VARODRY OEM
VD65/VD100/VD160/VD200

Operating instructions 300890265_002_C5

Part No.

111065Vxx

111100Vxx

111160Vxx

111200Vxx

10110065Vxx

10110100Vxx

10110160Vxx

10110200Vxx

Original instructions

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Published: 11/6/2024

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We accept no liability for loss of profit, loss of market or any other indirect or consequential loss whatsoever.

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

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

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1 Safety and compliance

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

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

1.1 Definition of Warnings and Cautions

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

WARNING:

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

CAUTION:

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

NOTICE:

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

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

1.2 Trained personnel

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

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

Safety and compliance

1.3 Safety symbols

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

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

	**Warning/Caution** Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.
	**Warning - Dangerous voltage** Risk of injury. Identifies possible sources of hazardous electrical shock.
	**Warning - Hot surfaces** Risk of injury. Identifies a surface capable of inflicting burns through contact.
	**Warning - Risk of explosion** Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.
	**Warning - Toxic material** Risk of injury or damage to the environment. Identifies a source of toxic gases, liquid or material.

2 Important Safety Information

Pressures given in bar or mbar are absolute values. If exceptionally a gauge pressure is meant, a “g” is added (for example, bar (g)).

2.1 Mechanical hazards

WARNING: EXPLOSION HAZARD

Risk of injury or damage to equipment. When rotated in the wrong direction, the pump will generate up to 4.5bar (g) pressure at the inlet. If a vacuum system is connected, the pressure build up can lead to explosion of the system.

1. Avoid exposing any part of the human body to the vacuum.
2. Select a secure place for the appliance (level surface).
3. Never operate the pump without a connected intake line or without fitting a blank flange.
4. The discharge port of the pump must not be blocked or constricted. Never operate the pump with a seal-off stopper in place blanking off the exhaust port. Operate the pump only with a connected vacuum system to the intake flange.
5. With a closed exhaust pipe, the pump can generate up to 4.5 bar (g) overpressure on the exhaust. The exhaust pipes should be laid out accordingly.
6. Condensates from the pump can collect inside or at the exhaust, escape and spill onto the floor, when operating the pump without an exhaust line or during transport with an exhaust being not blanked off. In this case there exists the risk of slipping.
7. Take note of the labelling of inlet and outlet. A mix-up can lead to dangerous build-up of pressure in the vacuum system or in the system. After each change of the electrical connection, check the pump's rotational direction.
8. In case of power supply outage, the vacuum system is ventilated by the pump. If this is not wanted, install a non-return valve at the inlet.
9. After a loss of power, the pump restarts independently. If this is not wanted, install a restart inhibitor.
10. Do not operate the pump with any of the covers removed. This may result in serious injury.

2.2 Electrical hazards

WARNING: AUTOMATIC RESTART AFTER VOLTAGE FAILURE

Risk of injury or damage to equipment. After a mains power failure, the pump will run up automatically again. This also applies in the case of an emergency shutdown. 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.

1. Never connect the pump to mains power when the motor junction box is not closed correctly.
2. The electrical connection must only be provided by a trained person.
3. Obey the national regulations in the country of use like EN 50110-1 for Europe.

4. Note the information on the IP type of protection.

2.3 Thermal hazards

WARNING: HOT SURFACE

Risk of injury . The surface of the pump may attain temperatures over 80 °C. There is the risk of burn injury.

1. Before servicing and maintenance work, always leave the pump to cool down.

2.4 Danger of ignition

WARNING: RISK OF EXPLOSION

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

The standard version of the pump is not suited for operation in explosion hazard areas. Contact us before planning to use the pump under such circumstances.

2.5 Hazards caused by materials and substances

CAUTION: HAZARDOUS MATERIAL AND SUBSTANCES

Risk of damage to equipment. Before commissioning the pump, make sure that the media which are to be pumped are compatible with each other to avoid hazardous situations. Observe the instructions for proper and improper use of the pump *Conforming use* **on page 12.**

2.6 Noise hazard

CAUTION: PERSONAL PROTECTIVE EQUIPMENT

The noise level of the pump during ultimate pressure operation corresponds to the values stated in the technical data. In other operating modes and depending on the connected vacuum system, higher values can be expected. Make sure that suitable protection measures are taken to protect your hearing.

2.7 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 objects (screws, nuts, washers, pieces of wire, etc.) through the inlet port. If required, use an inlet filter.
3. Do not use the pump for applications that produce abrasive or adhesive powder, 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 vapour that can condense into liquids when being compressed inside the pump, if these substances exceed the vapour tolerance of the pump.
6. 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.
7. The exhaust line should be laid so that it slopes down and away from the pump so as to prevent condensate from back streaming into the pump.
8. Avoid the entry of particles and fluids.
9. The air intakes of the pump and the motor must remain free.
10. It is not allowed to clean the pump from the outside during operation. After cleaning, make sure that there is no liquid residue on the pump housing.

3 Description

The pump is a dry-compressing vacuum pump and can evacuate containers in the rough vacuum range.

The pump is connected to a 3-phase network on the motor terminal board and operated directly from the mains. It is air-cooled and requires minimum maintenance.

3.1 Supplied equipment

The pump is delivered ready for operation. Intake and exhaust flanges are covered with caps.

3.2 Conforming use

The pump is designed for use in light and medium industrial applications. The pumps are capable to handle small amounts of dust and liquids, however the use of inlet filters or liquid traps is recommended in such cases. They are not hermetically sealed and will release small amounts of pumped gases to ambient even if the exhaust port is connected to an exhaust pipework. They are suitable for pumping water steam or other vapours within the limits of the vapour tolerance. The pump can be used both continuously at a suction pressure range of 0.1 mbar to 1200 mbar as well as for cyclic pump operations within this pressure range.

3.2.1 Non-conforming use

The pump is not suited for pumping of:

- Radioactive substances
- Explosive substances
- Ignitable gas mixtures
- Pyrophoric gases
- Liquids
- Media in significant amounts condensing in the pump (Except from water)
- Solids
- Corrosive gases
- Oxidative substances with the exception of ≤ 21% oxygen in the air
- Toxic gases

4 Technical data

Table 1 Technical data

VARODRY OEM	65	100	160	200
Maximum pumping speed without gas ballast *	65 m^3/h	105 m^3/h	155 m^3/h	185 m^3/h
Ultimate pressure without gas ballast	0.01 mbar			
Ultimate pressure with gas ballast	0.1 mbar			
Maximum permissible inlet pressure	1200 mbar			
Maximum permissible discharge pressure (Relative to ambient) [5]	200 mbar	200 mbar	200 mbar	100 mbar
Water vapour tolerance with gas ballast [4]	60 mbar			
Water vapour capacity with gas ballast [4]	1.9 kg/h	2.9 kg/h	5.2 kg/h	6.9 kg/h
Permissible ambient temperature	0 to +40 °C			
Storage temperature	-20 to +60 °C			
Noise level without external silencer, at ultimate pressure (according to DIN EN ISO 2151)	-			
50 Hz versions	67 dB(A)		70 dB(A)	
60 Hz versions	70 dB(A)		73 dB(A)	
Relative ambient atmospheric humidity	95%, non-condensing			
Maximum Installation height [1]	Up to 1000 m above sea level			
Cooling	Air			
Mains voltage 50 Hz versions [2]	400 V ± 10% or 200 V ± 10%			
Mains voltage 60 Hz versions [2]	460 V ± 10% or 230 V ± 10% or 200/380 V ± 10% , 3 ph			
Phases	3-ph			
Maximum current 50 Hz versions 200/400 V [3]	6.4/3.2 A	8.6/4.3 A	13.0/6.7 A	15.5/7.5 A
Maximum current 60 Hz versions 230/460 V [3]	5.6/2.8 A	7.6/3.8 A	11.3/5.7 A	13.7/6.5 A
Maximum current 60 Hz versions 200/380 V [3]	6.0/3.4 A	8.3/4.6 A	12.8/6.9 A	16.9/10.0 A
Permissible motor speed [2]	50/60 Hz			
Protection class	IP 55			
Intake connection	G 2"			
Discharge flange DN	G 1 1/2"			

Technical data

VARODRY OEM	65	100	160	200
Weight (approximate)	85 kg	95 kg	105 kg	115 kg
Maximum gas ballast flow	38 Nl/min	35 Nl/min	130 Nl/min	150 Nl/min

** Tolerance ± 5%*

1) Please inquire for installation heights above 1000 m.

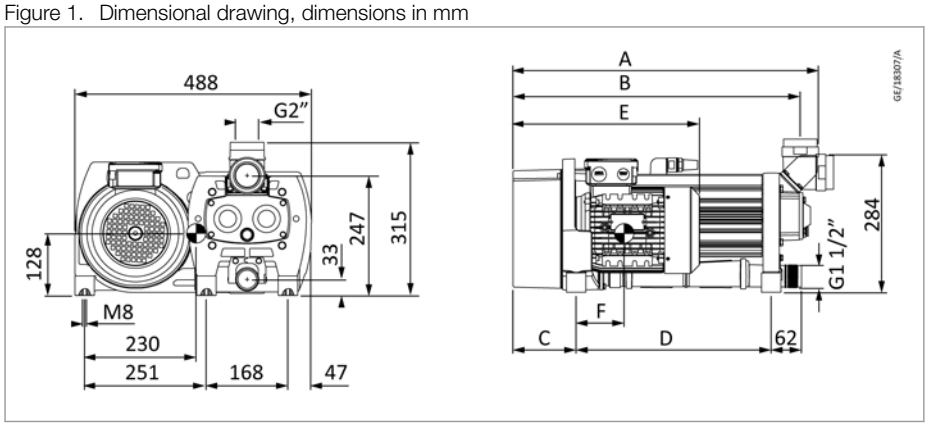
2) Depending on version 50 or 60 Hz. Refer to the pump nameplate.

3) Motor protective switch must be suitable for operation with IE3 motors.

4) Depending on installed configuration. Refer to Gas ballast configuration on page 22 for details.

5) Up to 200 mbar possible depending on the inlet pressure of the pump. With higher outlet pressure, the ultimate pressure will be higher.

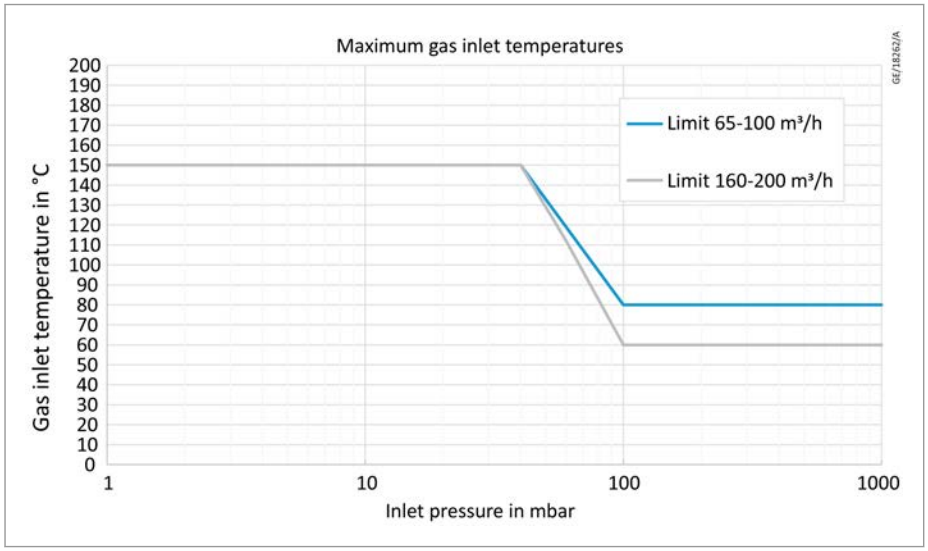
Figure 1. Dimensional drawing, dimensions in mm



Variable dimensions	VD65	VD100	VD160	VD200
A	630	722	919	919
B	592	684	881	881
C	130	130	174	174
D	402	494	647	647
E	385	385	405	424
F	99	139	219	219

CAUTION: OVERPRESSURE

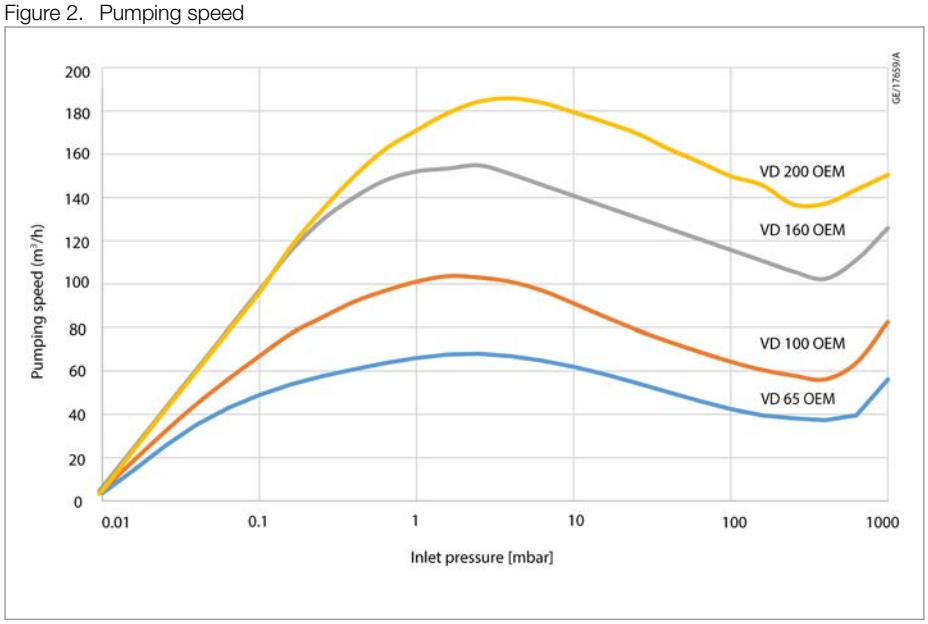
Risk of damage to equipment. When using a booster, increased gas inlet temperatures are to be expected. The maximum inlet pressure at the booster is 10 mbar to make sure safe operation.



