

Vacuum Pumps

Instrumentation

Fittings and Valves



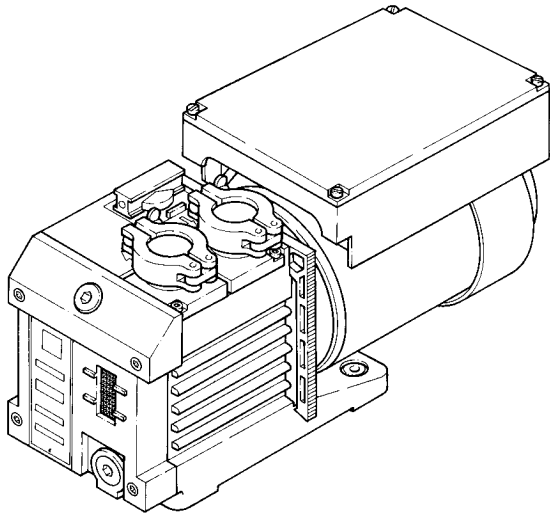
LEYBOLD VACUUM

GA 01.200/8.02

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# TRIVAC® B

Rotary Vane Vacuum Pump  
S/D 1,6 B

Cat. No.

- 102 25/26/27
- 112 25/26/27/31

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**Figures**

The references to figures, e.g. (1/2) consist of the Fig. No. and the Item No. in that order.

**Warning**

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



**Caution**

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

**Leybold Service**

If a pump is returned to Leybold, indicate whether the pump is free of substances damaging to health or whether it is contaminated.

If it is contaminated also indicate the nature of the hazard. Leybold must return any pumps without a "Declaration of Contamination" to the sender's address.

**Disposal of waste oil**

Under the amended law relating to waste disposal dated November 1, 1986 (valid in the Federal Republic of Germany) the disposal of used oil is subject to new provisions. According to legislation relating to waste disposal the so-called principle of causality is applied. Hence, anyone in possession of used oil is responsible for its proper disposal.

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

Used oils from vacuum pumps (LH-oils on the basis of mineral oils) having been affected by normal contamination due to oxygen from the ambient air, increases in temperature and mechanical wear, must be disposed of as used oil in accordance with the regulations. Used oils from vacuum pumps that have been contaminated by other substances must be labelled, stored and disposed of as special waste with reference to the kind of contamination.

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

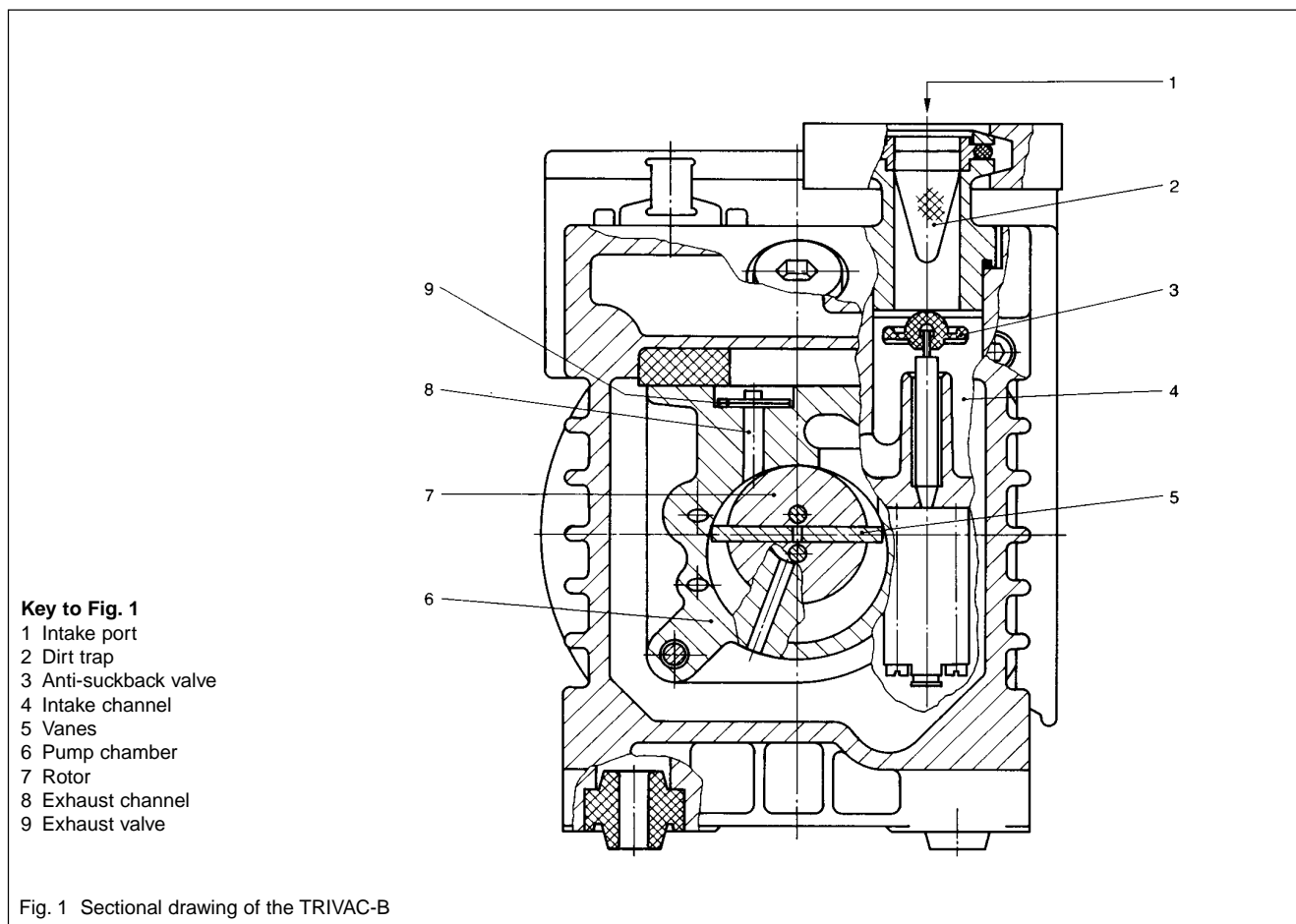
In many countries proof of where the oil has finally been left is required by Law and often shipping of such contaminated waste requires permission by the authorities. Waste disposal information is available through:

