	60	4			CYLINDRICAL PIN	241 03 585	D 8 x 20	Steel	
800746	60		2	2	CYLINDRICAL PIN	241 03 586	D 8 x 24	Steel	
800748	60		2	2	CYLINDRICAL PIN	241 03 590	D 8 x 40	Steel	
800748	61	2			CYLINDRICAL PIN	241 03 590	D 8 x 40	Steel	
800749	61		2	2	CYLINDRICAL PIN	241 03 593	D 8 x 60	Steel	
801104	62		1	1	AIR NOZZLE	392 25 204	0.36	Brass	
801112	63		1	1	VALVE DISK"	400 50 137	D 45	Steel/Viton	
801129	63	1			VALVE DISK"	400 50 139	D 32	Steel/Viton	
800504	64	1			PISTON (ballast)	321 06 104	D 12 x 30	Brass	

Cat. No. VES	Pos.	Pump Model			Description	Cat.№ Leybold	Dimension	Material	Notes
		16 A	30 A	60 A					
800505	64		1	1	PISTON	321 06 131	D 12 x 22	Brass	
800673	65		1	1	AIR INLET TUBE	431 31 174	D 8 x 143	Steel	
800674	65	1			AIR INLET TUBE	431 31 177	D 8 x 92,5	Steel	
801255	66	2	2	2	O-RING"	239 70 148	D 5 x 2	Viton	
801420	67	1	1	1	RETAINER DISK^	231 05 108	D6	Steel	
801170	68	1			Motor -50Hz,220V 1PH, 0.55Kw,1380rpm				
801171	68	1			Motor -50Hz,220/380V 3PH, 0.55kW,1380rpm				
801173	68		1		Motor -50Hz,220/380V 3PH, 1.1kW,1380rpm				
801174	68			1	Motor -50Hz,220/380V 3PH, 2.2kW,1400rpm				
802 500		1			GAS BALLAST VALVE -ASSEMBLY				Includes pos.17 -31
802501			1	1	GAS BALLAST VALVE -ASSEMBLY				Includes pos.17 -31
802614		1			Seal Kit				
802615			1		Seal Kit				
802616				1	Seal Kit				
802600		1			Major Repair Kit				
802601		1			Major Repair Kit (for pump model AC)				
802602			1		Major Repair Kit				
802603			1		Major Repair Kit (for pump model AC)				
802604				1	Major Repair Kit				
802605				1	Major Repair Kit (for pump model AC)				

" All parts marked with " are included in Seal Kits and Major Repair kits

^ All parts marked with ^ are included Major Repair kits

MANUFACTURER:

VACUUM EL SYSTEM LTD.

1, Yambolen Str.

8600 Yambol

Bulgaria

E-mail: info@vacuumsys.com

www.vacuumsys.com

Vacuum El System reserves the right to modify the design and the specified data.