oerlikon
leybold vacuum

RUVAC WH / WHU 4400 / 7000

Roots booster with synthetic oil or PFPE-filling

Operating Instructions 130001398_002_A1

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Contents

We strongly recommend that you read and observe the information provided in these Operating Instructions before installing and commissioning the RUVAC with care so as to ensure optimum operation of the pump right from the start.

The icon indicates procedures in these Operating Instructions that must be strictly observed to prevent hazards to persons.

Warning

High electrical voltages!
When touching parts at high-voltage there is the risk of suffering severe injury by an electric shock! Covers which are marked with this icon must only be removed by trained electricians after having reliably disconnected the electric power source.

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

Caution

Emphasises additional application information and other useful information provided within these Operating Instructions.

Note

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 which is subject to normal wear and which is 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.

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.

Figures

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

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

Safety information

Important Safety Information

The Oerlikon Leybold Vacuum RUVAC pump is designed for safe and efficient operation when used properly and in accordance with this manual. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the manual. The equipment must be operated only in the proper condition as detailed in the Operating Instructions and it must be only operated and subjected to maintenance by trained personnel. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to your nearest Oerlikon Leybold Vacuum office.

Warning

Non-compliance with the precautions detailed here can result in severe injury to personnel.

Before beginning with any maintenance or service work on the RUVAC, disconnect the pump from all power supplies.

Do not operate the pump with any of the covers removed.
Serious injury may result.

If exhaust gases must be collected or contained, do not allow the exhaust line to become pressurized.

Make sure that the gas flow from the exhaust port is not blocked or restricted in any way.

The RUVAC WH/WHU pumps are designed to be functional at altitudes up to 1000m above sea level. If the pump is operated on higher altitudes, special precautions have to be taken. Please consult Oerlikon Leybold Vacuum in this case.

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

Before starting up for the first time, the motor circuit must be equipped with a suitable protective motor switch. Please take note of the information in these Operating Instructions or on the electric motor (wiring diagram).

Basically the RUVAC pumps must not be used with flammable or explosive gases and vapors. In particular cases the composition of the substances may not be critical. In this case the user is obliged to analyse this carefully and to take appropriate precautions introduced by competent experts.

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 RUVAC pumps with toxic and/or aggressive gases, it is imperative that you consult your local Oerlikon Leybold Vacuum office.

Oerlikon Leybold Vacuum is 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.

The RUVAC 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.

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

Even during standstill of the RUVAC it is dangerous to grasp into the pump housing. 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 pressure.

Never operate the RUVAC without connected intake line or blank flange at the inlet.

The location at which the RUVAC (including its accessories) is operated should be such that angles over > 5° from the vertical are avoided.

The location of the RUVAC should be such that all controls are easily accessible.

Under certain ambient conditions the RUVAC may attain a temperature of over 80 °C (176 °F). There then exists the danger of receiving burns. Note the symbols on the pump pointing to the hazards, and in the case of a hot pump wear the required protective clothing.

The noise level of the RUVAC is between 63 and 75 dB(A). When operating the pump temporarily at pressures above 100mbar the noise level can be much higher. Make sure that suitable protection measures are taken to protect your hearing.

Before pumping oxygen (or other highly reactive gases) at concentrations exceeding the concentration in the atmosphere (> 21 % for oxygen) it will be necessary to use a special pump. Such a pump will have to be modified and degreased, and an inert special lubricant (like PFPE) must be used.

Before commissioning the RUVAC, 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.

It is recommended to always only operate the RUVAC with a suitable exhaust line which is properly connected.

When moving the RUVAC always use the allowed means.
Two crane eyes are provided on this pump as standard.

Do not allow the ingestion of any objects (screws, nuts, washers, pieces of wire, etc.) through the inlet port. The use of the inlet screen is strongly recommended. In case the pump is operated without inlet screen the operator hast 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.

Do **not** use the pump for applications that produce abrasive or adhesive powders or condensable vapors that can leave adhesive or high viscosity deposits. Please contact Oerlikon Leybold Vacuum.
Sales for selecting the right separator.

Vapors which condense upon being compressed within the pump to liquids must be avoided when their vapor pressure exceeds the vapor tolerance of the pump.

Warning

Warning

Failure to observe the following precautions could result in serious personal injury!

Safety information

Before pumping vapors, the RUVAC 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 intake line, for example.

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.

Caution

Operating the pump with less than the specified amount of cooling water will result in excessive surface temperatures and can damage the pump

Do not use the RUVAC WH/WHU pumps in combination with backing pumps that have an ultimate pressure above 10 mbar. This prevents excessive temperatures oft the RUVAC in idle mode operation.

The exhaust line should be laid so that it slopes down and away from the pump so as to prevent condensate from backstreaming into the pump.

In order to prevent the transfer of vibrations from the RUVAC to other parts of the system we recommend the use of corrugated hoses or compensators on both the intake and the exhaust sides.

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 max. differential pressures apply. Please consult OLV for further details.

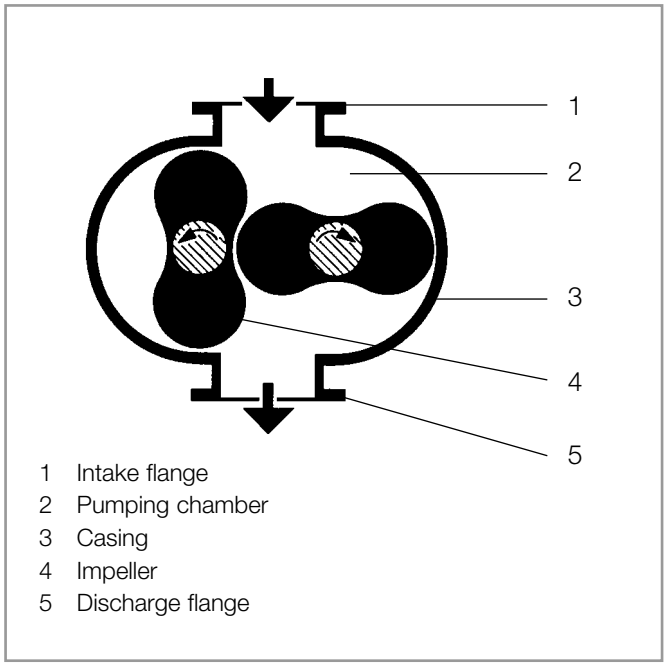


Fig. 1.1 Schematic cross-section of a Roots pump (vertical flow)

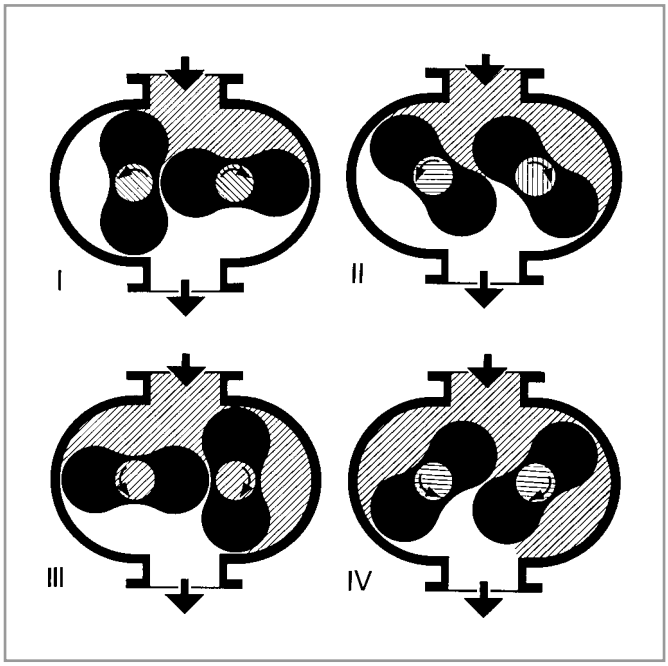


Fig. 1.2 Functional diagram of a Roots pump (vertical flow)

1 Description

1.1 Design and Function

The RUVAC WH and RUVAC WHU are Roots boosters driven by water cooled hermetically sealed motors.

The WHU types have a pressure balance line between the discharge and intake flanges.

The RUVAC WH and WHU are lubricated with mineral oil or perfluorized polyether (PFPE) or diester oil, depending on the customer requirements. Apart from the lubricant the mineral oil and PFPE models are identical in type.

Only special prepared RUVAC WH/WHU PFPE pumps can be used for pumping oxygen greater than atmospheric concentration.

Only RUVAC WH/WHU PFPE pumps can be used for pumping aggressive or hazardous gasses. In this cases it is imperative that you consult your local Oerlikon Leybold office.

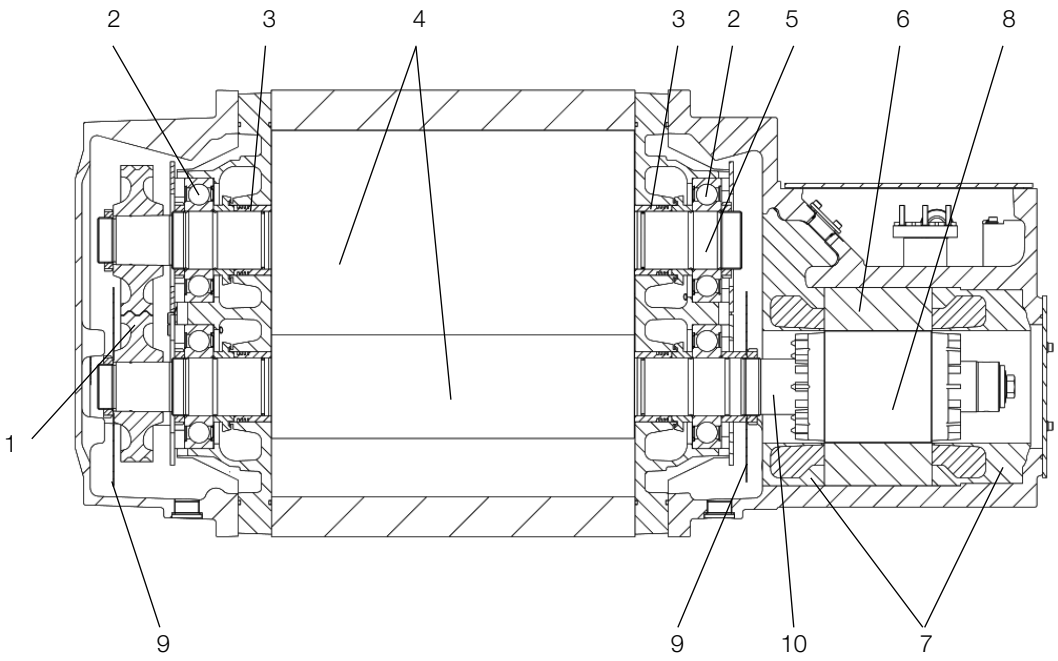
1.1.1 Principle of Operation

Roots boosters - also known as Roots pumps or Roots blowers - contain in their pump casing (1.1/3) two symmetrical impellers (1.1/4) rotating in opposite directions. 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 fig. 1.2.

In impeller positions I and II, the volume in the intake flange is increased.

Description



1 Timing gears
2 Bearings
3 Shaft seals
4 Impellers
5 Driven impeller shaft
6 Motor stator
7 Epoxy encapsulation
8 Motor rotor
9 Oil slinger disc
10 Drive shaft

Fig. 1.3 Longitudinal section of a RUVAC WH4400 **(horizontal flow)**

When the impellers rotate further to position III, part of the volume is sealed off from the intake side.