Bundesamt für Gewerbliche Wirtschaft (BAW)

Frankfurter Str. 29-31

D-65760 Eschborn/Taunus

Phone: +49 (0)6196 4041 - Telex: 415603/04



## 1 Description

TRIVAC-B pumps are oil-sealed rotary vane pumps. The TRIVAC S 1.6 B is a single-stage pump, and the TRIVAC D 1.6 B is a dual-stage pump. The number "1.6" in the type designation indicates the pumping speed in  $\text{m}^3 \times \text{h}^{-1}$

TRIVAC-B pumps can pump gases and vapours and evacuate vessels or vacuum systems in the fine vacuum range. Those of standard design are not suitable for pumping greater than atmospheric concentrations of oxygen, hazardous gases, or extremely aggressive or corrosive media.

The drive motor of the TRIVAC-B is directly flanged to the pump at the coupling housing. The pump and motor shafts are directly connected by a flexible coupling. The bearing points of the pump module are force lubricated sliding bearings. All connections are arranged on top of the pump. The oil-level glass is provided with prisms for better observation of the oil level.

### 1.1 Function

The rotor (1/7), mounted eccentrically in the pump housing (1/6) (pump chamber), has two radially sliding vanes (1/5) which divide the pump chamber into several compartments. The volume of each compartment changes periodically with the rotation of the rotor.

As a result, gas is sucked in at the intake port (1/1). The gas passes through the dirt trap sieve (1/2), flows past the open anti-suckback valve (1/3) and then enters the pump chamber. In the pump chamber, the gas is passed on and compressed, after the inlet aperture is closed by the vane.

The oil injected into the pump chamber is used for sealing and lubricating. The slap noise of the oil in the pump which usually occurs when attaining the ultimate pressure is prevented by admitting a very small amount of air into the pump chamber.

The compressed gas in the pump chamber is ejected through the exhaust valve (1/9). The oil entrained in the gas is trapped by diversion at the inner walls of the oil case and is then returned to the oil reservoir.

## Description

The gas leaves the TRIVAC-B through the exhaust port.

During compression, a controlled amount of air – the so-called gas ballast – can be allowed to enter the pump chamber by opening the gas ballast valve. The gas ballast stops condensation of vapours in the pump up to the limit of vapour tolerance as specified in the technical data for the pump.

The gas ballast valve is opened and closed by turning the gas ballast knob (5/2) on the front.

The lubricating system allows to employ the TRIVAC-B at intake pressures as high as 1000 mbar.

The built-in anti-suckback valve (1/3) seals the pump's intake and vents the pump during shutdown. Sealing the pump's intake prevents oil from entering the intake line during shutdown and holds the vacuum in the system. The anti-suckback valve functions independently of the pump's operating mode, i. e. during gas ballast operation, too.

## 1.2 Supplied Equipment

The equipment supplied with the TRIVAC-B pump includes:

Pump with motor, including initial filling of N 62 or HE-200 oil or Arctic oil SHC 244,

1 centering ring,

1 centering ring with dirt trap,

2 clamping rings DN 16 KF.

As protection during shipment, the connection ports are each blanked off by a rubber diaphragm and a ring.

The pumps are equipped with a single-phase AC motor and are supplied ready to operate with switch, built-in thermal motor protection switch, mains cable (2 m) and mains plug.

## 1.3 Accessories

	Cat. No. / Ref. No.
Condensate trap AK 1,6, DN 16 KF . . . . .	188 02
Exhaust filter AF 1,6, DN 16 KF . . . . .	189 02

Drain tap for condensate trap, exhaust filter, oil drain of the pump, vacuum-tight . . . . .	188 91
oil tight . . . . .	188 90

Adapter DN 16 KF / DN 7 hose nozzle . . . . .	182 90
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<b>Oil N 62</b>	1l	177 01
	5l	177 02
	20 l	177 03
<b>Arctic oil SHC 244</b>	1l	200 28 229

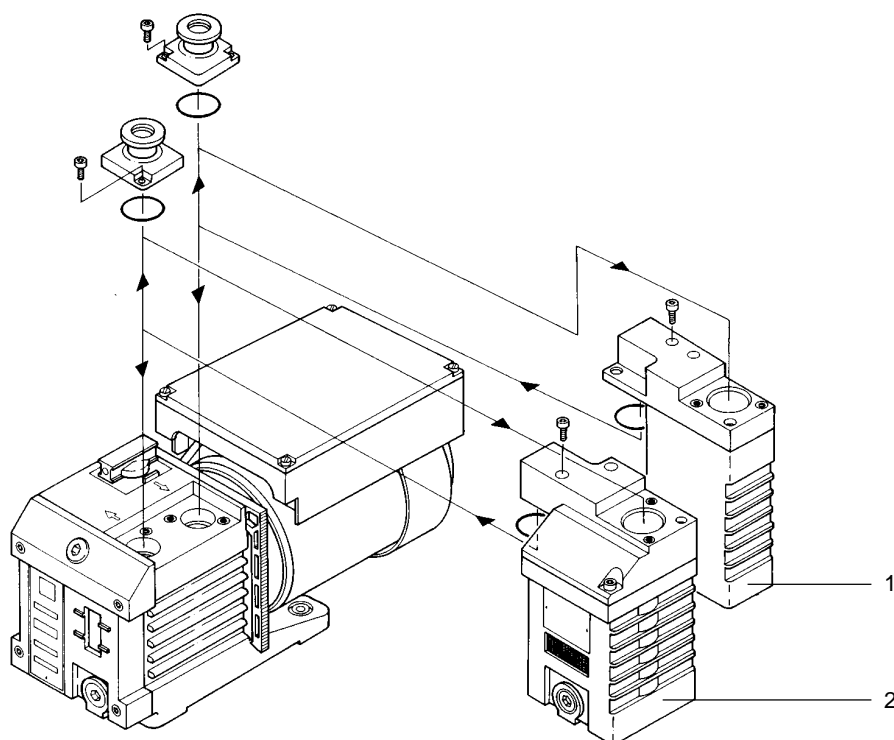
(Order from LH Cologne, Germany)

<b>Oil HE-200</b>	1 qt	98 198 006
	12 qt case	98 198 049
	1 gal	98 198 007
	5 gal	98 198 008

(Order from LHVP, Export Pa., USA)

The oil grades N 62 and HE-200 are interchangeable. Special oils upon request.

