GREENCO

Operating Instruction

Rotary Vane Vacuum Pump

1RV0020/1RV0025/1RV0040/1RV0063/1RV0100

Manufacturer

Zhejiang Greenco Industry Co Ltd

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Introduction

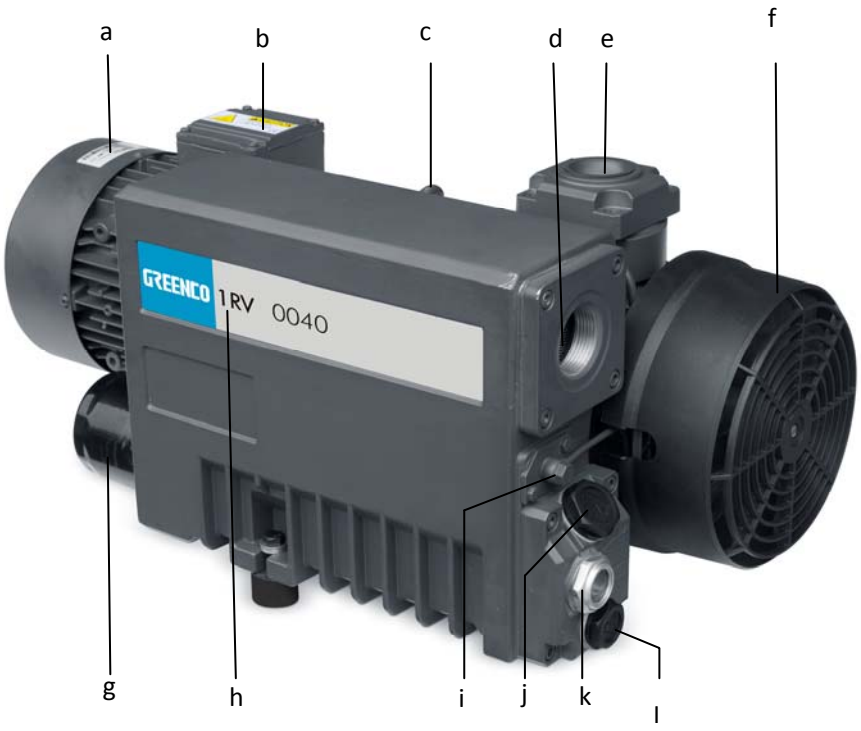
Congratulations on your purchase of the Greenco vacuum pump. As the global leader of the vacuum pump and pressure pump technology, Greenco is always committed to meeting the demands of customers and OEM manufacturers, and continuously delivering vacuum and pressure solutions geared to the industry worldwide.

These operating instructions contain information for
—product description,
—safety instructions
—transport
—storage
—installation and commissioning
—maintenance
—overhaul
—trouble shooting
—spare parts

This operating manual covers the installation and operation of vacuum pump, involving the transport, storage, installation, commissioning, influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

Prior to handling the vacuum system, these operating instructions shall be read carefully and understood. If anything remains to be clarified please contact Greenco !

Keep these operating instructions and, if applicable, other pertinent operating instructions available on site.



a. Motor data

b. Terminal box

c. Lifting ring

d. Gas discharge

e. Gas inlet

f. Radial fan

g. Oil filter

h. Nameplate

i. Ball valve

j. Oil fill plug

k. Oil sight glass

l. Oil drain plug

Technical data

	Unit	1RV0020	1RV0025	1RV0040	1RV0063	1RV0100
Pumping rate (50HZ/60HZ)	m^3/h	20/24	25/30	40/48	63/76	100/120
Pressure limit	mbar	2.0	0.1	0.1	0.1	0.1
Motor power (50HZ/60HZ)	kW	0.75	0.75/1.1	1.1/1.5	1.5/2.2	2.2/3.0
Motor rotation speed (50HZ/60HZ)	min^{-1}	3000/3600	1500/1800	1500/1800	1500/1800	1500/1800
Noise (50HZ/60HZ)	dB	67/70	62/64	64/67	64/66	65/68
Max. saturated vapor pressure	mbar	40	40	40	40	40
Removal rate of vapor	l/h	0.9	0.9	1.1	1.8	2.8
Operating temperature (50HZ/60HZ)	℃	80/85	80/85	82/90	84/92	84/93
Ambient temperature	℃	See Oil for vacuum pump	See Oil for vacuum pump	See Oil for vacuum pump	See Oil for vacuum pump	See Oil for vacuum pump
Oil quantity	L	0.45	1.0	1.0	2.0	2.0
Weight	kg	20	34	38	55	73

Product description

Use

The vacuum pump is intended for：the suction of air and other dry, non-aggressive, non-toxic and non-explosive gases.

Conveying media with a higher density than air leads to an increased thermal and mechanical load on the vacuum pump and is permissible only after prior consultation with Greenco.

The allowable temperature range of the inlet gas can be referred to in “Oil, Ambient temperature range”

In case the vacuum pump is equipped with a gas ballast (optional), water vapour within the gas flow can be tolerated within certain limits (see “Installation and Commissioning, Operating Notes, Conveying Condensable Vapours”). The conveyance of other vapours shall be agreed upon with GREENCO.

The vacuum pump is intended for the placement in a non-potentially explosive environment.

The vacuum pump is equipped with float valve (200) and return oil pipe.

The vacuum pump is thermally suitable for continuous operation (100% output).

The vacuum pump is provided with oil return valve (280).

The vacuum pump is applicable to continuous operation (Pay attentions to precautions of oil circulation; see Oil Circulation in Page 3; see Oil return in Page 8).
The vacuum pump is ultimate pressure proof.

Principle of operation

The vacuum pump works on the rotating vane principle.
A circular rotor (14) is positioned centrically on the shaft of the vacuum pump. The shaft of the vacuum pump is driven by the drive motor shaft by means of a flexible coupling (310).
The rotor (14) rotates in an also circular, fixed cylinder (1), the centerline of which is offset from the centreline of the rotor such that the rotor and the inner wall of the cylinder almost touch along a line. Vanes (22), sliding in slots in the rotor, separate the space between the rotor and the cylinder into chambers. At any time gas is sucked in and at almost any time ejected. Therefore the vacuum pump works almost pulsation free.
In order to avoid the suction of solids, the vacuum pump is equipped with a mesh screen (261) in the suction connection.
In order to avoid reverse rotation after switching off, the vacuum pump is equipped with a non-return valve (257)
NOTE: This valve shall not be used as a non-return valve or shut –off valve to the vacuum system and is no reliable means to prevent suction of oil into the vacuum system while the vacuum pump is shut down.
In case the vacuum pump is equipped a gas ballast (optional):
Through the gas ballast valve (440) a small amount of air is sucked into the pump chamber and compressed together with the process gas. This counteracts the accumulation of condensates from the process gas inside the vacuum pump (see “Conveying Condensable Steams” in Page 8).
The gas ballast is designed with paper filter (Note: 1RV0020-1RV0040 gas ballasts are configured with sintered metal filters).
Gas ballast version with ball valve:
The gas ballast line can be closed partially or completely by means of a ball valve.
In order to improve the operating characteristics the outlet of the pump chamber is equipped with a discharge valve (159).

Oil Circulation

The vacuum pump requires oil to seal the gaps, to lubricate the vanes (22) and to carry away compression heat.
The oil reservoir is located on the pressure side of the vacuum pump (i.e. high pressure) at the bottom of the bottom chamber of the oil separator (75).
The feed openings are located on the suction side of the vacuum pump (low pressure).
Forced by the pressure difference between pressure side and suction side oil is being drawn from the oil separator (75) through the oil supply lines (210) and injected on the suction side.
Together with the sucked gas the injected oil gets conveyed through the vacuum pump and ejected into the oil mist separator (75). Oil that separates before the exhaust filter (120) accumulates at the bottom of the bottom chamber of the oil separator (75).
Oil that is separated by the exhaust filter (120) accumulates at the bottom of the upper chamber of the oil separator (75).
The flow resistance of the exhaust filters (120) causes the inside of the exhaust filters (which is connected to be bottom chamber of the oil separator) to be on a higher pressure level than the outside of the exhaust filters (the upper chamber of the oil separator). Because of the higher pressure in the bottom chamber it is not possible to let oil that drips off the exhaust filters simply flow down to the bottom chamber.
As the vacuum pump is equipped with float valve (200) and oil return pipe at the inlet:
The oil accumulated in the upper chamber of the oil separator flows in the air inlet (250) through the float valve (200) and oil return pipe (195)
As the vacuum pump is equipped with oil return valve (280):
In continuous operating conditions, it is possible that the oil sucked into pump chamber accumulates at the bottom of the upper chamber of the oil separator, and then drains out along with the gas discharge/pressure, resulting in oil-free pump operation; therefore, turn off the vacuum pump and wait for at least 15 minutes for every 10 hours’ continuous operation. Depending on different working environments, the period of continuous operation may be even shortened (See Operation Notes in Page 8). After the vacuum pump is turned off, the pressure difference in and out of exhaust filter (120) is zero. The pressure in both chambers of oil separator is balanced. Open the oil return valve (280) between two chambers to drain the oil accumulated in the upper chamber of the oil separator by gravity into the bottom chamber.

Cooling

The vacuum pump is cooled by：
-the ambient air around the vacuum pump, including oil mist separator (75)
-he air flow from the fan wheel (400)
-the conveyed gas
-he air flow from the fan wheels (321) on the shaft of the vacuum pump

On/Off switch

The vacuum pump comes without on/off switch. The control of the vacuum pump is to be provided in the course of installation.

Safety

Intended use

DEFINITION: For the purpose of these instructions, “handling” the vacuum pump means the transport, storage, installation, commissioning, influence

on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

The vacuum pump is intended for industrial use. It shall be handled only by qualified personnel.

The allowed media and operational limits according to the "Product Description" (page 2) and the "Installation Prerequisites" (page 5) of the vacuum pump shall be observed both by the manufacturer and the operator.

The maintenance instructions shall be observed.

Prior to handling the vacuum pump these operating instructions shall be read and understood. If anything remains to be clarified please contact Greenco company!