In position IV, this volume is opened to the discharge side, and gas at backing pressure (higher than the intake pressure) flows in. The inflowing gas compresses the gas volume pumped from the intake 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 Hz). Thus a relatively high pumping speed is attained with small pumps.

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

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

RUVAC pumps from the WH/WHU range have been specifically designed for operation in the rough and medium 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 working pressure range
- the pressure difference between the inlet and the discharge flange (see fig. 1.6)
- and the type of gas to be pumped.

1.1.2 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 (1.3/1) and the bearings (1.3/2) are lubricated with synthetic oil or with PFPE. 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 (1.3/3). During operation of the pump, the side chambers are evacuated via the impeller seals.

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

RUVAC WH/WHUs are driven by a water cooled hermetically sealed motor. The hermetically sealed motor runs completely under vacuum and is sealed against atmosphere. Thus a shaft feedthrough to the atmosphere is not needed. The exposed motor material is very stable against chemicals.

With the standard motors, the RUVAC WH/WHUs can run on either 50 Hz or 60 Hz power supplies or with an appropriate frequency converter.

For the permissible electrical connection data with respect to these up to 80 Hz frequencies, see Section 1.3.

RUVAC WH/WHUs are water cooled by cooling water tubes integrated into the motor housing and the gearbox cover. A connection tube allows the cooling water to flow through both housing parts.

Built into the stator coil of the motor is a temperature switch and a PTC that have to be analyzed to shut down the pump in case of a motor overtemperature.

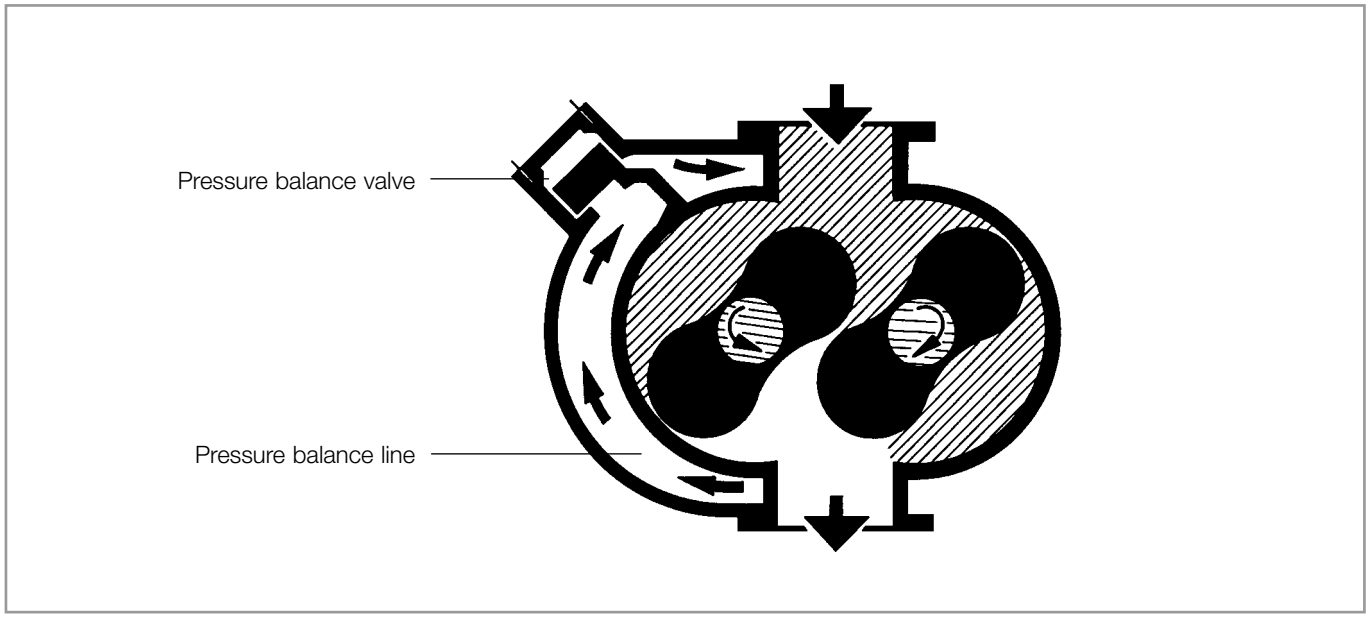


Fig. 1.4 Schematic diagram of a Roots pump with pressure balance line

1.1.3 Pressure Balance Line (Bypass Line)

The RUVAC WHU has an integrated pressure balance line (1.4/1). It links the discharge and intake flanges via a pressure balance valve. The valve is spring-loaded it. Works with both vertical and horizontal flow of the pump.

If the pressure differential between the flanges is too large, the valve opens (1.4/2). Some of the gas which has already been pumped flows back through the line to the intake flange.

The RUVAC WHU pumps are optimized for fast atmospheric cycling. They should be used in combination with a suitable roughing pump to achieve short pumpdown times for example in load lock applications. The RUVAC WHU pumps can be switched on together with a backing pump at atmospheric pressure. Thus the pumping speed of the pump combination is increased also at high intake pressures.

The bypass valve is therefore adjusted to generate a maximum differential pressure and will not protect the pump from thermal overload if opened continuously. If you want to protect the pump from overload over a longer period of time for example in process applications running close to or above the differential pressure limit of the pump, a frequency converter with a customized current limit will be the better choice. OLV offers suitable frequency converters and can assist you with adjusting the parameters.

1.1.4 Lubricants

RUVAC WH/WHU pumps are, as standard, prepared either for operation with synthetic oil or the special lubricant perfluoropolyether PFPE).
Other types of oil (white oil, for example) upon request.

Caution

If synthetic oil and PFPE come into contact with each other they will emulsify. That's why the pumps must only be run with the type of lubricant specified for the pump. If you want to change the type of lubricant please contact Oerlikon Leybold Vacuum.

The Operating Instructions GA 07.009 „PFPE for Vacuum Pumps“ will be enclosed with any RUVAC PFPE. Observe the handling notes for PFPE collected in these Operating Instructions.

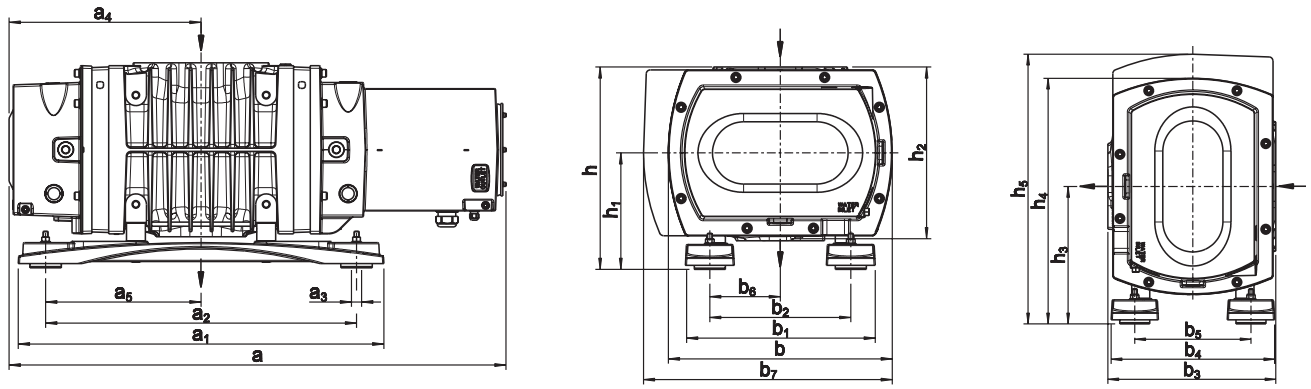
1.2 Standard Specification

RUVAC WH/WHU are supplied for vertical flow.

Before delivery the oil has been drained out. The quantity of synthetic oil or PFPE which is required for operation, is supplied separately with the pump.

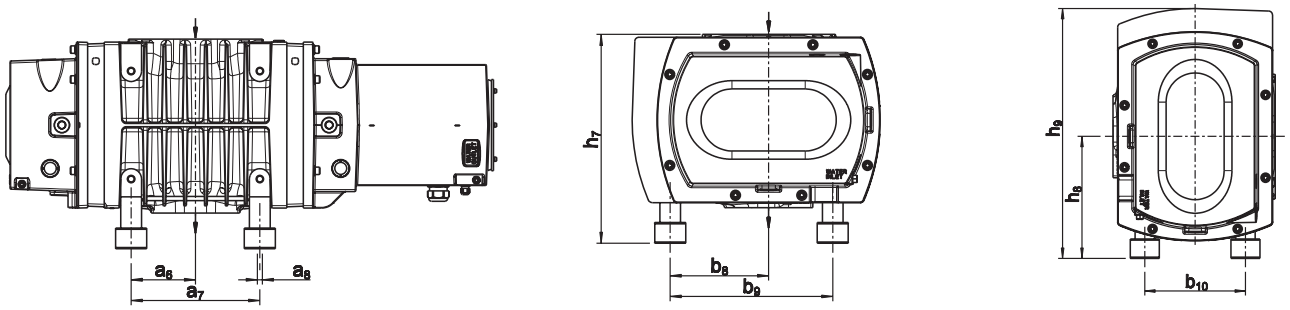
All pumps are equipped with an inlet screen in their intake flange and have been vented with nitrogen to protect the pump against corrosion. The flanges have been sealed off with adhesive foil.

Description



Type		Inlet Flange	Outlet Flange	a	a_1	a_2	a_3	a_4	a_5	b	b_1	b_2	b_3	b_4	b_5	b_6	b_7
WH 4400	mm	DN 250 ISO-K	DN 160 ISO-K	1183	870	740	M12	457	370	540	455	340	419	405	290	170	--
WHU 4400	mm	DN 250 ISO-K	DN 160 ISO-K	1183	870	740	M12	457	370	540	538	423	419	405	290	253	600
WH 7000	mm	DN 320 ISO-K	DN 160 ISO-K	1433	870	740	M12	582	370	540	455	340	419	405	290	170	--
WHU 7000	mm	DN 320 ISO-K	DN 160 ISO-K	1433	870	740	M12	582	370	540	538	423	419	405	290	253	600

Type		h	h_1	h_2	h_3	h_4	h_5
WH 4400	mm	498	291	419	343	613	--
WHU 4400	mm	498	291	419	343	613	673
WH 7000	mm	498	291	419	343	613	--
WHU 7000	mm	498	291	419	343	613	673



Type		a_6	a_7	a_8	b_8	b_9	b_{10}	h_7	h_8	h_9
WH 4400	mm	155	310	M12	155	310	260	505	315	645
WHU 4400	mm	155	310	M12	238	393	260	505	315	645
WH 7000	mm	280	560	M12	155	310	260	505	315	645
WHU 7000	mm	280	560	M12	238	393	260	505	315	645