**Caution** Only use the kind of oil specified by Leybold. Alternative types of oil are specified upon request.



Key to Fig. 2  
 1 Condensate trap AK 1.6  
 2 Exhaust filter AF 1.6

Fig. 2 Connection of the condensate trap AK 1.6 and the exhaust filter AF 1.6 to the TRIVAC S/D 1.6 B


## 1.4 Spare Parts

Set of gaskets .....	197 18
Pump module, complete S 1.6 B .....	200 390 37
D 1.6 B .....	200 390 38

When ordering spare parts, please indicate apart from the type designation also the serial number of the pump.

## 1.5 Transportation

- Caution**
- Pumps which are filled with operating agents must only be moved while standing upright. Otherwise oil may escape. Avoid any other orientations during transport.

- Warning**
- 
- Check the pump for the presence of any oil leaks, since there exists the danger that someone may slip on spilt oil.
  - When lifting the pump you must make use of the crane eyes provided on the pump for this purpose; also use the recommended type of lifting device.

## 1.6 Technical Data

	50 Hz operation, SI units		
		S 1,6 B	D 1,6 B
Nominal pumping speed*	m <sup>3</sup> · h <sup>-1</sup>	1.75	1.75
Pumping speed*	m <sup>3</sup> · h <sup>-1</sup>	1.6	1.6
Ultimate partial pressure without gas ballast*	mbar	5 · 10 <sup>-2</sup>	4 · 10 <sup>-4</sup>
Ultimate total pressure with gas ballast*	mbar	10	1 · 10 <sup>-1</sup>
Water vapour tolerance*	mbar	15	12
Connection ports	DN	16 KF	16 KF
Oil filling min./max.	cm <sup>3</sup>	160/250	160/220
Motor rating	W	100	100
Nominal speed	min <sup>-1</sup>	3000	3000
Weight	kg	8.6	8.8
Type of protection	IP	54	54

\*as per DIN 28 400 and following numbers

### Caution

We can only guarantee that the pump will meet its specifications when using the type of lubricant which has been specified by us.

Ordering information	Cat. No. for TRIVAC with AC motor	
220-240 V, 50 Hz / 230 V, 60 Hz	102 25	112 25
200-208 V, 50/60 Hz	102 26	112 26
100 V, 50/60 Hz / 115 V, 60 Hz	102 27	112 27

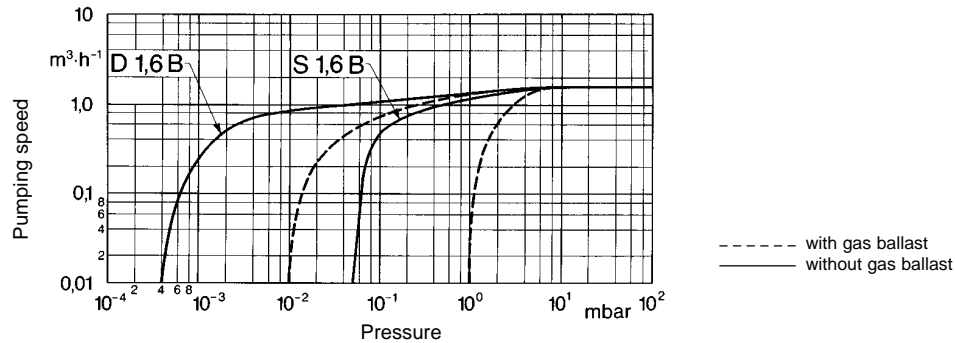
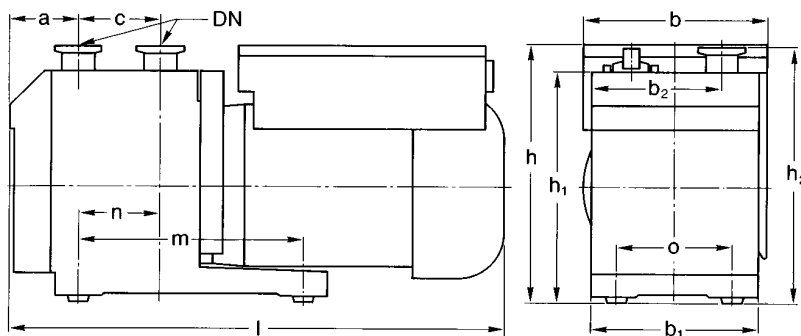


Fig. 3 Pumping speed characteristics of the TRIVAC S/D 1.6 B, 50 Hz operation, SI units



a	45
b	122
b <sub>1</sub>	111
b <sub>2</sub>	86
c	53
h	169
h <sub>1</sub>	151
h <sub>2</sub>	167
l	324
m	146
n	53
o	77

Fig. 4 Dimensional drawing for the TRIVAC rotary vane pumps (dimensions a, l, b bis b<sub>1</sub> and h<sub>1</sub> are approximate)

## 2 Operation

### 2.1 Installation

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



The TRIVAC-B pump can be set up on a flat, horizontal surface. Rubber feet under

the coupling housing ensure that the pump can not slip.

If you wish firmly install the pump in place, insert bolts through bore holes in the rubber feet.

**Caution** Max. tilt for the pump (without further attachment) with possibly fitted standard accessories is 10° from the vertical.

The rubber feet act as vibration absorbers. They must therefore not be compressed by screws. When installing the TRIVAC-B pump, make sure that the connections and controls are readily accessible.

The site chosen should allow adequate air circulation to cool the TRIVAC-B (keep front and rear unobstructed). The ambient temperature should not exceed +40 °C and not drop below +12 °C (see Section 2.5.3). The max. amount of heat given off approximately corresponds to the rated motor power.

