



# TRIVAC<sup>®</sup> C

## D8/16/30/40/60C

Two-Stage Rotary Vane Pump

Operating Instructions GA01.800\_002\_C0

Cat.-No:  
310 18  
310 86  
311 08  
311 59  
311 58  
and their variants



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All repair and service work should be done by a Leybold Service Center next to you. In such a case, Leybold will provide a replacement pump.



The TRIVAC® C is supplied with oil to be added for operation. We recommend that you read these Operating Instructions carefully so as to ensure optimum operating conditions right from the start.

### **Figures**

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

## Obligation to Provide Information

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

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

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

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

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

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

## Figures

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

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

Retain the Operating Instructions for further use.

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## NOTICE



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## DANGER



## WARNING



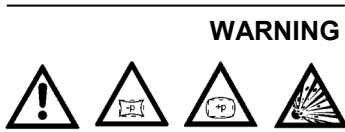
## CAUTION



## NOTICE



# Safety Information



## 0 Important Safety Information

### 0.1 Mechanical hazards

- 1 Avoid exposing any part of the human body to the vacuum.
- 2 Never operate the pump without a connected intake line or without fitting a blank flange.
- 3 Do not operate the pump with any of the covers removed. Serious injury may result.
- 4 The location at which the TRIVAC C (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 1.5 bar (absolute). An exhaust line which is too small in diameter or which is blocked can result in the formation of overpressures within the pump. Possible consequences can be damage or even burst open the pump. Thus the exhaust line must be checked from time to time to ensure that there are no obstructions.
- 8 When moving the TRIVAC C always use the lifting means provided.

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**WARNING**



### 0.2 Electrical hazards

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

# Safety Information

## 0.3 Thermal hazards

- 1 Under certain ambient conditions the TRIVAC C may attain a temperature of over 75 °C. There then exists the danger of receiving burns. Note the symbols on the pump pointing to the hazards, and in the case of a hot pump wear the required protective clothing. All work on the "pump still warm from operation" should only be done using protection gloves.
- 2 Before servicing and maintenance work always leave the pump to cool down.
- 3 Note the warning information on the housing surface. If these warning notices have been removed, covered or obstructed, include corresponding additional warning notices.

## 0.4 Hazards caused by materials and substances

- 1 The pump is not suited for oxygen operation.
- 2 Before commissioning the TRIVAC C, 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 pyrophorous substances, the user is under the obligation to comply with the national and international safety regulations and guidelines. Regarding the suitability of the TRIVAC C pumps for special applications in which such gases, substances shall be pumped, Leybold should be consulted first.
- 4 If the pump has previously handled hazardous gases, implement the proper precautionary measures before opening the intake or exhaust connection. Before opening the pump, purge it for a longer period of time with an inert gas. If necessary, use gloves, a respirator and/or protective clothing and work under an exhaust hood. Firmly seal off the pump. When shipping the contaminated pump for servicing, please also state the type of hazard. For this you must use a form which we have prepared for you.
- 5 When cleaning a system in which a TRIVAC C 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.
- 6 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.

## 0.5 Danger of ignition

- 1 The standard version of the TRIVAC C is **not** suited for operation in explosion hazard areas.
- 2 The TRIVAC C pumps including the accessories are fundamentally **not** suited for pumping of combustible and explosive gases or vapours.

## 0.6 Hazard caused by noise

- 1 The noise level produced by the pump is less than 60 dB(A).

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### CAUTION



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### DANGER



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### CAUTION



# Safety Information

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## NOTICE



### 0.7 Risk of damaging the pump

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

## 1 Description

### 1.1 Principle of operation

TRIVAC® C pumps are oil-sealed rotary vane pumps. The drive motor, is directly flanged onto the pump cylinder. The pump and motor shafts are directly connected by means of a flexible coupling. A fan mounted on the coupling and the cooling apertures serve to maintain low temperatures around the coupling even under extreme conditions. All bearing points are lubricated slide bearings.

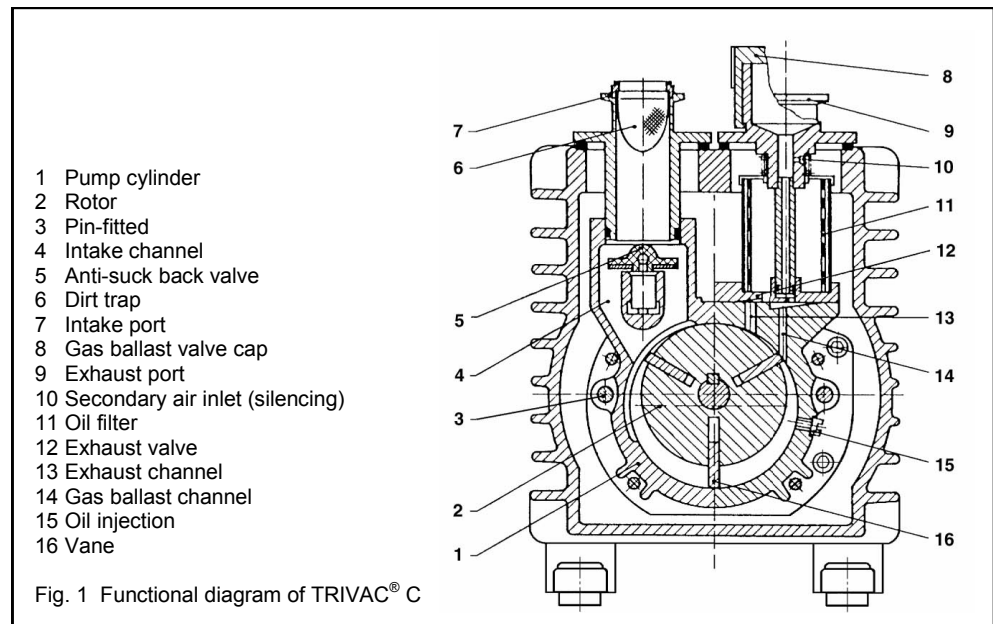
The pump cylinder consists of assembly parts sealed with O-rings. All parts are pin-fitted so as to allow easy disassembly. The inner pump body can easily be dismantled without special tools.

