



TRIVAC E 2 / D 2.5 E

Dual-Stage Rotary Vane Vacuum Pump

Operating instructions GA01602_002_C2

Part Numbers

140000

140001

140009



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Product warranty and limit of liability are dealt with in our standard terms and conditions of sale or negotiated contract under which this document is supplied.

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product. For manual enquiries, email documentation@leybold.com.

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1 Safety and compliance

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use. Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions.

The instruction manual is an important safety document that we often deliver digitally. It is your responsibility to keep the instruction manual available and visible while working with the equipment. Please download the digital version of the instruction manual for use on your device or print it if a device will not be available.

1.1 Definition of Warnings and Cautions

Important safety information is highlighted as warning and caution instructions which are defined as follows. Different symbols are used according to the type of hazard.

WARNING:

If you do not obey a warning, there is a risk of injury or death.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

1.2 Trained personnel

For the operation of this equipment “trained personnel” are:

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

Safety and compliance

1.3 Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that we use on the product or in the product documentation have the following meanings:

	Warning/Caution Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.
	Warning - Corrosive substances Risk of injury or damage to equipment. Identifies the presence of corrosive gases, liquids or materials.
	Warning - Dangerous voltage Risk of injury. Identifies possible sources of hazardous electrical shock.
	Warning - Flammable material Risk of fire. Identifies possible sources of flammable gases, liquids or materials.
	Warning - Hot surfaces Risk of injury. Identifies a surface capable of inflicting burns through contact.
	Warning - Pressurised Risk of injury or damage to equipment. Identifies equipment containing pressurised gases or liquids.
	Warning - Risk of explosion Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.
	Warning - Toxic material Risk of injury or damage to the environment. Identifies a source of toxic gases, liquid or material.
	Warning - Vacuum hazard Risk of injury. Identifies the source of a dangerous vacuum.
	Mandatory action symbol Failure to comply with this action may result in injury or damage to equipment.
	Warning - Use protective equipment Risk of injury. Use appropriate Personal Protective Equipment (PPE) when performing the task.

Important safety information

2 Important safety information

2.1 Mechanical hazards



WARNING: OPERATION SAFETY

Risk of injury. Avoid exposing any part of the human body to the vacuum.



WARNING: AUTOMATIC START UP

Risk of injury. The equipment can be started remotely and without warning.



WARNING: RISK OF EXPLOSION

Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.

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 pump (including its accessories) is being operated should be such that angles over 10° from the vertical are avoided. Select the operating place so that all controls are easily accessible.
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 (g). An exhaust line which is too small in diameter or which is blocked can result in the formation of overpressure 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 make sure that there are no obstructions.
8. When moving the pump always use the allowed means and follow the specified procedure. Use all lifting eyes when moving the pump body. Pay attention to the centre of gravity.

2.2 Electrical hazards



WARNING: DANGEROUS VOLTAGE

Risk of electric shock. Death or severe injury caused by an electric shock.

Important safety information

1. The electrical connection must only be provided by a trained person. Observe the national regulations in the country of use like EN 50110-1 for Europe, as an example.
2. Lethal voltages are present at the mains connections. Before you start 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.

2.3 Thermal hazards



WARNING: HOT SURFACES

Risk of injury. Identifies a surface capable of inflicting burns through contact.

-
1. Under certain ambient conditions the pump 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 information.

2.4 Hazards caused by materials and substances



WARNING: TOXIC MATERIAL

Risk of injury or damage to the environment. Identifies a source of toxic gases, liquid or material.



WARNING: FLAMMABLE MATERIAL

Risk of fire. Identifies possible sources of flammable gases, liquids or materials.

Important safety information



WARNING: CORROSIVE SUBSTANCES

Risk of injury or damage to equipment. Identifies the presence of corrosive gases, liquids or materials.



WARNING: RISK OF EXPLOSION

Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.

-
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 pump, 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 pyrophoric substances, the operating company is under the obligation to comply with the national and international safety regulations and guidelines. Regarding the suitability of the pumps for special applications in which such gases, respectively substances shall be pumped, we 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 pre- pared 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.

2.5 Danger of ignition



WARNING: RISK OF EXPLOSION

Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.

-
1. The standard version of the pump is not suited for operation in explosion hazard areas.

Important safety information

2. The pumps including the accessories are fundamentally not suited for pumping of combustible and explosive gases or vapours. The pump including accessories is only suited within the scope of the ATEX guideline for pumping of explosive gases and 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 therefore derive the necessary safety measures which must be introduced.
3. Provided ignitable or pyrophoric substances are present in the equipment you must:
 - Make sure that no air can enter into the equipment,
 - Make sure that the system is leak-tight,
 - With an inert gas purge (with dry nitrogen, as an 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.

2.6 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 pump 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.).

Important safety information

11. Corrosion, deposits and cracking of oil within the pump are not allowed.
12. 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.
13. 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.
14. In the case of custom pumps please note the information provided in the supplementary sheets.

Description

3 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 $\text{m}^3 \cdot \text{h}^{-1}$.

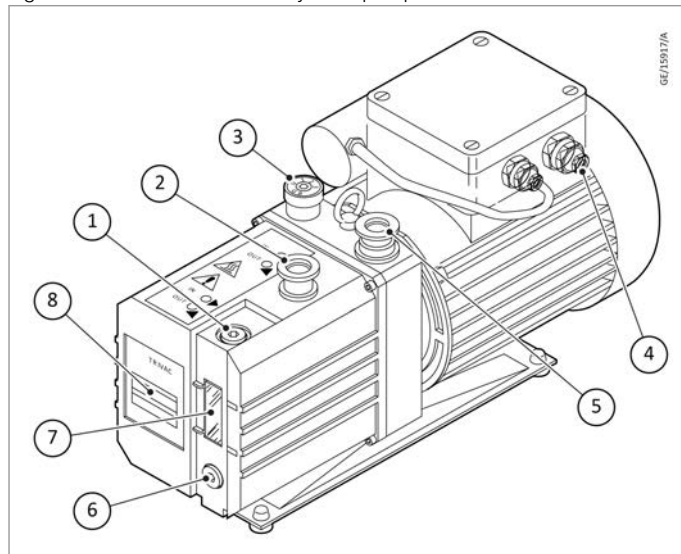
These pumps are capable of pumping gases and vapours out of vessels and vacuum systems down into the fine vacuum pressure range. The standard pumps are not designed to handle oxygen at concentrations exceeding the concentration of oxygen in the atmosphere. Moreover, these pumps are not suited for pumping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