Safety notes

The vacuum pump has been designed and manufactured with the state-of-the-art technology and latest safety standards. Nevertheless, residual risks may remain in case of improper installation or use. These operating instructions inform about potential hazards where appropriate. Safety notes are tagged with one of the keywords DANGER, WARNING and CAUTION as follows:

DANGER!
Disregard of this safety note will always lead to accidents with fatal or serious injuries.

WARNING!
Disregard of this safety note may lead to accidents with fatal or serious injuries.

CAUTION!
Disregard of this safety note may lead to accidents with minor injuries or property damage.

Emission of Oil Mist

CAUTION!
The non-OEM spares market offers exhaust filters that are geometrically compatible with GREENCO vacuum pumps, but do not feature the high retention capacity of genuine GREENCO exhaust filters.

Increased risk of damage to health .
In order to keep the emission on the lowest possible level only genuine Greenco exhaust filters shall be used.

The oil in the process gas is separated to the greatest possible extent, but not perfectly.

CAUTION!
Residual oil is present in gas discharged from vacuum pump. Aspiration of gas conveyed by the vacuum pump over extended periods can be harmful.

The room into which the gas conveyed by the vacuum pump is discharged must be sufficiently vented.

Note：The possibly sensible smell is not caused by droplets of oil, though, but either by gaseous process components or by readily volatile and thus gaseous components of the oil (particularly additives).

Noise

The sound pressure level in free field is tested according to EN ISO 2151.

Transport

Caution：Empty vaccum pump can contain oil left from testing, so make sure to keep vertical while transport and storage. Do not tilt or invert the vacuum pump.

Transport in Packaging

Packed on a pallet the vacuum pump is to be transported with a forklift.

Transport without Packaging

In case the vacuum pump is packed in the carton package lined with internal expanding lining：

◆ Remove the lining out of the carton.

If the vacuum pump is lined with corrugated foil in the carton：

◆ Remove the corrugated foil from the carton.

If the vacuum pump is wrapped in foam plastic in the carton：

◆ Remove the foam plastic from the carton.

If the vacuum pump is secured on the base with bolts：

◆ Unscrew the bolts between the pump and bolts.

If the vacuum pump is secured on the base with retaining tape：

◆ Remove the retaining tape.

CAUTION
Do not walk, work or stand under suspended loads.

- Make sure the eyebolt (391) is intact (replace the damaged ones).
- Make sure the eyebolt (391) is reliably locked.
- Attach lifting gear securely to the eyebolt (391) on the cylinder.
- Attach lifting gear to a crane hook with safety latch .
- Lift the vacuum pump with a crane hook.

In case the vacuum pump was bolted to a pallet:

◆ Remove the stud bolts from the rubber feet.

CAUTION

Tilting a vacuum pump that is already filled with oil can cause large quantities of oil to ingress into the cylinder.

Starting the vacuum pump with excessive quantities of oil in the cylinder will immediately break the vanes and ruin the vacuum pump.

Once the vacuum pump is filled with oil it shall not be lifted anymore.

- Prior to every transport make sure that the oil is drained.

Storage

Short-term Storage

Version with gas ballast device with ball-cock:

- Make sure that the ball-cock of the gas ballast (440) device is closed

Storage of vacuum pump equipped with ball-cock of the gas ballast (440) and paper filter (applicable to 1RV0063 and 1RV0100):

- Seal the paper filter of gas ballast (440) with tapes:

Storage of vacuum pump equipped with ball-cock of the gas ballast (440) and sintered metal filter (applicable to 1RV0020 and 1RV0040):

- Seal the sintered metal filter of gas ballast (440) with tapes:
- Make sure that the suction connection/gas inlet and the gas discharge/ pressure connection are closed
- Store the vacuum pump

— if possible in original packaging,
— indoors,
— dry,
— dust free
— vibration free

Conservation

In case of adverse ambient conditions (e.g. aggressive atmosphere, frequent temperature changes) conserve the vacuum pump immediately. In case of favorable ambient conditions conserve the vacuum pump if a storage of more than 3 months is scheduled.

During the factory tests, the vacuum pump inside has been completely in contact with oil. In case of favorable ambient conditions, it is not necessary to the pump with conservation oil. In case of unfavorable storage conditions, the vacuum pump draining with conservation oil is advised. If anything remains to be clarified please contact your Greenco representative!

Storage of vacuum pump with gas ballast (440) of ball-cock:

♦ Make sure that the ball-cock of the gas ballast device (440) is closed

Storage of vacuum pump with gas ballast (440) of ball-cock and paper filter:

♦ Seal the paper filter of gas ballast (440) with tapes;

Storage of vacuum pump with gas ballast (440) of ball-cock and sintered metal filter;

♦ Seal the sintered metal filter of gas ballast (440) with tapes;

- Make sure all openings are sealed; seal all the openings not protected with PTEF tape, washer or O-rings.
- Fill in conservation oil in small quantities by the suction connection, observe the oil type and the given quantity in the tables below:

Oil Type
Corex HLP-D 68, P/N 0831 512 575 (or a conservation oil from same quality)

NOTE: VCI stands for “Volatile Corrosion Inhibitor”. VCI-products (film, paper, cardboard, foam) evaporate a substance that condenses in molecular thickness on the packed good and by its electro-chemical properties effectively suppresses corrosion on metallic surfaces. However, VCI-products may attack the surfaces of plastics and elastomers. Seek advice from your local packaging dealer! GREENCO uses CORTEC VCI 126 R film for the overseas packaging of large equipment.

- Wrap the vacuum pump in VCI film.
- Store the vacuum pump.
  - ◆ if possible in original packing
  - ◆ indoors
  - ◆ dry
  - ◆ dust free
  - ◆ vibration free

Commissioning after conservation

- Make sure that the gasket, plug or adhesive tape are removed from the ports.
- Commission the vacuum pump as described in the chapter “Installation and Commissioning” (Page 5).

Installation and Commissioning

Installation prerequisites

CAUTION

In case of non-compliance with the installation prerequisites, particularly in case of insufficient cooling:

Risk of damage or destruction of the vacuum pump and adjoining plant components!

Risk of injury!

The installation prerequisites must be complied with.

- Make sure that the assembly of the vacuum pump is carried out in line with the essential safety requirements.

Mounting Position and space

- Make sure that the environment of the vacuum pump is not potentially explosive.
- Make sure that the following ambient conditions will be complied with：

— Ambient temperature: see “Oil”

- If the vacuum pump is installed in a environment of low temperature:

— Ambient pressure: atmospheric pressure

◆ Fit the vacuum pump either with an oil sump heater (on request) or fit the vacuum pump with a temperature switch and control the vacuum pump in such a way that it will start automatically when the oil sump

temperature rise above the allowable temperature.

- Make sure that the environmental conditions comply with the protection class of the drive motor (according to the nameplate).
- Make sure that the base for placement/mounting base is even.
- To warrant a sufficient cooling, make sure there is a clearance of minimum 50cm between the pump and nearby wall.
- Make sure that no temperature sensitive parts (plastics, wood, cardboard, paper, electronics) will touch the surface of the vacuum pump.
- Make sure that the installation space or location is vented so that a sufficient cooling of the vacuum pump is warranted.

CAUTION
During operation the surface of the vacuum pump may reach temperatures of more than 70℃.
Risk of burns!

- Make sure that the vacuum pump will not be touched inadvertently during operation, provide a guard if appropriate
- Make sure that the oil sight glass (83) will remain easily accessible if the oil change is meant to be performed on location:
- ♦ Make sure that the oil drain port (95), the oil filter (100) and the oil fill port (88) will remain easily accessible.
- Make sure that enough space will remain for the replacement of the exhaust filter(s) (120).

Suction Connection

CAUTION
Intruding foreign objects or liquids can destroy the vacuum pump.

In case the inlet gas can contain dust or other foreign solid particles:

- ◆ Make sure that a suitable filter (5 micron or less) is installed upstream the vacuum pump.
- Make sure that the suction pipeline fits to the suction connection/gas inlet (260) of the vaccum pump.
- Make sure that the gas will be sucked through a vacuum-tight flexible hose or a pipe.

In case of using a pipe：

◆ Make sure that the pipe will cause no stress on the vacuum pump's connection, if necessary use bellows.

- In case of very long suction lines it is prudent to use pipes of large line sizes in order to avoid a loss of efficiency. Seek advice from your Geenco representative.

If two or more vacuum pumps work on the same suction line, if the volume of the vacuum system is large enough to suck back oil or if the vacuum shall be maintained after switching off the vacuum pump：

- ◆ Provide a manual or automatic operated valve (=non-return valve) in the suction line.

(the non-return valve that is installed inside the suction connection is not meant to be used for this purpose!)

If the vacuum pump is planned to be used for the suction of gas that contains limited quantities of condensable vapor：

- ◆ Provide a shut-off valve, a drip-leg and a drain valve in the suction line, so that condensates can be drained from the suction line.
- Make sure that the suction line does not contain foreign objects, e.g. welding scales.

Discharge connection

It is required that the gas should be discharged without any obstruction; do not close or plug the discharge pipes or use the vacuum pump for compressing air.

The following guidelines for the discharge line do not apply, if the aspirated air is discharged to the environment right at the vacuum pump.

CAUTION
The discharged air contains small quantities of vacuum oil.
Staying in vacuum oil contaminated air bears a risk of damage to health.
If air is discharged into rooms where persons stay, sufficient ventilation must be provided for.

- Make sure that the discharge line fits to the gas discharge connection (155) of the vacuum pump.

In case of using a pipe：

- ◆ Make sure that the pipe will cause no stress on the discharge connection, if necessary use bellows.
- Make sure that the line size of the discharge line over the entire length is at least as large as the gas discharge connection (153) of the vacuum pump.

In case of very long discharge pipelines it is prudent to use larger line sizes in order to avoid a loss of efficiency and an overload of the vacuum pump. Seek advice from your Greenco representative.

Keep the back pressure at the discharge port (155) below 1.3 bar (absolute pressure) (Check it by starting the vacuum pump when appropriate).

- Make sure that the discharge line either slopes away from the vacuum pump or provide a liquid separator or a drip leg with a drain cock, so that no liquids can back up into the vacuum pump.

WARNING
Discharge lines made from non-conducting material can build up static charge.
Static discharge can cause explosion of potentially existing oil mist.
The discharge line must be made of conducting material or provisions must be made against static discharge.

