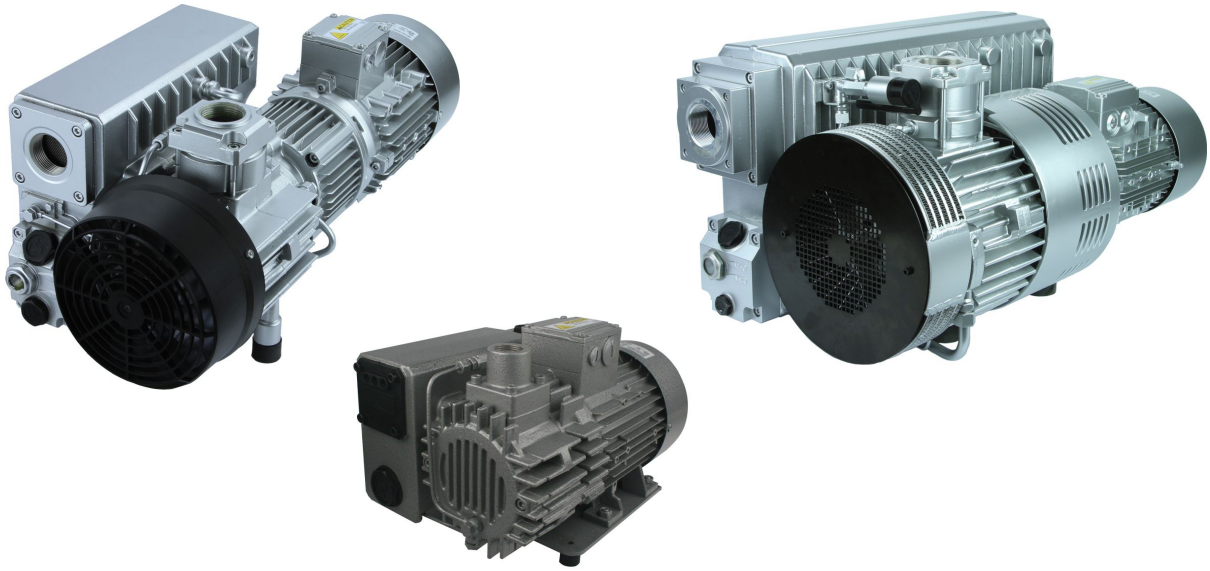
Installation- and Operating Instructions

Rotary Vane Vacuum Pumps

(oil lubricated)



Series SKV-RVP

Model SKV-RVP-O-20-0020
Models SKV-RVP-O-05-0040 up to -0300

High quality – Fair prices

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1 Important basic information

These operating instructions contains informations about

- product description,
- safety,
- transport,
- storage,
- set-up and operation,
- maintenance,
- servicing,
- troubleshooting and
- spare parts

of the rotary vane vacuum pump.

"handling" of the rotary vane vacuum pump in terms of these operating instructions are the transport, storage, set-up, operation, control over operating condition, maintenance, troubleshooting and servicing of the rotary vane vacuum pump.

Prior to handling of the rotary vane vacuum pump the responsible staff for operation and servicing have to completely read and understand the operating instructions. The operating instructions must be strictly adhered to. The operating instructions and all enclosed documents must be kept at the place of installation so it is always available.

If there a dubities please contact the responsible representation of the SKV-tec GmbH!

1.1 Definition

aggregate	**complete rotary vane vacuum pump including pump, power unit and its components**
pump	**rotary vane vacuum pump without power unit and components**
rotary vane	**construction or operating principle of the aggregate**
end pressure	**the maximum vacuum (expressed in absolute pressure) the aggregate is reaching with closed suction port**
permanent vacuum	**The vacuum in which the unit operates continuously. Permanent vacuum ≥ end pressure < atmospheric pressure**

1.2 Safety instructions

The rotary vane vacuum pump have been designed and manufactured in accordance with state-of-the-art technology. Nevertheless by exposure of the rotary vane vacuum pump there will remain some threats. In these operating instructions we will refer at suitable points to threats.
Safety instructions are marked with keywords like **DANGER**, **WARNING, CAUTION** or **ATTENTION**:

DANGER

Risk of personal injuries!

Disregarding this safety instruction **leads** to accidents resulting in death or severe injuries.

WARNING

Risk of personal injuries!

Disregarding this safety instruction **can lead** to accidents resulting in death or severe injuries.

CAUTION

Risk of personal injuries or property damage!

Disregarding this safety instruction **can lead** to accidents with minor injuries or property damage.

ATTENTION

Risk of hearing loss!

Depending on the size, the unit **can** emit sound of high volume.
Depending on the operating state of the unit **can** emit sounds in a narrow frequency band.
For longer stays in the vicinity of a non-sound-insulated aggregate hearing protection should be worn.

2 Safety

The manufacturer is not liable for damages caused by non-observance of these operating instructions.

WARNING

Risk of death or serious injuries due to improper use of the unit!

➔ These operating instructions must be fully read and understand prior to any work on the unit. The operating instructions has to be strictly adhered to. The operating instructions and all enclosed documents must be kept at the place of installation so it is always available!

➔ Operation of the unit is only permitted to the purpose indicated under "Intended Use". It must be operated at the values indicated under "Technical data"!

➔ Handling and all work on and with the unit must be carried out by qualified personnel!

WARNING

Risk of injury due to working on the unit by cutting, crushing!
Danger of burns and scalding by contact with hot surfaces or media!

➔ When handling the unit suitable protective equipment (saftey helmet, shoes and gloves) to wear!

Risk of injury by pulling in and/or unwrapping of hairs/clothes to moving and rotating parts!

No loose hair and / or wide, loose clothes!
➔ Wear suitable personal protective equipment eg hairnet!

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- At the connections suction and discharge nozzles conduits were installed
- These connections may not blocked, polluted or closed
- all conduits are dense and have a sufficient strength

➔ When working on the unit protective equipment must be worn!
➔ All the connections are tested at regular intervals for strength and tightness!

Risk by rotating parts!

Before operating the unit, it must be completely assembled.

Risk of injury by the operation of the unit!

When operating the unit the unit must not be touched nor works are carried out on this!

DANGER

Electrical danger!

Any electrical work must be performed by a qualified electrician!

Before starting work on the unit the following provisions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restart
- Earth and short circuit
- Cover and safeguard neighboring live parts

2.1 Intended use

- All provisions of this manual , including all safety instructions must be observed
- Inspektion and maintenance intervals must be complied with
- The unit may only be operated in perfect technical condition and in fully assembled condition
- The unit is designed for use in low and medium vacuum range. It may only be used for the extraction of approved media. It is used for vacuuming the following approved media:
  - dry air/gases, which are neither explosive, inflammable, aggressive or toxic
  - moist air or air-steam mixtures, but excluding water and other liquids. For suction of wet gases a gas ballast valve is required. **The maximum tolerable water vapor is observed!**
- In continuous operation of the unit a return suction of oil must be provided in the B-cover. While that the operating pressure must be below 300 mbar.
  It must be ensured that waste heat can be delivered freely to the environment. Furthermore, a sufficient supply of fresh air have to be guaranteed, as the unit is air-cooled.
- The unit may only be operated in ambient and suction temperature of **12 to 30°C** (depending on the vacuum oil). (see chapter 9.1, "Operating conditions")

The motor protection switch must be set at least at nominal current.
By not respecting the permissible operating temperatures, the temperature range of the vacuum oil and hence the lubricity of the needle bearings used may be exceeded.

- The unit is intended exclusively for professional use
- The handling of the unit is only permitted by qualified personnel

Prior to handling of the rotary vane vacuum pump the responsible staff for operation and servicing have to completely read and understand the operating instructions.
If in doubt, please contact the responsible representation of the SKV-tec GmbH!

	**CAUTION** **Risk of material damage!** It must be prevented that liquids and solids get into the unit. This can lead to destruction of the unit.

2.2 Potential misuse

- The operating limits of the unit concerning pressure, temperature of the medium, density, viscosity and velocity are observed and complied with
- Unauthorised opening of the unit will void any claims for defects
- If the unit is not approved for the requested use, operation is prohibited in the following scenarios
  - Operation in rooms where explosive gases may be present
  - Extracting, delivering or compressing of explosive, inflammable, aggressive or toxic media
  - Vacuuming oxidants, extremely humid air, traces of oil, oil vapor and grease
- Maintenance and repair work are only permitted to the operator as described in the present operating instructions.

