



RUVAC WA / WAU 251/501/1001/2001

Roots vacuum pumps

Operating instructions GA03107_002_C3

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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 - Automatic start up Risk of injury. The equipment can be started remotely and without warning.
	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 - Moving parts present Risk of injury. Identifies moving parts that may cause injury or damage to equipment.
	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.
	Mandatory action symbol Failure to comply with this action may result in injury or damage to equipment.
	Warning - Use protective equipment Risk of injury. Use appropriate Personal Protective Equipment (PPE) when performing the task.
	Warning - Wear eye protection Risk of injury. Wear appropriate protective goggles when performing the task.
	Warning - Wear hearing protection Risk of injury. Wear appropriate hearing protection when performing the task.
	Warning - Wear protective gloves Risk of injury. Wear appropriate protective gloves when performing the task.

Important safety information

2 Important safety information

2.1 Mechanical Hazards



WARNING: OPERATION SAFETY

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



WARNING: EXPLOSION HAZARD

Risk of injury or damage to equipment. Maintain the pressure and temperature of the system as per guidelines.

-
1. Avoid exposing any part of the human body to the vacuum.
 2. Even during standstill of the pump it is dangerous to reaching into the pump casing. Fingers can easily be squeezed between impellers due to the high inertia of the parts. Please use caution when grasping into the pump and make sure that the pump is secured against unwanted rotation due to differential pressures.
 3. The lifting eyes of the pumps must not be used to lift any pump combinations (Roots + backing pump). Exceptions are allowed only with approval from us. Secure the pump by the crane at the intended eyes until a firm connection has been established with the backing pump or a corresponding suspension has been installed.
 4. Do not operate the pump with any of the covers removed. Serious injury may result.
 5. Never operate the pump without connected inlet line or blank flange at the inlet.
 6. Make sure that the gas flow from the discharge port is not blocked or restricted in any way.
 7. It is recommended to always only operate the pump with a suitable discharge line which is properly connected.
 8. If discharged gases must be collected or contained, do not allow the discharge line to become pressurised.
 9. When moving the pump always use the allowed means. Two lifting eyes are provided on this pump as standard.
 10. Do not allow the ingestion of any objects (screws, nuts, washers, pieces of wire, etc.) through the inlet port of the pump. The use of the inlet screen is strongly recommended. In case the pump is operated without inlet screen the operator has to make sure that no objects can enter the pump through the inlet port. Objects falling into the pump can cause severe damage including leaks to atmosphere.
 11. Should malfunctions affect the pump, seized impellers in particular owing to hard deposits or foreign objects, the occurrence of leaks affecting the housing cannot be ruled out. When pumping hazardous gases the operator must ensure that the possibility of such an incident is excluded, respectively that leaks at the pump casing will not pose a hazard.

Important safety information

12. In order to prevent the destruction of equipment and injuries to the operating personnel, we urgently recommend to follow the installation instructions given in these Operating Instructions.
13. The pumps must only be operated at the permitted speeds. Especially when using frequency converters which have not been specifically approved by us, you need to ensure an effective protection against overspeeding.

2.2 Electrical Hazards



WARNING: DANGEROUS VOLTAGE

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



WARNING: AUTOMATIC START UP

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

-
1. Potentially lethal voltages are present at the mains connections. Before beginning with any maintenance or service work on the pump, disconnect the pump from all power supplies (lockout/tagout).
 2. The electrical connections must only be provided by a trained electrician as specified, for example, by the regulations EN 50110-1. Note the national regulations of the country in which the equipment is in being operated.
 3. Before initial commissioning install a suitable motor protection switch for the electric motor. Please note the information given in these Operating Instructions and on the electric motor (terminal diagram).
 4. Before commissioning, check the junction box to ensure that it is undamaged, perform a visual inspection on the seals.
 5. Install add-on parts (pressure switches, for example) without any tensions and protect these against damage by impacts, for example.
 6. Lay the connecting lines so that they cannot be damaged. Protect the lines against humidity and contact with water. Avoid thermally stressing the lines due to unfavourable laying. Observe the required standards when designing and laying the electrical connections.
 7. Provide strain relief for the connecting lines so that the plugs and the line connectors are not exposed to excessively high mechanical stresses.
 8. Lay the electric lines so that there is no risk of tripping over these.
 9. The pump must be integrated in the system control arrangement so that the pump can not run-up automatically after it has been shut down due to overtemperature of the motor. This applies equally to emergency shut-down arrangements. After having determined the fault cause, the pump should be switched on manually again.
 10. The following applies to pumps being operated with a frequency converter: after a mains power failure the pump will automatically start up again once the power returns.

Important safety information

2.3 Thermal Hazards



WARNING: HOT SURFACES

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

-
1. Hot surfaces, risk of suffering burns.
Under certain ambient conditions the pump may attain temperatures over 80° C. There then exists the risk of suffering burns. Note the danger symbols on the pump and in the case of a hot pump wear the required protection equipment.
If there is the risk of touching hot surfaces inadvertently, install corresponding protection. When working on a pump which is still warm from operation, always wear protective gloves.
 2. The pump must only be operated at ambient temperatures between 12 and 40 °C. It needs to be ensured that the thermal radiation produced by the pump can be dissipated sufficiently. If the pump has to be operated at higher ambient temperatures than 40 °C for any reason, reduced maximum differential pressures apply (derating). Please consult us for further details.
 3. Before any servicing and maintenance work always let the pump cool down first.
 4. Note the warning information on the housing surface. If these warning notices have been removed, are covered or obstructed, include corresponding additional warning information

2.4 Hazards Caused by Materials and Substances



WARNING: HAZARDOUS GASES

Risk of injury or damage to the equipment. The vacuum line and the exhaust line must be leak tight. Hazardous process gases may escape or the pumped gases can react with air or atmospheric humidity. After installation of the pump and after servicing work on the vacuum system, a leak search will always be necessary.

When pumping hazardous gases we recommend a leak search on a regular basis. Leaks in the pump cannot be ruled out under all circumstances. When pumping hazardous gases, the operator must make sure that leaks at the pump will not be a hazard.



WARNING: CONTAMINATION HAZARD

Risk of exposure. 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.

Important safety information

1. Since not all application related hazards for vacuum systems can be described in detail in these Operating Instructions, We have made available a separate document (Safety Booklet) in which the hazards and general safety concepts for design, operation and maintenance of vacuum systems are explained.

When planning to pump hazardous substances with this pump, read the related chapters in the Safety Booklet and in these Operating Instructions first. You can download the Safety Booklet from our homepage.

2. The user has to ensure that all appropriate safety codes and all safety procedures are applied in case of pumping toxic, chemically reactive, corrosive gases and/or pyrophoric substances. Before using the pumps with toxic and/or aggressive gases, it is imperative that you consult our local office.
3. We are not in a position to perform servicing (repairs) and waste disposal of radioactively contaminated pumps. Both needs to be ensured from the side of the user.
4. When pumping hazardous gases you must assume the presence of corresponding residues in the pump.
5. When changing the oil, remove any escaped oil as otherwise there exists the risk of slipping.
6. After having completed the installation work we recommend running of a leak test on the complete installation at an absolute pressure of 1100 mbar. Otherwise the possibility of escaping of process gases cannot be completely ruled out.

2.5 Ignition Risk

WARNING: EXPLOSION HAZARD



Risk of injury. 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. Check based on the nameplates for which zone the pump is suited.

Motor and accessories when installed within an explosion hazard zone must also be approved for this zone.

-
1. Before pumping oxygen (or other highly reactive gases) at concentrations exceeding the concentration in the atmosphere (> 21 % for oxygen) it will be necessary to use a special pump.
 2. Before commissioning the pump, make sure that the media which are to be pumped are compatible with each other so as to avoid hazardous situations. All relevant safety standards and regulations must be observed.

Important safety information

2.6 Noise Hazard



WARNING: NOISE HAZARD

Risk of injury. The noise level produced by the pump is between 64 and 80 dB(A). When operating the pump temporarily at pressures above 100 mbar the noise level can be much higher. Make sure that suitable protection measures are taken to protect your hearing.

When the pump is being started with open flanges, a noise level which is detrimental to health will be produced. If such operation is unavoidable, then it is mandatory to wear hearing protectors (ear muffs).

2.7 Danger of Pump Damage



CAUTION: OPERATION SAFETY

Risk of damage to the pump. Do not use the pump for applications that produce abrasive or adhesive powders or condensable vapours that can leave adhesive or high viscosity deposits. Please contact Our Sales for selecting the right separator.

1. Vapours which condense upon being compressed within the pump to liquids must be avoided when their vapour pressure exceeds the vapour tolerance of the pump.
2. Before pumping vapours, the pump should have attained its operating temperature. The pump will have attained its operating temperature about 1 hour after starting the pump. During this time the pump should be separated from the process by a valve in the inlet line, for example.
3. In order to prevent the transfer of vibrations from the pump to other parts of the system we recommend the use of corrugated hoses or compensators on both the inlet and the discharge sides.
4. Do not use the pumps in combination with backing pumps that have an ultimate pressure above 10 mbar. This prevents excessively high temperatures of the pump in idle mode operation.
5. In the case of wet processes we recommend the installation of liquid separators upstream and downstream of the pump so as to avoid a massive influx of liquid into the pump.
6. The discharge line should be laid so that it slopes down and away from the pump so as to prevent condensate from backstreaming into the pump.
7. The ingress of particles and liquids must be avoided under all circumstances.
8. Before installing, all flange covers must be removed.
9. The location where the pump is installed must be selected such that all controls are easily accessible.
10. In order to ensure an adequate supply of oil, the location at which the pump (including its accessories) is operated should be such that angles over $> 1^\circ$ from the vertical are avoided.

Description

3 Description

3.1 Design and Function

The RUVAC WA and RUVAC WAU are Roots vacuum pumps which are driven directly by an electric motor.

The WAU types have a pressure balance line between the discharge and inlet flange.

Standard RUVAC pumps are not suited for pumping of oxygen when the oxygen concentration exceeds that in the atmosphere.

Before planning to use RUVAC pumps for pumping of highly aggressive gases, contact us first.

3.1.1 Principle of Operation

Roots pumps - also known as Roots blowers - contain in their pump casing two symmetrical impellers rotating in opposite directions (see [Figure 2](#) on page 15). The impellers have roughly the cross section of a figure "8" and are synchronised by a toothed gear so that they move past each other and the casing without contact but with a small clearance.

The principle of operation is explained in [Figure 2](#) on page 15.

In impeller positions I and II, the volume in the inlet flange is increased. When the impellers rotate further to position III, part of the volume is sealed off from the inlet side.

In position IV, this volume is opened to the discharge side, and gas at backing pressure (higher than the inlet pressure) flows in. The inflowing gas compresses the gas volume pumped from the inlet side. As the impellers rotate further, the compressed gas is ejected via the discharge flange. This process occurs twice per complete revolution of each of the two impellers.

Due to the non-contacting rotation in the pumping chamber, Roots pumps can be operated at high speeds (standard $n = 3,000$ rpm at a mains frequency of 50 / 60 Hz). Thus a relatively high pumping speed is attained with small pumps.

The pressure differential and compression ratio between the inlet and discharge sides are limited on Roots pumps. If the allowable pressure differential is exceeded, the pump overheats.

Description

Figure 1. Schematic cross-section of a Roots pump (vertical flow)

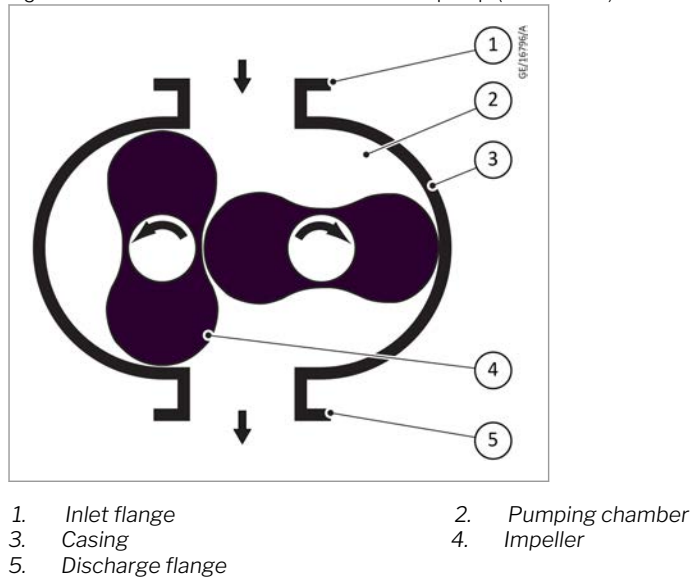
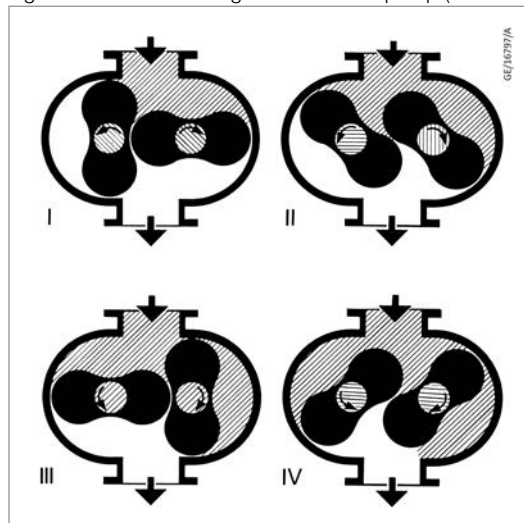


Figure 2. Functional diagram of a Roots pump (vertical flow)



In practise, the maximum attainable pressure differential is significant only in the rough vacuum range ($p > 10$ mbar), whereas for pressures in the fine vacuum range ($p < 1$ mbar) the attainable compression ratio is decisive.

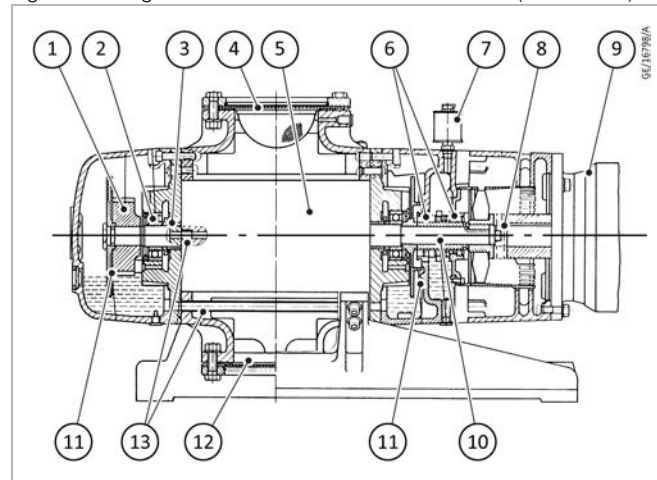
RUVAC WA/WAU pumps have been specifically designed for operation in the rough and fine vacuum ranges. They are thus either used in connection with backing pumps or in closed gas cycles.

