

# TRIVAC E 2 / D 2,5 E

Dual-Stage Rotary Vane Vacuum Pump

**Operating Instructions GA01602\_002\_C1**

Part Nos.

140 000  
140 001  
140 002  
140 003  
140 004  
140 005  
140 008  
140 009



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Original installation and operating instructions.

# Notes



## **Obligation to Provide Information**

Before installing and commissioning the TRIVAC E, carefully read these Operating Instructions and follow the information so as to ensure optimum and safe working right from the start.

The Leybold **TRIVAC E** has been designed for safe and efficient operation when used properly and in accordance with these Operating Instructions. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the Operating Instructions. The pump **must only be operated in the proper condition and under the conditions described in the Operating Instructions.** It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

“Trained personnel” for the operation of this pump are

- skilled workers with knowledge in the fields of mechanics, electrical engineering and vacuum technology, and
- personnel specially trained for the operation of vacuum pumps.

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### **DANGER**



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

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### **WARNING**



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

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### **CAUTION**



CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

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### **NOTICE**



NOTICE is used to notify users of installation, operation, programming or maintenance information that is important, but not hazard related.

## **Figures**

The references to figures, e.g. (4/2) consist of the consecutive Fig. No. and the Item No. in that order.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are not binding.

Retain the Operating Instructions for further use.

## 0 Important Safety Information

### 0.1 Mechanical hazards

- 1 Avoid exposing any part of the human body to the vacuum.
- 2 Never operate the pump without a connected intake line or without fitting a blank flange.
- 3 Do not operate the pump with any of the covers removed. Serious injury may result.
- 4 The location at which the TRIVAC E (including its accessories) is being operated should be such that angles over 10° from the vertical are avoided.
- 5 The pump when filled with oil must only be moved in its vertical position. Spilled oil involves the risk of falling.
- 6 Make sure that the gas flow from the exhaust port is not blocked or restricted in any way.
- 7 If exhaust gases must be collected or contained, do not allow the exhaust line to become pressurised. The pressure in the oil box must not exceed 0.5 bar relative to the atmospheric pressure. An exhaust line which is too small in diameter or which is blocked can result in the formation of overpressures within the pump. Possible consequences can be damage or even burst open the pump. Thus the exhaust line must be checked from time to time to ensure that there are no obstructions.
- 8 When moving the TRIVAC E always use the lifting means provided.

### WARNING



### 0.2 Electrical hazards

- 1 The electrical connections must only be provided by a trained electrician as specified, for example, by the regulations EN 50110-1. Observe local regulations.
- 2 Lethal voltages are present at the mains connections. Before starting with any maintenance and service work, de-energise (lockout/tagout) the product first.
- 3 Lay connecting lines so that they cannot be damaged. Protect the lines against humidity and contact with water. Avoid any heat stress on the line due to unfavourable laying conditions.
- 4 Suitably support the connecting lines so that the pumps are not exposed to any major mechanical stress.
- 5 After a mains power failure the pump will run up automatically again. This also applies in the case of an emergency shutdown. In order to prevent the pump from running up automatically again, the pump must be integrated within a control arrangement such that it can only be switched on manually again after the mains power has returned.
- 6 Provide an adequate ground connection for the pump so as to avoid any electrostatic charging.

### WARNING



# Safety information

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## CAUTION



### 0.3 Thermal hazards

- 1 Under certain ambient conditions the TRIVAC E may attain a temperature of over 70 °C (158 °F). There then exists the danger of receiving burns.  
Note the symbols on the pump pointing to the hazards, and in the case of a hot pump wear the required protective clothing. All work on the "pump still warm from operation" should only be done using protection gloves.
- 2 Before servicing and maintenance work always leave the pump to cool down.
- 3 Note the warning information on the housing surface. If these warning notices have been removed, covered or obstructed, include corresponding additional warning notices.

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## DANGER



### 0.4 Hazards caused by materials and substances

- 1 Before pumping oxygen (or other highly reactive gases) at concentrations exceeding the concentration in the atmosphere (> 21 % for oxygen) it will be necessary to use a special pump. Such a pump will have to be modified and degreased, and an inert special lubricant (like PFPE) must be used
- 2 Before commissioning the TRIVAC E, make sure that the media which are to be pumped are compatible with each other so as to avoid hazardous situations. All relevant safety standards and regulations must be observed.
- 3 When pumping toxic, chemical, radioactive and corrosive gases as well as pyrophorously substances, the user is under the obligation to comply with the national and international safety regulations and guidelines. Regarding the suitability of the TRIVAC E pumps for special applications in which such gases shall be pumped, Leybold should be consulted first.
- 4 If the pump has previously handled hazardous gases, implement the proper precautionary measures before opening the intake or exhaust connection.  
Before opening the pump, purge it for a longer period of time with an inert gas.  
If necessary, use gloves, a respirator and/or protective clothing and work under an exhaust hood. Firmly seal off the pump.  
When shipping the contaminated pump for servicing, please also state the type of hazard. For this you must use a form which we have prepared for you.
- 5 Contaminated parts can be detrimental to health and environment. Before beginning with any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

# Safety information

## 0.5 Danger of ignition

- 1 The standard version of the TRIVAC E is not suited for operation in explosion hazard areas.
- 2 The TRIVAC pumps including the accessories are fundamentally not suited for pumping of combustible and explosive gases or vapours. Mixtures of substances may, regarding the fire and explosion risk be critical or uncritical. The operating company is under the commitment to analyse this and rate the hazard potential accordingly so as to the- refrom derive the necessary safety measures which must be introduced.
- 3 Provided ignitable or pyrophorously substances are present in the equipment you must:
  - ensure that no air can enter into the equipment,
  - ensure that the system is leak-tight,
  - with an inert gas purge (a nitrogen purge, for example) dilute all ignitable gases or vapours which may enter into the pump through the pump's inlet and/or with an inert gas purge reduce the concentration of ignitable gases or vapours in the pump and in the exhaust line to less than a quarter of the lower explosion limit (LEL) published for the respective gases.

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## CAUTION



# Safety information

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**NOTICE****0.6 Risk of damaging the pump**

- 1 Before starting up for the first time, the motor circuit must be equipped with a suitable protective motor switch. Please take note of the information in these Operating Instructions and on the electric motor (wiring diagram).
- 2 Do not allow the ingestion of small objects (screws, nuts, washers, pieces of wire, etc.) through the inlet port. For this reason always use the inlet screen which is supplied as standard.
- 3 Do not use the pump for applications that produce abrasive or adhesive powders or condensable vapours that can leave adhesive or high viscosity deposits. When planning to pump vapours other than water vapour please contact our sales or service department for advice.
- 4 This pump is suited for pumping water vapour within the specified water vapour tolerance limits.
- 5 Avoid vapours that can condense into liquids when being compressed inside the pump, if these substances exceed the vapour tolerance of the pump.
- 6 Before pumping vapours the TRIVAC E should have attained its operating temperature. This will be the case approximately 30 minutes after having started the pump. During this warming up phase, the pump should be separated from the process, by a blocking valve in the intake line, for example.
- 7 In the case of wet processes we recommend the installation of liquid separators upstream and downstream of the pump as well as the use of the gas ballast.
- 8 The exhaust line should be laid so that it slopes down and away from the pump so as to prevent condensate from backstreaming into the pump.
- 9 The entry of particles and fluids must be avoided under all circumstances.
- 10 Reactive or aggressive substances in the pump chamber may impair the operating oil or modify it. In addition, such substances may be incompatible with the materials of the pump (Viton, grey cast iron, aluminium, steel, resins, glass etc.).
- 11 Normal amounts of humidity within the range of the pump's water vapour tolerance will not significantly affect pump performance when the gas ballast is active.
- 12 When operating the pumps at gas throughput, it is urgently recommended to connect an exhaust filter or use a suitable exhaust line. Here, the exhaust line must slope down and away from the pump.
- 13 In the case of custom pumps (with part numbers deviating from those stated in the EC Declaration of Conformity) please note the information provided in the supplementary sheets.

# Description

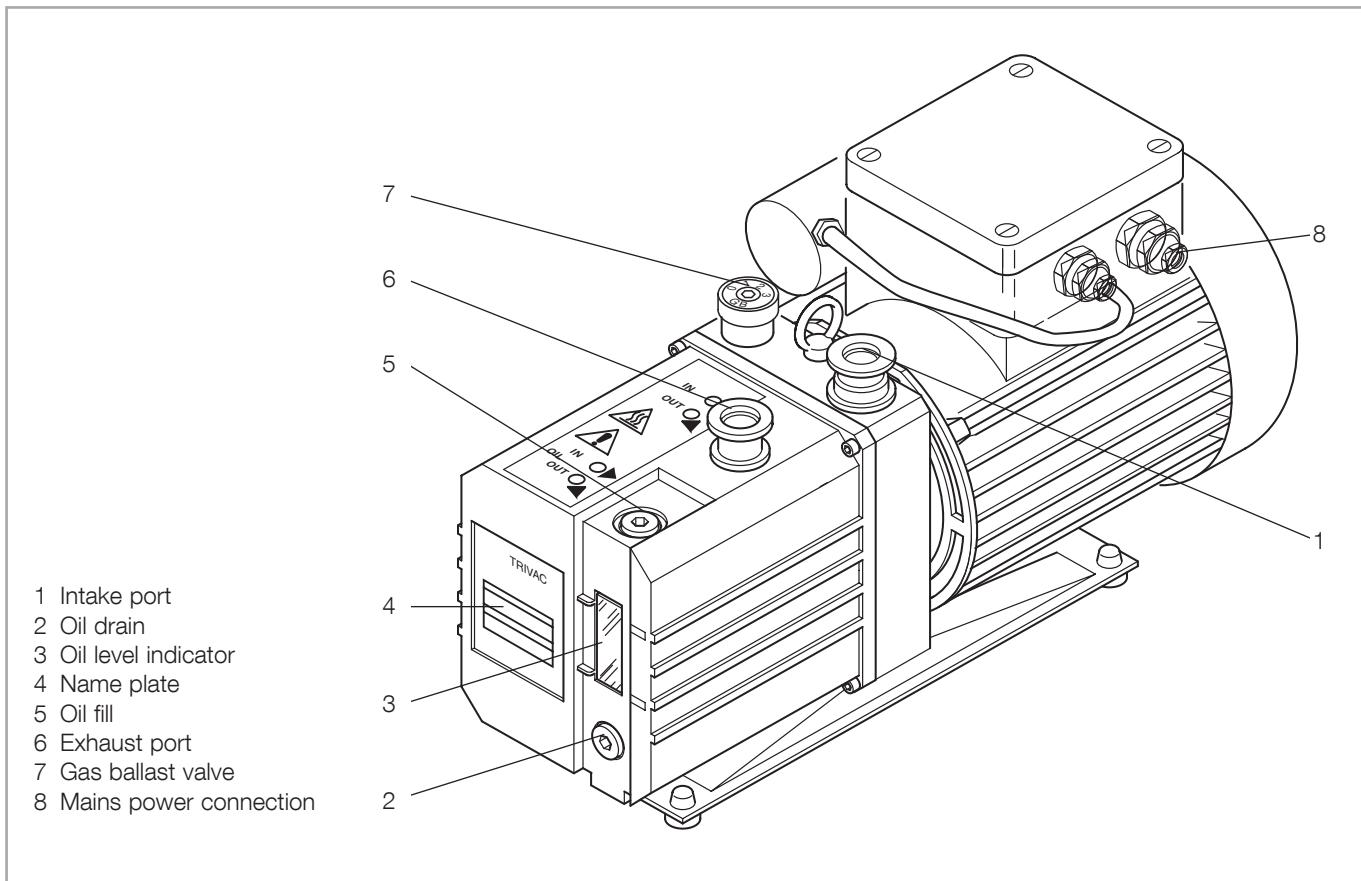


Fig. 1 TRIVAC D 2,5 E rotary vane pump

## 1 Description

The TRIVAC D 2,5 E are dual stage oil sealed rotary vane vacuum pumps.