The rotor (1/2), mounted eccentrically in the pump cylinder (1/1), has three radially sliding vanes (1/16) which divide the pump chamber into several compartments. The volume of each changes periodically with the rotation of the rotor.

As a result, gas is sucked in at the intake port (1/7). The gas passes through the dirt trap sieve (1/6), passes the open anti-suck back valve (1/5) and enters the pump chamber. In the pump chamber, the air is passed on and compressed, after the inlet aperture is closed by the vane. At (1/15), oil is sucked into the chamber; it is used, on the one hand, for lubrication and sealing of the space between the chamber wall and the vane head and, on the other, for lubrication and sealing of the vanes (1/16) in the rotor (1/2).

The gas compressed in the pump chamber is expelled to the atmosphere through the exhaust valve (1/12). The oil entrained with the compressed gas is trapped in the oil filter (1/11); there the oil is also filtered and freed of mechanical impurities. The admission of secondary air -so-called "gas ballast" - prevents condensation of vapours in the pump chamber. At the beginning of compression, an exactly dosed amount of gas ballast is admitted at (1/14); this ensures the water vapour tolerance stated in the Technical Data. The gas ballast valve is opened and closed by turning the locking cap (1/8). The slap noise of the oil in the pump, which normally occurs when the ultimate pressure is attained, is pre-vented by also admitting a very small amount of secondary air into the pump chamber at (1/14).

# Description



When the pump is stopped, a centrifugal switch on the pump shaft opens a venting pipe which feeds atmospheric air under the piston of the anti-suck back valve. As a result, the disc of the anti-suck back valves pressed against its seat in the intake port, the line leading to the vacuum vessel is closed and the pump is vented.

The built-in oil-level glass makes it easy to check the oil level. The standard pumps are available with single-phase or three-phase AC motor.



# Description

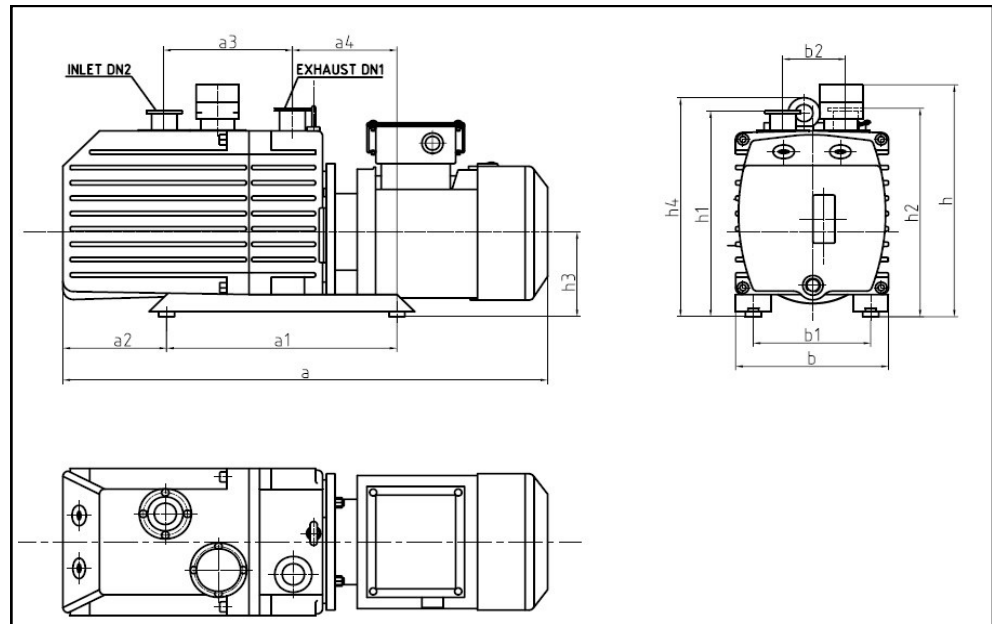
## 1.2 Technical Data (50Hz Operation, SI Units)