2.3 general safety instructions

The unit is designed and manufactured according to the state-of-the-art of technology and the generally acknowledged rules of safety. Nevertheless by the exposure of the unit it may occur to danger to life of the user or third parties as well as damage to the unit.
Therefore, the following guidelines must be observed:

- The unit may only be operated in a technically flawless condition and in compliance with the regulations, safety precautions and warnings included in this manual.
- Ensure that this manual and related documents are complete and readable. In addition, make sure that the staff has access to these documents at any time.
- Refrain from any operating mode which brings the staff or third parties at risk
- In case of error which impacts on safety, immediately shut down the unit and consult the person responsible for fault diagnosis.

2.4 Residual risks

⚠ WARNING

Risk of injuries from flying parts , which reach into the openings of the engine cooling or the coupling guard!

➔ Don't bring in lose parts!

Danger of burns and scalding by contact with hot surfaces or media!

➔ Do not touch or wear safety gloves!

⚠ WARNING

Risk of hearing damage!

Depending on the size the unit emit noise of high volume.
Depending on the operating state the unit emit noise in a narrow frequency band.
➔ For longer stays nearby a non noise insulated unit ear protection should be worn

3 Design and function

3.1 Nameplates

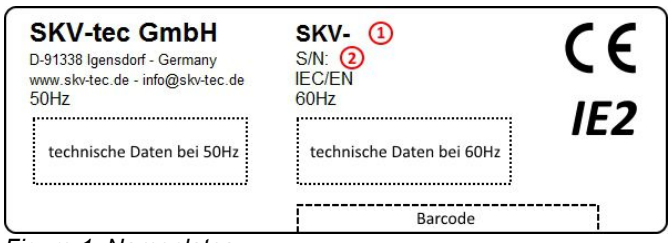


Figure 1: Nameplates

1 Product name
2 Serial number

3.2 Model type (Code)

	SKV	-	RVP	-	O	-	05	-	0040
Company									
Pump type									
Type of lubrication									
End pressure (abs.)									
Model size									

Figure 2: Model-/pump type

- Type of pump: RVP = **R**otary **V**ane Vacuum **P**ump
- Type of lubrication:
  - O = oil lubricated
  - D = dry running (not yet availlable)
- End pressure: achievable abs. end pressure (without gas ballast)
  - -05- = 0,5 mbar (abs.)
  - -20- = 2,0 mbar (abs.)
- Model size: Value specifies the maximum airflow (in m³/h) in pressureless operation

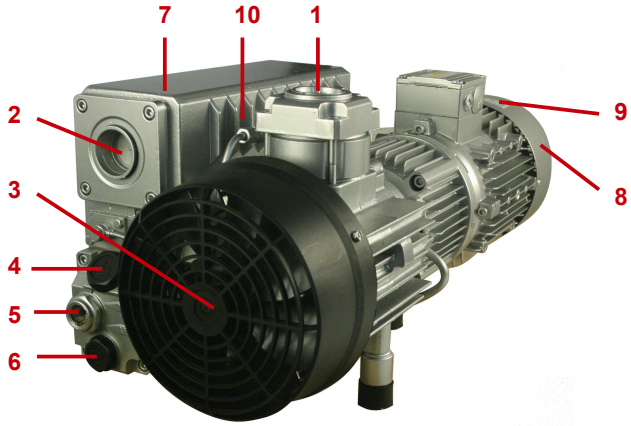


Figure 3: Schema of a rotary vane vacuum pump

Pos	Description
1	Suction side (gas inlet)
2	Pressure side (gas oulet)
3	Axial fan
4	Oil-filling screw
5	Oil-showcase
6	Oil-drainage screw
7	Oil separator
8	External motor fan
9	Nameplate (motor unit)
10	Gas ballast

Table 1: Legend Figure 3

3.3 Description and design of the unit

The rotary vane pumps of the RVP series are 1-stage vacuum pumps for vacuuming of air. The RVP-O series has 3 rotary vanes and an oil bath lubrication with oil return.

For the rotary vane pumps with an airflow up to 20 m³/h the electric motor is modularly screwed with the pump unit. The sealing of the driving shaft is ensured by a mechanical shaft seal.

The rotary vane pumps with an airflow of 40 - 300 m³/h are driven by a standard electric motor which are connected by a flexible coupling sleeve to the pump unit. These models are also equipped with an integrated check valve, which maintains the vacuum for some time even when the pump is at standstill.

The cooling of the unit is ensured by radiation and forced surface cooling by an external airflow. For this purpose a motor-side fan is mounted on the drive shaft of the motor. The models with a flow rate ≥ 40 m³/h are additionally equipped with an axial or radial fan mounted on the pump shaft. These fans are each protected by a fan cowl against contact. Some models also have a tube coil oil cooler. That way the flowing oil is further cooled by the external air stream.

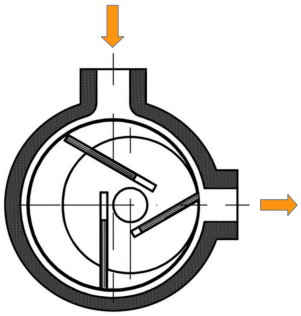
The nonreturn valve integrated on the suction-side ensures that after switching off the pump the evacuated system is not vented. It also prevent the pumping chamber from not sucking full of oil, which would inevitably lead to oil shocks by restarting the aggregate.

An oil recovery tank with built-in oil seperator elements is mounted on the pressure nozzle. These filter elements made of microfibre perform the task of an oil vapor separator and a silencer. This way the separated oil is returned to the oil circuit. Thus the recovered oil is available again for the lubrication, the cooling and the sealing of the rotating as well as the rigid parts.

All models of rotary vane pumps are prepared for the installation of a gas ballast valve, which allows the steam to be supplied with water vapor. The rotary vane pumps with a flow rate ≥ 160 m³/h are equipped with a gas ballast valve by default.

The drive of the pump unit is realized by a coupling flanged three-phase standard motor.

3.4 Design and operating mode of the unit



The rotary vane vacuum pump operates according to the displacement principle (pressure increase by volume reduction). A rotor, equipped with three rotary vanes, rotates eccentrically inside a stator.

The rotary vanes which are guided freely in the rotor are pressed against the stator wall by the centrifugal force and thus form a corresponding number of chambers. Due to the eccentric arrangement the volume of these chambers varies depending on the angle of rotation. During the suction phase a vacuum is generated by the increase in chamber volume. On the other hand in the outlet phase the chamber volume decreases, the air is compressed and discharged into the oil collecting tank via the discharge valve. The oil transported with the air stream is separated in the oil separator via the oil separator elements made of microfibre and thus returns to the oil circuit. The cleaned air leaves the unit at the pressure side (gas outlet) of the oil separator.

Our oil-lubricated rotary vane pumps can only be used to generate a vacuum. The maximum end pressure of the unit depends on whether it is operated with gas ballast.

Characteristics of these rotary vane vacuum pumps:

- robust and compact design
- easy to maintain, long service life
- reliable in operation and economical
- excellent oil separation
- Continuous operation even under difficult conditions

The rotary vane vacuum pump is cooled by

- Heat radiation from the surface of the unit
- the air flow from the external fan of the motor
- the air flow from the pump-side fan

4 Transport, storage and disposal

The unit is checked at the factory and carefully packaged. To protect the unit against contamination during transport, both the suction as well as the pressure connection are closed with appropriate plugs.

4.1 Transport

The weight data of the unit must be observed!

WARNING

Danger from overturning or falling loads!

➔ Before transporting all components must be securely mounted. Loose parts must be secured accordingly or removed!

CAUTION

Overturning or falling loads can lead to bruising, fractures, etc.!
Cuts from sharp edges!

➔ Protective equipment must be worn !

Packaging and inspection:

On delivery, the unit is screwed to a pallet and protected by a foil and a cardboard box. Unpack the unit and check for transport damage. Transport damages immediately report to the responsible representation of the SKV-tec GmbH!

Transport with lifting gear:

WARNING

Danger from overturning or falling loads!