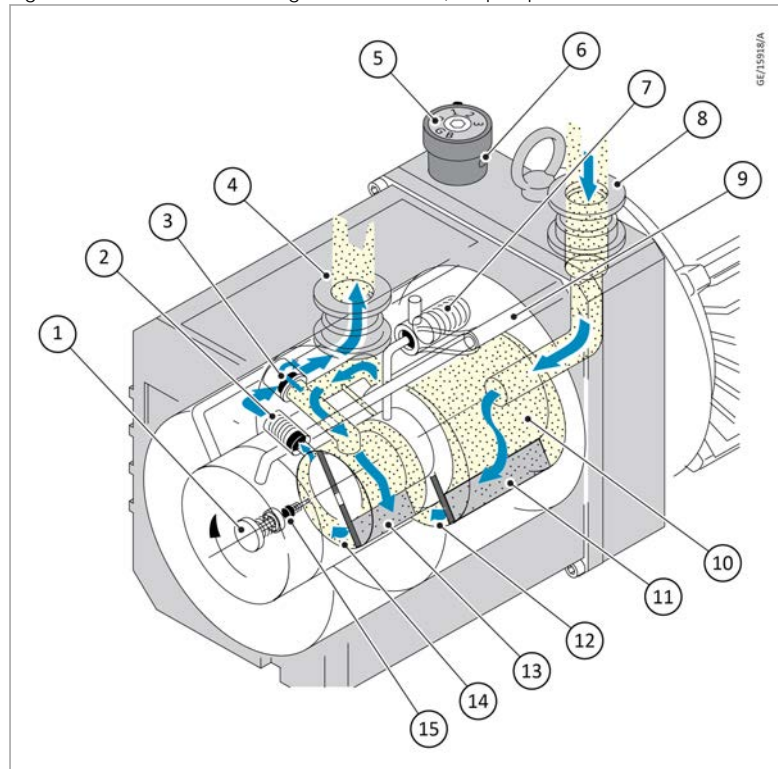
Figure 1. TRIVAC D 2.5 E rotary vane pump



- | | |
|------------------------|---------------------------|
| 1. Oil fill | 2. Exhaust port |
| 3. Gas ballast valve | 4. Mains power connection |
| 5. Intake port | 6. Oil drain |
| 7. Oil level indicator | 8. Name plate |

Description

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



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

3.1 Function

The rotor which is eccentrically arranged in the pump housing (pump chamber) has two radially sliding vanes 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 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.

By opening the gas ballast valve 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

Description

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 [Figure: Repair Set 2](#) on page 49). When fully opening this valve, the resulting gas flow will correspond to that of valve position 3 in [Table: Gas Ballast valve positions](#) on page 16.

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.

Table 1. Gas Ballast valve positions

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

3.2 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.

Description

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:

- Part number 140000 is supplied with cable and Schuko shockproof plug (CEE 7/4);
- Part number 140001 is supplied w/o cable, pls. order cable separately.

 Note:

Notes on the Oil and how to order. Oil LVO 130 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 us.

Technical data

4 Technical data

4.1 General technical data

Table 2. General technical data

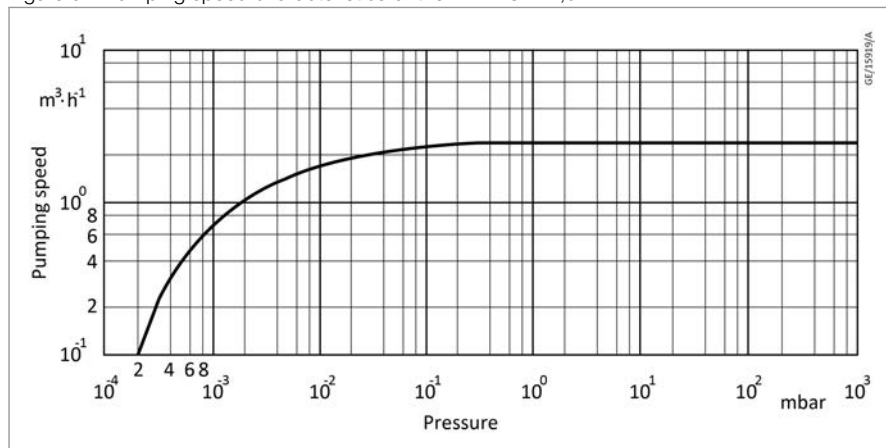
Parameter	Units	D 2.5 E two-stage 50 Hz / 60 Hz
Nominal pumping speed ¹⁾	$\text{m}^3 \cdot \text{h}^{-1}$	3.2 / 3.6
Pumping speed ¹⁾	$\text{m}^3 \cdot \text{h}^{-1}$	2.7 / 3.3
Ultimate partial pressure without gas ballast ¹⁾	mbar	5×10^{-4}
Ultimate total pressure without gas ballast ¹⁾	mbar	2×10^{-3}
Ultimate total pressure with gas ballast ¹⁾	mbar	3×10^{-3}
Water vapour tolerance ¹⁾		
Stage 1	mbar	10
Stage 2		20
Stage 3		30
Water vapour capacity		
Stage 1	$\text{g} \cdot \text{h}^{-1}$	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

¹⁾ In acc. with DIN 28 400 et seq. valid for LVO 130. For other oils the ultimate pressure may differ.

²⁾ 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.