Note:

Please contact our Sales for further information.

Figure 2. Pumping speed



Technical data

Figure 3. Power consumption

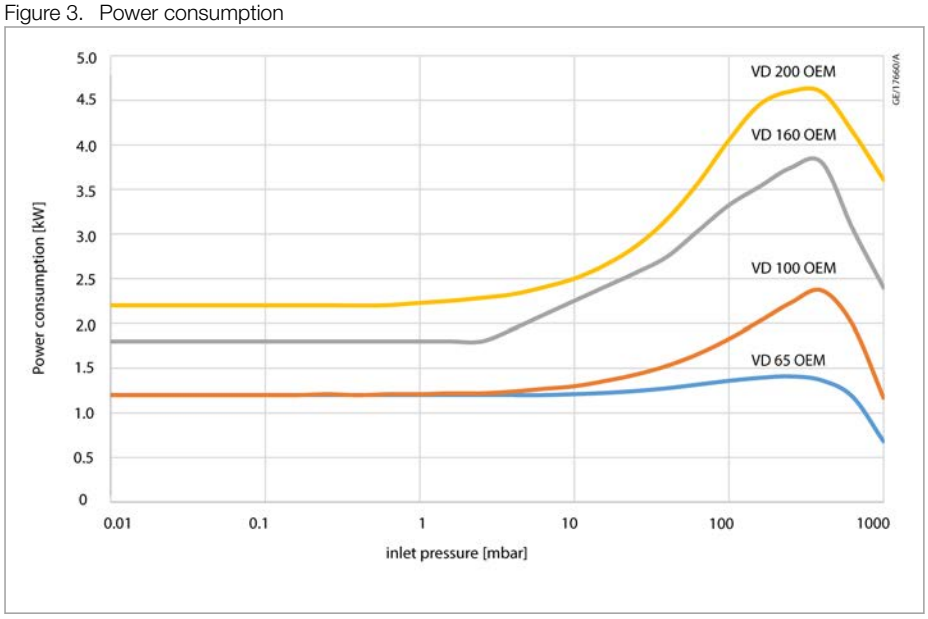


Table 2. Motor data

Model	Motor voltage supply range (V)		Nominal current (A)		Nominal speed (U/min)		Nominal power (kW)	
	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
VD 65 OEM	200 (YY)		6.4		2910		1.5	
		230 (YY)		5.6		3515		
		200 (Δ)		6.0				
	400 (Y)		3.2		2910			
		460 (Y)		2.8		3515		
		380 (Y)		3.4				
VD 100 OEM	200 (YY)		8.6		2880		2.2	
		230 (YY)		7.6		3480		
		200 (Δ)	8.3					
	400 (Y)		4.3		2880			
		460 (Y)		3.8		3480		
		380 (Y)		4.6				
VD 160 OEM	200 (YY)		12.6		2865		3.0	
		230 (YY)		10.6		3510		
		200 (Δ)		12.8				
	400 (Y)		6.3		2865			
		460 (Y)		5.3		3510		
		380 (Y)		6.9				
VD 200 OEM	200 (YY)		15.0		2890		4.0	
		230 (YY)		12.6		3510		
		200 (Δ)		16.9				
	400 (Y)		7.5		2890			
		460 (Y)		6.3		3510		
		380 (Y)		10				

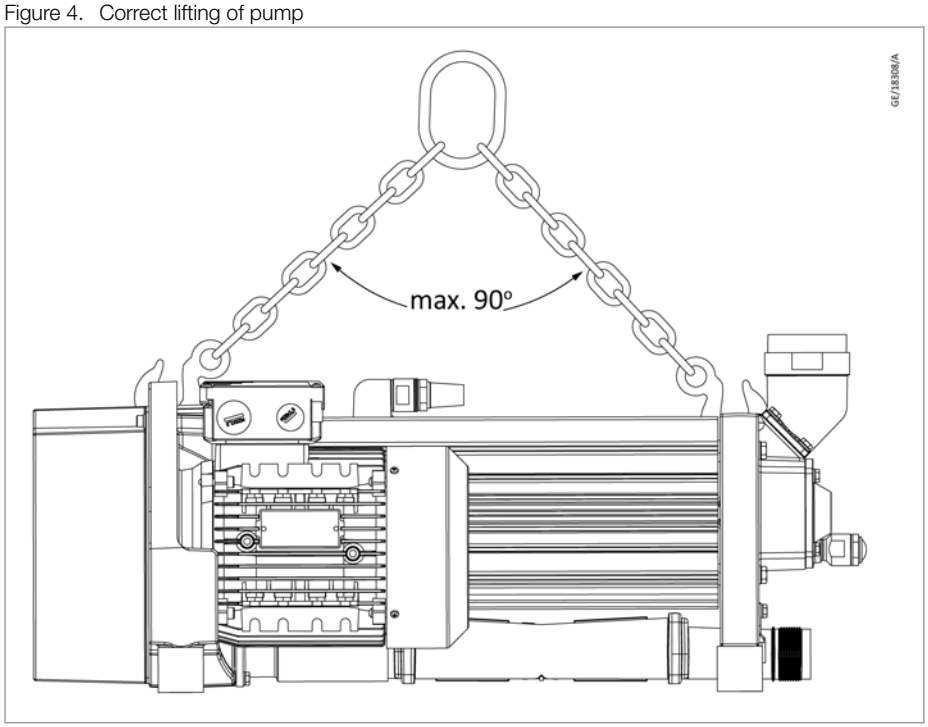
5 Transport and storage

Refer to *Figure: Correct lifting of pump*. Transport the pump on a pallet or with a crane using both lifting eyes at the top of the pump. Never try to lift the pump on just one lifting eye.

Storage

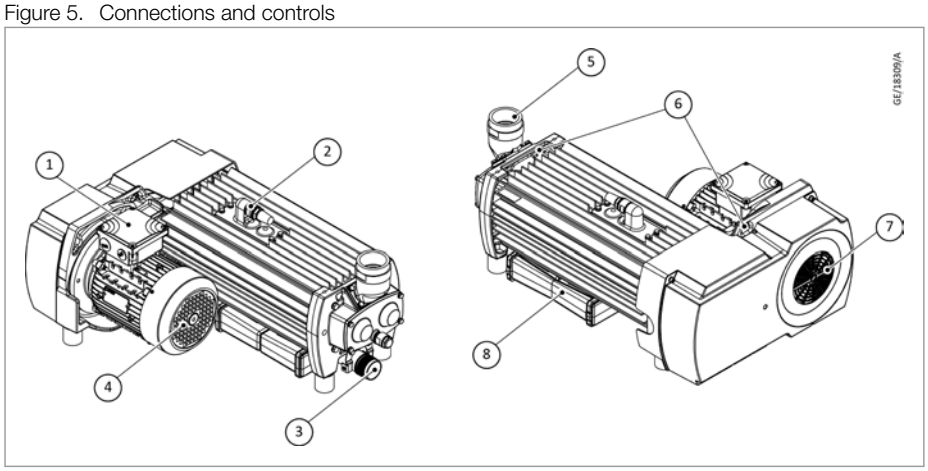
Store the pump in a dry place, preferably at room temperature. The pump must be sealed with the supplied end caps.

Figure 4. Correct lifting of pump



6 Installation

Figure 5. Connections and controls

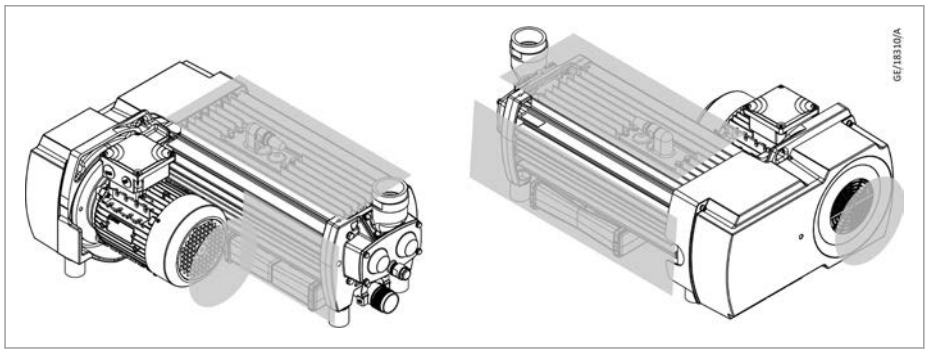


1. *Motor junction box*
2. *Gas ballast port*
3. *Pump exhaust*
4. *Motor fan*
5. *Pump inlet*
6. *Lifting eyes*
7. *Pump fan*
8. *Silencer*

6.1 Placement

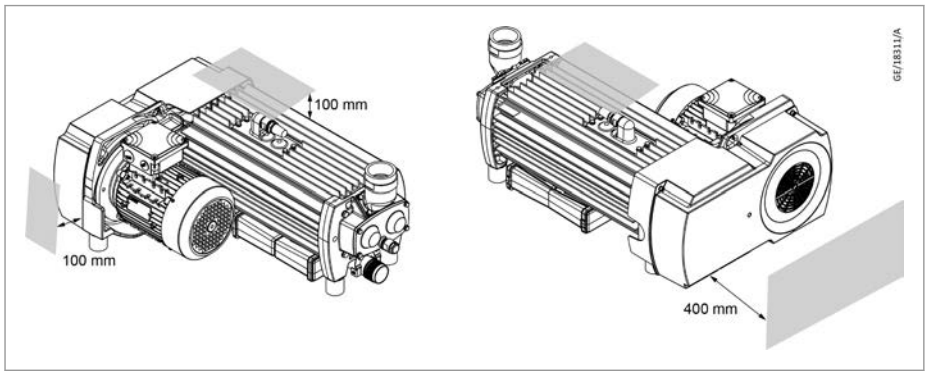
The cooling air intake and outlets must not have a blockage to prevent insufficient cooling of the pump. Refer to *Figure: Connections and controls*.

Make sure that there is a gap of minimum 50 mm from pump surfaces in the marked areas to assure sufficient cooling air flow.



Make sure that there is enough free space around the pump for maintenance.

Installation



Note:

The pump must be protected from direct sunlight and weather influences such as wind and rain.

6.2 Connect the pump

- Remove the caps. We recommend that you retain the caps for decommissioning of the pump.
- During installation work on the intake and discharge lines do not subject flanges to any excessive stresses.

Intake side

- At the intake side, connect the pipework to the vacuum chamber.
- The intake line must be clean. Deposits in the intake line can degas and impair the vacuum. The connecting flanges must be clean and undamaged.

Note:

Do not allow the ingestion of any objects (screws, welding beads, nuts, washers, pieces of wire, etc.) through the intake port of the pump. For this purpose, leave the inlet strainer in the pump. For smaller particles the provided strainer is not sufficient. If small, hard particles can be expected in the intake port, please install a suitable inlet filter. These can also be bought from us, please contact our Sales for further information.