Fig. 1.5 Dimensional drawing for the RUVAC WH/WHU

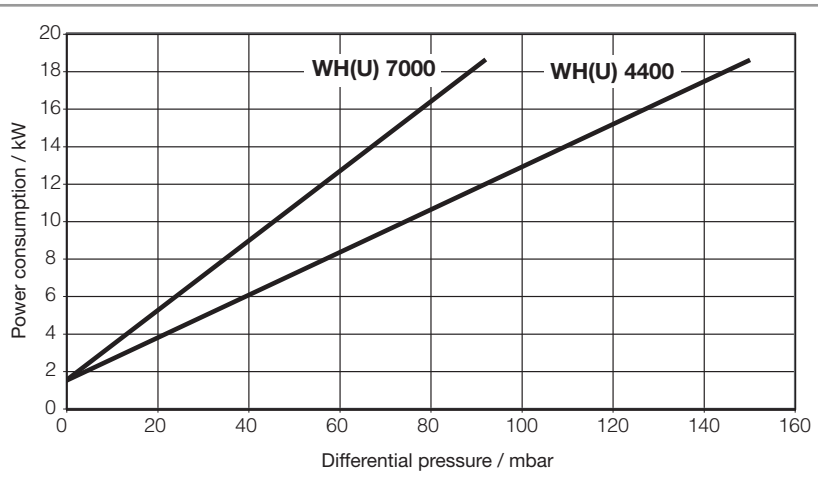


Fig. 1.6 Power consumption of the RUVAC WH/WHU

1.3 Technical Data (SI-Units)

RUVAC WH/WHU		4400			7000		
		50 Hz	60 Hz	80 Hz	50 Hz	60 Hz	70 Hz
Nominal pumping speed acc. to DIN 28426	$m^3 \cdot h^{-1}$	4400	5280	7040	7000	8400	9800
Max. effective pumping speed with backing pump SCREWLINE SP 630 (+ RUVAC WS 2001)	$m^3 \cdot h^{-1}$	3300 (3700)	3900 (4400)	4800 (5800)	4700 (5700)	5300 (6800)	5800 (7800)
Ultimate partial pressure							
Ultimate total pressure							
Max. permissible pressure difference during continuous operation	mbar	30 - 45[1)]	20 - 30[1)]	8 - 12[1)]	20 - 30[1)]	14 - 21[1)]	11 - 14[1)]
Leak rate, integral	$mbar \cdot l \cdot s^{-1}$	$1 \cdot 10^{-5}$					
Permissible ambient temperatures	°C	12 - 40					
Mains voltage	V	400 (200)[2)]	460 (200)[2)]	FC	400 (200)[2)]	460 (200)[2)]	FC
Nominal power consumption	kW	11 / 18,5					
Idle mode power consumption	kW	1.2	1.4	2	1.2	1.4	1.7
Nominal speed	rpm	3000	3600	4800	3000	3600	4200
Maximum permissible speed[3)]	rpm	4800			4200		
Protection class according acc. To EN 60529	IP	54					
Water connections	2 pcs.	G 1/4, female					
Cooling water quantity	l/h	min. 180					
Max. permiss. cooling water pressure	bar	6					
Lubricant filling (vertic. / horizont.)	l	4.75 / 1.8					
Connection flange (DIN 2501, ND 6) intake / outlet		250 ISO-K / 160 ISO-K			320 ISO-K / 160 ISO-K		
Painting	RAL	7011					
Weight (with standard feet) WH / WHU	kg	590 / 620			650 / 715		
Noise Level acc. to DIN EN ISO 2151	dB (A)	< 63[5)]					

1) permissible pressure differences are dependent on various factors. Please see section 1.4 for further details
2) 200 V available as option for the 11 KW-motor
3) Min. permissible speed: 1200rpm if run for more than 2 minutes
4) Higher ambient temperatures are possible with reduced operating limits. Please consult Oerlikon Leybold Vacuum for details.
5) Valid for 50Hz operation under ultimate pressure conditions. Higher rotational speeds and especially pressure levels above 10mbar will result in higher noise levels.

RUVAC WH(U) 4400 - available versions

P/N	Type	Bypass-valve	Motor power	Supply voltage		Oil type	Frequency converter
				50Hz	60Hz		
155150	WH4400	no	11KW	400V	460V	GS555	optional
155153	WHU4400 PFPE	yes	18.5KW	400V	460V	PFPE	no
155155	WH4400 PFPE	no	11KW	400V	460V	PFPE	optional
155156	WH4400 PFPE	no	11KW	200V	200V	PFPE	optional
155158V	WHU4400	yes	18.5KW	400V	460V	GS555	no

RUVAC WH(U) 7000 - available versions

P/N	Type	Bypass-valve	Motor power	Supply voltage		Oil type	Frequency converter
				50Hz	60Hz		
155160	WH7000	no	11KW	400V	460V	GS555	optional
155162	WHU7000	yes	18.5KW	400V	460V	GS555	no
155165	WH7000 PFPE	no	11KW	400V	460V	PFPE	optional
155166	WHU7000 PFPE	yes	18.5KW	400V	460V	PFPE	no
155167	WH7000	no	18.5KW	400V	460V	GS555	optional

1.3.1 Voltage ranges for the hermetically sealed motors of the RUVAC WH/WHU pumps

400V motor				
	Nominal power / nominal current at		Nominal power / nominal current at	
	50Hz, 360V-440V		60Hz, 414V-506V	
	KW	A	KW	A
RUVAC WH(U) 4400 11KW	11	20	11	17
RUVAC WH(U) 4400 18KW	18.5	35	18.5	29
RUVAC WH(U) 7000 11KW	11	20	11	17
RUVAC WH(U) 7000 18KW	18.5	35	18.5	29

200V motor				
	Nominal power / nominal current at		Nominal power / nominal current at	
	50Hz, 180V-220V		60Hz, 180V-220V	
	KW	A	KW	A
RUVAC WH 4400 11KW	11	41	11	41

Caution The motor overload protection switch must be set to the nominal current stated in the table in each case.

1.4 Maximum differential pressure

The maximum differential pressure that the RUVAC can be operated at is limited by two factors:

1. The installed motor power
2. The thermal limitations of the pump

The installed motor power must not be exceeded by more than a few seconds, which results in a fixed limit in differential pressure.

The thermal limits of the RUVAC can be exceeded for a limited time if this is followed by a period of time that allows it to recover at a rather low pressure.

The percentage of time within a repeating cycle for which the RUVAC is operated at high differential pressure is called the duty cycle.

If the duty cycle is for example 25 %, the pump runs at high differential pressure for a time period of 1 minute followed by a time period 3 minutes at a discharge pressure of less than 1 mbar. If a cycle time of 40 min is exceeded, the pump has to be considered in continuous operation.

Further factors can influence the maximum differential pressure as for example the pump ratio, the rotational speed of the RUVAC, the gas inlet temperature, the ambient temperature and the gas type.

The pump ratio is equal to the effective compression ratio described in section 4.1

In general will a lower pump ratio result in a higher allowable differential pressure.

RUVAC WH4400
Max. allowable differential pressures
50Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	45	38	30
Duty cycle 50%	75	63	50
Duty cycle 25%	120*	100*	80
Atmospheric cycling < 2min	120*	100*	80

* requires 18.5 kW-motor

RUVAC WH4400
Max. allowable differential pressures
60Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	30	25	20
Duty cycle 50%	57	47	38
Duty cycle 25%	97*	81*	65
Atmospheric cycling < 2min	97*	81*	65

* requires 18.5 kW-motor

RUVAC WH4400
Max. allowable differential pressures
70Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	23	19	15
Duty cycle 50%	42	35	28
Duty cycle 25%	72*	60	48
Atmospheric cycling < 2min	72*	60	48

* requires 18.5 kW-motor

RUVAC WH4400
Max. allowable differential pressures
80Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	12	10	8
Duty cycle 50%	18	15	12
Duty cycle 25%	30	25	20
Atmospheric cycling < 2min	30	25	20

* requires 18.5 kW-motor

RUVAC WH7000
Max. allowable differential pressures
50Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	30	25	20
Duty cycle 50%	45	37	30
Duty cycle 25%	75*	62*	50
Atmospheric cycling < 2min	75*	62*	50

* requires 18.5 kW-motor

RUVAC WH7000
Max. allowable differential pressures
60Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	21	17	14
Duty cycle 50%	31	25	21
Duty cycle 25%	52	42	35
Atmospheric cycling < 2min	52	42	35

* requires 18.5 kW-motor

RUVAC WH7000
Max. allowable differential pressures
70Hz operation [mbar]

Pump ratio	1:1-1:4	1:5-1:7	1:8-1:15
Continuous operation	14	12	11
Duty cycle 50%	21	18	16
Duty cycle 25%	35	30	27
Atmospheric cycling < 2min	35	30	27

* requires 18.5 kW-motor

The tables above give the maximum allowable differential pressures for the RUVAC WH4400 and WH7000 for 50/80 Hz operation depending on pump ratio and duty cycle.

The given values are valid for air with a maximum intake temperature of 40 °C and an ambient temperature not exceeding 40 °C.

Example – Max. allowable differential pressure in Duty Cycle:

RUVAC WH 4400 at 50 Hz / SCREWLINE SP 630

Operation: 10 minutes at high differential pressure
10 minutes at discharge pressure of less then 1mbar

$$\text{Pump ratio}^* = \frac{\text{Nominal pumping speed SP 630}}{\text{Nominal pumping speed RUVAC 4400}} = \frac{630\ m^3 \cdot h^{-1}}{4400\ m^3 \cdot h^{-1}} = 1{:}7$$

Duty cycle is 50 %. The maximum allowable differential pressure resulting from the table above is Δp_{max} = 63 mbar.

* Pump ratio is given by the nominal pumping speed of the backing pump relative to the nominal pumping speed of the Roots booster.

1.5 Accessories

P/N	**Description**
155190V	Frequency Converter RUVAC WH11kW continous operation
155191V	Frequency Converter RUVAC WH11kW short cycle operation
155193V	Frequency Converter RUVAC WH18,5kW short cycle operation
155195V	Line filter for FC WH4400/7000
155212V	Profibus card for frequency converter
155213V	LCD-Operator panel for for frequency converter
155214V	USB panel for for frequency converter
155180	Cast iron feet with vibration insulators

2 Transportation and Storage

The RUVAC WH pumps are heavy machines (> 500 kg) and thus should only be lifted using suitable lifting equipment tied to the eyes provided for this purpose. The correct lifting is described in Figure 2.1. Serious injury can result if the pump is dropped or not handled properly. Never lift the RUVAC when connected to a fore vacuum pump.

The RUVAC WH is supplied with standard rubber/metal feet or with optional cast iron feet.

In both cases the feet will be enclosed separately inside the shipping box. Please refer to Figure 2.2 for the correct assembly. Always use the rubber elements to avoid excessive stress being applied to the pump housing. If the pump is hanging on a crane never step under it.

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

Before transporting the pump always drain out the oil (see Section 5.2). Screw the oil-drain plug with its gasket back in and wipe any oil droplets off from the casing.

The pump should be transported and stored in a horizontal position (10° max. tilt). Otherwise 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.

When shelving the pump for a longer period of time you should seal off the flanges of the pump with a piece of foil or similar. 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.

Pumps having a filling of PFPE should be sealed off in a gas-tight manner and vented with nitrogen.