The number in the designation of the pump indicates the pumping speed of this pump in  $\text{m}^3 \cdot \text{h}^{-1}$ .

These pumps are capable of pumping gases and vapours out of vessels and vacuum systems down into the fine vacuum pressure range. The standard pumps are not designed to handle oxygen at concentrations exceeding the concentration of oxygen in the atmosphere. Moreover, these pumps are not suited for pumping of hazardous gases or extremely aggressive or corrosive media.

The drive motor of the TRIVAC D 2,5 E is screwed directly to the bearing piece. The shaft of the pump and the shaft of the motor are linked by a coupling piece. The bearings in the inner pump body are force-lubricated sliding bearings.

The oil level glass for viewing the minimum/maximum oil level and the oil drain plug as well as the name plate are located on the front of the pump.

The connection components, the gas ballast knob and the oil fill plug are located on the top of the pump.

# Description

- 1 Gas ballast valve
- 2 Gas ballast inlet
- 3 Tandem valve (vacuum protection)
- 4 Intake port
- 5 Oil feed (oil pump)
- 6 Rotor
- 7 Vane (HV)
- 8 High vacuum stage (pump chamber)
- 9 Vane (FV)
- 10 Forevacuum stage (pump chamber)
- 11 Non-return valve
- 12 Diaphragm valve
- 13 Exhaust valve
- 14 Bypass valve
- 15 Exhaust port

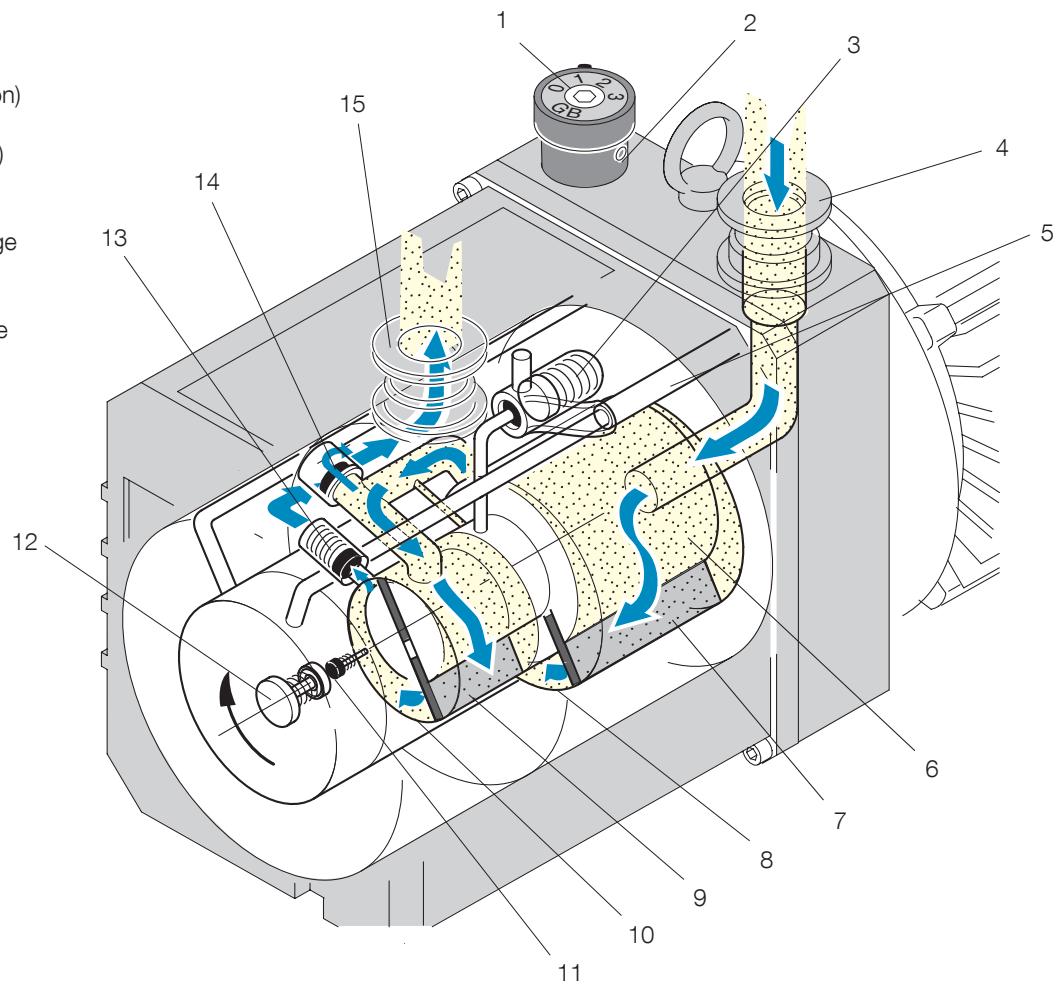


Fig. 2 Sectional view through a TRIVAC D 2,5 E pump

## 1.1 Function

The rotor (2/6) which is eccentrically arranged in the pump housing (pump chamber) has two radially sliding vanes (2/7 and 2/9) which divide the pump chamber of the pump into several chambers.

The volume of each chamber changes periodically with each turn of the rotor so that the gas at the intake port (2/4) is sucked in. The gas enters the pump chamber, and after the admission aperture has been sealed off by the vane, the gas is compressed and moved on.

The compressed gas is ejected from the pump chamber through the exhaust valve. Oil which is entrained in the gas is roughly separated by an internal demister and at the same time any mechanical contaminations are also removed from the oil. The gas exits the pump through the exhaust port.

Oil injected into the pump chamber serves the purpose of sealing and lubrication. The knocking noise (oil slap) which normally occurs when the pump approaches its ultimate pressure is avoided by injecting a small amount of air into the oil so that a silencing effect is attained.

# Description

By opening the gas ballast valve (2/1, optional) it is possible to admit a controlled quantity of air (gas ballast) into the pump chamber while the compression process is in progress. The gas ballast will prevent the condensation of vapours within the pump up to the extent of the vapour tolerance levels as stated in the specifications for the pump (these data refer to water vapour).

A special lubrication system with forced lubrication of the sliding bearings has been developed to enable operation of the pump at intake pressures up to 1000 mbar.

An oil pump supplies the oil from the oil reservoir into a high pressure oil system which in turn supplies all bearings. From here the oil enters the pump chamber of the vacuum pump.

The oil pump is located in bearing piece of the high vacuum stage.

Separation of oil and gas in the pump involves two stages. First an internal demister which is arranged ahead of the exhaust valve ensures the creation of larger droplets.

Next these are returned back to the oil reservoir via a separation panel. This ensures a minimal loss of oil.

This and the combination with the large usable oil reservoir, results in long intervals between the oil exchanges, even at high intake pressures.

The gas ballast valve (**GB**) is opened or closed by turning it (positions 0, 1, 2, 3).

Available as an option is a gas ballast valve having a knurled screw (see Fig. 11). When fully opening this valve, the resulting gas flow will correspond to that of valve position 3 in the following Table.

GB-Position	Explanation
0	no gas ballast maximum ultimate pressure
1	for cleaning the pump's oil at a good ultimate pressure and low oil consumption
2	good water vapour tolerance - without producing excessive noise
3	maximum water vapour tolerance in accordance with the technical data

When the pump is at standstill (mains power failure, or when the pump is shut down) the pump chamber is hermetically sealed off by two safety valves (tandem valve and gas ballast diaphragm valve) which are controlled through the oil pressure.

This reliably avoids any inadvertent venting of the vacuum chamber and the backstreaming of oil.

# Description

## 1.2 Supplied Equipment

Each TRIVAC D 2,5 E pump is supplied with the following basic equipment:

Pump with motor,

Separately included oil,

Separately included dirt sieve with O-ring,

Operating Instructions,

The connection ports are provided with foil protectors for protection during shipping.

The TRIVAC E pumps are supplied ready for operation, complete with switch, built-in thermal motor overload protection, mains cord (1.8 m long) and a mains plug which depends on the country of use.

The following part numbers are exceptions:

- P/N140000 is supplied with cable and Schuko shockproof plug (CEE 7/4);
- P/N140001 is supplied w/o cable, pls. order cable separately;
- P/N140008 is supplied with cable and custom plug;  
cf. Section 1.3 Motor Data.

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**NOTICE****Notes on the Oil and how to order**

Oil LVO 100 is used as standard. If any other kind of special oil is being used, this fact will be indicated by a sticker on the oil box stating the type of special oil used.

You must only use the kind of oil which has been specified for the particular pump.

Special oils upon request.

Only use the kind of oil specified by Leybold.

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## 1.3 Technical Data

**D 2,5 E**  
**two-stage**  
**50 Hz / 60 Hz**

Nominal pumping speed <sup>1)</sup>	$\text{m}^3 \cdot \text{h}^{-1}$	3.2 / 3.6
Pumping speed <sup>1)</sup>	$\text{m}^3 \cdot \text{h}^{-1}$	2.7 / 3.3
Ultimate partial pressure without gas ballast <sup>1)</sup>	mbar	$5 \cdot 10^{-4}$
Ultimate total pressure without gas ballast <sup>1)</sup>	mbar	$2 \cdot 10^{-3}$
Ultimate total pressure with gas ballast <sup>1)</sup>	mbar	$3 \cdot 10^{-3}$
Water vapour tolerance <sup>1)</sup>	mbar	
Stage 1		10
Stage 2		20
Stage 3		30
Water vapour capacity	$\text{g} \cdot \text{h}^{-1}$	
Stage 1		20 / 25
Stage 2		40 / 50
Stage 3		0 / 75
Oil filling, min./max.	l	0.4 / 0.7
Noise level to DIN 45 635 (without/with gas ballast)	dB (A)	47
Admissible ambient temperature 2)	°C	+12 ... +40
Connections, intake and exhaust side	DN	6 KF

<sup>1)</sup> In acc. with DIN 28 400 et seq. valid for LVO 100. For other oils the ultimate pressure may differ.

<sup>2)</sup> The motor may accelerate with a delay when simultaneously an undervoltage is present at the motor and the pump is at the minimum permissible ambient temperature.

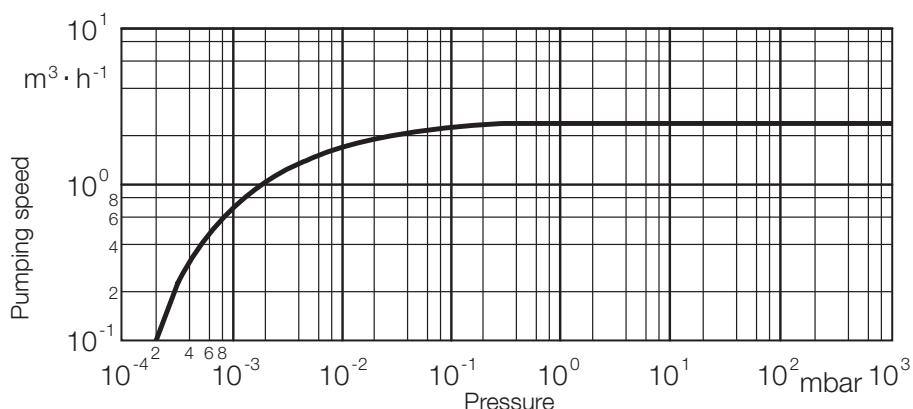


Fig. 3 Pumping speed characteristics of the TRIVAC D 2,5 E

# Description

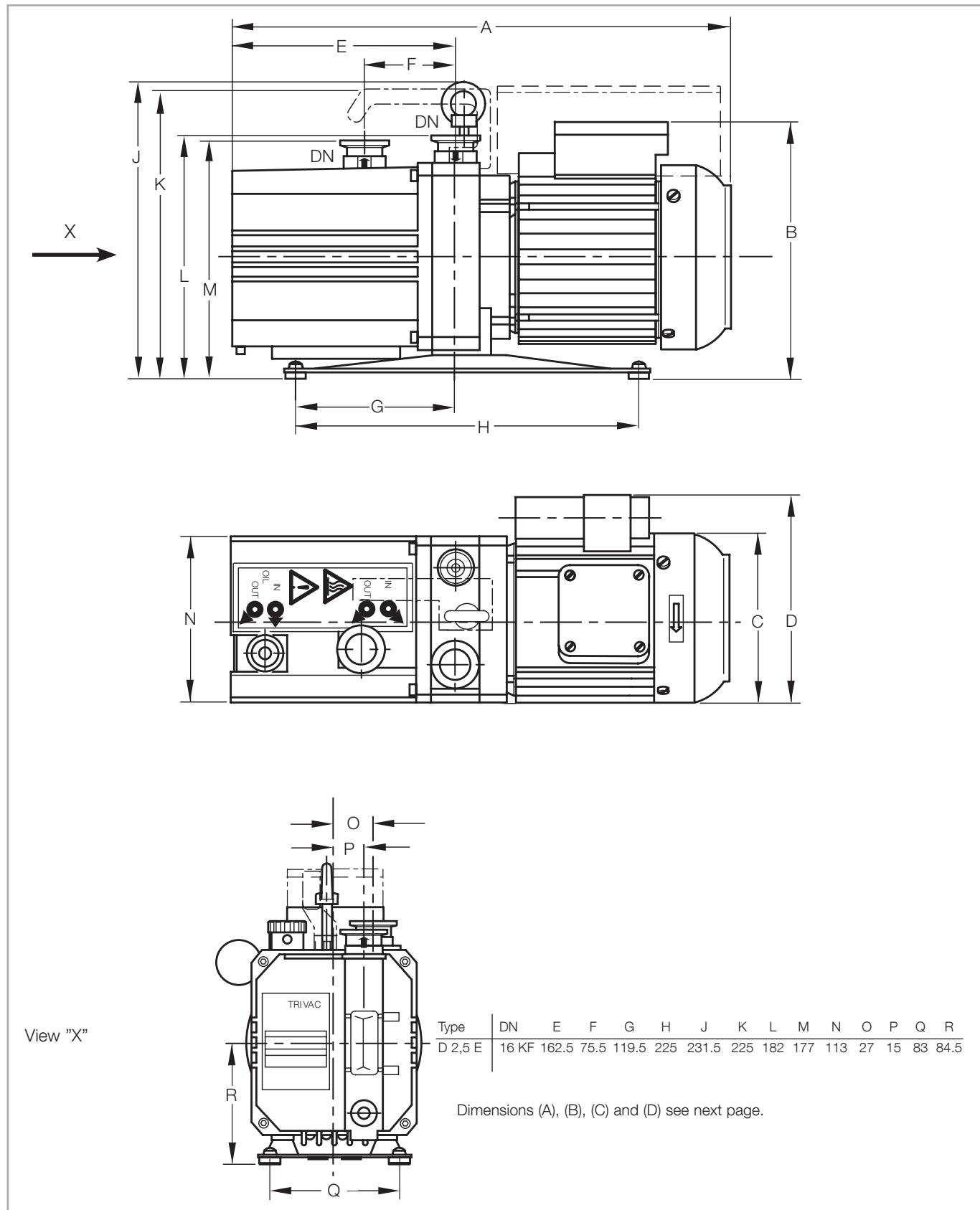


Fig. 4 Dimensional drawings for the TRIVAC D 2,5 E rotary vane vacuum pumps

# Description

<b>Cat.-No. of the pump</b>	<b>140 000</b>
<b>Motor type</b>	<b>E7B4B3-7-351</b>
<b>Motor L/N</b>	<b>20015412</b>
IP rating	
Operating mode IEC34 / Duty	
Isolation class	F
Phases	1~
Manufacturer	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany
Number of poles	4
Nom. output power at 50 Hz	280 W
Nom. output power at 60 Hz	300 W
Nom. in frequency	50 Hz 60 Hz
Nom. voltage range and nom. current at 50 Hz	220-240 V / 1.8 A
Nom. voltage range and nom. current at 60 Hz	230 V / 1.4 A
Tolerances of voltage range <sup>1)</sup>	±5 %
Nom. speed at 50 Hz	1400 rpm
Nom. speed at 60 Hz	1600 rpm
Disposal	local directives have to be considered
Max. altitude above sea level	1000 m above sea level
Max. ambient temperature when operating <sup>1)</sup>	40 °C
T-board / plug	Mains cord (0.37 m) with custom plug
Certificates <sup>2)</sup> for the motor	CE
Length of the pump (A)	392 mm
Height of the pump up to the upper edge of the junction box (B)	210 mm
Width of the moto (D)	148.5 mm
Weight of the motor	7.6 kg

# Description

<b>Cat.-No. of the pump</b>	<b>140 004</b>	<b>140 005</b>
<b>Motor type</b>	<b>E7B4B3-7-375</b>	<b>E7B4B3-7-376</b>
<b>Motor L/N</b>	<b>20015413</b>	<b>20015414</b>
IP rating	IP54	IP54
Operating mode IEC34 / Duty		
Isolation class	F	F
Phases	1~	1~
Manufacturer	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany
Number of poles	4	4
Nom. output power at 50 Hz	280 W	280 W
Nom. output power at 60 Hz	300 W	300 W
Nom. in frequency	50 Hz 60 Hz	50 Hz 60 Hz
Nom. voltage range and nom. current at 50 Hz	220-240 V / 1.8 A	220-240 V / 1.8 A
Nom. voltage range and nom. current at 60 Hz	230 V / 1.4 A	230 V / 1.4 A
Tolerances of voltage range <sup>1)</sup>	±5 %	±5 %
Nom. speed at 50 Hz	1400 rpm	1400 rpm
Nom. speed at 60 Hz	1600 rpm	1600 rpm
Disposal considered	local directives have to be considered	local directives have to be considered
Max. altitude above sea level	1000 m above sea level	1000 m above sea level
Max. ambient temperature when operating <sup>1)</sup>	40 °C	40 °C
T-board / plug	Mains cord (1.8 m) with British standard BS 1363	Mains cord (0.37 m) with Swiss central plug Type 12
Certificates <sup>2)</sup> for the motor		
Length of the pump (A)	392 mm	392 mm
Height of the pump up to the upper edge ) of the junction box (B)	210 mm	210 mm
Width of the motor (D)	153.5 mm	153.5 mm
Weight of the motor	7.5 kg	7.4 kg

# Description

<b>Cat.-No. of the pump</b>	<b>140 003</b>	<b>140 002</b>
<b>Motor type</b>	<b>E7B4B3-7-353</b>	<b>E7B4B3-7-352</b>
<b>Motor L/N</b>	<b>20015415</b>	<b>20015416</b>
IP rating	TE	TE
Operating mode IEC34 / Duty		
Isolation class	F	F
Phases	1~	1~
Manufacturer	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany
Number of poles	4	4
Nom. output power at 50 Hz	310 W	
Nom. output power at 60 Hz	330 W	370 W
Nom. in frequency	50 Hz 60 Hz	60 Hz
Nom. voltage range and nom. current at 50 Hz	100 V / 5.5 A	
Nom. voltage range and nom. current at 60 Hz	100 V / 4.0 A	110-120 V / 3.7 A
Tolerances of voltage range <sup>1)</sup>	±5 %	±5 %
Nom. speed at 50 Hz	1400 rpm	
Nom. speed at 60 Hz	1600 rpm	1600 rpm
Disposal considered	local directives have to be considered	llocal directives have to be
Max. altitude above sea level	1000 m above sea level	1000 m above sea level
Max. ambient temperature when operating <sup>1)</sup>	40 °C	40 °C
T-board / plug	Mains cord (1.8 m) with plug NEMA 5-15P	Mains cord (1.8 m) with plug NEMA 5-15P
Certificates <sup>2)</sup> for the motor		
Length of the pump (A)	392 mm	392 mm
Height of the pump up to the upper edge of the junction box (B)	210 mm	210 mm
Width of the motor (D)	153.5 mm	153.5 mm
Weight of the motor	7.4 kg	7.7 kg

# Description

<b>Cat.-No. of the pump</b>	<b>140 001, 140 009</b>	<b>140 008</b>
<b>Motor type</b>	<b>E7B4B3-7-350</b>	<b>E7B4B3-7-383</b>
<b>Motor L/N</b>	<b>20015417</b>	<b>20016678</b>
IP rating	IP54 / TE	IP54
Operating mode IEC34 / Duty		
Isolation class	F	F
Phases	1~	1~
Manufacturer	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany	Hanning-Elektro-Werke GmbH & Co. KG 33813 Oerlinghausen Germany
Number of poles	4	4
Nom. output power at 50 Hz	290 W	280 W
Nom. output power at 60 Hz	310 W	300 W
Nom. in frequency	50 Hz 60 Hz	50 Hz 60 Hz
Nom. voltage range and nom. current at 50 Hz	100-120 V / 4.4 A  200-240 V / 2.2 A	220-240 V / 1.8 A
Nom. voltage range and nom. current at 60 Hz	100-120 V / 3.0 A  200-240 V / 1.5 A	230 V / 1.4 A
Tolerances of voltage range <sup>1)</sup>	±5 %	±5 %
Nom. speed at 50 Hz	1400 rpm	1400 rpm
Nom. speed at 60 Hz	1600 rpm	1600 rpm
Disposal	local directives have to be considered	local directives have to be considered
Max. altitude above sea level	1000 m above sea level	1000 m above sea level
Max. ambient temperature when operating <sup>1)</sup>	40 °C	40 °C
T-board / plug	Multi pin plug at the junction box, mains cord: 20081091 (1.8 m) with Schuko plug CEE 7/7 (optional) 20081097 (1.8 m) with UK plug BS 1363 (optional) 20081099 (1.8 m) with CH plug SEV 1011 (optional) 20081141 (1.8 m) with US plug NEMA 6-15P (optional)	Without mains cord, with custom plug
Certificates <sup>2)</sup> for the motor		
Length of the pump (A)	392 mm	392 mm
Height of the pump up to the upper edge of the junction box (B)	227 mm	210 mm
Width of the motor (D)	127 mm	127 mm
Weight of the motor	7.7 kg	7.2 kg

# Description

<sup>1)</sup> The motor may accelerate with a delay when simultaneously an undervoltage is present at the motor and the pump is at the minimum permissible and ambient temperature.

<sup>2)</sup> Key to the certificates:

CSA certification mark for products certified in accordance with CSA for Canada.



UL certification mark for approved components for the USA.



UL certification mark for energy efficiency for listed products and approved components for Canada and the USA.



Observe the data given on the motor name plate.

For special pumps please note the information contained in the supplemental sheet.

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## NOTICE



# Description

## 1.4 Accessories

	Part-No.
Exhaust filter AF 8, DN 16 KF	190 50
Replacement filters FE 8 (5er Pack)	190 80
Drain tap for the exhaust filter AF 8	190 95
Condensate separator AK 8, DN 16 KF	190 60
Oil drain tap	190 90
Manual oil return AR-M via the gas ballast port (Kit for AF 8)	190 93
Oil suction facility controlled by a solenoid valve AR-V via the gas ballast port (Kit for AF 8)	190 92

Connection components required to connect the exhaust filter and the condensate separators in each case:

	Part-No.
1 Pipe bend	DN 16 KF
2 Centering rings with O-ring	DN 16 KF
2 Clamping rings	DN 16 KF

---

### NOTICE



Use only the kind of oil specified by Leybold.

# Transport and Storing

## 2 Transport and Storing

To lift the pumps only use the handle provided for this purpose, respectively use corresponding lifting facilities. When connecting or removing the pump, do not move under hoisted loads.

If possible transport the pump in its original packaging, if not available exercise due care.

Pumps which are filled with oil must only be moved while standing upright. Otherwise oil may escape. Avoid any other orientations during transport. Check the pump for the presence of any oil leaks, since there exists the danger that someone may slip on spilt oil.

Before putting a pump into operation once more it should be stored in a dry place preferably at room temperature (20 °C). Before the pump is stored it must be properly disconnected from the vacuum system, purged with dry nitrogen and the oil should be changed too.

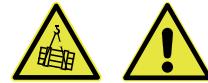
The inlets and outlets of the pump must be sealed with the shipping seals which are provided upon delivery.

The gas ballast switch must be set to the „0“ position and if the pump is to be stored for a longer period of time it should be sealed in a PE bag containing some desiccant (silica gel).

When a pump is put into operation after it has been stored for over one year, standard maintenance should be run on the pump and the oil should also be exchanged (see Section 5.4). We recommend that you contact the Leybold Service.

---

### CAUTION



# Installation

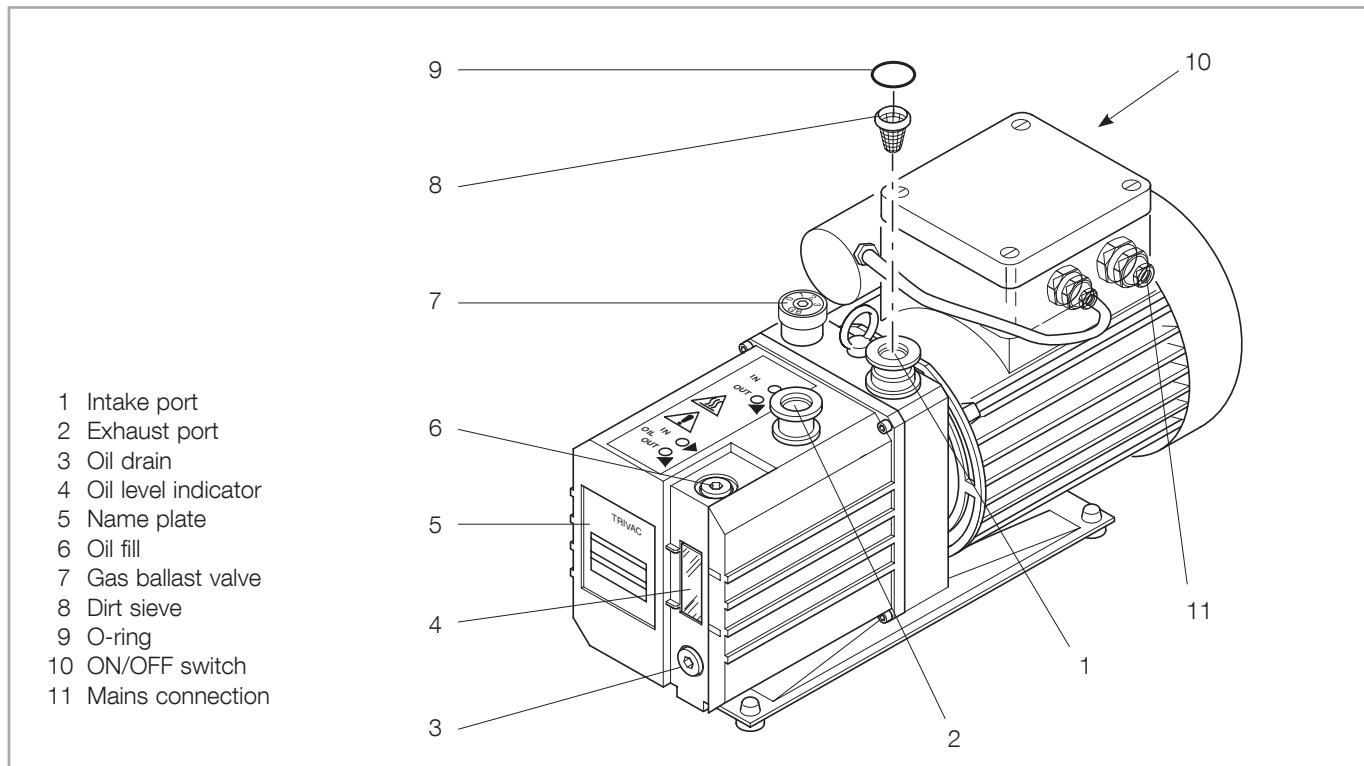


Fig. 5 Connections and controls

## 3 Installation

### NOTICE



### Instructions for the operating personnel

Before any kind of assembly work the personnel must be informed in advanced about potential hazards. Observe Safety Informations 0.1 to 05.

### 3.1 Placement

#### DANGER



#### Explosion risk

The standard pump is not suited for installation in the explosion hazard areas. Observe Safety Informations 0.5.

The TRIVAC E pump can be set up on a flat, horizontal surface. Rubber feet under the coupling housing ensure that the pump can not slip.

The location of the TRIVAC E should be such that all controls are easily accessible.

#### CAUTION



#### Risk of toppling

Max. tilt for the pump with possibly fitted standard accessories is 10° from the vertical.

If you wish firmly install the pump in place, insert bolts through bore holes (Ø 5 mm) in the rubber feet.

The rubber feet act as vibration absorbers. They must therefore not be compressed by screws.

When installing the TRIVAC E pump, make sure that the connections and controls are readily accessible.

The site chosen should allow adequate air circulation to cool the pump (keep front and rear unobstructed).

The oil-level glass must be visible.

#### **Note the ambient conditions during operation**

The ambient temperature should +40 °C not exceed and not drop below +12 °C (see Section 4.3.3).

For installation sites over 1000 m above sea level and/or a relative atmospheric humidity of over 90%, you must discuss this with technical sales.

The maximum heat which is dissipated corresponds approximately to the installed amount of motor power.

Install the pump so that only minimum quantities of dust can settle on the surfaces. Remove dust deposits in regular intervals.

If required the crane eye or the handle may be removed.

The oil filling has been included separately. Before operating the pump you must fill in the correct quantity of oil (see Section 5.4).

---

#### **NOTICE**



## **3.2 Normal use**

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

The pumps are suited for pumping water vapour within the specified water vapour tolerance limits. Avoid vapours that can condense into liquids when being compressed inside the pump, if these substances exceed the vapour tolerance of the pump. In the case of wet processes we recommend the installation of liquid separators upstream and downstream of the pump as well as the use of the gas ballast and we recommend to run the pump for 30 minutes allowing it to warm up before beginning with the pumpdown process.

#### **Pumping of dust or much contaminated media**

The pumps are not suited for pumping of liquids or media which carry large quantities of dust. Corresponding protection devices need to be provided.

Our technical sales department is available for further advice in these matters.

---

#### **NOTICE**



# Installation

## 3.2.1 Abnormal use

---

**CAUTION**

The TRIVAC is not suited for pumping of:

- radioactive and toxic substances
- pyrophorous substances
- corrosive gases
- oxygen (or other highly reactive gases) at concentrations exceeding that of the atmosphere (> 21 % for oxygen).

---

**NOTICE**

The pumps are not suited for pumping of liquids or media which carry large quantities of dust. Corresponding protection devices need to be provided.

---

**CAUTION**

The standard pump is not suited for pumping of hazardous gases or vapours.

When cleaning a system in which a TRIVAC pump has been integrated, all parts in contact with the medium need to be compatible with the cleaning agent so as to prevent a chemical reaction. Residues of the cleaning agent within the pump must be avoided.

## 3.3 Connection to the System

Before connecting the pump, the shipping seals on the connection flanges (5/1 and 5/2) must be removed.

If residues of adhesives are present on the connecting flanges you must remove these using a suitable solvent like alcohol, for example.

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

Insert the dirt sieve (5/8) with the O-ring (5/9).

The intake and exhaust lines are fitted with standard small flanges. The connection flanges must be clean and undamaged.

The intake line and the exhaust line must be connected using corrugated pipes or vacuum hoses so that no mechanical forces can be transferred to the pump.

The intake line must be clean. Any deposits in the intake line will tend to degas and impair the attainable vacuum pressures.

The cross section of the intake and exhaust line must at least be of the same diameter as that of the pump connections.

An intake line which is too small in diameter will throttle the pumping speed.

## Note the specified cross sections for the connection lines

If exhaust gases must be collected or contained, do not allow the exhaust line to become pressurised. The pressure in the oil box must not exceed 0.5 bar relative to the atmospheric pressure. An exhaust line which is too small in diameter or which is blocked can result in the formation of over-pressures within the pump. Possible consequences can be a damaged or even burst open the pump. Thus the exhaust line must be checked from time to time to ensure that there are no obstructions.

Never operate the pump with a sealed exhaust line. There is the danger of injury.

When pumping vapours we strongly recommend the installation of a condensate separator on the suction side and also on the exhaust side.

## Avoid backflowing condensate

Install the exhaust line with a downward slope (lower than the pump) so as to prevent condensate from flowing back into the pump. If this is not possible, insert a condensate trap.

## Safely lead the exhaust gases away

Exhaust gases may, depending on the type of application, present a health hazard and/or may be detrimental to the environment.

The exhaust gases from the vacuum pump must be safely led away and subjected to post-treatment as required. In order to reduce the emission of oil vapours we recommend the installation of an additional exhaust filter (Leybold accessory, see Section 1.4). Depending on the type of application or the kind of pumped media, the corresponding regulations and information sheets must be observed.

The maximum inlet pressure must not exceed atmospheric pressure (1013 mbar).

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## CAUTION



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## NOTICE



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## CAUTION



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## NOTICE



# Operation

## 3.4 Electrical Connections

### DANGER



#### Risk due to high voltages

Death or severe injury caused by an electric shock.

The electrical connections must only be made by a trained electrician as specified, for example, by the regulations EN 50110-1. Note the national regulations of the country in which the equipment is being operated.

The pumps are supplied with an AC motor.

The AC motor may be connected directly by means of a mains cord and a plug to the mains power. Fusing must be provided always in accordance with national and local regulations for single-phase mains power supplies (in Germany 16 A). A check on the direction of rotation is not required since it is fixed. A thermal motor protection with automatic reset will protect the motor against overloads.

The mains voltage must comply with the voltage stated on the name plate.

### WARNING



#### Warning against automatic start-up

If the thermal overload protector shuts off the pump, the motor will restart itself as soon as it cools. That's why the mains plug should be disconnected from the mains before starting with any work on the pump. Observe Safety Informations 0.2.

## 4 Operation

### 4.1 Media Compatibility

TRIVAC E pumps can pump condensable gases and vapours, provided that the gas ballast valve is open and the pump has attained its operating temperature.

The maximum vapour tolerance is attained when the gas ballast valve (5/7) is set to position 3.

### 4.2 Start-up

Check the oil level each time before switching on the pump, see Section 5.3.

Operate the pump only with the oil level above the minimum. Open all blocking devices in the exhaust line. Never operate the pump with a blocked or constricted exhaust line.

The pump is started up by operating the ON/OFF switch (5/10 - does not apply in the case of pumps with a three-phase motor). The ON/OFF switch may be operated at all pressures.

During initial start up and after a longer period during which the pump has not been used, the pump may not immediately attain the specified ultimate pressure because the oil has to be degassed first. For this you should let the pump run for about 30 minutes with the intake line closed and the gas ballast valve (5/7) open (position 2 of the gas ballast valve).

## Use matching accessories only

Before starting the pump ensure that the pump and the fitted accessories meet the requirements of your application and that safe operation can be guaranteed.

## Start up the pump only after it has been fully installed

Never operate the pump with an open intake port. Vacuum connections as well as oil feed and discharge openings must not be opened while the pump is operating. Avoid exposing any part of the human body to the vacuum. There is the risk of suffering injury.

Observe Safety Informations 0.1.

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## WARNING



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## WARNING



## 4.3 Operation

The TRIVAC D 2.5 E is capable of pumping gases and vapours. For pumping vapours it is required that the gas ballast valve be open (5/7) and that the pump has attained its operating temperature.

If exhaust gases must be collected or contained, do not allow the exhaust line to become pressurised. The pressure in the oil box must not exceed 0.5 bar relative to the atmospheric pressure. An exhaust line which is too small in diameter or which is blocked can result in the formation of over-pressures within the pump. Possible consequences can be a damaged or even burst open pump. Thus the exhaust line must be checked from time to time to ensure that there are no obstructions.

---

## CAUTION



### 4.3.1 Pumping of Non-Condensable Gases and Vapours

If the process contains mainly permanent gases, the TRIVAC E may be operated without gas ballast (position 0), provided that the saturation vapour pressure at operating temperature is not exceeded during compression.

If the composition of the gases to be pumped is not known and if condensation in the pump cannot be ruled out, run the pump with the gas ballast valve open in accordance with Section 4.3.2.

### 4.3.2 Pumping of Condensable Gases and Vapours

With the gas ballast valve open (position 1) and at operating temperature, TRIVAC E pumps can pump pure water vapour up to the water vapour tolerance specified by the technical data. (position 3 of the gas ballast valve). If the vapour pressure increases above the permissible level, the water vapour will condense in the oil of the pump.

When pumping vapours ensure that the gas ballast valve is open and that the pump has been warmed up for approximately 30 minutes with the intake line closed.

# Operation

---

**NOTICE****Pumping of Vapours**

Vapour phases may only be pumped up to the permissible limit after the pump has attained its operating temperature.

During pumping, vapours may dissolve in the oil. This changes the oil properties and thus there is a risk of corrosion in the pump. Therefore, don't switch off the pump immediately after completion of the process. Instead, allow the pump to continue operating with the gas ballast valve open and the intake line closed until the oil is free of condensed vapours. We strongly recommend operating the TRIVAC E in this mode for about 30 minutes after completion of the process.

---

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

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

**4.3.3 Operating Temperature**

Proper operation of the TRIVAC D 2,5 E is ensured at ambient temperatures between 12 °C and 40 °C.

When the pump is warm, the temperature at the surface of the TRIVAC D 2,5 E may rise to between 40 °C and 80 °C, depending on the load on the pump.

---

**CAUTION****Beware of hot surfaces**

There is the danger of receiving burns.  
Observe Safety Informations 0.3.

---

If – due to the ambient conditions – this temperature range is exceeded at either end of the range, contact Leybold Sales.

The motor may accelerate with a delay when simultaneously an undervoltage is present at the motor and the pump is at the minimum permissible ambient temperature.

## 4.4 Shutdown

Under normal circumstances, all that you need do is to electrically switch off the TRIVAC E.

No further actions will be required.

When pumping condensable media let the pump continue to operate with the gas ballast valve open and the intake line closed before switching off (see Section 4.3.2).

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

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

### Pump and operating agents may be contaminated

If hazardous substances have been pumped, then these substances can escape from the pump and from the oil. Introduce adequate safety precautions; use gloves, face protection or a respirator, for example. Observe Safety Informations 0.4.

---

### WARNING



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

Please also take note of the information given in Section 2 Transport and Storing.

### 4.4.1 Shutdown through Monitoring Components

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

---

### DANGER



### 4.4.2 Controller/Mains Power Failure

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

---

### CAUTION



# Maintenance

## 5 Maintenance

### DANGER



#### Danger by High Electric Voltages

Death or severe injury caused by an electric shock!

The electrical connections must only be provided by a trained electrician in accordance with the guidelines laid down in the international series of standards IEC 64.

Disconnect the electrical connections before disassembling the pump.

Make absolutely sure that the pump cannot be accidentally started.

Observe Safety Informations 0.2.

If the pump has pumped harmful substances, contrary to what has been stated in Section 3.2, ascertain the nature of hazard and take adequate safety measures. Observe Safety Informations 0.4.

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

Due to the design concept, TRIVAC E pumps require very little maintenance when operated under normal conditions. The work required is described in the sections below. In addition to this, a maintenance plan is provided in Section 5.1.

### NOTICE



All work must be carried out by suitably trained personnel. Maintenance or repairs carried out incorrectly will affect the life and performance of the pump and will void any warranty claims.

Leybold offers practical courses on the maintenance, repair, and testing of TRIVAC E pumps. Further details are available from Leybold on request.

### NOTICE



If the TRIVAC E is used in ambient air which is much contaminated, make sure that the air circulation and the gas ballast valve are not adversely affected.

When the TRIVAC E has been pumping corrosive media we recommend that possibly planned maintenance work be carried out immediately in order to prevent corrosion of the pump while it is at standstill.

Please take the spare parts numbers from the enclosed spare parts list.

In case of special designs and variants please always indicate the serial number.

## 5.1 Maintenance Plan

No.	Rotary vane pump TRIVAC D 2,5 E	Measurement/test quantity Operating/auxiliary materials	Interval						Remarks
			VE	VP	t	6m	a	n-a	
1	Operate the pump for at least 1 h with gas ballast.				x				Condensed water is thus removed from the oil.
2	Check the oil level, if required change the oil.	Oil: LVO 100 or special and alternative oils	x		x				Refill: Only after the pump has been switched off.
3	Check the quality of the oil, change the oil if required.	visually (all oils) chemically mechanically	x		x		x		<b>Visually:</b> normally light and transparent, oil change is required when discolorations increase. <b>Chemically:</b> to DIN 51558, when the neutralisation number exceeds 2; then an oil change will be required. <b>Mechanically:</b> when dynamic viscosity at 25 °C exceeds 240 mPas; then an oil change will be required. (See section: 5.3.1)
4	Clean the dirt trap in the intake port, change it as required.	Suitable cleaning agent and compressed air.				x			<ul style="list-style-type: none"><li>■ Clean dirt trap with a cleaning agent and blow it out with compressed air under a suction hood</li><li>■ Replace the faulty dirt trap. Use a cleaning agent which complies with the national/international specifications.</li></ul> <b>Observe the safety regulations when using cleaning agents.</b>
5	Clean the internal demister, change it as required.	Suitable cleaning agent.					x		Already clean before the maintenance interval has elapsed when the noise level increases. <ul style="list-style-type: none"><li>■ Clean internal demister with cleaning agent.</li><li>■ Replace the defective internal demister.</li><li>■ Dispose of the defective internal demister as special waste. Cleaning agent according to national/international specifications.</li></ul> <b>Observe the safety regulations when using cleaning agents.</b> (parts are contained in Maintenance Kit 1) (see Section 7.1)
6	Check the coupling bushings for damage and wear.							3	Check also in advance of the scheduled maintenance interval in case of extreme noise (parts are contained in Repair Set 1, see Section 7.1)
7	Change the oil  and  clean the oil level glass.	Oil: LVO 100 or special- and alternative oils  Suitable cleaning agent and compressed air.					x		<b>Oil change:</b> (see section 5.4) <ul style="list-style-type: none"><li>■ First oil change after 100 operating hours.</li><li>■ Further oil changes: at least every 2000 - 3000 operating hours or after one year.</li><li>■ Pump switched off and cold.</li></ul> Exchange the oil while the pump is cold so as to avoid releasing adsorbed gases.  Clean the oil level glass with a cleaning agent and blow it out with compressed air under a suction hood. Use cleaning agents only corresponding to the national/international specifications. <b>Observe the safety regulations when using cleaning agents</b> <b>Quantity of oil:</b> see Section 1.3 <b>Oil disposal:</b> see Section 8
8	Check the fan of the pump and motor as well as the cooling fins on the motor for deposits, and clean as required.	Brush and industrial vacuum cleaner.					x		Already clean before the maintenance interval has elapsed when the pump or the motor gets too warm. <b>Caution:</b> switch off the pump and ensure that it cannot run inadvertently (disconnect from the mains).
9	Full maintenance	Maintenance-Kit 2						3	Clean and perform maintenance on the pump as described in the instructions included with Maintenance Kit 2 (see Section 7.1).

### Key to maintenance plan

VE = Maintenance before switching on the system

VP = Maintenance before starting production

t = Daily maintenance

6m = Six monthly maintenance

a = Annual maintenance

n-a = Maintenance every n years

We recommend that you service the pump every two years covering the following:

- Cleaning
- Checking the individual components
- Exchange of all seals
- Functional check

This check should be run by the Leybold - Service.

# Maintenance

## 5.2 Leybold Service

Whenever you send a pump to Leybold, indicate whether the pump is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose.

This form is available from the Leybold homepage:  
[www.leybold.com](http://www.leybold.com) → Downloads → Download Documents.

Please attach this form to the pump or enclose it with the pump.

This statement detailing the contamination is required to satisfy legal requirements and for the protection of our employees.

Pumps which are not accompanied by a contamination statement will be returned to the sender.

---

### CAUTION



#### Use secure shipping packaging

Package the pump such that it will not suffer any damage when being shipped and so that no oil or hazardous materials can escape from the packaging.

---

## 5.3 Monitoring the Oil Level

During operation of the TRIVAC E the oil level must always remain between marks (6/2) and (6/3) on the oil-level glass. The amount of oil must be checked and topped up as required.

Check and top up oil only after having shut down the pump first.  
Please note the safety information given in Section 0.3 and 0.4.



Pumps which have not directly been delivered from Leybold, e.g. in systems, may have been filled with oils different from LVO 100. In this case a refill with LVO 100 may cause problems. Therefore check before the refill the kind of oil in the pump and fill in only suitable oil or change the oil.

## 5.3.1 Checking the Condition of LVO 100

The ageing process for the standard operating fluid LVO 100 (see Section 1.2) will depend very much on the area of application for the pump.

There exist the following ways of checking the oil:

### a) Visual check

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

### b) Chemical check

The neutralisation number of LVO 100 oil is determined according to DIN 51558. If it exceeds 2, the oil should be changed.

### c) Viscosity check

If the viscosity of LVO 100 at 25 °C exceeds a level of 240 mPas (20 % higher than the viscosity of fresh oil) an oil change is recommended.

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

When wanting to check the oil, switch off the pump first and drain out from the warm pump the required amount of oil through the oil drain (6/4) into a beaker or similar.

Please note the safety information given in Section 5.4.

# Maintenance

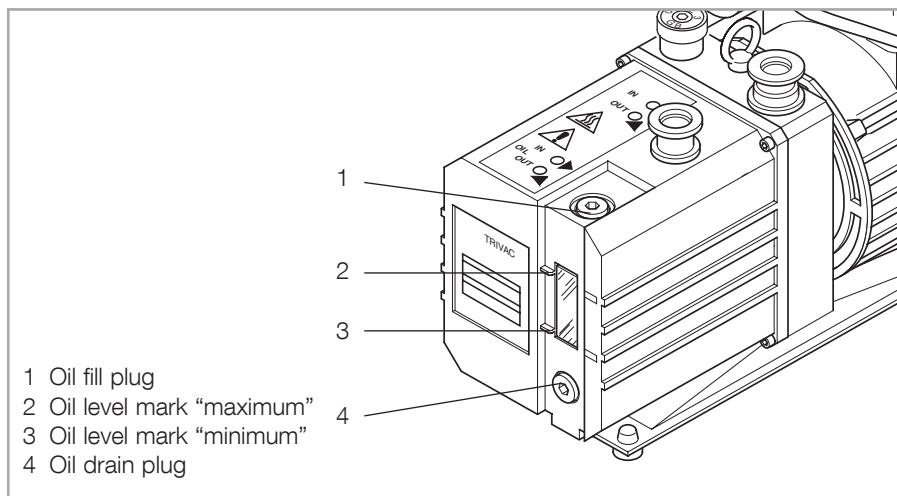


Fig. 6 Oil change

## 5.4 Oil Change

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**DANGER****Pump and operating agents may be contaminated**

Hazardous substances may escape from the pump and the oil. If there is the danger that the operating agent may present a hazard in any way due to decomposition of the oil, or because of the media which have been pumped, you must determine the kind of hazard and ensure that all necessary safety precautions are taken use gloves, face protection or a respirator, for example.

Observe Safety Informations 0.3 und 0.4.

Change the oil while the pump is cold so as to avoid releasing adsorbed gases. If releasing adsorbed gases is no problem, change the oil after the pump has been switched off and while the pump is still warm.

**Risk of suffering burns**

With the pump warm from operation, both pump and oil can get so hot that there is the risk of suffering burns. If required, wear gloves.

Check and top up oil only after having shut down the pump first. When disposing of waste oil, observe the applicable environment protection regulations!

When changing the oil use the same type of oil which was previously in the pump. If you want to change the type of oil entirely please consult us first.

The oil should be changed after the first 100 operating hours and then at least every 2000 - 3000 operating hours or after one year. At high intake pressures and intake temperatures and/or when pumping contaminated gases, the oil will have to be changed much more frequently.

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

Contact us for more information in this matter.

Required tool: Allen key 8 mm.

Remove the oil-drain plug (6/4) and let the used oil drain into a suitable container. When the flow of oil slows down, screw the oil-drain plug back in, briefly switch on the pump (max. 10 s) and then switch it off again. Remove the oil-drain plug once more and drain out the remaining oil.

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

Remove the oil-fill plug (6/1) and fill in with fresh oil.

Screw the oil-fill plug (6/1) back in.

The tightening torque for the bolts (6/1) and (6/4) has been specified at 10 Nm.

We can only guarantee that the pump operates as specified by the technical data if the lubricants recommended by us are used.

---

**NOTICE**

## 5.5 Cleaning the Inlet Screen

A wire-mesh sieve is located in the intake port of the pump to act as a dirt trap for coarse particles. It should be kept clean to avoid a reduction of the pumping speed.

For this purpose, remove the inlet screen (7/9) from the intake port and rinse it in a suitable vessel with solvent. Then thoroughly dry it with compressed air. If the inlet screen is defective, replace it with a new one.

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

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**NOTICE**

# Maintenance

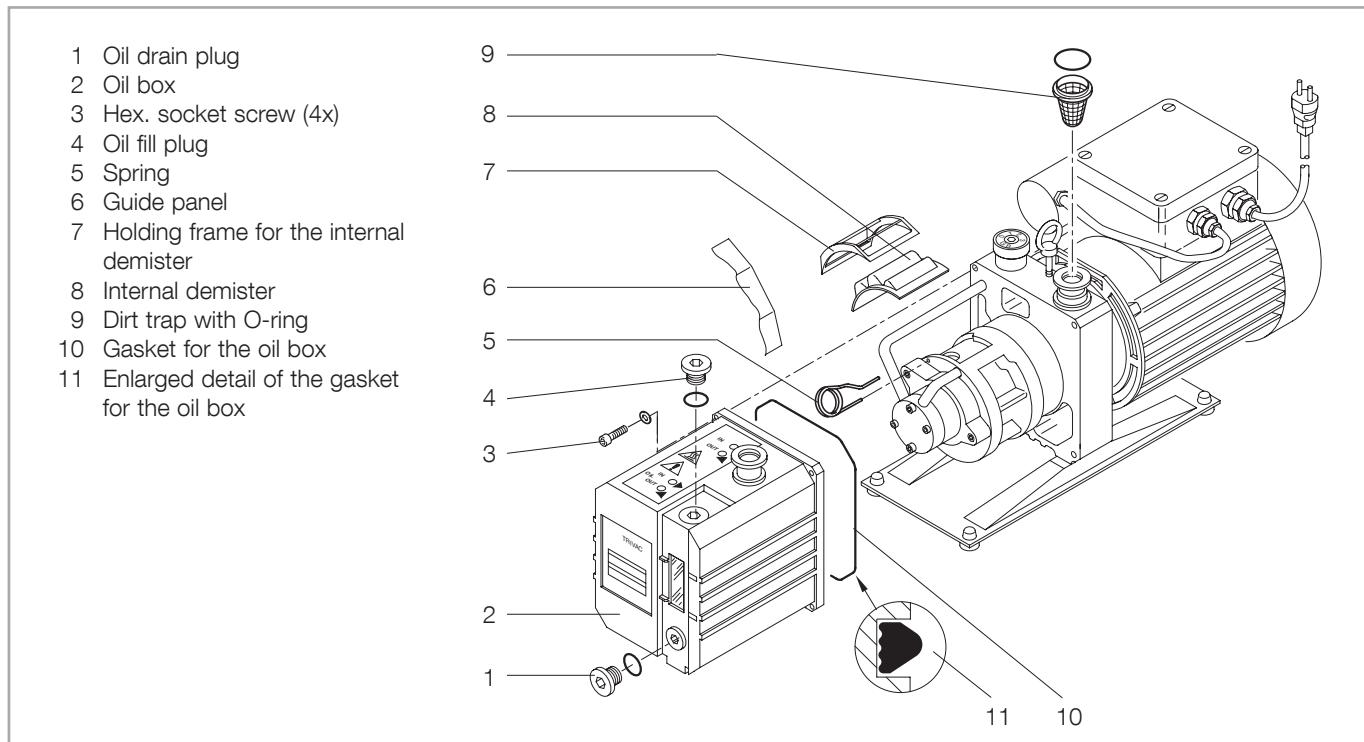


Fig. 7 Removing and inserting the internal demister

## 5.6 Removing and Fitting the Internal Demister

Simple maintenance on the side of the pump using Maintenance Kit 1

**Required tools:** Allen keys SW 4 and SW 8

The internal demister has been installed in a resilient frame. When it has clogged it will lift itself up periodically at high intake pressures in order to equalise the resulting pressure difference.

The increased noise level at high intake pressure is thus a sign for a clogged internal demister.

Depending on the operating conditions the internal demister will have to be cleaned regularly or it must be exchanged. Cleaning must be performed using a suitable solvent.

Switch the pump off and drain out the oil (in accordance with Section 5.4).

In order to collect the remaining oil in the oil box we recommend that you lift the pump up slightly at the side of the motor.

Unscrew the four hex. socket screws (7/3) of the oil box.

Pull the oil box (7/2) out to the front.

Remove the gasket (7/10) of the oil box.

Use a pair of pliers to pull the spring (7/5) out to the front.

Detach the holding frame (7/7) and the internal demister (7/8).

Clean all parts and check them for perfect condition and replace them as required.

Reassemble in the reverse order.

Make sure to fit the gasket for the oil box (7/10) with the flat side in the groove, see item 11 in Fig. 7.

Torque for the hex. socket screws (7/3) is 5.5 Nm.

## 5.7 Disassembly and Reassembly of the Electric Motor

### Risk due to high voltages

Death or severe injury caused by an electric shock!

Before starting work, always disconnect the motor from the mains. Pull the mains plug. Observe Safety Informations 0.2.

#### Required tools:

Spanner size 8 and special tool for the tie rod

We recommend that you remove the foot (8/8) of the pump.

Place the pump on the front side of the oil box (8/1). Remove the two hex. screws (8/2) from the fan cowl (8/3).

Detach the fan cowl.

Unscrew the tie rod (8/4).

Detach the motor (lever off using two screwdrivers inserted in parallel between the end plate A and the HV bearing piece (8/6 and 8/7).

Clean all parts and make sure that they are in perfect condition; replace any parts as required.

### NOTICE



### DANGER

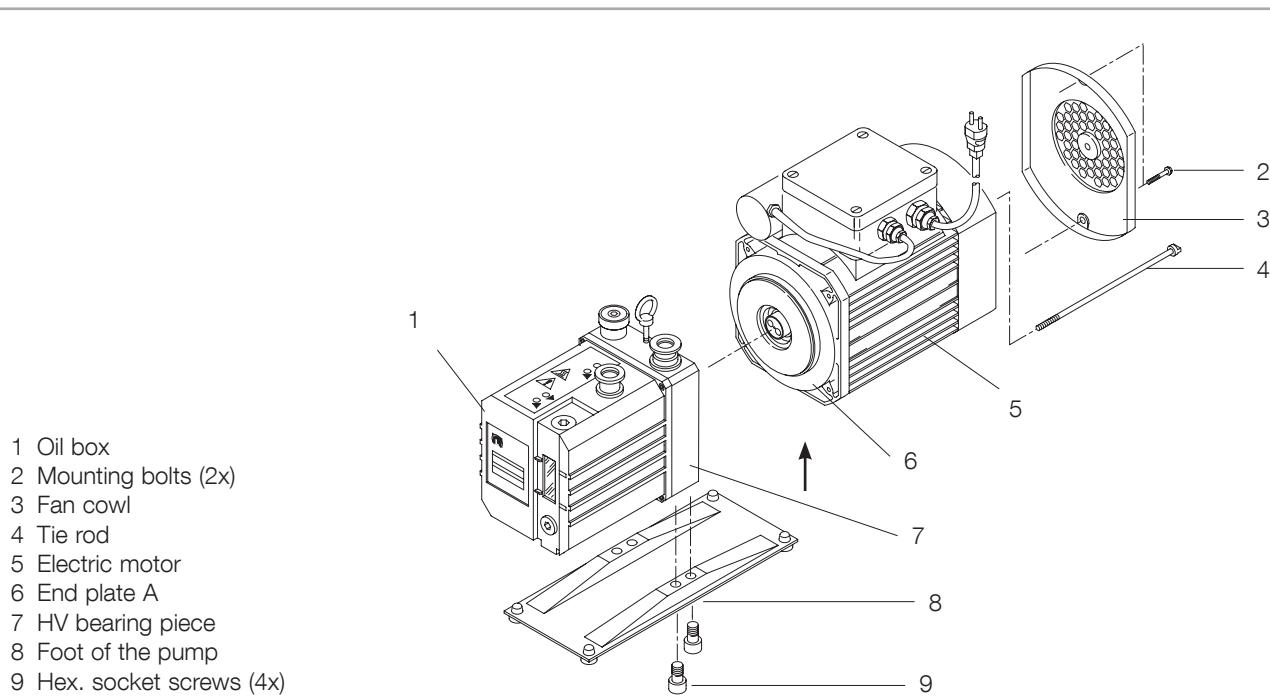


Fig. 8 Disassembly and assembly of the electric motor

# Maintenance

In case of wear exchange the coupling bushings; these are included in repair set 1.

Reassemble in the reverse order.

Tighten the tie rods crosswise to 4 Nm.

Tighten the bolts for the pump's base to 5 Nm.

---

**NOTICE**

Especially note the position of the oil ejection hole (see arrow in Fig. 8) in the end plate A. The hole must always lead downward.

## 5.8 Full maintenance

Clean the pump and run maintenance on it.

Clean and perform maintenance on the pump as described in the instructions for maintenance kit 2.

# Troubleshooting

Fault	Possible cause	Remedy	Repair*
<b>6 Troubleshooting</b>			
Pump does not start.	Wiring is malfunctioning.  Power supply voltage does not match the rating of the motor.  Motor is malfunctioning.  Oil temperature is below 12 °C.  Oil is too thick.  Exhaust filter/exhaust line is clogged.  Pump is seized up (sign: pump is jammed).	Check and repair wiring  Replace the motor.  Replace the motor.  Heat the pump and pump oil or use a different oil.  Change the oil.  Replace the filter or clean the exhaust line.  Repair the pump.	-  5.7  5.7  4.3.3/5.4  5.4  -
Pump does not reach ultimate pressure.	Measuring technique or gauge is unsuitable.  External leak <sup>1)</sup> .  Dirty internal demister  Exhaust valve is malfunctioning.  Oil is unsuitable.  Intake line dirty or leaky.  Pump is too small.	Use correct measuring technique and gauge. Measure the pressure directly at the pump's intake port.  Repair the pump.  Perform maintenance  Repair the valve.  Change the oil (degas it, if necessary).  Clean or exchange the intake line.  Check the process data, replace the pump, if necessary.	-  Service  M. Kit 1 / 5.6  Rep. Set 2  5.4  -
Pumping speed is too low.	Dirt trap in the intake line is clogged.  Clogged exhaust filter.  Connecting lines are too narrow or too long.	Clean the dirt trap  Preventive action: install a dust filter in the intake line  Exchange the filter element.  Use adequately wide and short connecting lines.	5.5  -  3.3
After switching off the pump under vacuum, pressure in the system rises too fast.	System has a leak.  Faulty tandem valve.  Inner shaft seal is faulty.  Faulty exhaust or bypass valve.	Check the system.  Repair the valve.  Exchange the shaft seal.  Repair the valve(s).	-  Rep. Set 3  Rep. Set 3  Rep. Set 2

\* Repair: Refer to the stated section in these Operating Instructions.

<sup>1)</sup> Bubble test: The warm pump with degassed oil is running without gas ballast and the intake is blanked off. The exhaust line is led into a vessel with water.

If an evenly spaced line of bubbles appears then the pump has an external leak.

# Troubleshooting

Fault	Possible cause	Remedy	Repair*
Pump gets hotter than previously observed.	Supply of cooling air is obstructed.  Ambient temperature is too high. Process gas is too hot. Not enough oil. Unsuitable oil. Oil circulation is obstructed	Properly install the pump.  Properly install the pump. Change the process. Fill in oil. Change the oil. Clean or repair the oil channels.	3.1  3.1/4.3.3 - 5.4 5.4 Service
	Clogged exhaust filter or exhaust line. Exhaust valve faulty. Deviating mains voltage.	Change the exhaust filter, clean the exhaust line. Repair the valve. Check power supply rating of the motor and the mains supply	- - Rep. Set 2 -
Oil in the intake line or in the vacuum chamber	Oil comes from the vacuum system.  Blocked tandem valve.	Check the vacuum system.  Clean or repair the valve.	- Rep. Set 3
Oil is turbid.	Condensation.	Degas the oil or change the oil and clean the pump. Precaution: open the gas ballast valve or fit separator.	4.3.2/5.4
Pump is excessively noisy.	Oil level is much too low (oil level is no longer visible).  Intake pressure is too high. Internal demister is clogged. Coupling bushings worn out. Vanес or bearings are damaged. Faulty motor bearing.	Add oil.  Reduce the intake pressure. Clean or replace demister. Replace the coupling bushings. Repair pump. Exchange the motor bearing.	5.3/5.4 - 5.6 / M. Kit 1 Rep. Set 1 Service Service
Oil leak at the side of the motor.	Outer shaft seal damaged or worn out.	Exchange the shaft seal.	Rep. Set 1

# Wearing Parts and Original Spare Parts

## 7 Wearing Parts and Original Spare Parts

As to spare parts for your vacuum pump, please refer to the spare parts list enclosed with the product.

### 7.1 Maintenance Kits and Repair Sets

The maintenance and repair kits have been so arranged that the spare and exchange parts they contain cover any servicing work which might be required.

Each set comes with brief instructions in which the necessary work is detailed. This very much simplifies the servicing or repair work.

Given in the following is a brief description of the individual kits and how to use these.

#### **Maintenance Kit 1**

This kit is recommended for maintenance after an operating period of one year. It contains the gaskets for the oil box, the internal demister which separates the oil from the gas (for contents see Fig. 9) leeves and compression spring for the oil pump (for contents see Fig. 10).

#### **Repair Set 1**

This kit is used for the seal on the side of the motor. It contains the gaskets for the side of the motor, the shaft sealing ring as well as the following wearing parts: coupling sleeves and compression spring for the oil pump (for contents see Fig. 10).

#### **Repair Set 2**

This set will only be required in those cases where the pump is not capable of attaining its ultimate pressure. This kit contains the valves, the internal demister which separates the oil from the gas as well as the gaskets for the oil box (for contents see Fig. 11).

#### **Maintenance Kit 2 / Repair Set 3**

These kits are identical. They contain all wearing parts, all gaskets and the internal demister which separates the oil from the gas.

They are used as follows:

1. Maintenance after three years of operation
2. Complete repair

(for contents see Fig. 10, 11 and 12).

# Wearing Parts and Original Spare Parts

## 7.2 Ordering Information for the Maintenance Kits and the Repair Sets

### TRIVAC

**D 2,5 E 2**

Maintenance kit 1	200 40 022
Maintenance kit 2	E 100 000 347
Repair set 1	E 100 000 351
Repair set 2	200 40 024
Repair set 3	E 100 000 347

The use of the maintenance kits and the repair sets is detailed in the Tables 5.1 - Maintenance Plan and 6 - Troubleshooting.

## 7.3 Ordering Information for the Special Tools

### TRIVAC

**D 2,5 E 2**

Special tool for the tie rods	200 02 760
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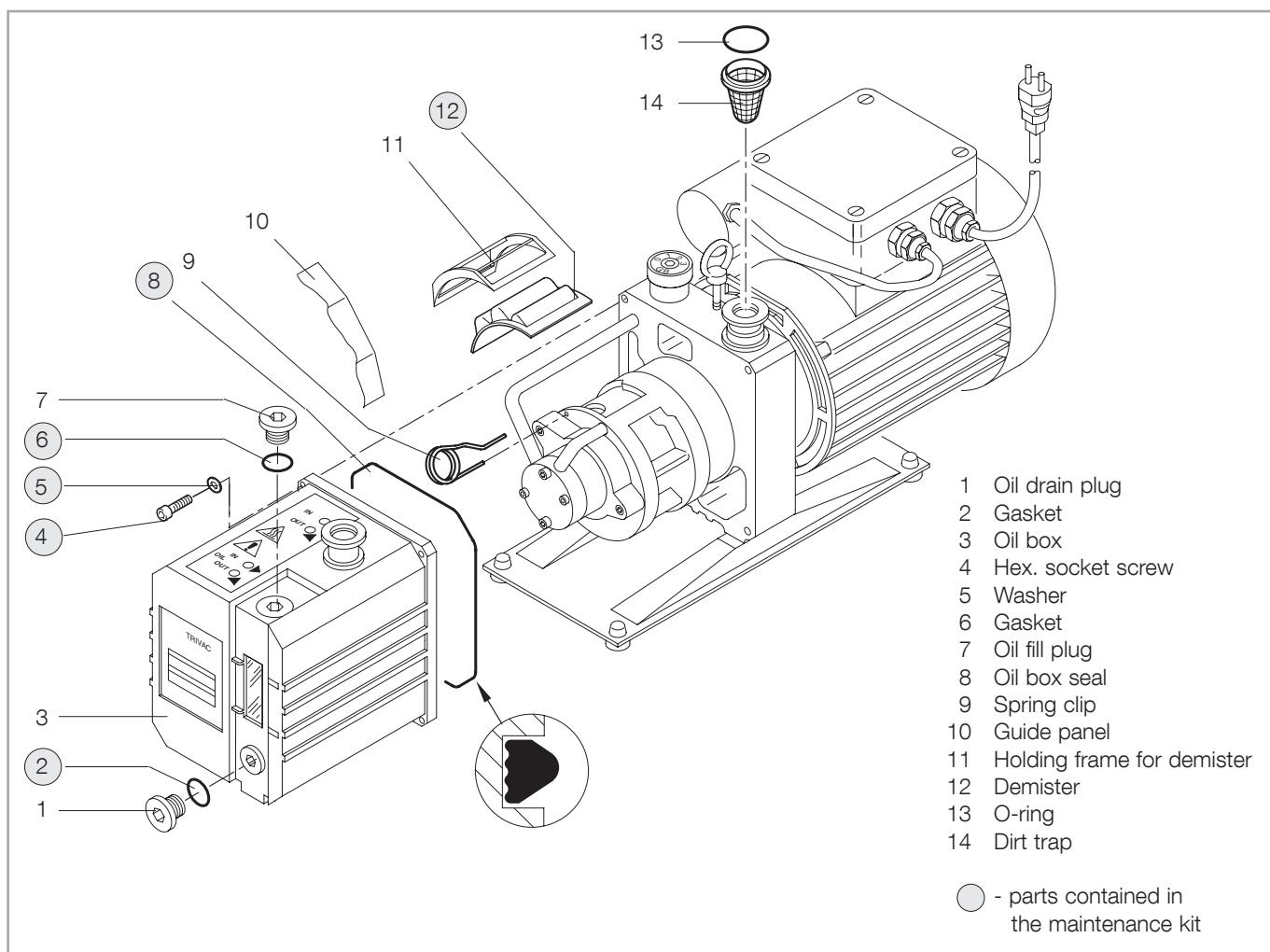
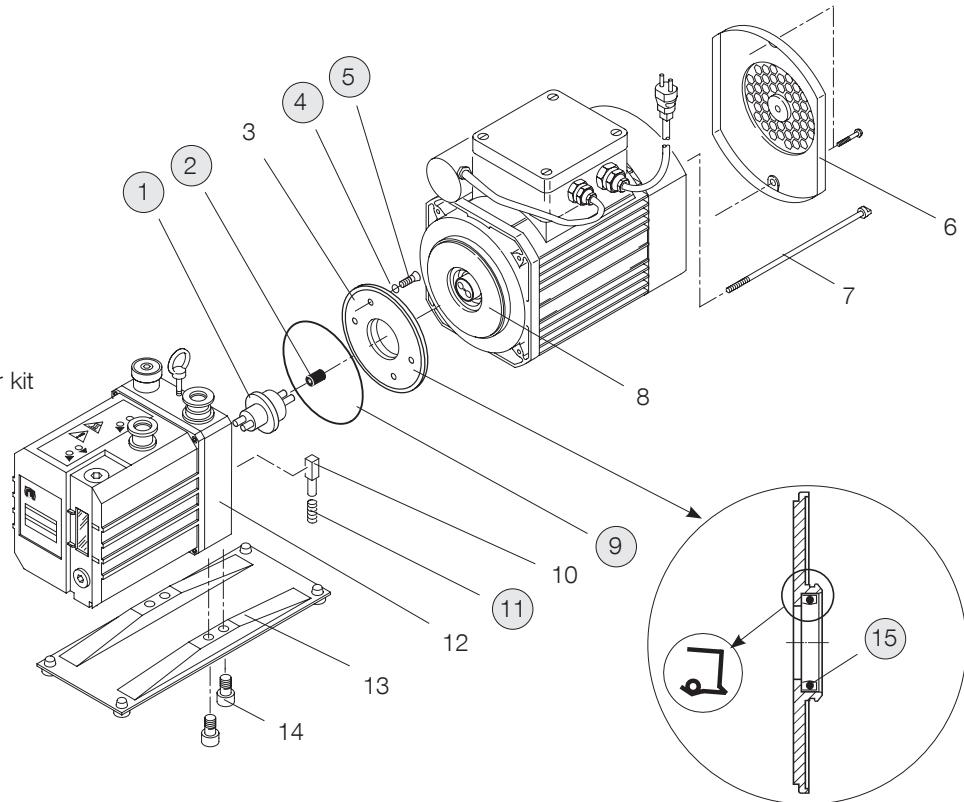