6.3 Exhaust line

WARNING: HARMFUL GASES

Risk of injury or damage to equipment. The operator must check, whether the pumped gases will lead to safety risks on the environment if the pump is operated without an exhaust line (i.e. risk of suffocation, risk of slipping due to condensing vapours, etc.).

WARNING: OVERPRESSURE

Risk of injury or damage to equipment. Smaller cross sections may cause an undesirable overpressure within the system. Do not start up the system with a constricted or blocked exhaust. Make sure that any valves or blocking devices in the exhaust line are open.

Clogged exhaust lines will reduce the available pumping speed, increase temperature and cause overloading of the pump motors or a dangerous overpressure within the system. There is the risk of bursting.

- Connect the exhaust line with a flex tube to the pump, or when operating the pump without a connected exhaust line, operate the pump only in a well ventilated room.
- The cross-section of the exhaust line must at least match the inside diameter of the connections.
- When pumping vapours, we recommend connecting a condensate separator at the exhaust. The exhaust lines should be laid so that they drop down and away, thereby preventing condensate from flowing back into the pump.
- If there is a need for a leak tight silencer, use the outlet pipe accessory
  - E6536491 for VD65 - 100
  - E6536613 for VD160 - 200

6.4 Electrical connection

The pump is supplied with three-phase motor but without accessories for electrical connection. They must be connected with the appropriate cable, and a suitable motor protection switch.

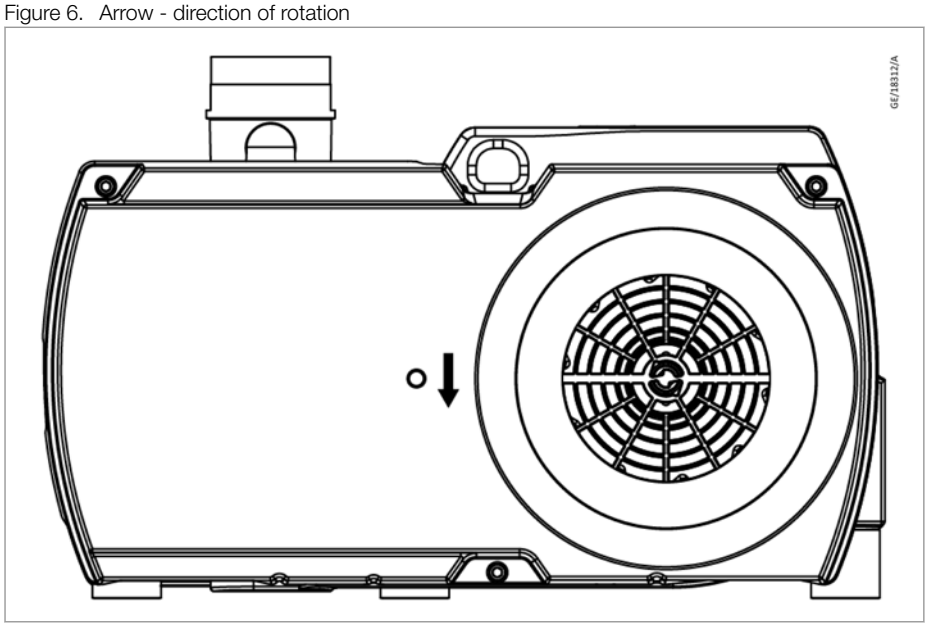
Set the switch in accordance with the rating on the pump nameplate.

Please observe the diagram inside the motor junction box.

After connecting the motor and after every time you alter the wiring, check the direction of rotation. To do so, briefly switch on the motor and make sure that the pump fan rotates in counter-clockwise direction. If not, interchange two phases of the connection.

An arrow (sticker) indicating the correct direction of rotation is placed on the drive cover. To avoid damage to the pump or the vacuum system make sure that the inlet of the pump is not connected to a closed vacuum system when doing this test. Running the pump at full speed in the wrong direction of rotation will generate pressures up to 4.5 bar (g) at the inlet port and damage the pump, if not vented to atmosphere.

Figure 6. Arrow - direction of rotation



6.5 Optional VFD use

If desired the pumps can be operated via an external variable frequency drive (VFD). However it is not allowed to run the pump with more than the nominal speed. Please consult us if other types of VFDs shall be used. The permissible motor speed defined in the *Technical data* on page 13 must be obeyed.

Please note that the pump performance and power consumption is not a linear function of motor speed.

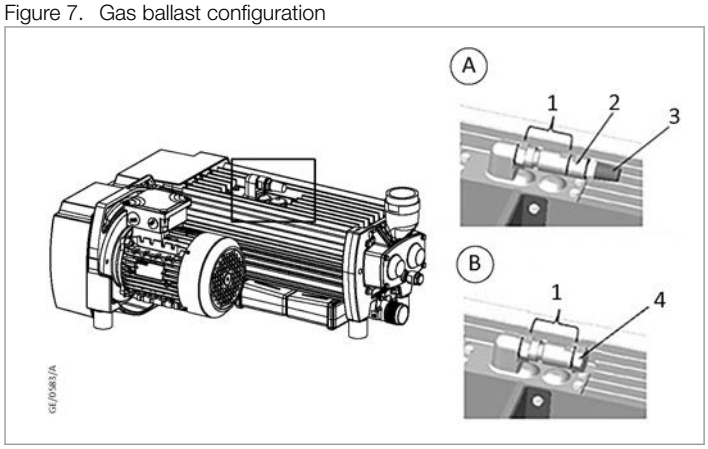
6.6 Gas ballast

The pump is equipped with a gas ballast which feeds ambient air into the pump to dilute condensable vapours and keep the partial pressure below the condensation level. With the gas ballast in use the pump has a water vapour tolerance of 60 mbar. If the presence of condensable vapours in the pumped gases can be ruled out the gas ballast can be closed. Using the gas ballast will improve the vapour handling but reduce the vacuum performance of the pump.

6.7 Gas ballast configuration

The pump can be operated with gas ballast active (open) or closed. When changing the setup make sure that the gaskets are in good condition and that the parts are tightened correctly.

Figure 7. Gas ballast configuration



A. Vapour tolerance 60 mbar
B. No gas ballast
1. Non return valve
2. Nozzle
3. Silencer/Filter
4. Plug (no gas ballast)

7 Operation

WARNING: EXHAUST CONNECTION

Risk of injury or damage to equipment. Connect the pump to an exhaust gas pipework if other gases than clean air are pumped.The exhaust of the pump must not be blocked or constricted. Never operate the pump with the seal-off stoppers in place blanking off the exhaust port.

7.1 Start

Start the pump by applying the supply voltage. The pump can be started up to 20 times per hour.

7.2 Shutdown

Switch off the pump by disconnecting from the mains voltage.

If condensable vapours have been conveyed, operate the pump for 30 minutes with closed process valve and open gas-ballast before switching off in order to evaporate the residual condensate.

The pump will run down for several seconds. Due to the design, the vacuum system is then vented through the pump, if no valve is closed between the pump and the vacuum system. In this case, the pump runs backwards until the pressure is equalised. In case of vacuum chambers exceeding a defined volume a valve must be closed before switching off the pump to avoid over-speeding of the pump and contamination of the vacuum system with dust streaming back from the exhaust pipework.

The maximum chamber sizes to be vented through the pump are:

- VARODRY VD 65 OEM: 500 l
- VARODRY VD 100 OEM: 800 l
- VARODRY VD 160-200 OEM: 1000 l

The ventilation process may take several minutes, depending on the size of the container. Wait for the pressure equalisations before opening the vacuum system or disconnecting the pump from the vacuum system.

In order to avoid back-venting of the vacuum chamber close the inlet of the pump with a valve before switching off. A suitable inlet non return valve is available as optional accessory.

8 Maintenance

8.1 Maintenance schedule

CAUTION: BELT WEAR

Risk of damage to equipment. Some aspects can increase belt wear and maintenance frequency. These are: dustiness in the environment, humid environment and increased numbers of starts and stops. Observe the belt wear behavior and consider more frequent belt replacement. Contact us for additional information.

The maintenance for the pump includes the following:

1. Belt change
2. Major maintenance

The belt change can be done by the user of the pump. (Refer to instructions in *Pump timing belt change* on page 25).

Note:
Do not re-tighten the used belt, as this may damage the pump.

The major maintenance requires special equipments and must be done by our service engineer only.

Maintenance	Interval (operation hours)	
	Ambient temperature: 0 °C-30 °C	**Ambient temperature: 30 °C-40 °C**
Major maintenance	24000 hours or 4 years	19200 hours or 3 years
Blow off valve inspection (applications which form deposits only)	6000 hours or 1 year	4800 hours or 1 year

Table 3. Belt change requirement

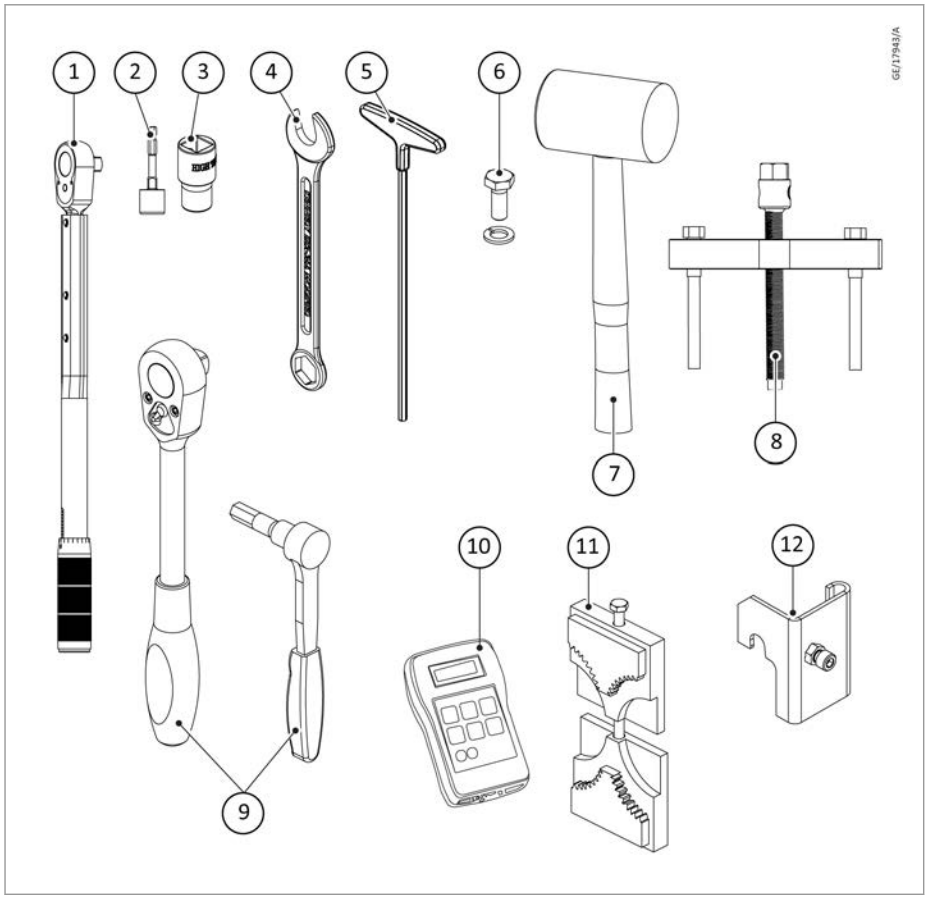
Pump mode	Max. belt operation hours		Belt tension	Start cycles
	P_{ult}/ pump down	Continuously > 40 mbar		
VD65 OEM and VD100 OEM	6000*		Belt tension below 35 Hz (Measured with VSM Mini), 43 Hz (Measured with App/ Trummeter)	25000
VD160 OEM and VD200 OEM	6000*	4000*		

**If ambient temperature is higher than 30°C consider an additional lifetime decrease of approx. 20%.*

Interval which ever comes first

Note:
If 160/200 pumps shall be used continuously above 40 mbar and t_{amb} > 30°C please consult our representative.

8.2 Tools required for maintenance



Sr No.	Description	Quantity
1	Torque wrench	1
2	Allen key socket No. 6	1
3	Socket wrench insert 22	1
4	Wrench 12	1
5	Allen key T handle 5	1
6	M8 hex screw	1
7	Mallet	1
8	Pulling device	1
9	Ratchet	1
10	Tool for belt tension measurement (G9200015)	1
11	Equipment fail safe gear adjustment (E10015117)	1
12	Tool for belt tension adjustment (E6534677)	1

8.3 Pump timing belt change

The pump timing belt is subjected to wear and must be replaced after a defined operation period (refer to the *Maintenance schedule* on page 24). The belt exchange can be either performed by us or by the pump user.