Transportation and Storage

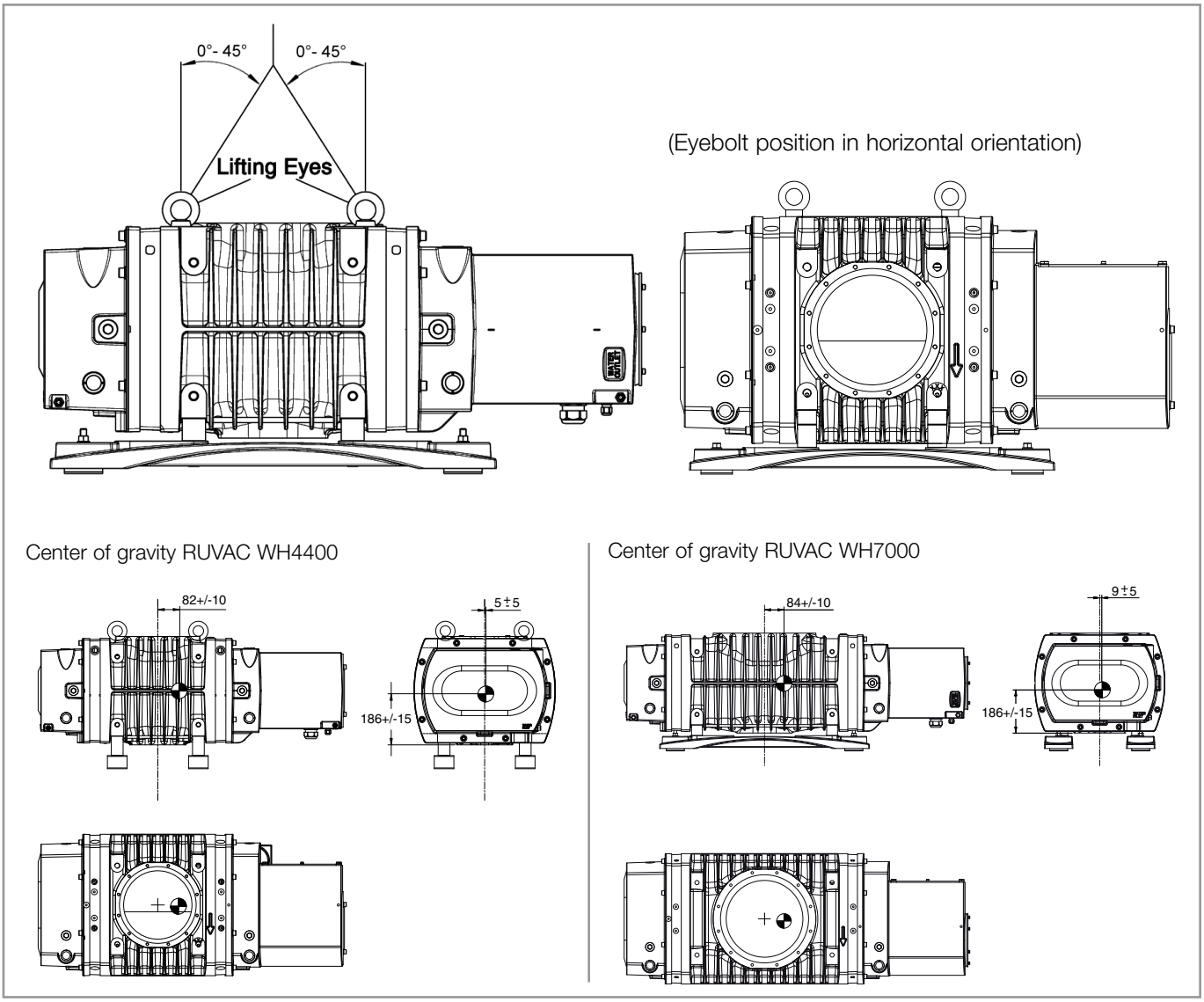


Fig. 2.1 Transporting the RUVAC WH/WHU

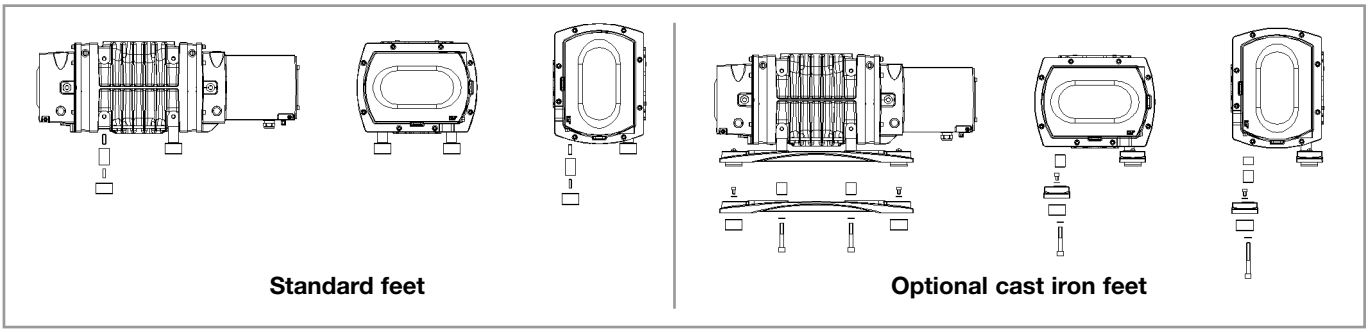


Fig. 2.2 Feet Assembly RUVAC WH/WHU

3 Installation

Only fill in the oil after having installed the pump.

Caution

In the case of the RUVAC WH PFPE also observe the additional information provided in Operating Instructions GA 07.009.

3.1 Installation

Install RUVAC WH/WHU pumps on a flat, horizontal surface (5° max. tilt).

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

Caution

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.

In combination with the maximum allowable differential pressure they can even lead to a damage of the pump.

Caution

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

Install the WH/WHU pumps only in rooms with a roof. Sudden cooling of the pump housing during operation due to water dripping on it will damage the pump.

Secure the pump.
Use the bores at the bottom of the rubber elements.

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).

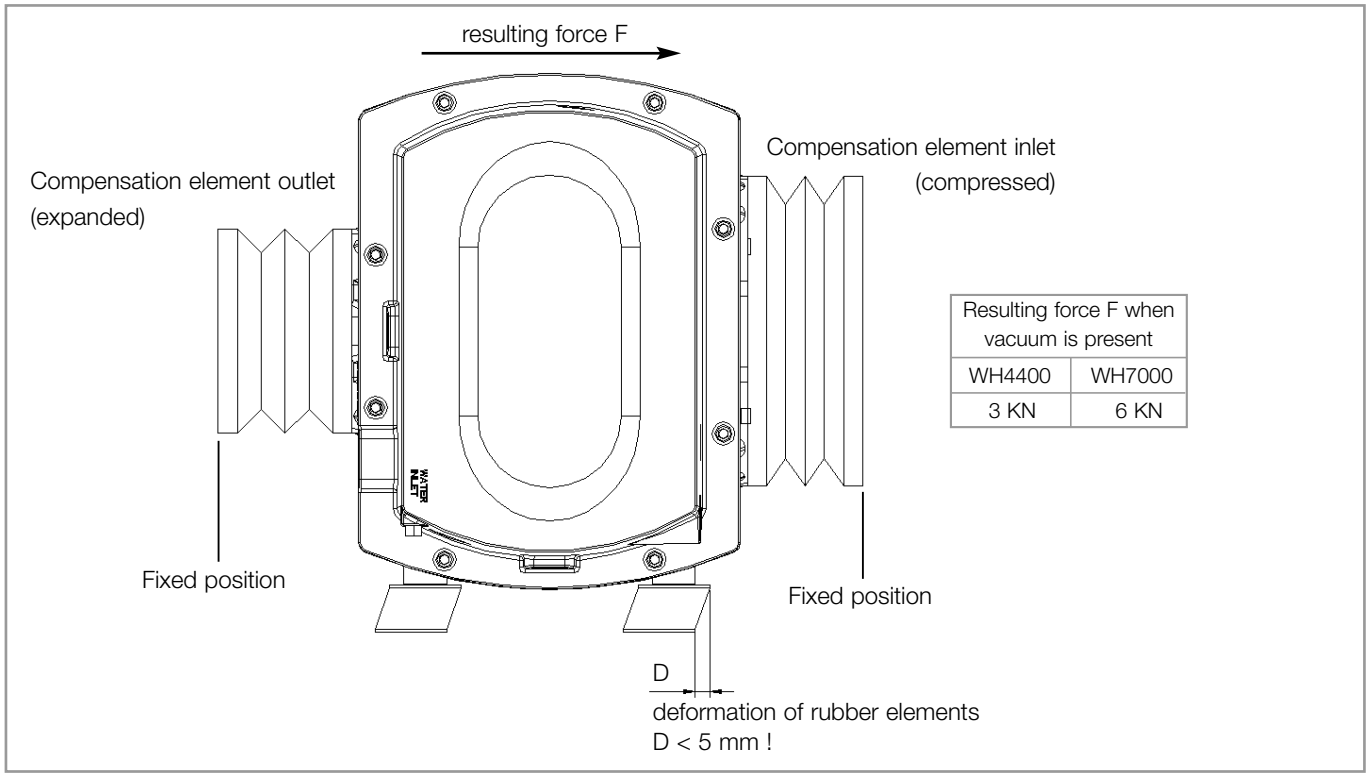
Caution

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.

Warning

Use the following screws:

RUVAC WH 4400 / 7000: 4 x M 12



Resulting force F when vacuum is present	
WH4400	WH7000
3 KN	6 KN

Fig. 3.0 Outer forces on evacuated pumps

3.1.1 Outer forces on evacuated pumps

Due to the large flange area of the RUVAC WH pumps significant forces affect the pipe work that is connected to the pump. If compensation elements are used as recommended it has to be obeyed that due to the different sizes of inlet and outlet flange the forces might not be balanced properly.

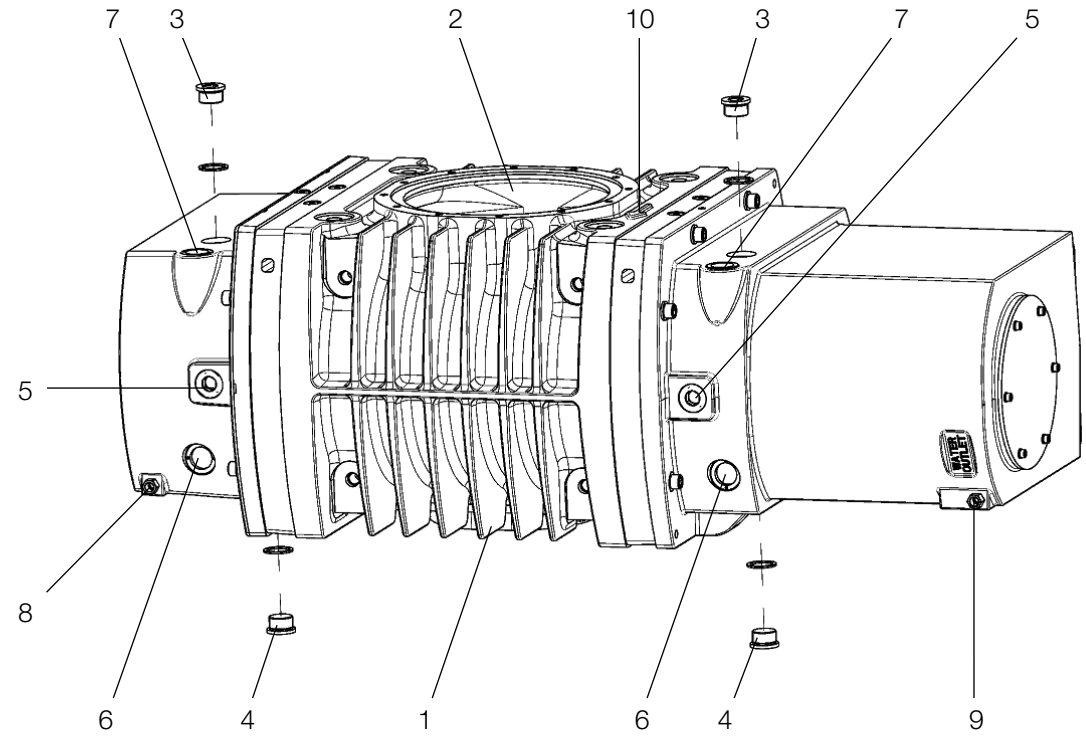
In vertical pumping direction this is typically not a problem if the pump's feet are properly fixed to a stable surface.