TRIVAC® C		D8C	D16C	D30C	D40C	D60C
Pumping speed (50Hz) (according to PNEUROP)	m <sup>3</sup> ·h <sup>-1</sup>	8.11	17.01	32.24	42.99	64.37
Pumping speed (60Hz) (according to PNEUROP)	m <sup>3</sup> ·h <sup>-1</sup>	9.65	20.33	36.64	51.78	72.23
Ultimate partial pressure without gas ballast	mbar	4·10 <sup>-4</sup>	4·10 <sup>-4</sup>	4·10 <sup>-4</sup>	4·10 <sup>-4</sup>	4·10 <sup>-4</sup>
Ultimate total pressure <sup>1)</sup> without gas ballast	mbar	3·10 <sup>-3</sup>	3·10 <sup>-3</sup>	3·10 <sup>-3</sup>	3·10 <sup>-3</sup>	3·10 <sup>-3</sup>
Ultimate total pressure <sup>1)</sup> with gas ballast	mbar	6·10 <sup>-3</sup>	6·10 <sup>-3</sup>	6·10 <sup>-3</sup>	6·10 <sup>-3</sup>	6·10 <sup>-3</sup>
Water vapour tolerance	mbar	30	20	40	20	25
Connecting ports (Inlet and exhaust)	DN (mm)	25KF	25KF	40KF	40KF	40KF
Noise <sup>2)</sup> (sound pressure level at 1 m with gas ballast closed / open (50Hz))	dB (A)	54/56	56/58	58/60	58/60	58/60
Oil filling (Capacity) Max / Min	L	1.1/0.7	1.5/1.0	3.7/3.2	5.0/4.5	5.0/4.5
Weight (without oil filling) <sup>3)</sup>	Kg	30	32	72	90	84
Ambient temperature (Max / Min)	°C	40/10	40/10	40/10	40/10	40/10
Single-Phase motor power						
1ph, 220V/50Hz,	W	550	750			
Overall length a <sup>4)</sup>	mm	471	560			
<b>Cat. No.</b>		<b>310 46</b>	<b>310 50</b>			
Three-Phase motor power						
3ph, 50Hz/YY200/Y380/415V & 60Hz/YY200/220/Y440/460V	W	550	550	1300		
Overall length a <sup>4)</sup>	mm	507	547	665		
<b>Cat. No.</b>		<b>310 18</b>	<b>310 86</b>	<b>311 08</b>		
Three-Phase motor power						
3ph, 50Hz/YY200/Y380/415V & 60Hz/YY200/220/Y380/Y400/Y440/460V	W				1300	1800
Overall length a <sup>4)</sup>	mm				780	745
<b>Cat. No.</b>					<b>311 59</b>	<b>311 58</b>

Remark:

- 1) To DIN28400 and following numbers; The values are measured by Capacitance Diaphragm Gauge. If using Priani Gauge, the values will be half or a decade higher. The values are defined by pumps with LVO 100 oil.
- 2) The values is for 3 phase motor. It will be a little higher for 1 phase motor.
- 3) +/- 2kg
- 4) The "a" value is for your reference. If you select other type of motor, the "a" value will change a little.
- 5) Other motors on request
- 6) Asbestos free

# Description



Type	DN1	DN2	a1	a2	a3	a4	b	b1	b2	h	h1	h2	h3	h4
D8C	25KF	25KF	260	75	146	118	173	133	71	272	243	246	100	260
D16C	25KF	25KF	260	117	146	118	173	133	71	272	243	246	100	260
D30C	40KF	40KF	395	112	224	185	245	190	90	377	360	373	166	366
D40C	40KF	40KF	395	188	224	185	245	190	90	377	360	373	166	366
D60C	40KF	40KF	395	188	224	185	245	190	90	377	360	373	166	366

Fig. 2 TRIVAC® C dimension

Unit: mm

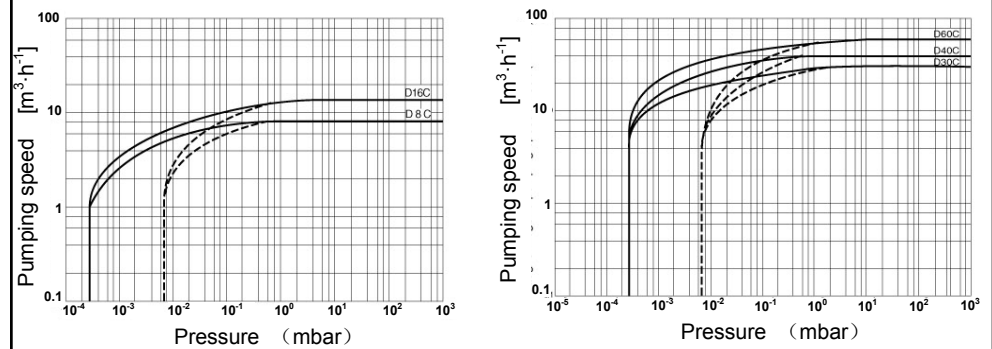


Fig. 3 Pumping speed of the TRIVAC® C Pumps (At 50Hz)

— Without gas ballast  
 --- With gas ballast

# Description

## 1.3 Accessories

	<b>Cat.No</b>
Oil drain cock	190 90
<b>For D8C,D16C</b>	
Exhaust filter AF16 -25 DN25KF	189 11
Replacement filters FE16 -25 (set of 5)	189 72
Condensate separator AK16 -25 DN25KF	188 11
Dust separator, AS 8 -16	186 11
<b>For D30C,D40C,D60C</b>	
Exhaust filter AF40-65 DN40KF	189 16
Replacement filters FE40-65 (set of 5)	189 73
Condensate separator AK40-65 DN40KF	188 16
Dust separator, AS 30-60	186 16

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

### For D8C,D16C

1 Pipe bend, DN25KF	184 37
1 Centering ring with O-Ring, DN25KF	182 07
1 Clamping ring, DN25KF	183 42

### For D30C,D40C,D60C

1 Pipe bend, DN40KF	184 38
1 Centering ring with O-Ring, DN40KF	182 08
1 Clamping ring, DN40KF	183 43

<b>Oil LVO 100</b>	1L	L100 01
	5L	L100 05
	20L	L100 20
	208L	L100 99

**Remarks: Any other request about accessories, please contact us.**

## 1.4 Spare parts

	<b>D8/16C</b>	<b>D30/40/60C</b>
<b>Specification</b>	<b>Cat.No</b>	<b>Cat.No</b>
Set of seals	99710481	99710581
Repair set	99710482/99710492	99710582/99710592
Service kit	99710483	99710583
Gas ballast valve assembly	20039991	99999039

# Transport and Storing

## 2 Transport and Storing

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**Caution**

Before pump delivery, oil must be drained out from pump. Otherwise there is danger of oil escape.