Fig. 9 Maintenance Kit 1

# Wearing Parts and Original Spare Parts

- 1 Coupling/Oil pump
- 2 Coupling bushing (2x)
- 3 Flange for the shaft sealing ring
- 4 O-ringe (4x)
- 5 Bolt (4x)
- 6 Fan cowl
- 7 Tie rods (4x)
- 8 A-bearing plate
- 9 O - ring
- 10 Stopper
- 11 Compression spring
- 12 HV-bearing piece
- 13 Base
- 14 Hex. socket bolt (4x)
- 15 Shaft sealing ring

○ - parts included in the repair kit



Sectional view of the flange for the shaft sealing ring and orientation of the shaft sealing ring

Fig. 10 Repair Set 1

# **Wearing Parts and Original Spare Parts**

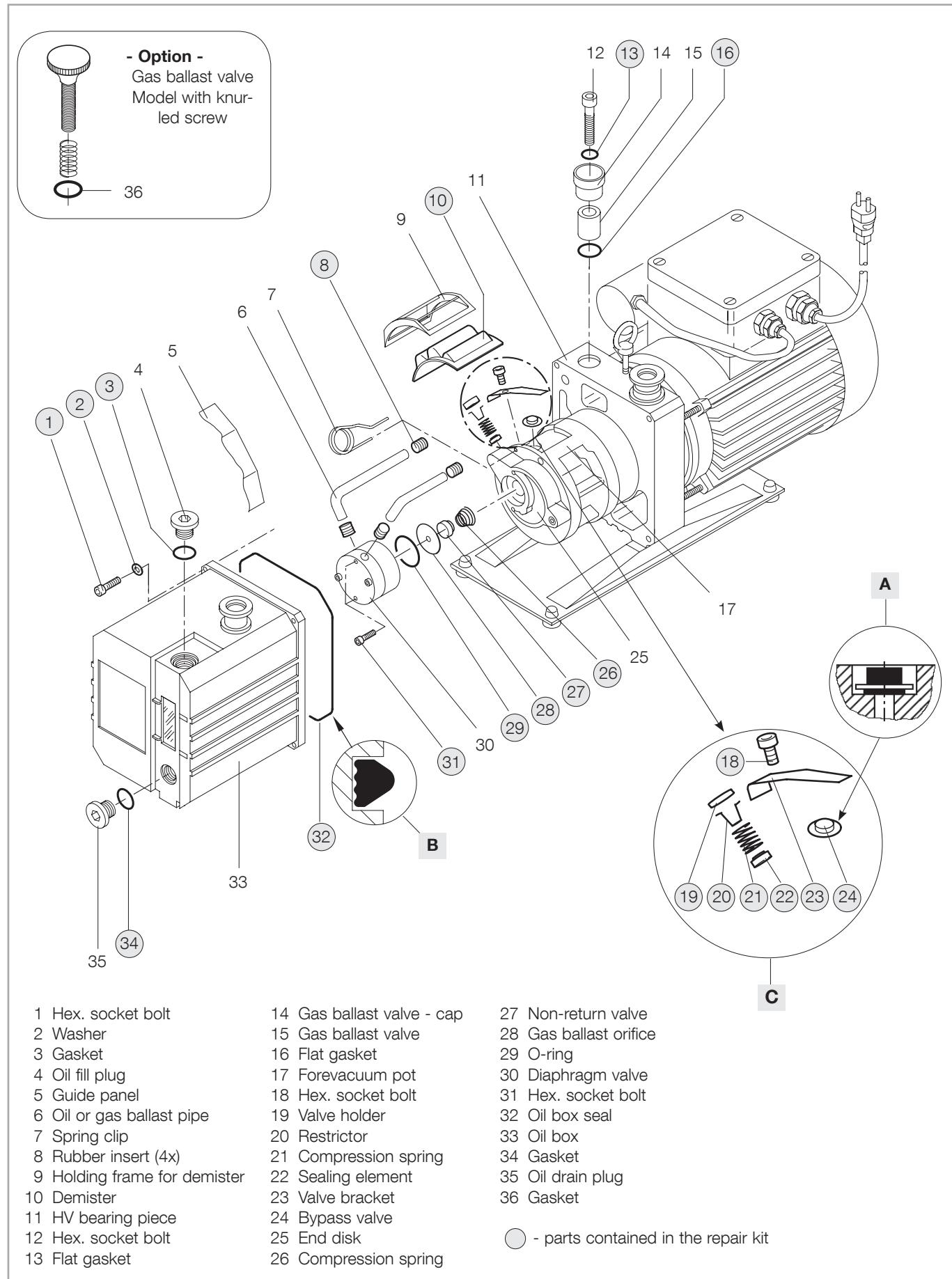
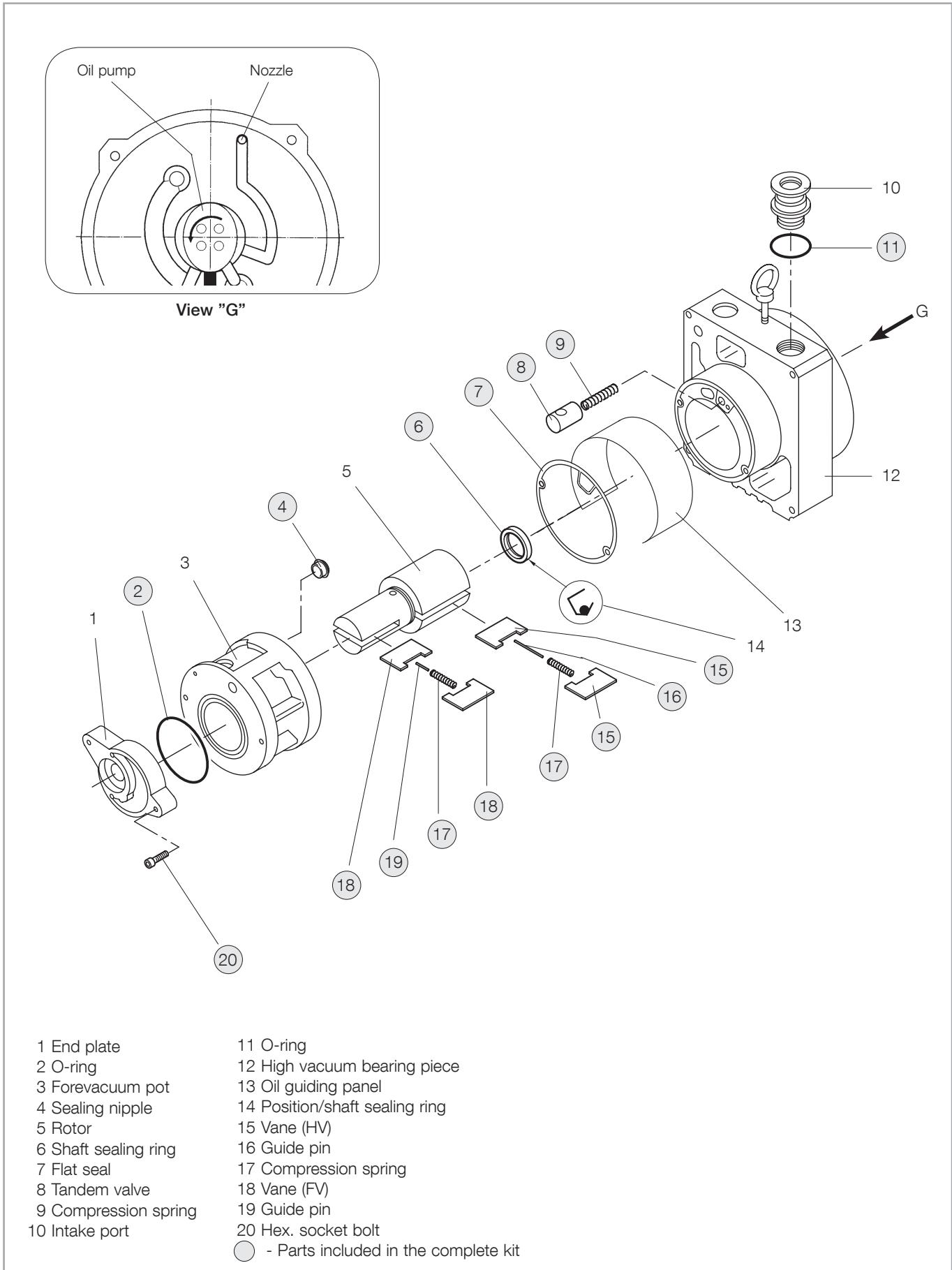


Fig. 11 Repair Set 2

# Wearing Parts and Original Spare Parts



- 1 End plate
- 2 O-ring
- 3 Forevacuum pot
- 4 Sealing nipple
- 5 Rotor
- 6 Shaft sealing ring
- 7 Flat seal
- 8 Tandem valve
- 9 Compression spring
- 10 Intake port
- 11 O-ring
- 12 High vacuum bearing piece
- 13 Oil guiding panel
- 14 Position/shaft sealing ring
- 15 Vane (HV)
- 16 Guide pin
- 17 Compression spring
- 18 Vane (FV)
- 19 Guide pin
- 20 Hex. socket bolt

○ - Parts included in the complete kit

Fig. 12 Complete Kit

# Disposal

## 8 Waste Disposal

The equipment may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices. Further details are available on request.

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### WARNING



Risk of injury and environmental damage

Contaminated parts can be detrimental to health and environment. Before beginning with any work, first find out whether any parts are contaminated.

Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts; For example wear gloves, face protection or breathing protection.

Separate clean components according to their materials, and dispose of these accordingly. We offer this service. Further details are available on request.

When sending us any equipment, observe the regulations given in Section "5.2 Leybold Service".

### Disposal of Waste Oil

Owners of waste oil are entirely self-responsible for proper disposal of this waste.

Waste oil from vacuum pumps must not be mixed with other substances or materials.

Waste oil from vacuum pumps (Leybold oils which are based on mineral oils) which are subject to normal wear and which are contaminated due to the influence of oxygen in the air, high temperatures or mechanical wear must be disposed of through the locally available waste oil disposal system.

Waste oil from vacuum pumps which is contaminated with other substances must be marked and stored in such a way that the type of contamination is apparent. This waste must be disposed of as special waste.

European, national and regional regulations concerning waste disposal need to be observed. Waste must only be transported and disposed of by an approved waste disposal vendor.

## EU Declaration of Conformity

(Translation of original Declaration of Conformity)

**The manufacturer:**

Leybold GmbH  
Bonner Strasse 498  
D-50968 Köln, Germany

herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EU Directives. This declaration becomes invalid if modifications are made to the product without agreement of Leybold GmbH.

**Product designation:** Rotary vane pump

**Type designation:** TRIVAC D2,5E

**Catalogue No.:** 140000; 140001; 140002; 140003; 140004; 140005; 140008;  
140009; 140020; 140021; 140022; E140020

**The products complies to the following Directives:**

Machinery Directive (2006/42/EC)

The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Appendix 1 No. 1.5.1 of Machinery Directive 2006/42/EC.

Electromagnetic Compatibility (2014/30/EU)

**The following harmonized standards have been applied:**

EN 1012-2:1996+A1:2009	Compressors and vacuum pumps — Safety requirements Part 2: Vacuum pumps
EN 60204-1:2006	Safety of machinery — Electrical equipment of machines Part 1: General requirements
EN 61000-6-2:2005/AC:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4:2007/A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

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