In case the feet are not fixed properly the pump might lift up and get out of control if the vacuum is broken. Therefore before evacuating the pump always make sure that the feet are properly fixed.

In horizontal pumping direction the resulting force would overload the rubber elements of the pump feet if not compensated by the pipe work. Always make sure that the compensation elements are designed in a way that a horizontal movement of the pump of 5 mm is not exceeded upon evacuation of the system.

5 mm horizontal deformation (shear) is the maximum that the rubber elements can handle.

If this limitation of shear can not be assured, the rubber elements must be replaced by metal parts. Please consult OLV in this case.



1	Outlet flange	6	Oil-level-glasses (vertical operation)
2	Inlet flange	7	Oil-level-glasses (horizontal operation)
3	Oil inlet ports	8	Cooling water inlet port
4	Oil outlet ports (vertical operation)	9	Cooling water outlet port
5	Oil outlet ports (horizontal operation)	10	Direction of rotation arrow

Fig. 3.1 Connections and controls

3.2 Filling in of the Lubricants

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

Unscrew the oil-fill plugs (4.1/4) and add lubricant. Please note that both oil reservoirs (gear and motor side) have to be filled separately. There is no connection between them.

An oil without additives and of viscosity class ISO VG 100 (formerly SAE 30) must be used for the pump. We recommend the use of our special oil GS555. As PFPE we recommend our NC 1/14 or HE-1600. Please consult us if you intend to run the pump with other oils or special lubricants.

Caution

It needs to be ensured that the oil filling levels stated in Fig. 3.2 which apply to switched off pumps (at standstill) are 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 and the pump could overheat.

Installation

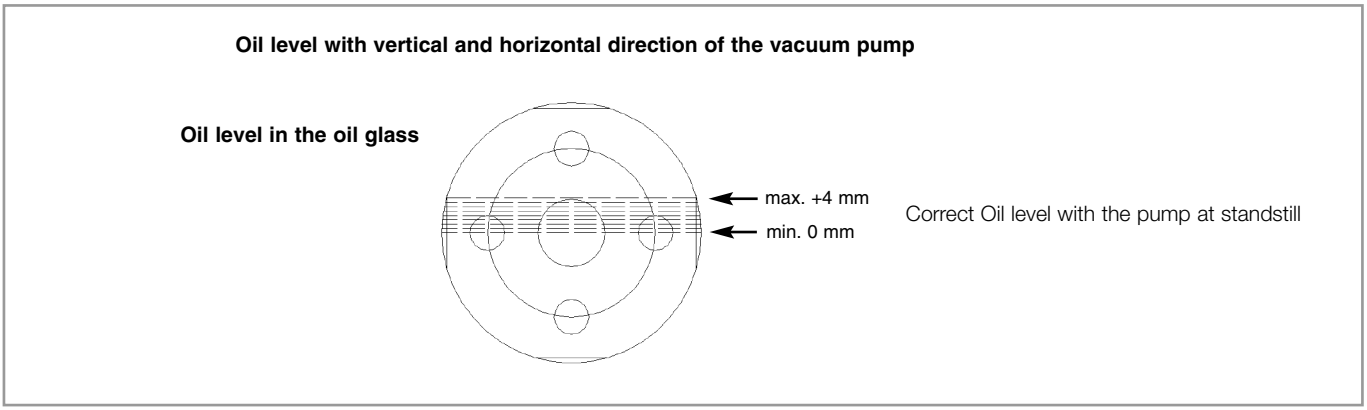


Fig. 3.2 WH (U) 4400, WH (U) 7000, GS555, PFPE oil

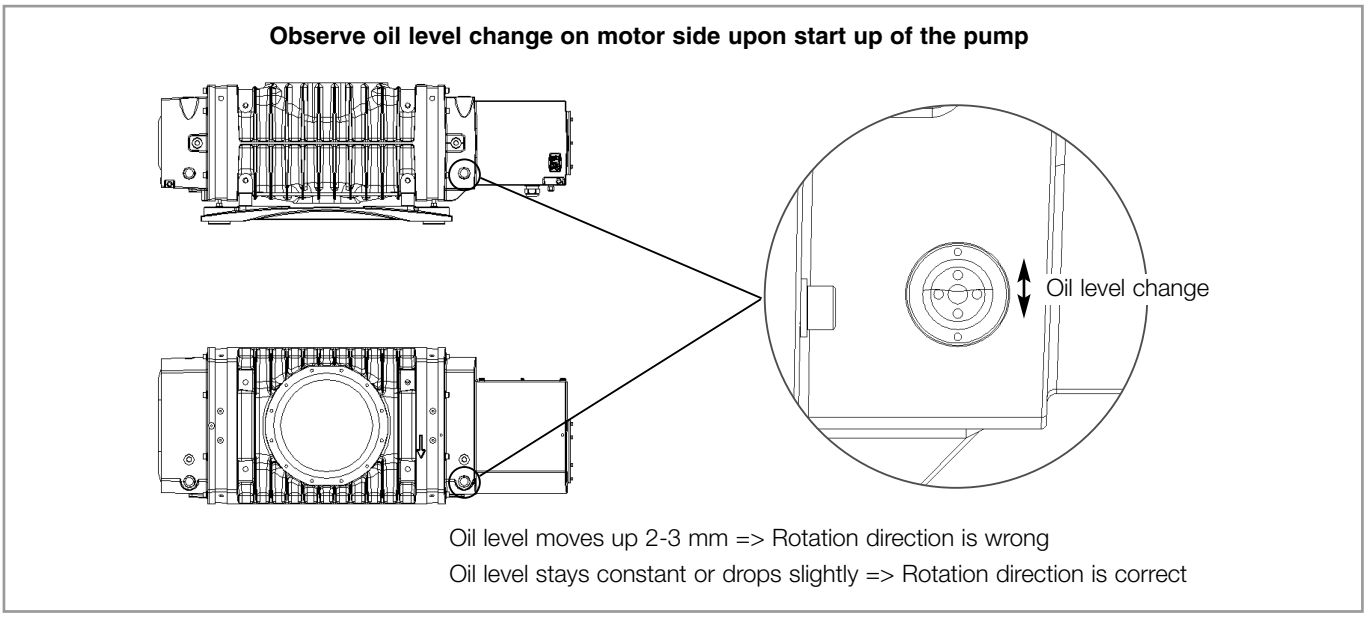


Fig. 3.2.1 Checking the direction of rotation

Caution

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.

3.3 Electrical Connection

Warning

Disconnect the mains before doing work on the wiring.

The electrical connections must only be provided by a trained electrician in accordance with the regulations of the IEC 64 international series of standards.

For proper connection, a suitable motor protection switch must be used. Set the switch in accordance with the rating on the motor nameplate.

The pumps of the RUVAC WH/WHU series may also be operated by a frequency converter. For maximum speeds, refer to Section 1.3. Please note, that at increased speeds and at the available maximum power, the max. permissible pressure difference (see Section 1.3 and 1.3.1) is no longer obtained.

For selecting the right frequency converter for your application please consult OLV.

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.

Caution

Connect the pump to the correct mains voltage through the terminals provided in the junction box (see Fig. 3.3).

Do not link control circuits to the power circuit of the motor. Observe the wiring diagrams of Fig. 3.3.

The RUVAC WH motor is equipped with a temperature switch (PTO) and a temperature sensitive resistor (PTC). When operating the pump you must monitor one of them and make sure that the pump is shut down immediately if the sensor trips. (for recommendations, see Fig. 3.3).

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

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

An arrow (3.1/10) on the pump housing shows the correct direction of rotation for the impeller connected to the motor shaft.

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

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

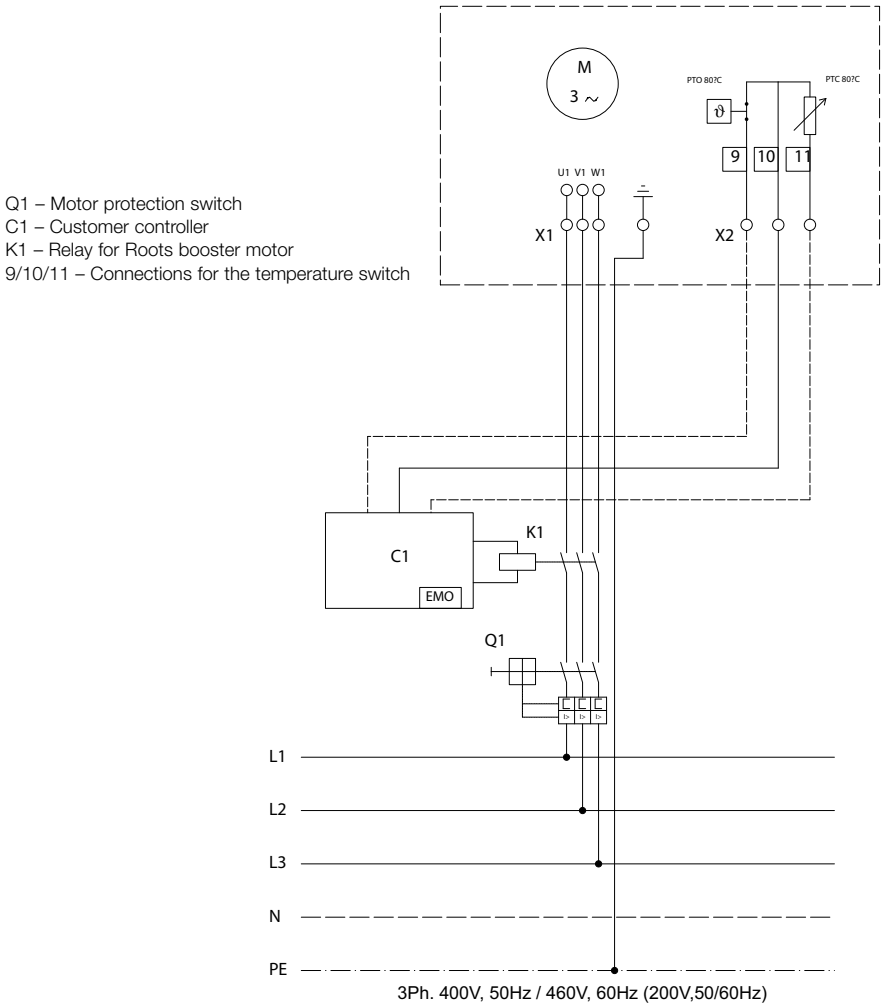
Then rewire as described below, if the direction of rotation is wrong (see Fig. 3.2.1).

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

In a case of deviating voltages an appropriate transformer must be used.