Maintenance

Accessories required:

- Replacement timing belt
  - 50 Hz Versions: EK6528531
  - 60 Hz Versions: EK6528533

Refer to the *Tools required for maintenance* on page 25 for more details.

8.4 Replace the belt

WARNING: ELECTRIC SHOCK

Risk of injury or damage to equipment. Make sure that the main power source is disconnected and all parts with electric supply are covered or closed.

WARNING: PRESSURE HAZARD

Risk of injury or damage to equipment. Make sure that there is no pressure difference between inlet and outlet of the pump during the belt change as the pressure difference will force the pump to rotate. If this can not be ruled out disconnect the pump from the vacuum system before changing the belt.

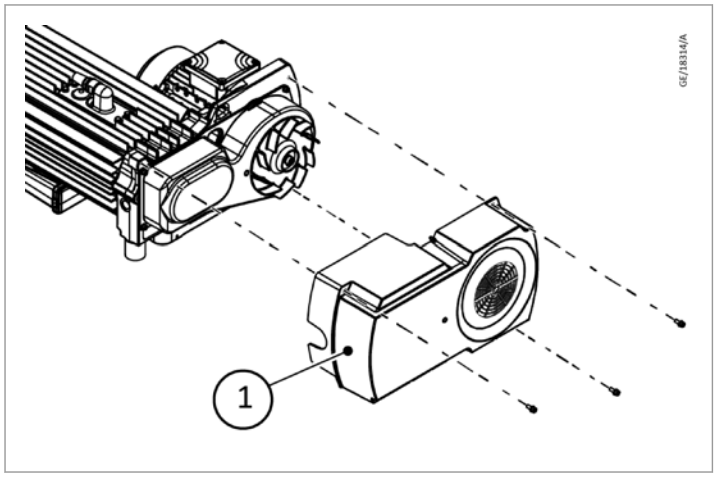
For belt replacement, refer to the link "*Belt replacement*".

8.4.1 Disassemble drive enclosure

WARNING: SUCTION HAZARD

Risk of injury. Do not close the pump inlet with your hands or any other body part and avoid objects from being sucked inside the pump.

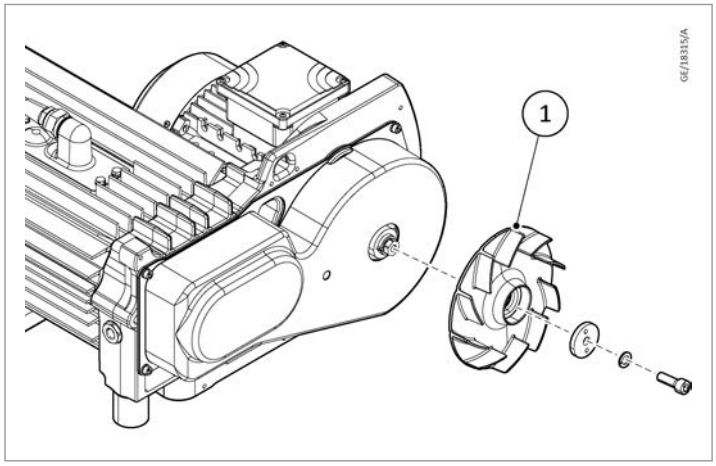
1. Use a 5 mm Allen key to remove the 3 screws which secure the drive enclosure.
2. Separate the drive enclosure from the pump.



1. Drive cover

8.4.2 Disassemble rotor disc, screw and fan

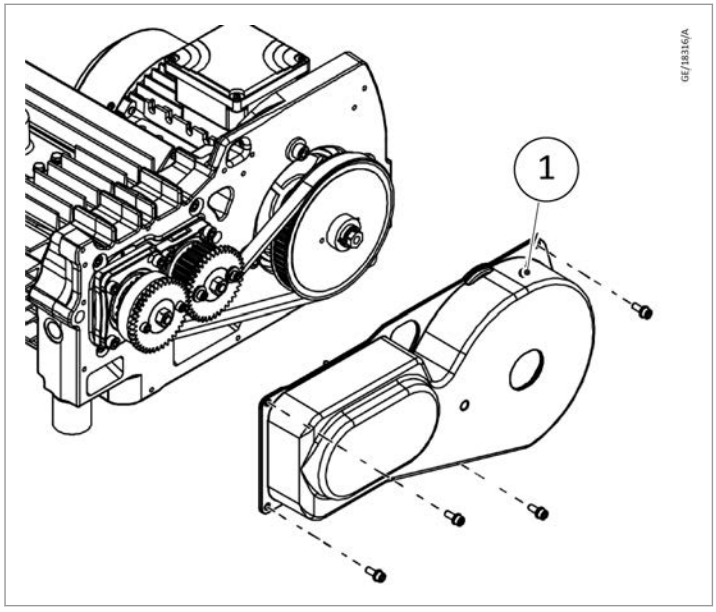
1. Use a 8 mm Allen key to remove the screws, washer and rotor washer which secure the fan on the belt chamber.
2. Separate the fan from the pump.



1. Fan

8.4.3 Disassemble belt chamber cover

1. Use a 5 mm Allen key to remove the 4 screws which secure the belt chamber cover.
2. Separate the belt chamber cover from the pump.



1. Belt chamber cover

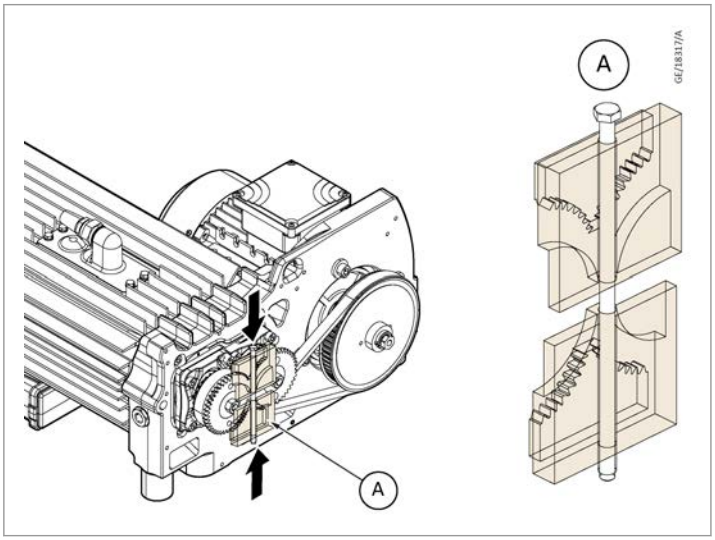
8.4.4 Disassemble fail safe gears

CAUTION: BEARING DAMAGE

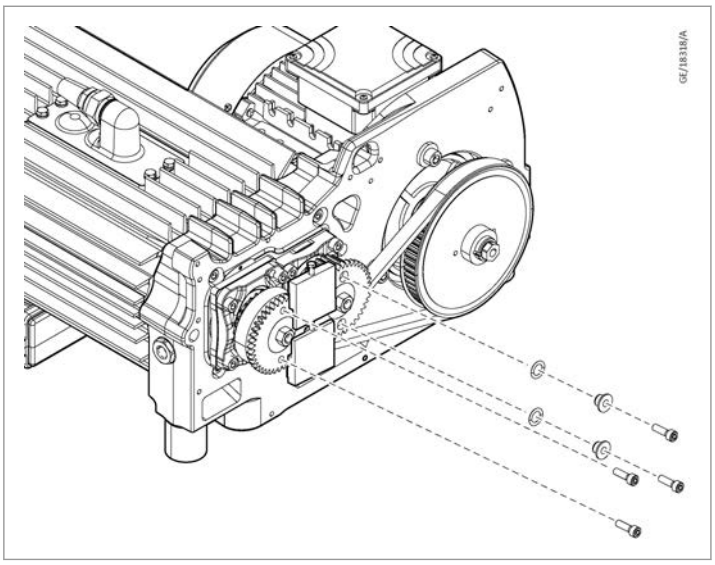
Risk of damage to equipment. Loosening the hexagon nuts of rotors will cause severe bearing damages.

Maintenance

1. Turn the rotors so that the screws fixing the gears stand vertically to each other.
2. Mount the fail-safe gear adjustment tool to the gears by precisely interlocking its toothing to the gears. Clamp the rotors by fasting the tool with about 2 Nm.

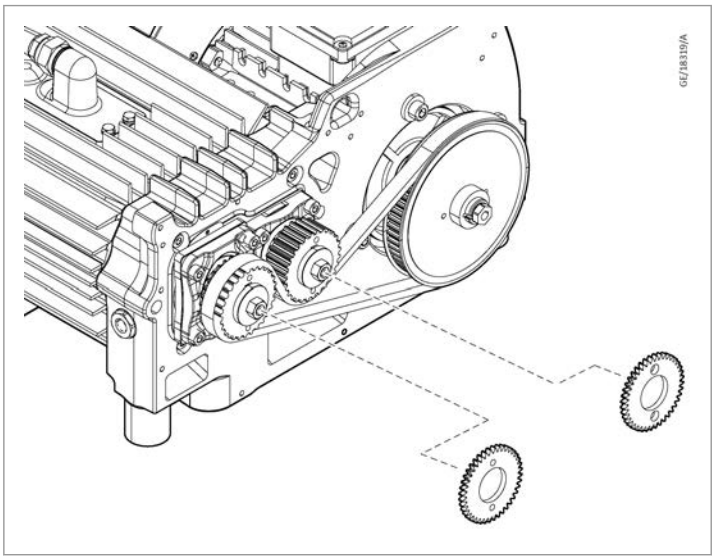


3. Loosen the 4 bolts fixing the gears with a 5 mm Allen key and remove the bolts.



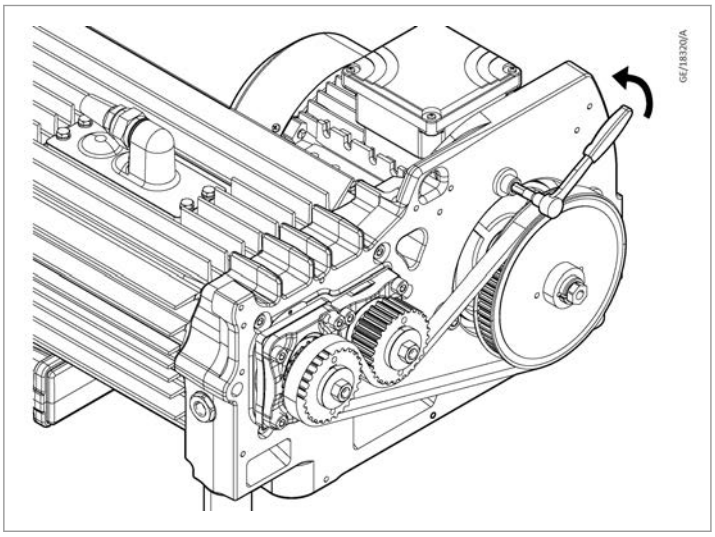
4. Remove the gear adjustment tool.

5. Remove the fail-safe gears and their fixing accessories.

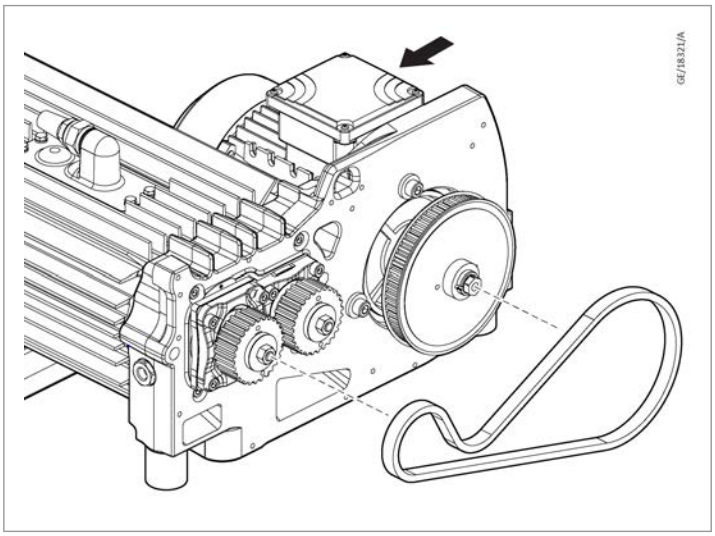


8.4.5 Disassemble belt

1. To enable belt removal, use a 8 mm Allen key to loosen the 4 screws which secure the motor and pulley to the bearing flange by only 1 rotation.