### 2.2 Connection to the System

Before connecting the TRIVAC-B, remove the shipping seals from the connection flanges (5/2) and (5/3).

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

Connect the intake and exhaust lines with a centering ring and a clamping ring each. Use the centering ring with dirt trap for the intake port.

Connect the intake and exhaust line using anti-vibration bellows, without placing any strain on the pump.

Upon request the TRIVAC may also be connected via hose nozzles.

The intake line must be clean. Deposits in the intake line may outgas and adversely affect the vacuum. The connecting flanges must be clean and undamaged.

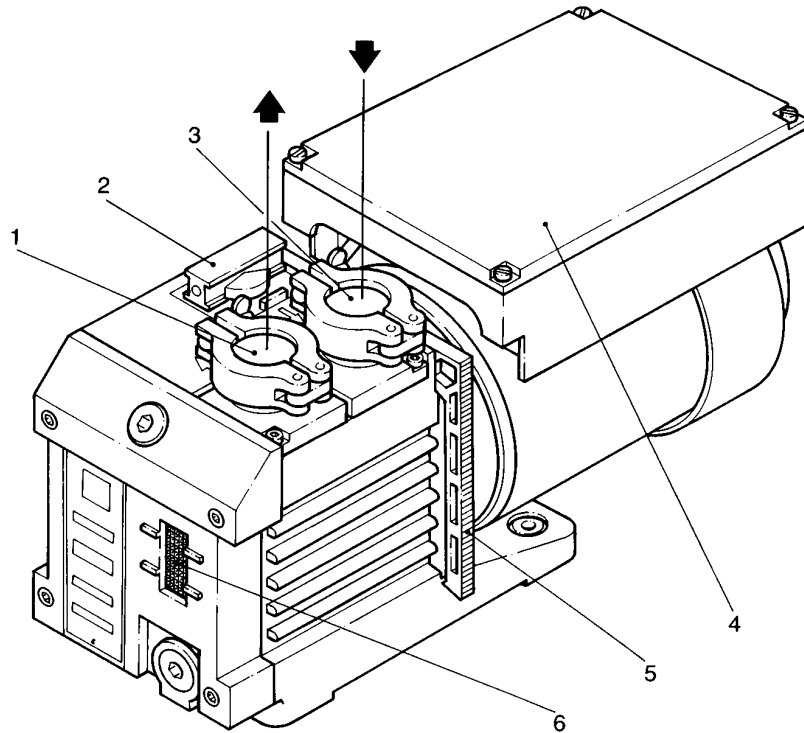
The maximum throughput of the pump is equivalent to the pumping speed of the pump (see Section 1.6).

**Caution** The cross-section of the intake and exhaust lines should be at least the same size as the connection ports of the pump. If the intake line is too narrow, it reduces the pumping speed. If the exhaust line is too narrow, overpressures may occur in the pump; this might damage the shaft seals and cause oil leaks. The maximum pressure in the oil case must not exceed 1.5 bar (absolute).

When pumping vapours, it is advisable to install condensate traps on the intake and exhaust sides.

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.

The exhaust gases from the vacuum pump must be safely lead 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).



**Key to Fig. 5**

- 1 Exhaust port
- 2 Gas ballast activator
- 3 intake port
- 4 Junction box
- 5 Handle
- 6 Oil-level glass

Fig. 5 Connections and Controls

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

In inlet pressure for the gas ballast should be about 1000 mbar (absolute) and sufficient quantities of gas must be available (about  $1/_{10}$  of the pumping speed).

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

Before starting any work on the pump, the personnel must be informed about possible dangers first. All safety regulations must be observed.

## 2.3 Electrical Connections

**Warning** Before wiring the motor or altering the wiring, ensure that mains supply for the pump is off and that it can not be applied inadvertently (pull the mains plug).



If the thermal overload protector has shut the motor off, the motor will cut in automatically as soon as the temperature has dropped below the max. permissible operating temperature.



**Warning** 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.



Electrical connections must be done by a qualified electrician as defined by VDE 0105 in accordance with the VDE 0100 guidelines. Observe all safety regulations.

TRIVAC-B pumps are supplied with a single-phase AC motor.

The pump may be connected directly to the mains via its mains cord and mains plug.

The direction of rotation need not be checked as it is fixed.

The motor is protected against overloading by a thermal overload switch with automatic resetting.



## 2.4 Start-up

Each time before starting up ensure that the oil level is visible in the oil level glass.

On initial start-up, after prolonged idle periods or after an oil change, the specified ultimate pressure cannot be attained immediately until the oil is degassed. This can be done by running the pump for approx. 30 min. with the intake line closed and the gas ballast valve (5/2) open.

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



Avoid exposure of any part of the body to the vacuum. There is the danger of injury. Never operate the pump with an open intake port. Vacuum connections as well as oil-fill and oil-drain openings must never be opened during operation.

The safety regulations which apply to the application in each case must be observed. This applies to installation, operation and during maintenance (service) as well as waste disposal and transportation.

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

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

### 2.4.1 Areas of Application

**Warning** The pump is not suitable for pumping of:

- ignitable and explosive gases or vapours,
- oxidants,
- pyrophorous gases.



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

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

## 2.5 Operation

TRIVAC-B pumps can pump condensable gases and vapours, provided that the gas ballast valve (5/2) is open and the pump has attained its operating temperature.

### 2.5.1 Pumping of Non-Condensable Gases

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

If the composition of the gases to be pumped is not known and if condensation in the pump cannot be ruled out, run the pump with the gas ballast valve open in accordance with Section 2.5.2.

### 2.5.2 Pumping of Condensable Gases and Vapours

With the gas ballast valve open and at operating temperature, TRIVAC-B pumps can pump pure water vapour up to the water vapour tolerance specified by the technical data. 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.

**Caution** 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's properties and thus there is a risk of corrosion in the pump. Therefore, don't switch off the TRIVAC-B 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-B in this mode for about 30 minutes after completion of the process.