Caution

Installation



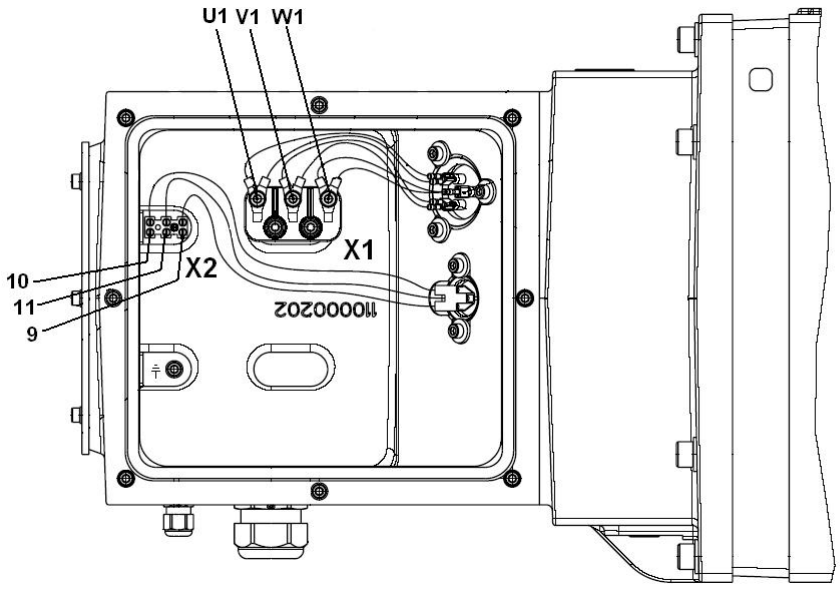


Fig. 3.3 Electrical connection

3.3.1 External Frequency Converter (FC operation)

FC operation serves the purpose of adjusting the speed of the pump (process pressure control). Only frequencies in the range between 20 Hz and 80 Hz may be set up.

Caution

The maximum speed of 80 Hz must not be exceeded! We specifically recommend the use of frequency converters and mains filters which are listed under the heading “Accessories”.

Depending on the level and the quality of the output voltage from the frequency converter the circumstances may be such that not all operating modes of the pump can be run constantly owing to the additional heat produced in the motor coils. For this reason the signals from the temperature sensors (PTCs) in the motor must be evaluated. For the motor power supply line shielded types of cable must be used.

In the case of FC operation considerable electromagnetic interference occurs. Here the limits specified in the pertinent standards and guidelines need to be complied with under all circumstances by the installer. In order to reduce the level of electromagnetic interference, shielded motor cables, shielded cable feedthroughs, mains filters and EMC compliant ground connections are required between frequency converter and pump (see Fig. 3.7). In order to protect the pump, current limits in the frequency converter as a function of the frequency must be taken into account.

Caution

The information provided for the respective frequency converter must be observed under all circumstances!

3.3.2 Frequency Converter

Caution

The frequency converters listed under “Accessories” (Chapter 1.5) serve exclusively the purpose of being able to infinitely vary the speed of the WH 4400 respectively WH 7000. For this reason these frequency converters have been set up (parameterized) accordingly.

Operation of the frequency converter requires the corresponding mains filter. See “Accessories”, Chapter 1.5.

Warning

Under all circumstances observe the information on the frequency converter provided in the enclosed Operating Instructions issued by the manufacturer.

Please read these Operating Instructions and understand the information provided before installing, operating or doing maintenance work on the frequency converter. The frequency converter must be installed in agreement with the information provided in these Operating Instructions and in agreement with the locally applicable regulations. Non-compliance with the safety information can result in serious or even deadly injury, or may damage the products or facilities and systems connected to the product.

The frequency converter has been designed to be installed within an electrical cabinet. Please note particularly the safety information relating to installation and operation.

The FC has been set up in the factory so that the following functions have been assigned to the inputs and outputs listed in the following:

3.3.2.1 Connection Start/Stop

The following connections need to be provided to the bottom terminal strip, see Fig. Terminal Block:

- SC and S6 linked (enable drive)
- SC and S1 linked (start drive)

Excerpt from the FC manual:

Input Terminals:

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-function Digital Inputs	S1	Multi-function input 1 (Closed: Forward run, Open: Stop)	Photocoupler 24 VDC, 8 mA **Note:** Drive preset to sinking mode. When using source mode, set DIP switch S3 to allow for a 24 VDC (± 10 %) external power supply. *Refer to Sinking/Sourcing Mode Switch on page 44.*
	S2	Multi-function input 2 (Closed: Reverse run, Open: Stop)	
	S3	Multi-function input 3 (External fault (N. O.)	
	S4	Multi-function input 4 (Fault reset)	
	S5	Multi-function input 5 (Multi-step speed reference 1)	
	S6	Multi-function input 6 (Multi-step speed reference 2)	
	S7	Multi-function input 7 (Jog reference)	
	SC	Multi-function input common (Control common)	Sequence common
Safe Disable Input	HC	Power supply for safe disable input	+24 VDC (max. 10 mA allowed))
	H1	Safe disable input	Open: Output disabled Closed: Normal operation **Note:** Disconnect wire jumper between HC and H1 when using the safe disable input. The wire length should not exceed 30 m.

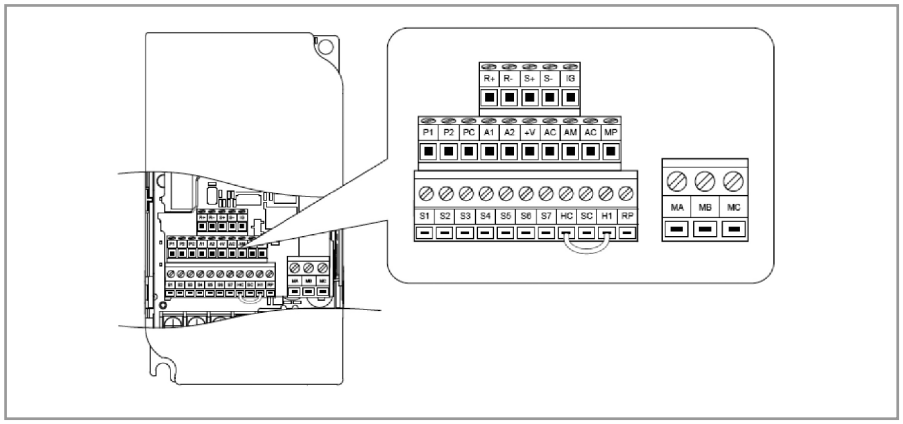


Fig. 3.4 Opened junction box on the frequency converter

Note

If inputs relevant to the safety shall be used, please note the information provided in the Operating Instructions issued by the manufacturer.

3.3.2.2 Connection of the Motor PTC to the Frequency Converter

In order to process the signals provided by the PTCs in the motor, the following connections need to be provided to the middle terminal strip, see Fig. 3.4 Terminal Block:

- Resistor 12 kOhm 0.25 W between terminals +V and A2
- PTC between terminals A2 and AC
- DIP switch S1 in position “V” (left position)

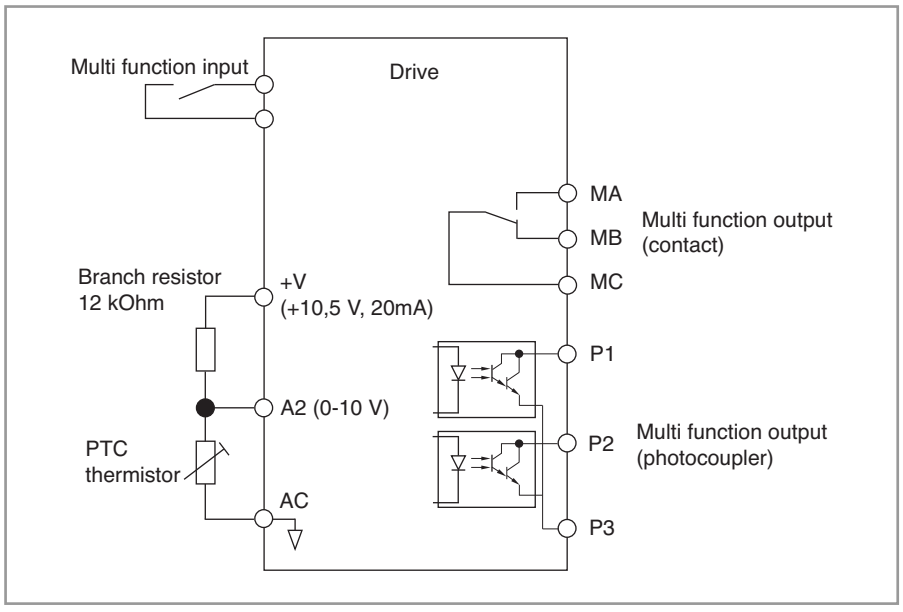
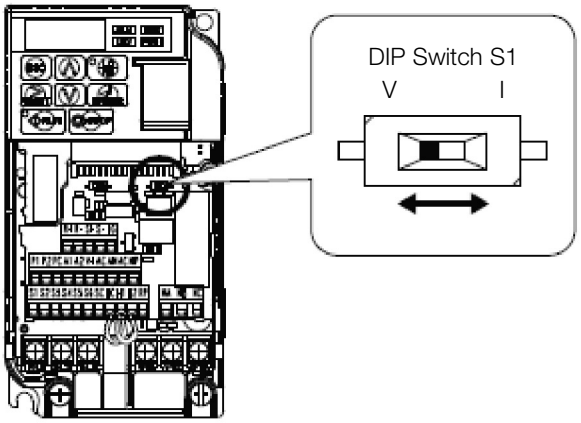


Fig. 3.5 Connection of the motor PTC



Setting Value	Description
V (left position)	voltage input (0 to 10 Volt)
I (right position)	current input (4 to 20 mA or 0 to 20 mA) default setting

Fig. 3.6 DIP switches

3.3.3 Establishing Potential Equalisation

Caution

In the case of operation with a frequency converter and ground leakage currents of over 3.5 mA, the protective ground conductor must have a cross-section of the least 10 mm^2. Or a further protective ground conductor having at least the same cross-section as the connection cable must be provided.

An M 10 thread is provided at the motor housing for connecting the external potential equalisation cable.

The potential equalisation conductor must be connected as depicted in Fig. 3.7.

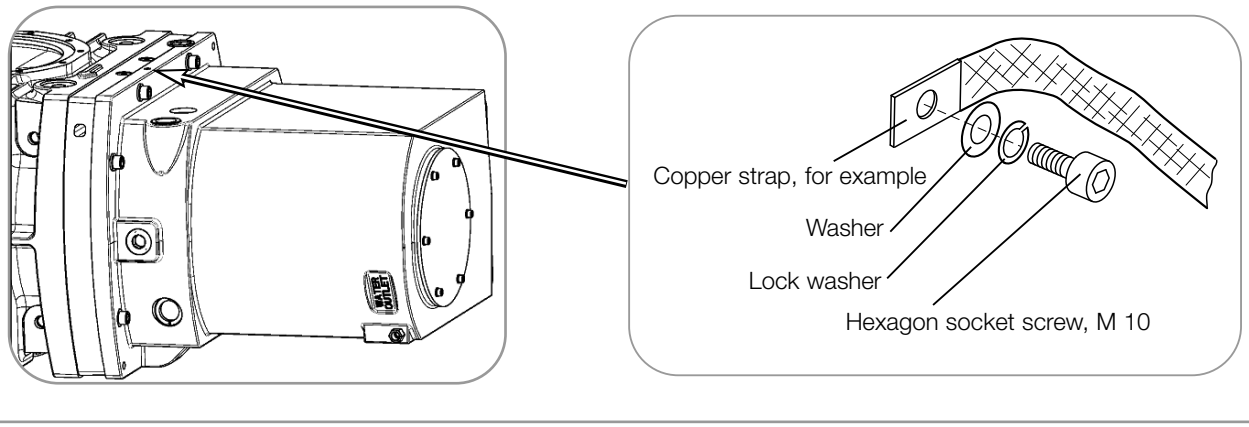


Fig. 3.7 Establishing the potential equalisation at the pump housing

3.4 Connection of the Flanges

Caution

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).