➔ The following basic rules must be observed when transporting with lifting equipment:

- the carrying capacity of the lifting gear must be at least the weight of the aggregate
- check the ring lug before each transport for tight fit
- The unit must be secured against overturning/falling down
- Do not stand under suspended loads

CAUTION

Risk of material damage!

The aggregate may not be raised at the two fan cowls!

The shipment of the unit is basically **without** oil.
➔ The operation of the unit without oil destroys the pump!

If the unit is delivered on a pallet, it can be transported including its package with a hand lift truck / forklift truck.

4.2 Storage

Units prepared by the factory are preserved. This protects the aggregate for a maximum of three months when properly stored indoors. The following must be observed:

- Seal all openings and connections with appropriate sealing plugs or screw caps
- The storage room must be dry, frost-free, vibration-free, protected and have to ensure a constant humidity

For longer storage periods, poor storage conditions (eg aggressive atmosphere, frequent temperature changes, high humidity, etc.) or aggregates which were already in operation and should be stored, the unit must be reconserved (see chapter 4.3, “Preservation”).

CAUTION

Risk of material damage due to improper storage!

The unit must be stored in accordance with the guidelines of this manual!

4.3 Preservation

CAUTION

Risk of material damage due to improper preservation!

The unit must be handled in accordance with the guidelines of these operating instructions inside and outside with an approved preservative!

Risk of corrosion due to condensate!

Closures periodically removed so that accumulated water can escape.

Risk of bearing damage!

Mechanical shocks at standstill and in operation are to be avoided.

- Seal all openings and connections with appropriate sealing plugs or screw caps
- Pack the unit in VCI film

VCI stands for "Volatile Corrosion Inhibitor" (volatile corrosion inhibitor). VCI products (foil, paper, cardboard, foam) evaporate a substance that manifests in molecular thickness on the packaged goods and effectively suppress corrosion on many metal surfaces by their electrochemical properties. However, VCI products can attack plastics and elastomers. Seek advice from your local packaging dealer! SKV-tec GmbH uses CORTEC VCI 126 R film for the overseas packaging of larger aggregates.

- The storage room must be dry, frost-free, vibration-free, protected and have to ensure a constant humidity
- The motor shaft must be moved once a month. It must be ensured that the position of the motor shaft and the needle bearings changes.
- For storage periods longer than 3 months an appropriate preservative oil have to be used instead of the operating oil.
- For storage periods longer than 6 months all components made of elastomers (EPDM) must be replaced for recommissioning. Components such as o-rings and shaft seals must be checked for elasticity and replaced if necessary.

4.4 Disposal

WARNING

Risks of environmental damage!

- Oil and grease must be collected / drained and disposed of separately
- Do not mix solvents, limescale removers and paint residues
- Plastic parts must be removed and disposed of separately
- Residues of any kind in the aggregate must be removed

➔ The local and national regulations / waste laws are complied with!
➔ Assign an authorized company with the disposal of the unit

Danger from flammable, corrosive or toxic substances!

Units which have come into contact with hazardous substances must be decontaminated before disposal!

5 Installation and connection

CAUTION

Risk of material damage due to contamination!

➔ Remove transport locks until immediately prior to installation of the unit
➔ Remove the transport covers of the connections until just before installation of the pipes to the unit

Risk of material damage due to overheating of the unit!

➔ Set up the unit according to the specified minimum distances (see chapter 9.2, “minimum distance WT”) so that heat dissipation and cooling air are unimpeded!
➔ Sucking air from other units must be avoided!

WARNING

Overturning or falling loads can lead to bruising, fractures, etc.!
Cuts from sharp edges!

➔ While transporting and installing protective equipment (safety gloves and safety shoes) must be worn!
➔ The unit must be mounted on a solid foundation or a fixed acreage. The strength of the fittings must be checked regularly!

Danger of tripping and falling !

➔ The unit must not form a tripping hazard!

Danger from flying parts !

➔ Ensure that loose parts are secured and/or removed!
➔ Provide sufficient safety margin so that no persons may be hurt by a fraction due to a fault in the external fan!

Risk of burns by hot surfaces and/or hot media!

In operation the unit must not be touched because it may result in temperatures above 70°C at the surface!
The installation of the unit must be executed in such a way (eg perforated plate/wire cover) that accidental contact is prevented!
Allow to cool after decommissioning!

GEFAHR

Electrical danger!

- Installation of the unit must be performed in such a way that it does not harm the electrical device
- Supply lines should be routed safety as cable ducts or in the ground

➔ Any electrical work must be performed by a qualified electrician!

5.1 Preparation

➔ The required environmental conditions (see chapter 9.1, “operating conditions”) must be checked

➔ Minimum distances (see chapter 9.2, “minimum distance WT”) for heat dissipation must be observed

➔ The location of installation must meet the following conditions:

- The environment of the unit must not be at risk of explosion
- The unit must be freely accessible from all sides
- Ensure sufficient space for installation / removal and maintenance work on the unit
- Keep ventilation grilles and openings free
- The unit must be set up vibration-free

Only with adequate vibration freedom faultless operation and a long service life of the equipment is ensured

5.2 Set-up of the unit

The guidelines from chapter 5.1, „Preparation“ must be observed.

Furthermore, the following must be observed when setting up the unit :

- must be carried out on flat areas
- The unit may only be installed in horizontal axis position
- on stationary areas or structures must be ensured that the viability of this area is designed for at least the weight of the aggregate
- the unit must be secured with the appropriate feet/ mounting plate using suitable fasteners on the ground

When installed on a substructure the unit can be mounted via elastic vibration mounts.

5.3 Connecting pipes/flexible pipes

	CAUTION
	**Risk of material damage due to contamination!** ➔ The interior of the unit must be free of contamination! ➔ It must be prevented that dirt/dust can be sucked! If this risk exists it is necessary to provide a suitable filter (10 microns or less).

When designing the pipes/hoses the following guidelines should be observed :

- the suction (vacuum) must be made via a vacuum-tight flexible hose or through a decoupled piping
- when using pipelines it is to ensure that no forces are transferred to the unit and if necessary compensators must be used

A fixed piping is not permitted!

- Diameter of the suction/discharge line should be at least as large as the corresponding connection diameter on the unit

Constrictions in the connection lines reduce the suction power!

- the exhaust air/compressed air line is either equipped with a continuous gradient, a liquid separator or a siphon with drain valve so that no condensate can flow back into the aggregate
- in the exhaust line no shut-off valve must be installed and must not be blocked or narrowed

On the exhaust side backpressures are permitted only up to +0,1 bar!

When installing the lines ensure the following :

- Before installation all pipes and connections must be cleaned
- Make sure that no gasket or sealing material (sealing tape) extends into the interior
- The flanges must be free of flange lids, plugs and/or security films

5.4 Fill in the lubricating oil

	CAUTION
	**Risk of material damage!** The shipment of the unit is always **without** oil. ➔ The operation of the unit without oil destroys the pump!

Before commissioning necessarily oil needs to be filled in the unit, to do that proceed as follows:

- The vacuum pump must be switched off and secured against involuntary start-up.
- Loosen oil filling screw and fill suitable vacuum oil up to the top of the oil showcase
- Screw oil filling plug back

On the following pages you will find suitable types of oil (see Table 2, page 18) and recommended amount of oil (see chapter 9.2, “oil quantity”).

After filling with oil, the rotary vane pump must always be horizontal!

5.5 Electrical connection

The electrical connection must be carried out in accordance with the following guidelines:

- appropriate VDE or national regulations
- the applicable national, local and system-specific regulations
- applicable regulations of the utility company at the location of installation

DANGER

Electrical danger!

Any electrical work must be performed by a qualified electrician!

Before starting work on the unit the following provisions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restart
- Earth and short circuit
- Cover and safeguard neighboring live parts

The data **on the nameplate** of the motor must necessarily match with the conditions at the set-up place!

Permissible deviations (without reduction in performance):

- ± 5% voltage deviation
- ± 2% frequency deviation

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit, unit and pipes must be depressurised

Electrical danger!