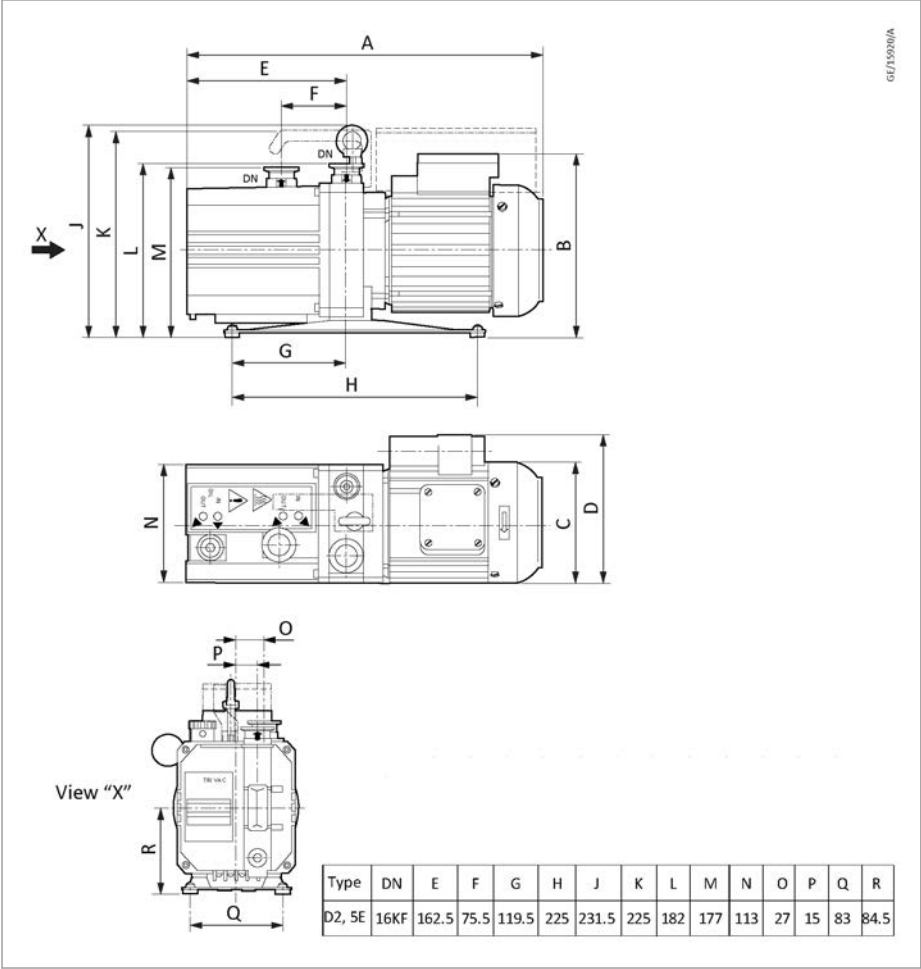
4.2 Dimensional drawing

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



Technical data

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



Dimensions (A), (B), (C) and (D) see next page

Technical data

4.3 Technical data

Table 3. Technical data

Cat.-No. of the pump	14000,140001, 140009
Motor type	MDE71p4
Motor L/N	20015419
IP rating	IP55/ TE
Operating mode IEC34 / Duty	-
Isolation class	F(B)
Phases	1~
Manufacturer	Carpanelli S.p.A. Via 2 Agosto 1980, n.5, 40016 S.Giorgio di Piano Bologna - Italy
Number of poles	4
Nominal output power at 50/60 Hz	300 W
Nominal in frequency	50 Hz 60 Hz
Nominal voltage range and nominal current at 50 Hz	115/230V, 4.4/2.2A
Nominal voltage range and nominal current at 60 Hz	115/230V, 3.8/1.9A
Tolerances of voltage range ¹⁾	±10%
Nominal speed at 50 Hz	1430 rpm
Nominal speed at 60 Hz	1730 rpm
Disposal	local directives have to be considered
Max. altitude above sea level	1000 m above sea level
Max. ambient temperature when operating ¹⁾	40 °C
T-board / plug	Multi pin plug at the junction box, mains cord: <ul style="list-style-type: none"> ▪ 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)
Length of the pump (A)	401 mm
Height of the pump up to the upper edge of the junction box (B)	240 mm
Width of the motor (D)	140 mm
Weight of the motor	8 kg



Note:

The P/N 140001 does not come with cable

5 Transportation



WARNING: HEAVY OBJECT

Risk of injury and/ or damage to the equipment. 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.

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).

5.1 Storage

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.

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 [Oil change](#) on page 35). We recommend that you contact us.

Installation

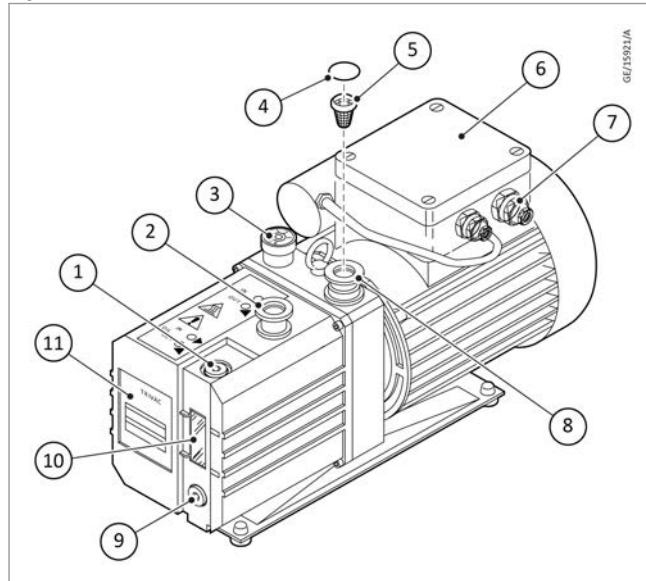
6 Installation



WARNING: INSTALLATION SAFETY

Instructions for the operating personnel. Before any kind of assembly work the personnel must be informed in advanced about potential hazards. Observe [Important safety information](#) on page 9 .

Figure 5. Connections and controls



- | | |
|----------------------|-------------------------|
| 1. Oil fill | 2. Exhaust port |
| 3. Gas ballast valve | 4. O-ring |
| 5. Dirt sieve | 6. ON/OFF switch |
| 7. Mains connection | 8. Intake port |
| 9. Oil drain | 10. Oil level indicator |
| 11. Name plate | |

6.1 Placement



WARNING: EXPLOSION RISK

Risk of injury and/ or damage to the equipment. The standard pump is not suited for installation in the explosion hazard areas. Observe [Danger of ignition](#) on page 11.



CAUTION: RISK OF TOPPLING

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

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

**NOTICE:**

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.

**NOTICE:**

Note the ambient conditions during operation

The ambient temperature should +40 °C not exceed and not drop below +12 °C (see [Operating Temperature](#) on page 29).

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 [Oil change](#) on page 35).

6.2 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.

**NOTICE:**

Pumping of dust or much contaminated media. e 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.

Installation

6.2.1 Abnormal use

WARNING: CORROSIVE AND TOXIC SUBSTANCES



Risk of injury or damage to the pump. 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).

CAUTION: INSTALLATION SAFETY



Risk of damage to the pump. 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.



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.

6.3 Connection to the System

WARNING: OVERPRESSURE IN EXHAUST LINE



Risk of injury and damage to the equipment. 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 (g).



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 a damaged or even burst open pump. Thus the exhaust line must be checked from time to time to make sure that there are no obstructions.

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

WARNING: EXHAUST EMISSION HAZARD



Risk of injury. Safely lead the exhaust gases away. Exhaust gases, depending on the type of application, may 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. To reduce the emission of oil vapours we recommend the installation of an additional exhaust filter (refer to [Accessories](#) on page 45).

Depending on the type of application or the kind of pumped media, the corresponding regulations and information sheets must be observed.

**NOTICE:**

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

Avoid back flowing 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.

**NOTICE:**

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

Refer to [Figure: Connections and controls](#) on page 22. Before connecting the pump, the shipping seals on the connection flanges 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 with the O-ring.

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.

6.4 Electrical Connections

**WARNING: HAZARDOUS VOLTAGE**

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.

**WARNING: AUTOMATIC START UP**

Risk of injury and/ or damage to the equipment. 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 [Electrical hazards](#) on page 9

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

Installation

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.

7 Operation

7.1 Media compatibility

TRIVAC 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 is set to position 3.

7.2 Start-up



WARNING: OPERATION SAFETY

Risk of injury and/ damage to pump. 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.



WARNING: OPERATION SAFETY

Risk of injury. 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.

Observe [Mechanical hazards](#) on page 9.

Check the oil level each time before switching on the pump, see [Monitoring the oil level](#) on page 34.

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 (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 open (position 2 of the gas ballast valve).

Operation

7.3 Operation

CAUTION: EXPLOSIVE HAZARD



Risk of injury and/ or damage to the pump. 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.

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 and that the pump has attained its operating temperature.

7.3.1 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 [Pumping of Condensable Gases and Vapours](#) on page 28.

7.3.2 Pumping of Condensable Gases and Vapours

CAUTION: CORROSIVE SUBSTANCE

Risk of damage to the pump. 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.

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.

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.

7.3.3 Operating Temperature



WARNING: HOT SURFACES

Risk of injury. Beware of hot surfaces

There is the danger of receiving burns. Observe [Thermal hazards](#) on page 10.

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.

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

7.3.4 Shutdown



WARNING: USE CORRECT PPE

Risk of injury. 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 [Hazards caused by materials and substances](#) on page 10.