Warning

The RUVAC WH/WHU pumps have **not** been designed to pump ignitable or explosive mixtures without additional protection.

If the pumps are none-the-less to be used under such conditions, the customer himself must ensure that proper measures for the purpose of protection against explosions (pressure monitor, flame arresters etc.) are introduced in line with the requirements of the applicable laws.

Caution

The RUVAC WH pumps are vented with nitrogen for protection during transport. Only remove the packing flanges before immediate connection.

If not already done, remove the protective shipping covers, foil or packing flanges from the flanges (3.1/1) and (3.1/2).

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

Flange the pump to the vacuum system.

Caution

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

Inspect the rubber elements of the pump feet for excess deformation (see Section 3.1).

When attaching the pump directly (without bolting down the feet) to the forevacuum pump, a special adapter has to be used. Please consult OLV in this case.

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

A suitable inlet screen should always be fitted into the intake 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.

Observe the maintenance information provided in Section 5.4.

4 Operation

4.1 Start-up

Caution

Check the pump motor's direction of rotation (see Section 3.3).

RUVAC WHU

The RUVAC WHU can be started together with the backing pump at atmospheric pressure.

It is protected against excessively high pressure differentials by a bypass line.

Caution

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

RUVAC WH

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

For processes in which condensable vapors 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 vapors in the cold pump.
Avoid flushing back of condensate because of wrong piping installation. We strongly recommend a vertical flow direction

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

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

Since k_{eff} is not known in all cases, the following equation may be used

for a first approximation:

$$p_E \sim \frac{\Delta p_{max}}{k_{th} - 1}$$

p_E = Cut-in pressure

Δp_{max} = Maximum permissible pressure difference (see Technical Data)

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

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

1) at the corresponding operating frequency

Example - Pump combination:
RUVAC WH 4400 at 50 Hz / SCREWLINE SP 630

$$k_{th} = \frac{4400\ m^3 \cdot h^{-1}}{630\ m^3 \cdot h^{-1}} \sim 7$$

$$p_E \sim \frac{40\ mbar}{7 - 1} \sim 6.5\ mbar$$

With small vacuum vessels, the maximum permissible pressure differential can be briefly exceeded (max. 3 min) 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.

Note

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

If the RUVAC WH is operated via a frequency converter, it can be treated like a RUVAC WHU. However it is not recommended to repeatedly do shock venting with frequency converter driven pumps because the mechanical forces on bearings and gears may lead to a reduced lifetime.

4.2 Operation

Warning

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 or while the pump is still running.

During operation of the RUVAC, check the lubricant level from time to time and also the condition of the lubricant. Correct as required (see Section 5.2). Normally, the oil GS555 is light-brown. If it turns dark, it could be a sign of ageing. When using PFPE as intended, PFPE will not be subject to ageing.

Caution

Run the Roots pump exclusively under the operating conditions for which it has been designed. Any modification of the operating parameters (e. g. intake pressure, intake 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.

Warning

During normal operation temperatures exceeding 80 °C may occur at the pump housing and at the line on the pressure side. When touching these there is the danger of receiving burns.

Note the labels on the pump.

Never open the oil-fill or oil-drain screws (Fig. 4.1) in the presence of a vacuum or while the pump is running. There is the danger that oil may squirt out.

4.3 Shutdown and Storage

Caution

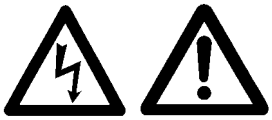
We recommend to keep the RUVAC WH with a PFPE filling running even during prolonged intervals (e. g. over night) with the intake line closed. This can help to avoid corrosion during standstill.

For shutdown, 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 - after 30-60 min. running without process- with dry protective gas (e.g. N_2) 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.

Warning



Before removing pump from the vacuum system, disconnect it from the mains supply. Note any contamination affecting the pump. Comply with all safety regulations.

Before removing the RUVAC WH PFPE from the system it must be purged with nitrogen and sealed in a gas-tight manner.

For transportation and storing of the pump, observe the information provided in Section 2.

4.4 Changing from Vertical to Horizontal Flow

The RUVAC WH/WHUs are supplied as standard for vertical flow. Moreover, the pump may be converted from one flow direction to the other.

For this proceed as follows:

Unscrew the oil drain plugs (4.1/2 and 4.1/4) and drain out the lubricant. Seal off the bottom opening with the oil drain plug using a gasket which is in perfect condition so that a vacuum tight seal is attained again. Remove the feet, turn the pump by 90° as shown in Fig. 1.5 and Fig. 2.2 (dimensional drawing) and mount the feet for the new direction of flow.
Always make sure that proper lifting equipment is used and step back from the pump when turning it. Getting hit by a tilting pump might result in serious injury. It is recommendable to tilt the pump on a soft surface to avoid damage to the painting.

Caution

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

Fill in lubricant (4.1/4); (see Section 3.2).

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

5 Maintenance

5.1 Safety Information (see additionally page 4-6)

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

Warning

Disconnect the electrical power before disassembling the pump. Make absolutely sure that the pump cannot be accidentally started.

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

Observe all safety regulations !

If you send a pump to Oerlikon Leybold Vacuum for repair please indicate any harmful substances existing in or around the pump. For this use the „Declaration of Contamination“ form which has been prepared by us and which we will provide upon request. A pump without a declaration of contamination will not be opened by OLV staff.

Any pump received by us without, or an incompletely filled in declaration will delay the repair.

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

Caution

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

When disposing of used lubricants please observe the relevant environmental regulations.

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 the Oerlikon Leybold Vacuum service.

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

5.2 Exchanging the Lubricant

Caution

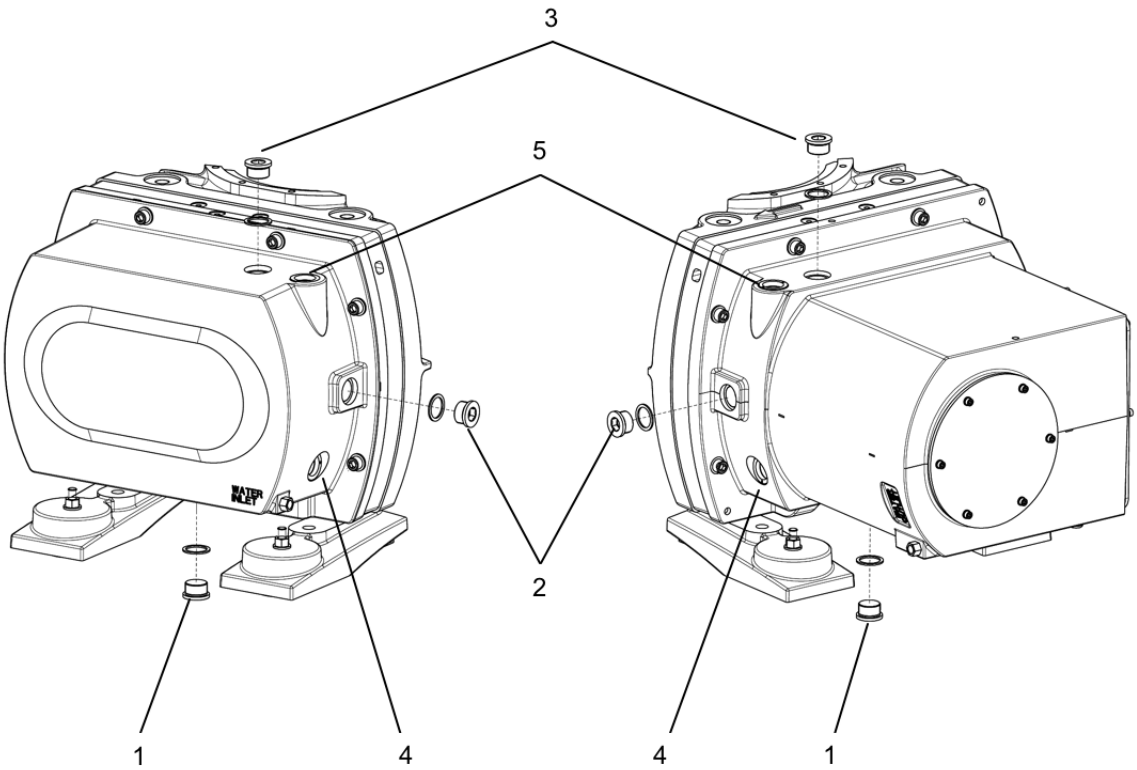
Before pumping oxygen (or other highly reactive gases) at concentrations exceeding the concentration in the atmosphere (> 21 % for oxygen) it will be necessary to use a special pump. Such a pump will have to be modified and de-greased, and an inert special lubricant (like PFPE) must be used.

Observe all safety information provided in Section 5.1.

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.

In the case of clean operating conditions, the lubricant is only consumed due to wear in the bearings and within the gear.

Maintenance



1 Oil drain plug for vertical flow
2 Oil drain plug for horizontal flow
3 Oil filling plug
4 Oil level glasses vertical flow
5 Oil level glasses horizontal flow

Fig. 4.1 Changing the lubricant

When using PFPE as intended, PFPE is not subject to ageing. It must only be changed if it is contaminated by the process gas. It can only be determined for each individual case when the PFPE is so contaminated that it must be changed. To be sure, we recommend changing the PFPE once a year.

Please also take note of the Operating Instructions „PFPE for Vacuum Pumps“ included with the pump.

For recycling contaminated PFPE we ask you to consult us. As PFPE we recommend our NC 1/14 or the HE-1600.

Change the oil more frequently when pumping corrosive vapors 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 exceeds 2, an oil exchange will be required.

Warning

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.

Unscrew the oil-drain plugs (4.1/2) and the oil-fill plugs (4.1/3) and drain the oil.

Clean the sealing surface and firmly reinstall the oil-drain plugs (4.1/2) or (4.1/4) 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 ºC to 25 ºC.

For oil quantities and ordering data see Sections 1.3 and 1.4.

Make sure to use the right kind of oil. PFPE pumps are marked with a red label.

Only use Oerlikon Leybold Vacuum oil.

Caution

Mineral oils, synthetic oils and PFPE do not mix.

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

It must be observed under all circumstances that the oil filling levels stated in Fig. 3.2 - which apply to the shutdown (standing still) pump - are maintained correctly.

Caution

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 (4.1/3) using a gasket which is in perfect condition. Wipe off any oil residues from the casing.

5.3 Cleaning the inlet screen

Warning

Observe all safety information provided in Section 5.1.

A wire-mesh sieve is located in the intake 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 intake line. Remove the inlet screen from the intake flange and rinse it using a suitable solvent. Then thoroughly dry it with compressed air. If the inlet screen is damaged, replace it.

5.4 Cleaning the Pumping Chamber

Warning

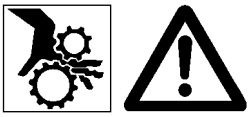
Observe all safety information provided in Section 5.1.

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

Warning



During cleaning, the blower must be turned only by hand.

Please make sure that the impellers are turned in a way that fingers or hands can not be trapped between the impellers or between impellers and housing. Due to the high mass and inertia of the impellers serious injuries can occur even if the impellers are turned by hand only.