Terminal box must be free from:

- foreign bodies
- contaminations
- humidity

The electrical connection must be made in accordance with the circuit diagram in the terminal box cover , thereby following should be noted:

- Protective conductor must be connected
- Terminals must be used
- Ensure that the connections are safe in the long term
- Terminal box cover and cable entries must be close to dust and water

The terminal box must be checked regularly for leaks

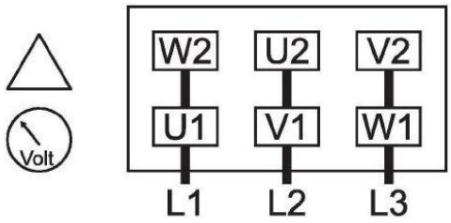
Wiring diagram AC motor:

- Connection with 1 capacitor (230 V):

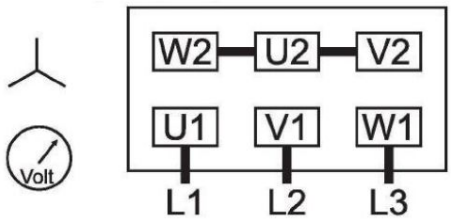
  ➔ See cover of the terminal box
  (left & center: the capacitor /
  right & center: the supply voltage)

Wiring diagram three-phase motor:

- Delta connection (low voltage):



- Star connection (high voltage):



To **protect the motor against overload** according to VDE 0113 the use of a motor protection switch is necessary. This must be set to the nominal current which can be found on the nameplate of the motor. It is recommended to use a motor protection switch with a off time delay, as during a cold start of the aggregate a momentary overcurrent may occur.

CAUTION

Risk of material damage due to incorrect direction of rotation!

An operation in the wrong direction of rotation can damage the aggregate in a short time

➔ Before starting up the unit check for correct direction of rotation!
➔ Check polarity of the electrical connection (if necessary swap two phases)!

Check for correct direction of rotation:

- Determine the intended direction of rotation by means of the glued/molded arrow
- Turn on the driving motor for a split second
- Determine the direction of rotation by means of the external fan wheel shortly before the standstill

  ➔ If the direction of rotation is wrong swap any two phases (three-phase motor)

6 Operation

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media (aerosole)!

Before operating the unit the following conditions must be met:

- At the connections suction and pressure lines were installed
- All lines are dense and have a sufficient strength
- All lines must not be closed, blocked or dirty

➔ When working on the unit protective equipment must be worn!

➔ Despite oil mist separation, the air contains small residues of aerosols. Continual inhalation of these aerosols can be harmful!

Danger from rotating parts!

Before operating the unit the blower cover, the silencers on the suction/discharge nozzle and the fan cowl must be installed!

Risk of burns by hot surfaces and/or hot media!

In operation the unit must not be touched because it may result in temperatures above 70°C at the surface!

Risk of injury from the operation of the unit!

When operating the unit the following must be avoided:

- To touch the aggregate
- Performing works on aggregate

DANGER

Electrical danger!

Any electrical work must be performed by a qualified electrician!

Before starting work on the unit the following provisions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restart
- Earth and short circuit
- Cover and safeguard neighboring live parts

6.1 Preparations prior to commissioning

➔ Identification of the unit model by the nameplate (see chapter 3.1, page 7)

➔ For treated and/or stored aggregates the seals must be removed (see chapter 4.3, page 10)

➔ Determination / verification of downtime

- for downtime **over** a year the manufacturer must be contacted for necessary steps
- for downtimes **less** than one year the prescribed steps (see chapter 6.2, “commissioning”) must be performed

6.2 Commissioning

Start up:

The following must be checked **before the first start-up**:

- Tightness of the piping and hose connections
- Direction of rotation
- Correct electrical connection of the motor
  Set motor protection switch to the specified nominal current!
- The values given on the unit (nameplate) must be observed!
- The unit is prepared

Then continue with the following steps:

- Opening a (if present) suction-side shut-off valve
- Turning on the engine for 2 minutes
- If necessary, lack of oil fill up to top of the oil showcase

ⓘ The Oil-filling screw must not be opened during operation of the unit

Shutdown:

- Shutting down the motor
- Close the (if present) suction-side shut-off valve
- Repeat checking for leaks of the lines, the unit and the fittings

If condensable vapors conveyed, following must be considered:

- a gas ballast valve in the fan side cylinder cover is required (at delivery the ball valve is opened at the gas ballast valve)
- The rotary vane pump must first be brought to an operating temperature of about 75°C by operating with closed suction port for about 30 minutes

Only after reaching operating temperature conveying of condensable vapors is possible!

- After reaching the operating temperature the suction port can be opened
- to clean the oil after the process of possibly enriched condensate, the pump has to continue running for about 30 minutes

The maximum water vapor tolerance of the units (described in this manual) is 40 mbar (when using a gas ballast valve).

WARNING

Risk of serious hearing damage due to noise radiation!

The actual noise emission during operation may vary from the measured noise emission values of the manufacturer, as they are highly dependent on installation and system conditions.
Therefore carry out an acoustic emission measurement after installing the unit and if necessary following steps shall be taken:

- Noise area marked with warning sign
- Wear hearing protection

Risk of hearing damage!

Depending on the model size the unit emit noise of high volume.
Depending on the operating state the unit emit noise in a narrow frequency band.
➔ For longer stays in the vicinity of a non noise insulated unit ear protection should be worn!

WARNING

Risk of burns by hot surfaces and/or hot media!

In operation the unit must not be touched because it may result in temperatures above 70°C at the surface!
The installation of the unit must be executed in such a way (eg perforated plate/wire cover) that accidental contact is prevented!
Allow to cool after decommissioning!

CAUTION

Risk of bearing damage!

Mechanical shocks at standstill and in operation are to be avoided.

Risk of material damage!

It is important to observe the prescribed amount of vacuum oil and sufficient supply of cooling air, as this can otherwise lead to overheating of the aggregate, destruction of machine parts and/or the emergence of an ignitable mixture.

6.3 Decommissioning

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Unit and pipes depressurised

➔ When working on the unit protective equipment must be worn!

➔ escaping fluids must be collected and disposed of in accordance with the guidelines!

The following provisions must be performed if the pump / unit is taken out of operation or shut down:

- If the unit is shut down but will remain operational:

  ➔ Once a month, the unit briefly (5-10 minutes) must be put into operation
- If the unit is taken out of operation:
  - Shut down unit and disconnect from mains
  - Close shut-off valves on the suction / discharge connections and relief pressure
  - Depressurise the unit
- If the unit is dismantled:
  - Take unit from the mains and secure it against unauthorized switch
  - Dismantle pipes / hoses
  - Depressurise the unit
  - Close all connections / fittings
- If the unit is decommissioned for an extended period or **stored**, the appropriate actions (see chapter 4.2, page 9) must be performed

6.4 Recommissioning

The following steps must be performed before recommissioning:

- Checking the condition of the pump (cleanliness, cabling etc.)
- Drain preservative

After that all the steps of commissioning – as described in chapter 6.1, „Preparations prior to commissioning“ and chapter 6.2, „Commissioning“ – must be performed.

After long downtimes the insulation resistance of the motor should also be measured and checked. The motor winding is too wet for values of less than 1 kOhm per volt of rated voltage and must be dried.

If the unit is temporarily turned off and remains ready for operation and filled, it is sufficient if the unit is operated once a week.

7 Service and maintenance

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Unit and pipes depressurised

➔ When working on the unit protective equipment must be worn!

WARNING

Danger from rotating external fan!

The fan cover must not be dismantled!

Danger from rotating rotor of the unit!

Before starting work on the unit, the unit must be taken out of service and the rotor completely stopped!

WARNING

Danger of burns from hot surfaces and / or hot fluids!

In operation, the unit must not be touched!
Allow to cool after decommissioning!

CAUTION

Overturning or falling loads can lead to bruising, fractures, etc.!
Cuts from sharp edges!

➔ While transporting and handling the unit protective equipment must be worn!

7.1 Monitoring of the aggregate

The following points must be checked at regular intervals:

- Check for adequate oil level
- Contamination of the motor and the filter
- conspicuous running noise of the needle bearings
- Current consumption of the motor

For trouble-free operation pay attention to:

- tightness of the connections and the aggregate
- intact and clean filter
- no overload
- no unusual running noises or vibrations

7.2 Cleaning of contaminations

Maintenance has to be done periodically on the aggregate to ensure the operational safety. The lengths of the intervals are dependent both on the installation site as well as the loading of the aggregate.