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 [Pumping of Condensable Gases and Vapours](#)).

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:

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

Please also take note of the information given in [Transportation](#) on page 21.

Operation

Shutdown through Monitoring Components



WARNING: OPERATION SAFETY

Risk of damage to equipment. 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.

Controller/Mains Power Failure



WARNING: AUTOMATIC RESTART AFTER VOLTAGE FAILURE

Risk of injury or damage to equipment. 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.

8 Maintenance



WARNING: HAZARDOUS VOLTAGES

Risk of injury. 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 [Electrical hazards](#) on page 9.



WARNING: HAZARDOUS SUBSTANCES

If the pump has pumped harmful substances, contrary to what has been stated in [Normal use](#) on page 23, ascertain the nature of hazard and take adequate safety measures. Observe [Hazards caused by materials and substances](#) on page 10.

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 [Maintenance plan](#) on page 32.

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

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. We offer practical courses on the maintenance, repair, and testing of TRIVAC E pumps. For further details contact us.



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.

Maintenance

8.1 Maintenance plan

Table 4 Maintenance plan

Action	Measure / Test Quantity Option / Auxiliary Materials	Interval	Remarks
Operate the pump for at least 1 hour with gas ballast.		Daily	Condensed water is thus removed from the oil
Check the oil level, if required change the oil.	Oil: LVO130 or special and alternative.	Daily, before switching on the system	Refill: Only after the pump has been switched off.
Check the quality of the oil, change the oil if required.	Visually (all oils)	Daily, before switching on the system	Visually: normally light and transparent, oil change is required when discolorations increase.
	Chemically	Six monthly	Chemically: to DIN 51558, when the neutralisation number exceeds 2; then an oil change will be required.
	Mechanically	Six monthly	Mechanically: when viscosity is 20 % above the one of fresh oil; then an oil change will be required
Clean the inlet screen in the intake port, change it as required.	Suitable cleaning agent and compressed air.	Six monthly	<ul style="list-style-type: none"> ▪ Clean inlet screen with a cleaning agent and blow it out with compressed air under a suction hood. ▪ Replace the defective inlet screen. Use a cleaning agent which complies with the national/international specifications. Observe the safety regulations when using cleaning agents.
Clean the internal demister, change it as required.	Suitable cleaning agent.	Annually	Already clean before the maintenance interval has elapsed when the noise level interval has elapsed when the noise level increases. <ul style="list-style-type: none"> ▪ Clean internal demister with cleaning agent ▪ Replace the defective internal demister ▪ Dispose of the defective internal demister as special waste. Cleaning agent according to national/international specifications. Observe the safety regulations when using cleaning agents.
Check the edges of the teeth on the coupling element for any	-	Annually	-

Maintenance

Action	Measure / Test Quantity Option / Auxiliary Materials	Interval	Remarks
damages, change the coupling element as required.			
Change the oil.	Oil: LVO130	Annually	Oil change: <ul style="list-style-type: none"> First oil change after 100 operating hours. Pump switched off and cold. Exchange the oil while the pump is cold so as to avoid releasing adsorbed gases.
Clean the oil level glass.	Suitable cleaning agent and compressed air.	Annually	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. Observe the safety regulations when using cleaning agents. Quantity of oil: see Technical data on page 18
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.	Annually	Depending on the amount of dust check the pump and keep it clean. Caution: switch off the pump and make sure that it cannot run inadvertently (disconnect from the mains). Wipe plastic parts on the pumps of category 3G outside only with a moistened piece of cloth.
Full maintenance	Maintenance-Kit 2	Every 3 years	Clean and perform maintenance on the pump as describe in the instructions included with Maintenance-Kit 2

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 should be done by our service team.

Maintenance

8.2 Monitoring the oil level



WARNING: MAINTENANCE SAFETY

Risk of damage to the equipment. Check and top up oil only after having shut down the pump first. Please note the safety information given in [Thermal hazards](#) on page 10 and [Hazards caused by materials and substances](#) on page 10.

During operation of the TRIVAC E the oil level must always remain between marks (figure: [Oil change](#) on page 35) on the oil-level glass,. The amount of oil must be checked and topped up as required.

Pumps which have not directly been delivered from us, e.g. in systems, may have been filled with oils different from LVO 130. In this case a refill with LVO 130 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.

8.2.1 Checking the condition of LVO 130

The ageing process for the standard fluid LVO 130 (see [Supplied Equipment](#) on page 16) 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 130 oil is determined according to DIN 51558. If it exceeds 2, the oil should be changed.
- c. **Viscosity check**
If the viscosity of LVO 130 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 into a beaker or similar container.

Please note the safety information given in [Oil change](#) on page 35.

8.3 Oil change

WARNING: HAZARDOUS SUBSTANCES



Risk of injury or damage to the pump. 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 make sure that all necessary safety precautions are taken.

Use gloves, face protection or a respirator, for example: Observe Safety Information [Thermal hazards](#) on page 10 and [Hazards caused by materials and substances](#) on page 10.

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.



WARNING: HOT SURFACE



Risk of injury. 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.



NOTICE:

Check and top up oil only after the pump has been shut down.

When disposing of waste oil, observe the applicable environmental 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 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 and let the used oil drain into a suitable container.
- When the flow of oil slows down, screw the oil-drain plug back in, briefly switch on the pump (max. 10 s) and then switch it off again.
- Remove the oil-drain plug once more and drain out the remaining oil.
- Screw the oil-drain plug back in (check the gasket and reinstall a new one if necessary).
- Remove the oil-fill plug and fill in with fresh oil.
- Screw the oil-fill plug back in.
- The tightening torque for the bolts has been specified at 10 Nm.

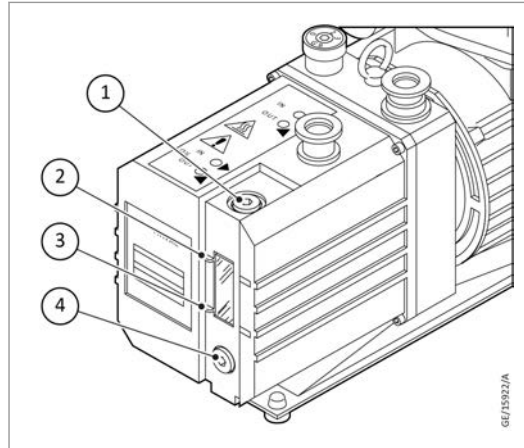
Maintenance



NOTICE:

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

Figure 6. Oil change



- | | |
|-----------------------------|-----------------------------|
| 1. Oil fill plug | 2. Oil level mark "maximum" |
| 3. Oil level mark "minimum" | 4. Oil drain plug |

8.4 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 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.



NOTICE:

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

8.5 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 [Oil change](#) on page 35).