Electrical connection/Controls

- Make sure that the stipulations acc. to the EMC-Directive 2004/108/EC, Standard 2006/95/EC for LV applications as well as the EN-standards, electrical and occupational safety directives and the local or national regulations, respectively, are complied with.
- Make sure that the voltage and frequency of power supply is compatible with the data on the nameplate of the drive motor (400).
- Make sure that an overload protection according to EN 60204-1 is provided for the drive motor.
- Make sure that the drive of the vacuum pump will not be affected by electric or electromagnetic disturbance from the mains; if necessary seek advice from the GREENCO service.

In case of mobile installation：

◆ Provide the electrical connection with grommets that serve as strain-relief.

Installation

Mounting

- Make sure that the "Installation Prerequisites" (Page 5) are complied with.
- Set down or mount the vacuum pump at its location

Connecting electrically

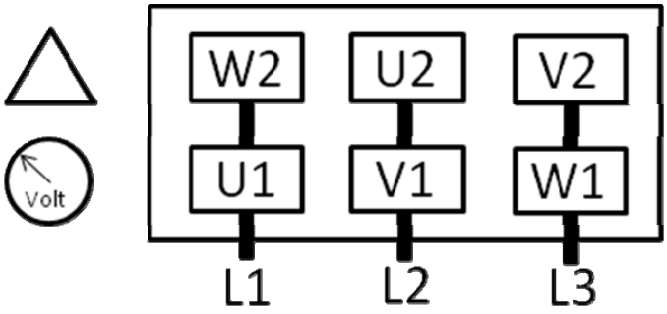
WARNING
Risk of electrical shock, risk of damage to equipment .
Electrical installation work must only be executed by qualified personnel that knows and observes the following regulations:
- IEC 364 or CENELECH HD 384 or DIN VDE 0100， respectively,
- IEC-Report 664 or DIN VDE 0110，
-BGV A2 (VBG 4) or corresponding national accident prevention regulation .

CAUTION
The connection schemes given below are typical. Depending on the specific order or for certain markets deviating connection schemes may apply.
Risk of damage to the drive motor!
The inside of the terminal box shall be checked for drive motor connection instructions/schemes.

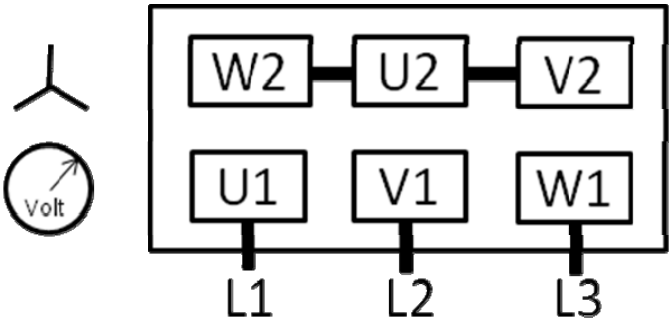
- Electrically connect the drive motor (400).
- Connect the protective earth conductor

Diagrams of electrical connection:

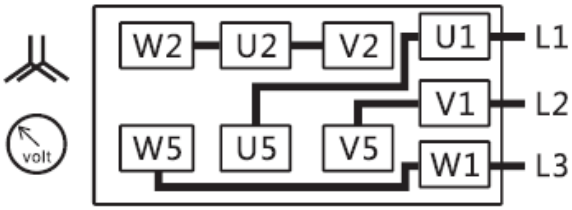
Delta connection (Low voltage):



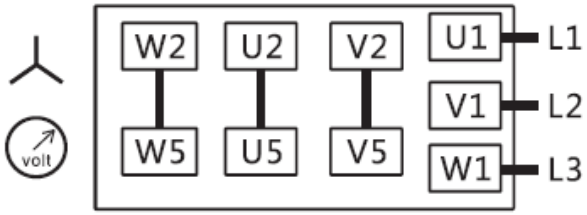
Star connection (High voltage):



Star connection, multi-voltage motor (High voltage):



Star connection, multi-voltage motor (High voltage):



CAUTION
Operation in the wrong direction of rotation can destroy the vacuum pump in short time.
Prior to starting-up it must be made sure that the vacuum pump is operated in the proper direction.

Setting vacuum pump with three-phase motor

- Determine the intended direction of rotation with the arrow (431).
- "Bump" the drive motor (400).
- Watch the fan wheel of the drive motor (400) and determine the direction of rotation just before the fan wheel stops.

If the rotation of the fan wheel must be changed:

◆ Switch any two of the drive motor wires in the terminal box.

Connecting Lines/Pipes

In case the suction line is equipped with a shut-off valve:

◆ Connect the suction line.

- Connect the discharge line.

Installation without discharge line:

◆ Make sure that the gas discharge (155) is open.

- Make sure that all provided covers, guards, hoods etc. are mounted.
- Make sure that cooling air inlets and outlets are not covered or

obstructed and that the cooling air flow is not affected adversely in any other way.

Filling Oil

In case the vacuum pump was treated with conservation oil:

◆ Drain the remainders of conservation oil and top up oil.

CAUTION
The vacuum pump is shipped without oil.
Operation without oil will ruin the vacuum pump in short time.
Prior to commissioning it must be made positively sure that oil is filled in.

The vacuum pump is delivered without oil (oil specification see “Oil” in page 22).

- According to the description in Oil (Page 22), at least 2L oil shall be kept in the oil tank (Note: 0.45L oil in 1RV0020, 1L in 1RV0025 and 1RV0040).

NOTE: The amount given in these operating instructions is a guide. The oil sight glass (83) indicates the actual amount to be filled in.

CAUTION
Filling oil through the gas inlet (260) will result in breakage of the vanes (22) and destruction of the vacuum pump.
Oil may be filled through the oil fill port only (88).

CAUTION
During operation the oil separator is filled with hot, pressurised oil mist.
Risk of injury from hot oil mist with open oil fill port .
Risk of injury if a loosely inserted oil fill plug (88) is ejected .
Remove the oil fill plug (88) only if the vacuum pump is stopped.
The vacuum pump must only be operated with the oil fill plug (88) firmly inserted.

- Remove the oil fill plug (88)
- Filling about 2L oil according to the values set in the table “Oil” (Note: 0.45L oil in 1RV0020, 1L in 1RV0025 and 1RV0040).
- Make sure that the level is between the MIN and the MAX-markings of the oil sight glass (83)
- Make sure that the sealing ring (89) is inserted into the oil fill plug (88) and undamaged, replace if necessary
- Firmly reinsert the oil fill plug (88) together with the sealing ring (89)

NOTE: Starting the vacuum pump with cold oil is made easier when at this very moment the suction line is neither closed nor covered with a rubber mat.

- Switch on the vacuum pump.

In case the suction line is equipped with a shut-off valve:

◆ Close the shut-off valve

In case the suction line is not equipped with a shut-off valve：

◆ Cover the suction connection with a rubber mat (260).

- Let the vacuum pump run for a few minutes.
- Shut down the vacuum pump and wait a few minutes.
- Make sure that the level is between the MIN and the MAX-markings of the oil sight glass (83)

In case the level has fallen below the MIN-marking of the oil sight glass:

◆ Top-up oil

In case the suction line is equipped with a shut-off valve:

◆ Open the shut-off valve

In case the suction line is not equipped with a shut-off valve:

◆ Remove the rubber mat, and connect the suction connection

Recording of Operational Parameters

As soon as the vacuum pump is operated under normal operating conditions:

- Measure the drive motor current and record it as reference for future maintenance and troubleshooting work.

Version with exhaust filter pressure gauge：

◆ Read the scale of the exhaust filter pressure gauge and record it as reference for future maintenance and troubleshooting work (Check during operation in Page 11).

Operation Notes

Application

CAUTION
The vacuum pump is designed for operation under the conditions described below.
In case of disregard risk of damage or destruction of the vacuum pump!
Risk of Injury!
The vacuum pump must be operated under the conditions described below.

The vacuum pump is designed for the suction of air and other dry, non-aggressive, non-toxic and non-explosive gases
Conveying media with a higher density than air leads to an increased thermal and mechanical load on the vacuum pump and is permissible only after prior consultation with Greenco company.
Max. allowed temperature of the inlet gas, see “Oil, Ambient temperature range”
In case the vacuum pump is equipped with a gas ballast (optional) water vapor within the gas flow can be tolerated within certain limits (see “Installation and Commissioning, Operating Notes, Conveying Condensable vapors” in Page 8). The conveyance of other vapors shall be agreed upon with GREENCO.
The vacuum pump is made for the intended use in potentially non-explosive areas.
If the vacuum pump is equipped with ball-lock valve (200) and oil return pipe:

The vacuum pump is suitable for continuous operation.

If the vacuum pump is equipped with oil return valve (280):

The vacuum pump is suitable for continuous operation. (Follow the relevant matters concerned in oil circulation; oil circulation in Page 3; oil return in Page 8).

The vacuum pump is ultimate pressure proof.

CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 70℃.

Risk of burns!

The vacuum pump shall be protected against contact during operation.

CAUTION

The discharged air contains small quantities of vacuum oil.

Staying in vacuum oil contaminated air bears a risk of damage to health.

If air is discharged into rooms where persons stay, sufficient ventilation must be provided for.

- Make sure that all provided covers, guards, hoods etc. are mounted
- Make sure that protective devices will not be disabled.
- Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way
- Make sure that the “Installation Prerequisites” (see “Installation Prerequisites and Commissioning” in Page 5) are complied with and will remain complied with, particularly that a sufficient cooling will be ensured

Oil return

It is only applicable to vacuum pumps equipped with oil return valves (280).

When the pump is operating, the oil builds up at the bottom of the upper chamber of oil separator (75), and is unable to flow into the bottom chamber of oil separator (75). (See Oil circulation in Page 3 for details).

After 10 hour’s continuous run, the pressure difference arises between the inlet and discharge; turn off the vacuum pump and wait for 15 minutes to allow the oil to flow from the upper chamber of oil separator (75) into the bottom chamber.

Note: It is the right time to check the oil temperature, oil level and color.

Conveying Condensable Steams

CAUTION

The residual condensable substances can dilute the vacuum pump oil, thus compromising the lubricating performance, or even jamming the rotor.