### 2.1 Transport and packaging

TRIVAC® C vacuum pumps pass a rigorous operating test in our factory and are packaged to avoid transport damages. Please check packaging on delivery for transport damages.

Packing materials should be disposed off according to environmental laws or recycled. These operating instructions are part of the consignment.

Upon delivery, the small-flange connection ports of the pump are blanked off. Two centering rings and two clamping rings each (DN 25 KF/DN40 KF) are supplied as standard equipment to connect the intake and discharge lines. One centering ring is including a dirt trap sieve for the intake port. Oil is supplied in a can beside the pump. The pump is supplied with motor and crane eye. A switch, motor protection switch, mains cable and plug are not part of the standard equipment. Except the pump with single phase motor.

### 2.2 Mounting orientation

See required space on drawings in paragraph 1.2.

Pumps which have been filled with oil must only be moved in the upright position (horizontally). Otherwise oil may escape. The angle of slope may not be over 10° max. Avoid any other orientations while moving the pump.

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**Warning**

Pumps which are filled with operating agents 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 spilled 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.

### 2.3 Storing

Before stocking the TRIVAC® C for a long time put it back in its original condition (blank off inlet ports with the shipping seals, drain the oil sump) and store the pump in a dry place at room temperature. Special preservation or slushing oils need not be used.

If the pump has been shelved for over one year, standard maintenance must be run and the oil must be exchanged too before the pump is put into service once more. We recommend that you contact the service from Leybold.

## 3 Installation

### 3.1 Installation and connection

Before connecting the TRIVAC<sup>®</sup> C pumps, remove the transport seals from the connection flange.

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**Note**

When installing the TRIVAC<sup>®</sup> C pumps, make sure that the connections and controls are readily accessible. The site chosen should allow adequate air circulation to cool the pump. The ambient temperature should not exceed +40 °C and not drop below +10°C (see Section 4.2.3).

The pump can be set up on a flat, horizontal surface; it need not be secured to the floor. The cross-section of the connecting lines (intake and discharge lines) should be at least the same size as the connection ports of the pump. If the intake line is too narrow or too long, it reduces the pumping speed. If the discharge line is too narrow, excessive pressure may occur in the pump at high intake pressures; this might damage the shaft seals and cause oil leaks.

For avoiding of overpressure, you can install the exhaust fan at the end of exhaust pipe or use the short wide exhaust pipe.

If the medium pumped contains dust, a filter should at all events be installed.

Vacuum-tight connection of the pump is essential so that the pump can attain the ultimate pressure. We shall gladly offer you solutions attuned to your specific needs.

The exhaust line should preferably be installed with a downward slope so as to prevent condensate from flowing back into the pump and contaminating the oil. If the exhaust line has an upward slope, a condensate trap must at all events be installed.

If no exhaust line is connected, it is advisable to fit an exhaust filter.

If several pumps are connected to one exhaust line, ensure an adequate cross-section and a non-return valve at the exhaust of each pump.

On no account may the pump be operated with a blocked or constricted exhaust line. Make sure before start-up that any blinds or similar shut-off devices in the exhaust line on the pressure side are opened and that the exhaust lines are not obstructed by deposits.

Depending on the type of use of the pump and the medium pumped, please observe the relevant safety rules and specifications.

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**Caution**

# Installation

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**Warning**

## 3.2 Electrical Connections

Electrical connection work must only be carried out by a skilled electrician in accordance with the applicable safety rules (VDE 0100).

### 3.2.1 Pump with Single-Phase AC Motor

With this design, the pump can be directly connected by means of the connecting cable and plug to the 220 V AC mains, using a suitable fuse; refer to the current value stated on the name plate of the motor.

The direction of rotation need not be checked as it is fixed. The motor is protected against overloading by a thermal overload switch. After this switch has cut out the motor, the motor is automatically switched back on once it has cooled down.

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**Warning**

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

### 3.2.2 Pump with Three-Phase AC Motor

TRIVAC® C pumps with three-phase motor are supplied without accessories for electrical connection.

You must connect the pump using an appropriately rated and a suitably rated motor protection switch. The value set on the motor protection switch must correspond to the current rating stated on the name plate of the motor. Please refer to SF in the motor name plate, set 1.2 times of rated current for motor protection switch.

After connecting the motor and after every change of connection, check the direction of rotation. To do so, switch on/off the motor immediately and see whether a blank cover is sucked on at the intake port. If not, inter-change two phases of the connection, Observe the direction arrow!

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**Caution**

If the pump runs for too long in the wrong direction, it ejects its oil. There is also the danger of the pin-hole parts and the disc of built-in anti-suck back valve being destroyed. When checking the direction of rotation, it is advisable to cover the intake port with a rag or something similar so as to avoid being squirted with oil.

## 4 Operation

### 4.1 Start-up

There are no special rules for initial start-up of TRIVAC® C pumps; they can be started up without special measures, except 3-phase motor, see note below.

On TRIVAC® C pumps with three-phase motor, check the direction of rotation (see Section 3.2.2).

On initial start-up, after prolonged idle periods or after an oil change, the specified ultimate pressure cannot be attained immediately because the oil must first be degassed. This can be done by running up the pump for approx. 30 min. with the intake line closed and the gas ballast valve (4/3) open.

### 4.2 Operation

To avoid overloading the motor, do not start the pump more than 6 times within one hour. If more than 6 starts per hour are necessary keep the pump running and mount a valve which opens and closes into the intake line.

In cycle operation, the pump should not be switched off between the cycles but should continue to run with gas ballast valve open and intake port closed (if possible via a valve). Power consumption is minimal when the pump is operating at ultimate pressure.

These pumps are capable of pumping gases and vapours. Vapours can only be pumped provided the gas ballast valve is open and provided the pump has attained its operating temperature.

The TRIVAC® C pump cannot continuously run at operating pressures over 250 mbar without exhaust filter, 350 mbar with exhaust filter. It should reach to permitted pressure within 20min.

If media that must not come into contact with the ambient air are to be pumped, please consult us for our special solutions.

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

In the presence of excess quantities of permanent gases the pump may be operated without gas ballast, provided the saturation vapour pressure at the operating temperature is not exceeded during compression.

If the composition of the gases which are to be pumped is not known and if the possibility of condensation within the pump can not be excluded, we recommend operation of the pump with the gas ballast valve open (in accordance with Section 4.2.2).

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#### Note



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#### Caution



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#### Note



# Operation

## 4.2.2 Pumping of Condensable Gases and Vapours

With the gas ballast valve open and when the pump is running at its operating temperature, pure water vapour can be pumped up to 20~40 mbar (see Section 1.2). When the vapour pressure increases above the permissible level, the vapour will condense in the oil of the pump. In this case we recommend a condenser in the intake line.

When pumping vapours make sure that the gas ballast valve is open and that the pump has been running for at least 30 minutes with the intake line closed and with gas ballast.

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### Caution



It will be possible to pump vapours up to the permissible limit only after the pump has reached its operating temperature.

During the pumping process vapours may dissolve in the oil of the pump. This impairs the properties of the oil and there is the risk of corrosion within the pump. For this reason the pump must not be switched off immediately after termination of the process. The pump must remain on with the gas ballast valve open and the intake line sealed until all vapours which were dissolved in the oil have been removed.

We strongly recommend that the TRIVAC® C pump be left running for about 30 minutes after termination of the process.

In the case of cyclic or repetitive processes the TRIVAC® C should not be switched off during the breaks between the individual work phases (low energy requirement when running at ultimate pressure). The gas ballast valve should be opened and the intake line should be sealed (through a valve, if possible).

When all vapours have been pumped from a process (drying, for example) the gas ballast valve can be closed to improve the attainable ultimate pressure.

## 4.2.3 Operation under Special Climatic and Other Conditions

Proper start-up of the TRIVAC® C is ensured ambient temperatures from 10 to 40 °C. At its operating temperature, the surface temperature of the TRIVAC® C (oil sump) may lie between 40 and 75 °C, depending on the load. If the temperature is above or below this range owing to the ambient conditions, the operating range of the TRIVAC® C can be adapted by using other oils or motors with other insulation classes. Leybold-Sales Dept. gladly answer any queries.

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### Warning



TRIVAC® C pumps may attain high surface temperatures.

There is the danger of receiving burns.



There is the danger of scald.

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## 4.3 Switching Off

Under normal circumstances, the pump merely has to be switched off, without any other action being necessary.

When using the TRIVAC<sup>®</sup> C in processes with aggressive or corrosive media, it is advisable to 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<sup>®</sup> C is to be put out of operation for a prolonged period after having been used to pump aggressive or corrosive media, it should at once be thoroughly flushed out and filled with clean oil.

In the pumps intake port there is an anti-suck back valve, which closes the intake port when the pump is switched off, thus maintaining the vacuum in the vessel connected. The safe valve should be installed if necessary.

When the pump is switched off, a centrifugal switch opens the built-in venting valve. The atmospheric air entering via the venting valve flows under the piston of the anti-suck back valve, thereby closing the intake port, venting the pump and preventing oil suck back.

Closure of the intake port occurs independently of the pump's mode of operation, i. e. even if the pump is run with the gas ballast valve open.

# Maintenance

## 5 Maintenance

### 5.1 Maintenance Information

Observe all safety regulations.

---

#### Warning



Disconnect the electrical connections for all disassembly work on the pump. Make absolutely sure that the pump cannot be accidentally started.

---

#### Caution



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

In this connection, your attention is drawn to Leybold practical courses in which our experts provide instruction on the maintenance, repair and checking of TRIVAC<sup>®</sup> C pumps. Further details are available on request.

If the TRIVAC<sup>®</sup> C pumps is used in ambient air containing many impurities, make sure that the air cooler and the gas ballast device are not impaired.

Where the TRIVAC<sup>®</sup> C pumps is employed for corrosive media, we recommend that any maintenance work be carried out immediately so as to avoid corrosion during idle periods.

---

### 5.2 Maintenance Intervals

The intervals stated in the maintenance schedule are approximate values for normal pump operation. Unfavorable ambient conditions and/or aggressive media may significantly reduce the maintenance intervals.

Maintenance job	Frequency	Section
Check the oil level	Daily	A
1st oil change	After 100 h of operation	C
Subsequent oil changes	Every 2000~3000 h or annually (depending on application)	C
Gas ballast	Monthly	E
Clean the dirt trap	6 months	D
Clean the internal demister	Annually	E
Check the coupling element	Annually	
Fan cover cleaning	Annually	F
Clean the oil level glass	Annually	

# Maintenance

## 5.3 Leybold Service

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

A copy of the form has been reproduced at the end of these Operating Instructions: "Declaration of Contamination for Compressors, Vacuum Pumps and Components". Another suitable form is available from [www.leybold.com](http://www.leybold.com) → Downloads → Download Documents → Declaration of Contamination .

Attach the form to the equipment or enclose it with the equipment.

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

We must return to the sender any equipment which is not accompanied by a contamination statement.

The pump must be packaged in such a way that it will not be damaged during shipping, and so that no harmful substances can escape from the package.

When disposing of used oil, please observe the relevant environmental regulations.

## 5.4 Maintenance Work

Due to the design concept of the TRIVAC<sup>®</sup> C pumps, maintenance is normally kept to a minimum. The work required is described in the sections below.

### A Oil Level

During operation the oil level of the TRIVAC<sup>®</sup> C must always be visible between the marks on oil viewing glass. The quantity of oil must be checked and topped up as required.

**Recommendation:** The oil level should always be visible in the middle of the oil viewing glass.

The pump must be switched off before topping up any oil.

---

### Caution

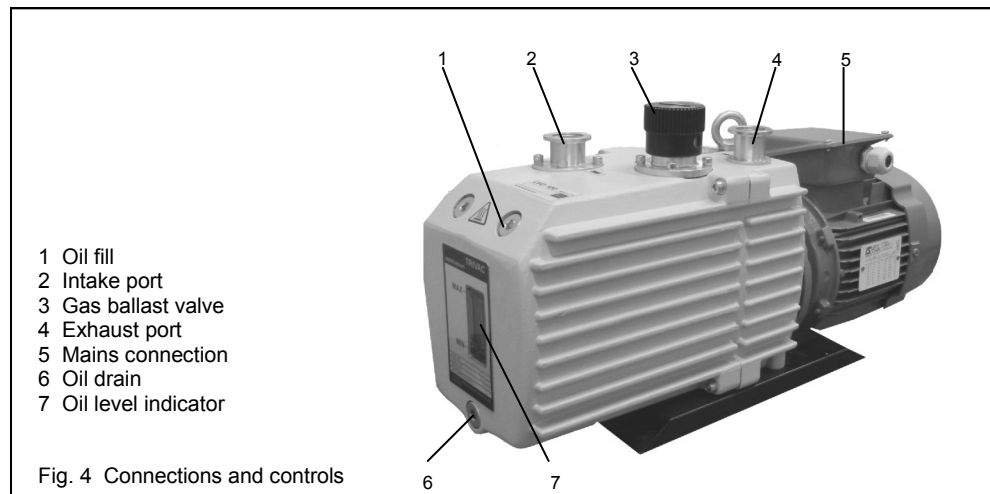


---

### Note



# Maintenance



## B Oil Condition

On our TRIVAC® C pumps filled with LVO 100 oil, there are three ways of checking the condition of the oil.

### a) Visual check

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

### b) Chemical check

The neutralization value is determined according to DIN51558. If it reaches 2, the oil should be changed.

### c) Viscosity check

If the viscosity at 25 °C exceeds 0.3 Pa s, the oil should be changed.

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

When an oil sample is needed so as to determine whether an oil change is required, it should be discharged via the oil-drain plug (4/6) into a beaker or similar receptacle with the pump switched off but still at operating temperature.

---

## Warning



Dangerous substances may escape from the pump and oil. Appropriate precautions should be taken, e.g. use of gloves, safety mask or breathing mask.

Observe the safety rules.

# Maintenance

## C Oil Change

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 pressure and intake temperatures and/or when pumping contaminated gases, the oil will have to be changed more frequently.

**Please arrange for the frequency of change oil as your different operate situation.**

---

**Caution**



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.

Tool required: Allan key 8 mm

Always carry out the oil change when the pump is switched off but still warm.

Remove the oil-drain plug (4/6) and let the used oil drain into a suitable receptacle.

When the flow of oil slows down, screw the oil-drain plug back in, briefly switch on the pump (max. 10 s) and switch it off. Remove the oil-drain plug again and drain off the remaining oil.

Screw the oil-drain plug back in (check the washer and replace it if necessary).

Remove the oil-filling plug (4/1) and fill in fresh oil.

Then screw the oil-filling plug (4/1) back in.

**Recommend:** Before filling fresh oil in, please keep pump running and fill around 100ml fresh oil into inlet, then open and close inlet 2~3 times briefly (interval 2s) to get chamber good flushed. Remove the oil-drain plug and drain off the used oil, at the same time look the flowing oil color to decide flush times. If necessary, repeat the above process until the pump chamber is good flushed. Finally fill in the good amount of fresh oil through oil-filling plug.

---

**Note**



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.

---

**Warning**



We can only guarantee that the pump operates as specified by the technical data if the lubricants recommended by us are used. If pumps are operated with lubricants which is not recommended by Leybold in warranty term, there is the risk of pump performance down, and the pump can not get any warranty from Leybold.

---

**Note**



# Maintenance

## D Cleaning the Dirt Trap

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

For this purpose, remove the dirt trap from the intake port and rinse it in a vessel using a suitable solvent.

Then thoroughly dry it with compressed air. If the dirt trap is defective, replace it. The cleaning intervals depend on requirements. If large amounts of abrasive materials occur, a dust filter should be fitted into the intake line.

## E Maintaining the Gas Ballast Valve and Oil Filter

Tools required:

Allan key 5 mm

Circlip pliers

Completely remove the valve cap (5/1)

Unscrew the four hex head screws (5/6)

Remove the gas ballast valve housing (5/8)

Remove the circlip (5/14)

Take off the oil filter (5/12), gasket (5/10), spring (5/9) and O-ring (5/13).

Remove the gasket (5/15)

Clean the parts and check that they are in perfect condition; if not, replace them.

Remount in the reverse order.

Ordering number of Gas Ballast Valve kit can be found in the following spare parts list.

## F Fan cover cleaning

Soiling of the fan cover may lead to overheating of the motor and the pump.

Put off the cover and clean it with blast air.

Before starting the pump again, be sure that the cover has been reassembled.

## G Disposal of Used Pump Materials

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

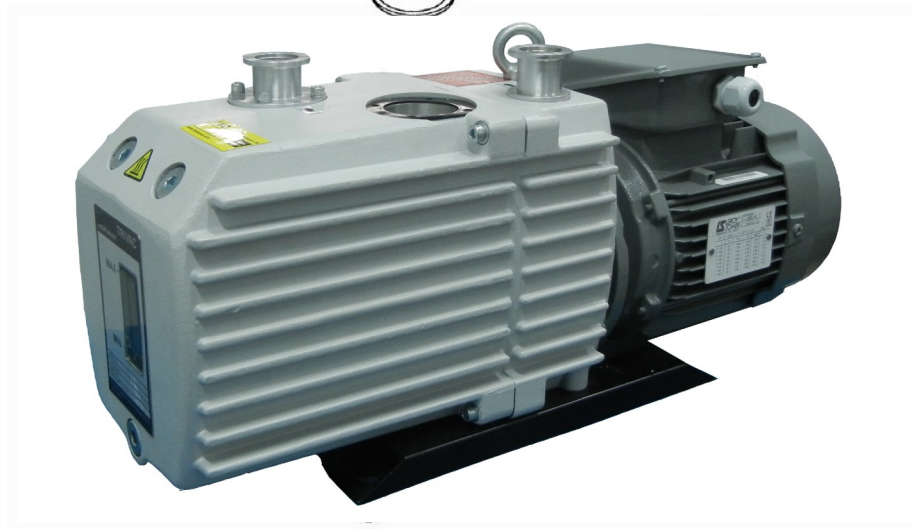
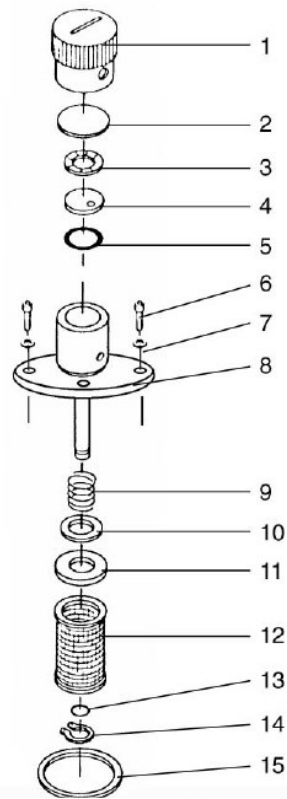
- In the case of hazardous substances determine the kind of hazard first and observe the applicable safety regulations. If the potential hazard still persists, the pump must be decontaminated before starting with any maintenance work. For professional decontamination we recommend our Leybold service.
- Never exchange the oil or the filters while the pump is still hot. Let the pump cool down to uncritical temperatures first. You must wear suitable protective clothing.

---

### Warning



# Maintenance



## Key to Fig. 5

- |                             |               |
|-----------------------------|---------------|
| 1 Valve cap                 | 9 Spring      |
| 2 Reinforcement plate       | 10 Gasket     |
| 3 Star washer               | 11 Hood       |
| 4 Valve                     | 12 Oil Filter |
| 5 O-ring                    | 13 O-ring     |
| 6 Hex. Head screw           | 14 Circlip    |
| 7 Washer                    | 15 Gasket     |
| 8 Gas ballast valve housing |               |

Fig. 5 Dirt trap and gas ballast valve disassembled

# Troubleshooting

## 6 Trouble shooting

Fault	Possible reason	Remedy	Reference Section *
Pump does not start.	Wiring is malfunctioning. Operating voltage does not match motor. Motor is malfunctioning. Oil temperature is below 10□. Oil is too viscous. Exhaust filter or exhaust line is clogged. Pump is seized up (sign:pump is jammed).	Check and repair wiring. Replace the motor. Replace the motor. Heat the pump and pump oil or use different oil. Change the oil. Replace the filter or clean the exhaust line. Repair the pump.	3.2 3.2 3.2 5.4.C 5.4.C 5.4.E -
Pump does not reach ultimate pressure.	Measuring technique or gauge is unsuitable.  External leak <sup>1)</sup> . Anti-suck back 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 vacuum lines. Check the process data; replace the pump, if necessary.	- - - - - 5.4.C - -
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. Exchange the filter element. Use adequately wide and short connecting lines.	5.4.D 5.4.E 3.1
After switching off pump under vacuum, pressure in system rises too fast.	System has a leak. Anti-suck back valve is malfunctioning.	Check the system. Repair the valve.	- -
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 or exhaust line is obstructed. Exhaust valve is malfunctioning. Pump module is worn out.	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.	3.1 3.1 - 5.4.A 5.4.C - 5.4.E - -
Oil in the intake line or in vacuum vessel.	Oil comes from the vacuum system. Anti-suck back valve is obstructed. Sealing surfaces of anti-suck back 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 the anti-suck back valve. Drain the excess oil.	- - - 5.4.A
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.	4.2.2
Pump is excessively noisy.	Oil level is much too low (oil is no longer visible). Silencing nozzle is clogged. Intake pressure is too high. Internal demister is clogged. Coupling element is worn. Vaness or bearings are damaged.	Add oil. Clean or replace the silencing nozzle. Lower the intake pressure. Clean or replace demister. Install new coupling element. Repair pump.	5.4.A - - 5.4.E - -

\* 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 led in to a vessel with water. If an evenly spaced line of bubbles appears, then the pump has an external leak.



# Spare parts

## 7 Spare parts

To guarantee safe operation of the Leybold pump, only original spare parts and accessories should be used. When ordering spare parts and accessories, always state pump type and serial number. You can find part numbers in the spare parts list.

Consumables and main spare parts kits for TRIVAC® C pumps are usually available on stock at Leybold's service centers. The list of these parts is given here after and in the spare parts table where the contents of each kits is detailed.

- Exhaust filter (on some models)
- LVO 100 oil (Special oils please contact Leybold)
- Service kit
- Set of seals
- Repair kit

We recommend to use these kits which have been defined to allow an optimal maintenance or repair. Individual spare parts may need longer .

## Declaration of Contamination of Compressors, Vacuum Pumps and Components

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

A separate declaration has to be completed for each single component.

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

Customer/Dep./Institute : _____ Address : _____ _____ Person to contact: _____ Phone : _____ Fax: _____ End user: _____	Reason for return: <input checked="" type="checkbox"/> applicable please mark <b>Repair:</b> <input type="checkbox"/> chargeable <input type="checkbox"/> warranty <b>Exchange:</b> <input type="checkbox"/> chargeable <input type="checkbox"/> warranty <input type="checkbox"/> Exchange already arranged / received <b>Return only:</b> <input type="checkbox"/> rent <input type="checkbox"/> loan <input type="checkbox"/> for credit <b>Calibration:</b> <input type="checkbox"/> DKD <input type="checkbox"/> Factory-calibr. <input type="checkbox"/> Quality test certificate DIN 55350-18-4.2.1																																								
<b>A. Description of the Leybold product:</b> _____ <b>Failure description:</b> _____ Material description : _____ Catalog number: _____ <b>Additional parts:</b> _____ Serial number: _____ <b>Application-Tool:</b> _____ Type of oil (ForeVacuum-Pumps) : _____ <b>Application- Process:</b> _____																																									
<b>B. Condition of the equipment</b> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:35%;"></th> <th style="width:10%; text-align: center;">No<sup>1)</sup></th> <th style="width:10%; text-align: center;">Yes</th> <th style="width:10%; text-align: center;">No</th> <th style="width:35%;"></th> </tr> </thead> <tbody> <tr> <td>1. Has the equipment been used</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>toxic</td> </tr> <tr> <td>2. Drained (Product/service fluid)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>corrosive</td> </tr> <tr> <td>3. All openings sealed airtight</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>flammable</td> </tr> <tr> <td>4. Purged</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>explosive <sup>2)</sup></td> </tr> <tr> <td>If yes, which cleaning agent</td> <td></td> <td></td> <td></td> <td>radioactive <sup>2)</sup></td> </tr> <tr> <td>and which method of cleaning</td> <td></td> <td></td> <td></td> <td>microbiological <sup>2)</sup></td> </tr> <tr> <td colspan="4"> <sup>1)</sup> If answered with "No", go to D. ←         </td> <td>other harmful substances</td> </tr> </tbody> </table>			No <sup>1)</sup>	Yes	No		1. Has the equipment been used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	toxic	2. Drained (Product/service fluid)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	corrosive	3. All openings sealed airtight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	flammable	4. Purged	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	explosive <sup>2)</sup>	If yes, which cleaning agent				radioactive <sup>2)</sup>	and which method of cleaning				microbiological <sup>2)</sup>	<sup>1)</sup> If answered with "No", go to D. ←				other harmful substances
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<b>C. Description of processed substances (Please fill in absolutely)</b> 1. What substances have come into contact with the equipment ? Trade name and / or chemical term of service fluids and substances processed, properties of the substances According to safety data sheet (e.g. toxic, inflammable, corrosive, radioactive)																																									
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<sup>2)</sup> Components contaminated by microbiological, explosive or radioactive products/substances will not be accepted without written evidence of decontamination.																																									

### D. Legally binding declaration

I / we hereby declare that the information supplied on this form is accurate and sufficient to judge any contamination level.

Name of authorized person (block letters) : \_\_\_\_\_

Date \_\_\_\_\_

signature of authorized person \_\_\_\_\_

firm stamp



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