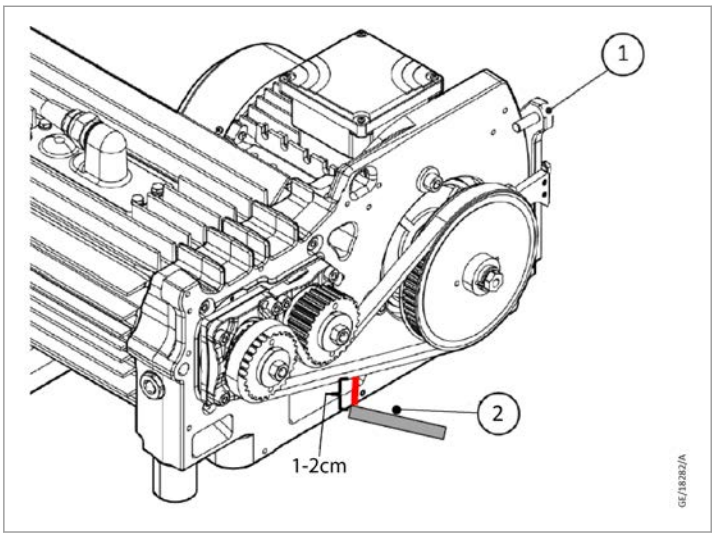
2. Push the motor towards the pump body to loosen the belt.



3. Take the belt from the pulleys.
4. Clean the pulleys with recommended cleaning agent.
5. Dispose of the old belt and the plastic fail-safe gear.

8.4.6 Assemble tooth belt

1. Place the belt on the pulleys.
2. Install the belt tightening tool by use of the outer motor fixation screw as shown in the picture below.
3. Tighten the screw of the tightening tool in order to tense the belt slightly.
4. Measure the belt tension according to one of the selectable methods described in *Belt tension measurement* on page 31.
5. Repeat steps 3 and 4 iteratively until the correct pre-tension is reached.
6. Rotate the motor pulley 5 to 8 times in counter clockwise direction.
7. Check the belt tension again. If the correct value is reached continue with section *Assemble motor screw* on page 33 (fixation of the motor). If not, please start again from step 5.



1. *Belt tightening tool*
2. *Measurement device*

8.4.7 Belt tension measurement

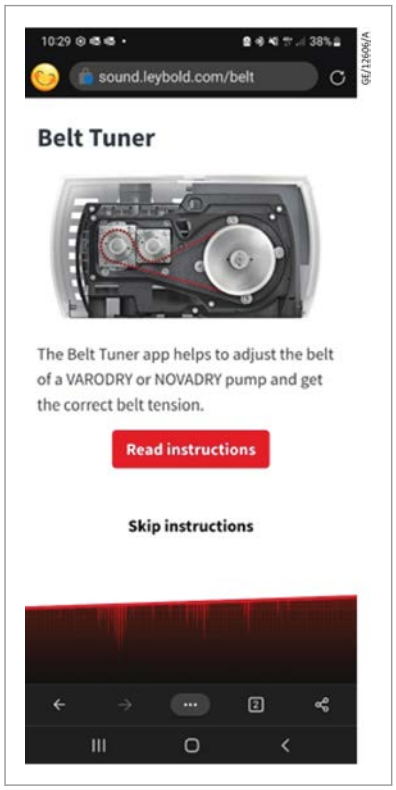
CAUTION: PUMP DAMAGE

Risk of damage to equipment. The belt tension frequencies stated in table on page 33 are defined for new, unused belts during belt exchange / new assembly. After the first use of the belt the (worn) belt must not be re-tensed to the initial state. Always exchange to a new belt once the belt is worn out. A re-tension can cause serious damage to the pump.

The belt tension measurement is normally executed by measuring the belt trums natural frequency. In the following 3 different methods are described, which can be chosen as alternatives based on the availability of tools or other boundary conditions.

1. The “Leybold belt tuner App”

   The “Leybold belt tuner App” can be found as part of the “Leybold SoundAnalyzer” at the *https://sound.leybold.com/ webpage*. It can be used online using the browser of your smartphone as well as offline. The app will closely guide you through the different steps of the process as it can be seen in the screenshot below and uses the microphone of your smartphone to analyse the belt trum vibrations. Therefore, the environment should be preferably less disturbed of very loud background noises.

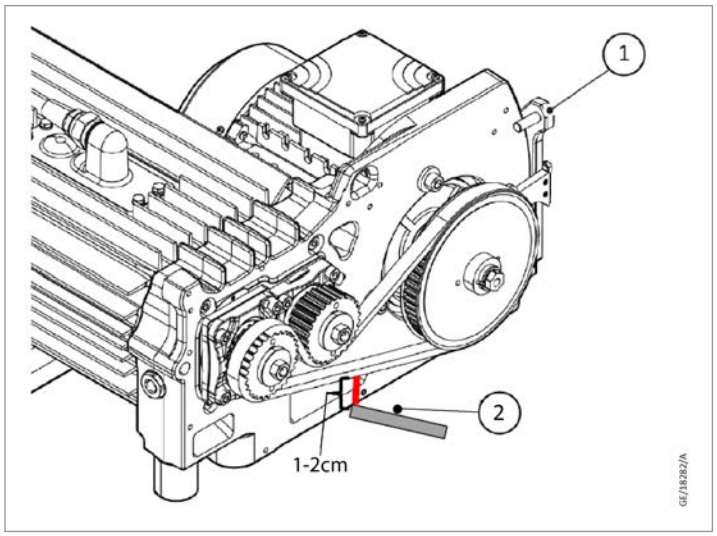


2. Laser-based vibration measurement devices.

   Laser-based vibration measurement devices are frequently used devices for belt tension measurement and work always very similar. Just place the laser sensor close below the middle of the load trum (refer to the *step 1* on page 31) and adjust the laser beam to a belt tooth. You might use a tripod for stabilization. While during this, pluck

the belt chord to trigger a natural vibration and read the frequency from the main control. The target frequency for new, unused belts can be found in *Table: Belt trums natural frequency*. Repeat the procedure several times to eliminate potential uncertainties and adjust the tension iteratively using the motor tensioning device (1).

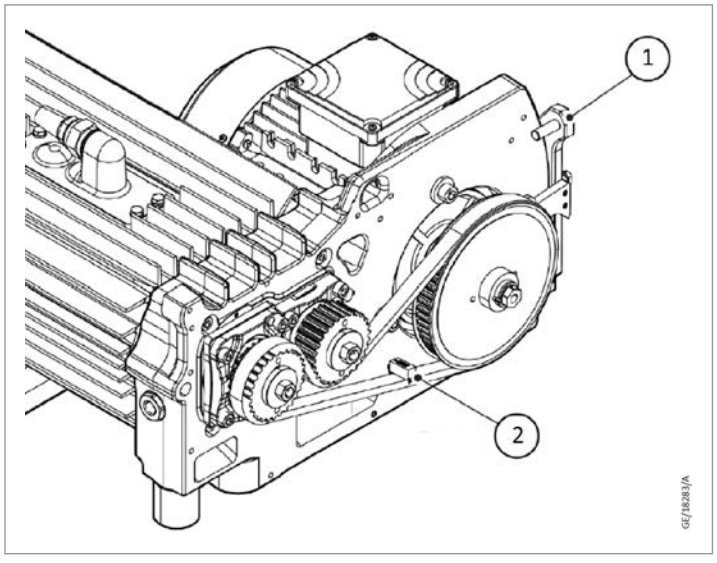
Please contact our sales to purchase a suitable laser-based measuring device.



1. Belt tightening tool *2. Measurement device*

3. VSM Mini device (no longer available for purchase)

The VSM Mini is an integrated vibration measurement tool for chord attachment. With it's attached rubber strap it can be installed to the middle of the belt drives load trum as shown in *step 1* on page 31. After switching on using the button on the top, it automatically detects vibrations once it's stimulated. By plucking the belt trum like a guitar chord, the natural frequency can be measured. Be aware that the necessary frequency deviates from the target frequency using a laser-based method, since the device adds mass to the belt trum. You can find the target value in *Table: Belt trums natural frequency*. Repeat the procedure several times to eliminate potential uncertainties and adjust the tension iteratively using the motor tensioning device (1).



1. *Belt tightening tool*
2. *Measurement device*

Table 4. Belt trums natural frequency

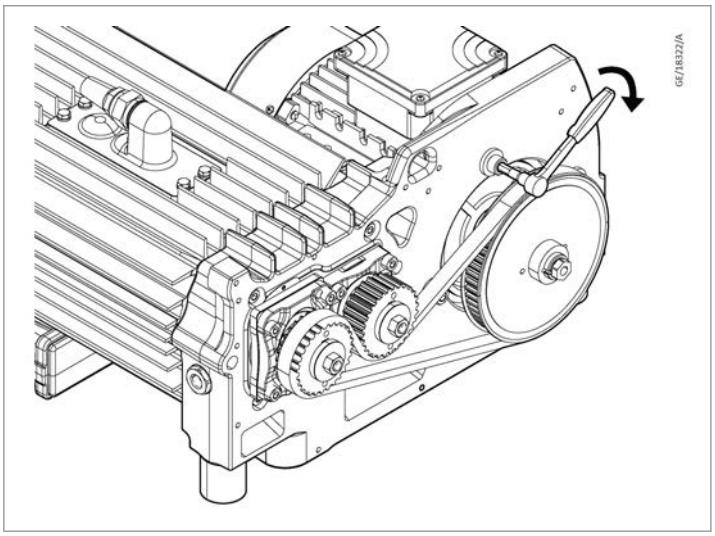
Tool	Frequency
VSM mini	83 +/- 5 Hz
Leybold belt tuner App	Automatically
Laser-based measuring device	105 +/- 5 Hz

Note:

The Leybold belt tuner App can also be used instead of the VSM mini or laser-based measuring device. When using the Leybold belt tuner App., the correct frequency range is automatically displayed. With an optical meter, the correct frequency range changes according to the table above.

8.4.8 Assemble motor screw

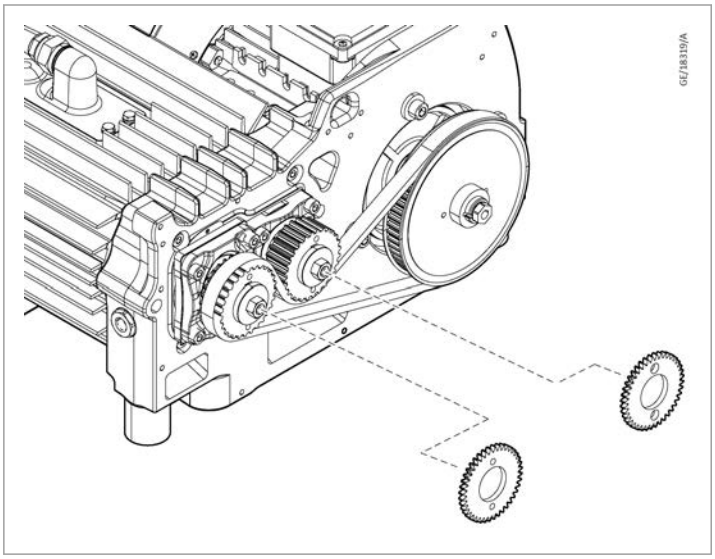
1. Tighten the 4 motor cap screws not used of the tightening tool in cross pattern to 35 Nm +/- 3.5 Nm with an 8 mm allen key.
2. Rotate the pulley by hand for 5 to 8 times and make sure that the belt is tightened and running correctly.
3. Check the belt tension again. If it is not correct, please repeat the tightening procedure from the beginning.