In cyclic operation, the TRIVAC-B 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.

### 2.5.3 Operating Temperature

Proper operation of the TRIVAC-B is ensured in the ambient temperature range between 12 °C to 40 °C.

At operating temperature, the surface temperature of the TRIVAC-B may lie between 40 °C and over 80 °C, depending on the load.

If the temperature must be above or below this range due to the ambient conditions, the operating range of the TRIVAC-B can be adapted. LEYBOLD Sales Dept. will gladly answer any queries.

#### Warning

The surface temperature of the TRIVAC-B pumps may rise above 80 °C. There is the danger of receiving burns.



## 2.6 Switching Off/Shutdown

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

No further measures 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 2.5.2).

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-B 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:

#### Warning

When pumping harmful substances, take adequate safety precautions.



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

Drain the oil (see Section 3.2).

Add clean oil until the oil-level is at the "min" mark (see Section 3.2) and let the pump operate for some time.

Then drain the oil and add clean oil until the oil level is at the "max." mark (see Section 3.2).

Seal the connection ports. Special conservation or anti-corrosion oils aren't necessary.

#### Caution

Please also take note of the information given in Section 3.9 (storage and storage conditions).

### 2.6.1 Shutdown through Monitoring Components

#### Warning

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.



### 2.6.2 Failure of the Control System or the Mains Power

#### Warning

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.



## 3 Maintenance

**Warning** Disconnect the electrical connections before disassembling the pump.



Make absolutely sure that the pump cannot be accidentally started (pull the mains plug).



If the pump has pumped harmful substances, contrary to what has been stated in Section 2.4, ascertain the nature of hazard and take adequate safety measures.

Observe all safety regulations.

If you send a pump to LEYBOLD for repair please indicate any harmful substances existing in or around the pump. A form is available from LEYBOLD for this purpose.

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

Due to the design concept, TRIVAC-B 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 3.11.

**Caution** All work must be carried out by suitably trained personnel. Maintenance or repairs carried out incorrectly will affect the life and performance of the pump and may cause problems when filing warranty claims.

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

**Caution** If the TRIVAC-B 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-B has been pumping corrosive media, we recommend to perform any possibly planned maintenance work immediately in order to prevent corrosion of the pump while at standstill.

For the spare part numbers please refer to the enclosed spare parts list. In case of special versions please always state the special number, model number and the serial number.

### 3.1 Checking the Oil Level

During operation of the TRIVAC-B 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.

**Caution** Check and fill in oil only after the pump has been switched off.

#### 3.1.1 Checking the Condition of N 62 or HE-200 Oil

The amount of oil required for an oil check should be drained via the oil-drain port (6/4) into a beaker or similar container with the pump switched off but still at operating temperature.

- **Visual check**

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

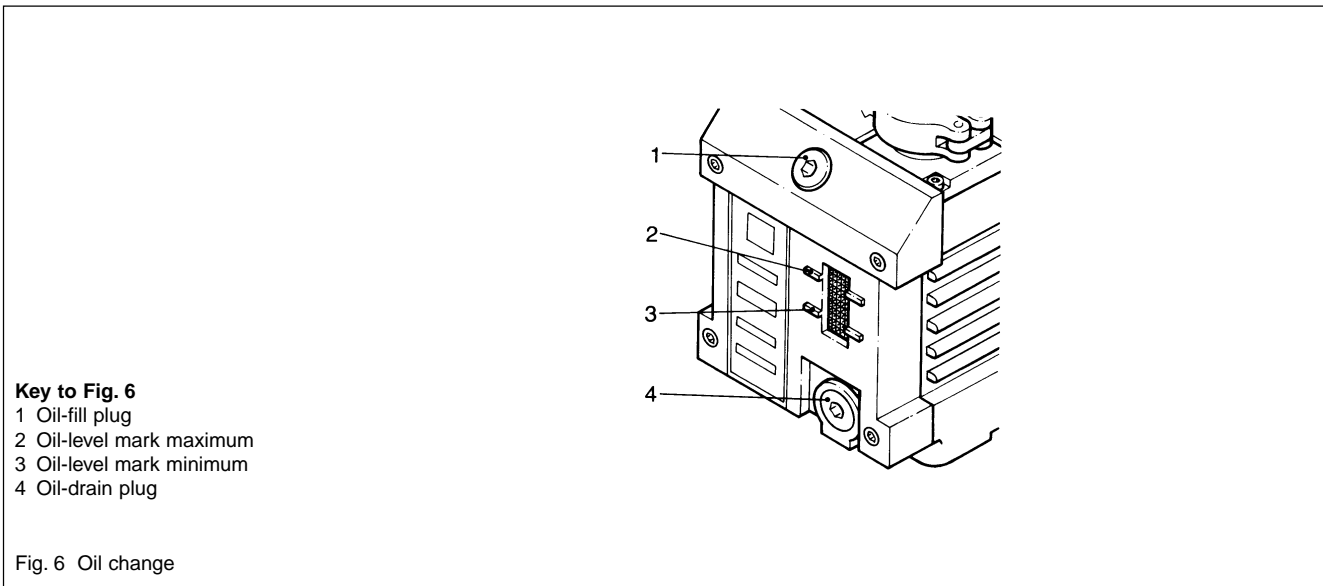
- **Chemical check**

The neutralisation number of N 62 oil is determined according to DIN 51558. If it exceeds 2, the oil should be changed.

- **Viscosity check**

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

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



### 3.2 Oil Change

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

The oil must be changed when it looks dirty or if it appears chemically or mechanically worn out (see Section 3.1.1).

The oil should be changed after the first 100 operating hours and then at least every 2,000 to 3,000 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 more frequently.

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

If the oil becomes contaminated too quickly, install a dust filter and/or oil filter (see Section 1.3). Contact us for more information in this matter.

**Caution** Only change the oil after the pump has been switched off and while the pump is still warm.

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.