Therefore, following actions must be performed regularly:

- The oil level have to be checked **daily**
- The connections and fittings of the unit shall be tested **monthly** for leaks and tight fit
- **Once a month** remove dirt which is in the cooling fins, the external fan and the fan cowl of the motor.
  ➔ Clean using compressed air
- Depending on the contamination of the extracted medium the suction filter and possibly the filter from the gas ballast valve must be cleaned **regularly**

Cleaning the air intake filter

CAUTION

Risk of material damage due to insufficient maintenance of the air filter!

➔ A reduction of power as well as damage to the unit may result

Depending on the contamination of the conveyed medium the air intake filter have to be cleaned or replaced **regularly**.

- Unscrew the four screws holding the suction flange and remove the suction flange
- Remove the inlet screen and blow/wash it out with compressed air, if heavily soiled replace it

Oil level check / correction

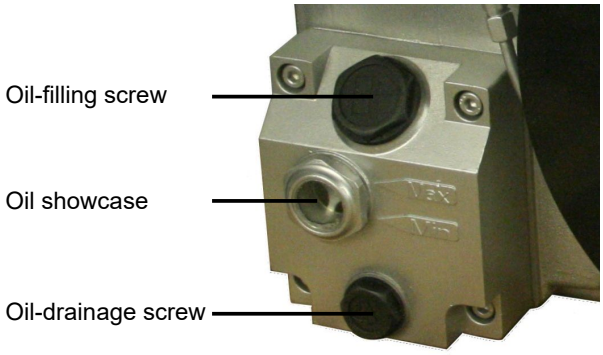
- The pump has to be switched off and secured against involuntary start-up
- If the oil level fall below the MIN mark of the oil showcase
  - Oil has to be refilled
  - Refill oil until the MAX mark of the showcase is reached
- If the oil level rises above the MAX mark
  - unpermissible thinning of the oil through condensates
    →change oil and check process!
  - Upgrade/Check gas ballast valve, check its filter

Oil change

WARNING

Risks of environmental damage!

Oils and oil filters must be collected and disposed of separately
➔ The local and national regulations / waste laws are complied with!
➔ Assign an authorized company with the disposal



The following intervals must be complied with:

- first oil change after 100 hours of operation
- further oil changes depend on the operating conditions
  ➔ after 500 - 2000 hours of operation, but at least twice a year
- in case of strong contamination a change of oil may be necessary earlier

The following steps are required for the oil change:

- the unit must be switched off and depressurized at operating temperature
- Open oil-drainage screw and collect the oil in a suitable container
- if the oil flow is fading close oil-drainage hole, run the unit briefly (a few seconds) and drain the residual oil by reopening the oil-drainage hole
- Tightly screw in the oil-drainage screw again
- Remove old oil filter and replace it with a new oil filter
- Open oil-filling plug and fill in new oil (Table 2) up to the MAX mark on the oil showcase
  (see chapter 9.2, "oil quantity")

Only oils corresponding to DIN 51506 group VC / VCL or recommended vacuum oils should be used. (see Table 2)

recommended type of oil	Ambient temperature	part number	
		5l container	20l container
VM 032	< 0°C	1040-VM032-5	
VM 068	0 - 12°C		1040-VM068-20
VM 100	12 - 30°C	1040-VM100-5	
VS 100	> 30°C	1040-VS100-5	1040-VS100-20

Table 2: ***recommended type of oil***

Flushing the vacuum pump

Decomposed oil can block the pipes and cooling unit of the rotary vane pump. This increases the chance of damages due to insufficient lubrification. Furthermore it creates the possibility of an explosion of the pump due to over-heating.
→ **The pump has to be flushed when deposits are present in the vacuum pump**

- the used oil has to be drained completely
- create the flushing solution
  (for quantity see chapter 9.2, "oil quantity")
  - 50% new oil
  - 50% kerosene
- Open oil-filling plug and fill in this flushing solution
- Tightly screw in the oil-filling plug
- Close the suction side and run the vacuum pump for at least an hour
- Remove the flushing solution and fill in fresh oil

Change / control of exhaust filters

WARNING

Risk of elevated temperature and fire!

Contaminated exhaust filters lead to excessive pump temperatures and can lead to self-ignition of the lubricating oil in extreme cases.

The exhaust filters must be checked **once a month**.
Under the following criteria the exhaust filter must be replaced:

- for a filter resistance > 0,6 bar (filter resistance gauge screwed into the oil-filling plug)
- if while the operation of the aggregate oil mist escapes from the oil separator
- generally every 2000 hours

Excessive pump temperatures and increased power consumption of the motor may indicate a dirty exhaust filter.

When installing a new exhaust filter a new seal for the exhaust cover must be used!

The following maintenance intervals must be complied with:

	Type of maintenance	Intervale
Oil level	Control	daily
1. oil change	Change	after 100 hours
further oil changes		all 500 – 2000 hours
Exhaust filter		~ yearly
Gas ballast valve (option)	Cleaning	~ monthly
Inlet screen		half-yearly
Fan cowl		half-yearly
Electrical connection	Control	half-yearly

7.3 Service / Support

For maintenance and repair work, please contact our service.

When returning the unit following must be observed:

- Unit must be cleaned inside and outside
  (see chapter 7.2, page 17)
- Unit must not be disassembled and must be supplied with all the necessary parts
- The identification of the unit on the nameplate must be unrestricted
- a duly completed "Declaration of Harmlessness" must be accompanied by any declining aggregate
- For returning the original packaging should be used

7.4 Spare parts

As spare parts, the spare and wearing parts listed in the table (page 28) are provided. If other parts are necessary for the maintenance contact your responsible representative of the SKV-tec GmbH to determine whether a repair is economically or whether a replacement can be considered.

When ordering spare parts and accessories following information is required:

- complete model code of the unit using the nameplate
  (see chapter 3.1, page 7)
- Serial number (S/N) of the aggregate
  (see chapter 3.1, page 7)
- Position and parts designation
  (see table, page 28)

Commercially available standard parts can be purchased in free trade.

8 Troubleshooting

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk of injuries when the engine is running!

During operation the unit must not be touched! During operation, no work may be performed on the unit!

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit, the unit and the lines must be depressurised

If the operator of the unit can not resolve the disturbance, the contact person responsible for the maintenance of the unit is to be contacted.

If the problem can not be resolved, contact your responsible representation of the SKV-tec GmbH!

Defect	Cause	Rectification
Engine will not start (no running noise)	At least one phase of the power supply is interrupted	Check the power supply and eliminate interruption
	Motor protection switch has triggered	Check the motor and switch on protection switch again
	Motor blocked	Check the motor
Motor protection switch triggers	Frequency / voltage is not consistent with the motor data	Inspection by a qualified electrician
	Faulty connection of the motor terminal board	
	Short circuit in the motor winding	Check the motor winding
	Incorrect setting of the motor protection switch	Check settings, if necessary, replace the motor protection switch
	Motor protection switch is triggered too quickly	if necessary, use motor protection switch with overload-dependent switch-off delay
	Excessive back pressure on the exhaust side	Check hose / pipe
	Vacuum pump or the used oil is too cold	Observe ambient and suction temperature
	Too high viscosity of the used oil	Use only recommended vacuum oils (see Table 2)
	Exhaust filters are dirty	Change of exhaust filters
	Motor/pump blocked	See „Engine will not start”
insufficient suction capacity	Suction line is too long or too tight	Check hose / pipe
	Leak on the suction side or in the system	Check system / connections and seal if necessary
	Soiled suction filter	Clean / Change the suction filter (inlet screen)