Caution

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.

5.5 Service at Oerlikon Leybold Vacuum

If you send a pump to Oerlikon Leybold Vacuum indicate whether the pump is free of substances damaging to health or whether it is contaminated.

If it is contaminated also indicate the nature of hazard. To do so, you must use a preprinted form which we shall send to you upon request.

A copy of this form is reproduced at the end of these Operating Instructions: “Declaration of Contamination of Compressors, Vacuum Pumps and Components”. Moreover, you may download a suitable form from the Internet:
www.oerlikon.com → Oerlikon Leybold Vacuum → Documentation → Download Documents.

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

This “Declaration of Contamination” is required to meet the requirements of German Law and to protect our personnel.

Oerlikon Leybold Vacuum must return any pumps without a “Declaration of Contamination” to the sender’s address.

Before packaging (respectively shipping) the pump it should, if possible, be purged with inert gas, but as a minimum requirement it should be completely emptied of all pumped substances.

Warning

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

Oerlikon Leybold Vacuum is 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.

5.6 Maintenance Schedule

No.	Process	Meas./test quantity Operating/auxiliary materials	Maintenance interval					Remark
			Bef. switching on	daily	Weekly	1/4 yearly	Yearly	
1	Check the oil level	min./max. oil level in oil level glass	x	x				Check oil level while the pump has been shut down (see Sec. 3.2 with Fig. 3.2 and 3.2.1).
2	Oil quality	visual			x			In the normal state, PFPE is light, clear and transparent. In the case of black oil an oil change is necessary (see Section 5.2).
		Neutralisation value (DIN 51 558)			When pumping corrosive vapors in the case of much dust and for cyclic operation. If the neutralisation number is > 2 and oil changes required (see Section 5.2).		For normal operating conditions	
3	Exchange the oil				When pumping corrosive vapors in the case of much dust and for cyclic operation. If the neutralisation number is > 2 and oil changes required (see Section 5.2).		For normal operating conditions	Oil change (see Section 5.2) ■ Order No. PFPE (Cat. No. see Section 1.3) ■ Waste oil disposal (see page 3).
4	Check leak tightness of the cooling water connections					x		

6 Troubleshooting

Malfunction	Likely cause	Remedy	Repair
Pump does not start up	Motor/frequency converter incorrectly connected.	Connect motor/frequency converter correctly.	3.3
	Overtemperature switch or motor stator defective.	OLV-Service	-
	Pressure switch is defective.	Replace the pressure switch.	3.3
	Lubricant is too thick.	Exchange the lubricant or warm up lubricant and pump.	5.2
	Motor rotor defective.	OLV-Service	_
	Pump has seized: detectives pistons, bearings or toothed gears.	OLV-Service	_
Pump gets too hot	Ambient temperature is too high or cooling air flow is obstructed.	Install the pump at a suitable place or ensure a sufficient flow of cooling air.	3.1/5.3
	Pump is operating in the wrong pressure range.	Check the pressure levels within the system.	_
	Pressure differences too high.	Check the pressure levels within the system.	_
	Gas temperature is too high.	Check system.	_
	Clearance between housing and rotors are too small due to		
	- contamination	Clean pumping chamber.	5.4
	- distortion of the pump	Affix and connect the pump free of tensions.	3.1/3.4
	Friction resistance is too high due to contaminated bearings and/or contaminated lubricant.		
	Lubricant level is too high.	Drain lubricant down to the correct level.	5.2
	Lubricant level is too low.	Top up lubricant to the correct level.	5.2
	Wrong lubricant filled in.	Drain lubricant, fill in correct lubricant.	5.2
	Bearing is defective.	OLV-Service	_
	Fan improperly/not connected.	Connect the fan correctly.	3.3
	Fan defective.	OLV-Service	-
	Valve of the pressure balance line does not open.	Clean the valve or have it repaired.	5.5
Power consumption of the motor is too high. Pump is to loud.	Like „Pump gets too hot“.	Like malfunction „Pump gets too hot“.	-
	Incorrect mains voltage for the motor.	Connect the motor to the correct mains voltage.	1.3/3.3
	Motor stator defective.	Leybold-Service	-
	Motor rotor defective.	Leybold-Service	-
	Distances between housing and rotors is too small due to		
	- contamination	Clean pumping chamber.	5.4
	- distortion of the pump	Affix and connect the pump free of tensions.	3.1/3.4
	Bearing or gear damage.	OLV-Service, shutdown the pump immediately.	-
	Pistons make contact with the housing.	OLV-Service, shutdown the pump immediately.	-
	Rotor is running untrue.	OLV-Service, shutdown the pump immediately.	-
	Oil splash duct makes contact with the gear housing or the oil pipe.	OLV-Service.	-
	Oil pump is blocked or defective.	OLV-Service, shutdown the pump immediately.	-
Pump is losing lubricant	Lubricant leak is apparent:		
	Oil drain plug is leaky. ..	Drain lubricant, firmly screw in a new oil drain plug with the gasket, fill in correct lubricant quantity	5.2
	Oil level glasses leaky.	OLV-Service	-
	Gear cover is leaky.	Replace the O-ring of the gear cover.	-
	No lubricant leak is apparent:		
	See malfunction „Lubricant in the pump chamber“.	See malfunction „Lubricant in the pump chamber“.	-
Oil gets too dark	Oil has been used up.	Exchange the oil.	5.2
	Pump gets too hot.	See malfunction „Pump gets too hot“; after remedy of the malfunction, exchange the oil.	-
Lubricant in the pump chamber.	Lubricant level is too high.	Drain the lubricant down to the correct level.	5.2
	Lubricant is ejected from the system.	Check system.	-
	Pump is not standing horizontally.	Place the pump correctly.	3.1
	Pump has a gas leak towards the outside.	Check to see that the oil fill and oil drain plugs are correctly seated, if required replace gaskets.	5.2
		Replace the O-ring of the gear cover.	-
	Pump has an internal leak.	OLV-Service	-
	Piston rings are defective.	OLV-Service	-
Pump does not attain its pumping speed.	Inlet screen is clogged.	Clean inlet screen.	5.3
	Motor incorrectly connected.	Connect motor correctly.	3.3
	Motor stator defective.	OLV-Service	-
	Motor rotor defective.	OLV-Service	-
	Pump vacuum pump system has a gas leak.	Detect leak and seal it.	-
	Piston play is too great.	OLV-Service	-
	Bearing defective.	OLV-Service	-
	Valve of the pressure balance line does not close.	Clean the valve or have it repaired.	5.5

* Repair information: refer to the section stated in the Operating Instructions

Wearing and original parts

7 Wearing and Original Spare Parts

Original spare parts are available from the Oerlikon Leybold Vacuum Service facilities.

8 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
Risk to health and the environment

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 Section “5.6 Oerlikon Leybold Vacuum Service”. We offer this service. Further details are available on request.

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CE

EG- Konformitätserklärung

Hiermit erklären wir, die Oerlikon Leybold Vakuum GmbH, dass die nachfolgend bezeichneten Produkte in der von uns in Verkehr gebrachten Ausführung den einschlägigen EG-Richtlinien entsprechen.

Bei einer nicht mit uns abgestimmten Änderung eines Produktes verliert diese Erklärung ihre Gültigkeit.

Die Einhaltung der EMV -Richtlinien setzt einen EMV -angepassten Einbau der Komponenten in der Anlage oder Maschine voraus.

Bezeichnung der Produkte: „Wälzkolbenvakuumpumpe RUVAC"

Typen: **RUVAC WH4400, RUVAC WH7000**

Kat-Nr.: 155150, 155151, 155154, 155155, 155156, 155160, 155161, 155164, 155165, 155167

Die Produkte entsprechen folgenden Richtlinien:

- EG-Maschinenrichtlinie (98/37/EG)
- EG-Niederspannungsrichtlinie (2006/95/EG)
- EG-Richtlinie Elektromagnetische Verträglichkeit (2004/108/EWG)

Angewandte harmonisierte Normen:

- EN 1012 -2, 1996
  Sicherheitsanforderungen an Kompressoren und Vakuumpumpen,
  Teil 2: Vakuumpumpen
- EN 60034 - 1, 2004
  Drehende elektrische Maschinen
  Teil 1: Bemessungen und Betriebsverhalten
- EN 60204 - 1, 2006
  Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen
  Teil 1: Allgemeine Anforderungen

Köln, den 19.12.2008

Dr. Ulrich Jung
Head of Research & Development
Vice President

Köln, den 19.12.2008

i.V.

Harald Udelhoven
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Safety information
on contamination of compressors, vacuum pumps and components.

Scope

Every employer (user) is held responsible for the health and safety of his employees. This also applies to service personnel performing maintenance work either at the premises of the user or the service company in charge.

By means of the declaration attached the contractor is to be informed about any possible contamination of the compressor, vacuum pump or component sent in for servicing. Based on this information the contractor will be able to take the necessary safety precautions.

Preparation before dispatch

Before shipping any parts, the user must complete the following declaration and add it to the dispatch papers. All dispatch instructions laid down in the manual must be followed e.g.:

Drain all service fluids
Remove filter elements
Seal all openings airtight
Pack / handle appropriately
Attach the declaration of contamination **outside** of the packaging

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Declaration of Contamination of Compressors, Vacuum Pumps and Components

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

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

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

Customer/Dep./Institute : _____

Address : _____

_____

_____

Person to contact: _____

Phone : _____ Fax: _____

End user: _____

Reason for return: ☒ applicable please mark

Repair: ☐ chargeable ☐ warranty

Exchange: ☐ chargeable ☐ warranty

☐ Exchange already arranged / received

Return only: ☐ rent ☐ loan ☐ for credit

Calibration: ☐ DKD ☐ Factory-calibr.

☐ Quality test certificate DIN 55350-18-4.2.1

A. Description of the product:

Material description : _____

Catalog number: _____

Serial number: _____

Type of oil (ForeVacuum-Pumps) : _____

Failure description: _____

_____

Additional parts: _____

Application-Tool: _____

Application- Process: _____

B. Condition of the equipment

	No [1]	Yes	No
1. Has the equipment been used	☐	☐	→
2. Drained (Product/service fluid)		☐	☐
3. All openings sealed airtight		☐	
4. Purged		☐	☐
If yes, which cleaning agent			
and which method of cleaning			

[1] If answered with "No", go to **D**. ←

Contamination :	No [1]	Yes
toxic	☐	☐
corrosive	☐	☐
flammable	☐	☐
explosive [2]	☐	☐
radioactive [2]	☐	☐
microbiological [2]	☐	☐
other harmful substances	☐	☐

↓

C. Description of processed substances (Please fill in absolutely)

1. **What substances have come into contact with the equipment** ?
   Trade name and / or chemical term of service fluids and substances processed, properties of the substances
   According to safety data sheet (e.g. toxic, inflammable, corrosive, radioactive)

X	Tradename:	Chemical name:
a)		
b)		
c)		
d)		

	No	Yes
2. **Are these substances harmful ?**	☐	☐ ←
3. **Dangerous decomposition products when heated ?**	☐	☐

If yes, which ? _____

[2] **Components contaminated by microbiological, explosive or radioactive products/substances will not be accepted without written evidence of decontamination.**

D. Legally binding declaration

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

Name of authorized person (block letters) : _____

_____ Date

_____ signature of authorized person

firm stamp

17200001_002_A1

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LV_10127_2009 08.09