Take appropriate measure to completely remove the condensable substances out of vacuum pump.

In order to use the vacuum pump for the conveyance of condensable vapours, the vacuum pump must be equipped with shut-off valve in the suction line and with a gas ballast valve.

Version with gas ballast device with ball-cock:

- Make sure that the ballast valve is open and will remain open during operation.
- Close the shut-off valve in the suction line.
- Operate the vacuum pump with the shut-off valve in the suction line closed for approx. half an hour, so that the operating temperature will rise to approx. 75℃.

At process start:

- Open the shut-off valve in the suction line.

At process end:

- Close the shut-off valve in the suction line.
- Operate the vacuum pump for approx. half an hour.

Maintenance

WARNING

In case the vacuum pump conveyed gas that was contaminated with foreign materials which are dangerous to health, harmful material can reside in filters.

Danger to health during inspection, cleaning or replacement of filters .

Danger to the environment .

Personal protective equipment must be worn during the handling of contaminated filters.

Contaminated filters are special waste and must be disposed of separately in compliance with applicable regulations

CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 70℃.

Risk of burns!

Prior to action that requires touching of the vacuum pump, let the vacuum pump cool down.

In case of oil draining, let the vacuum pump cool down for no more than 20 minutes.

Prior to disconnecting connections make sure that the connected pipes/lines are vented to atmospheric pressure.

Maintenance Schedule

NOTE: The maintenance intervals depend very much on the specific operating conditions. The intervals given below shall be considered as starting values which should be shortened or extended as appropriate. Particularly heavy duty operation, such like high dust loads in the environment or in the process gas, other contaminant or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

Daily:

- Check the level and the color of the oil (see “Checking the Oil” in Page 9).

Weekly:

Check the vacuum pump for oil leaks; in case of leaks have the

vacuum pump repaired (GREENCO service).

Monthly:

- Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- Check the function of the exhaust filters (120) (see “Exhaust Filters” in Page 11).

In case an inlet air filter is installed:

◆ Check the inlet air filter (261), or replace the filter when necessary.

In case of operation in a dusty environment:

◆ Follow the requirements in Every 6 Months in page 9.

Every 6 Months:

- Make sure that the vacuum pump is shut down and locked

against inadvertent start up.

- Make sure that the housing is free from dust and dirt, clean if necessary.
- Clean the fan cowlings, fan wheels, ventilation protection screen and cooling fins.

Yearly:

- Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- Replace the exhaust filters (120) (see “Exhaust filters” in page 11).

In case an inlet filter is installed：

◆ Replace the inlet air filter cartridge

Check the inlet air filter (261), or clean the filter when necessary.

In case a gas ballast (440) with sintered metal filter is installed:

◆ Clean with compressed air or replace the sintered metal filter.

In case a gas ballast (440) with paper filter is installed:

◆ Replace the paper filter cartridge.

Every 500 - 2000 Operating hours: （see “Oil Life” in page 9）

- Change the oil, replace the oil filter(s) (100) and clean the float valve (194) (see “Oil and Oil Filter Change” in page 10).

If the vacuum pump is equipped with float valve (200) and oil return pipe:
Check the float valve (2000) (See Check float valve in page 10).

Checking the oil

Checking the level

- Make sure that the oil has collected at the bottom of the oil separator (75)
- Read the level on the sight glass (83)

In case the level has dropped underneath the MIN-marking:

◆ Top up oil (see “Topping up Oil” in page 9)

In case the level exceeds the MAX-marking:

◆ Check the dilution with condensates. Replace the vacuum pump oil and check process;

◆ Replace gas ballast when necessary (carried out by GREENCO), and follow the requirements in Conveying Condensable Steams in page 8.

If the gas ballast is used appropriately, the oil level exceeds MAX marking:

Clean with compressed air or replace the sintered metal filter (applicable to 1RV0020-1RV0040).
Replace filter cartridge (1RV0063 and 1RV0100).

Topping up Oil

NOTE: Under normal conditions there should be no need to top up oil during the recommended oil change intervals. A significant level drop indicates a malfunction (see “Troubleshooting” in page 13).

NOTE: During operation the exhaust filter gets saturated with oil. It is therefore normal that the oil level will drop slightly after replacement of the exhaust filter.

CAUTION

Filling oil through the suction connection/gas inlet (260) will result in breakage of the vanes (22) and destruction of the vacuum pump.
Oil may be filled through the oil fill port only (88).

CAUTION

During operation the oil separator is filled with hot, pressurised oil mist.
Risk of injury from hot oil mist with open oil inlet plug .
Remove the oil inlet port (88) only the vacuum pump is stopped.
The vacuum pump must only be operated with the oil fill plug (88 firmly inserted.

- Make sure that the vacuum pump is shut down and locked against inadvertent start up. Remove the oil fill plug (88).
- Top up oil until the level reaches the middle of the oil sight glass (83).
- Add the special oil of Greenco and make sure that the level is in the middle of the oil sight glass (83).
- Make sure that the sealing seat (89) on the oil fill plug (88) is undamaged, if necessary replace the oil fill plug.
- Firmly reinsert the oil fill plug (88) with its sealing seat (89).

Checking the Colour of the Oil

NOTE: The oil should be light, either transparent, a little foamy or a little tarnished. A milky discolouration that does not vanish after sedation of the oil indicates contamination with foreign material. Oil that is either contaminated with foreign material or burnt must be changed (see “Oil Change” in page 10).

If the gas ballast is installed and applied properly, the oil is still contaminated by water or other condensed matters:

◆ Replace filter cartridge.
◆ Clean with compressed air or replace sintered metal filter.

Oil Life

The oil life depends very much on the operating conditions. A clean and dry air stream and operating temperatures below 100℃ are ideal. Under these conditions the oil and the oil filter (100) shall be changed every 500-2000 operating hours or after half a year.

Under very unfavourable operating conditions the oil life can be less than 500 operating hours. Extremely short life times indicate malfunctions (see “Troubleshooting” in page 13) or unsuitable operating conditions, though.

Choose synthetic oil over mineral oil for a longer oil life. Contact Greenco to select the suitable oil for your process.

If there is no experience available with regard to the oil life under the prevailing operation conditions, it is recommended to have an oil analysis carried out every 500 operating hours and establish the change interval accordingly.

Oil and Oil Filter Change

WARNING

In case the vacuum pump conveyed gas that was contaminated with harmful foreign material the oil will be contaminated with harmful material.

Danger to health during the changing of contaminated oil.

Danger to the environment .

Personal protective equipment must be worn during the changing of contaminated oil.

Contaminated oil is special waste and must be disposed of separately in compliance with applicable regulations.

Draining Used Oil

NOTE: After switching off the vacuum pump at normal operating temperature wait no more than 20 minutes to ensure the hot oil is drained.

- Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- Make sure that the vacuum pump is vented to atmospheric pressure.
- Put a drain tray underneath the oil drain port (95)
- Remove the oil drain plug (95), drain the oil

When the oil stream dwindles:

- Close the oil drain plug (95).
- Switch the vacuum pump on for a few seconds.
- Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- Remove the oil drain plug (95) again to drain up the residual oil.
- Make sure that the sealing seat (96) on the oil drain plug (95) is undamaged, if necessary replace the sealing seat.
- Firmly reinsert the oil drain plug (95) on the sealing seat (96).
- Dispose of the used oil in compliance with applicable regulations.

Flushing the vacuum pump

WARNING

Degraded oil can choke pipes and coolers.

Risk of damage to the vacuum pump due to insufficient lubrication .

Risk of explosion due to overheating .

If there is a suspicion that deposits have gathered inside the vacuum pump the vacuum pump shall be flushed.

- Make sure that all the used oil is drained.
- Make sure that the used oil filter (100) is still in place.
- Create respectively 2 litres of flushing agent (0.45 litres for 1RV0020; 1L for 1RV0025 and 1RV0040) from 50 percent oil and 50 percent paraffin or diesel fuel/fuel oil.
- Make sure that the oil drain plug (95) is reinserted correctly.
- Remove the oil fill plug (88).
- Fill in the flushing agent.
- Firmly reinsert the oil fill plug (88).
- Close the suction line.
- Run the vacuum pump for at least half an hour.
- Drain the flushing agent and dispose of it in compliance with applicable regulations.

NOTE: Due to the use of paraffin and even more in case of using Diesel fuel/fuel oil, unpleasant odour can occur after recommissioning. If this is a problem, Diesel fuel/fuel oil should be avoided and the vacuum pump be run at idle in a suitable place until the unpleasant odour vanishes.

Cleaning of the float valve

(Applicable only to the the vacuum pump with float valve and oil return pipe)

Note: Make sure the float valve (200) works normally, and the vacuum pump generates limit pressure; the prevent the oil from spilling out from discharge port (155).

- Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- Before removing the pipes, make sure the pipe is connected to open air.
- When necessary, remove the exhaust pipe.
- Take off the exhaust cover (155）.
- Drain up the oil in the cavity of float valve with suction pipe or used oil collector.
- Loosen the screws (341) and remove the fan cover (340).

Note: When removing oil return pipe (195), a small amount of oil will be left there; mop it off; be careful not to damage the sealing parts of joints.

- Remove the joints between oil return pipe (195) and oil separator (75); slightly bend the oil return pipe.
- Unscrew the two screws on float valve (200); take out the float valve from oil separator (75).
- Check if the float valve (200) is clean or damaged; if necessary, clean it with compressed air.
- Make sure the flanges of float valve (200) are installed with sealing rings in good condition; if necessary, replace the sealing ring.
- Install the float valve (200) in the right position of oil separator (75), and fix the float valve with two screws and locking washer.
- Connect the oil return pipe (195) and oil separator (75) with screws and sealing washers.
- Tighten the screws (341) to secure the fan cover (340).

If the exhaust filter (120) needs no replacement:

- ◆ Make sure the sealing ring (141) of exhaust cover (155) is clean and intact; if necessary, replace the sealing ring (141).
- ◆ Refit the exhaust cover (155) with sealing ring (141) with hex screws (146); fasten the washers on the oil separator (75).
- ◆ When necessary, connect the exhaust pipe.