Defect	Cause	Rectification
End pressure is not reached	Leak on the suction side or in the system	Check system / connections and seal if necessary
	Too high or wrong viscosity of the used oil	Use only recommended vacuum oils (see Table 2)
Aggregate is too hot	Too high ambient or suction temperature	Observe Intended use (see chapter 2.1 and 9.1, „Operating conditions“)
	Cooling air flow is restricted	Check ambient conditions
		Clean the ventilation slots (see chapter 7.2)
	Too high viscosity of the used oil	Use only recommended vacuum oils (see Table 2)
	Exhaust filters are dirty	Change of exhaust filters
	Excessive back pressure on the exhaust side	Check hose / pipe
Unit generates unusual noises (At cold start a hammering noise of the vanes is normal)	Worn coupling rubbers	Replace coupling rubbers
	The vacuum regulation valve (if present) flutters	Replace regulation valve
	Vacuum pump or the used oil is too cold	Observe ambient and suction temperature
	Too high viscosity of the used oil	Use only recommended vacuum oils (see Table 2)
	Vanes are damaged	Replacement / repair by manufacturer
	Pump housing is worn	
Visible oil mist in the exhaust air	Exhaust filters are not installed properly or the seals (O-rings) are missing	Check the correct seating of the exhaust filters
	Exhaust filters are dirty	Change of exhaust filters
	Unsuitable lubricating oil is used	Use only recommended vacuum oils (see Table 2)
	Excessive back pressure on the exhaust side	Check hose / pipe
	Too high ambient or suction temperature	Observe Intended use (see chapter 2.1 and 9.1, „Operating conditions“)
	Cooling air flow is restricted	Check ambient conditions
		Clean the ventilation slots (see chapter 7.2)
Water in lubricating oil	Pump sucks in water	Install water separator before aggregate
	Water vapor tolerance of the pump is exceeded	Consult the manufacturer
	Unit operates only briefly and does not reach the operating temperature	after extraction of water vapor the unit must continue running with closed suction side until the water is completely evaporated from the oil

9 Technical Specifications

The model-specific technical data are referred to the separate data sheets of the model series.

9.1 Operating conditions

Temperatures:

- Temperature of the transported gas
  - max. permissible temperature: +30°C
  - Nominal value of the temperature: +20°C
- Temperature of the ambient
  - max. permissible temperature: +30°C
  - min. permissible temperature: +12°C
  - Nominal value of the temperature: +20°C

Deviating temperatures from nominal value have an impact on the permissible pressure differences.
At higher temperatures, both damage to the motor windings as well as a shortening oil durability can not be excluded.

Pressures:

The pressure differences indicated (on the nameplate) are exclusively under the following conditions:

- Ambient temperature: **+20°C**
- Ambient pressure: **1013 mbar** (atmospheric)

Altitude is max. 1000 m above sea level.

Divergent operating conditions consultation of your responsible representation of the SKV-tec GmbH is required!

9.2 General technical data

Oil quantity:

Oil quantity	volume ca.
SKV-RVP-O-20-0020	0,45 l
SKV-RVP-O-05-0040	1,0 l
SKV-RVP-O-05-0063	2,0 l
SKV-RVP-O-05-0100	
SKV-RVP-O-05-0160	5,0 l
SKV-RVP-O-05-0200	
SKV-RVP-O-05-0250	6,5 l
SKV-RVP-O-05-0300	

Minimum distance WT (heat dissipation):

Model	Distance for the cooling air to adjacent walls	Distance for maintenance to the unit
SKV-RVP-O-20-0020	> 20 cm	> 40 cm
SKV-RVP-O-05-0040		
SKV-RVP-O-05-0063	> 30 cm	
SKV-RVP-O-05-0100		
SKV-RVP-O-05-0160		
SKV-RVP-O-05-0200		> 50 cm
SKV-RVP-O-05-0250		
SKV-RVP-O-05-0300		

Connection thread dimensions:

Model	Pressure / suction connection	
SKV-RVP-O-20-0020	3x Ø7,9	G ¾“
SKV-RVP-O-05-0040	G 1¼“	
SKV-RVP-O-05-0063		
SKV-RVP-O-05-0100		
SKV-RVP-O-05-0160	G 2“	
SKV-RVP-O-05-0200		
SKV-RVP-O-05-0250		
SKV-RVP-O-05-0300		