**Warning**

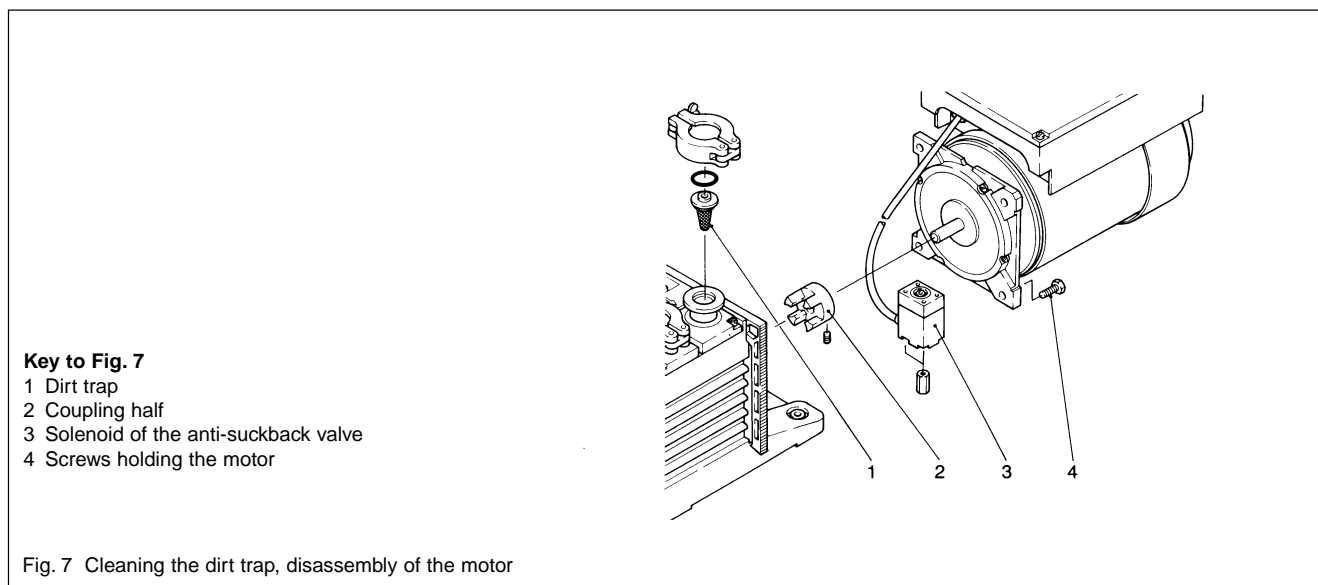


If there is the danger that the operating agent may present a hazard in any way due to decomposition of the oil, or because of the media which have been pumped, you must determine the kind of hazard and ensure that all necessary safety precautions are taken.



**Caution**

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



### 3.3 Cleaning the Dirt Trap

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

For this purpose, remove the dirt trap (7/1) from the intake port and rinse it in a suitable vessel with solvent. Then thoroughly dry it with compressed air. If the dirt trap is defective, replace it with a new one.

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

### 3.4 Disassembly and Reassembly of the Electric Motor

**Warning** Before starting work, always disconnect the motor from the mains.



Required tools:

Screwdriver 0.6 x 4.5 mm, ring wrench (10 mm across flats).

Coming from the pump-bottom side, undo the two non-sealed screws of electromagnetic anti-suckback valve (7/3).

Unscrew the socket hex head screws (7/4) of the motor fixture. Take off the motor. If the

motor is to be replaced, loosen the setscrew and pull off the coupling half (7/2).

Clean all parts and check their perfect condition. Replace, if necessary.

Reassemble is in reverse order.

**Key to Fig. 8**

- 1 Cover plate
- 2 Gasket
- 3 Module
- 4 Oil injection nozzle
- 5 Silencing nozzle
- 6 Radial shaft seal
- 7 Coupling half
- 8 Coupling element
- 9 O-rings

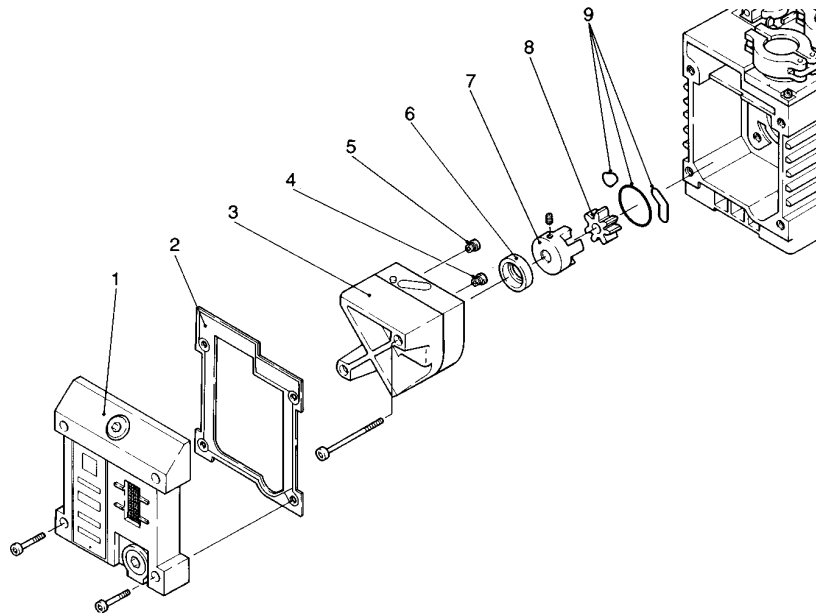


Fig. 8 Removing the pump module

### 3.5 Removing and Remounting the Pump Module

Required tools:

Allen key 4 mm, 8 mm.

As spare part we offer a completely mounted pump module which can be removed and remounted without needing special tools.

**Caution** If you employ these Operating Instructions for older pump models, please check the serial number of the pump. Only as of series 2 are the inner parts sealed by O-rings. Most of the pumps of series 1 have a flat gasket; on some of them the module is cemented to the coupling housing. On pumps with cemented module we recommend that you have the pump module replaced by Leybold.

Drain the oil (according to Section 3.2).

Unscrew four screws and remove the cover plate (8/1). Remove the gasket (8/2).

Unscrew two screws and remove the complete module (8/3) to (8/8). Take off the O-rings (8/9).