Maintenance

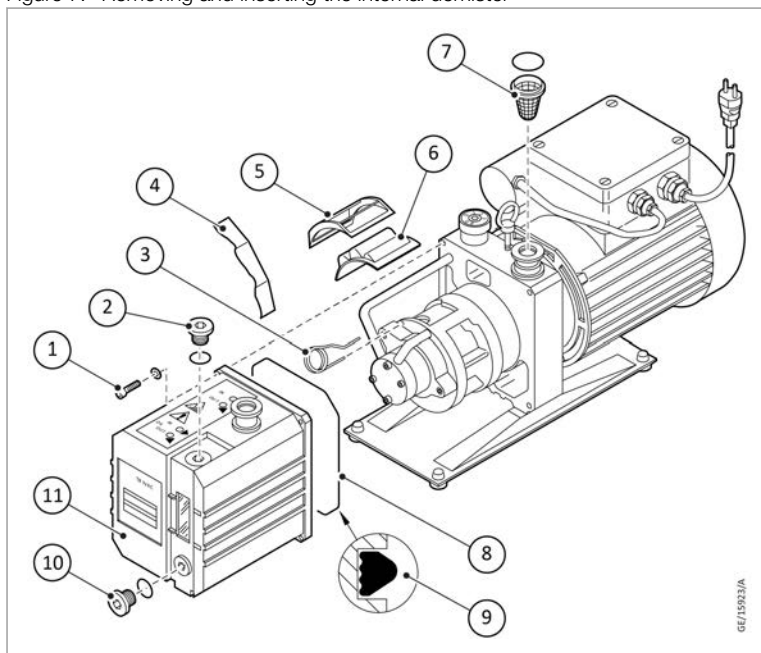
- In order to collect the remaining oil in the oil box we recommend that you lift the pump up slightly at the side of the motor.
- Unscrew the four hex. socket screws of the oil box. Pull the oil box out to the front.
- Remove the gasket of the oil box.
- Use a pair of pliers to pull the spring out to the front. Detach the holding frame and the internal demister.
- Clean all parts and check them for perfect condition and replace them as required.
- Reassemble in the reverse order.

Note:

Make sure to fit the gasket for the oil box with the flat side in the groove, see item 11 in [Figure: Removing and inserting the internal demister](#) on page 37.

Torque for the hex. socket screws is 5.5 Nm.

Figure 7. Removing and inserting the internal demister



- | | |
|--|---------------------------|
| 1. Hex. socket screw (4x) | 2. Oil fill plug |
| 3. Spring | 4. Guide panel |
| 5. Holding frame for the internal demister | 6. Internal demister |
| 7. Dirt trap with O-ring | 8. Gasket for the oil box |
| 9. Enlarged detail of the gasket for the oil box | 10. Oil drain plug |
| 11. Oil box | |

Maintenance

8.6 Disassembly and Reassembly of the Electric Motor



WARNING: HAZARDOUS VOLTAGE

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 [Electrical hazards](#) on page 9.

Required tools:

- Spanner size 8
- Special tool for the tie rod

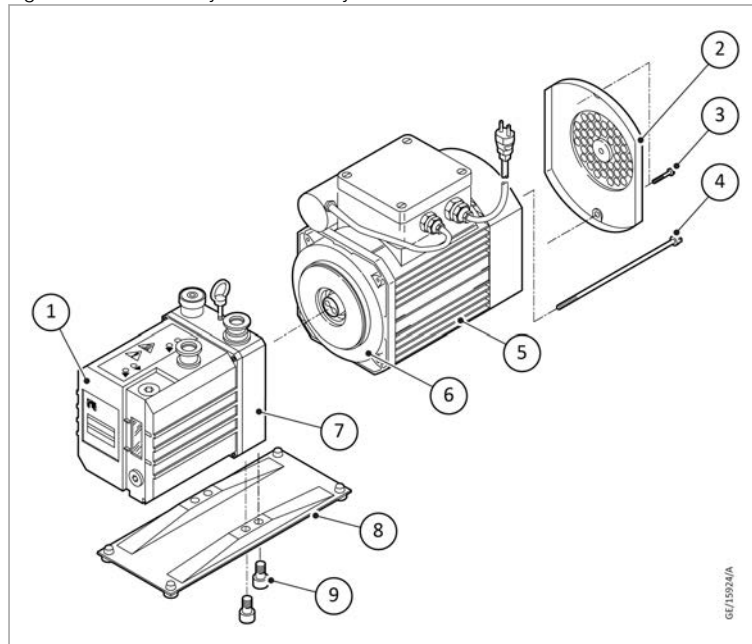
We recommend that you remove the foot of the pump.

- Place the pump on the front side of the oil box.
- Remove the two hex. screws from the fan cowl.
- Detach the fan cowl.
- Unscrew the tie rod.
- Detach the motor (lever off using two screwdrivers inserted in parallel between the end plate A and the HV bearing piece).
- Clean all parts and make sure that they are in perfect condition; replace any parts as required.
- In case of wear exchange the coupling bushings; these are included in [Repair Set 1](#) on page 46.
- Reassemble in the reverse order.
- Tighten the tie rods crosswise to 4 Nm.
- Tighten the bolts for the pump's base to 5 Nm.

Note:

Especially note the position of the oil ejection hole (see arrow in [Figure: Disassembly and assembly of the electric motor](#) on page 39) in the end plate A. The hole must always lead downward.

Figure 8. Disassembly and assembly of the electric motor



- | | |
|----------------------------|---------------------|
| 1. Oil box | 2. Fan cowl |
| 3. Mounting bolts (2x) | 4. Tie rod |
| 5. Electric motor | 6. End plate A |
| 7. HV bearing piece | 8. Foot of the pump |
| 9. Hex. socket screws (4x) | |

8.7 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.

9 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.



WARNING: CONTAMINATION HAZARD

Risk of contamination. 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 [Service](#) on page 51.

9.1 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 (our 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.

10 Fault finding

Fault Pump does not start	
Cause	Wiring is malfunctioning.
Remedy	Check and repair wiring.
Cause	Power supply voltage does not match the rating of the motor.
Remedy	Replace the motor. See Disassembly and Reassembly of the Electric Motor on page 38.
Cause	Motor is malfunctioning.
Remedy	Replace the motor. See Disassembly and Reassembly of the Electric Motor on page 38.
Cause	Oil temperature is below 12 °C.
Remedy	Heat the pump and pump oil or use a different oil. See Operating Temperature on page 29 / Checking the condition of LVO 130 on page 34.
Cause	Oil is too thick.
Remedy	Change the oil. See Checking the condition of LVO 130 on page 34.
Cause	Exhaust filter / exhaust line is clogged.
Remedy	Replace the filter or clean the exhaust line.
Cause	Pump is seized up (sign: pump is jammed).
Remedy	Repair the pump. See Service on page 51.

Fault finding

Fault Pump does not reach ultimate pressure.	
Cause	Measuring technique or gauge is unsuitable.
Remedy	Use correct measuring technique and gauge. Measure the pressure directly at the pump's intake port.
Cause	External leak ¹⁾.
Remedy	Repair the pump. See Service on page 51.
Cause	Dirty internal demister.
Remedy	Perform maintenance. See Maintenance Kit 1 on page 45/ Removing and Fitting the Internal Demister on page 36.
Cause	Exhaust valve is malfunctioning.
Remedy	Repair the valve. See Repair Set 2 on page 46.
Cause	Oil is unsuitable.
Remedy	Change the oil (degas it, if necessary). See Oil change on page 35.
Cause	Intake line dirty or leaky.
Remedy	Clean or exchange the intake line.
Cause	Pump is too small.
Remedy	Check the process data, replace the pump, if necessary.