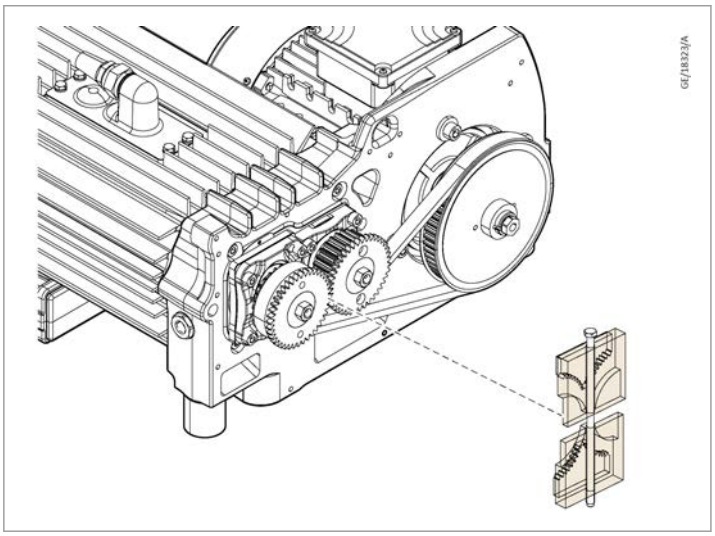


8.4.9 Assemble fail safe gear

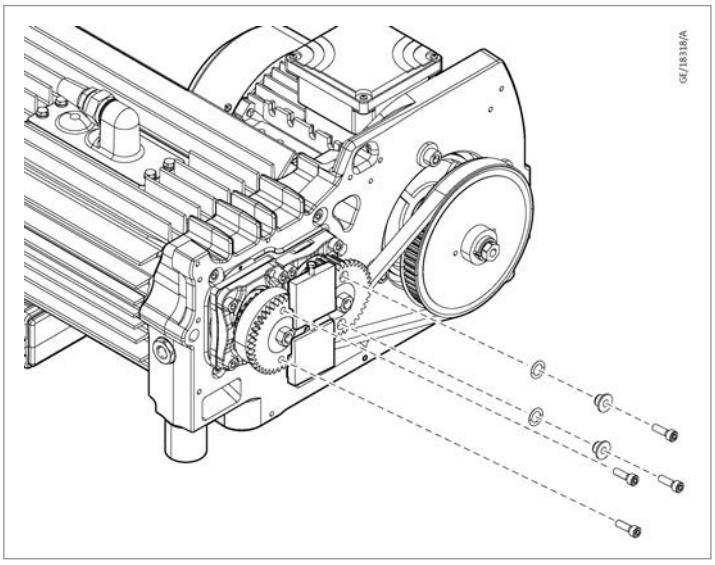
1. Assemble a new, unused plastic fail-safe gear coming with the belt exchange kit by putting on the two enclosed o-rings to the related bushings. Afterwards plug the bushings into the plastic gear.
2. Mount both gears - metal and plastic - loosely to the pulleys using 4 bolts. The gears still need to be slightly rotatable afterwards.

3. Mount the fail-safe gear adjustment tool as described in step 2, *Disassemble fail safe gears* on page 27 and adjust the gears to a symmetric fit to each other.





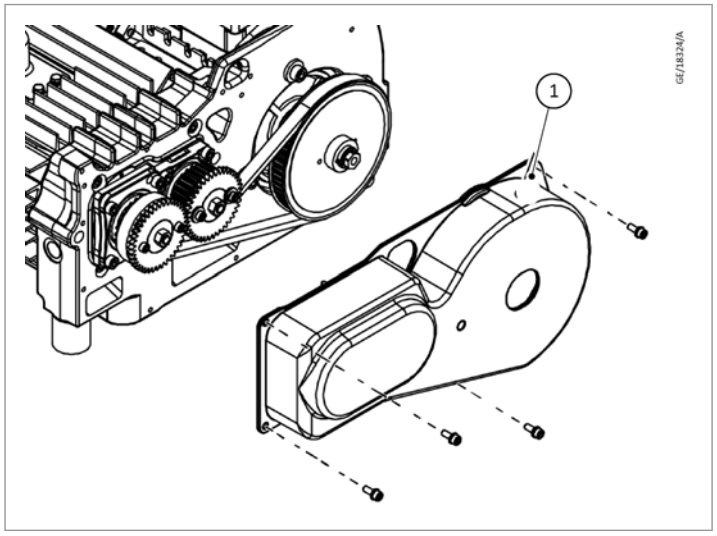
4. Tighten both the steel and the plastic gear with 2 bolts each to 10 Nm.



5. Remove the gear adjustment tool.
6. Rotate the motor pulley in counter clockwise direction by hand for three revolutions.
7. Make sure that the gears do not touch. If the gears touch, repeat step 3 to step 6.

8.4.10 Assemble belt chamber cover

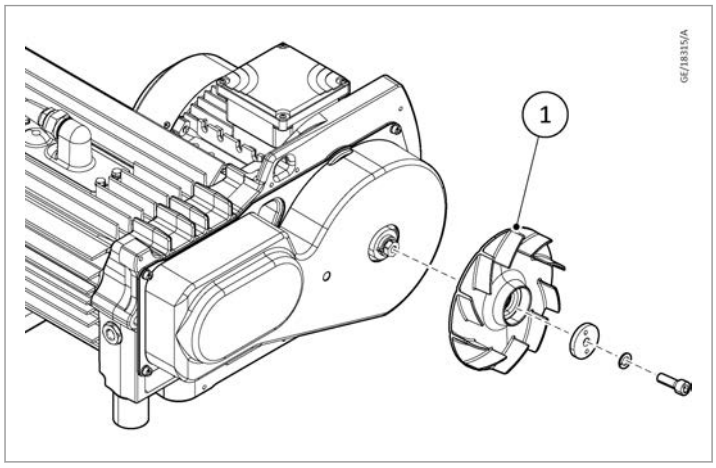
1. Assemble the belt chamber cover onto the bearing flange with 4 cap screws with a 5 mm Allen key.
2. Tighten the cap screws by hand and torque each screw to 2.5 Nm.



1. Belt chamber cover

8.4.11 Assemble fan

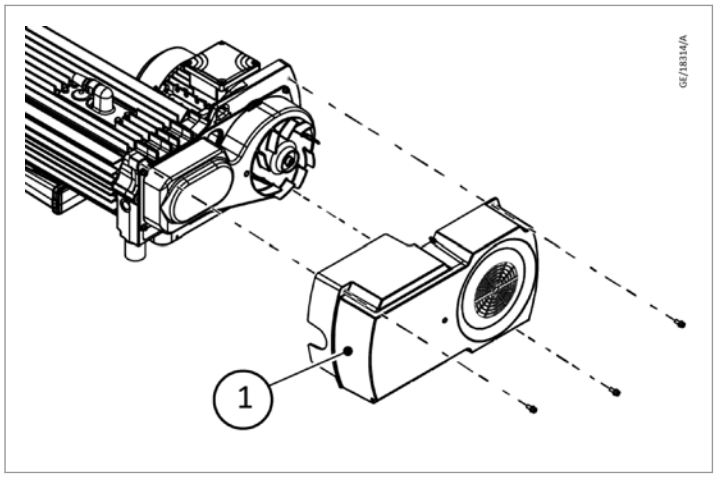
1. Assemble the fan with a 8 mm Allen key.
2. Tighten the cap screw by hand and torque screw to 20 Nm after locking the fan by spanner.



1. *Fan*

8.4.12 Assemble drive enclosure

1. Assemble the drive enclosure onto the bearing flange with 3 cap screws with a 5 mm Allen key.
2. Tighten the cap screws by hand and torque each screw to 2.5 Nm.



1. *Drive enclosure*

8.5 Blow off valve cleaning

WARNING: PERSONAL PROTECTIVE EQUIPMENT (PPE)

Risk of injury. Obey the safety regulations. Make sure that the main power source is disconnected and all parts with electric supply are covered or closed. As there will be exposure to the pumped substances, use appropriate PPE such as rubber gloves depending on the substances that are present in the process.

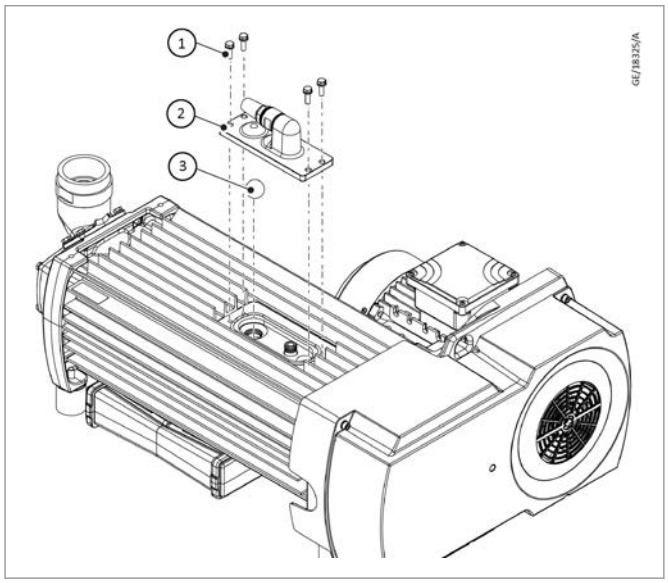
Accessories required to clean the blow off valve:

- Spanner: 10 mm
- Lint free cloth for cleaning
- Water or isopropanol for cleaning

To clean the blow off valve:

1. Remove the 4 x M6 screws (9) of the blow off cover (10).
2. Pull the blow off cover (10) up gently.

3. Remove the valve ball (11).
4. Check all surfaces for contamination. If required, clean with water or isopropanol.
5. Check the valve ball and all O-rings for damage or wear, replace if necessary (EK6525317).
6. Reassemble the components (a missing valve ball will destroy the pump).
7. Tighten the 4 x M6 screws with 8 Nm.



1. M6 screws *2. Blow off cover*
3. Valve ball

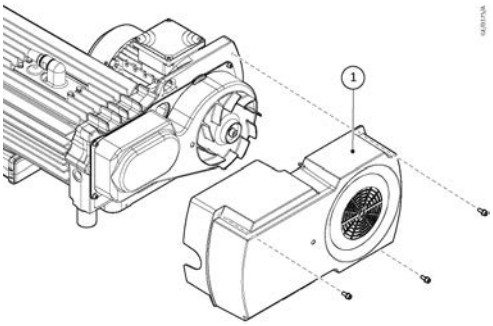
Note:
ND160/200 have two valve balls.

8.6 Replace electrical motor

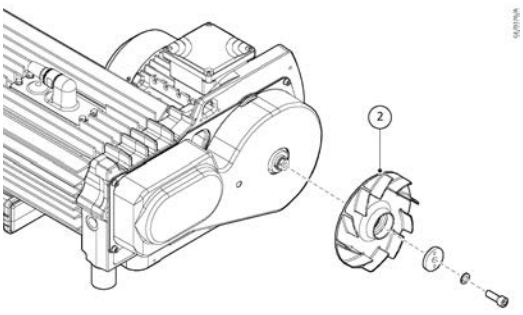
8.6.1 Motor disassembly

To replace the electric motor, do the steps that follow:

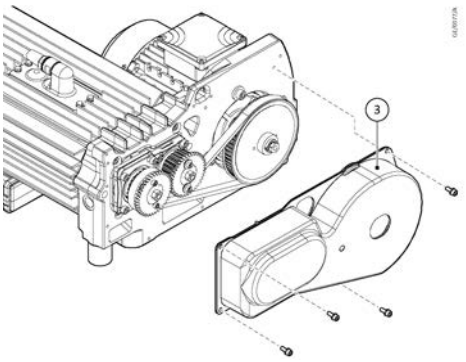
1. Remove the fan cover (1).



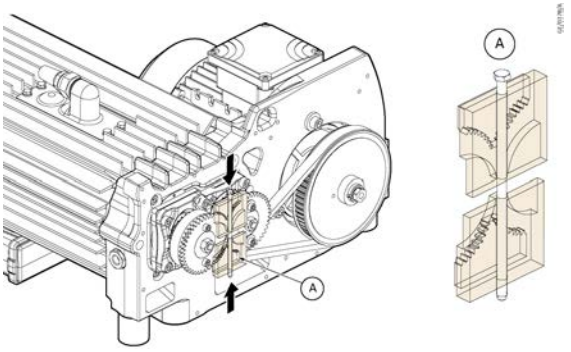
2. Remove the fan (2).



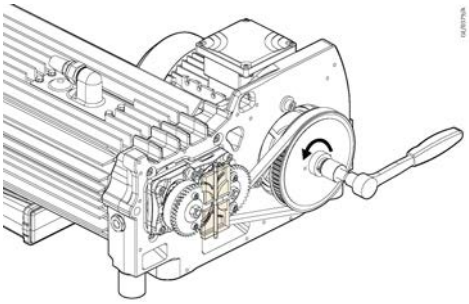
3. Remove the belt enclosure (3).