Remount the new pump module in the reverse order.

### 3.6 Replacing the Radial Shaft Seal, Cleaning the Oil Injection and Silencing Nozzle

Required tools:

Allen key 2.5 mm, 4 mm, and 8 mm, screwdriver 1.0 x 5.5 mm, driver for radial shaft seal.

Remove the pump module (according to Section 3.5).

At the rear of the pump module both nozzles are accessible. Clean the nozzles or replace them.

Take the coupling element (8/8) out of the coupling.

Loosen the setscrew and pull off the coupling half (8/7).

Remove the radial shaft seal (8/6).

Moisten the new shaft seal slightly with some oil and carefully insert it with a suitable driver.

Mount the coupling half, insert the coupling element and mount the pump module.

### 3.7 Leybold Service

If a pump is returned to Leybold, indicate whether the pump free of substances damaging to health or whether it is contaminated.

If it is contaminated also indicate the nature of the hazard. For this you must use a form which has been prepared by us which we will provide upon request.

A copy of this form is reproduced at the end of these Operating Instructions: "Declaration of Contamination of Vacuum Instruments and Components".

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

This "Declaration of Contamination" is required to meet German Law and to protect our personnel.

Leybold must return any pumps without a "Declaration of Contamination" to the sender's address.

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



### 3.8 Waste Disposal of Used Pump Materials

The corresponding environmental and safety regulations apply. This applies equally to used filters and filter elements (oil filter, exhaust filter and dust filter).

**Warning** – In the case of hazardous substances determine the kind of hazard first and observe the applicable safety regulations. If the potential hazard still persists, the pump must be decontaminated before starting with any maintenance work. For professional decontamination we recommend our Leybold service.



– Never exchange the oil or the filters while the pump is still warm. Let the pump cool down to uncritical temperatures first. You must wear suitable protective clothing.

### 3.9 Storing the Pump

**Caution** 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 shelved it must be properly disconnected from the vacuum system, purged with dry nitrogen and the oil should be changed too.

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

The gas ballast switch must be set to the "0" position and if the pump is to be shelved 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 shelved for over one year, standard maintenance should be run on the pump and the oil should also be exchanged (see Operating Instructions). We recommend that you contact the Leybold service.

## 3.10 Troubleshooting

Fault	Possible cause	Remedy	Repair*
Pump does not start.	Wiring is malfunctioning. Motor protection switch incorrectly set (3-phase motors only). Operating voltage does not match motor. Motor is malfunctioning. Oil temperature is below 12 °C. Oil is too viscous. Exhaust filter/exhaust line is clogged. Pump is seized up (sign: pump is jammed).	Check and repair wiring. Set motor protection switch properly. Replace the motor. Replace the motor. Heat the pump and pump oil or use different oil. Change the oil. Replace the filter or clean the exhaust line. Repair the pump.	– 2.3 3.5 3.5 2.5.3/3.2 3.2 – Service
Pump does not reach ultimate pressure.	Measuring technique or gauge is unsuitable. External leak <sup>1)</sup> . Anti-suckback valve is malfunctioning. Exhaust valve is malfunctioning. Oil is unsuitable. Intake line is dirty. Pump is too small.	Use correct measuring technique and gauge. Measure the pressure directly at pump's intake port. Repair the pump. Repair the valve. Repair the valve. Change the oil (degas it, if necessary). Clean the intake line. Check the process data; replace the pump, if necessary.	– Service Service Service 3.2 – –
Pumping speed is too low.	Dirt trap in the intake port is clogged. Exhaust filter is clogged. Connecting lines are too narrow or too long.	Clean the dirt trap; Precaution: install a dust filter in intake line. Install a new filter element. Use adequately wide and short connecting lines.	3.3 – 2.2
After switching off pump under vacuum, pressure in the system rises too fast.	System has a leak. Anti-suckback valve is malfunctioning.	Check the system. Repair the valve.	– Service
Pump gets hotter than usually observed.	Cooling air supply is obstructed. Ambient temperature is too high. Process gas is too hot. Oil level is too low. Oil is unsuitable. Oil cycle is obstructed. Exhaust filter/exhaust line is obstructed. Exhaust valve is malfunctioning. Pump module is worn out. Deviating mains voltage.	Set pump up correctly. Set pump up correctly. Change the process. Add oil. Change the oil. Clean or repair the oil lines and channels. Replace the exhaust filter, clean the exhaust line. Repair the valve. Replace the pump module. Check the motor voltage and the available mains voltage.	2.1 2.1/2.5.3 – 3.1 3.2 Service – Service 3.7
Oil in the intake line or in vacuum vessel.	Oil comes from the vacuum system. Anti-suckback valve is obstructed. Sealing surfaces of anti-suckback valve are damaged or dirty. Oil level is too high.	Check the vacuum system. Clean or repair the valve. Clean or repair the intake port and anti-suckback valve. Drain the excess oil.	– Service Service 3.1
Oil is turbid.	Condensation.	Degas the oil or change the oil and clean the pump. Precaution: open the gas ballast valve or insert a condensate trap.	2.5.2/3.2
Pump is excessively noisy.	Oil level is much too low (oil is no longer visible). Intake pressure is too high. Coupling element is worn. Vaness or bushings are damaged.	Add oil. Lower the intake pressure. Install new coupling element. Repair pump.	3.1/3.2 – 3.5/3.6 Service

\* Repair information: refer to the Section in the Operation Instruction stated here.

1) Bubble test: The warm pump with degassed oil is running without gas ballast and the intake blanked off. The exhaust line is lead into a vessel with water. If an evenly spaced line of bubbles appears, then the pump has an external leak.