¹⁾ 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

Fault Pumping speed is too low.	
Cause	Dirt trap in the intake line is clogged.
Remedy	Clean the dirt trap. Preventive action: install a dust filter in the intake line. See Cleaning the inlet screen on page 36.
Cause	Clogged exhaust filter.
Remedy	Exchange the filter element.
Cause	Connecting lines are too narrow or too long.
Remedy	Use adequately wide and short connecting lines. See Connection to the System on page 24.

Fault finding

Fault	After switching off the pump under vacuum, pressure in the system rises too fast
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Cause	System has a leak.
Remedy	Check the system.
Cause	Faulty tandem valve.
Remedy	Repair the valve. See Maintenance Kit 2 / Repair Set 3 on page 46.
Cause	Inner shaft seal is faulty.
Remedy	Exchange the shaft seal. See Maintenance Kit 2 / Repair Set 3 on page 46.
Cause	Faulty exhaust or bypass valve.
Remedy	Repair the valve(s). See Repair Set 2 on page 46.

Fault	Pump gets hotter than previously observed
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Cause	Supply of cooling air is obstructed.
Remedy	Properly install the pump. See Placement on page 22.
Cause	Ambient temperature is too high.
Remedy	Properly install the pump. See Placement on page 22/ Operating Temperature on page 29.
Cause	Process gas is too hot.
Remedy	Change the process.
Cause	Not enough oil.
Remedy	Fill in oil. See Oil change on page 35.
Cause	Unsuitable oil.
Remedy	Change the oil. See Oil change on page 35.
Cause	Oil circulation is obstructed.
Remedy	Clean or repair the oil channels. See Service on page 51.
Cause	Clogged exhaust filter or exhaust line.
Remedy	Change the exhaust filter, clean the exhaust line.
Cause	Exhaust valve faulty.
Remedy	Repair the valve. See Repair Set 2 on page 46.
Cause	Deviating mains voltage.
Remedy	Check power supply rating of the motor and the mains supply.

Fault	Oil in the intake line or in the vacuum chamber
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Cause	Oil comes from the vacuum system.
Remedy	Check the vacuum system.
Cause	Blocked tandem valve.
Remedy	Clean or repair the valve. See Maintenance Kit 2 / Repair Set 3 on page 46.

Fault finding

Fault	Oil is turbid.
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Cause **Condensation.**

Remedy Degas the oil or change the oil and clean the pump.
 Precaution: open the gas ballast valve or fit separator. See [Pumping of Condensable Gases and Vapours](#) / [Oil change](#) on page 35.

Fault	Pump is excessively noisy.
-------	----------------------------

Cause **Oil level is much too low(oil level is no longer visible).**

Remedy Add oil. See [Monitoring the oil level](#) on page 34 / [Oil change](#) on page 35.

Cause **Intake pressure is too high.**

Remedy Reduce the intake pressure.

Cause **Internal demister is clogged.**

Remedy Clean or replace demister. See [Removing and Fitting the Internal Demister](#) on page 36 / [Maintenance Kit 1](#) on page 45.

Cause **Coupling bushings worn out.**

Remedy Replace the coupling bushings. See [Repair Set 1](#) on page 46.

Cause **Vanes or bearings are damaged.**

Remedy Repair pump. See [Service](#) on page 51.

Cause **Faulty motor bearing.**

Remedy Exchange the motor bearing. See [Service](#) on page 51.

Fault	Oil leak at the side of the motor.
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Cause **Outer shaft seal damaged or worn out.**

Remedy Exchange the shaft seal. See [Repair Set 1](#) on page 46.

11 Accessories

11.1 Accessories

Table 5. Accessories

Description	Part number
Exhaust filter AF 8, DN 16 KF	19050
Replacement filters FE 8 (5er Pack)	19080
Drain tap for the exhaust filter AF 8	19095
Condensate separator AK 8, DN 16 KF	19060
Oil drain tap	19090
Manual oil return AR-M via the gas ballast port (Kit for AF 8)	19093
Oil suction facility controlled by a solenoid valve AR-V via the gas ballast port (Kit for AF 8)	19092

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

Description		Part number
1 Pipe bend	DN 16 KF	18436
2 Centering rings with O-ring	DN 16 KF	18326
2 Clamping rings	DN 16 KF	18341



Note:

Use only the kind of oil specified by us.

11.2 Spare parts

11.2.1 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.

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 [Figure: Maintenance Kit 1](#) on page 47) leaves and compression spring for the oil pump (for contents see [Figure: Repair Set 1](#) on page 48).

Accessories

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 [Figure: Repair Set 1](#) on page 48).

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 [Figure: Repair Set 2](#) on page 49).

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 [Figure: Repair Set 1](#) on page 48, [Figure: Repair Set 2](#) on page 49 and [Figure: Complete Kit](#) on page 50).

11.2.2 Ordering Information for the Maintenance Kits and the Repair Sets

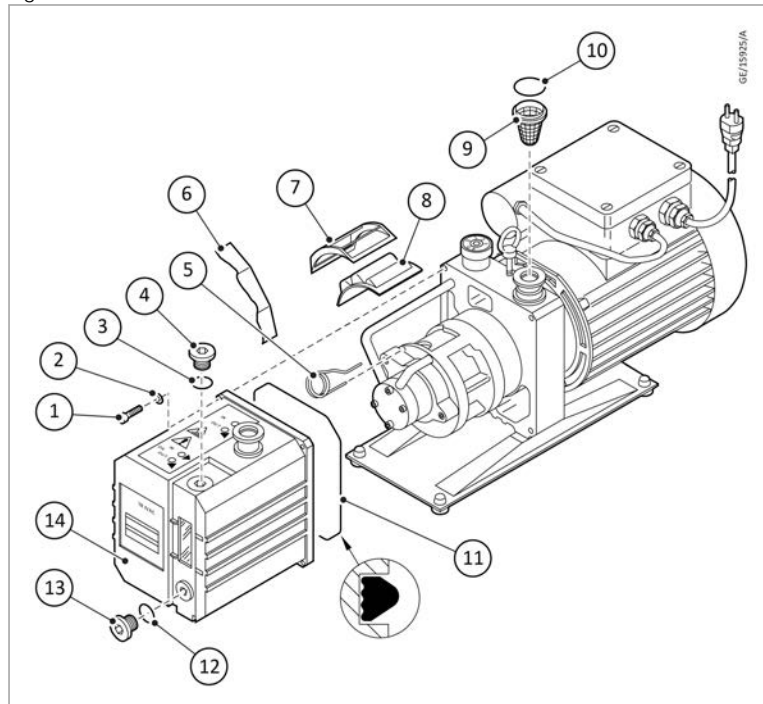
TRIVAC	D 2.5 E 2
Maintenance kit 1	200 40 022
Maintenance kit 2	E 100 000 347
Repair set 1	E 100 000 351
Repair set 2	200 40 024
Repair set 3	E 100 000 347

The use of the maintenance kits and the repair sets is detailed in the Tables [Maintenance plan](#) on page 32 and [Fault finding](#) on page 41.

11.2.3 Ordering Information for the Special Tools

TRIVAC	D 2.5 E 2
Special tool for the tie rods	200 02 760

Figure 9. Maintenance Kit 1



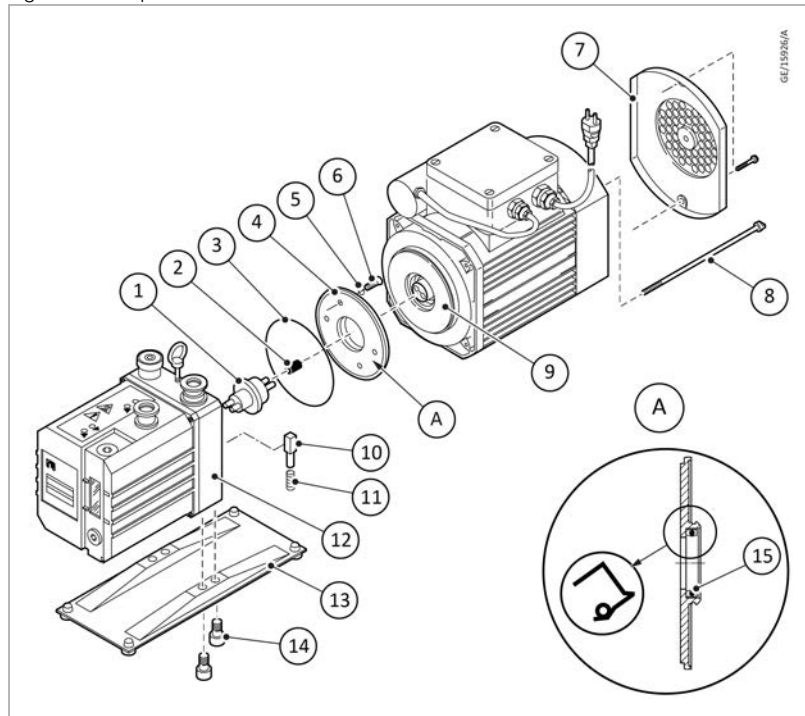
- | | |
|-------------------------------|------------------|
| 1. Hex. socket screw | 2. Washer |
| 3. Gasket | 4. Oil fill plug |
| 5. Spring clip | 6. Guide panel |
| 7. Holding frame for demister | 8. Demister |
| 9. Dirt trap | 10. O-ring |
| 11. Oil box seal | 12. Gasket |
| 13. Oil drain plug | 14. Oil box |

 Parts contained in the maintenance kit

1,2,3,8,11,12

Accessories

Figure 10. Repair Set 1

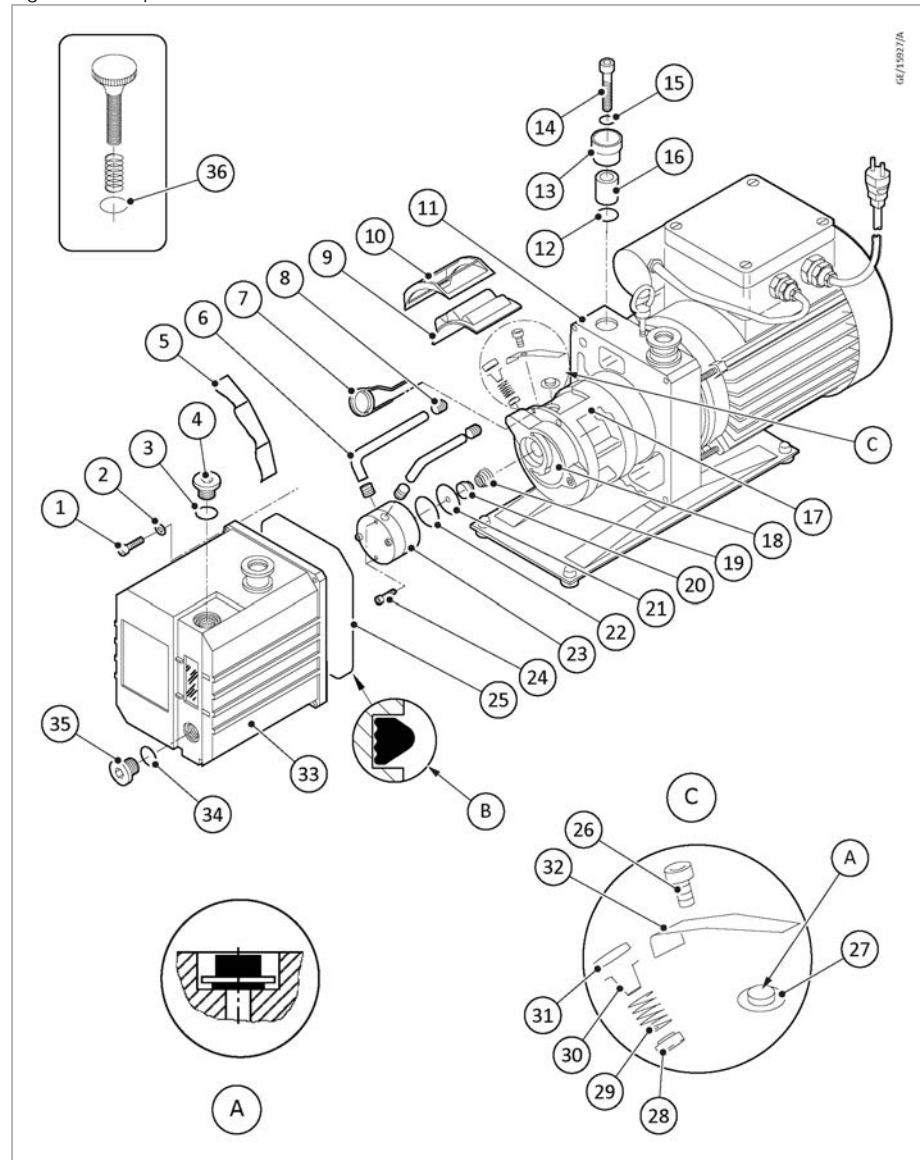


- | | |
|------------------------|--------------------------------------|
| 1. Coupling/Oil pump | 2. Coupling bushing (2x) |
| 3. O - ring | 4. Flange for the shaft sealing ring |
| 5. O-ring (4x) | 6. Bolt (4x) |
| 7. Fan cowl | 8. Tie rods (4x) |
| 9. A-bearing plate | 10. Stopper |
| 11. Compression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

Parts contained in the maintenance kit

1,2,3,5,6,11,15

Figure 11. Repair Set 2



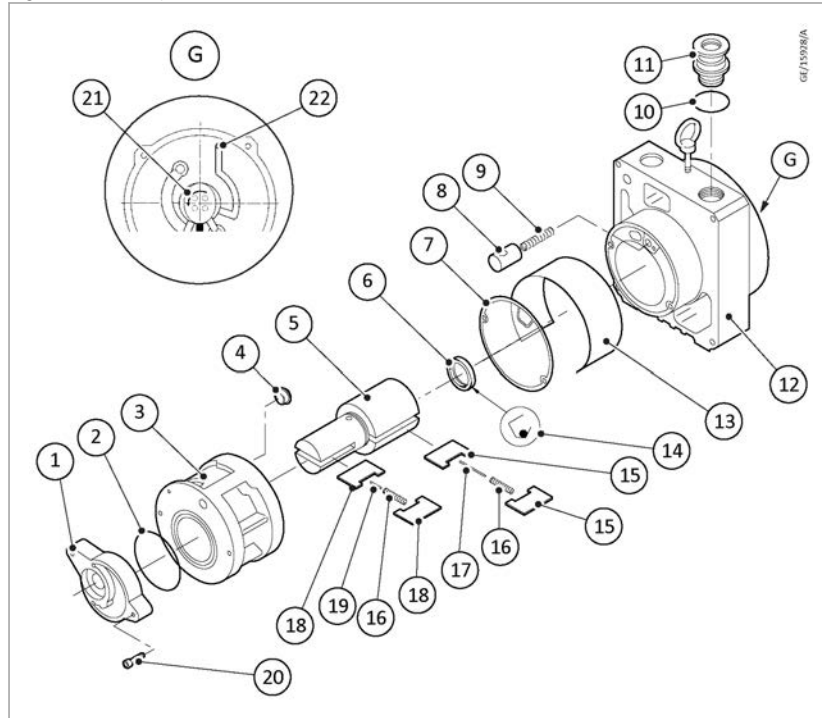
- | | |
|-----------------------------|--|
| 1. Hex. socket bolt | 2. Washer |
| 3. Gasket | 4. Oil fill plug |
| 5. Guide panel | 6. Oil or gas ballast pipe |
| 7. Spring clip | 8. Rubber insert (4x) |
| 9. Demister | 10. Holding frame for demister |
| 11. HV bearing piece | 12. Flat gasket |
| 13. Gas ballast valve - cap | 14. Hex. socket bolt |
| 15. Flat gasket | 16. Gas ballast valve |
| 17. Forevacuum pot | 18. End disk |
| 19. Compression spring | 20. Non-return valve |
| 21. Gas ballast orifice | 22. O-ring |
| 23. Diaphragm valve | 24. Hex. socket bolt |
| 25. Oil box seal | 26. Hex. socket bolt |
| 27. Bypass valve | 28. Sealing element |
| 29. Compression spring | 30. Restrictor |
| 31. Valve holder | 32. Valve bracket |
| 33. Oil box | 34. Gasket |
| 35. Oil drain plug | 36. Option: Gas ballast valve Model with knurled screw |

Parts contained in the repair kit:

1,2,3,8,9,12,15,19,20,21,22,24,25,26,27,28,29,30,31,32,34

Accessories

Figure 12. Complete Kit



- | | |
|-----------------------|---------------------------------|
| 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. O-ring |
| 11. Intake port | 12. High vacuum bearing piece |
| 13. Oil guiding panel | 14. Position/shaft sealing ring |
| 15. Vane (HV) | 16. Compression spring,, |
| 17. Guide pin | 18. Vane (FV) |
| 19. Guide pin | 20. Hex. socket bolt |
| 21. Oil pump | 22. Nozzle |

 Parts included in the complete kit:

2,4,6,7,8,9,10,15,16,17,18,19,20

12 Service

12.1 Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must complete a Declaration of Contamination Form. The form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

If you are returning equipment note the following:

- If the equipment is configured to suit the application, make a record of the configuration before returning it. All replacement equipment will be supplied with default factory settings.
- Do not return equipment with accessories fitted. Remove all accessories and retain them for future use.
- The instruction in the returns procedure to drain all fluids does not apply to the lubricant in pump oil reservoirs.

Download the latest documents from leybold.com/en/downloads/download-documents/declaration-of-contamination/, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to us.



NOTICE:

If we do not receive a completed form, your equipment cannot be serviced.

EU Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the manufacturer:

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

Documentation Officer
T: +49(0) 221 347 0
documentation@leybold.com

The product specified and listed below:

- **Product:** *Two stage oil sealed rotary vane pump with Single phase motor*
- **Model:** *TRIVAC D2,5E*
- **Pump family codes:** *140000; 140001; 140009; 140020; 140021; 140022*

Is in conformity with the relevant Union harmonisation legislation:

2006/42/EC	Machinery directive <i>Note: The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Annex 1 No. 1.5.1 of this directive.</i>
2011/65/EU	Restriction of certain hazardous substances (RoHS) directive as amended by Delegated Directive (EU) 2015/863
2014/30/EU	Electromagnetic compatibility (EMC) Class A Emissions, Industrial Immunity

Based on the requirements of relevant harmonised standards and technical documentation:

EN 1012-2:1996+A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Industrial Immunity Standard
EN 61000-6-4:2007	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Industrial Emission Standard

This declaration, based on the requirements of the listed Directives and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: *2025-12-03*

You must retain the signed legal declaration for future reference

This declaration becomes invalid if modifications are made to the product without prior agreement.



*Andries De Bock – Vice President Engineering
Industrial Vacuum Division
Cologne*



*Jan Večeřa – General manager
Product Company Lutín*

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION

EMC (EU, UK): Industrial equipment

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

RoHS (EU, UK): Material Exemption Information

This product is compliant with the following Exemptions

Annex III:

- 6(a) **Lead** as an alloying element in steel for machining purposes and in galvanised steel containing up to 0.35 % lead by weight (Table 1-17)
- 6(b) **Lead** as an alloying element in aluminium containing up to 0.4% by weight (Table 1-15)
- 6(c) Copper alloy containing up to 4% **lead** by weight (Table 1-18)

REACH (EU, UK)

This product is a complex article which is not designed for intentional substance release. To the best of our knowledge the materials used comply with the requirements of REACH. The product manual provides information and instruction to ensure the safe storage, use, maintenance and disposal of the product including any substance based requirements.

Article 33.1 Declaration (EU, UK)

This product contains Candidate List Substances of Very High Concern above 0.1%ww by article as clarified under the 2015 European Court of Justice ruling in case C-106/14.

- Lead (Pb)
This substance is present in certain steel / aluminium / brass components.

WASTE FRAMEWORK DIRECTIVE (EU)

SCIP Number: b24e1657-95ab-488d-b25c-281809e211a7

Compliance Information – incorporated products and assemblies

Motors

Regulation (EU) No 2019/1781 electric motors and variable speed drives

Based on the requirements of harmonised standard:

EN 60034-30:2009: Rotating electrical machines -- Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)

Additional Applicable Requirements

The product is in scope for and complies with the requirements of the following:

2012/19/EU

Directive on waste electrical and electronic equipment (WEEE)

材料成分声明
China Material Content Declaration

部件名称 Part name 	有害物质 Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
铸铝及铝合金制品 Aluminium alloys	X	O	O	O	O	O
钢合金制品 Steel alloys	X	O	O	O	O	O
铜管管件 Brass pipe fitting	X	O	O	O	O	O
<p>O: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。 O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.</p> <p>X: 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求。 X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.</p>						

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Pioneering products. Passionately applied.

Leybold GmbH
Bonner Strasse 498
50968 Cologne
GERMANY
+49-(0)221-347-0
info@leybold.com
www.leybold.com