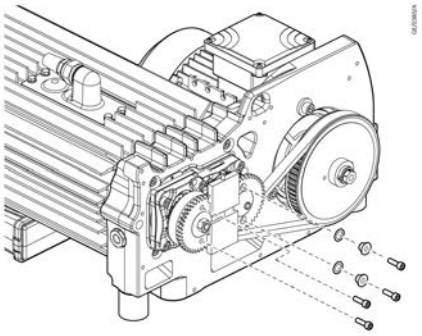
4. Block the fail safe gears with the gear adjustment tool (A).



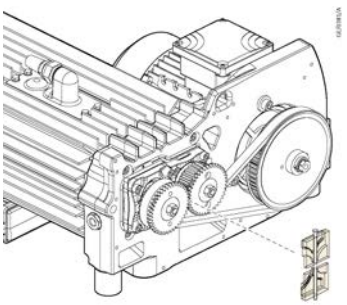
5. Loosen the centre screw.



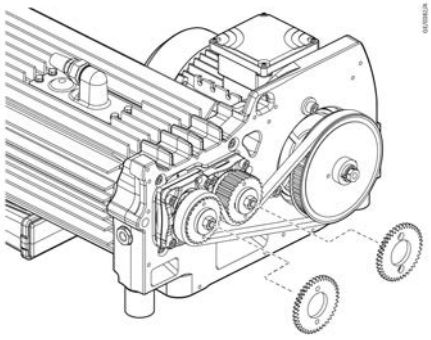
6. Loosen and remove the bolts of fail safe gears.



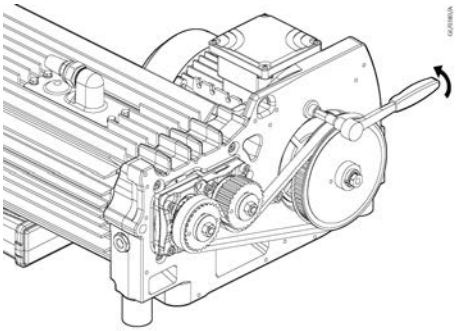
7. Remove the gear fixation tool.



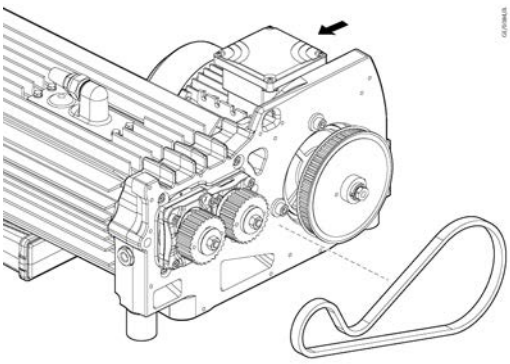
8. Remove the fail safe gears.



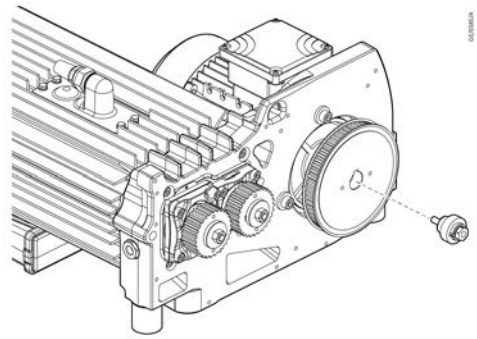
9. Loosen the 4 motor screws.



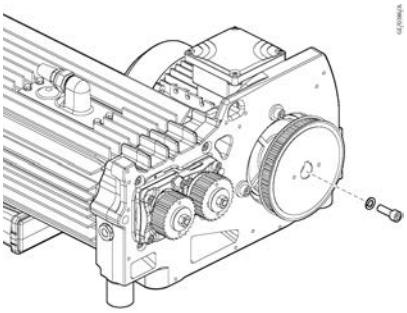
10. Push the motor gently and pull out the belt.



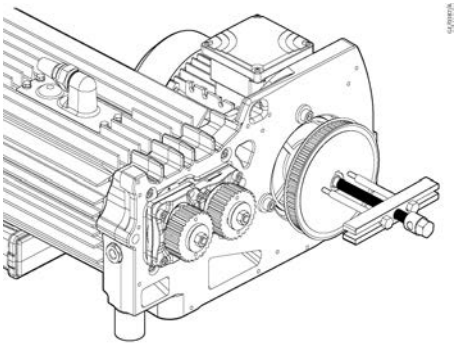
11. Remove the centre screw.



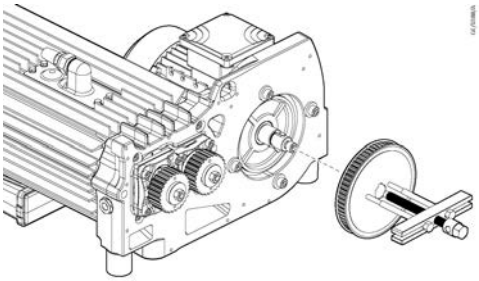
12. Install the M8 hexagonal screw.



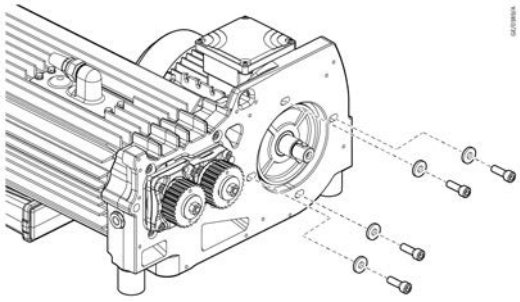
13. Install the gear puller into the middle of the pulley.



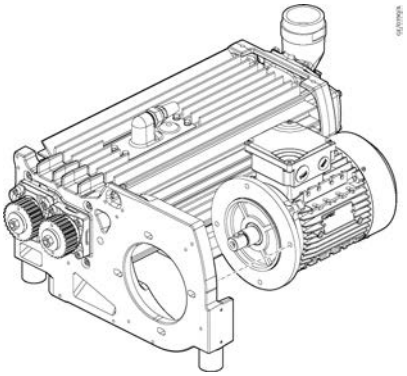
14. Remove the pulley with the gear puller tool and M8 hexagonal screw.



15. Unscrew the 4 motor screws. Hold the motor while unscrewing and unscrew the uppermost screw last.



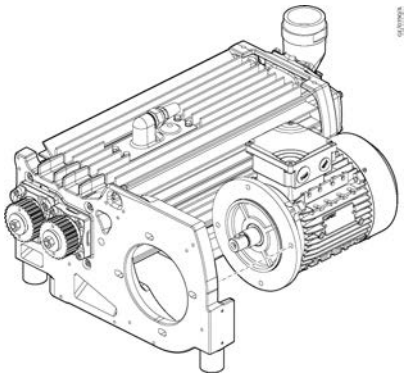
16. Remove the motor.



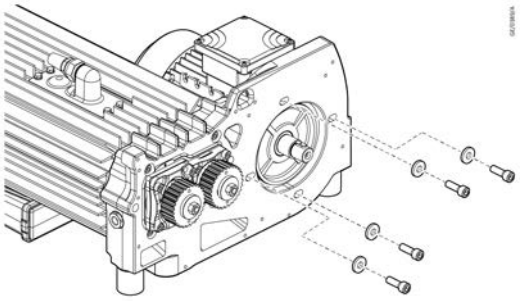
Maintenance

8.6.2 Motor assembly

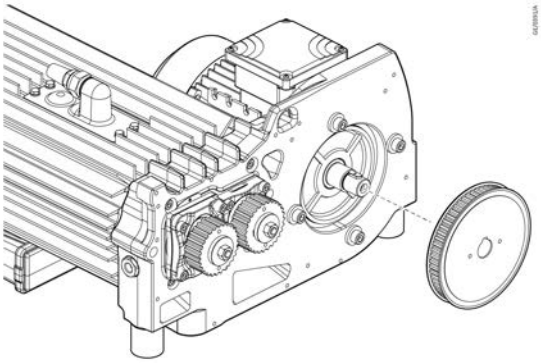
1. Place the new motor for installation.



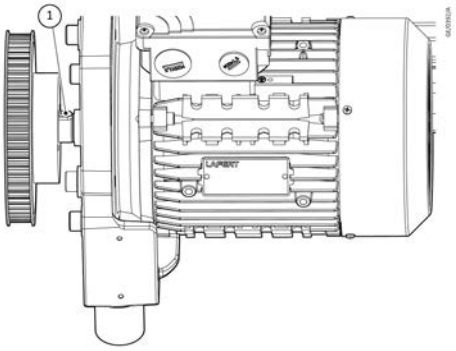
2. Install the 4 motor screws and hand tighten.



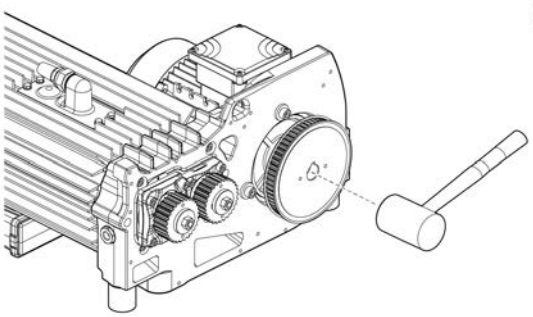
3. Install the pulley to the motor.



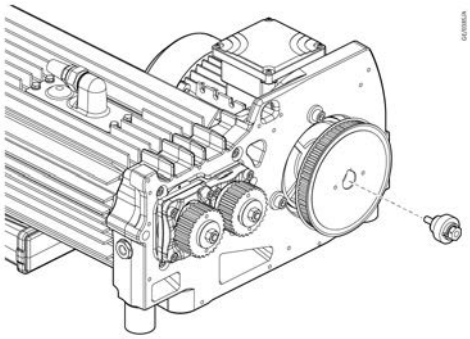
4. Make sure that the key (1) and keyway are aligned correctly.



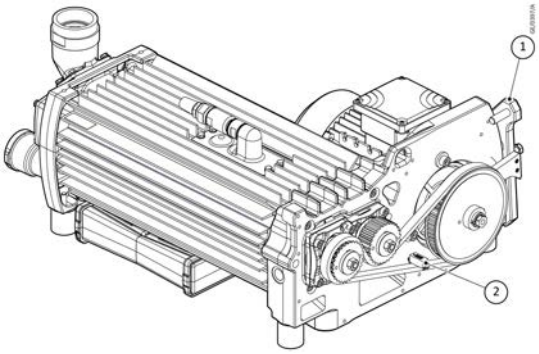
5. Tap the pulley with a mallet gently to push the pulley.



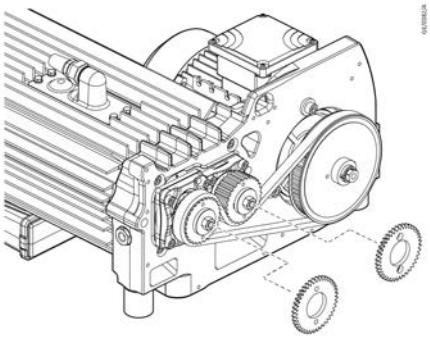
6. Insert the centre screw and hand tighten.



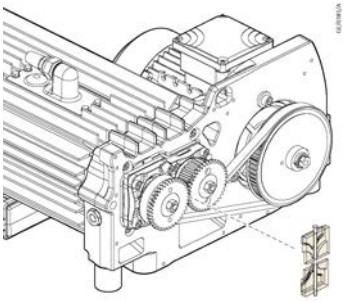
7. Install the belt.



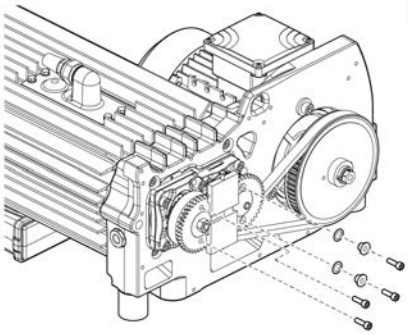
8. Assemble both fail-safe gears. Replace the plastic fail-safe gear if it is worn.



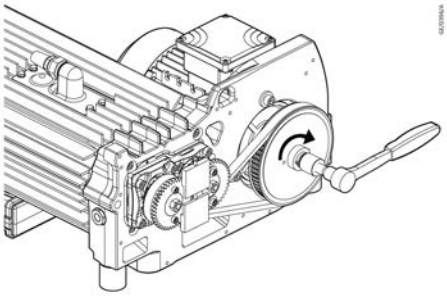
9. Install the gear adjustment tool on the fail safe gears.