### 3.11 Maintenance Plan (Recommendation)

No	Rotary vane pumps TRIVAC S 1.6 B TRIVAC D 1.6 B	Measurement/test quantity Operating/auxiliary materials	Interval						Remarks
			VE	VP	t	6m	a	n-a	
1	Operate the pump for at least 0.8 hours with gas ballast.				x				Refer also to the Operating Instructions – Section: individual components. Condensed water is thus removed from the oil.
2	Check the oil level, change the oil if required.	Oil: N 62 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  chemically  viscosity	x		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 neutralization number exceeds 2; then an oil change will be required.  <b>Viscosity:</b> when dynamic viscosity at 25 °C exceeds 300 mPas; then an oil change will be required. Disposal of waste oil: see Section 3.8.1 and 5.2.
4	Clean the dirt trap in the intake port, change it as required.	Suitable cleaning agent and compressed air.				x			<input type="checkbox"/> Clean dirt trap with a cleaning agent and blow it out with compressed air under a suction hood.  <input type="checkbox"/> Replace the defective dirt trap. Use a cleaning agent which complies with the national / international specifications.  <b>Observe the safety regulations when using cleaning agents.</b>
5	Check the edges of the teeth on the coupling element for any damages, change the coupling element as required.						x		

No	Rotary vane pumps TRIVAC S 1.6 B TRIVAC D 1.6 B	Measurement/test quantity Operating / auxiliary materials	Interval						Remarks
			VE	VP	t	6m	a	n-a	
6	Change the oil –  and  clean the oil level glass.	Oil: N 62 or special and alternative oils.  Suitable cleaning agent and compressed air.						x	Refer also to the Operating Instructions – Section: individual components.  Oil change: • First oil change after 100 operating hours. • Pump switched off and cold. Change the oil when the pump is cold in order to avoid releasing absorbed gases.  <input type="checkbox"/> Clean the oil level glass with a cleaning agent and blow it out with compressed air under a suction hood. Cleaning agent according to national / international specifications. <b>Observe the safety regulations when using cleaning agents.</b>  <b>Quantity of oil:</b> see Operating Instructions, Section 1.6. <b>Waste disposal of oil:</b> see Operating Instructions, Section 3.8.1.
7	Check the fan of the pump and the 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 to warm. <b>Caution:</b> switch off the pump and ensure that it can not run up inadvertently (disconnect from the mains).

**Key to the maintenance plan**

VE = Maintenance before switching on the system

VP = Maintenance before starting production

t = Daily maintenance

w = Weekly maintenance

2w = Twice weekly maintenance

m = Monthly maintenance

3m = Three monthly maintenance

6m = Six monthly maintenance

a = Annual maintenance

n-a = Maintenance every n years.

We recommend servicing the pump every two years covering the following:

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

This check should be run by the Leybold service.



## EEC Declaration of Conformity



We – LEYBOLD AG – herewith declare that the products defined below meet the basic requirements regarding safety and health of the relevant EEC directives by design, type and versions which are brought into circulation by us.

In case of any product changes made without our approval, this declaration will be void.

Designation of the products: Rotary vane pump,  
single and dual stage

Types: TRIVAC B;  
S/D 1,6 B

Cat. Nos.:

102 25; 102 26; 102 27;

112 25; 112 26; 112 27;

112 28; 112 29; 112 30;

112 31; 112 32;

200 28 530; 200 28 595;

200 39 330; 200 39 331

**The products conform to the following directives:**

- EEC Directive on Machinery (89/392/EWG) and subsequent 91/368/EWG
- EEC Directive on Low-Voltages (73/23/EWG)

**Applied harmonised standards:**

- EN 292 Part 1 and Part 2 Nov. 1991
- pr. EN 1012 Part 2 1993
- EN 60 204 1993

**Applied national standards and technical specifications:**

- DIN 31 001 April 1983

Cologne, January 23, 1995

Dr. Henn, Business Area Manager  
Forevacuum pumps

Cologne, January 23, 1995

Frings, Design Department Manager  
Forevacuum pumps



### Declaration of Contamination of Vacuum Equipment and Components

The repair and/or service of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer could refuse to accept any equipment without a declaration.

This declaration can only be completed and signed by authorized and qualified staff.

<b>1. Description of Vacuum Equipment and Components</b> - Equipment type/model: _____ - Code No.: _____ - Serial No.: _____ - Invoice No.: _____ - Delivery date: _____	<b>2. Reason for Return</b> _____ _____ _____ _____
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<b>3. Condition of the Vacuum Equipment and Components</b> - Has the equipment been used? yes <input type="checkbox"/> no <input type="checkbox"/> - What type of pump oil/liquid was used? _____ - Is the equipment free from potentially harmful substances? yes <input type="checkbox"/> (go to Section 5) no <input type="checkbox"/> (go to Section 4)	<b>4. Process related Contamination of Vacuum Equipment and Components:</b> - toxic                           yes <input type="checkbox"/> no <input type="checkbox"/> - corrosive                       yes <input type="checkbox"/> no <input type="checkbox"/> - explosive*)                   yes <input type="checkbox"/> no <input type="checkbox"/> - biological hazard*)         yes <input type="checkbox"/> no <input type="checkbox"/> - radioactive*)                yes <input type="checkbox"/> no <input type="checkbox"/> - other harmful substances   yes <input type="checkbox"/> no <input type="checkbox"/>
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\*) Vacuum equipment and components which have been contaminated by biological explosive or radioactive substances, will not be accepted without written evidence of decontamination!

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

Trade name Product name Manufacturer	Chemical name (or Symbol)	Dangerous material class	Measures if spillage	First aid in case of human contact
1.				
2.				
3.				
4.				
5.				

### 5. Legally Binding Declaration

I hereby declare that the information supplied on this form is complete and accurate. The despatch of the contaminated vacuum equipment and components will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.

Name of organisation or company: \_\_\_\_\_

Address: \_\_\_\_\_ Post code: \_\_\_\_\_

Tel.: \_\_\_\_\_

Fax: \_\_\_\_\_ Telex: \_\_\_\_\_

Name: \_\_\_\_\_

Job title: \_\_\_\_\_

Date: \_\_\_\_\_ Company stamp: \_\_\_\_\_

Legally binding signature: \_\_\_\_\_

Copies: Page 1 (white) to manufacturer or representative - Page 2 (yellow) attach to consignment packaging security - Page 3 (blue) copy for file of sender

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We reserve the right to modify the design and the specified data. The illustrations are not binding.

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**LEYBOLD AG**

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