10 Appendix

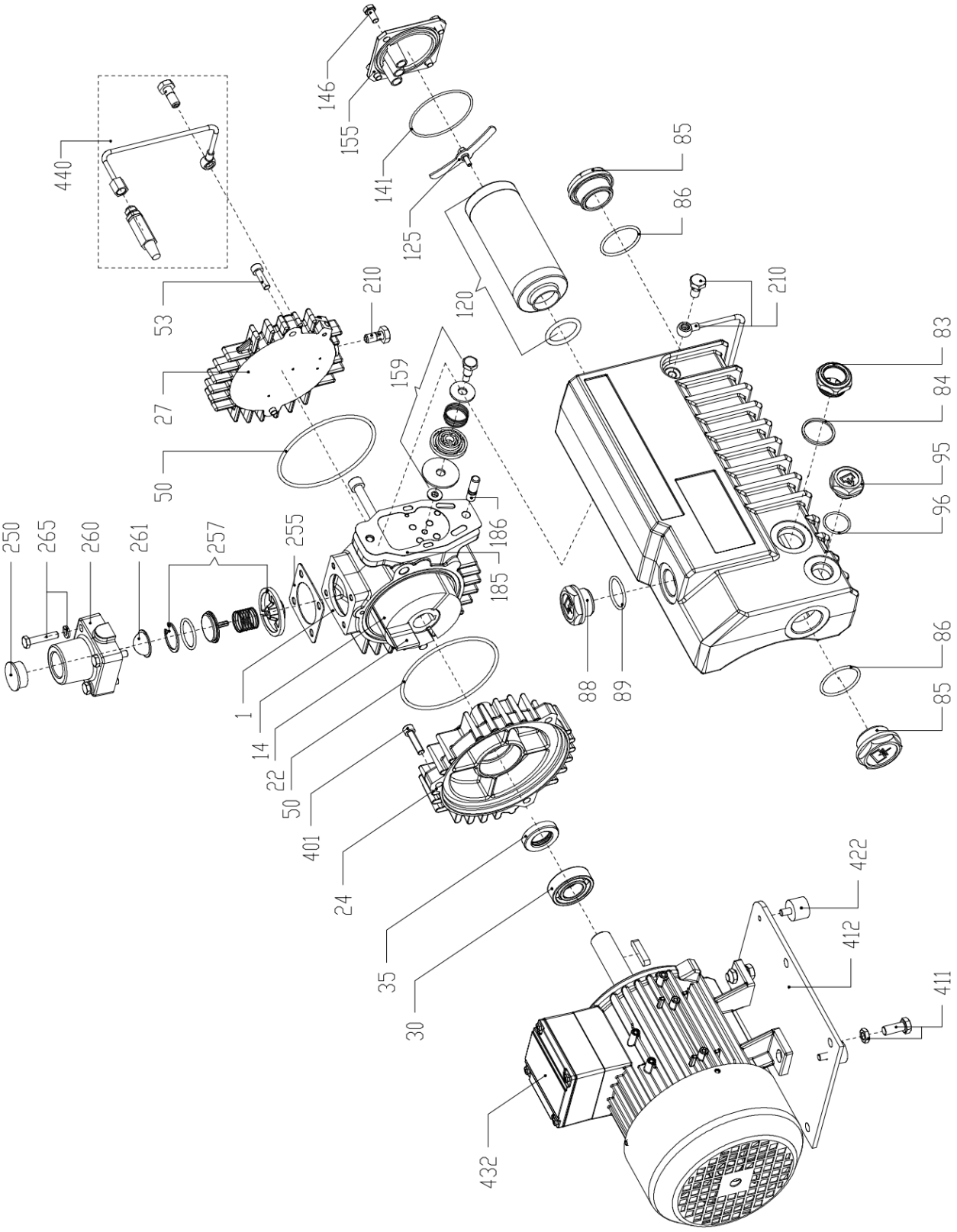


Figure 4: exploded drawing of model -0020

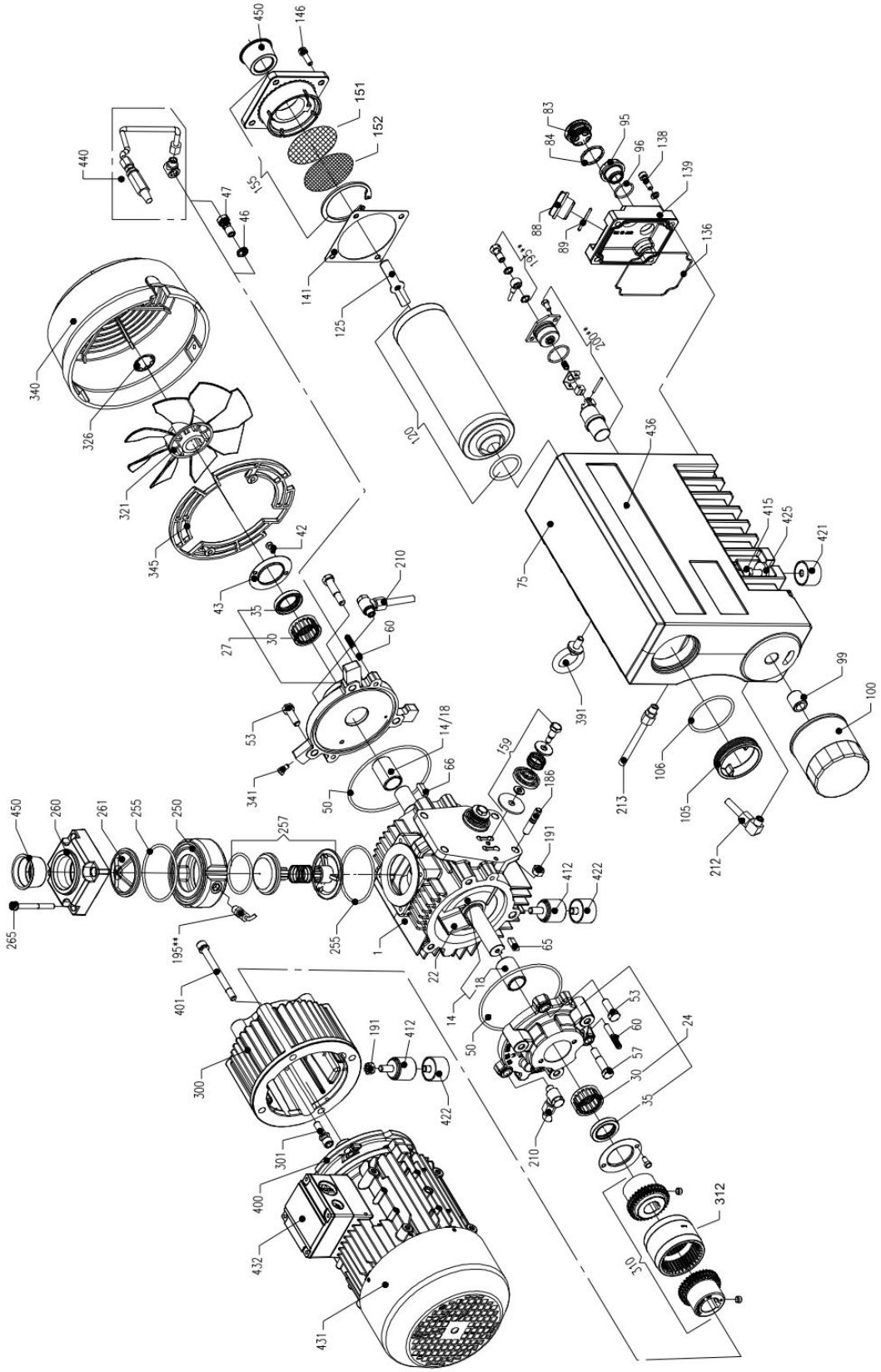


Figure 5: exploded drawing of model -0040

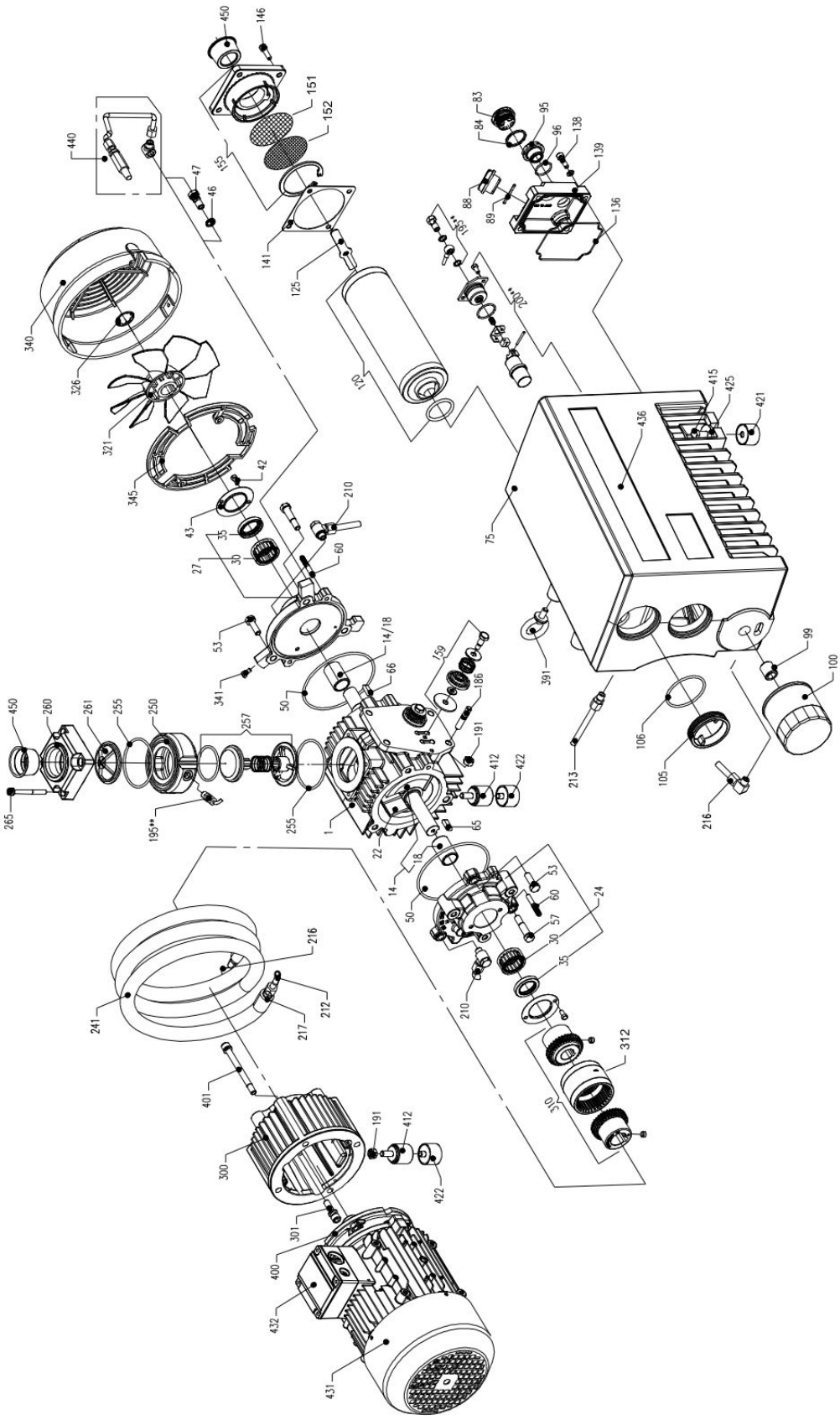


Figure 6: Exploded drawing of models -0063 / -0100

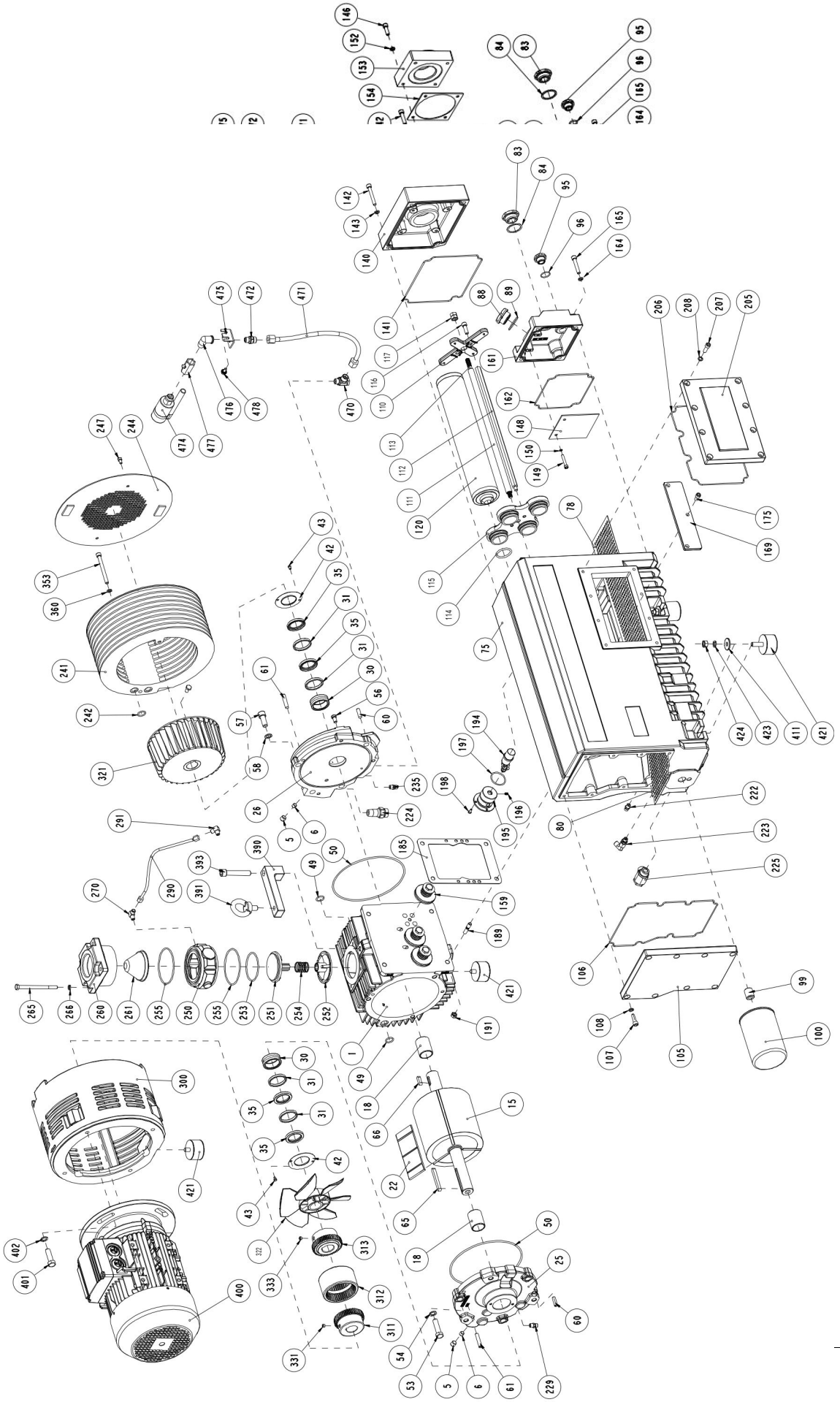


Figure 8: Exploded drawing of the models -0250 / -0300

Gasket set / Servicing kit / Overhaul kit

90400	05	0040	-	DS
Spare part base number				
End pressure (05 = 0,5mbar)				
Model size (0040 = 40 m³/h)				
Set code: **DS** : Gasket set / **WS** : Servicing kit / **VS** : Overhaul set				

Format Spare part article number

***e*.g. Overhaul set for SKV-RVP-O-05-0100 → 90400 05 0100-VS (see symbolic picture)**

Teilenr. No **)	**Bezeichnung des Teils**	**Description**	SKV-RVP-O-								
			-20-0020			-05-0040 bis -05-0100			-05-0160 bis -05-0300		
			DS	**WS**	**VS**	**DS**	**WS**	**VS**	**DS**	**WS**	**VS**
022	Schieber	Vane			3			3			3
030	Nadellager	Needle bearing			1			2			2
035	Wellendichtring	Shaft seal			1			2			4
050	O-Ring (Zylinder)	O-ring (cylinder)	2			2			2		
084	Dichtung (Sichtglas)	Seal (oil window)	1								
086	Dichtung (Verschraubung vorne & hinten)	Seal (plug front & rear)	1								
089	Dichtung (Verschraubung oben)	Seal (plug top)	1								
096	Dichtung (Öldrainage)	Seal (oil drainage)	1								
100	Ölfilter	Oil filter					1			1	
106	Dichtung (Abluft hinten)	Seal (exhaust back)							1		
120	Luftentölelement	Exhaust filter		1			1 / 2 *)			2 / 3 *)	
136	Dichtung (Servicedeckel)	Seal (service cover)				1					
141	Dichtung (Abluft)	Seal (exhaust)	1			1			1		
151	Sieb (rund, grob)	Screen rough						1			
152	Sieb (rund, fein)	Screen fine						1			
162	Dichtung (Servicedeckel)	Seal (service cover)							1		
185	Abscheiderdichtung	Separator gasket	1			1			1		
206	Dichtung (seitlicher Deckel)	Seal (side cover)							1		
255	Dichtung/O-Ring (Saugflansch)	Seal/O-ring (suction side)	1			1			1		
261	Saugsieb	Inlet screen			1			1			1
312	Kupplungshülse	Coupling sleeve						1			1

*) Number of parts depends on the model series

**) Part numbers can be found in the exploded drawing in the respective operating instruction

not included in this kit

not installed/existent in this model series

EC - Declaration of Conformity

Object of the declaration: Rotary Vane Vacuum Pump of the SKV-RVP-Series

Types: **SKV-RVP-O-20-0020**

SKV-RVP-O-05-0040 / -0063 / -0100

SKV-RVP-O-05-0160 / -0200 / -0250 / -0300

We hereby declare that the pump unit described above - in its delivered state - complies with the following relevant provisions:

- **Machinery Directive 2006/42/EC** of the European Parliament and of the Council of 17.5.2006
- The **safety objectives of the Low Voltage Directive** are complied in accordance with Directive 2006/95/EC