Replacing the Oil Filter

- Make sure that the entire used oil is drained.
- Remove the oil filter (100)
- Apply a drop of fresh oil on the sealing ring of the new oil filter (100).
- Mount the new oil filter (100) and tighten it by hand.
- Dispose of the used oil filter in line with relevant regulations.

Filling in Fresh Oil

- Keep oil acc. to the table “Oil” ready.

NOTE: The amount given in these operating instructions is a guide.
The oil sight glass (83) indicates the actual amount to be filled in.

- Make sure that the oil outlet plug (95) is firmly inserted.

CAUTION
Filling oil through the suction connection/gas inlet (260) will result in breakage of the vanes (22) and destruction of the vacuum pump.
Oil may be filled through the oil fill port only (88).

- Remove the oil fill plug (88).

Fill in Greenco oil.

- Make sure that the level is between the MIN and the MAX-markings of the oil sight glass (83).
- Make sure that the sealing ring (89) is inserted into the oil inlet plug (88) and undamaged, replace if necessary.
- Firmly reinsert the oil inlet plug (88) together with the sealing ring (89).

Exhaust Filter

Check during operation

Greenco recommends the use of a filter pressure gauge (available as accessory, see “Accessories” in page 21). Without filter pressure gauge the filter resistance shall be assessed on the basis of the drive motor current drawn.

Version with filter pressure gauge:

- Remove the gas inlet pipe from the inlet joint (260).
- Make sure the pump is running.
- Check that the indication of the filter pressure gauge is in the green range.
- Reinstall the inlet pipe to the inlet (260).

Version without exhaust filter pressure gauge:

Make sure the vacuum pump is running

- Check that the indication of the filter pressure gauge is in the usual range.
- Version with oil return valve (280):

NOTE: The discharge air will also contain oil if the vacuum pump is operated without interruption for a too long period (see “Operation Notes” in page 8).

- Check that the discharge air is free from oil

Assessment

If the indication of the filter pressure gauge is in the red field or the drive motor draws too much current and/or the pump flow rate has dropped, then the exhaust filters (120) are clogged and must be replaced.

NOTE: Exhaust filters cannot be cleaned successfully. Clogged exhaust filters must be replaced with new ones.

If the filter pressure gauge indicates a lower pressure than usual, or
the drive motor draws less current than usual, the exhaust filters (120) can be clogged and must be replaced.

If the discharge air contains oil, the exhaust filters (120) can be clogged or broken through and, if applicable, must be replaced.

Change of the exhaust filters

WARNIGN
In case the vacuum pump conveyed gas that was contaminated with foreign materials which are dangerous to health, harmful material can reside in filters.
Danger to health during inspection, cleaning or replacement of filters .
Danger to the environment .
Personal protective equipment must be worn during the handling of contaminated filters.
Contaminated filters are special waste and must be disposed of separately in compliance with applicable regulations.

CAUTION
Be ware that the spring (125) of filter may pop out when dismantling or installing exhaust filter.
Risk of eye injury .
Wear goggles when dismantling or installing spring (125) of exhaust filter.

Removing the exhaust filters

- Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- Prior to disconnecting pipes/lines make sure that the connected pipes/lines are vented to atmospheric pressure.
- Remove the discharge line, if necessary.
- Remove the discharge cover (155) from the oil separator (75).
- Release the spring elements (125) by unscrewing the screws (126), but do not remove them.
- Press down the filter spring (125) in the slot with special tools and rotate.
- Remove the exhaust filter spring (125) from the oil separator (75).
- Take the exhaust filter (120) out of the oil separator (75).

Inserting the Exhaust Filters

CAUTION

The non-OEM spares market offers exhaust filters that are geometrically compatible with Greenco-vacuum pumps, but do not feature the high retention capacity of genuine Greenco-exhaust filters and deteriorate the service life and the efficiency of the vacuum pump due to their increased back pressure.

Increased risk of damage to health .

Adverse effect on efficiency and service life .

In order to keep the emission on the lowest possible level and to preserve efficiency and service life only genuine Greenco-exhaust filters shall be used.

- Insert the new exhaust filters (120) with the new o-rings.
- Be sure to fit the exhaust filters (120) and ensure it is installed in the correct position of oil separator (75).
- Make sure the top end of the bolt in the center of exhaust filter spring (125) projects about 2-5 threads.
- With special tools, mount the exhaust filter spring (125), fitting the end in the socket on the oil separator (75); tighten the screws in the slots of exhaust filters (120).
- Fasten the screws on the exhaust filter spring (125), and make the nuts touch the steel strip on the spring.
- Make sure the sealing seat (141) of discharge cover (155) is clean and intact; replace the damaged one.
- Mount the discharge cover (155) with sealing seat (141), hex bolts (146) and locking washers on the oil separator (75).
- When necessary, connect the discharge pipeline

NOTE: During operation the exhaust filters get saturated with oil. It is therefore normal that the oil level will drop slightly after replacement of the exhaust filters.

Overhaul

CAUTION

In order to achieve best efficiency and a long life the vacuum pump was assembled and adjusted with precisely defined tolerances.

This adjustment will be lost during dismantling of the vacuum pump.

It is therefore strictly recommended that any dismantling of the vacuum pump that is beyond of what is described in this manual shall be done by the Greenco service.

WARNING

In case the vacuum pump conveyed gas that was contaminated with foreign materials which are dangerous to health, harmful material can reside in oil and condensates.

Contaminating matters may reside in air bores, gaps and internal parts of vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

Prior to shipping, the vacuum pump must imperatively be decontaminated and the degree of contamination must be documented in a declaration of decontamination (“Declaration of Decontamination”).

Removal from Service

Temporary Removal from Service

- Prior to disconnecting pipes/lines make sure that all pipes/lines are vented to atmospheric pressure.

Recommissioning

CAUTION

Vanes (22) can stick after a long period of standstill.

Risk of vane breakage if the vacuum pump is started with the drive motor .

After longer periods of standstill the vacuum pump shall be turned by hand.

After longer periods of standstill:

- ◆ Make sure that the vacuum pump is shut down and locked against inadvertent start up.
- ◆ Remove the cover around the fan of the drive motor (400).
- ◆ Slowly rotate the fan wheel by hand several revolutions in the intended direction of rotation [see stuck on or cast arrow (431).
- ◆ Mount the cover around the fan wheel of the drive motor (400).

If deposits could have gathered in the vacuum pump:

- ◆ Flush the vacuum pump (see “Maintenance” in page 8)
- Observe the chapter “Installation and Commissioning” (page 5)

Dismantling and Disposal

WARNING

In case the vacuum pump conveyed gas that was contaminated with harmful foreign material the operating fluid and the exhaust filter(s) will be contaminated with harmful material.

Harmful material can reside in pores, gaps and internal spaces of the vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

During dismantling of the vacuum pump personal protective equipment must be worn.

The vacuum pump must be decontaminated prior to disposal.

Prior to shipping, the vacuum pump must imperatively be decontaminated.

Handle the oil, oil filter and exhaust filter separately according to applicableregulations.

CAUTION

Used oil, used exhaust filters and used oil filters are special waste and must be disposed of in compliance with applicable regulations.

CAUTION

Be ware that the spring (125) of filter may pop out when dismantling or installing exhaust filter.

Risk of eye injury.

Wear goggles when dismantling or installing spring (125) of exhaust filter.

- Remove the exhaust filter (120) (see “Exhaust Filter” in page 11).
- Drain the oil.
- Remove the oil filter (100).
- Make sure that materials and components to be treated as special waste have been separated from the vacuum pump.
- Make sure that the vacuum pump is not contaminated with harmful foreign material.

As declared in this manual, the latest technology is adopted, so the used material of vacuum pump is non-hazardous.

- Dispose of the used oil in compliance with applicable regulations.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the vacuum pump as scrap metal.

Troubleshooting

WARNING

Risk of electrical shock, risk of damage to equipment.

Electrical installation work must only be executed by qualified personnel that knows and observes the following regulations: -IEC 364 or CENELEC HD 384 or DIN VDE 0100, respectively,

-IEC-Report 664 or DIN VDE 0110,

-BGV A2 (VBG 4) or equivalent national accident prevention regulation.

CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 70℃.

Risk of burns!

Let the vacuum pump cool down prior to a required contact or wear heat protection gloves.

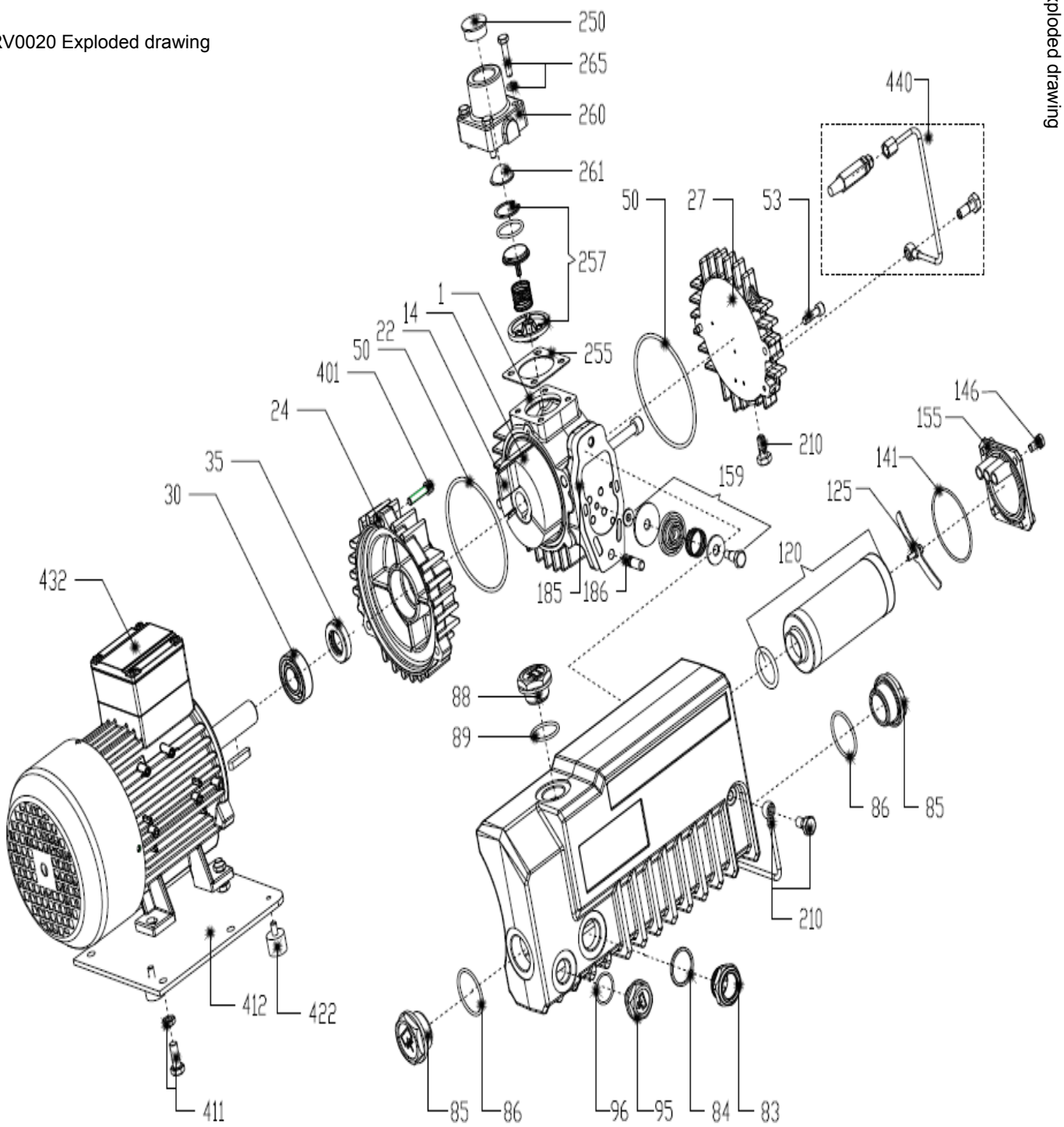
Fault	Possible Cause	Remedy
The vacuum pump does not reach the usual pressure The drive motor draws a too high current (compare with initial value after commissioning) Evacuation of the system takes too long	The vacuum system or suction line is not leak-tight	Check the hose or pipe connections for possible leak
	If installed with vacuum release valve/regulating system, vacuum release valve/regulating system is faulty or damaged	Adjust, repair or replace parts
	Contaminated oil (the most common cause)	Drain the oil (see “Maintenance” in page 8)
	No or not enough oil in the reservoir	Top up oil (see “Maintenance”in page 8)
	The exhaust filters (120) are partly clogged	Replace the exhaust filters (120) (see “Maintenance”in page 8)
	The oil filter(100) is partly clogged (the oil flows through the bypass only, the oil does not get filtered any more)	Replace the oil filter (100) (see “Maintenance”in page 8)
	Mesh screen (261) on the suction connection (260) is partly clogged	Clean the mesh screen (261) If cleaning is required too frequently install a filter upstream
	In case an inlet filter is installed on the suction connection (260): The filter on the suction connection (260) is partly clogged	Clean or replace the inlet filter, respectively
	Partial clogging in the suction, discharge or pressure line	Remove the clogging
	Long suction, discharge or pressure line with too small diameter	Use larger diameter
	The valve disk of the inlet non-return valve is stuck in closed or partially open position	Disassemble the inlet valve, clean the mesh screen (261) and the valve (257) as required and reassemble
	The oil tubing is defective or leaking The oil return pipe (195) is broken	Tighten the connections Replace the connections and/or the tubing (replace with identically dimensioned parts only)
	Version with float valve (200) and oil return pipe: float ball of float valve (200) stuck at the outlet	Roll the float valve (200); replace it when necessary (Check float valve in page 10)
	A shaft seal is leaking	Replace the shaft sealing ring (Greenco service)
	The exhaust valve (159) is not properly seated or stuck in partially open position	Disassemble and reassemble the exhaust valve(159) (Greenco service)
	A vane(22) is blocked in the rotor or otherwise damaged	Free the vanes (22) or replace with new ones (Greenco service)
	The radial clearance between the rotor (14) and the cylinder (1) is no longer adequate	Readjust the vacuum pump (Greenco service)
	Internal parts worn or damaged	Repair the vacuum pump (Greenco service)
The gas conveyed by the vacuum pump smells displeasing	Process components evaporating under vacuum readily volatile and thus gaseous components of the oil, particularly right after an oil change.	Check the process, if applicable Use a different type of oil, if applicable Oil (Maintenance in page 8)
	Oil not changed for a long time	Replace oil, including cleaning and replacing oil filter (Maintenance in page 8)
	Clogged exhaust filter (120) and oil turning black	Flush pump Replace oil filter (100) Replace exhaust filter (120) Fill in fresh oil (Maintenance in page 8) If the service life of oil is short, use oil of desirable

		thermal insulation (Oil in page 22) or replace cooling system
	Foreign matters in the pump, damaged vane (22) or bearing	Repair the vacuum pump (Greenco service)
The vacuum pump runs very noisily	Defective bearings	Repair the vacuum pump (Greenco service)
	Worn coupling element (310)	Replace the coupling element (310)
	Stuck vanes (22)	Repair the vacuum pump (Greenco service) Use only approved oils (see “Oil” in page 22) and change more frequently
The vacuum pump runs very hot (the oil sump temperature shall not exceed 100 ℃)	Insufficient air ventilation	Make sure that the cooling of the vacuum pump is not impeded by dust/dirt Clean the fan cowlings, fan wheels, ventilation screens and cooling fins Install the vacuum pump in a narrow space only if sufficient ventilation is ensured On a vacuum pump with oil-cooler: Clean the intermediate spaces of the finned tube
	Ambient temperature too high	Observe the permitted ambient temperatures
	Temperature of the inlet gas too high	Observe the permitted temperatures for the inlet gas
	The exhaust filter(l20) is partially clogged	Replace the exhaust filters (120)
	The oil filter (100) is partially clogged (the oil flows through the bypass only, the oil does not get filtered any more)	Replace the oil filter (100) (see “Maintenance” in page 8)
	Not enough oil in the reservoir	Top up oil
	Oil burnt from overheating	Flush the vacuum pump Replace the oil filter (100) Replace the exhaust filters (120) Fill in new oil (see “Maintenance” in page 8) In case the oil life is too short: use oil with better heat resistance (see “Oil” in page 22)or retrofit cooling
	Mains frequency or voltage outside tolerance range	Provide a more stable power supply
	The mesh screen or filter clogged. The suction connection, discharge or pressure pipe clogged	Remove the clogging
	Long suction, discharge or pressure line with- too small diameter	Use larger diameter
The vacuum pump fumes at the exhaust side or expels oil droplets through the outlet The oil level drops	The exhaust filters (120) are not properly seated	Check the proper position of the exhaust filters (120) (see “Maintenance” in page 8)
	The O-rings from the exhaust filters are missing or damaged	Add or replace the O-rings (see “Maintenance”in page 8)
	The exhaust filters (120) show cracks	Replace the exhaust filters (120 (see “Maintenance”in page 8)
	The exhaust filters (120) are clogged with fo- reign matter NOTE: The saturation of the exhaust filters- with oil is no fault and does not impair the function of the exhaust filters! Oil dropping down from the exhaust filters is returned to the oil circulation.	Replace the exhaust filters (120) (see “Maintenance” in page 8)
	Version with oil return valve (280): if pump continuously run Note: oil separator shows no fault; oil returns to oil	Periodically turn off vacuum pump and check the oil return valve (280)

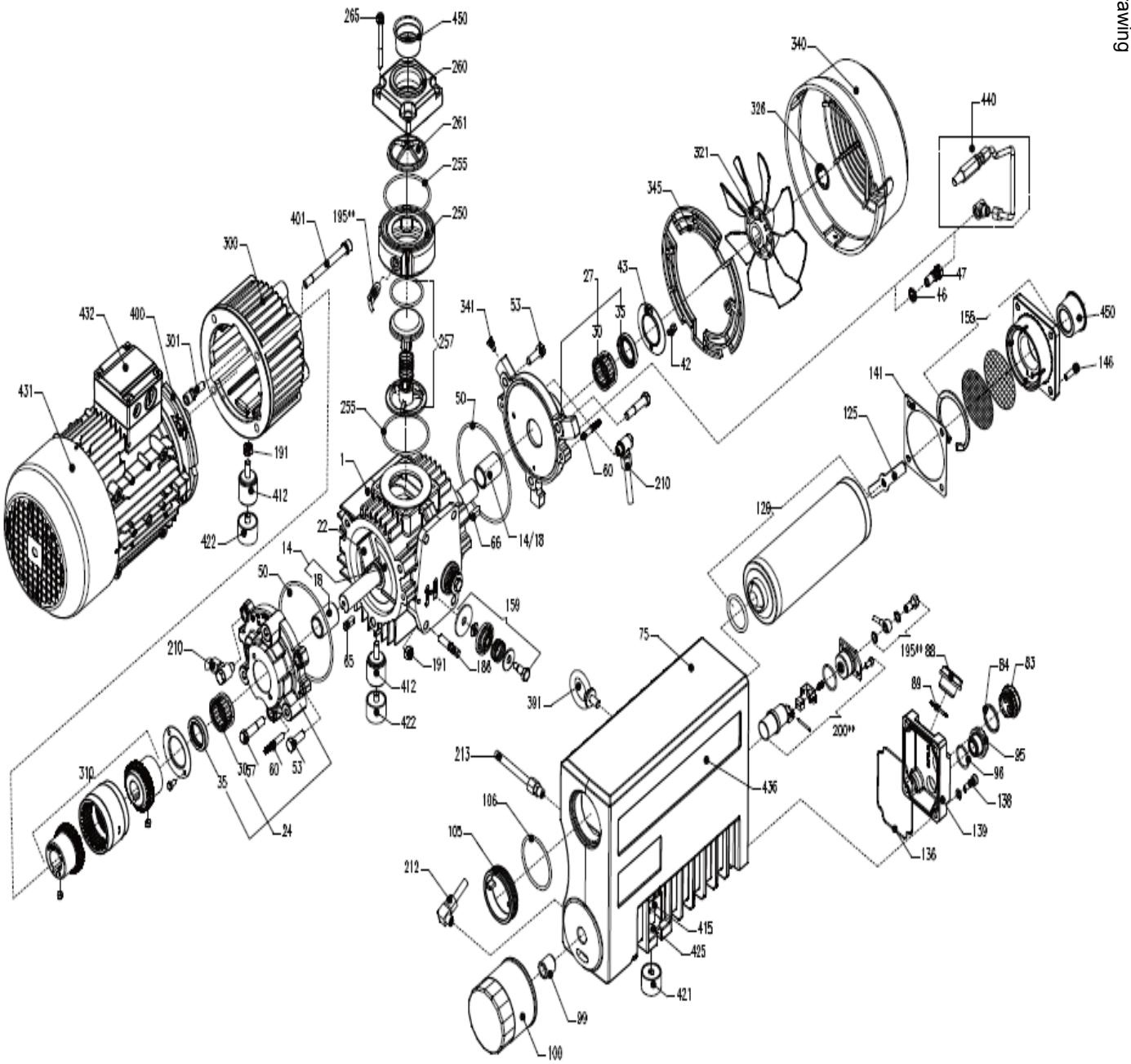
	separator and no gaseous matter generates.	
The vacuum pump does not start	The drive motor (400) is not supplied with the correct voltage or is overloaded	Supply the drive motor (400) with the correct voltage
	The drive motor starter overload protection is too small or trip level is too low	Compare the trip level of the drive motor starter overload protection with the data on the nameplate Correct if necessary In case of high ambient temperature: Set the trip level of the drive motor starter overload protection 5 percent above the nominal drive motor current
	One of the fuses has blown	Check the fuses
	Version with AC drive motor: capacitor damaged	Repair motor (Greenco service)
	The connection cable is too small or too long causing a voltage drop at the vacuum pump	Use sufficiently dimensioned cable
	The vacuum pump or the drive motor is blocked	Make sure the drive motor is disconnected from the power supply Remove the fan cover Try to turn the fan by hand If the unit vacuum pump/drive motor is still frozen,remove the drive motor and check the drive motor and the vacuum pump separately If the vacuum pump is blocked: Repair the vacuum pump (Greenco service)
	The drive motor (400) is defective	Replace the drive motor (Greenco service)
The vacuum pump is blocked	Solid foreign matter has entered the vacuum pump	Repair the vacuum pump (Greenco service) Make sure the suction line is equipped with a mesh screen If necessary additionally provide a filter
	Corrosion in the vacuum pump from remaining condensate	Repair the vacuum pump (Greenco service) Check the process Observe the chapter “Installation and Commissioning, Operating Notes, Conveying Condensable vapors” in page 8
	The vacuum pump runs in the wrong direction in the case that it is equipped withi three-phase motor	Repair the vacuum pump (Greenco service) When connecting the vacuum pump make sure the vacuum pump will run in the correct direction (see “Installation” in page 6)
	After shutting down the vacuum pump the vacuum system exerted under pressure onto the pump chamber which sucked back excessive oil from the oil separator into the pump chamber When the vacuum pump was restarted too much oil was enclosed between the vanes (22) Oil could not be compressed and thus broke a vane (22)	Repair the vacuum pump (Greenco service) Make sure the vacuum system will not exert underpressure onto the shut-down vacuum pump, if necessary provide an additional shut-off valve or non-return valve
	Condensate ran into the pump chamber When the vacuum pump was restarted too much condensate was enclosed between the vanes (22) Condensate could not be compressed and thus broke a vane (22)	Repair the vacuum pump (Greenco service) Make sure no condensate will enter the vacuum pump, if necessary provide a drip leg and a drain cock Drain condensate regularly
The vacuum pump starts, but labours or runs noisily or rattles The drive motor draws a too high current (compare with initial value after commissioning)	Connection(s) in the drive motor terminal box are defective Not all drive motor coils are properly connected The drive motor operates on two phases only	Check the proper connection of the wires against the connection diagram Tighten or replace loose connections
	The vacuum pump runs in the wrong direction	Verification and rectification see “Installation and

		Commissioning" in page 5，correct if necessary
	Standstill over several weeks or months	Let the vacuum pump run warm with inlet closed
	Oil viscosity is too high for the ambient temperature	Use synthetic oil, if necessary use oil of the next lower viscosity class (CAUTION: operation with too low viscosity can cause chatter marks inside the cylinder) Warm up the oil with a heating prior to starting up the vacuum pump or, make sure that the vacuum pump runs in intervals in order not to let it get too cold.
	Improper oil quantity, unsuitable oil type	Use the proper quantity of one of the recommended oils (see "Oil" in page 22, Oil change see "Maintenance")
	Over ten hours, the oil accumulates in the upper chamber of oil separator (75); it can spill out along with the gas discharged when it reaches a certain amount	If it is intact, and help the oil flow from the upper chamber of oil separator (75) to the bottom chamber after the pump is shut down (Oil circulation in page 3)
	For the pump equipped with oil return valve (280): oil return valve stop working or clogged (correct operation mode: oil flows into the oil return valve, and it closes; the vacuum generates and it opens. Note: do not suck the oil return valve with mouth0	Clean or replace oil return valve (280)
	For the vacuum pump equipped with float valve (200) and oil return pipe: float valve (200) stuck at opening	Roll the float valve (200) or replace it when necessary (Checking float valve in page 10)
	Oil return pipe (195) clogged or damaged	Clean the clogged oil return pipe (195); replace the damaged oil return pipe (195); and fill in oil (request service from Greenco when necessary)
The oil is black	Oil change intervals are too long The oil was overheated	Flush the vacuum pump Replace the oil filter(100) Replace the exhaust filters (120) Fill in new oil (see "Maintenance" in page 8) In case the oil life is too short: use oil with better heat resistance (see "Oil" in page 22) or retrofit cooling
The oil is watery and coloured white	The vacuum pump aspirated water or significant amounts of humidity For the vacuum pumps equipped with gas ballast: clogged filter cartridge	Flush the vacuum pump Replace the oil filter(100) Replace the exhaust filters (120) Flush the vacuum pump (see "Maintenance"in page 8) Modify the operational mode (see "Installation and Commissioning, Operating Notes, Conveying Condensable vapors"in page 8) For the pump equipped with gas ballast (440): replace filter
The oil is resinous and/or sticky	Improper oil type, perhaps in confusion	Flush the vacuum pump Replace the oil filter(100) Replace the exhaust filters (120) Fill in new oil (see "Maintenance"in page 8) Make sure the proper oil is used for the application
The oil foams	Mixing of incompatible oils	Flush the vacuum pump Replace the oil filter(100) Replace the exhaust filters (120) Fill in new oil (see "Maintenance" in page 8) Make sure the proper oil is used for the application

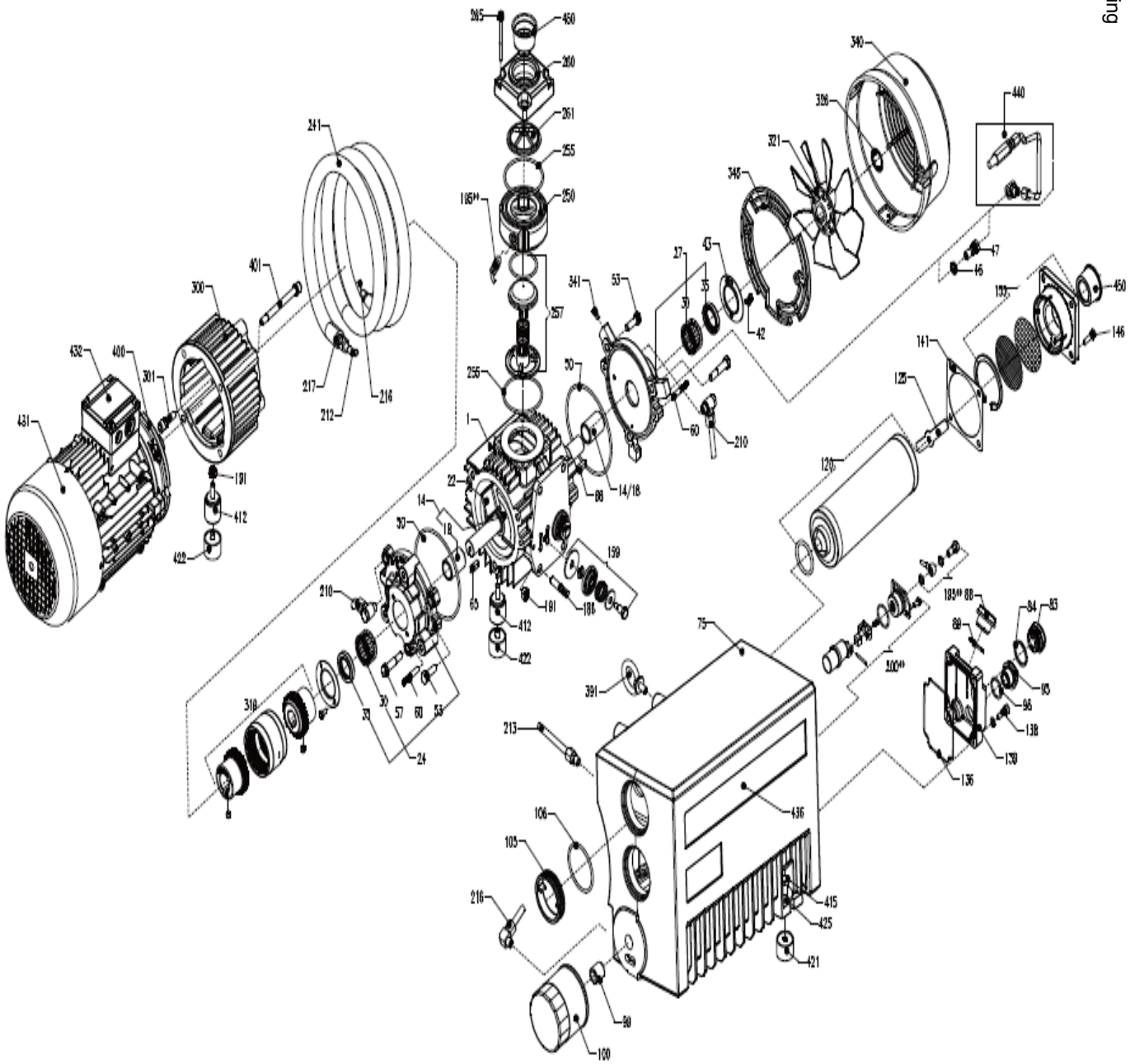
1RV0020 Exploded drawing



1RV0025-0040 Exploded drawing



1RV0063-0100 Exploded drawing



Spare parts

NOTE: When ordering spare parts or accessories according to the table below please always quote the type and the serial no. of the vacuum pump. This will allow GREENCO service to check if the vacuum pump is compatible with a modified or improved part.