Power consumption of the pump depends on

- the volume of the pump chamber
- the speed of the pump
- the existing pressure range
- the pressure difference between the inlet and the discharge flange (see [Figure 7](#) on page 23)
- and the type of gas to be pumped.

Description

Figure 3. Longitudinal section of a RUVAC WAU 2001 (vertical flow)



- | | |
|---------------------------------|--------------------|
| 1. Gearwheels | 2. Bearings |
| 3. Impeller seals | 4. Inlet port |
| 5. Impellers | 6. Shaft seals |
| 7. Oiler | 8. Coupling |
| 9. Motor | 10. Drive shaft |
| 11. Centrifugal disc lubricator | 12. Discharge port |
| 13. Connecting pipes | |

3.1.2 Design

RUVAC Roots pumps can pump gas in the vertical or horizontal direction.

Although the pumping chamber of Roots pumps is free of sealing agents and lubricants, the two gearwheels of the synchromesh gearing and the bearings are lubricated with mineral oil (see [Figure 3](#) on page 16). The gearwheels and bearings of the RUVAC are located in two side chambers which also contain the oil supply.

These two side chambers are separated from the pumping chamber by the impeller seals. During operation of the pump, the side chambers are evacuated via the impeller seals.

The side chambers are linked to each other by two passages. These passages are arranged so that for either horizontal or vertical flow the pressure will be equalised between the oil supplies.

In both side chambers there are integrated oil pumps to ensure that the bearings and gearwheels receive sufficient lubricant at all recommended speeds.

The motor of the RUVAC WA/WAU is directly flanged to the coupling housing. One shaft of the pump is linked to the shaft of the motor by an elastic coupling. The shaft of the other impeller is driven via the synchromesh gear.

With the standard motors, the RUVAC WA/WAUs can run on either 50 Hz or 60 Hz power supplies.

The speed is then increased to 3,600 rpm and the pumping speed increases correspondingly.

The feedthrough of the impeller's shaft between the evacuated bearing space and the atmosphere is sealed by means of shaft seals. The shaft seals are immersed in oil. They are located in a seal housing with a separate oil reservoir. The oil level in the shaft seal housing can be checked at oiler.

Description

RUVAC WA/WAUs are air-cooled. The airflow for cooling the motor and pump is produced by a fan which sits on the motor.

An additional blade wheel is located on the coupling for additional cooling.

The pumps are lubricated with our vacuum pump oil LVO 130.

3.1.3 Pressure Balance Line

The RUVAC WAU has an integrated pressure balance line. It links the discharge and inlet flanges via a pressure balance valve.

If the pressure differential between the flanges is too large, the valve opens. Some of the gas which has already been pumped then flows back through the line to the inlet flange.

The valve is weight-and spring-loaded so that it works with both vertical and horizontal flow of the pump.

In the case of 50/60 Hz operation and due to the pressure balance line, no additional controlling equipment will be needed to protect the pump against pressure differences which are too high (see [Start-up](#) on page 40). The RUVAC can then be switched on together with a backing pump at atmospheric pressure. Thus the pumping speed of the pump combination is increased also at high inlet pressures.

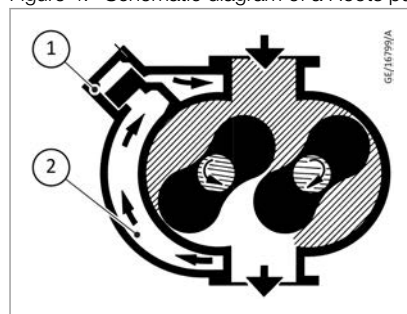
Some models are equipped with an ACE shock absorber in the pressure balance line. In the case of pressure bursts this prevents the valve from making contact at the cover. This reduces valve noise and increases its durability.

In the case of short cycle operation we recommend the use of a gear chamber evacuation facility so as to avoid oil spreading. See Ordering data.

Note:

The pressure balance valve will not protect the pump from thermal overload if opened continuously.

Figure 4. Schematic diagram of a Roots pump with pressure balance line



1. Pressure balance valve

2. Pressure balance line

3.2 Standard Specification

RUVAC WA/WAUs are supplied for vertical flow as standard. The shaft seal housing is supplied with a filling of oil.

Before the pump is shipped the oil has been drained out. The quantity of oil needed for running the pump is supplied in a separate container.

Description

The inlet flanges of all pumps contain an inlet screen and have been vented with nitrogen for protection against corrosion. The flanges are sealed with galvanised sheets equipped with sealing lips.

The WA/WAU models without a motor have been prepared for operation in connection with a motor which complies with the IEC standard. The motor flange is sealed with a cardboard disc. The coupling is included with the pump.

4 Technical Data

Table 1 General technical data

RUVAC WA/WAU		251	501	1001	2001
Nominal pumping speed at 50 Hz ¹⁾	m ³ .h ⁻¹	253	505	1000	2050
Max. pumping speed at 50 Hz	m ³ .h ⁻¹	210	410	800	1850
Nominal pumping speed at 60 Hz ¹⁾	m ³ .h ⁻¹	304	606	1200	2460
Max. pumping speed at 60 Hz	m ³ .h ⁻¹	251	530	1000	2100
with backing pump TRIVAC		D 65 B	-	-	-
with backing pump SOGEVAC	mbar		SV 200	SV 300	SV 630 F
Ultimate partial pressure ²⁾	mbar	< 2 · 10 ⁻⁵	< 8 · 10 ⁻³	< 8 · 10 ⁻³	< 8 · 10 ⁻³
Ultimate total pressure ²⁾	mbar	< 8 · 10 ⁻⁴	< 4 · 10 ⁻²	< 4 · 10 ⁻²	< 4 · 10 ⁻²
Poss. cut-in pressure ²⁾ – RUVAC WA	mbar	90	100	60	30
Maximum allowable pressure differential in continuous operation ³⁾	mbar	80	80	80	50
Leak rate, integral	mbar l · s ⁻¹	≤ 5 · 10 ⁻⁴			
Permissible ambient temperatures	°C	12 - 40			
Main supply IEC motor ⁵⁾	YY/Y V	220-240/	220-240/	220-240/	-
		380-460	380-460	380-460	380-460
Temperature class		F	F	F	F
Motor power	kW	1.1	2.2	4	7.5
Nominal speed, 50/60 Hz	min ⁻¹	3000 / 3600			
Max. permissible speed	min ⁻¹	3600			
Motor protection category	IP	55			
Maximum humidity		90%			
Contamination grade		2			
Oil filling for the bearing chamber ⁴⁾		1. Filling 5 / 2. Filling	1. Filling 5 / 2. Filling	1. Filling 5 / 2. Filling	
▪ vertical pumping action, approx.	I	0.5 / 0.4	0.9 / 0.8	2.0 / 1.8	4.2 / 3.6
▪ horizontal pumping action, approx.	I	0.5 / 0.4	0.8 / 0.7	1.2 / 1.1	2.0 / 1.8
Oil filling of the shaft sealing ring housing	I	0.6	1	1.3	1.6
Connection flanges	DN	63 ISO - K	63 ISO - K	100 ISO - K	160 ISO - K

Technical Data

RUVAC WA/WAU		251	501	1001	2001
Weight WA / WAU	kg	85 / 89	128 / 133	220 / 225	400 / 406
Noise level ⁶⁾	dB (A)	< 64	< 67	< 75	< 80

1) To DIN 28 400 and subsequent numbers

2) With double-stage rotary vane vacuum pump TRIVAC, respectively single-stage rotary vane vacuum pump SOGEVAC. (Type of backing pump look at max. pumping speed). When using 2-stage backing pumps the ultimate pressures will be correspondingly lower.

3) Applicable for ratio up to 1 : 10 between backing pump and Roots vacuum pump at 3000 rpm

4) Authoritative, however, is the oil level at the oil-level glass

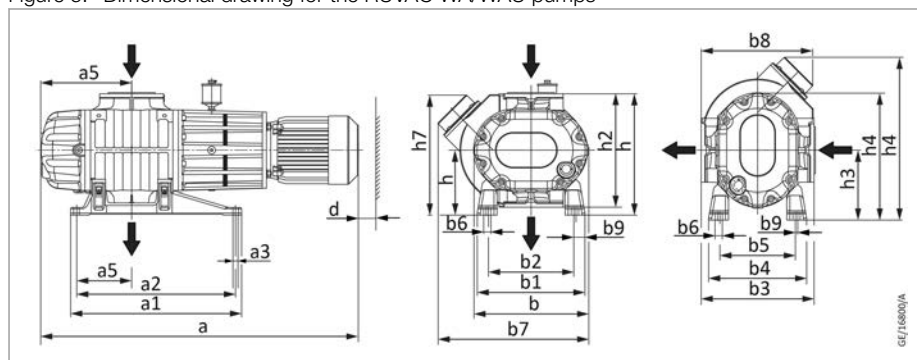
5) After a complete disassembly

6) At an operating pressure below $< 10^{-1}$ mbar ($< 0.75 \times 10^{-1}$ Torr)

8) Motor voltage and current may deviate depending on the type of motor. Please always note the information on the nameplate.

Technical Data

Figure 5. Dimensional drawing for the RUVAC WA/WAU pumps



Typ	DN	DN ₁	a	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆
WA/WAU 251	65	63 ISO-K	732	405	365	14	209	120	194
WA/WAU 501	65	63 ISO-K	830	486	450	14	237	155	218
WA/WAU 501 H	65	63 ISO-K	830	486	450	14	237	155	218
WA/WAU 1001	100	100 ISO-K	1058	560	520	16,5	298	180	262
WA/WAU 1001 H	100	100 ISO-K	1058	560	520	16,5	298	180	262
WA/WAU 2001	150	160 ISO-K	1256	800	740	18	367	220	310
WA/WAU 2001 H	150	160 ISO-K	1256	800	740	18	367	220	310

Typ	b	b ₁	b ₂	b ₃	b ₄	b ₅	b ₆	b ₇	b ₈
WA/WAU 251	250	270	210	280	230	170	24	305	285
WA/WAU 501	310	299	229	320	271	201	24	390	313
WA/WAU 501 H	310	299	229	320	271	201	24	414	330
WA/WAU 1001	376	352	278	370	320	246	24	494	366
WA/WAU 1001 H	376	352	278	370	320	246	24	524	398
WA/WAU 2001	463	518	388	460	422	292	24	638	456
WA/WAU 2001 H	463	518	388	460	422	292	24	642	460

Typ	b ₉	d	h	h ₁	h ₂	h ₃	h ₄	h ₅ ¹⁾	h ₆	h ¹⁾
WA/WAU 251	7.5	50	300	160	280	180	306	360	330	307
WA/WAU 501	7.5	50	340	180	320	194	348	430	370	332
WA/WAU 501 H	7.5	50	340	180	320	194	348	450	370	350
WA/WAU 1001	7.5	50	396	211	370	227	414	532	425	392
WA/WAU 1001 H	7.5	50	396	211	370	227	414	564	425	424
WA/WAU 2001	7.5	50	530	300	460	348	578	753	541	523
WA/WAU 2001 H	7.5	50	530	300	460	348	578	760	541	530

1) For RUVAC WAU only

Outside dimensions +/- 3 mm

DN = ND 6 pump flange in accordance with DIN 2501

DN1 = Collar flange with gasket for connecting ISO-K standard components

Technical Data

Figure 6. Pumping speed of the RUVAC WA/WAU, 50 Hz

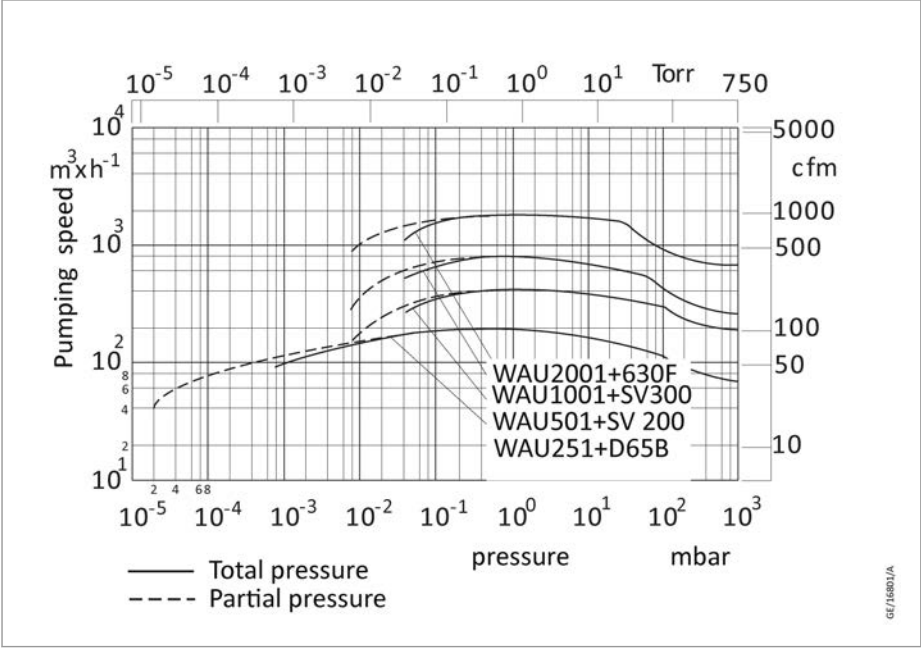
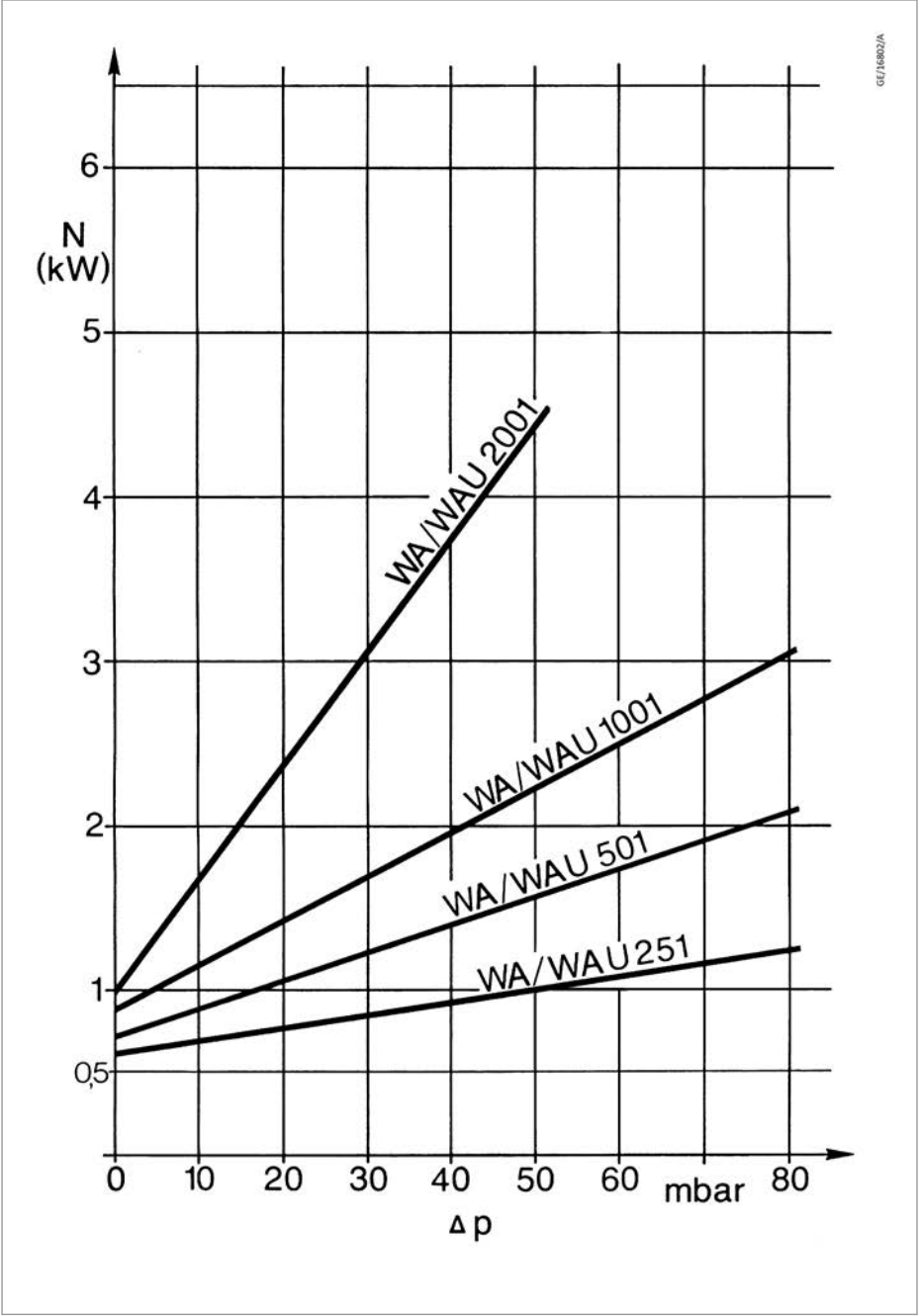