10. Assemble the fail safe gears bolts and tighten with 10 Nm .



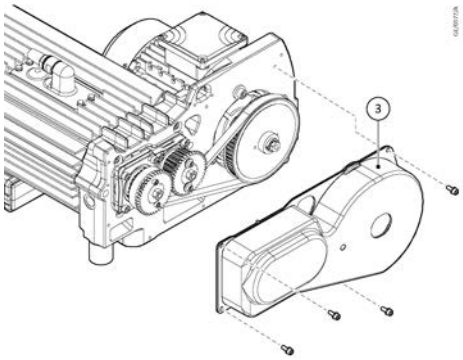
11. Fix the centre nut. Use a torque wrench to tighten the screw to 25 Nm.



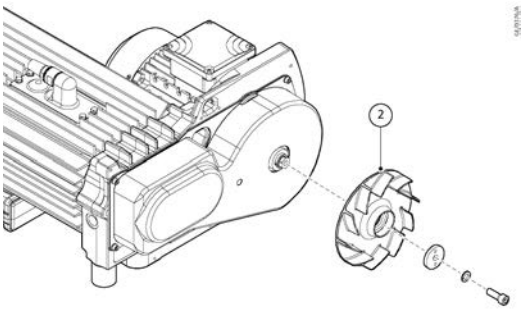
12. Remove gear adjustment tool.

13. Tighten the motor screws by following steps 2-7 in *Assemble tooth belt* on page 30.

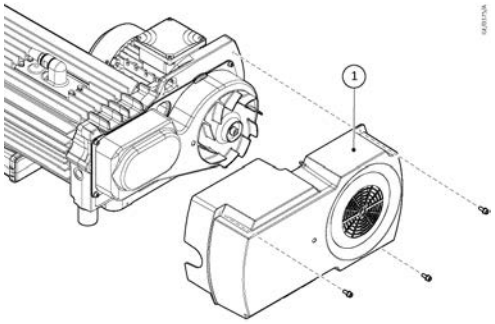
14. Install the belt enclosure (3). Tighten with 2.5 Nm.



15. Install the fan (2). Tighten with 20 Nm.



16. Install the fan cover (1). Tighten with 2.5 Nm.



Maintenance

8.7 Motor part list

Table 5 Motor part list

Product name	Motor spare part no.							
	E6524957	E6537817	E6524959	E6537818	E6524971	E6537819	G6545859	E6537850
VARODRY VD 65 OEM, 50 Hz, 200/400 V	•							
VARODRY VD 65 OEM, 60 Hz, 230/460 V	•							
VARODRY VD 65 OEM, 60 Hz, 200/380 V		•						
VARODRY VD 100 OEM, 50 Hz, 200/400 V			•					
VARODRY VD 100 OEM, 60 Hz, 230/460 V			•					
VARODRY VD 100 OEM, 60 Hz, 200/380 V				•				
VARODRY VD 160 OEM, 60Hz, 230/460 V					•			
VARODRY VD 160 OEM, 60 Hz, 230/460 V					•			
VARODRY VD 160 OEM, 60 Hz, 200/380 V						•		
VARODRY VD 200 OEM, 50 Hz, 200/400 V							•	
VARODRY VD 200 OEM, 60 Hz, 230/460 V							•	
VARODRY VD 200 OEM, 60 Hz, 200/380 V								•

9 Fault finding

Fault	Pump does not start up
Cause	**Wrong or loose connection at motor terminal**
Remedy	Check the connections
Cause	**Pump is blocked**
Remedy	Contact us
Cause	**Belt is broken**
Remedy	Contact us
Cause	**Motor is defective**
Remedy	Contact us
Cause	**Wrong supply voltage**
Remedy	Check the mains power or inverter

Fault	Motor protective switch triggers
Cause	**Pump is blocked**
Remedy	Contact us
Cause	**Motor is defective**
Remedy	Contact us
Cause	**Wrong setting of protective switch**
Remedy	Adjust the setting. Refer to *Technical data* on page 13.
Cause	**Wrong direction of rotation**
Remedy	Check and change the direction of rotation if applicable
Cause	**Wrong supply voltage**
Remedy	Check the mains power
Cause	**Exhaust line is clogged**
Remedy	Clean the exhaust line

Fault	Pump does not reach vacuum performance
Cause	**Inlet filter is clogged**
Remedy	Clean the inlet filter (if in use)
Cause	**Gas leak at the pump inlet**
Remedy	Check O-ring at inlet port or connections of accessories

Fault finding

Cause	**Wrong rotational speed**
Remedy	Check the mains frequency or inverter
Cause	**Wrong setting of gas ballast**
Remedy	Correct if applicable
Cause	**Inlet seal purge is defective**
Remedy	Contact us
Cause	**Loose gas ballast connection**
Remedy	Check tight fit of gas ballast parts
Cause	**Cold pump**
Remedy	Wait for 30 minutes to warm-up the pump
Cause	**Wrong voltage wiring**
Remedy	Check with drawing in the motor connection box
Cause	**Wrong position or type of vacuum gauge**
Remedy	Check pressure direct at the inlet port. We recommend type TTR or CTR 0.1 torr
Cause	**Purge connection is loose**
Remedy	Tighten the purge connection and check tight fit of hose

Fault	Pump is noisy or has high vibration level
Cause	**Pump is clogged with process deposition**
Remedy	Follow the cleaning instructions
Cause	**Belt is worn or defective**
Remedy	Exchange the belt Contact us
Cause	**Bearing is defective**
Remedy	Contact us
Cause	**Silencer is defective**
Remedy	Exchange the silencer Contact us

10 Disposal

10.1 Waste disposal

DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Waste Electrical and Electronic Equipment (WEEE)

This equipment falls under the provisions of the European Directive 2012/19/EU on Waste Electrical and Electronic Appliances (WEEE) and may not be disposed as unsorted waste.

The equipment is labelled in accordance with the European Directive 2012/19/EU with the crossed-out wheelie bin symbol.

At the end of life-time of the electric and electronic equipment (EEE) it must be taken to separate collection.

For more information check with your local waste authority, customer center or distributor.

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

WARNING: CONTAMINATED PARTS

Risk of damage to equipment. Contaminated parts can be detrimental to health and the 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.

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

When sending us a pump, observe the regulations given in *Leybold service* on page 48.

11 Accessories

Table 6. Accessories

Centering ring, aluminium, FPM DN 40 ISO-KF	18208
Clamping ring, aluminium DN 40 ISO-KF	18343
Inlet adapter G 1¼"	111005A21
Inlet adapter DN40 ISO-KF	111005A20
Inlet adapter DN63 ISO-K	111005A24
Exhaust adapter DN40 ISO-KF	111005A30
Exhaust adapter G 1½	111005A32
Replacement timing belt 50 Hz versions	EK6528531
Replacement timing belt 60 Hz versions	EK6528533
Pump flushing kit	111005A00
Inlet non return valve (for operation > 10 mbar)	111005A15
Inlet adapter NPT 1¼ - 11.5	111005A22
Inlet adapter NPT 2 - 11.5	111005A23
Exhaust adapter NPT 1½ - 11.5	111005A31
Fail safe gear replacement kit	EK6528264
Blow off valve replacement kit	EK6525317
Replacement sealing plug for silencer	GM6542410
Outlet pipe VD65-100	E6536491
Outlet pipe VD160-200	E6536613
Hour counter	E6532074
Equipment fail safe gear adjustment	E10015117
Tool for belt tension adjustment	E6534677
Purge Upgrade Kit ND/VD OEM	111005A01
Optical belt tension measuring device	G9200015
Outlet adapter G1½	111005A32

Table 7 Variants and Feature matrix

Cat.-No.	Product Name	Pumping speed				Gas ballast		Additional features
		65 m³/h	105 m³/h	155 m³/h	185 m³/h	Gas ballast with check-valve	Purge-gas kit	Stainless steel pipe/ PEEK Blow off ball
111065V45	VARODRY VD 65 OEM HD/O2, 50Hz, 200/400 V	x					x	x
111065V46	VARODRY VD 65 OEM HD/O2, 60Hz, 230/460 V	x					x	x
111065V47	VARODRY VD 65 OEM HD/O2, 60Hz, 200/380 V	x					x	x
10110100V01	VARODRY VD 100 OEM HD/O2, 50Hz, 200/400 V, Purge		x			x		
10110100V02	VARODRY VD 100 OEM HD/O2, 60Hz, 230/460 V, Purge		x			x		
10110100V03	VARODRY VD 100 OEM HD/O2, 60Hz, 200/380 V, Purge		x			x		
10110160V01	VARODRY VD 160 OEM HD/O2, 50Hz, 200/400 V, Purge	x					x	x
10110200V02	VARODRY VD 200 OEM HD/O2, 60Hz, 230/460 V, Purge			x			x	
10110160V03	VARODRY VD 160 OEM HD/O2, 60Hz, 200/380 V, Purge	x					x	x
10110200V01	VARODRY VD 200 OEM HD/O2, 50Hz, 200/400 V, Purge			x		x		
10110160V02	VARODRY VD 160 OEM HD/O2, 60Hz, 230/460 V, Purge	x					x	x
10110200V03	VARODRY VD 200 OEM HD/O2, 60Hz, 200/380 V, Purge			x		x		

12 Leybold service

Whenever you send us 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.

The form Declaration of Contamination for Compressors, Vacuum Pumps and Components is available on *www.leybold.com-> Downloads -> Download Documents*.

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

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

P200501 29A
300672940

EU Declaration of Conformity

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

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

The product specified and listed below

- Product: Screw Vacuum Pump-with motor
- Models: VARODRY VD 65-200
- Pump family codes: 111065V…,111100V…,111160V…,111200V…, 10110065V…, 10110100V…, 10110160V…, 10110200V…

Is in conformity with the relevant requirements of European CE legislation:

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

Based on the relevant requirements of harmonised standards:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Industrial Immunity Standard
EN 61000-6-4:2007\AI:2011	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Industrial Emission Standard

This declaration, based on the requirements of the listed Directives and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: *2022-11-10*

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.

Andries de Bock – VP Engineering
Industrial Division
Cologne

Bram Claes – VP Operations
Industrial Vacuum Division
Cologne

P200501 29A
300672940

Declaration of Conformity

Leybold GmbH
Bonner Strasse 498
D-50968 Koln
Germany

Documentation Officer
Innovation Drive
Burgess Hill
West Sussex
RH15 9TW
documentation@leybold.com

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

- Product: Screw Vacuum Pump-with motor
- Models: VARODRY VD 65-200
- Pump family codes: 111065V…,111100V…,111160V…,111200V…, 10110065V…, 10110100V…, 10110160V…, 10110200V…

The object of the declaration described above is in conformity with relevant statutory requirements:

Supply of Machinery (Safety) Regulations 2008
The objectives of the Electrical Equipment (Safety) Regulations 2016 are governed by Annex 1 1.5.1 of this regulation.

Electromagnetic Compatibility Regulations 2016

Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Relevant designated standards or technical specifications are as follows:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Industrial Immunity Standard
EN 61000-6-4:2007\AI:2011	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Industrial Emission Standard

This declaration, based on the requirements of the listed Statutory Instruments and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: *2022-11-10*

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.

Signed for and on behalf of Leybold GmbH

Andries de Bock – VP Engineering
Industrial Division
Cologne

Bram Claes – VP Operations
Industrial Vacuum Division
Cologne

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION

EMC (EU, UK): Class A/B Industrial equipment

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

RoHS (EU, UK): Material Exemption Information

This product is compliant with the following Exemptions
Annex III:

- 6(c) Copper alloy containing up to 4% **lead** by weight

REACH (EU, UK)

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

Article 33.1 Declaration (EU, UK)

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

- Lead (Pb)
  This substance is present in certain brass / electrical or electronic components.

TSCA PBTs (US)

Regulation of Persistent, Bioaccumulative, and Toxic Chemicals Under TSCA Section 6(h)
The product does not knowingly or intentionally contain substances in contravention with the above requirements.

Additional Applicable Requirements

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

2012/19/EU	Directive on waste electrical and electronic equipment (WEEE)

材料成分声明
China Material Content Declaration

	有害物质 Hazardous Substances					
部件名称 Part name 	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
铜接头 Brass connectors	X	O	O	O	O	O
电子元件和控件 Electronics and Controls	X	O	O	O	O	O

O: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。
O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X: 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求。
X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

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Leybold

Pioneering products. Passionately applied.

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