The exclusive use of genuine spare parts and consumable is a prerequisite for the proper function of the vacuum pump and for the granting of warranty, guarantee or goodwill.

Contact details for GREENCO service and spare parts

Zhejiang Greenco Industry Co,. Ltd.

ADD: Danya Industrial Zone, Zeguo Town, Wenling, Taizhou City, Zhejiang Province

Tel.: +86 0576 86403999

This parts list applies to a typical configuration of the standard 1RV0160-0200 vacuum pump. If you have any request for special spare parts, please contact us.

Pos.	Part	Qt	Part No.
1	Pump (1RV0020)	1	
1	Pump (1RV0040)	1	
14	Rotor with sleeve (1RV0020)	1	
14	Rotor with sleeve (1RV0040)	1	
18	Sleeve	2	
22	Vanes(1RV0020)	3	
22	Vanes(1RV0040)	3	
24	End cap A	1	
27	End cap B	1	
30	Needle bearing	2	
35	Shaft seal	2	
42	Support ring	2	
43	Hex bolt	4	
46	Sealing ring	1	
47	Plug	1	
50	O-ring	2	
53	Hex bolt	6	
57	Parallel pin	1	
60	Taper pin	4	
65	Shaft pin	1	
66	Shaft pin	1	
75	Oil mist separator (with float valve and oil return oil)	1	
75	Oil mist separator (with oil return valve)	1	
83	Oil sight glass	1	
84	Seal of sight glass	1	
88	Plug	1	
89	O-ring	1	
95	Drain plug	1	
96	O-ring	1	
99	Threaded joint		
100	Oil filter		
105	End cap of exhaust filter		
106	Seal		
107	Hex bolts		
122	Exhaust filter with O-rings		
125	Exhaust filter springs		
136	Seal		
138	Hex bolt		
139	Maintenance cover		
141	Seal		
146	Hex bolt		
155	End cap of exhaust filter	1	
159	Discharge valve	2	
185	Oil separator seal	1	
186	Studs	4	
191	Hex nuts	4	
195	Oil return pipe	1	
200	Float valve	1	
210	Oil pipe (1RV0020)	1	
210	Oil pipe (1RV0040)	1	
250	Inlet flange base	1	
255	O-ring	2	
257	Non-return valve	1	
260	Air inlet flange	1	
261	Inlet filter	1	
265	Hex bolt	4	
280	Oil return valve	1	
300	Motor flange	1	
301	Hex bolt	3	
310	Coupling	1	
312	Coupling sleeve	1	
315	Protective sleeve	3	
321	Axial flow fan (1RV0020)	1	
321	Axial flow fan (1RV0040)	1	
326	Chain tooth sleeve	1	
340	Fan cover	1	
341	Fixing screw	2	
345	Protection screen	1	
391	Eyebolt	1	
400	Motor	1	
401	Hex bolt	2	
411	Hex bolt	2	
412	Anchor bolts	1	
415	Hex bolt	1	
421	Rubber anchor bolts	1	
422	Rubber anchor bolts	2	
425	Washer	1	
431	Arrow indicator	1	
432	Label-before installation	1	
434	Label-surface heating	1	
436	GREENCO label	1	
440	Gas ballast (optional)	1	
440	Adjustable Gas ballast (optional)	1	

This parts list applies to a typical configuration of the standard 1RV0063-0100 vacuum pump. If you have any request for special spare parts, please contact us.

Pos.	Part	Qt	Part No.
1	Pump (1RV0063F)	1	
1	Pump (1RV0100F)	1	
14	Rotor with sleeve (1RV0063F)	1	
14	Rotor with sleeve (1RV0100F)	1	
18	Sleeve	2	
22	Vanes(1RV0063F)	3	
22	Vanes(1RV0100F)	3	
24	End cap A	1	
27	End cap B	1	

30	Needle bearing	2	
35	Shaft seal	2	
42	Support ring	2	
43	Hex bolt	4	
46	Sealing ring	1	
47	Plug	1	
50	O-ring	2	
53	Hex bolt	6	
57	Parallel pin	1	
60	Taper pin (1RV0063F)	4	
60	Taper pin(1RV0100F)	4	
65	Shaft pin	1	
66	Shaft pin	1	
75	Oil mist separator (with float valve and oil return oil)	1	
75	Oil mist separator (with oil return valve)	1	
83	Oil sight glass	1	
84	Seal of sight glass	1	
88	Plug	1	
89	O-ring	1	
95	Drain plug	1	
96	O-ring	1	
99	Threaded joint	1	
100	Oil filter	1	
105	End cap of exhaust filter	1	
106	Seal	1	
107	Hex bolts	8	
122	Exhaust filter with O-rings	2	
125	Exhaust filter springs	2	
136	Seal	1	
138	Hex bolt	4	
139	Maintenance cover	1	
141	Seal	2	
146	Hex bolt	8	
155	End cap of exhaust filter	2	
159	Discharge valve	2	
185	Oil separator seal	1	
186	Studs	4	

Wearing parts kit

Wearing parts kit	Description	Part No
Maintenance kit	Including oil filters, exhaust filters and related sealing parts.	
Sealing kit	Including all sealing parts. (Excluding the sealing parts of the float valve.)	
Overhaul kit (1RV0020)	Including maintenance group briefing, sealing kit and all overhaul accessories. (Excluding the float valve and its sealing parts.)	
Overhaul kit (1RV0040)	Including maintenance group briefing, sealing kit and all overhaul accessories. (Excluding the float valve and its sealing parts.)	
Overhaul kit (1RV0063)	Including maintenance group briefing, sealing kit and all overhaul accessories. (Excluding the float valve and its sealing parts.)	
Overhaul kit (1RV0100)	Including maintenance group briefing, sealing kit and all overhaul accessories.(Excluding the float valve and its sealing parts.)	

Accessories

Accessories	Description	Part No.
Inlet filter	Located at the inlet side of the vacuum pump, mounted vertically, equipped with paper filter element for separating solids.	
Inlet filter	Located at the inlet side of the vacuum pump, mounted vertically, equipped With polyester filter for separating solids.	
Inlet filter	Located at the inlet side of the vacuum pump, mounted horizontally, fitted with paper filter element for separating solids.	
Inlet filter	Located at the inlet side of the vacuum pump, mounted horizontally, fitted with polyester filter for separating solids.	
Filter pressure gauge	Monitoring the exhaust filter saturation.	
Vacuum regulating unit	Adjustable to the required working pressure, Connect the thread R1 1^{11}	
Gas ballast	Removing condensable gas, equipped with a paper filter.	
Gas ballast, adjustable	Extracting condensable gas, equipped with a paper filter and ball valves.	
Motor safety switch	Adjustment range: 1.6-2.4A, 3Ph.	-
Motor safety switch	Adjustment range: 2.4-4.0A, 3Ph.	
Motor safety switch	Adjustment range: 4.0-6.0A, 3Ph.	
Motor safety switch	Adjustment range: 6.0-10.0A, 3Ph.	
Motor safety switch	Adjustment range: 10.0-16.0A, 3Ph.	
Motor safety switch	Adjustment range: 10.0-16.0A, 1Ph.	
Oil solid separator	Preventing the suction of solid, or liquid objects via inlet	
Liquid separator	Preventing suction of condensate and liquid via the inlet.	
Liquid separator	Preventing suction of the condensate and liquid via inlet, automatically discharging.	
Cyclone liquid separator	Extracting gas and liquid mixed in gas.	

Oil

Denomination	VM 100	VE 101
ISO-VG	100	100
Base	Mineral oil	Synthetical oil
Density [g/cm^3]	0.888	0.96
Ambient temperature range	12 …30	0…40
Kinematic viscosity at 40℃[mm^2/s]	110	95
Kinematic viscosity at 100℃ [mm^2/s]	11.5	9.5
Flashpoint [℃]	260	255
Pourpoint [℃]	-15	-30
Part no.1Ⅰ bottle		
Part no. 5Ⅰ canister		
Note	Standard oil for vacuum pump, applicable to any industry	Standard oil for vacuum pump, applicable to any industry
Filling quantity, approx. [Ⅰ]	0.45 (for 1RV 0020)	
	1.0 (for 1RV 0025 and 1RV 0040)	
	2.0 (for 1RV 0063 and 1RV 0010)	

Quality Guarantee

GREENCO Industry Co.,Ltd. undertakes to provide one-year quality guarantee for any product sold by us. During the guarantee period, under the normal use, if there is any defect caused by materials or processing, GREENCO will be responsible for the replacement and repairmen for the damaged parts free of charge. The oil, filtering core, discharging filter and inlet filtering core etc which are fragile should be maintained and exchanged periodically by user according to the actual condition, which is out of the guarantee scope.

The precondition of quality guarantee is to install, use and maintain the product strictly as per the use manual. The wrong use, no any maintenance, dismantle or repairmen without authorization by GREENCO are also out of the guarantee scope. The non-proper application such as voltage, high or low environment temperature will affect the performance and life, therefore, it will be out of the guarantee scope.

During guarantee period, in case the product is returned for repairmen, if identified for quality defect, GREENCO will repair or change the damaged parts without charge; if not for quality defect, related repairmen and parts will be charged.

Quality guarantee must be applied during guarantee period. In any condition, the legal liability undertaken by GREENCO will not exceed the equivalent value of the vacuum pump and spare parts. Meanwhile, GREENCO will not undertake any special, direct and indirect loss caused by the pump damage.

GREENCO reserves the final right for the quality guarantee.

If any condition exceeding the quality guarantee happens, it will be out of the quality guarantee.

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