Figure 7. Power consumption of the RUVAC WA/WAU



Technical Data

4.1 Motor data (pumps with Lafert motor)

Table 2 Motor data (pumps with Lafert motor)

		WA(U) 251	WA(U) 501	WA(U) 1001	WA(U) 2001
Motor Type		AMPH 80Z BA2	AMPH 90L BA2	AMPH 112M AA2	AMPH 132M TA2
Motor Power 50/60Hz		1.1 kW	2.2 kW	4 kW	7.5 kW
Number of phases		3			
Number of pole pairs		1			
Nominal Frequency		50/60 Hz			
Nominal rotating speed 50Hz		2890 rpm	2870 rpm	2910 rpm	2910 rpm
Nominal rotating speed 60 Hz		3490 rpm	3490 rpm	3520 rpm	3510 rpm
Nominal voltage and nominal current 50 Hz	YY	200-240 V / 5 A	200-240 V / 8.6 A	200-240 V / 14.6 A	200-240 V / 26 A
	YY	200 V / 4.6 A (IE3) (Grade 2)	200 V / 8.6 A (IE3) (Grade 2)	200 V / 14.6 A (IE3) (Grade 2)	200 V / 26A (IE3) (Grade 2)
	Y	380-400 V / 2.3 A	380-400 V / 4.3 A	380-400 V / 7.3 A	380-400 V / 13.3 A
	Y	380-400 V / 2.5 A (IE3) (Grade 2)	380-400 V / 4.6 A (IE3) (Grade 2)	380-400 V / 7.3 A (IE3) (Grade 2)	380-400 V / 13.3 A (IE3) (Grade 2)
Nominal voltage and nominal current 60 Hz	YY	200-240 V / 4.4 A	200-240 V / 8.2 A	200-240 V / 14 A	200-240 V / 25.4 A
	YY	208-240 V / 4.2 A	208-240 V / 7.8 A	208-240 V / 13.6 A	208-240 V / 24.4 A
	YY	230 V / 4 A (IE3)	230 V / 7.4 A (IE3)	230 V / 12.8 A (IE3)	230 V / 24.2 A (IE3)
	Y	380-480 V / 2.2 A	380-480 V 14.1 A	380-480 V / 7 A	380-480 V /12.7 A
	Y	416-480 V 12.1 A	416-480 V / 3.9 A	416-480 V / 6.8 A	416-480 V /12.2 A
	Y	460 V / 2 A (IE3)	460V / 3.7A (IE3)	460 V / 6.4 A (IE3)	460V / 12.1A (IE3)
Connectable cable cross-section		maximum 16 mm ²			
Nominal Efficiency [%]					
50 Hz/400 V 50 Hz: 200/380-400 V (IEC 60034-2-1)	100%	81.5	85.5	88.6	90.1
	100%	82.7	85.9	88.1	90.1
	75%	82.9	86.5	88.0	90.2
	50%	79.9	85.1	87.0	89.6
50 Hz: 380 V (GB/T 1032)	100%	82.7	85.9	88.1	90.1
	75%	82.9	86.5	88.0	90.2
	50%	79.9	85.1	87.0	89.6

Technical Data

		WA(U) 251	WA(U) 501	WA(U) 1001	WA(U) 2001
60 Hz: 230/460 V (CSA 390)	100%	84.0	86.5	88.5	90.2
	75%	84.6	87.1	88.3	90.5
	50%	81.9	86.1	87.2	89.6
Maximum ambient temperature		40 °C			
Type of protection		IP 55			
Maximum installation height		1000 m			
Supplier		Lafert SpA / Via J.F.Kennedy / I-30027 San Doná di Piave (Venezia)			

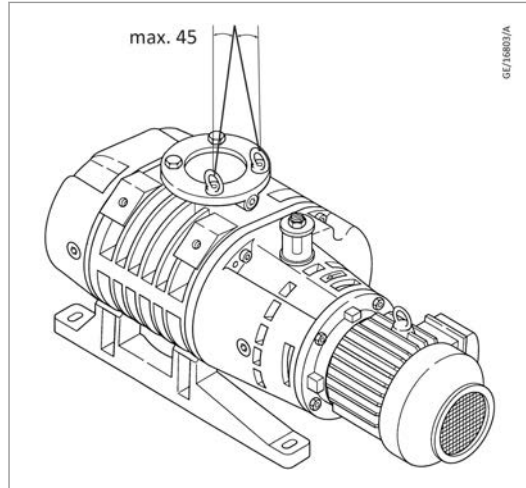
Technical Data

Table 3 Motor data (pumps with WEG motor)

		WA(U) 251	WA(U) 501	WA(U) 1001	WA(U) 2001
Motor Type		AL80-02	AL90S/L-02	AL112M-02	AL132S-02
Motor Power 50/60Hz		1.1 kW	2.2 kW	4 kW	7.5 kW
Number of phases		3			
Number of pole pairs		1			
Nominal Frequency		50/60 Hz			
Nominal rotating speed 50Hz		2840 rpm	2870 rpm	2900 rpm	2900 rpm
Nominal rotating speed 60 Hz		3400 rpm	3450 rpm	3480 rpm	3480 rpm
Nominal voltage and nominal current 50 Hz	Δ	220-240 V / 4.3A	220-240 V / 7.9A	200-240 V / 14.7A	220-240 V / 24.8A
	YY	200 V / 4.8A	200 V / 8.9A	-	200 V / 27.6A
	Y	380-415 V / 2.5A	380-415 V / 4.6A	380-415 V / 7.9A	380-415 V / 14.4A
Nominal voltage and nominal current 60 Hz	Δ	220 V / 4.0A	220 V / 7.6A	200-220 V / 14.5A	220 V / 24.2A
	YY	200 V / 4.4A	200 V / 8.4A	-	200 V / 26.7A
	Y	380 V / 2.3A	380 V / 4.4A	380 V / 7.7A	380 V / 14.0A
	Y	440-460 V / 2.1A	440-460 V / 4.0A	440-460 V 7.0A	440-460 V 12.4A
Nominal Efficiency [%]					
50 Hz 220-230-240/ 380-400-415 V (IEC 60034-1)	100%	82.8	85.9	88.1	90.1
	75%	82.9/82.9/82.8	85.9/85.9/85.1	87.9/88.1/88.1	90.1/90.1/89.2
	50%	82.3/80.7/79.0	84.1/84.2/83.2	86.3/85.8/85.8	88.6/88.2/87.5
60 Hz 200-220/ 380-440-460 V (IEC 60034-1)	100%	84.0	86.5	88.5	90.2
	75%	83.3/83.5/83.2/ 82.5	86.0/85.7/86.2/ 85.7	86.3/87.5/88.5/ 87.9	89.1/89.5/89.5/ 89.5
	50%	81.5/82.0/80.2/ 78.9	85.4/85.0/85.1/ 84.5	85.4/86.3/86.0/ 86.0	87.6/88.3/88.1/ 87.3
Maximum ambient temperature		40 °C			
Type of protection		IP 55			
Maximum installa- tion height		1000 m			
Supplier		WEG Nantong			

5 Transport

Figure 8. Transport



Roots pumps are heavy machines made of cast iron and thus should only be lifted using suitable lifting equipment tied to the eyes provided for this purpose, see Figure: Transport.

When the pump is removed from the shipping container it has to be secured with suitable lifting equipment until it is safely bolted on either a vacuum flange or a rack that is stable enough to support the weight of the pump. If bolted to a forevacuum pump or a rack, sufficient tilt resistance has to be ensured.



CAUTION:

When connecting or removing the pump, do not step under hoisted loads. Notice [Mechanical Hazards](#) on page 9.

Note:

Before transporting the pump always drain out the oil (see [Exchanging the Oil / Bearing Chambers](#) on page 45). Screw the oil-drain plug with its gasket back in and wipe any oil droplets off from the casing. It will not be required to drain out the oil from the shaft seal housing (oiler).

The pump should be transported and stored in a horizontal position (5° max. tilt). Otherwise the oil from the shaft seal housing (oiler) may drain. In addition, there is the danger that oil from the side chambers may enter the pump chamber, even before the pump is filled with oil for the first time.

6 Installation



NOTICE:

Only fill in the oil after having installed the pump.



NOTICE:

If the pump is not level, lubricant may enter the pumping chamber from the gear chambers.

Install RUVAC WAWAU pumps on a flat, horizontal surface (1° max. tilt).

Keep the air inlet and exhaust ducts for cooling the motor unobstructed (for minimum clearance with respect to the fan cowl, see [Figure 5](#) on page 21).

The pump's ambient temperature should be between 12 °C and 40 °C . Lower temperatures hamper run-up; higher ones shorten the lubricant change intervals and may lead to greater wear.

Special oil for operation at temperatures below 12 °C is available upon request.

Secure the pump. Four bores in the feet are provided for this purpose.



Note:

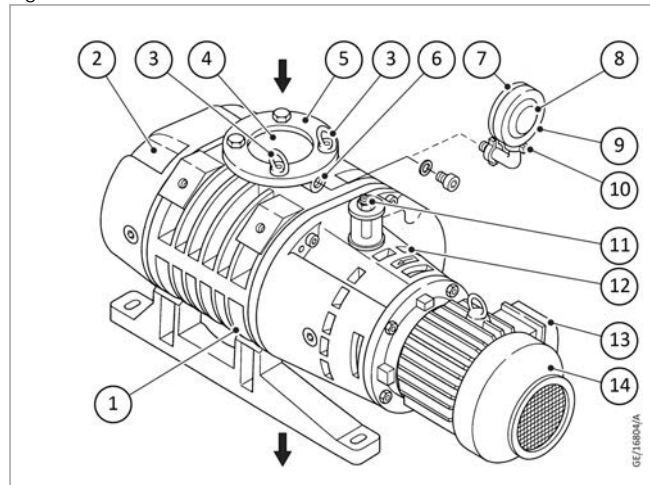
When bolting the feet down, make certain that there is no stress or twist on the pump casing. Stress on the pump can change the close tolerances between the impellers and the pump casing and may result in damage to the pump (use washers to equalise).

Since compensation elements must be attached to the flanges on the suction and pressure sides, the screws for attachment of the feet must always be fitted and tightened.

Use the following screws:

RUVAC 251/501	4 x M 12
RUVAC 1001/2001	4 x M 16

Figure 9. Connections and controls



- | | |
|--------------------------------|-----------------------------------|
| 1. Discharge flange | 2. Oil-level glass |
| 3. Crane eye | 4. Oil-fill port |
| 5. Inlet flange | 6. Connection for pressure switch |
| 7. Adapter | 8. Pressure switch |
| 9. Centering and clamping ring | 10. Right-angle bend |
| 11. Oiler | 12. Direction-of-rotation arrow |
| 13. Junction box | 14. Fan cowl |

6.1 Filling in of the oil

The housing for the shaft seal and the oiler are filled with oil when the pump is supplied. The oil level must be visible in the oiler.

Correct oil level: 1/3 of the oiler must be filled when the pump is cold. Top up oil as required.

The lubricant needed for running the pump is supplied in a separate container.

Unscrew the oil-fill plug and add oil.

An oil without additives and of viscosity class ISO VG 100 (formerly SAE 30) VG 68 must be used for the pump. We recommend our special oil LVO 130. Please consult us if you intend to run the pump with other oils or special lubricants.

Note:

The oil filling levels stated in [Figure 10](#) on page 30 which apply to switched off pumps (at standstill) must be correctly maintained.

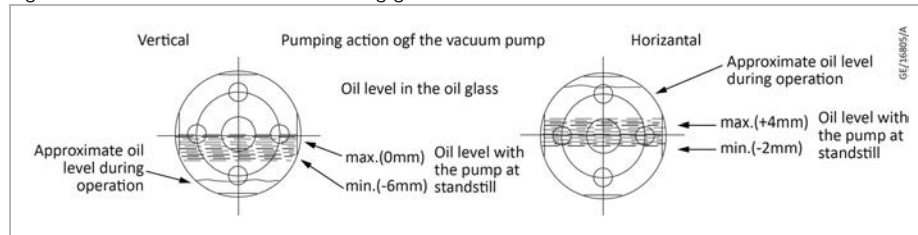
If the oil level is too low, the bearings and gearwheels are not lubricated adequately; if it is too high oil may enter the pumping chamber or the pump may overheat.

Clean the oil-fill port and screw the plug back in using a gasket which is in perfect condition.

The oil-fill port must be sealed air-tight. Entry of air from the outside may cause oil-containing gas to enter the pumping chamber via the impellers seals.

Installation

Figure 10. Oil level in the oil level viewing glass



6.2 Conforming Use

The RUVAC pumps are vacuum pumps which in connection with suitable backing pumps are capable of pumping gases and vapours.

They are employed to increase the pumping speed of backing pumps below 10-100 mbar by a very significant factor or for the purpose of attaining a lower ultimate pressure.

Accessories which have not been specified by Us may only be used after approval by us.

6.2.1 Abnormal operation



WARNING: NON CONFORMING USE

Risk of injury or damage to equipment. The abnormal operation of pump and accessories may result in severe injury or damage to the components.

Pumping any of the processes below is strictly prohibited:

- Pumping of gases and vapours for which the materials of the pump are not suited.
- Pumping of condensable vapours without adequately controlling the temperature of the pump. Upon compression in the pump, these vapours may condense or form deposits.
- Pumping of dusts and solids without suitable screens and filters.
- Pumping of liquids.
- Operation at an impermissibly high differential pressures.
- Pumping of process gases which form hard or sticky deposits which may cause the pump to seize.
- Non-compliance with the described maintenance and service intervals.
- Use in systems and pump systems in which the pressure may increase over 1.2 bar abs.
- Operation with an inadequately affixed pump.
- Operation without suitable backing pump.
- Operation at impermissibly high gas temperatures.
- Use in systems where pump, frequency converter and cables are subjected to impact stresses.
- Operation on movable systems or system components (locks or mobile pump systems).
- Use of pump, fitted ad-on components, drive electronics, flanges and cables to climb onto the system.
- Removing, covering or obstructing warning notices.

- Standstill or storing of pump and drive electronics without suitable sealing and drying. When stored in a humid atmosphere corrosion can occur.
- Conversions, manipulations and maintenance work by persons not authorised by us.
- Operation outside of building.

6.3 Electrical Connection



WARNING: HAZARDOUS VOLTAGE

Notice [Electrical Hazards](#) on page 10.

Always provide an uninterrupted connection for the protective ground conductor connecting it in a professional manner. Never leave the protective ground conductor for the pump unconnected. .



NOTICE:

Do not link control circuits to the power circuit of the motor. Observe the wiring diagrams.

The WA/WAU pumps are only limited suitable for operation in connection with frequency converters. The max. permissible speed is 3,600 rpm regardless of the size of the pump.

Never allow the pump to run in the wrong direction or with open flanges for a longer period of time.

The pump needs to be sufficiently grounded so as to avoid any electrostatic charging. This is attained when the ground connection is properly connected at the point provided for this purpose. During normal operation no dangerous electrical charges will be produced (for further information relating to the hazards caused by static electricity, see CENELEC report CLC/TR 50404: 2003 Electrostatics - Code of practise for the avoidance of hazards due to static electricity).

With optional frequency inverter, leakage current must be checked.

We recommend to use the Leytronic frequency converters.

Connect the mains voltage in accordance with [Figure 11](#) on page 32 using a standards-compliant lead and a suitable motor protection switch (circuit breaker). The motor protection switch setting must match the power rating indicated on the motor's nameplate (see [Motor data \(pumps with Lafert motor\)](#) on page 24).

For motor monitoring using thermistors (full motor protection), temperature sensors (PTCs) are integrated within the motor windings. Evaluate the PTC signals such that the motor circuit is interrupted when the permissible winding temperature is exceeded. When doing this, only ever connect these terminals to the pump controller via a protection switch with galvanic isolation (e.g. Klöckner Möller EMT6DBK).

When using the frequency converter, connect the PTC to the corresponding shutdown input.

Only the fittings provided on the junction box may be used.

The pump has no switching devices of its own. All protection measures in connection with the power supply need to be implemented from the side of the plant in the full responsibility of the customer.

Installation

After a mains power failure the pump will restart automatically once the power returns.

If for this reason there results in connection with the application a danger potential it needs to be ensured that a restart can only be performed after a manual reset. This applies equally **emergency** shutdowns.

The local connection conditions will possibly necessitate means for the purpose of reducing the surge currents upon switching the pump on. Star-delta start-up is not possible.

Figure 11. Electrical connection (Lafert motors)

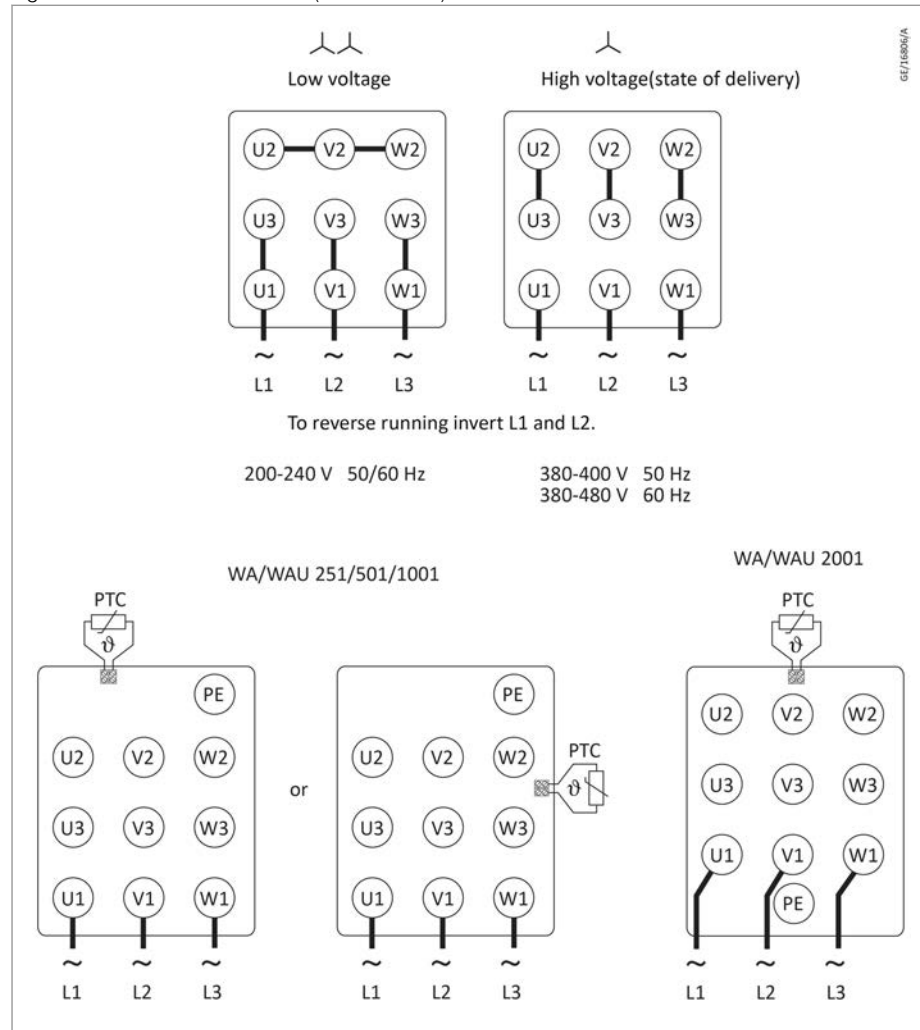
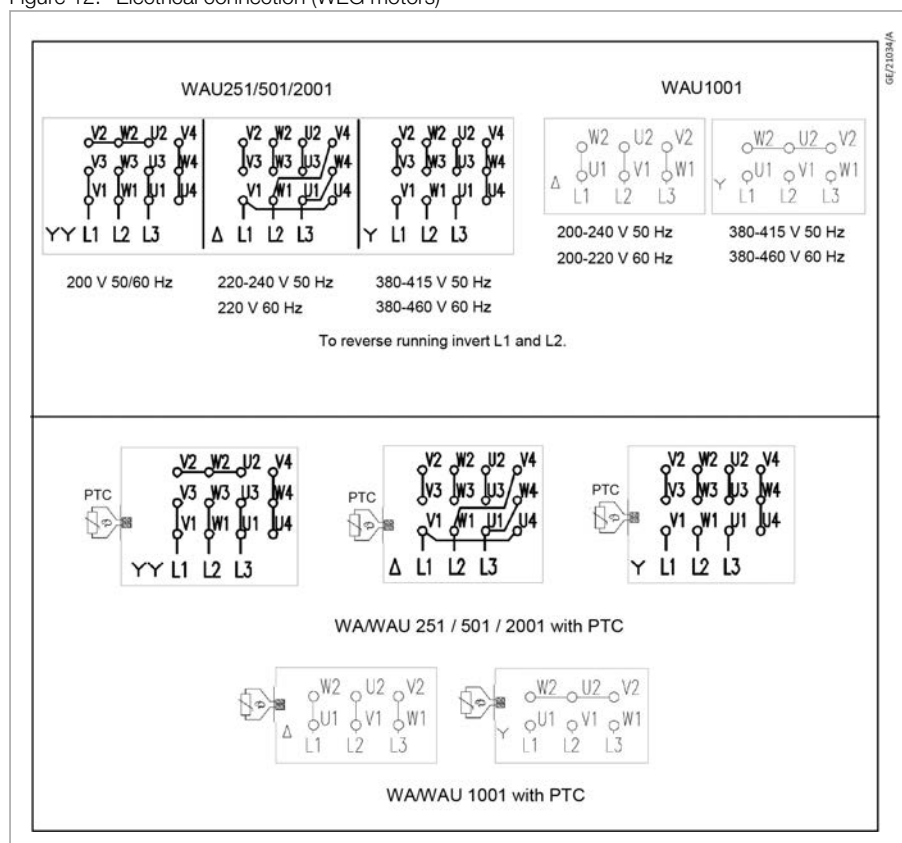


Figure 12. Electrical connection (WEG motors)



Motor protection switch

High-efficiency motors exhibit higher inrush currents during direct start-up, and require a circuit breaker suitable for fuse-protecting IE3 motors. For RUVAC WA(U) for example, we recommend the following products from the manufacturer Eaton:

Table 4. Motor protection switch

	WA(U) 251	WA(U) 501	WA(U) 1001	WA(U) 2001
YY 200-240V	PKE12/XTU(A)-12 PKE32/XTU(A)-12 (3 A - 12 A)	PKE12/XTU(A)-12 PKE32/XTU(A)-12 (3 A - 12 A)	PKE32/XTU(A)-32 (8 A - 32 A)	PKE32/XTU(A)-32 (8 A - 32 A)
Y 380-480V	PKE12/XTU(A)-4 PKE32/XTU(A)-4 (1 A - 4 A)	PKE12/XTU(A)-12 PKE32/XTU(A)-12 (3 A - 12 A)	PKE12/XTU(A)-12 PKE32/XTU(A)-12 (3 A - 12 A)	PKE32/XTU(A)-32 (8 A - 32 A)

After connecting the motor and every time you alter the wiring, check the direction of rotation.



WARNING: FLANGE OPENING

Risk of injury. Wear protective goggles for protection against particles which may be forced out of the flange opening. Keep your hands away from the flange opening.

An arrow on the motor flange shows the correct direction of rotation for the impeller connected to the motor shaft (see [Figure 9](#) on page 29). To check

Installation

rotation, switch on the motor briefly and observe the direction of impeller rotation through the pump's inlet and then immediately switch off again.

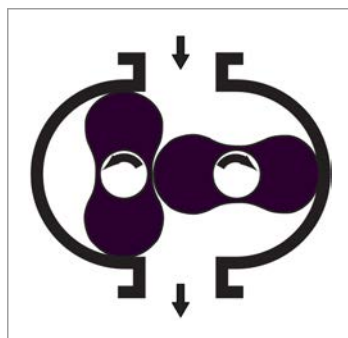
The impellers should move up from the centre and drop down to the side.

If this is not the case, disconnect the pump from the mains and interchange two mains phases.

Even if the pump has been already firmly connected to the piping, you may determine the direction of rotation.

For this, evacuate the vacuum system down to a pressure below 20 mbar with the aid of the backing pump. Then switch on the RUVAC briefly; now the pressure must drop. If the pressure increases or remains constant, the RUVAC is turning in the wrong direction.

Then rewire as described above.



The RUVAC can be automatically switched on and off via a contactor using a pressure switch and the contact amplifier SV 110.

The pressure switch PS 115 is set to a fixed value. When ordering the pressure switch please state the required switch-on pressure.

After removing a screw plug, the pressure switch together with an adapter and a right-angle bend can be mounted on the bore (see [Figure 9](#) on page 29).

When doing so, ensure proper sealing and air-tight installation.

It is advisable to mount the switch vertically to reduce the entry of contaminants.

6.4 Connecting the Flanges

Note:

Already small quantities of liquids (from the vacuum chamber or the piping) can lead to liquid damages within the pump. These may lead to a deformation of the impellers and may entirely destroy the pump. Suitable protective measures should be provided as required in the piping on the suction side (separator, T-piece).

The pumps are vented with nitrogen. Only remove the packing flanges before immediate connection.

If not already done, remove the protective shipping covers, plastic pieces, foil or packing flanges from the flanges (see [Figure 9](#) on page 29).

Installation

We recommend that you retain the transport flanges in case you want to store the pump at a later date.

Clean the flanges and check that the sealing surfaces are in perfect condition.

Flange the pump to the vacuum system.

Note:

Don't place any stress on the pump casing when installing the inlet and exhaust lines. Fit compensation elements in order to avoid such stresses.

When attaching the pump directly (without bolting down the feet) to the forevacuum pump, you must always use on the pressure side the full number of screws defined by the flange standard (ISO-K, DIN or ASA) whereby these must comply with the demanded property class rating.

You must also check whether the backing pump is rigid and stable enough to support the load of the RUVAC pump in each case.

The inlet screen which is supplied with the pump should always be fitted into the inlet flange when there is the possibility of contaminants entering the pump coming from the vacuum chamber or the piping. Even with clean vacuum processes, contaminants from the system may enter upon initial start-up. Depending on the operating conditions, the inlet screen may reduce the pumping speed of the pump.

When using the pumps in explosion hazard areas the use of an inlet screen is mandatory.

6.5 Connecting the Customized-Motor

The RUVAC WA pump can also be ordered without a connected motor (see [Ordering information \(EMEA + AMER\)](#) on page 64 and [Ordering information \(APAC\)](#) on page 66).



NOTICE:

When motor is fitted by the customer, the operator will be responsible for selecting and operating the motor. Mounting the motor has an influence on the operation and reliability of various pump components, coupling and bearings in particular. Not complying with the technical data and installation information in the following will void CE conformity resulting in a rejection of any warranty claims.

3-ph motors must be ordered with a reduced diameter.

Table 5 Motors data

Specific motor data			WA 251	WA 501	WA 1001	WA 2001
Type			3-ph. motor	3-ph. motor	3-ph. motor	3-ph. motor
Model			IM B5	IM B5	IM B5	IM B5
Size			80 L	90 L	112 M	132 M
Flange			FF165	FF165	FF215	FF265
Nominal power rating ¹	P	kW	1.1	2.2	4	7.5
Outside flange diameter	D1	mm	200	200	250	300
Pitch circle diameter, bolts	D2	mm	165	165	215	265
IP- rating			min. IP54	min. IP54	min. IP54	min. IP54

Installation

Specific motor data			WA 251	WA 501	WA 1001	WA 2001
Screw size	M	-	M10	M10	M12	M12
Number of screws	N	-	4	4	4	4
Centering diameter ¹	D3	mm	130 _{j6}	130 _{j6}	180 _{j6}	230 _{j6}
Shaft journal, motor ¹	D4	mm	19 _{j6}	24 _{j6}	28 _{j6}	38 _{k6}
Concentricity, shaft journal ²	X1	mm	0.04	0.04	0.04	0.05
Coaxiality, centering flange ²	X2	mm	0.1	0.1	0.1	0.125
Run out, mounting flange ²	X3	mm	0.1	0.1	0.1	0.125

¹ Three-phase motors with standardised dimensions and power ratings in accordance with EN 50347 and IEC 60072-1.

² Concentricity of the shaft journals, coaxiality and run out of the mounting flange in accordance with DIN 42955, see also [Figure 13](#) on page 36.

6.6 General Installation Information

Make sure that the respective motor complies with the information given in the Table (see also [Figure 13](#) on page 36).

For mounting the motors use only the original parts supplied by us.

- Motor coupling half
- Coupling star
- Nuts and washers

When mounting motors for WA 1001 or larger pumps, we recommend the use of a lifting device.

The motor must be fitted with the pump aligned horizontally. Tilting the pump by over 5° can cause oil to flow from the gear chambers into the pump chamber.

Note:

All mating surfaces and centering surfaces must be clean, undamaged and free of any paint residues.

Only air cooled motors must be used. The fan on the side of the motor is also required to cool the pump housing. If this air cooling arrangement is not present, then the surface temperatures may under certain circumstances exceed the permissible temperature range for the pump (T3, T4).

Figure 13. General Installation specification

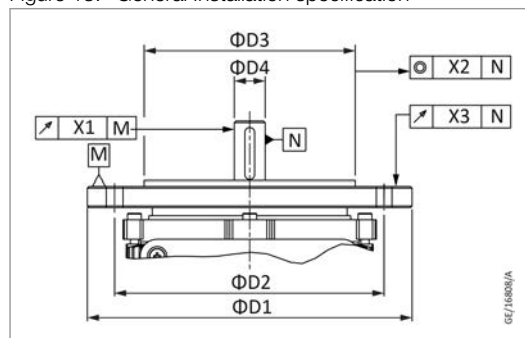
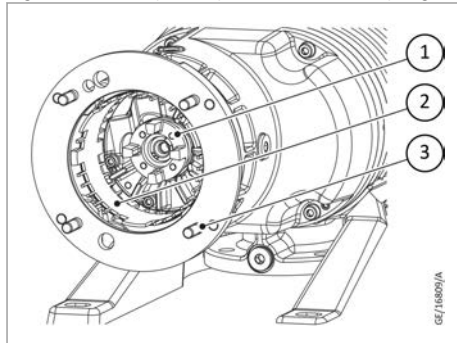
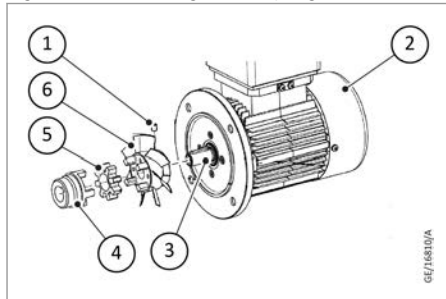


Figure 14. Pump with preassembled coupling half



- | | |
|--|-----------------------------------|
| 1. Coupling half of the pump, preassembled | 2. Touch protection, preassembled |
| 3. Stud | |

Figure 15. Mounting the coupling half at the motor



- | | |
|---------------------------------|--|
| 1. Set screw M8 | 2. Motor |
| 3. Shaft journal with shim ring | 4. Pump coupling half (already preassembled) |
| 5. Coupling star | 6. Motor coupling half with fan |

6.7 Fitting the Coupling



CAUTION: MECHANICAL SPARK

When not complying with this requirement there exists the likelihood of a mechanical contact and thus the creation of sparks between the coupling halves.

The RUVAC WA is supplied by us with the coupling (Fig. [Figure 14](#) on page 37) preassembled on the pump's shaft. The coupling half ([Figure 15](#) on page 37) for the motor side and the coupling star are enclosed. Depending on the type of pump, a fan wheel has been attached with an adhesive to the coupling half on the motor side.

Vertically place the motor on a matching pin, the fan housing must not be used for supporting purposes.

Check the shaft journal and the shim ring for any damage. Lightly grease shaft journal and the bore in the coupling half.

Warm the coupling half (to approximately 80 °C) and push, respectively press it on to the shaft journal.

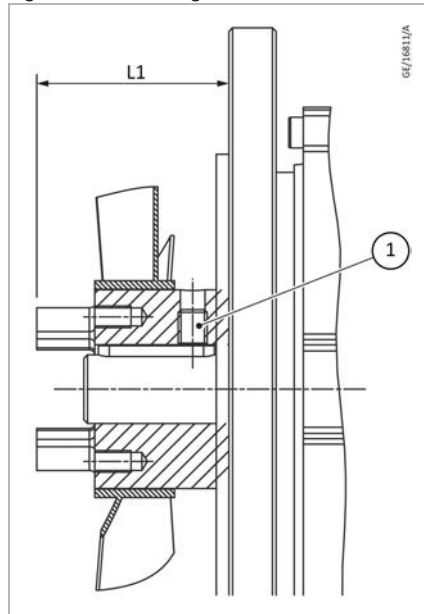
The bores in the coupling are manufactured to tolerance class H7, the shaft journals of the motor to tolerance class j6 resp. k6.

Installation

The axial distance L1 ([Figure 16](#) on page 38) to the flange surface (area M in [Figure 13](#) on page 36) needs to be maintained according to the table.

Affix the coupling half with the M8 set screw (4.7), torque 10 Nm.

Figure 16. Checking the axial distance dimension for the coupling

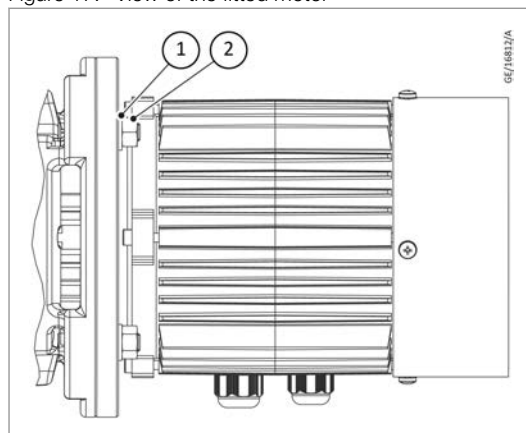


1. Set screw M8 / torque 10 Nm

	WA 251	WA 501	WA 1001	WA 2001
L1 (± 0.2 mm)	54.3 mm	63.3 mm	74.6 mm	100.6 mm

L1 = Axial distance dimension for the coupling

Figure 17. View of the fitted motor



1. Washer (4x) : (WA 251 / 501: Ø 11), (WA 1001 / 2001: Ø 13)
2. Nut (4x) : (WA 251/501: M10 / torque 40 Nm), (WA 1001/2001: M12 / torque 40 Nm)

6.8 Fitting the Motor

At the pump's flange the respective studs have been preassembled, the washers and nuts which must be used have been enclosed with the pump.

Check to ensure that the touch protection ([Figure 14](#) on page 37) has been correctly fitted in the pump's flange.

Installation

Insert the coupling star into the coupling half on the side of the pump.

Align the coupling halves and push the motor on making sure that the flange surfaces run in parallel.

Any tilt between motor axis and impeller axis can give rise to increased wear on the coupling star.

Fit washers and nuts, and tighten according to the torque levels given in [Figure 17](#) on page 38.

6.9 Electrical Connection

Connect the motor according to [Electrical Connection](#) on page 31 and to the information of the manufacturer of the motor.

7 Operation

7.1 Start-up



NOTICE:

Check the pump motor's direction of rotation and the oil level in the oiler and the bearing chambers (see Section [Filling in of the oil](#) on page 29).

RUVAC WAU

The RUVAC WAU can be started together with the backing pump at atmospheric pressure. It is protected against excessively high pressure differentials by a bypass line.

Note:

The opening pressure of the differential valve is designed only for 50 or 60 Hz operation of the pumps.

RUVAC WA

Do not switch on the RUVAC WA until the backing pump has evacuated the vacuum vessel to the cut-in pressure.

For processes in which condensable vapours are pumped, it is advisable to evacuate the vacuum vessel via a roughing line to the cut-in pressure. Electrically switch on the Roots pump together with the backing pump and cut it in upon reaching the cut-in pressure. The initial bypassing of the Roots pump serves to prevent condensation of vapours in the cold pump.

The permissible cut-in pressure depends on the ratio between the Roots pump and the backing pump

$$p_{in} = \frac{\Delta p_{max}}{k_{eff} - 1}$$

Since k_{eff} is not known in all cases, the following equation may be used for a first approximation:

$$p_{in} = \frac{\Delta p_{max}}{k_{th} - 1}$$

p_{in} = Switch-on pressure

Δp_{max} = Maximum permissible pressure difference (see [Technical Data](#) on page 19)

$$k_{th} = \text{Theoretical compression ratio} = \frac{\text{Nominal pumping speed } ^1) \text{ RUVAC}}{\text{Nominal pumping speed of the backing pump}}$$

$$k_{\text{eff}} = \text{Effective compression ratio} = \frac{\text{Effective pumping speed RUVAC}}{\text{Effective pumping speed of the backing pump}}$$

Example - Pump combination:

RUVAC WA 501 ²⁾ / Sogevac SV 100

$$k_{\text{th}} = \frac{505 \text{ m}^3 \cdot \text{h}^{-1}}{100 \text{ m}^3 \cdot \text{h}^{-1}} \sim 5$$

$$p_{\text{in}} \sim \frac{80 \text{ mbar}}{5 - 1} \sim 20 \text{ mbar}$$

1) at the corresponding operating frequency

2) at 50 Hz operation

With small vacuum vessels, the maximum permissible pressure differential can be briefly exceeded (maximum 3 minute) upon start-up. If a pressure switch has been installed, do not set it to this higher pressure because it will fail to protect the pump against overload in the event of a greater gas quantity.



NOTICE:

It is advisable to switch the RUVAC WA on and off via a pressure switch to ensure that it runs only in the permissible pressure range.

7.2 Operation



CAUTION: OPERATION SAFETY

Risk of injury. Do not operate the pump without having connected the flanges to a vacuum system.

The screws of the flanges on the suction and the pressure side must not be loosened in the presence of a vacuum even if the pump is not running.

During operation of the RUVAC, check the oil level and the condition of the oil in the oil level glass and the oiler from time to time. Correct as required (see [Exchanging the Oil / Bearing Chambers](#) on page 45 and [Oil change / Shaft Seal Housing](#) on page 46). Normally, the oil LVO 130 is transparent. If it turns dark, this is a sign of early ageing due to excessively high temperatures.

Dirt Ingress into the Oil via the Piston Rings



CAUTION: HOT SURFACE

Hot surfaces, risk of suffering burns. Notice [Thermal Hazards](#) on page 11.

Note the labels on the pump.

Operation

In the case of dusty processes which are frequently vented with atmospheric air, there is the risk of dust being forced into the oil chambers. This can be prevented by a pressure equalisation between the oil chamber and the pump chamber. For this, install a valve at the oil inlet which during operation is opened simultaneously with the venting valve.

 Note:

Run the Roots pump exclusively under the operating conditions for which it has been designed. Any modification of the operating parameters (e. g. inlet pressure, inlet temperature, ratio between Roots pump and backing pump) for a longer period may place an inadmissible thermal load on the pump. Increases in temperature which are not compensated by taking suitable measures may damage the Roots pump and/or the backing pump.

Never open the oil-fill or oil-drain screw in the presence of a vacuum or while the pump is running. There is the danger that oil may squirt out.

The oil level for the shaft seal housing must always be visible in the oiler (see [Figure 18](#) on page 43). The correct oil level is 1/3 of the height of the oil when the pump is cold 1/2 of the height of the oiler when the pump is warm. Top up any oil as required.

If it is required to top up oil very often, it is quite likely that a shaft seal is faulty.

7.3 Shutdown and Storage



WARNING: ELECTRICITY HAZARD

Risk of injury or damage to the equipment. Before removing pump from the vacuum system, disconnect it from the mains supply. Note any contamination affecting the pump. Comply with all safety regulations. Observe [Electrical Hazards](#) on page 10.

Close the valve between the Roots pump and the vacuum system. First switch off the Roots pump, then the backing pump.

After working with corrosive gases, the system should be vented with dry protective gas (e.g. N₂) to prevent corrosion during standstill.

When shutting down the pump and removing it from the system, it is advisable to seal the connecting flanges tightly.

For transportation and storing of the pump, observe the information provided in [Transport](#) on page 27 and [Storage](#) on page 60.

7.4 Changing from Vertical to Horizontal Flow

The RUVAC WA/WAUs are supplied as standard for vertical flow unless you specifically request horizontal flow. Moreover, the pump may be converted from one flow direction to the other.

For this proceed as follows:

Unscrew the sealing screws and drain out the oil from the side chambers (see [Figure 19](#) on page 44). Drain the oil from the oiler (see [Oil change / Shaft Seal Housing](#) on page 46).

Seal off of the bottom opening with the closure screw and a seal which is in perfect condition so that a vacuum-tight seal is attained again.

Unscrew the pump's feet, turn the pump by 90° and as shown in [Figure 5](#) on page 21 fit the feet for the changed direction of pumping action.

Note:

The longitudinal axis of the pump must remain horizontal so that no residual lubricant can flow from the side chambers into the pumping chamber.

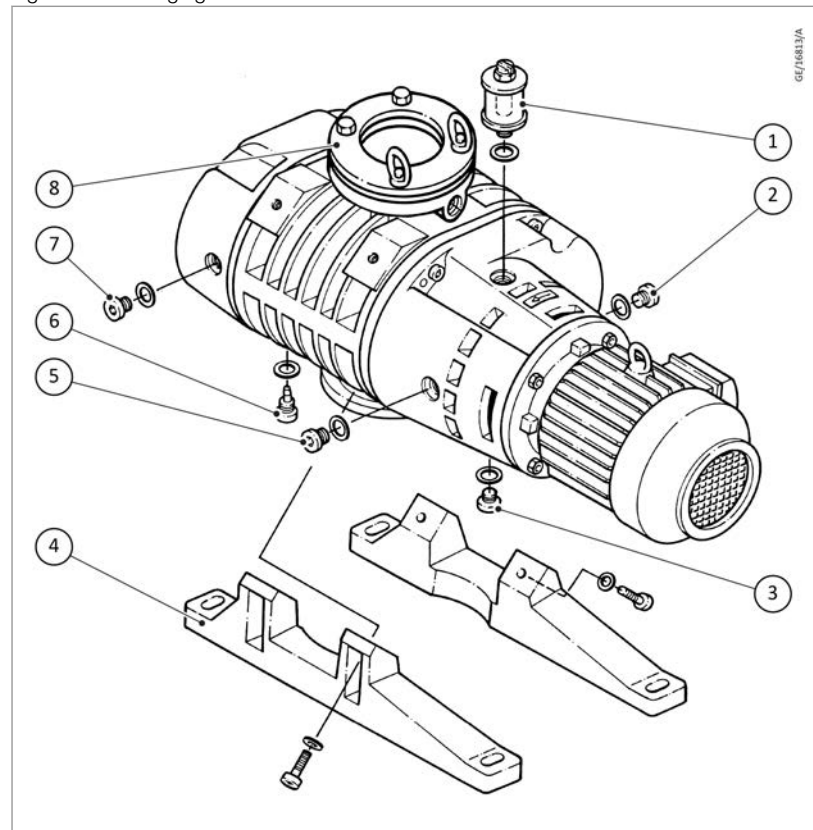
Unscrew oiler and sealing screw. Screw in the oiler from the top using a perfect gasket and screw in the sealing screw from the side also using a perfect gasket.

Fill in the oil for the side chambers at and the oil for the shaft seal housing at the oiler.

If a pressure switch has been installed, turn it so that it again points vertically upwards.

The valve in the pressure balance line of the RUVAC WAU is designed to work with both vertical and horizontal flow of the pump.

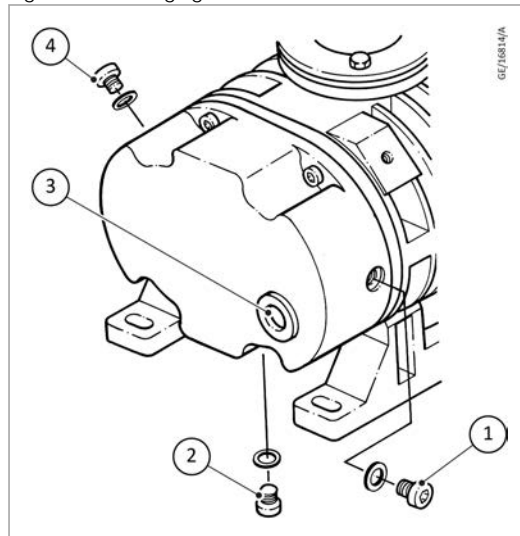
Figure 18. Changing the direction of flow



- | | |
|------------------|---------------------|
| 1. Oiler | 2. Sealing screw |
| 3. Sealing screw | 4. Feet of the pump |
| 5. Sealing screw | 6. Sealing screw |
| 7. Sealing screw | 8. Oil-fill opening |

Operation

Figure 19. Changing the oil



- | | |
|--|--|
| 1. Oil-drain screw for horizontal gas flow | 2. Oil-drain screw for vertical gas flow |
| 3. Oil level glass | 4. Oil-fill screw |

8 Maintenance

8.1 Maintenance safety information



WARNING: MAINTENANCE SAFETY

Notice safety information [Mechanical Hazards](#) on page 9 to [Thermal Hazards](#) on page 11..



WARNING: AUTOMATIC RESTART

Risk of injury. Disconnect the electrical power before disassembling the pump. Make absolutely sure that the pump cannot be accidentally started (logout/ tagout)

The safety information given in the following applies to all maintenance work.

If the pump has been pumping harmful substances, determine the nature of hazard and introduce suitable safety measures. Observe all safety regulations !

When shipping contaminated pumps which require approval by the authorities, you must observe the applicable packaging and shipping regulations.

All maintenance and cleaning work described in this section must be carried out only by suitably trained personnel.

Improper maintenance or repairs may affect the service life and performance of the pump, and cause problems when filing warranty claims.

Advanced repair work not described here should be left to our service.

We would like to point out that we offer training courses on the maintenance, repair, and troubleshooting of RUVAC pumps. Further details are available on request.

8.2 Exchanging the Oil / Bearing Chambers



WARNING: HOT SURFACE

Risk of injury. Before removing the oil-drain or oil-fill plug always switch off the pump first and vent to atmospheric pressure. When the pump has become warm during operation, the casing and the oil temperature may exceed 80 °C. Leave the pump to cool down. Always wear protective gloves also to protect yourself against aggressive residues in the oil.



To simplify the process and also for safety reasons we recommend the use of our oil-drain facility (see [Accessories](#) on page 63).



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in sections [Thermal Hazards](#) on page 11 to [Ignition Risk](#) on page 12.

Before pumping oxygen (or other highly reactive gases) at concentrations exceeding the concentration in the atmosphere (> 21 % for oxygen) it will be necessary to use a special pump.

Maintenance

Very little oil is consumed by wear in the bearings and the gear under clean operating conditions. Under normal operating conditions, change the oil annually.

Change the oil more frequently when pumping corrosive vapours or large amounts of dust or when cycling frequently from atmospheric to working pressure.

Under such operating conditions it is recommended to regularly check the neutralisation value (to DIN 51 558) based on a sample of oil. If the neutralisation value for LVO 130 exceeds 2, an oil exchange will be required.

Unscrew the oil-drain screws and the oil-fill screw and drain the oil (see [Figure 19](#) on page 44).

Clean the sealing surface and firmly reinstall the oil-drain screw using a gasket which is in perfect condition. Wipe off any oil residues from the casing.

Fill in new oil at a pump temperature of 15 °C to 25 °C. For this use a clean funnel.

For oil quantities and ordering data see [Filling in of the oil](#) on page 29 and Ordering data.

Only use our oil.

Please consult us if you intend to run the pump with other oils or special lubricants.

The oil filling levels stated in [Figure 10](#) on page 30 - which apply to the shutdown (standing still) pump - must be observed.

The filling level visible in the oil-sight glass depends on the size of the pump and the type of oil used.

If the oil level is too low, the bearings and gearwheels are not lubricated adequately; if it is too high, oil may enter the pumping chamber or the pump may overheat.

Clean the oil-fill port and reinstall the plug using a gasket which is in perfect condition. Wipe off any oil residues from the casing.

The oil-fill port must be sealed air-tight. In the presence of a vacuum, the entry of air may cause oil-containing gas to enter the pumping chamber via the impeller seals.

8.3 Oil change / Shaft Seal Housing



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in Sections [Thermal Hazards](#) on page 11 to [Ignition Risk](#) on page 12 and [Maintenance safety information](#) on page 45.

The oil in the shaft seal housing should be changed every year.

Unscrew the oil-drain screw under the shaft seal housing, drain out the oil and screw in the oil-drain screw using a gasket which is in perfect condition (see [Figure 18](#) on page 43).

Only use our oil.

Fill in fresh oil at the oiler. The oil level for the shaft seal housing must be visible in the oiler.

Maximum level:

- when the pump is warm = 1/2 of the height of the oiler
- when the pump is cold = 1/3 of the height of the oiler.

Wipe off any oil residues from the casing.

8.4 Cleaning the Fan Cowl and the Cooling Fins



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in Sections [Thermal Hazards](#) on page 11 to [Ignition Risk](#) on page 12 and [Maintenance safety information](#) on page 45.

The slits in the fan cowl as well as the fins on the motor and on the pump may be contaminated depending on humidity conditions and the degree of contamination in the ambient air.

In order to ensure a sufficient air flow for the motor and the pump's casing, the grid of the fan cowl must be cleaned with a clean brush when contaminated.

Any coarse dirt must be removed from the fins on the motor and the pump.

8.5 Cleaning the Inlet Screen



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in Sections [Mechanical Hazards](#) on page 9 to [Hazards Caused by Materials and Substances](#) on page 11 and [Maintenance safety information](#) on page 45.

An inlet screen is located in the inlet port to collect foreign objects. It should be kept clean in order to avoid a reduction of the pumping speed.

To do so, take off the inlet line. Remove the inlet screen from the inlet flange and rinse it using a suitable solvent. Then thoroughly dry it with compressed air. If the inlet screen is damaged, replace it.

8.6 Cleaning the Pumping Chamber

WARNING: ROTATING PARTS

Risk of injury. During cleaning, the rotors must be turned only by hand.

Please make sure that the rotors are turned in a way that fingers or hands can not be trapped between the rotors or between rotors and housing.

Due to the high mass and inertia of the rotors serious injuries can occur even if the rotors are turned by hand only.



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in Sections [Thermal Hazards](#) on page 11 to [Ignition Risk](#) on page 12 and [Maintenance safety information](#) on page 45.

Under dirty operating conditions, contaminants may be deposited in the pumping chamber or on the impellers. After removing the two connecting

Maintenance

lines, the contaminants can be blown out with dry compressed air or flushed out with a suitable solvent.

Contaminants that cannot be blown or flushed out, can be removed completely from the pumping chamber with a wire brush, metallic sponge or scraper.

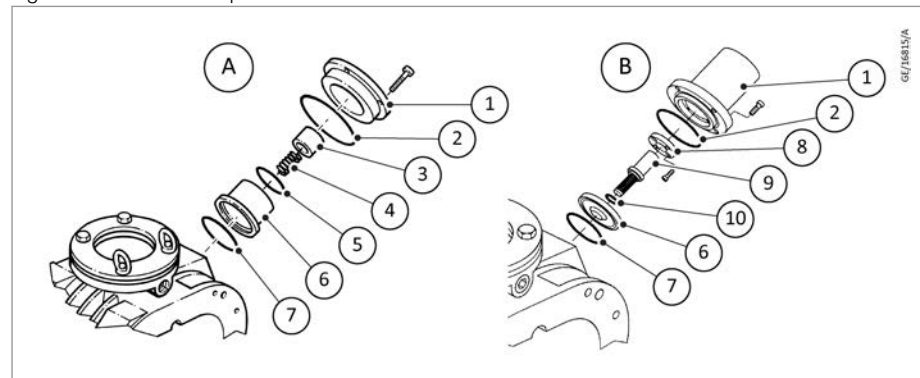
Then change the oil.

 Note:

The loosened deposits must not remain in the pump. After cleaning, check the pump by slowly turning the impellers by hand. They should move freely and without any resistance.

Generally, the Roots pump does not need to be disassembled. If necessary, this should only be done by our after-sales service.

Figure 20. Valve of the pressure balance line



- | | |
|----------------------|-------------------|
| 1. Cover | 2. O-ring |
| 3. Bushing | 4. Spring |
| 5. O-ring | 6. Valve disc |
| 7. O-ring | 8. Fastening disc |
| 9. Dampening element | 10. Circlip |

8.7 Cleaning the Valve of the Pressure Balance Line



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in Sections [Thermal Hazards](#) on page 11 to [Ignition Risk](#) on page 12 and [Maintenance safety information](#) on page 45.

Remove the screws and take off the cover with O-ring. Take out the spring.

Remove the valve disk with O-rings.

If the bushing is damaged, pull it out of the valve disk and replace it.

Clean all parts or replace them if necessary. Reassemble in the reverse sequence. When doing so, check the O-rings for leak-tightness and replace if found faulty. Finally a leak test should be run.

8.8 Exchanging the Shaft Seals



CAUTION: MAINTENANCE SAFETY

Observe all safety information provided in Sections [Thermal Hazards](#) on page 11 to [Ignition Risk](#) on page 12 and [Maintenance safety information](#) on page 45.



CAUTION: SPILLED OIL

Risk of injury. Collect the oil which drips out under the motor. There is the danger that someone may slip. Have the pump repaired.

The shaft seals should be exchanged every year.

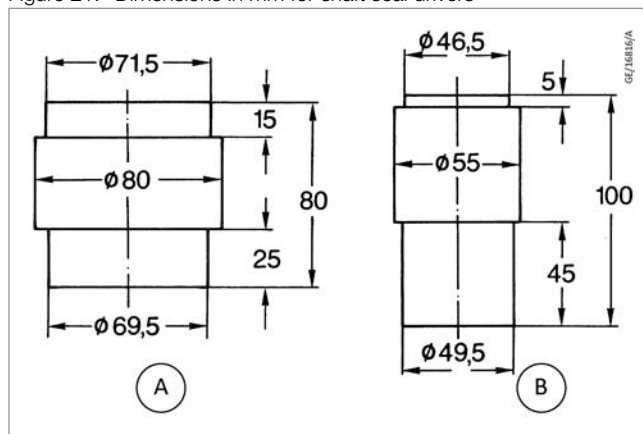
The shaft feedthrough of the RUVAC WA/WAU is sealed with two shaft seals. In order to reduce wear on the shaft these shaft seals run on a bushing.

A dropping oil level in the oiler is a sign for malfunctioning shaft seals.

When the oil level in the oiler drops and when no oil appears under the shaft seal housing, it is likely that the inner shaft seal is faulty. In this case the oil flows from the shaft seal housing into the bearing spaces of the pump thereby creating in the bearing spaces an unacceptably high oil level. In such a case the pump must be switched off immediately and it must be repaired.

When the oil level in the oiler drops and when oil appears under the shaft seal housing, it is likely that the outer shaft seal is malfunctioning. If the oil loss is only slight, the pump may still be operated for some time, provided the lost oil is topped up regularly.

Figure 21. Dimensions in mm for shaft seal drivers



A. RUVAC WA/WAU 251/501

B. RUVAC WA/WAU 1001/2001

8.8.1 Preparations

1. Unscrew sealing screw with the gasket, drain the oil out from the shaft seal housing and screw the sealing screw back in using a gasket which is in perfect condition.
2. Support the motor so that it can not drop.
3. Unscrew the nuts and remove the motor with the coupling piece.
4. Remove protection tube. Remove the coupling element.

Maintenance

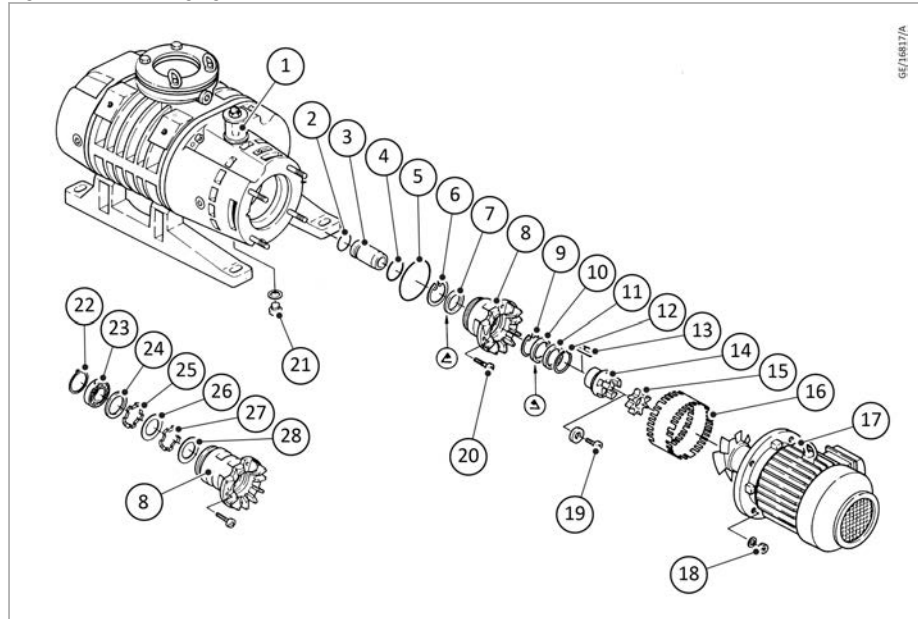
5. Unscrew screw with the disc and pull off coupling piece using the puller.
6. Remove key.
7. Unscrew screws.

8.8.2 RUVAC WA/WAU 251, 501

(see [Figure 21](#) on page 49 and [Figure 22](#) on page 51).

1. Pull the shaft seal housing out. Forcing threads are provided on the shaft seal housing for this purpose.
2. Take the O-ring out of the flange of the coupling.
3. Use a puller to pull the bushing off from the shaft.
4. Take the O-ring from the shaft.
5. Take the O-ring from the housing. Remove securing ring.
6. Pull out the shaft seal.
7. Take out snap ring and felt ring.
8. Take out shaft seal. Remove securing ring.
9. It is strongly recommended always to exchange the shaft seals, the bushing and the felt ring against new parts. Clean all other parts and replace them as required.
10. Fit securing ring.
11. Use shaft seal driver to drive the shaft seal down to the securing ring. Fit felt ring and snap ring.
12. Use shaft seal driver to drive the shaft seal down. Here the depth must be defined by the tool.
13. Fit securing ring.
14. Now reassemble the parts in the reverse order as for disassembly.
15. Before starting the pump, fill in the required amount of oil at the oiler (see [Filling in of the oil](#) on page 29).

Figure 22. Exchanging the shaft seal



- | | |
|---|-------------------------------|
| 1. Oiler | 2. O-ring |
| 3. Bushing | 4. O-ring |
| 5. O-ring | 6. Securing ring |
| 7. Shaft seal | 8. Shaft seal housing |
| 9. Securing ring (WA/WAU 251 and 501 only) | 10. Shaft seal |
| 11. Felt ring | 12. Snap ring |
| 13. Key | 14. Coupling piece (one half) |
| 15. Coupling element | 16. Protection tube |
| 17. Motor with coupling piece (other half) | 18. Nuts |
| 19. Screw | 20. Screw |
| 21. Sealing screw (WA/WAU 1001 and 2001 only) | 22. Securing ring |
| 23. Ball bearing | 24. Spacing disc |
| 25. Wave washer | 26. Adjusting disc |
| 27. Wave washer | 28. Adjusting disc |

8.8.3 RUVAC WA/WAU 1001, 2001

(see [Figure 21](#) on page 49 and [Figure 22](#) on page 51).

1. Use a puller to pull out shaft seal housing and bushing together.
2. Remove O-rings.
3. Pull the bushing out of the housing.
4. Take the O-ring out of the housing. Remove securing ring.
5. Pull out shaft seal.
6. Pull out snap ring and felt ring.
7. Remove shaft seal.
8. Remove securing ring. Pull out bearing.
9. Take out spacing disc, wave washers as well as adjusting discs.
10. It is strongly recommended always to exchange the shaft seals, the bushing and the felt ring against new parts. Clean all other parts and replace them as required.
11. Place adjusting disc, wave washer, adjusting disc, wave washer and spacing disc into the housing.

Maintenance

12. Drive bearing back in.
13. Fit securing ring.
14. Use shaft seal driver to drive the shaft seal down to the stop.
15. Fit felt ring and snap ring.
16. Use shaft seal driver to drive the shaft seal down.
17. Here the depth must be defined by the tool.
18. Fit securing ring.
19. Now reassemble the parts in the reverse order as for disassembly.

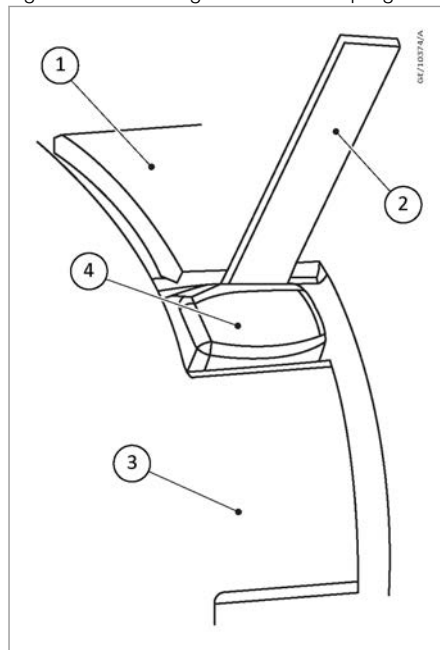
Before starting the pump, fill in the required amount of oil at the oiler (see [Filling in of the oil](#) on page 29).

8.9 Visual Inspection of coupling

Measure the gap between the coupling star and hub of the coupling with a feeler gauge. The max. allowed gap is 3mm. (see picture)

In case of noise, perform the inspection immediately. Exchange the coupling in case of noise.

Figure 23. Checking the wear of coupling



1. Hub
3. Hub 2

2. Feeler gauge
4. Spider

Maintenance

Table 6 Maintenance Schedule

Process	Meas./test quantity	Maintenance interval	Remark
Check oil level	Min./max. oil level in oil level glass	Before switching on and daily	Check oil level with the pump at stand- still, see Filling in of the oil on page 29.
Check oil quality	Visual	Weekly	In the normal state LVO 130 is transparent. In the case of black oil an oil change is necessary, see Exchanging the Oil / Bearing Chambers on page 45.
Check oil quality	Neutralisation value (DIN 51 558)	For normal operating conditions annually When pumping corrosive vapours, in the case of much dust and cyclic operation weekly to quarter yearly	If the neutralisation value of LVO 130 is > 2, then an oil change will be required, see Exchanging the Oil / Bearing Chambers on page 45.
Oil change		For normal operating conditions annually When pumping corrosive vapours, in the case of much dust and cyclic operation weekly to quarter yearly	See Exchanging the Oil / Bearing Chambers on page 45.
Clean motor fan and cooling fins		The cleaning intervals will depend on the ambient conditions.	See Cleaning the Fan Cowl and the Cooling Fins on page 47.
Check the oil level in the shaft sealing ring housing			The oil level in the oiler can be checked during operation (see Ordering data).
Exchange the oil for the shaft sealing ring housing.		1 year or depending on application	See Oil change / Shaft Seal Housing on page 46.
Exchange shaft seals		2 year or depending on application	See Exchanging the Shaft Seals on page 49.
Exchange bearings		Recommended interval 40.000h. Depending on application impacts, running conditions, cooling and maintenance these interval might vary.	

Fault finding

9 Fault finding

Fault Pump does not start	
Cause	Motor incorrectly connected.
Remedy	Connect motor correctly. Refer to Connecting the Flanges on page 34.
Cause	Pressure switch is defective.
Remedy	Replace the pressure switch. Refer to Connecting the Flanges on page 34.
Cause	Motor defective.
Remedy	Replace the motor. Refer to Exchanging the Oil / Bearing Chambers on page 45
Cause	Lubricant is too thick.
Remedy	Exchange the lubricant or warm up lubricant and the pump. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Pump has seized: defective impellers, bearings or toothed gears
Remedy	Contact us.
Fault Motor protection switch trips	
Cause	Motor defective.
Remedy	Replace the motor. Refer to Exchanging the Oil / Bearing Chambers on page 45
Cause	Motor protection switch incorrectly set.
Remedy	Set motor protection correctly. Refer to Electrical Connection on page 31.
Cause	Pump seizes mechanically.
Remedy	Contact us.
Fault Pump gets too hot	
Cause	Ambient temperature is too high or cooling air flow is obstructed.
Remedy	Install the pump at a suitable place or ensure a sufficient flow of cooling air. Refer to Installation on page 28.
Cause	Pump is operating in the wrong pressure range.
Remedy	Check the pressure levels within the system.
Cause	Pressure differences too high.
Remedy	Check the pressure levels within the system.
Cause	Gas temperature is too high.
Remedy	Check system.

Fault finding

Cause	Clearance between housing and rotors are too small due to - contamination - distortion
Remedy	Clean pumping chamber. Refer to Cleaning the Fan Cowl and the Cooling Fins on page 47. Affix and connect the pump free of tension.
Cause	Friction resistance is too high due to contaminated bearings and/or contaminated oil.
Remedy	Change oil. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Oil level is too high.
Remedy	Drain oil down to the correct level. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Oil level is too low.
Remedy	Top up oil to the correct level. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Wrong oil filled in.
Remedy	Drain oil, fill in correct oil.
Cause	Lubricant level is too low.
Remedy	Top up lubricant to the correct level.
Cause	Wrong lubricant is filled in.
Remedy	Contact us.
Cause	Bearing is defective.
Remedy	Contact us.
Cause	Valve of the pressure balance line does not open.
Remedy	Clean the valve or have it repaired. Refer to Cleaning the Pumping Chamber on page 47.

Fault	Motor power consumption is too high
Cause	Pump gets too hot
Remedy	Refer remedy in Pump gets too hot on page 54.
Cause	Incorrect mains voltage for the motor
Remedy	Connect the motor to the correct mains voltage. Refer to Technical Data on page 19/ Connecting the Flanges on page 34.

Fault	Pump is too loud
Cause	Motor stator is defective.
Remedy	Contact us.

Fault finding

Cause	Oil level is too low.
Remedy	Top up oil to the correct level.
Cause	Distances between housing and rotors is too small due to contamination or distortion of the pump.
Remedy	Clean pumping chamber. Refer to Cleaning the Fan Cowl and the Cooling Fins on page 47. Affix and connect the pump free of tensions. Refer to Installation on page 28.
Cause	Bearing or gear is damaged.
Remedy	Shutdown pump immediately. Contact us.
Cause	Pistons make contact with the housing.
Remedy	Shutdown pump immediately. Contact us.
Cause	Rotor is running untrue.
Remedy	Shutdown pump immediately. Contact us.
Cause	Oil slinger disc makes contact with the gear housing or the oil pipe.
Remedy	Contact us.
Cause	Oil pump is blocked or defective.
Remedy	Shutdown pump immediately. Contact us.

Fault	Pump is losing lubricant (Lubricant leak is apparent)
Cause	Oil drain plug leaks
Remedy	Drain lubricant, firmly screw in a new oil drain plug with the gasket, fill in correct lubricant quantity. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Oil level glass leaks
Remedy	Contact us.
Cause	Gear cover leaks
Remedy	Replace the O-ring of the gear cover.
Cause	Leaky coupling flange
Remedy	Replace the O-ring of the gear cover.
Cause	Puddle under the motor, leak in the seal
Remedy	Shutdown pump immediately. Contact us.

Fault	The oil level in the oiler drops.
Cause	Visible oil leak:
Remedy	Replace the shaft sealing rings. Refer to Exchanging the Shaft Seals on page 49..

Fault finding

Cause	Outer shaft sealing ring is defective.
Remedy	In case the oil loss is only slight, the pump may continue to operate providing it is ensured that a sufficient quantity of oil is topped up at the oiler.
Cause	No visible oil leak:
Remedy	Replace the shaft sealing rings.
Cause	Inner shaft sealing ring is defective.
Remedy	Switch the pump off; the draining out oil enters into the bearing chambers causing there an unacceptably high oil a level.

Fault	Oil gets too dark
Cause	Oil has been used up.
Remedy	Exchange the oil. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Pump gets too hot.
Remedy	Refer Pump gets too hot on page 54. After the corrective action is taken for the malfunction, exchange the oil.

Fault	Lubricant in the pump chamber
Cause	Lubricant level is too high.
Remedy	Drain the lubricant down to the correct level. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Lubricant is ejected from the system.
Remedy	Check the system.
Cause	Pump is not standing horizontally.
Remedy	Place the pump correctly.
Cause	Pump has a gas leak towards outside.
Remedy	Check to see that the oil fill and oil drain plugs are correctly seated, if required replace gaskets. Replace the O-ring of the gear cover. Refer to Exchanging the Oil / Bearing Chambers on page 45.
Cause	Pump has an internal leak.
Remedy	Contact us.
Cause	Piston rings are defective.
Remedy	Contact us.

Fault	Pump does not attain its pumping speed
Cause	Inlet screen is clogged.
Remedy	Clean inlet screen. Refer to Oil change / Shaft Seal Housing on page 46.

Fault finding

Cause	Motor is incorrectly connected.
Remedy	Connect the motor correctly. Refer to Connecting the Flanges on page 34.
Cause	Vacuum pump system has a gas leak.
Remedy	Detect leak and seal it.
Cause	Valve of the pressure balance line does not close (WAU only).
Remedy	Clean the valve or have it repaired. Refer to Cleaning the Pumping Chamber on page 47.

Wearing and Original Spare Parts

10 Wearing and Original Spare Parts

Original spare parts are available from the our service facilities.

Storage

11 Storage

When storing the pump for a longer period of time (> 2 weeks) the flanges should be sealed off with a piece of foil. Place a bag with desiccant in the pump chamber, if required. Before operating the pump once more do not forget to remove this bag first.

Parameter	Value
Temperature	-20 °C to +60 °C
Storage site	dry
Maximum atmospheric humidity	95 %, non-condensing

The area of the motor (fan and slits at the flange of the motor) must be protected against dust and dripping water.

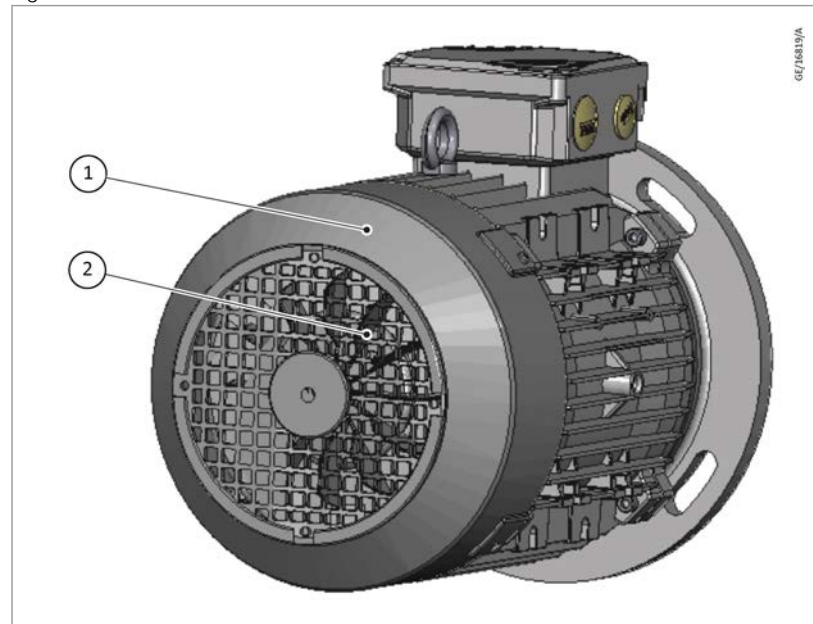
NOTICE:



The pump may only be stored for a maximum of 6 months. Longer storage with subsequent direct turning of the rotors damages the bearings or the shaft sealing rings.

To do this, open the fan cover from the motor and turn softly the fan by hand. Then connect the pump, let it run briefly and take it out of operation again (as described in the following chapters). The suction port can remain closed for this short operation, the exhaust port must be opened.

Figure 24. Motor cover



1. Fan cover

2. Fan

12 Disposal

Waste Disposal

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: CONTAMINATION HAZARD

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.

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 [Service](#) on page 62.

12.1 Disposal of Waste Oil

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

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

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

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

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

13 Service

13.1 Return the equipment or components for service

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

If you are returning equipment note the following:

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

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



NOTICE:

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

14 Accessories

Table 7. Accessories for all RUVAC WA/WAU

Description	Part Number
Oil drain facility (M 16 x 1.5) ▪ with right-angled drain coupling	200 14 271
Pressure switch adjustment	160 05
Accessories for mounting PS 115	
Pressure switch PS 115 (stainless steel)	160 04
Right-angle bend DN 16 KF	184 36
Centering ring DN 16 KF, 2 x	183 26
Clamping ring DN 16 KF, 2x	183 41
Contact amplifier SV 110, 230 V	160 78
Gearbox Evacuation Kit for RUVAC WA/WAU 1001/2001	155 184V
Mineral oil LVO 130	
1 litre	L13001
5 litres	L13005
20 litres	L13020
208 litres	L13098

Ordering information (EMEA + AMER)

15 Ordering information (EMEA + AMER)

Table 8 Ordering data (EMEA + AMER)

Roots vacuum pump	WA/WAU 251	WA/WAU(H) 501	WA/WAU(H) 1001	WA/WAU(H) 2001
RUVAC WA	117 20	117 30	117 40	117 50
RUVAC WAU	117 21	117 31	117 41	117 51
WAU with horizontal flow	-	-	-	167 004
RUVAC WA, without motor	117 24	117 34	117 44	112 54
RUVAC WAU, without motor	155 011V	155 008	112 17	113 22
RUVAC WAU H, with ACE absorber	-	118 31	118 41	118 51
Mandatory Accessories				
Connection				
Collar flange with retaining ring, DIN 2501 For connection to flange system DN ...ISO-K				
DN 63 ISO-K	E6530635	E6530635	-	-
DN 100 ISO-K	-	-	267 50	-
DN 160 ISO-K	-	-	-	86751V01
Accessories				
RUVAC WS/WSU(H) seal kit	194 60	194 64	194 68	194 72
Flange adapter set, consisting of Flange adapter with screws, bolts, washers and nuts for ANSI flange	(3" ANSI)	(3" ANSI)	(4" ANSI)	(6" ANSI)
▪ WA/WS pump	200 03 179	200 03 179	200 03 180	200 03 181
▪ WAU/WSU pump	200 03 179	200 03 179	200 03 180	200 03 182
RUVAC WA US conversion kit, consisting of ANSI flanges 3 in., NEMA motor flange, cou- pling and installation components	155 013V	-	155 015V	155 016V
ACE vibration absorber (DA valve)	-	200 03 251	200 03 252	100 22
Frequency converter LEYTRONIC	14111000A007DGN	14111000A005DGN	14111000A001DGN	14111000A004DGN

Ordering information (EMEA + AMER)

Roots vacuum pump	WA/WAU 251	WA/WAU(H) 501	WA/WAU(H) 1001	WA/WAU(H) 2001
Spare parts				
Shaft sealing ring replacement kit Kit WA/WAU	EK 110 002 661	EK 110 002 661	EK 110 002 662	EK 110 002 662
Major maintenance kit				
WA	EK 110 002 663	EK 110 002 664	EK 110 002 667	EK 110 002 669
WAU	EK 110 002 665	EK 110 002 666	EK 110 002 668	EK 110 002 670

**special models for single customers, order only possible after consultation with us.*

Ordering information (APAC)

16 Ordering information (APAC)

Table 9 Ordering data (APAC)

Roots vacuum pump	WA/WAU 251	WA/WAU(H) 501	WA/WAU(H) 1001	WA/WAU(H) 2001
RUVAC WA	117 20TE			
WA with horizontal flow	-	128 38TE	-	
RUVAC WAU	117 21TE	117 31TE	117 41TE	117 51TE
WAU with horizontal flow	-	-		-
RUVAC WA, without Motor	-	117 34TE	-	112 54TE
RUVAC WAU, without Motor	155 011VTE	-	-	113 22TE
WAU H with ACE vibration absorber	-	118 31TE	118 41TE	118 51TE
Mandatory Accessories				
Collar flange with retaining ring, DIN 2501 For connection to flange system DN ...ISO-K				
DN 63 ISO-K	267 47 T	267 47 T	-	-
DN 100 ISO-K	-	-	267 50 T	-
DN 160 ISO-K	-	-	-	267 51 T
Accessories				
RUVAC WS/WSU(H) seal kit	194 60	194 64	194 68	194 72
ACE vibration absorber (DA valve)	-	200 03 251	200 03 252	100 22
Spare parts				
Shaft sealing ring replacement kit Kit WA/WAU	EK 110 002 661	EK 110 002 661	EK 110 002 662	EK 110 002 662
Major maintenance kit WA	EK 110 002 663	EK 110 002 664	EK 110 002 667	EK 110 002 669
Major maintenance kit WAU	EK 110 002 665	EK 110 002 666	EK 110 002 668	EK 110 002 670

EU Declaration of Conformity CE

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

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

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

The product specified and listed below:

Product	RUVAC roots pump, bare shaft and motorised
Range	WA 251-2001 ATEX Cat3, WAU 251-2001 ATEX Cat3
Product number	- Motorised: 11720, 11721, 11730, 11731, 11740, 11741, 11750, 11751, 11831, 11841, 11851, 167004 - Bare shaft* (IEC flange): 11217, 11254, 11322, 11724, 11734, 11744, 155008, 155011V
Frequency converters	14111000A001DGN, 14111000A004DGN, 14111000A005DGN, 14111000A007DGN; configured with a parameter set for each size

Is in conformity with the relevant Union harmonisation legislation:

2006/42/EC	Machinery directive <i>Note: The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Annex 1 No. 1.5.1 of this directive.</i>
2014/34/EU	ATEX directive on use in potentially explosive atmospheres Motorised Internal: Ex II 3G Ex h IIC T4...T2 Gc X External: Safe area Ambient Temperature: +12°C to +40°C Bare shaft (for * marked numbers) Internal: Ex II 3G Ex h IIC T4...T2 Gc X External: Ex II 3G Ex h IIC T4...T2 Gc X Ambient Temperature: +12°C to +40°C Leybold TCF Number : TCF 301194923
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 ISO 80079-36:2016	Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres. Basic method and requirements
EN ISO 80079-37:2016	Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres -- Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"

*: not valid for pump bare shaft versions without motor as indicated above

CE marking information for pre-certified major components:

Motor	Regulation (EU) No 2019/1781 electric motors and variable speed drives Based on the requirements of harmonised standard: EN 60034-30:2009: Rotating electrical machines -- Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)
Flameproof motors**	2014/34/EU ATEX directive on use in potentially explosive atmospheres EN 60079-0:2018: Explosive atmospheres - Part 0: Equipment - General requirements
Fans	Regulation (EU) No 327/2011: Industrial fans driven by motors

** : only applicable for bare shaft versions

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: 2026-05-11

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



Nicolas Lebreton – Vice President Engineering
Industrial Vacuum Division
Bourg-Les-Valence



Philipp Koebnick – General Manager
Product Company
Cologne

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION (EU/UK)

EMC (EU, UK): Class A 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 (UKCA equivalent given in brackets).

Annex III:

- 6(a)-I: **Lead** as an alloying element in steel for machining purposes containing up to 0.35 % lead by weight (UK: Table 1-12)
- 6(a)-II: **Lead** as an alloying element in steel for machining purposes and in galvanised steel containing up to 0.35 % lead by weight (UK: Table 1-12)

REACH (EU, UK)

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

Article 33.1 Declaration (EU, UK)

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

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

WASTE FRAMEWORK DIRECTIVE (EU)

SCIP Number: 99b4523d-d638-430c-b019-690c7cd2279e

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (EU, UK)

This product must be disposed of in accordance with the requirements of the WEEE Directive.

Additional Applicable Requirements

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

TSCA PBTs	Regulation of Persistent, Bioaccumulative, and Toxic Chemicals under TSCA Section 6(h) This product does not knowingly or intentionally contain substances in contravention with the above requirements.
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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)	邻苯二甲酸二 丁酯 Dibutyl phthalate (DBP)	邻苯二甲酸丁 基苄酯 Benzyl butyl phthalate (BBP)	邻苯二甲酸双（2- 乙基己基）酯 Bis(2-ethylhexyl) phthalate (DEHP)	邻苯二甲酸二异 丁酯 Diisobutyl phthalate (DIBP)
 钢合金制品 Steel alloys	X	O	O	O	O	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.										

EU Declaration of Conformity CE

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

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

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

The product specified and listed below:

Product	RUVAC roots pump, bare shaft and motorised
Range	WA 251-2001 ATEX Cat3, WAU 251-2001 ATEX Cat3
Product number	- Motorised: 14950250V10CJL, 14950250V11CJL, 14950500V10CJL, 14950500V11CJL, 14951000V10CJL, 14951000V11CJL, 14952000V10CJL, 14952000V11CJL, 14950500V12CJL, 14951000V12CJL, 14952000V12CJL, 14952000V13CJL - Bare shaft* (IEC flange): 14951000V16CJL, 14952000V15CJL, 14952000V16CJL, 14950250V15CJL, 14950500V15CJL, 14951000V15CJL, 14950500V16CJL, 14950250V16CJL
Frequency converters	14111000A001DGN, 14111000A004DGN, 14111000A005DGN, 14111000A007DGN; configured with a parameter set for each size

Is in conformity with the relevant Union harmonisation legislation:

2006/42/EC	Machinery directive <i>Note: The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Annex 1 No. 1.5.1 of this directive.</i>
2011/65/EU	Restriction of certain hazardous substances (RoHS) directive electronic or electrical equipments as amended by Delegated Directive (EU) 2015/863
2014/34/EU	ATEX directive on use in potentially explosive atmospheres Motorised Internal: Ex II 3G Ex h IIC T4...T2 Gc X External: Safe area Ambient Temperature: +12°C to +40°C Bare shaft (IEC flange) (for * marked numbers) Internal: Ex II 3G Ex h IIC T4...T2 Gc X External: Ex II 3G Ex h IIC T4...T2 Gc X Ambient Temperature: +12°C to +40°C Leybold TCF Number : TCF 301194923

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 ISO 80079-36:2016	Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres. Basic method and requirements
EN ISO 80079-37:2016	Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres -- Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"

*: not valid for pump bare shaft versions without motor as indicated above

CE marking information for pre-certified major components:

Motor	Regulation (EU) No 2019/1781 electric motors and variable speed drives Based on the requirements of harmonised standard: EN 60034-30:2009: Rotating electrical machines -- Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)
Flameproof motors**	2014/34/EU ATEX directive on use in potentially explosive atmospheres EN 60079-0:2018: Explosive atmospheres - Part 0: Equipment - General requirements
Fans	Regulation (EU) No 327/2011: Industrial fans driven by motors

** : only applicable for bare shaft versions

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: 2026-05-14

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



Nicolas Lebreton – Vice President Engineering
Industrial Vacuum Division
Valence



Andries De Bock – General Manager
Product Company
Tianjin

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION (EU/UK)

EMC (EU, UK): Class A 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 (UKCA equivalent given in brackets).

Annex III:

- 6(a)-I: **Lead** as an alloying element in steel for machining purposes containing up to 0.35 % lead by weight (UK: Table 1-12)
- 6(a)-II: **Lead** as an alloying element in steel for machining purposes and in galvanised steel containing up to 0.35 % lead by weight (UK: Table 1-12)

REACH (EU, UK)

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

Article 33.1 Declaration (EU, UK)

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

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

WASTE FRAMEWORK DIRECTIVE (EU)

SCIP Number: 99b4523d-d638-430c-b019-690c7cd2279e

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (EU, UK)

This product must be disposed of in accordance with the requirements of the WEEE Directive.

Additional Applicable Requirements

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

TSCA PBTs	Regulation of Persistent, Bioaccumulative, and Toxic Chemicals under TSCA Section 6(h) This product does not knowingly or intentionally contain substances in contravention with the above requirements.
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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)	邻苯二甲酸二 丁酯 Dibutyl phthalate (DBP)	邻苯二甲酸丁 基苄酯 Benzyl butyl phthalate (BBP)	邻苯二甲酸双（2- 乙基己基）酯 Bis(2-ethylhexyl) phthalate (DEHP)	邻苯二甲酸二异 丁酯 Diisobutyl phthalate (DIBP)
 钢合金制品 Steel alloys	X	O	O	O	O	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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Pioneering products. Passionately applied.

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