- **Directive 2004/108/EC** of the European Parliament and of the Council of 15.12.2004 - legislation relating to electromagnetic compatibility
  (applicable only with frequency converters VACON 0100)

Applied harmonized standards:

DIN EN 1012-1	Compressors and vacuum pumps - Safety requirements - Part 1: Compressors
DIN EN 1012-2	Compressors and vacuum pumps - Safety requirements - Part 2: Vacuum Pumps
DIN EN 60034-1	Rotating electrical machines - Part 1: Rating and performance
EN ISO 12100	General principles for design - Risk assessment and risk reduction

This declaration loses its validity if the pump assemblies described above are technically modified without our approval.

Igensdorf, 10.01.2016
(place, date)

Robert Krämer, CEO
(name and function)

(signature Robert Krämer)

SKV-tec GmbH
Forchheimer Str. 4 / D-91338 Igensdorf
Tel.: +49 (0) 9192 – 99 53 14 / Fax: +49 (0) 9192 – 99 52 68

Declaration of Harmlessness

Each send in aggregate this declaration **has to** be accompanied by completely filled!
The following criteria must comply with the declaration:

- It must be completely filled, otherwise the repair / disposal can be refused.
- It must be completed, checked and signed by an authorized service personnel.
- It must be completed in German or English
- It must be attached easily visible on the outside of of the packaging material and if necessary inform the relevant forwarding agency

Type designation: _____

Serial number (S/N): _____

Reason for return: _____

The unit came into contact with hazardous substances: ☐ yes ☐ no
(In repairing / Disposal danger consists for people and the environment)

If the unit came in contact with hazardous substances, the relevant substances in the following are mentioned:

Trade name	**Chemical designation**	**Hazardous Material Class**	**Properties (z.B. corrosive, flammable, toxic)**

The unit has been completely drained, flushed and cleaned both from the inside and from the outside in accordance with these operating instructions ☐ yes

All safety data sheets are enclosed ☐ yes

When handling with the aggregate safety precautions must be taken? ☐ yes ☐ no

If yes, _____

_____

Legally binding statement

We assure that all information provided are complete and correct and I - the undersigned – am authorized and empowered to confirm this. We are aware that in case of incomplete, incorrect information we are liable for damages incurred by the contractor. Due to incomplete, incorrect information we keep the contractor free from damage claims of third parties. Independent of this statement, we are aware that we are directly liable to third parties, which particularly refers to the responsible personnel for the repair of the contractor.

Company: _____ Name: _____

Street: _____ Date, signature: _____

City: _____ Stamp: