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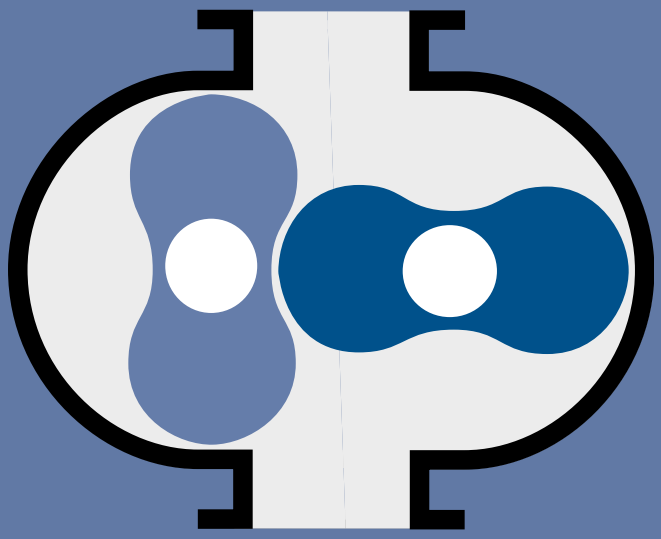

C07

RUVAC

Roots Vacuum Pumps
Single-Stage
250 - 13000 $m^3 \times h^{-1}$ (147.3 - 7657 cfm)

Leybold vacuum

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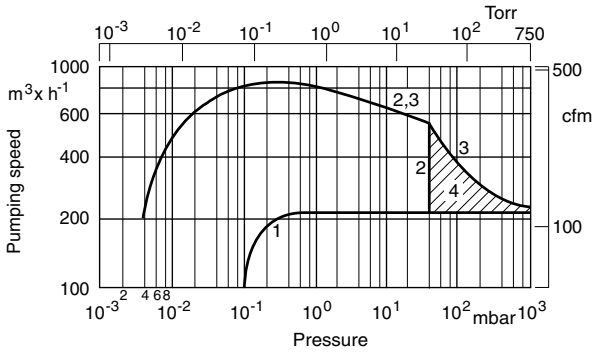
General Information on Roots Vacuum Pumps

Applications

For many years now Roots vacuum pumps have been well established in the area of vacuum technology.
In combination with backing pumps, which compress against the atmosphere, these pumps offer the following advantages:

Shifting the Operating Pressure into the High Vacuum Range

As a rule of the thumb one may say that Roots vacuum pumps are capable of improving the attainable ultimate pressure of a pump system by a factor of 10. With two Roots vacuum pump stages and a corresponding backing pump it is possible to attain pressures in the range down to 10^{-5} mbar (0.75×10^{-5} Torr). Under certain circumstances this will make the use of additional high vacuum pumps (turbomolecular pumps or diffusion pumps) unnecessary.



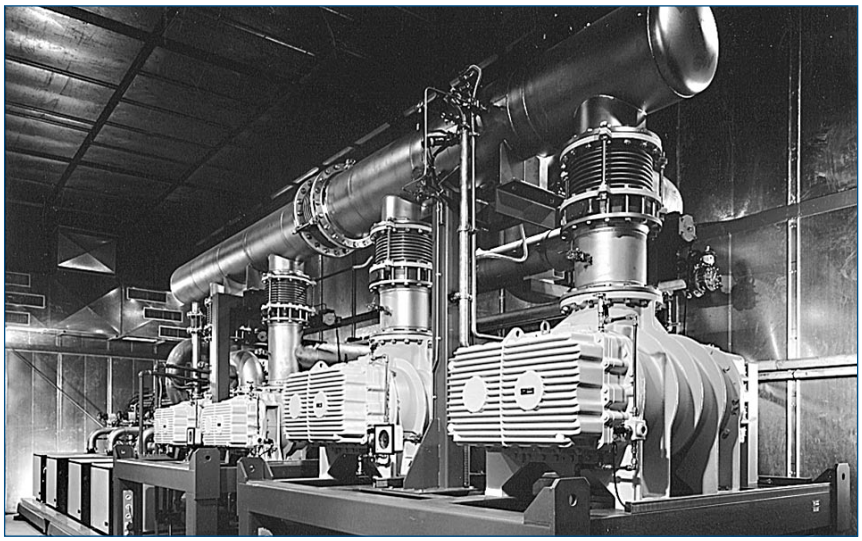
1 Pumping speed of the backing pump
2 Pumping speed of the Roots pump system without pressure equalization line
3 Pumping speed of the Roots pumpsystem with pressure equalization line
4 Pumping speed gained by the pressure equalization line

Comparison of pumping speed characteristics with and without pressure equalization line

Multiplied Pumping Speed

Due to the non-contact rotation of the impellers, Roots vacuum pumps are able to run at higher speeds. Thus a high pumping speed is obtained with a relatively small size pump. Pumping speeds in excess of 1000 m^3/h (589 cfm) can only be attained with Roots vacuum pumps.

When selecting the right kind of backing pump (sizing) it will be possible to pump large quantities of gas in connection with smaller backing pumps. Energy consumption of such a pump system is much less compared to a single backing pump offering the same pumping speed.



Pump system with RA Roots vacuum pumps

The use of Roots vacuum pumps in the area of vacuum technology has resulted in further specializations and improvements:

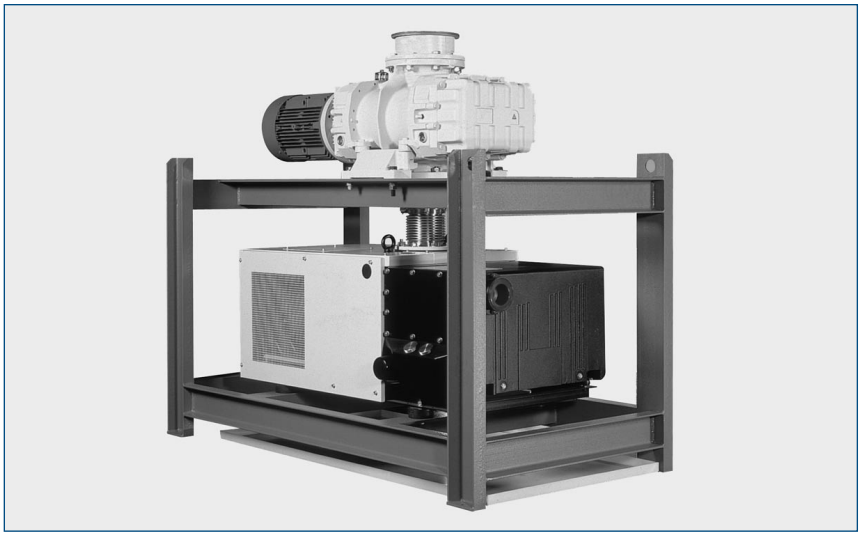
- Through an integrated bypass (pressure equalization line) it is also possible to utilize the pumping speed of the Roots vacuum pump at high pressures and large quantities of gas at an early stage. This reduces the pumpdown time especially for cyclic operation (see figure “Comparison of pumping speed characteristics with and without pressure equalization line”).
- High-purity gases or hazardous gases impose strict requirements on the leak-tightness of the system. Canned motors are hermetically sealed. There are no seals in contact with the atmosphere which might be subject to wear. This prevents leaks and failures due to oil leaks. A service life of over 20000 hours without maintenance is quite common.
- Tolerances and the quality of the balancing combined with forcefed lubricated bearings and toothed gears permit high speeds and the use of frequency converters. Thus it is possible to attain a high pumping speed while the process is in progress and to reduce the speed when the process has been stopped or while changing the batch. This results in a lower consumption of energy and a longer service life with uncompromised reliability.
- Conversion from vertical to horizontal flow is easily implemented and can be performed at the place where the pump has been installed. Thus the pump can be adapted more closely to the operating conditions of your system.

Lately, a further characteristic is gaining prominence: Roots vacuum pumps are capable of compressing the media in the pump chamber without the presence of any further media. This mostly avoids interaction between different media in the pump itself and also in the connected vacuum chamber. Therefore

- the medium which is pumped is not contaminated with lubricants or sealants; complex accessories (exhaust filters, separators, etc.) are not needed;
- the lubricant in the side chambers is hardly affected, so that service life is not reduced;
- backstreaming of oil from the backing pump into the connected vacuum chamber is prevented.

The effective air cooling arrangement reduces operating costs to a minimum. Cooling water is not required.

These characteristics make the Roots vacuum pump attractive for almost all rough and medium vacuum applications.



Pump system with RA Roots vacuum pump and SOGEVAC rotary vane vacuum pump

Semiconductor Technology

In the area of semiconductor technology, Roots vacuum pumps are found in etching processes among others, and in use with dry compressing vacuum pumps.

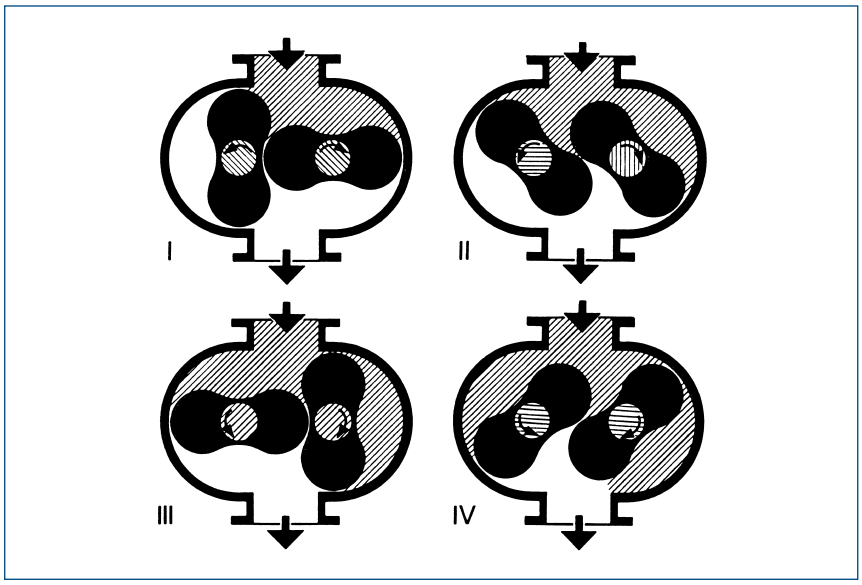
The pumping speed of the combination of backing pumps amounts to 200 to 500 m^3/h (118 to 295 cfm) and it ensures a cut-in pressure of 10^{-1} mbar (0.75×10^{-1} Torr) for the turbomolecular pump. In the case of dry compression, corrosive gases which also have a high particulate content must be pumped.

Canned motors and PFPE fluids provide a good seal against the outside and allow long periods between servicing, high reliability and thus very low operating costs (WS PFPE types).

Specific suitable for this processes and use in clean rooms are Roots vacuum pumps filled with PFPE and water-cooled motors.
These kind of motor has only a little heat dissipatoion.

Central Vacuum Supply Systems

Large Roots vacuum pumps, usually in connection with single-stage rotary vane vacuum pumps serve several consumers of vacuum (packaging machines, for example) at the same time.



Operational diagram of a single-stage Roots vacuum pump (with vertical pumping action)

Due to the uncontrolled influx of gas, a high of pumping speed must be attained quickly, in order to keep the vacuum (1 to 30 mbar (0.75 to 22.5 Torr)) permanently available to all consumers. This in particular, is implemented by Roots vacuum pumps having a pressure equalization line (WAU types).

Chemistry

Replacement of vapor jet or gas jet pumps on liquid ring pumps in drying and distillation plants is necessary for attaining the required operating pressure of about 1 mbar (0.75 Torr). Reduction of operating costs by entirely eliminating vapor or gas quantities includes separation of these on the pressure side (WA and RA types).

Laser Systems

Continuous circulation of the gas in order to remove heat from a closed cycle in which pressure differentials of up to 100 mbar (75 Torr) must be maintained. The tough requirements regarding purity necessitate a total absence of contamination by oil and dust. This is ensured by reducing the pressure level in the oil chambers as well as by coating the pump chamber. The pumps are assembled and tested under clean room conditions.

The canned motor ensures a high degree of leak-tightness to the outside and permits operation in connection with a frequency converter (WSLF types).

Operating Principle

Roots vacuum pumps, which are also called Roots blowers, are rotary plunger type pumps where two symmetrically shaped impellors rotate in opposite directions inside the pump housing.

The figure-of-eight rotors are synchronized by a gear which ensures that the impellors are counter-rotating in such a way, that they are near to one another and to the housing without actual contacting.

In rotor positions I and II (see figure “Operational diagram of a single-stage Roots vacuum pump (with vertical pumping action)”) the volume of the intake is increased. As the rotors turn further to position III a part of the volume is cut off from the intake side.

In position IV this volume is opened to the exhaust side and gas under fore-vacuum pressure (higher than the intake pressure) flows in. This gas compresses the gas coming from the intake. As the rotors turn further the compressed gas is ejected through the exhaust flange.

This process repeats itself twice for each rotor per full turn.

As the rotors do not come into contact with the pump’s housing Roots vacuum pumps may be operated at high speeds. Thus a high pumping speed is obtained from comparably small pumps.

The pressure difference and the compression ratio between intake and exhaust is limited in Roots vacuum pumps.

In practice the maximum attainable pressure difference is of significance only in the rough vacuum range ($p > 10$ mbar ($p > 7.5$ Torr)) where-as in the medium vacuum range ($p < 1$ mbar ($p < 0.75$ Torr)) the attainable compression ratio is of importance.

Roots vacuum pumps from Leybold have been designed to specially meet the requirements of the fine vacuum range. They are normally used in connection with backing pumps (exception RAV) or in closed gas cycles (WSLF series).

Design

The pump chamber of Roots vacuum pumps is free of any sealing agents or lubricants. Only the toothed wheels of the synchronous gear are lubricated with oil. Toothed gear wheels and bearings of the RUVAC are placed in two side chambers which also contain the oil reservoir. These two side chambers are separated from the pump chamber by piston ring seals.

Suitably designed oil supply systems in both chambers ensure that a sufficient quantity of oil is supplied to the gear wheels and bearings at all permissible speeds.

Almost all RUVAC Roots vacuum pumps are designed for a horizontal and vertical pumping action.

Pump system consisting of RUVAC WAU 1001 and SOGEVAC SV 200

Types

Various types of Roots vacuum pumps have been developed to ensure optimum adaptation to the widely varying applications for this type of pump.

- **Flange mounted motor**
  The drive shaft of the pump is directly connected to an electric motor via a flexible coupling. The required seal of the drive shaft against atmospheric pressure is obtained by oiled shaft seals.
- **Canned motor**
  In the canned motor, rotor and stator pack are separated by a vacuum-tight can made of a non-magnetic material. The rotor operates on the drive shaft of the pump in the vacuum, so that a shaft seal which would be subject to wear is not required.
- **Pressure equalization line**
  The integrated pressure equalization line connects the exhaust flange to the intake flange through a differential pressure valve.
  This valve opens at a high pressure differential between the flanges. Part of the gas then flows through this line back to the intake flange. This is why the Roots vacuum pump may be switched on at atmospheric pressure together with the backing pump. This also increases the pumping speed of the pump combination at high intake pressures.
- **Special ACE vibration absorber**
  These pumps are best used in applications involving frequent pumpdown cycles. The vibration absorber is of an oil sealed or filled design where minute amounts of oil may enter the vacuum system via the piston of the vibration attenuator.

RUVAC WA/WAU, WS/WSU

The series WA/WAU Roots vacuum pumps are provided with directly flange-mounted air-cooled standard three-phase motors. The oiled radial sealing rings of the RUVAC WA/WAU for sealing the shaft against the atmosphere are made of FPM (fluor caoutchouc).

The WS/WSU series pumps are driven by air or water-cooled canned motors.

Roots vacuum pumps of the series WAU/WSU are provided with an additional integrated pressure equalization line and a differential pressure valve.

Pumps from these series are supplied with a vertical pumping action as standard.

RUVAC WS with FC

This type of pump is equipped with an integrated frequency converter fitted directly to the canned motor. The frequency converter has been specially matched to the pump.

The main characteristics of the RUVAC WS are:
Simulation of a pressure equalisation line
The frequency converter has been matched to the pump so that the possibility of mechanically over-loading it is excluded. In the case of a pressure difference which is too high, the rotational speed of the pump is automatically reduced until its load drops in to the permissible range.

This WS type with integrated frequency converter can be switched on together with the backing pump at atmospheric pressure. In this way significantly shorter pumpdown times are attained. When using this mode of operation, the minimum pumping speed rating of the backing pump needs to be observed.

Operation at any rotational speeds
The frequency converter is equipped with a 0 to 10 V signal input and is thus in a position to control the rotational speed of the pump.

Increasing the pumping speed
The pump is prepared to handle a maximum rotational speed of 6000 rpm so that the frequency converter permits an increase in the nominal pumping speed of up to 100 %.

Note
Please enquire about possibly existing usage limits (process dependent).

RUVAC WSLF

The pumps of these series are especially adapted Roots vacuum pumps from the RUVAC WS series which are intended for operation with gas lasers.

They are driven by a canned motor so that a shaft seal for sealing against atmospheric pressure is not required.

Air-cooled series with nominal pumping speeds of 1000 $m^3 \times h^{-1}$ (589 cfm) are available.

The RUVAC WSLF series with increased motor ratings is intended for operation in connection with frequency converters.

These pumps are available with nickel-plated or plasma-nitrated surface as standard.

All pumps of these series are supplied with a horizontal pumping action.

Vertical pumping action is available upon request.

RUVAC RA

RA series Roots vacuum pumps are equipped with a directly flange-mounted three-phase motor (RA 13000 via V-belt drive).

Backing Pumps

The backing pumps from Leybold listed in the following are recommended for connection to the RUVAC Roots vacuum pumps:

- Rotary vane vacuum pumps
  - TRIVAC B with pumping speeds between 16 and 65 $m^3 \times h^{-1}$ (9.4 and 38.3 cfm)
  - SOGEVAC with pumping speeds between 16 and 1200 $m^3 \times h^{-1}$ (9.4 and 707 cfm)
- Dry compressing piston vacuum pumps
  - EcoDry M with pumping speeds between 38 and 48 $m^3 \times h^{-1}$ (22 and 28 cfm)
- Dry compressing screw vacuum pumps
  - ScrewLine SP250 and SP630 with pumping speed of 250 and 630 $m^3 \times h^{-1}$ (147 and 371 cfm)
- Rotary piston vacuum pumps
  - E and DK with pumping speeds between 200 and 250 $m^3 \times h^{-1}$ (117.8 and 147.3 cfm)
- Roots vacuum pumps with pre-inlet cooling
  - RUVAC RAV G with pumping speeds between 250 and 8100 $m^3 \times h^{-1}$ (147.3 and 4770.9 cfm)
- Liquid ring vacuum pumps upon request

Accessories

Frequency Inverter RUVATRONIC RT 5

The electronic frequency inverters RUVATRONIC RT 5/251 to 5/16000 have been designed specially for use in connection with Leybold Roots pumps of the RUVAC type.

For each Roots vacuum pump size, a matching frequency inverter is available.

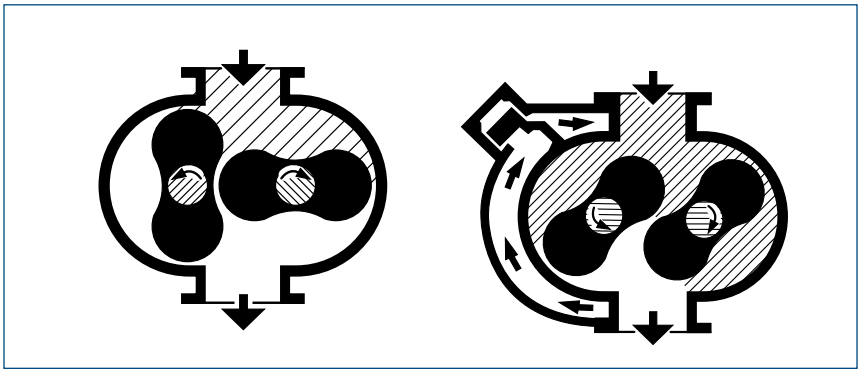
The main characteristics of the RUVATRONIC RT 5 are:
Simulation of a pressure equalisation line
The software of the frequency inverters is adapted to each pump and ensures that the risk of mechanically overloading the pump can be excluded. In the case of too high pressure differences, the rotational speed will be decreased automatically until the load is reduced to within the pump's limits.RUVAC Roots vacuum pumps of the types WA, WS and RA (without pressure equalisation line) can be switched on together with the fore-pump at atmospheric pressure. Through this, the pumpdown time can be reduced drastically. The minimum pumping speed of the backing pump needs to be considered in this case.

Operation at up to 3 predefined speeds
Via floating contacts, the pump can be operated at one of the 3 pre-defined speeds. Switching over to another predefined speed is possible during operation.

Operation at any rotational speed
With a 0 to 10 V signal, any speed can be predefined to operate the pump between the minimum and maximum rotational speed. The software reliably ensures that the rotational speed cannot drop below the minimum speed or exceed the maximum speed.

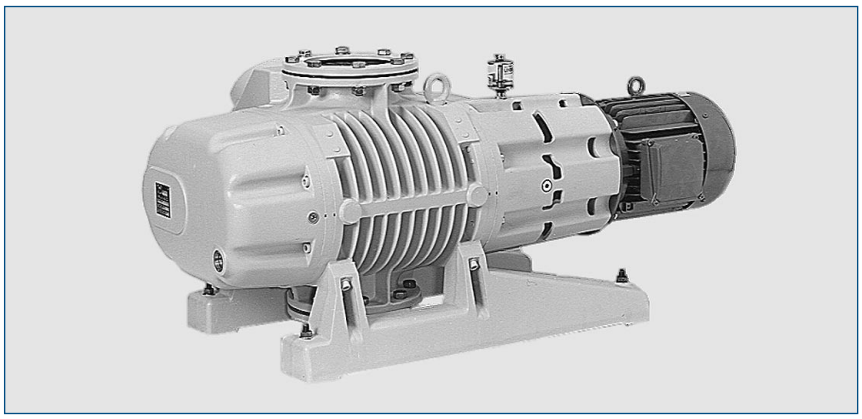
Increase in the pumping speed
By operating the Roots vacuum pumps at frequencies over 50 Hz, the nominal pumping speed of the pumps can be increased. Depending on the type of pump, an increase between 20 and 100 % is possible.

Note
Please enquire about possible application limitations (process dependent).



Schematic section through a RUVAC WA/WS (left) and a RUVAC WAU/WSU (rights)

RUVAC WA/WAU Roots Vacuum Pumps with Air-Cooled Flange-Mounted Motors



RUVAC WAU 2001 single-stage Roots vacuum pump shown with ISO-K 160 collar flanges

Advantages to the User

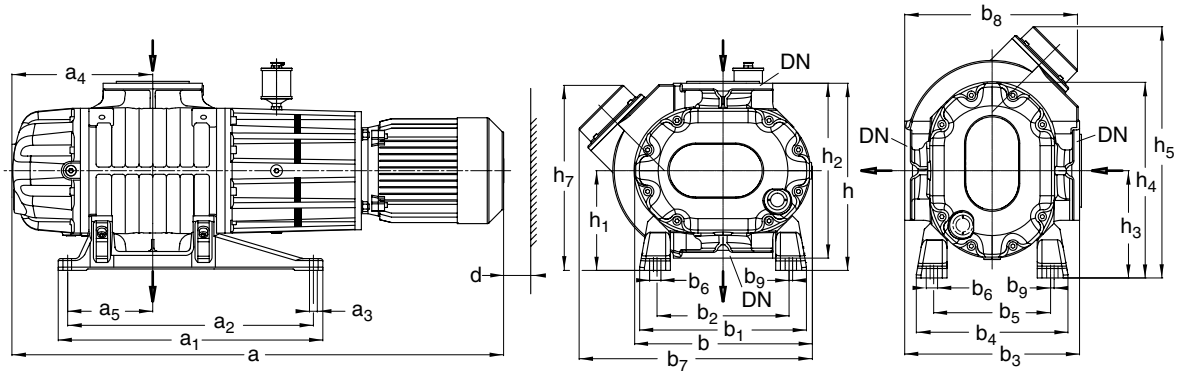
- Two air-cooled series, each with four models
- Reliable and trouble-free
- Sealing rings with their housing can be readily replaced
- Shaft seals and elastomer seals made of FPM/Viton
- Air-cooled standard motors in accordance with IEC dimensions eg. NEMA dimensions
- Easy to exchange with custom motors
- Integrated pressure equalization line for protection against overloading at high pressures on WAU models
- Pumping direction may be changed as required
- ATEX versions compliant to 94/9/EC possible

Typical Applications

- For oil-free compression of gases and vapors in combination with a backing pump
- Short cycle pumping processes also in the presence of large quantities of gas and vapor

Supplied Equipment

- RUVAC WA/WAU are supplied as standard for a vertical pumping action, horizontal pumping action upon request
- Mineral oil N 62 is used as standard
- Gasket in the intake flange with dirt sieve
- The required oil filling is included in separate bottles



Type		DN/DN$_1$	a [1]	a [2]	a_1	a_2	a_3	a_4	a_5	a_6
WA/WAU 251	mm	63 ISO-K	729	790	405	365	14	209	120	194
	in.		28.70	31.10	15.94	14.37	0.55	8.23	4.72	7.64
WA/WAU 501	mm	63 ISO-K	825	918	486	450	14	237	155	218
	in.		32.48	36.14	19.13	17.72	0.55	9.33	6.10	8.58
WA/WAU 501H	mm	63 ISO-K	825	918	486	450	14	237	155	218
	in.		32.48	36.14	19.13	17.72	0.55	9.33	6.10	8.58
WA/WAU 1001	mm	100 ISO-K	1054	1085	560	520	16.5	298	180	262
	in.		41.50	42.72	22.05	20.47	0.65	11.73	6.10	10.31
WA/WAU 1001H	mm	100 ISO-K	1054	1085	560	520	16,5	298	180	262
	in.		41.50	42.72	22.05	20.47	0.65	11.73	6.10	10.31
WA/WAU 2001	mm	160 ISO-K	1237	1283	800	740	18	367	220	310
	in.		48.70	50.51	31.50	29.13	0.71	14.45	8.66	12.20
WA/WAU 2001H	mm	160 ISO-K	1237	1283	800	740	18	367	220	310
	in.		48.70	50.51	31.50	29.13	0.71	14.45	8.66	12.20

		b	b_1	b_2	b_3	b_4	b_5	b_6	b_7 [3]	b_8	b_9
WA/WAU 251	mm	250	270	210	280	230	170	24	305	285	7.5
	in.	9.84	10.63	8.27	11.02	9.06	6.69	0.94	12.01	11.22	0.30
WA/WAU 501	mm	310	299	229	320	271	201	24	390	313	7.5
	in.	12.20	11 77	9.02	12.60	10.67	7.91	0.94	15.35	12 32	0.30
WA/WAU 501H	mm	310	299	229	320	271	201	24	414	330	7.5
	in.	12.20	11 77	9.02	12.60	10.67	7.91	0.94	16.30	12 99	0.30
WA/WAU 1001	mm	376	352	278	370	320	246	24	494	366	7.5
	in.	14.80	13 86	10.94	14.57	12.60	7.91	0.94	19.45	14.41	0.30
WA/WAU 1001H	mm	376	352	278	370	320	246	24	524	398	7.5
	in.	14.80	13.86	10.94	14.57	12.60	7.91	0.94	20.63	15.67	0.30
WA/WAU 2001	mm	463	518	388	460	422	292	24	638	456	7.5
	in.	18.23	20.39	15.28	18.11	16.61	11.50	0.94	25.12	17.95	0.30
WA/WAU 2001H	mm	463	518	388	460	422	292	24	642	460	7.5
	in.	18.23	20.39	15.28	18.11	16.61	11.50	0.94	25.28	18.11	0.30

		d	h	h_1	h_2	h_3	h_4	h_5 [2]	h_6	h_7
WA/WAU 251	mm	50	300	160	280	180	306	360	330	307
	in.	2.00	11.81	6.30	11.02	7.09	12.05	14.17	12.99	12.09
WA/WAU 501	mm	50	340	180	320	194	348	430	370	332
	in.	2.00	13.39	7.09	12.60	7.48	13.70	16.93	14.57	13.07
WA/WAU 501H	mm	50	340	180	320	194	348	450	370	350
	in.	2.00	13.39	7.09	12.60	7.48	13.70	17.72	14.57	13.78
WA/WAU 1001	mm	50	396	211	370	227	414	532	425	392
	in.	2.00	15.59	8.31	14.57	8.94	16.30	20.94	425	15.43
WA/WAU 1001H	mm	50	396	211	370	227	414	564	425	424
	in.	2.00	15.59	8.31	14.57	8.94	16.30	22.20	425	16.69
WA/WAU 2001	mm	50	530	300	460	351	578	753	541	523
	in.	2.00	20.87	11.81	18.11	13.82	22.76	29.65	21.3	20.59
WA/WAU 2001H	mm	50	530	300	460	351	578	760	541	530
	in.	2.00	20.87	11.81	18.11	13.82	22.76	29.92	21.3	20.87

[1] This dimension “a” relates to pumps with the IEC motor used as standard by Leybold

[2] This dimension “a” relates to pumps with the NEMA motor used as standard by Leybold

[3] For RUVAC WAU only

DN = ND 6 pump flange in accordance with DIN 2501

DN$_1$ = Collar flange with gasket for connecting ISO-K standard components

Outside dimensions +/- 3mm

Dimensional drawing for the RUVAC WA/WAU pumps

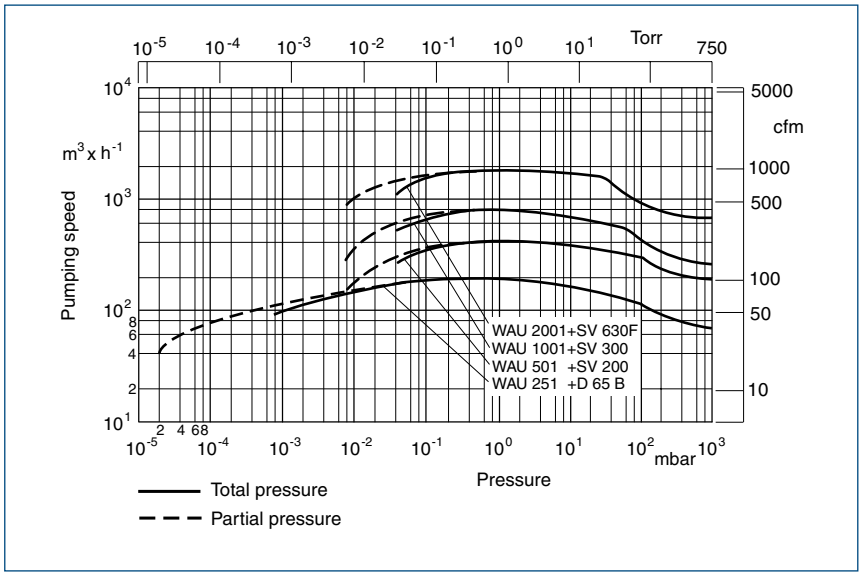
Technical Data		WA/WAU 251 50 Hz	WA/WAU 251 60 Hz	WA/WAU(H) 501 50 Hz	WA/WAU(H) 501 60 Hz
Nominal pumping speed [1]	**$m^3 \times h^{-1}$ (cfm)**	253 (149)	304 (179)	505 (297.4)	606 (357)
Max. pumping speed with backing pump	**$m^3 \times h^{-1}$ (cfm)**	210 (123.7)	251 (148)	410 (241)	530 (312)
	TRIVAC	D 65 B	D 65 B	–	–
	SOGEVAC	–	–	SV 200	SV 200
Ultimate partial pressure [2]	**mbar (Torr)**	< 2×10^{-5} (< 1.5×10^{-5})	< 2×10^{-5} (< 1.5×10^{-5})	< 8×10^{-3} (< 6×10^{-3})	< 8×10^{-3} (< 6×10^{-3})
Ultimate total pressure [2]	**mbar (Torr)**	< 8×10^{-4} (< 6×10^{-4})	< 8×10^{-4} (< 6×10^{-4})	< 4×10^{-2} (< 3×10^{-2})	< 4×10^{-2} (< 3×10^{-2})
Permissible cut-in pressure [2] **RUVAC WA**	**mbar (Torr)**	90 (67.5)	60 (45.0)	100 (75.0)	80 (60.0)
Max. permissible pressure difference during continuous operation [3]	**mbar (Torr)**	80 (60.0)	80 (60.0)	80 (60.0)	80 (60.0)
Main supply					
IEC motor	**Δ / Y V**	220-240 / 380-420	220-277 / 380-480	220-240 / 380-420	220-277 / 380-480
NEMA motor (US version)	**Δ / Y V**	230 / 400	200-230 / 460	230 / 400	200-230 / 460
Thermal class		F	F	F	F
Motor power	**kW (hp)**	1.1 (1.5)	1.1 (1.5)	2.2 (3.0)	2.2 (3.0)
Nominal speed, approx. (50/60 Hz)	**rpm**	3000/3600	3000/3600	3000/3600	3000/3600
Max. permissible speed	**rpm**	3600	3600	3600	3600
Type of protection	**IP**	55	55	55	55
Oil filling for the bearing chamber [4]		1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling
vertical pumping action, approx.	**l (qt)**	0.65 (0.69) / 0.6 (0.63)	0.65 (0.69) / 0.6 (0.63)	0.9 (0.95) / 0.8 (0.85)	0.9 (0.95) / 0.8 (0.85)
horizontal pumping action, approx.	**l (qt)**	0.5 (0.53) / 0.45 (0.48)	0.5 (0.53) / 0.45 (0.48)	0.75 (0.79) / 0.7 (0.74)	0.75 (0.79) / 0.7 (0.74)
Oil filling of the shaft sealing ring housing	**l (qt)**	0.6 (0.63)	0.6 (0.63)	1.0 (1.06)	1.0 (1.06)
Connection flanges [6]	**DN**	63 ISO-K	63 ISO-K	63 ISO-K	63 ISO-K
	DN	3" ANSI	3" ANSI	3" ANSI	3" ANSI
Weight WA/WAU	**kg (lbs)**	85/89 (187.4/196.2)	85/89 (187.4/196.2)	128/133 (282.2/293.3)	128/133 (282.2/293.3)
Noise level [7]	**dB(A)**	< 64	< 64	< 67	< 67

1) To DIN 28 400 and subsequent numbers
2) With double-stage rotary vane vacuum pump TRIVAC, resp. 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) Authoriative, however, is the oil level at the oil-level glass
5) After a complete disassembly
6) US models ANSI flanges
7) At an operating pressure below < 10^{-1} mbar (< 0.75×10^{-1} Torr)

Technical Data		WA/WAU (H) 1001 50 Hz	WA/WAU (H) 1001 60 Hz	WA/WAU(H) 2001 50 Hz	WA/WAU(H) 2001 60 Hz
Nominal pumping speed [1]	$m^3 \times h^{-1}$ (cfm)	1000 (589)	1200 (707)	2050 (1207.5)	2460 (1449)
Max. pumping speed	$m^3 \times h^{-1}$ (cfm)	800 (470)	1000 (588)	1850 (1089)	2100 (1236)
with backing pump	SOGEVAC	SV 300	SV 300	SV 630 F	SV 630 F
Ultimate partial pressure [2]	mbar (Torr)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)
Ultimate total pressure [2]	mbar (Torr)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)
Permissible cut-in pressure [2] **RUVAC WA**	mbar (Torr)	60 (45.0)	45 (33.5)	30 (22.5)	25 (18.5)
Max. permissible pressure difference during continuous operation [3]	mbar (Torr)	80 (60.0)	80 (60.0)	50 (37.5)	50 (37.5)
Main supply					
IEC motor	Δ / Y V	220-240 / 380-420	220-277 / 380-480	380-420 / 655-725	440-480 / –
NEMA motor (US version)	Δ / Y V	230 / 400	200-230 / 460	400 / –	– / 460
Thermal class		F	F	F	F
Motor power	kW (hp)	4.0 (5.4)	4.0 (5.4)	7.5 (10.0)	7.5 (10.0)
Nominal speed, approx. (50/60 Hz)	rpm	3000/3600	3000/3600	3000/3600	3000/3600
Max. permissible speed	rpm	3600	3600	3600	3600
Type of protection	IP	55	55	55	55
Oil filling for the bearing chamber [4]		1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling
vertical pumping action, approx.	l (qt)	2.0 (2.11) / 1.8 (1.90)	2.0 (2.11) / 1.8 (1.90)	3.85 (4.07) / 3.6 (3.81)	3.85 (4.07) / 3.6 (3.81)
horizontal pumping action, approx.	l (qt)	1.2 (1.27) / 1.1 (1.16)	1.2 (1.27) / 1.1 (1.16)	2.65 (2.75) / 2.4 (2.54)	2.65 (2.75) / 2.4 (2.54)
Oil filling of the shaft sealing ring housing	l (qt)	1.3 (1.37)	1.3 (1.37)	1.6 (1.69)	1.6 (1.69)
Connection flanges [6]	DN	100 ISO-K	100 ISO-K	160 ISO-K	160 ISO-K
	DN	4" ANSI	4" ANSI	6" ANSI	6" ANSI
Weight WA/WAU	kg (lbs)	220/225 (485.1/496.1)	220/225 (485.1/496.1)	400/406 (882/895.2)	400/406 (882/895.2)
Noise level [7]	dB(A)	< 75	< 75	< 80	< 80

1) To DIN 28 400 and subsequent numbers
2) With 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) Authoriative, however, is the oil level at the oil-level glass
5) After a complete disassembly
6) US models ANSI flanges
7) At an operating pressure below $< 10^{-1}$ mbar ($< 0.75 \times 10^{-1}$ Torr)

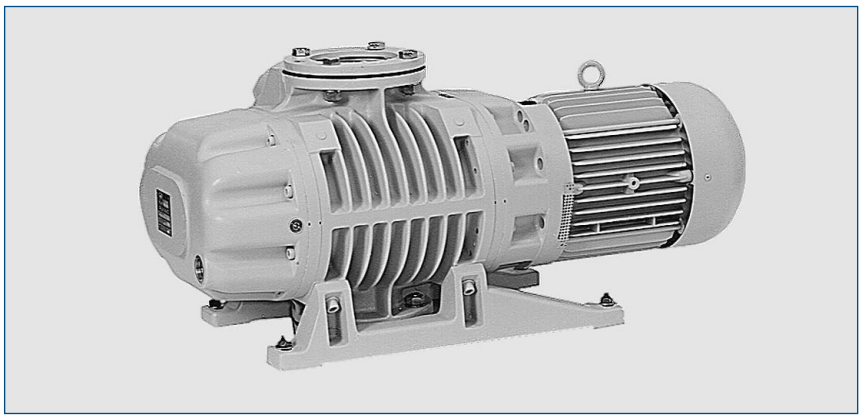
Ordering Information	WA/WAU 251	WA/WAU(H) 501	WA/WAU(H) 1001	WA/WAU(H) 2001
Roots vacuum pump				
RUVAC WA (IEC motor)	Part No. 117 20	Part No. 117 30	Part No. 117 40	Part No. 117 50
RUVAC WA (NEMA motor, US version)	Part No. 917 20	Part No. 917 30	Part No. 917 40	Part No. 917 50
RUVAC WAU (IEC motor)	Part No. 117 21	Part No. 117 31	Part No. 117 41	Part No. 117 51
RUVAC WAU (NEMA motor, US version)	Part No. 917 21	Part No. 917 31	Part No. 917 41	Part No. 917 51
RUVAC WA, without motor	Part No. 117 24	Part No. 117 34	Part No. 117 44	Part No. 112 54
RUVAC WAU, without motor	–	Part No. 155 008	Part No. 112 17	Part No. 113 22
RUVAC WAU(H) (IEC motor), with special ACE vibration absorber	–	Part No. 118 31	Part No. 118 41	Part No. 118 51
RUVAC WA/WAU, ATEX version	upon request	upon request	upon request	upon request
RUVAC WS/WSU(H) seal kit	Part No. 194 60	Part No. 194 64	Part No. 194 68	Part No. 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	Part No. 200 03 179	Part No. 200 03 179	Part No. 200 03 180	Part No. 200 03 181
WAU/WSU pump	Part No. 200 03 179	Part No. 200 03 179	Part No. 200 03 180	Part No. 200 03 182
Frequency inverter RUVATRONIC (see description in Section "General", paragraph "Accessories")	RT 5/251 Part No. 500 001 381	RT 5/501 Part No. 500 001 382	RT 5/1001 Part No. 500 001 383	RT 5/2001 Part No. 500 001 384



Pumping speed of the RUVAC WA/WAU, 50 Hz

Notes

RUVAC WS/WSU Roots Vacuum Pumps with Air-Cooled Canned Motors



Single-stage Roots vacuum pump RUVAC WSU 1001 shown with ISO-K 100 rotatable flanges

Advantages to the User

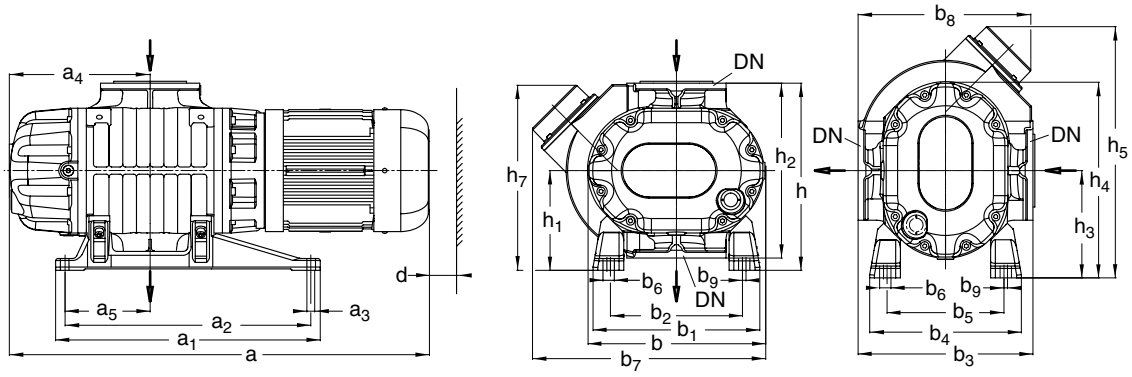
- Two series, each with four models
- Highly leak-tight air-cooled pumps driven by a air-cooled canned motor
- Lubricated with mineral oil. RUVAC WS/WSU PFPE with perfluoropolyether (PFPE)
- WS and WS PFPE pumps are identical except for the lubricant and the shipping package
- No thermal problems due to the speed independent cooling arrangement using a separately connected fan, thus no thermal problems at low speeds
- Over-temperature switch in the stator coil of the motor
- All elastomer seals made of FPM/Viton
- Integrated pressure equalization line with differential pressure valve prevents overloading on WSU model
- RUVAC WS 251 to 2001 for use with a frequency inverter for a wide frequency range
- No shaft feedthrough to the atmosphere, thus particularly leaktight
- Pumping direction may be changed as required

Typical Applications

- For applications which require a high pumping speed at pressures between 10^{-2} and 10^{-4} mbar (0.75×10^{-2} and 0.75×10^{-4} Torr)
- Used where the possibility of contamination due air ingress or pumped media leakage must be avoided
- Suction or pumping of high-purity or radioactive gases
- Is used in clean rooms were the air must not be recirculated by the motor‘s fan

Supplied Equipment

- The required oil or PFPE filling is included in separate bottle
- If no other type of oil is stated, then mineral oil N 62 is used as standard
- Purged with nitrogen for corrosion protection
- Gasket in the intake flange with integrated dirt sieve



Type		DN/DN1	DN_1	a	a_1	a_2	a_3	a_4	a_5
WS/WSU 251	mm	65	63 ISO-K	694	405	365	14	212	120
	in.			27.32	15.94	14.37	0.55	8.35	4.72
WS/WSU 501	mm	65	63 ISO-K	752	486	450	14	237	155
	in.			29.61	19.13	17.72	0.55	9.33	6.10
WS/WSU 501H	mm	65	63 ISO-K	752	486	450	14	237	155
	in.			29.61	19.13	17.72	0.55	9.33	6.10
WS/WSU 1001	mm	100	100 ISO-K	885	560	520	16,5	298	180
	in.			34.84	22.05	20.47	0.65	11.73	7.09
WS/WSU 1001H	mm	100	100 ISO-K	885	560	520	16,5	298	180
	in.			34.84	22.05	20.47	0.65	11.73	7.09
WS/WSU 2001	mm1	50	160 ISO-K	1042	800	740	18	367	220
	in.			41.02	31.50	29.13	0.71	14.45	8.66
WS/WSU 2001H	mm	150	160 ISO-K	1042	800	740	18	367	220
	in.			41.02	31.50	29.13	0.71	14.45	8.66
WS 2001 FC	mm	150	160 ISO-K	1042	800	740	18	367	220
	in.			41.02	31.50	29.13	0.71	14.45	8.66

		b	b_1	b_2	b_3	b_4	b_5	b_6	b_7 [1)]	b_8
WS/WSU 251	mm	250	270	210	280	230	170	24	305	285
	in.	9.84	10.63	8.27	11.02	9.06	6.69	0.94	12.01	11.22
WS/WSU 501	mm	310	299	229	320	271	201	24	390	313
	in.	1220	11.77	9.02	12.60	10.67	7.91	0.94	15.35	12.32
WS/WSU 501H	mm	310	299	229	320	271	201	24	414	330
	in.	12.20	11.77	9.02	12.60	10.67	7.91	0.94	16.30	12.99
WS/WSU 1001	mm	376	352	278	370	320	246	24	494	366
	in.	14.80	13.86	10.94	14.57	12.60	9.69	0.94	19.45	14.41
WS/WSU 1001H	mm	376	352	278	370	320	246	24	524	398
	in.	14.80	13.86	10.94	14.57	12.60	9.69	0.94	20.63	15.67
WS/WSU 2001	mm	463	518	388	460	422	292	24	638	456
	in.	18.23	20.39	15.28	18.11	16.61	11.50	0.94	25.12	17.95
WS/WSU 2001H	mm	463	518	388	460	422	292	24	642	460
	in.	18.23	20.39	15.28	18.11	16.61	11.50	0.94	25.28	18.11
WS 2001 FC	mm	463	518	388	460	422	292	24	–	–
	in.	18.23	20.39	15.28	18.11	16.61	11.50	0.94	–	–

		b_9	d	h	h_1	h_2	h_3	h_4	h_5 [1)]	h_6
WS/WSU 251	mm	7.5	50	300	160	280	180	306	360	307
	in.	0.30	2.00	11.81	6.3	11.02	7.09	12.05	14.17	12.09
WS/WSU 501	mm	7.5	50	340	180	320	194	348	430	332
	in.	0.30	2.00	13.39	7.09	12.60	7.48	13.70	16.93	13.07
WS/WSU 501H	mm	7.5	50	340	180	320	194	348	450	350
	in.	0.30	2.00	13.39	7.09	12.60	7.48	13.70	17.72	13.78
WS/WSU 1001	mm	7.5	50	396	211	370	227	414	532	392
	in.	0.30	2.00	15.59	8.31	14.57	8.94	16.30	20.94	15.43
WS/WSU 1001H	mm	7.5	50	396	211	370	227	414	564	424
	in.	0.30	2.00	15.59	8.31	14.57	8.94	16.30	22.20	16.69
WS/WSU 2001	mm	7.5	50	530	300	460	351	578	760	523
	in.	0.30	2.00	20.87	11.81	18.11	13.82	22.76	29.92	20.59
WS/WSU 2001H	mm	7.5	50	530	300	460	351	578	753	530
	in.	0.30	2.00	20.87	11.81	18.11	13.82	22.76	29.65	20.87
WS 2001 FC	mm	7.5	50	530	300	460	351	578	–	–
	in.	0.30	2.00	20.87	11.81	18.11	13.82	22.76	–	–

[1)] For RUVAC WSU only

Outside dimensions +/- 3mm

DN = ND 6 pump flange in accordance with DIN 2501

DN_1 = Collar flange with gasket for connecting ISO-K standard components

Dimensional drawing for the RUVAC WS/WSU pumps

Technical Data		WS/WSU 251		WS/WSU(H) 501	
		50 Hz	60 Hz	50 Hz	60 Hz
Nominal pumping speed [1]	$m^3 \times h^{-1}$ (cfm)	253 (149)	304 (179)	505 (297.4)	606 (357)
Max. pumping speed with backing pump	$m^3 \times h^{-1}$ (cfm)	210 (123.7)	251 (148)	410 (241)	530 (312)
	TRIVAC	D 65 B	D 65 B	–	–
	SOGEVAC	–	–	SV 200	SV 200
Ultimate partial pressure [2]	mbar (Torr)	$< 2 \times 10^{-5}$ ($< 1.5 \times 10^{-5}$)	$< 2 \times 10^{-5}$ ($< 1.5 \times 10^{-5}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)
Ultimate total pressure [2]	mbar (Torr)	$< 8 \times 10^{-4}$ ($< 6 \times 10^{-4}$)	$< 8 \times 10^{-4}$ ($< 6 \times 10^{-4}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)
Permissible cut-in pressure [2] **RUVAC WS**	mbar (Torr)	90 (67.5)	60 (45.0)	100 (75.0)	80 (60.0)
Max. permissible pressure difference during continuous operation [3]	mbar (Torr)	80 (60.0)	80 (60.0)	80 (60.0)	80 (60.0)
Main supply					
Δ / Y	V	200 / –	200-208 / –	200 / –	200-208 / –
Δ / Y	V	230 / 400	265 / 460	208-265 / 460	265 / 460
Thermal class		F	F	F	F
Motor power, 50/60 Hz	kW (hp)	1.1 (1.5) / 1.4 (1.9)	1.1 (1.5) / 1.4 (1.9)	2.2 (3.0) / 2.4 (3.3)	2.2 (3.0) / 2.4 (3.3)
Nominal speed, approx. (50/60 Hz)	rpm	3000/3600	3000/3600	3000/3600	3000/3600
Max. permissible speed	rpm	6000	6000	6000	6000
Type of protection	IP	20	20	20	20
Oil filling for the bearing chamber [4]		1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling
PFPE					
vertical pumping action, approx.	l (qt)	0.6 (0.63) / 0.55 (0.58)	0.6 (0.63) / 0.55 (0.58)	0.85 (0.9) / 0.75 (0.79)	0.85 (0.9) / 0.75 (0.79)
horizontal pumping action, approx.	l (qt)	0.5 (0.53) / 0.45 (0.48)	0.5 (0.53) / 0.45 (0.48)	0.75 (0.79) / 0.7 (0.74)	0.75 (0.79) / 0.7 (0.74)
other oils					
vertical pumping action, approx.	l (qt)	0.65 (0.69) / 0.6 (0.63)	0.65 (0.69) / 0.6 (0.63)	0.9 (0.95) / 0.8 (0.85)	0.9 (0.95) / 0.8 (0.85)
horizontal pumping action, approx.	l (qt)	0.5 (0.53) / 0.45 (0.48)	0.5 (0.53) / 0.45 (0.48)	0.75 (0.79) / 0.7 (0.74)	0.75 (0.79) / 0.7 (0.74)
Connection flanges	DN	63 ISO-K	63 ISO-K	63 ISO-K	63 ISO-K
Weight WS/WSU	kg (lbs)	90/95 (198.5/209.5)	90/95 (198.5/209.5)	130/135 (286.7/297.7)	130/135 (286.7/297.7)
Noise level [6]	dB(A)	< 63	< 63	< 63	< 63

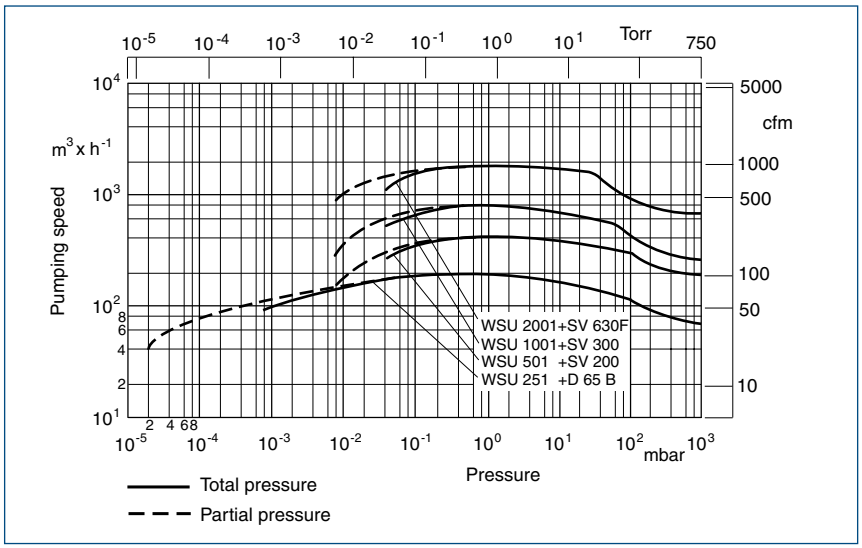
1) To DIN 28 400 and subsequent numbers
2) With double-stage TRIVAC, resp. single-stage rotary vane vacuum pump SOGEVAC or dry compressing vacuum pump ScrewLine (Type of backing pump look at max. pumping speed)
When using 2-stage backing pumps the ultimate pressures will be correspondingly lower
3) Applicable for ratio up to 1 : 10 between backing pump and Roots vacuum pump at 3000 rpm
4) Authoriative, however, is the oil level at the oil-level glass
5) After a complete disassembly
6) At an operating pressure < 10^{-1} mbar (< 0.75 x 10^{-1} Torr)

Technical Data		WS/WSU (H) 1001		WS/WSU (H) 2001		WS FC 2001 [1]
		50 Hz	60 Hz	50 Hz	60 Hz	until 100 Hz
Nominal pumping speed [2]	$m^3 \times h^{-1}$ (cfm)	1000 (589)	1200 (707)	2050 (1207.5)	2460 (1449)	4100
Max. pumping speed with backing pump	$m^3 \times h^{-1}$ (cfm)	800 (470)	1000 (588)	1850 (1089)	2100 (1236)	3200 (1883)
	SOGEVAC	SV 300	SV 300	SV 630 F	SV 630 F	–
	ScrewLine	–	–	–	–	SP 630
Ultimate partial pressure [3]	mbar	$< 8 \times 10^{-3}$	$< 8 \times 10^{-3}$	$< 8 \times 10^{-3}$	$< 8 \times 10^{-3}$	$< 8 \times 10^{-3}$
	(Torr)	($< 6 \times 10^{-3}$)	($< 6 \times 10^{-3}$)	($< 6 \times 10^{-3}$)	($< 6 \times 10^{-3}$)	($< 6 \times 10^{-3}$)
Ultimate total pressure [3]	mbar	$< 4 \times 10^{-2}$	$< 4 \times 10^{-2}$	$< 4 \times 10^{-2}$	$< 4 \times 10^{-2}$	$< 4 \times 10^{-2}$
	(Torr)	($< 3 \times 10^{-2}$)	($< 3 \times 10^{-2}$)	($< 3 \times 10^{-2}$)	($< 3 \times 10^{-2}$)	($< 3 \times 10^{-2}$)
Permissible cut-in pressure [3] **RUVAC WS**	mbar (Torr)	60 (45.0)	45 (33.5)	30 (22.5)	25 (18.5)	1013 (760.0)
Max. permissible pressure difference during continuous operation [4]	mbar (Torr)	80 (60.0)	80 (60.0)	50 (37.5)	50 (37.5)	40 (30.0)
Main supply						
Δ / Y	V	200 / –	200-208 / –	200 / –	200-208 / –	400
Δ / Y	V	230 / 400	265 / 460	230 / 400	265 / 460	400
Thermal class		F	F	F	F	F
Motor power, 50/60 Hz	kW	4.0/4.4	4.0/4.4	7.5 /8.5)	7.5/8.5	7.5/8.5
	(hp)	(5.4/6.0)	(5.4/6.0)	(10.0/11.6)	(10.0/11.6)	(10.0/11.6)
Nominal speed, approx. (50/60 Hz)	rpm	3000/3600	3000/3600	3000/3600	3000/3600	to 6000
Max. permissible speed	rpm	6000	6000	4200 [5]	4200 [5]	6000
Type of protection	IP	20	20	20	20	20
Oil filling for the bearing chamber [6]		1. Filling [7] / 2. Filling	1. Filling [7] / 2. Filling	1. Filling [7] / 2. Filling	1. Filling [7] / 2. Filling	1. Filling [7] / 2. Filling
PFPE						
vertical pumping action, approx.	l	1.95 / 1.75	1.95 / 1.75	3.0 / 2.7	3.0 / 2.7	3.0 / 2.7
	(qt)	(2.06 / 1.85)	(2.06 / 1.85)	(3.17 / 2.85)	(3.17 / 2.85)	(3.17 / 2.85)
horizontal pumping action, approx.	l	1.2 / 1.1	1.2 / 1.1	2.1 / 1.9	2.1 / 1.9	2.1 / 1.9
	(qt)	(1.27 / 1.16)	(1.27 / 1.16)	(2.22 / 2.00)	(2.22 / 2.00)	(2.22 / 2.00)
other oils						
vertical pumping action, approx.	l	2.0 / 1.8	2.0 / 1.8	3.85 / 3.6	3.85 / 3.6	3.5 / 3.3
	(qt)	2.11 / 1.90	2.11 / 1.90)	(4.07 / 3.81)	(4.07 / 3.81)	(3.70 / 3.49)
horizontal pumping action, approx.	l	1.2 / 1.1	1.2 / 1.1	2.6 / 2.4	2.6 / 2.4	2.4 / 2.2
	(qt)	1.27 / 1.16)	(1.27 / 1.16)	(2.75 / 2.54)	(2.75 / 2.54)	(2.54 / 2.33)
Connection flanges	DN	100 ISO-K	100 ISO-K	160 ISO-K	160 ISO-K	160 ISO-K
Weight WS/WSU	kg	228/233	228/233	458/465	458/465	466
	(lbs)	(502.7/513.8)	(502.7/513.8)	(1009.9/1025.3)	(1009.9/1025.3)	(1028.70)
Noise level [8]	dB(A)	< 68	< 68	< 72	< 72	< 72

1) FC = frequency controlled motor
2) To DIN 28 400 and subsequent numbers
3) With double-stage TRIVAC, resp. single-stage rotary vane vacuum pump SOGEVAC or dry compressing vacuum pump ScrewLine (Type of backing pump look at max. pumping speed)
When using 2-stage backing pumps the ultimate pressures will be correspondingly lower
4) Applicable for ratio up to 1 : 10 between backing pump and Roots vacuum pump at 3000 rpm
5) Also 6000 rpm upon order
6) Authoriative, however, is the oil level at the oil-level glass
7) After a complete disassembly
8) At an operating pressure < 10^{-1} mbar (< 0.75×10^{-1} Torr)

Ordering Information	WS/WSU 251	WS/WSU(H) 501	WS/WSU(H) 1001	WS/WSU(H) 2001	WS FC[1] 2001
Roots vacuum pump					
RUVAC WS	Part No. 117 22	Part No. 117 32	Part No. 117 42	Part No. 117 52	–
RUVAC WSU	Part No. 117 23	Part No. 117 33	Part No. 117 43	Part No. 117 53	–
RUVAC WS PFPE	Part No. 117 27	Part No. 117 37	Part No. 117 47	Part No. 117 57	–
RUVAC WSU PFPE	Part No. 117 28	Part No. 117 38	Part No. 200 00 763	Part No. 200 03 123	–
RUVAC WSU PFPE (US version)	–	–	Part No. 917 48	–	–
RUVAC WS 2001, ANDEROL 555 (max. 100 Hz)	–	–	–	Part No. 167 007	–
RUVAC WS 2001, PFPE (max. 100 Hz)	–	–	–	Part No. 150 95	–
RUVAC WSU 2001, PFPE (max. 100 Hz)	–	–	–	Part No. 150 96	–
RUVAC WS FC, ANDEROL 555	–	–	–	–	Part No. 155 020
RUVAC WS FC, PFPE	–	–	–	–	Part No. 155 030
RUVAC WSU(H) with special ACE vibration absorber	–	118 33	118 43	Part No. 118 53	–
RUVAC WS/WSU(H) seal kit	Part No. 194 62	Kat.-Nr 194 66	Part No. 194 70	Part No. 194 74	Part No. 194 74
Flange adapter set, consisting of flange adapter with screws, bolts, washers and nuts for ANSI flange	(3" ANSI)	(3" ANSI)	(4" ANSI)	(6" ANSI)	(6" ANSI)
WA/WS pump	Part No. 200 03 179	Part No. 200 03 179	Part No. 200 03 180	Part No. 200 03 181	Part No. 200 03 181
WAU/WSU pump	Part No. 200 03 179	Part No. 200 03 179	Part No. 200 03 180	Part No. 200 03 182	–
Frequency inverter RUVATRONIC (see description in Section "General", paragraph "Accessories")	RT 5/251 Part No. 500 001 381	RT 5/501 Part No. 500 001 382	RT 5/1001 Part No. 500 001 383	RT 5/2001 Part No. 500 001 384	–

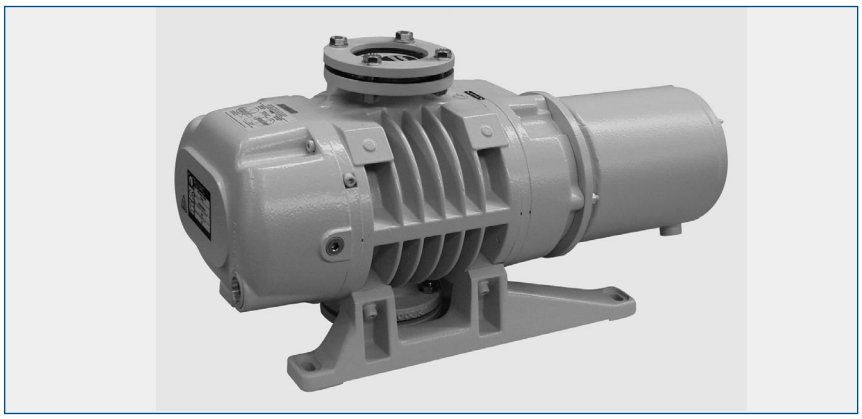
[1] FC = Frequency Controlled Motor



Pumping speed of the RUVAC WS/WSU, 50 Hz

Notes

RUVAC WS/WSU (W) PFPE Roots Vacuum Pumps with Water-Cooled Canned Motors



Single-stage Roots vacuum pump RUVAC WS 501 W shown with ISO-K 63 rotatable flanges

Advantages to the User

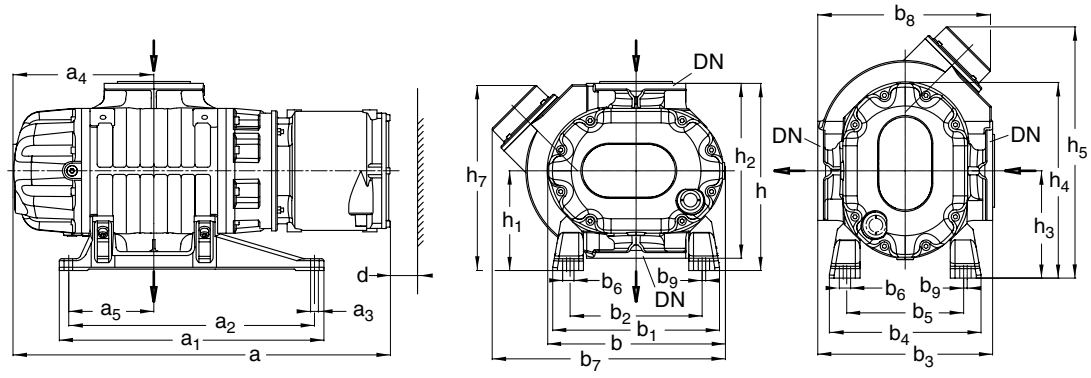
- Two series, each with four models
- Highly leak-tight air-cooled pumps driven by a water-cooled canned motor
- RUVAC WS/WSU(W) PFPE lubricated with perfluoropolyether (PFPE)
- WS and WS PFPE pumps are identical except for the lubricant and the shipping package
- No thermal problems due to the speed independent cooling arrangement using a separately connected fan, thus no thermal problems at low speeds
- Over-temperature switch in the stator coil of the motor
- All elastomer seals made of FPM/Viton
- Integrated pressure equalization line with differential pressure valve prevents overloading on WSU model
- RUVAC WS 251 to 2001 for use with a frequency inverter for a wide frequency range
- No shaft feedthrough to the atmosphere, thus particularly leaktight
- Pumping direction may be changed as required

Typical Applications

- For applications which require a high pumping speed at pressures between 10^{-2} and 10^{-4} mbar (0.75×10^{-2} and 0.75×10^{-4} Torr)
- Used where the possibility of contamination due air ingress or pumped media leakage must be avoided
- Suction or pumping of high-purity or radioactive gases
- Is used in clean rooms were the air must not be recirculated by the motor‘s fan

Supplied Equipment

- The required oil or PFPE filling is included in separate bottle (exceptions are marked)
- PFPE is used as standard
- Purged with nitrogen for corrosion protection
- Gasket in the intake flange with integrated dirt sieve



Type		DN	DN_1	a	a_1	a_2	a_3	a_4	a_5
WS 501 W	mm	63 ISO-K	63 ISO-K	738	496	450	14	237	155
	in.			29.06	19.53	17.72	0.55	9.33	6.10
WS/WSU 1001 W	mm	100 ISO-K	100 ISO-K	793	560	520	16,5	298	180
	in.			31.22	22.05	20.47	0.65	11.73	7.09
WS/WSU 2001 W	mm	160 ISO-K	160 ISO-K	958	800	740	18	367	220
	in.			437.72	31.50	29.13	0.71	14.45	8.66

		b	b_1	b_2	b_3	b_4	b_5	b_6	b_7 [1]	b_8
WS 501 W	mm	310	299	229	305	271	201	24	–	–
	in.	12.20	11.77	9.02	12.01	10.67	7.91	0.94	–	–
WS/WSU 1001 W	mm	372	352	278	370	320	246	24	494	366
	in.	14.65	13.86	10.94	14.57	12.60	9.69	0.94	19.45	14.41
WS/WSU 2001 W	mm	457	518	388	460	422	292	24	638	456
	in.	17.99	20.39	15.28	18.11	16.61	11.50	0.94	25.12	17.95

		b_9	d	h	h_1	h_2	h_3	h_4	h_5 [1]	h_6
WS/WSU 501 W	mm	7.5	50	331	180	305	194	348	–	–
	in.	0.30	2.00	13.03	7.09	12.01	7.64	13.70	–	–
WS/WSU 1001 W	mm	7.5	50	396	211	370	227	414	532	392
	in.	0.30	2.00	15.59	8.31	14.57	8.94	16.30	20.94	15.43
WS/WSU 2001 W	mm	7.5	50	530	300	460	351	578	760	523
	in.	0.30	2.00	20.87	11.81	18.11	13.82	22.76	29.92	20.59

[1] For RUVAC WSU ... W only

Outside dimensions +/- 3mm

DN = ND 6 pump flange in accordance with DIN 2501

DN_1 = Collar flange with gasket for connecting ISO-K standard components

Dimensional drawing for the RUVAC WS/WSU(W) PFPE pumps

Technical Data	WS 501 W	
	50 Hz	60 Hz
Nominal pumping speed [1] **$m^3 \times h^{-1}$ (cfm)**	505 (297.4)	606 (357)
Max. pumping speed $m^3 \times h^{-1}$ (cfm) **with backing pump SOGEVAC**	410 (241) SV 200	530 (312) SV 200
Ultimate partial pressure [2] **mbar (Torr)**	< 8 x 10^{-3} (< 6 x 10^{-3})	< 8 x 10^{-3} (< 6 x 10^{-3})
Ultimate total pressure [2] **mbar (Torr)**	< 4 x 10^{-2} (< 3 x 10^{-2})	< 4 x 10^{-2} (< 3 x 10^{-2})
Permissible cut-in pressure [2] **RUVAC WS mbar (Torr)**	100 (75)	80 (60)
Max. permissible pressure difference **during continuous operation** [3] **mbar (Torr)**	80 (60)	80 (60)
Main supply		
Δ / Y V	200 / –	200-208 / –
Δ / Y V	230 / 400	265 / 460
Thermal class	F	F
Motor power, 50/60 Hz kW (hp)	2.2 (3.0) / 2.4 (3.3)	2.2 (3.0) / 2.4 (3.3)
Nominal speed, approx. (50/60 Hz) rpm	3000/3600	3000/3600
Max. permissible speed rpm	6000	6000
Type of protection IP	40	40
Cooling water connection **with inside thresd**	1/4" 18 NPT	1/4" 18 NPT
Cooling water consumption, min. **at inlet temperature, max. 25 °C $l \cdot h^{-1}$**	200	200
Max. permissible cooling water pressure **bar**	6	6
Oil filling for the bearing chamber [4]	1. Filling [5] / 2. Filling	1. Filling [5] / 2. Filling
PFPE		
vertical pumping action, approx. **l (qt)**	0.85 (0.9) / 0.75 (0.79)	0.85 (0.9) / 0.75 (0.79)
horizontal pumping action, approx. **l (qt)**	0.75 (0.79) / 0.7 (0.74)	0.75 (0.79) / 0.7 (0.74)
Connection flanges DN	63 ISO-K	63 ISO-K
Weight WS kg (lbs)	130 (286.7)	130 (286.7)
Noise level [6] **dB(A)**	< 63	< 63

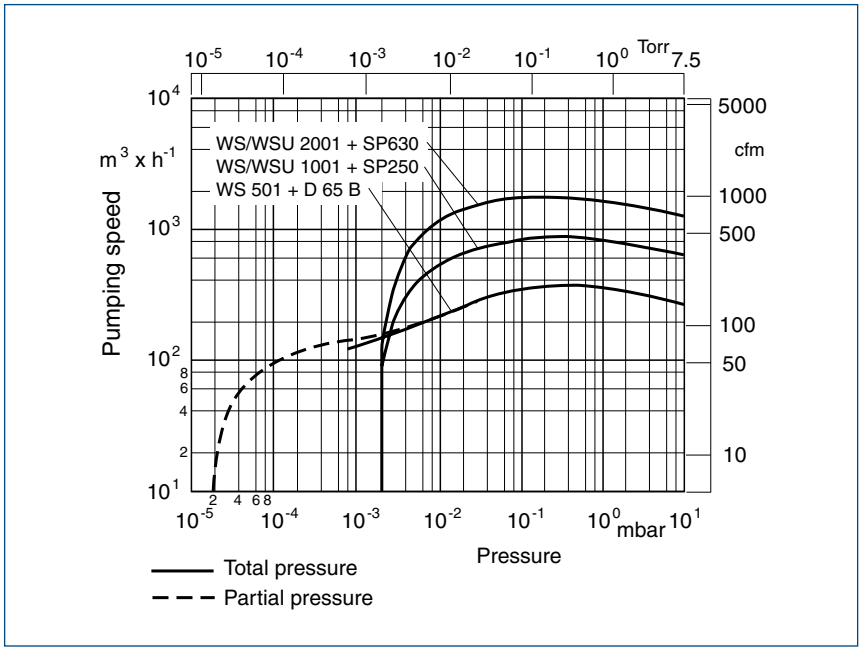
1) To DIN 28 400 and subsequent numbers
2) With single-stage rotary vane vacuum pump SOGEVAC, resp. dry compressing vacuum pump ScrewLine (Type of backing pump look at max. pumping speed).
When using 2-stage backing pumps the ultimate pressures will be correspondingly lower
3) Applicable for ratio up to 1 : 10 between backing pump and Roots vacuum pump at 3000 rpm
4) Authoriative, however, is the oil level at the oil-level glass
5) After a complete disassembly
6) At an operating pressure < 10^{-1} mbar (< 0.75 x 10^{-1} Torr)

Technical Data	WS/WSU 1001 W 50 Hz	WS/WSU 1001 W 60 Hz	WS/WSU 2001 W 50 Hz	WS/WSU 2001 W 60 Hz
Nominal pumping speed [1] $m^3 \times h^{-1}$ (cfm)	1000 (589)	1200 (707)	2050 (1207.5)	2460 (1449)
Max. pumping speed $m^3 \times h^{-1}$ (cfm)	830 (489)	1000 (588)	1780 (1044)	2080 (1224)
with backing pump ScrewLine	SP 250	SP 250	SP 630	SP 630
Ultimate total pressure [2] mbar	$< 1 \times 10^{-3}$	$< 1 \times 10^{-3}$	$< 1 \times 10^{-3}$	$< 1 \times 10^{-3}$
(Torr)	$(< 7.5 \times 10^{-4})$	$(< 7.5 \times 10^{-4})$	$(< 7.5 \times 10^{-4})$	$(< 7.5 \times 10^{-4})$
Permissible cut-in pressure [2] RUVAC WS mbar (Torr)	50 (37.5)	20 (15.0)	23 (17.25)	18 (13.5)
Max. permissible pressure difference during continuous operation [3] mbar (Torr)	80 (60.0)	50 (37.5)	50 (37.5)	50 (37.5)
Main supply				
Δ / Y V	200 / –	200-208 / –	200 / –	200-208 / –
Δ / Y V	230 / 400	265 / 460	230 / 400	265 / 460
Thermal class	F	F	F	F
Motor power, 50/60 Hz kW	4.0/4.4	4.0/4.4	7.5 /8.5	7.5/8.5
(hp)	(5.4/6.0)	(5.4/6.0)	(10.2/11.6)	(10.2/11.6)
Nominal speed, approx. (50/60 Hz) rpm	3000/3600	3000/3600	3000/3600	3000/3600
Max. permissible speed rpm	6000	6000	4200 [4]	4200 [4]
Type of protection IP	54	54	54	54
Cooling water connection with inside thresd	2x G 3/8"	2x G 3/8"	2x G 1/2"	2x G 1/2"
Cooling water consumption, min. at inlet temperature, max. 25 °C $l \cdot h^{-1}$	90	90	150	150
Max. permissible cooling water pressure bar	7	7	7	7
Oil filling for the bearing chamber [5]	1. Filling [6] / 2. Filling	1. Filling [6] / 2. Filling	1. Filling [6] / 2. Filling	1. Filling [6] / 2. Filling
PFPE				
vertical pumping action, approx. l	1.95 / 1.75	1.95 / 1.75	3.0 / 2.7	3.0 / 2.7
(qt)	(2.06 / 1.85)	(2.06 / 1.85)	(3.17 / 2.85)	(3.17 / 2.85)
horizontal pumping action, approx. l	1.2 / 1.1	1.2 / 1.1	2.1 / 1.9	2.1 / 1.9
(qt)	(1.27 / 1.16)	(1.27 / 1.16)	(2.22 / 2.00)	(2.22 / 2.00)
Connection flanges DN	100 ISO-K	100 ISO-K	160 ISO-K	160 ISO-K
Weight WS/WSU kg	228/233	228/233	458/465	458/465
(lbs)	(502.7/513.8)	(502.7/513.8)	(1009.9/1025.3)	(1009.9/1025.3)
Noise level [7] dB(A)	< 68	< 68	< 72	< 72

1) To DIN 28 400 and subsequent numbers
2) With single-stage rotary vane vacuum pump SOGEVAC, resp. dry compressing vacuum pump ScrewLine (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) Also 6000 rpm upon order
5) Authoriative, however, is the oil level at the oil-level glass
6) After a complete disassembly
7) At an operating pressure < 10^{-1} mbar (< 0.75×10^{-1} Torr)

Ordering Information	WS 501 W	WS/WSU 1001 W	WS/WSU 2001 W
Roots vacuum pump			
RUVAC WS PFPE	**Part No. 128 60**	**upon request [1]**	**upon request [1]**
RUVAC WSU PFPE	**–**	**upon request [1]**	**upon request [1]**
RUVAC WS/WSU(H) seal kit	Part No. 194 66	Part No. 194 70	Part No. 194 74
Flange adapter set, consisting of flange adapter with screws, bolts, washers and nuts for ANSI flange	(3" ANSI)	(4" ANSI)	(6" ANSI)
WA/WS pump	Part No. 200 03 179	Part No. 200 03 180	Part No. 200 03 181
WAU/WSU pump	–	Part No. 200 03 180	Part No. 200 03 182
Frequency inverter RUVATRONIC (see description in Section "General", paragraph "Accessories")	RT 5/501 Part No. 500 001 382	RT 5/1001 Part No. 500 001 383	RT 5/2001 Part No. 500 001 384

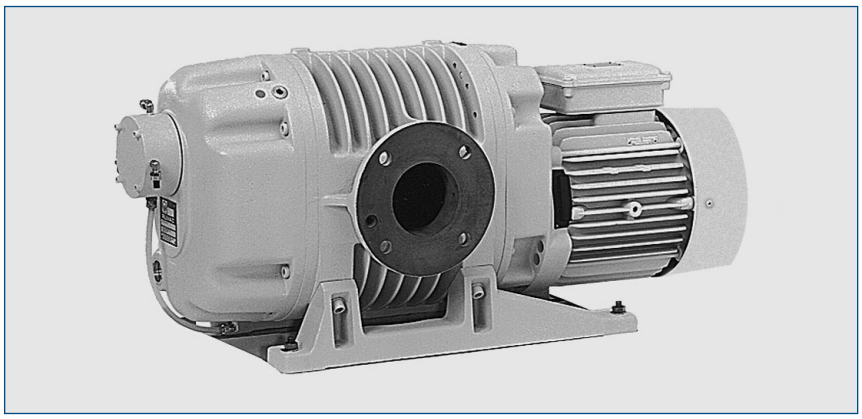
[1] prepared for PFPE, upon request with or without PFPE in a bottle



Pumping speed of the RUVAC WS/WSU (W) PFPE, 50 Hz

Notes

RUVAC WSLF Roots Vacuum Pumps for Laser Gas Systems



RUVAC WSLF 1001 LF Roots vacuum pump

Roots vacuum pumps driven by canned motors are available for gas laser systems.

Advantages to the User

- A gas mixture of helium, nitrogen and carbon monoxide is continuously circulated at a reduced system pressure
- High pumping speed from a small, quiet running pump
- Operation with a frequency inverter is possible
- Nickel-plated pump chamber surfaces
- Through an additional vacuum pump the bear-ing chambers may be evacuated to a pressure lower than the pressure within the pumping chamber of the RUVAC
- Water-cooled oil separating system
- Integrated oil separating system for extended maintenance intervals

Typical Applications

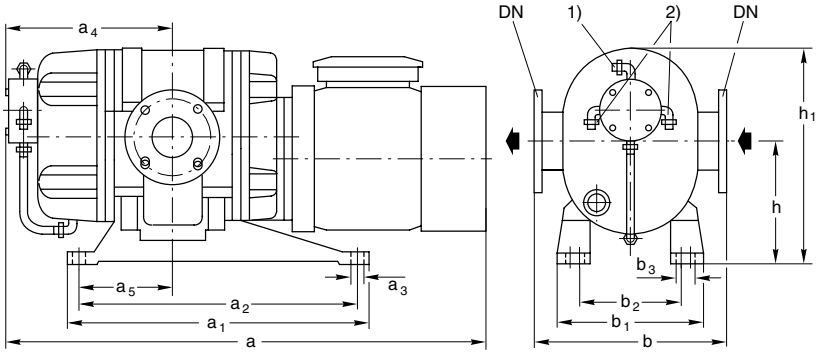
- Processing of ferrous and non-ferrous materials like welding, cutting and surface refinement

Technical Note

- The gas circulation system must be very clean and entirely free of hydrocarbons

Supplied Equipment

- Horizontal pumping action as standard
- With oil pressure switch and oil drain facility
- The required oil filling is included separately (special oil ANDEROL® 2100 HTCL)
- Purged with nitrogen for corrosion protection



		DN	a	a_1	a_2	a_3	a_4
WSLF 1001	mm	100	990	560	520	16,5	360
	in.	100	39.0	22.05	20.47	0.65	14.17

		a_5	b	b_1	b_2	b_3	h	h_1
WSLF 1001	mm	180	370	320	246	24	227	414
	in.	7.09	14.57	12.60	9.69	0.94	8.94	16.302

1) Connection for a vacuum pump
2) 4 mm water connection for the oil separator

DN = ND 6 3) pump flange to DIN 2501
3) ND = nominal pressure

Dimensional drawing for the RUVAC WSLF pumps

Technical Data	WSLF 1001	
	50 Hz	60 Hz
Nominal pumping speed [1] $m^3 \times h^{-1}$ (cfm)	1000 (589)	1200 (707)
Max. permissible pressure difference during continuous operation mbar (Torr)	80 (60)	80 (60)
Main supply Δ / Y V	200-230 / 400	200-265 / 460
Motor power kW (hp)	7.5 (10.2)	8.5 (11.6)
Nominal speed rpm	3000	3600
Max. permissible speed rpm	6000	6000
Type of protection IP	20	20
Oil filling of the bearing chambers l (qt)	1.2 (1.27)	1.2 (1.27)
Connection flange DIN 2501 DN	100	100
Weight kg (lbs)	275 (606.4)	275 (606.4)
Cooling water pressure bar (psi)	1 - 5 (14.5 - 72.5)	1 - 5 (14.5 - 72.5)
Cooling water throughput $l \times h^{-1}$ (cfm)	200 (0.9)	200 (0.9)
Hose connection for hose	6 x 1	6 x 1

Ordering Information	WSLF 1001
RUVAC WSLF Roots vacuum pump RUVAC WSLF 1001	Part No. 117 94
RUVAC WSLF seal kit	Part No. 194 70

[1] To DIN 28 400 and subsequent numbers

RUVAC RA Roots Vacuum Pumps with Flange-Mounted Motors

RUVAC RA 5001 single-stage Roots vacuum pump

Roots vacuum pumps offering a high pumping speed.

Advantages to the User

- Oil immersed radial shaft seals made of FPM for sealing against the atmosphere
- Use of universal IEC motors (50/60 Hz)
- The motors fulfil in Europe (50 Hz) the efficiency requirements in accordance with EFF1
- In the USA (60 Hz) the motors are UL approved and fulfil the efficiency requirements in accordance with EPAC.
- If required with external pressure equalisation line and differential pressure valve so that the pump may be switched on jointly with the backing pump at atmospheric pressure
- Motors can easily be exchanged for special voltage motors. Explosion protected motors and motors for special main frequencies upon request
- Over-temperature switch in the stator coil of the motor
- Rugged dry compressing vacuum pump
- Most reliable even under rough operating conditions
- ATEX versions compliant to 94/9/EC possible

Typical Applications

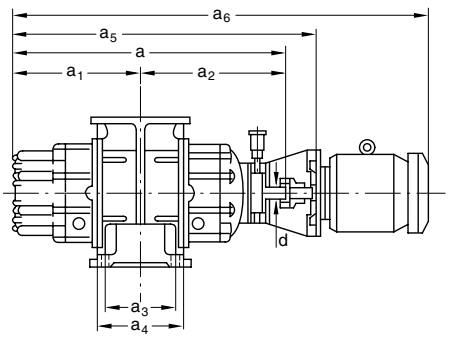
- Large vacuum systems like sintering and annealing furnaces which require multi-stage pumpsets
- In large vacuum rectification systems Roots vacuum pumps with postcondensers for compressing of vapors

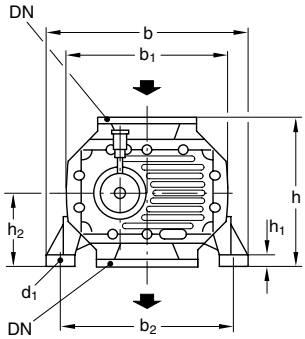
Custom Pumps

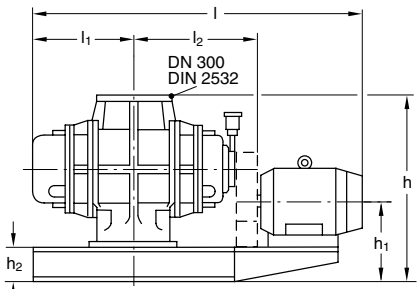
- If required the RA pumps are also available as C versions (chemical versions)
- Pumps made of special materials may be specified as well as pressure burst resistant pumps
- Custom designed pumps for pumping speeds of 250 m^3/h to 2000 m^3/h (147.3 to 1178 cfm)

Technical Note

For operation ordering of oil is necessary (see section “Accessories”)







RUVAC RA 13 000
* Width = 1000

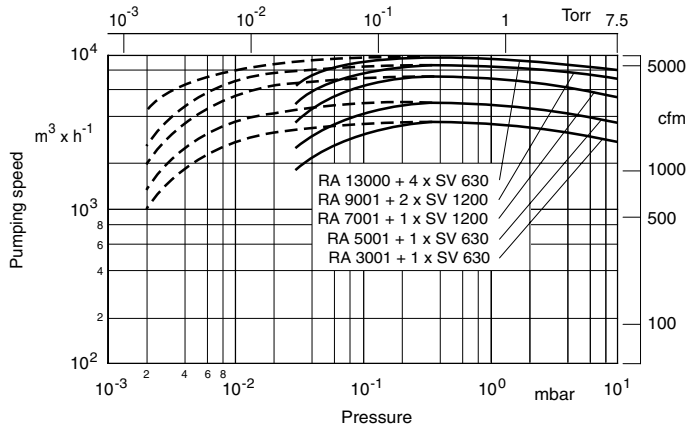
		DN	a	a_1	a_2	a_3	a_4	a_5	a_6
RA 3001	mm	200	980	470	510	290	350	1118	1606
	in.		38.58	18.50	20.08	11.42	13.78	44.02	63.23
RA 5001	mm	200	1013	468	545	280	360	1151	1639
	in.		9.88	18.43	21.46	11.02	14.17	45.31	64.53
RA 7000	mm	250	1143	533	610	410	490	1281	1813
	in.		45.0	20.98	24.02	16.14	19.29	50.43	71.38
RA 9001	mm	300	1467	685	782	655	800	1612	2204
	in.		57.76	26.97	30.79	25.79	31.50	63.46	86.77

		b	b_1	b_2	ø d_{k6}	ø d_1	h	h_1	h_2
RA 3001	mm	652	538	600	35	23	500	35	250
	in.	25.67	21.18	23.62	1.38	0.91	19.69	1.38	9.84
RA 5001	mm	800	652	720	42	23	630	50	315
	in.	31.50	25.67	28.35	1.65	0.91	24.80	1.97	12.40
RA 7000	mm	800	652	720	42	23	630	50	315
	in.	31.50	25.67	28.35	1.65	0.91	24.80	1.97	12.40
RA 9001	mm	910	810	830	55	27	710	30	355
	in.	35.83	31.89	32.68	2.17	1.06	27.95	1.18	13.98

		DN	l	l_1	l_2	h	h_1	h_2
RA 13000	mm	300	2110	685	782	930	420	220
	in.	300	83.07	26.97	30.79	36.61	16.54	8.66

DN = PN 10 pump flange to DIN-EN 1092-2
Outside dimensions +/- 3mm

Dimensional drawing for the RUVAC RA pumps



Pumping speed curves for the RUVAC RA, 50 Hz

Technical Data		RA 3001		RA 5001	
		50 Hz	60 Hz	50 Hz	60 Hz
Nominal pumping speed [1]	$m^3 \times h^{-1}$ (cfm)	3845 (2264)	4625 (2724	5450 (3210)	6560 (3864)
Max. pumping speed with backing pump	$m^3 \times h^{-1}$ (cfm) SOGEVAC	3200 (1883) SV 630 F	3850 (2266) SV 630 F	4300 (2531) SV 630 F	5200 (3061) SV 630 F
Ultimate partial pressure [2]	mbar (Torr)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)	$< 8 \times 10^{-3}$ ($< 6 \times 10^{-3}$)
Ultimate total pressure [2]	mbar (Torr)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)	$< 4 \times 10^{-2}$ ($< 3 \times 10^{-2}$)
Max. permissible pressure difference during continuous operation [3]	mbar (Torr)	53 (39.8)	53 (39.8)	53 (39.8)	53 (39.8)
for < 3 min.	mbar (Torr)	93 (69.8)	93 (69.8)	93 (69.8)	93 (69.8)
Main supply Δ / Y	V	380 / 660	440 / –	380 / 660	440 / –
Δ / Y	V	400 / 690	460 / –	400 / 690	460 / –
Δ / Y	V	415 / –	–	415 / –	–
Thermal class		F	F	F	F
Motor power	kW (hp)	11.0 (15.0)	12.5 (17.0)	15.0 (20.4)	17.0 (23.1)
Nominal speed, 50 Hz	rpm	3000/3600	3000/3600	3000/3600	3000/3600
Max. permissible speed	rpm	3600	3600	3600	3600
Type of protection	IP	55	55	55	55
Oil filling, approx.					
vertical pumping action	l (qt)	7.0 (7.4)	7.0 (7.4)	12.0 (12.7)	12.0 (12.7)
horizontal pumping action	l (qt)	3.5 (3.7)	3.5 (3.7)	5.4 (5.7)	5.4 (5.7)
Connection flange					
suction side [4, 5]	DN	200	200	200	200
pressure side [4, 5]	DN	200	200	200	200
Adapter flange package					
suction side	DN	250 ISO-K	250 ISO-K	250 ISO-K	250 ISO-K
pressure side	DN	160 ISO-K	160 ISO-K	160 ISO-K	160 ISO-K
Weight complete, approx.	kg (lbs)	580 (1278.9)	580 (1278.9)	770 (1697.9)	770 (1697.9)

Ordering Information	RA 3001 50 / 60 Hz	RA 5001 50 / 60 Hz
Roots vacuum pump RUVAC RA with motor, coupling and lantern [6] **RUVAC RA, ATEX version**	**Part No. 119 50 upon request**	**Part No. 119 53 upon request**
Adapter flange package for suction and pressure side, including centering ring with integrated dirt sieve in the intake flange	**Part No. 200 14 472**	**Part No. 200 14 472**
Frequency inverter RUVATRONIC (see description in Section "General", paragraph "Accessories")	**RT 5/3001 Part No. 500 001 385**	**RT 5/5001 Part No. 500 001 386**

[1] To DIN 28 400 and subsequent numbers
[2] With single-stage rotary vane vacuum pumps SOGEVAC
[3] Valid for a ratio of 1 : 5 between backing pump and Roots vacuum pump
[4] According to DIN 2532
[5] Without adapter flange to ISO-K flange
[6] Without oil filling

Technical Data		RA 7001		RA 9001		RA 13000
		50 Hz	60 Hz	50 Hz	60 Hz	50 Hz
Nominal pumping speed [1]	$m^3 \times h^{-1}$ (cfm)	7337 (4321)	8819 (5194)	9567 (5635)	11484 (6762)	13000 (7657)
Max. pumping speed	$m^3 \times h^{-1}$ (cfm)	6100 (3590)	7200 (4238)	7500 (4414)	8900 (5239)	10000 (5890)
with backing pump	SOGEVAC	SV 1200	SV 1200	2 x SV 1200	2 x SV 1200	–
or	$m^3 \times h^{-1}$ (cfm)	–	–	–	–	2500 (1473)
Ultimate partial pressure [2]	mbar	$< 8 \times 10^{-3}$	$< 8 \times 10^{-3}$	$< 1 \times 10^{-2}$	$< 1 \times 10^{-2}$	$< 1 \times 10^{-2}$
	(Torr)	($< 6 \times 10^{-3}$)	($< 6 \times 10^{-3}$)	($< 7.5 \times 10^{-3}$)	($< 7.5 \times 10^{-3}$)	($< 7.5 \times 10^{-3}$)
Ultimate total pressure [2]	mbar	$< 4 \times 10^{-2}$	$< 4 \times 10^{-2}$	$< 5 \times 10^{-2}$	$< 5 \times 10^{-2}$	$< 5 \times 10^{-2}$
	(Torr)	($< 3 \times 10^{-2}$)	($< 3 \times 10^{-2}$)	($< 3.8 \times 10^{-2}$)	($< 3.8 \times 10^{-2}$)	($< 3.8 \times 10^{-2}$)
Max. permissible pressure difference during continuous operation [3]	mbar (Torr)	53 (39.8)	53 (39.8)	66 (49.5)	66 (49.5)	53 (39.8)
for < 3 min.	mbar (Torr)	93 (69.8)	93 (69.8)	133 (99.8)	133 (99.8)	93 (69.8)
Main supply Δ / Y	V	380 / 660	440 / –	380 / 660	440 / –	380 / 660
	V	400 / 690	460 / –	400 / 690	460 / –	400 / 690
	V	415 / –	–	415 / –	–	415 / –
Thermal class		F	F	F	F	F
Motor power	kW (hp)	18.5 (25.1)	21.0 (28.6)	22.0 (30.0)	25.0 (34.0)	30.0 (40.8)
Nominal speed, 50 Hz	rpm	3000/3600	3000/3600	1500/1800	1500/1800	2000
Max. permissible speed	rpm	3600	3600	1800	1800	2000
Type of protection	IP	55	55	55	55	55
Oil filling, approx.						
vertical pumping action	l (qt)	12.0 (12.7)	12.0 (12.7)	11.0 (11.6)	11.0 (11.6)	11.0 (11.6)
horizontal pumping action	l (qt)	5.4 (5.7)	5.4 (5.7)	7.6 (8.0)	7.6 (8.0)	7.6 (8.0)
Connection flange						
suction side [4, 5]	DN	250	250	300	300	300
pressure side [4, 5]	DN	250	250	300	300	300
Adapter flange package						
suction side	DN	250 ISO-K	250 ISO-K	320 ISO-K	320 ISO-K	320 ISO-K
pressure side	DN	250 ISO-K	250 ISO-K	250 ISO-K	250 ISO-K	250 ISO-K
Weight complete, approx.	kg (lbs)	840 (1852.2)	840 (1852.2)	1400 (3087.0)	1400 (3087.0	upon request

Ordering Information	RA 7001 50 / 60 Hz	RA 9001 50 / 60 Hz	RA 13000 50 Hz
Roots vacuum pump RUVAC RA with motor, coupling and lantern [6]	**Part No. 119 60**	**Part No. 119 63**	**upon request**
RUVAC RA, ATEX version	**upon request**	**upon request**	**–**
Frequency inverter RUVATRONIC (see description in Section "General", paragraph "Accessories")	RT 5/7001 Part No. 500 001 387	RT 5/9001 Part No. 500 001 388	RT 5/13000 Part No. 500 001 389

[1] To DIN 28 400 and subsequent numbers
[2] With single-stage rotary vane vacuum pumps SOGEVAC
[3] Valid for a ratio of 1 : 5 between backing pump and Roots vacuum pump
[4] According to DIN 2532
[5] Without adapter flange to ISO-K flange
[6] Without oil filling

Pressure Switches

The RUVAC vacuum pumps may be switched on and off automatically through a pressure switch driven by a SV 110 switching amplifier and a contactor.

The pressure switch may be installed in the intake of the RUVAC using a screw-in adaptor, an elbow and two centering and two clamping rings.

Upon request the pressure switch may be set by Leybold to a fixed value. Please state this pressure value in your order.

Ordering Information	Pressure Switches
Pressure switch	
PS 115, adjustable setting	**Part No. 160 04**
Pressure switch setting	**Part No. 160 05**
Accessories for fitting the PS pressure switch	
Screw-in adaptor DN 16 KF, M 16 x 1.5 mm (0.06 in.)	Part No. 168 40
Elbow DN 16 KF	Part No. 184 36
Centering ring DN 16 KF (2 are required)	Part No. 183 26
Clamping ring DN 16 KF (2 are required)	Part No. 183 41
SV 110 switching amplifier (for PS 114/115)	**Part No. 160 78**
Oil pressure switch for RUVAC WSLF 1001 and WS-PFPE	**Part No. 194 82**

Vacuum Pump Oils

Lubricating oils for rotary vacuum pumps need to fulfil demanding requirements. Their vapor pressure must be low also at high temperatures, water content and water uptake must be minimal. Their viscosity characteristics needs to be flat, lubricating properties need to be excellent and they must resist cracking upon being mechanically stressed.

All the vacuum pump oils listed in the following have been subjected in our factory laboratories to very comprehensive tests closely resembling the conditions encountered in practice by the pumps from the RUVAC series.

We therefore recommend the exclusive use of vacuum pump oils fully qualified by Leybold so as to ensure optimum performance of the Leybold vacuum pumps and also to ensure optimum oil change intervals.

Under vacuum conditions lubricating oils, especially those with additives may behave quite differently than expected. Additives may adversely affect the attainable ultimate pressure and may react with the media being pumped.

When using not suitably qualified third party oils, the oil change intervals and the performance of the vacuum pump may be reduced. Also unwanted deposits may occur which may even cause severe damage to the vacuum pump.

For these reasons please understand that we must make our warranty commitment dependent on the use of oils which have been qualified by us. Damages caused by the use of not suitably qualified lubricating oils are not covered by our warranty.

In order to adapt the pumps to the different applications of our customers, different types of oil are used in the RUVAC pumps.

Please note that owing to differing properties not all types of oil may be used in all pumps of the RUVAC series. If you can not find the combination of pump and oil you require please ask us for a quotation.

Lubricant Types

Mineral Oils

Mineral oils are products distilled and refined from crude oil. These do not consist of precisely defined compounds but rather consist of a complex mixture. The way in which the mineral oil is pre-treated and its composition are decisive as to the applications it will be suited for. Depending on the distribution of the hydrocarbons and the dominance of certain properties, mineral oils are grouped according to paraffin-base, naphthenic and aromatic. For the purpose of attaining especially low ultimate pressures, mineral oils must be selected on the basis of a core fraction.

The thermal and chemical resistance of mineral oils has been found to be adequate in the majority of applications. They offer a high degree of compatibility with elastomers and resistance to hydrolysis.

Synthetic Oils

Synthetic oils are produced by a chemical reaction. The group of synthetic oils includes liquids differing widely as to their chemical structure and composition. Correspondingly their physical and chemical properties differ considerably. Synthetic oils are used in those cases where special properties of the oil are required which can not be fulfilled by mineral oils.

The oils given in the following belong to the group of synthetic oils:

Ester Oils

Ester oils are organic compounds which excel especially through their high thermal resistance to cracking compared to mineral oils. Chemical resistance is generally quite good, but will depend on the type of ester oil. Elastomer compatibility and resistance against hydrolysis are not so good compared to mineral oils.

Perfluorinated polyether (PFPE)

These are oils which are only composed of carbon (C), fluorine (F) and oxygen atoms (O). The existing C-O and C-F bonds are highly stable. For this reason PFPE oils are practically inert against all chemical and oxidising influences.

Perfluorinated polyether will not polymerise under the influence of high energy radiation.

PFPE is non-flammable. Leybold NC1/14 has the approval of BAM (Federal Institute for Materials Research and Testing) for pumping of pure oxygen.

Perfluorinated polyether are used when pumping strongly reactive substances like oxygen (O_2), fluorine (F_2) and uranium hexafluoride (UF_6). Regarding Lewis acids (for example, boron trifluoride (BF_3), aluminum trichloride ($AlCl_3$)) they are not completely inert. Here reactions may take place at temperatures over 100 °C (212 °F).

Perfluorinated polyether are thermally highly stable. Thermal decomposition may only take place at temperatures of over 290 °C (554 °F).

Caution: Perfluorinated polyether will – when decomposed – release toxic and corrosive gases: hydrogen fluoride (HF), carbonyl difluoride (COF_2). For this reason open fires must be avoided in the workspace where PFPE is being used. Do not smoke in the workspace where PFPE is being used.

Only suitably prepared pumps must be used in connection with perfluorinated polyether, since it is essential that the pumps be free of hydrocarbons.

Changing from one basic type of oil to PFPE must be left exclusively to authorised Service Centers. The pump will have to be fully dis-assembled and carefully cleaned. Gaskets and filters will have to be exchanged and suitable greases will have to be used.

Safety data sheets are available to professional users from:
e-mail "safety-data@leyboldvac.de" or Internet "www.leybold.com/safety-data".

Overview Oils

Application Data	Special Oil	ANDEROL® 555
Type of oil	Paraffin-base mineral oil, core faction, free of additives	Diester oil
Examples of areas of application and process media	Standard oil For pumping air, chemically inert permanent gases (noble gases, for example), water vapor	Used at elevated temperatures. Pumping of air, chemically inert permanent gases (noble gases, for example), carbon dioxide CO_2, carbon monoxide CO, aliphatic compounds (for example, methane CH_4, propane C_3H_8, ethylene C_2H_4), organic solvent vapors
Remarks	The ultimate pressures stated in our catalogs are based on operation of the pump with N62 (except for the PFPE pumps)	
Elastomer compatibility **FPM (Viton)** **NBR (Perbunan) [1)]** **EPDM**	 Suited Conditionally suited Not suited	 Suited Conditionally suited Not suited

Technical Data		Special Oil	ANDEROL® 555
Viscosity			
at 40 °C (104 °F)	**mm^2/s**	90	94
at 100 °C (212 °F)	**mm^2/s**	10	9
Flash point	**°C (°F)**	> 255 (491)	250 (482)
Vapor pressure			
at 20 °C (68 °F)	**mbar (Torr)**	$< 1 \times 10^{-5}$ ($< 0.75 \times 10^{-5}$)	7×10^{-5} (5.3×10^{-5})
at 100 °C (212 °F)	**mbar (Torr)**	$< 3 \times 10^{-3}$ ($< 2.3 \times 10^{-3}$)	1.5×10^{-3} (1.1×10^{-3})
Density at 15 °C (59 °F)	**g/ml**	0.88 [2)]	0,96
Pour point	**°C (°F)**	< -9 (< -16)	-42 (-44)
Middle molecular weight	**g/mol**	550	530

Ordering Information	Special Oil	ANDEROL® 555
1 litre (1.06 qt)	**Part No. 177 01**	**Part No. 200 10 272**
5 litres (5.29 qt)	**Part No. 177 02**	**Part No. 200 10 891**
20 litres (21.14 qt)	**Part No. 177 03**	**Part No. 200 00 193**
180 kg (397.35 lbs)	**Part No. 177 05**	**–**

Please note that the technical data stated are only typical data. Slight variations from batch to batch must be expected.
The technical data stated here can not be taken as assured properties

1) Resistance to decomposing is very much dependent on the share of acrylonitrile in the NBR

2) at 20 °C (68 °F)

Application Data	ANDEROL® 2100 HTCL	NC 1/14
Type of oil	Polyolester	Perfluorinated polyether PFPE
Examples of areas of application and process media	Used in the RUVAC WSLF for operation in connection with gas lasers	For pumping strong oxidants like oxygen, O_2, ozone O_3, nitrogen oxides NOx and sulphur oxides (SO_2, SO_3) as well as reactive substances like halogens (for example fluorine F_2, chlorine Cl_2), hydrogen halides (for example hydrogen chloride HCl, hydrogen bromide HBr), uranium hexafluoride UF_6 and conditionally Lewis acids (for example, boron trichloride BCl_3)
Remarks		Use only PFPE modified pumps. For operation with PFPE we recommend the exclusive use of such pump types which are equipped with a split-pole motor Mixing with other types of oil must be absolutely avoided
Elastomer compatibility		
FPM (Viton)	Suited	Suited
NBR (Perbunan) [1]	Conditionally suited	Conditionally suited
EPDM	Not suited	Not suited

Technical Data		ANDEROL® 2100 HTCL	NC 1/14
Viscosity			
at 40 °C (104 °F)	**mm^2/s**	94	47
at 100 °C (212 °F)	**mm^2/s**	13	5
Flash point	**°C (°F)**	265 (509)	– [2]
Vapor pressure			
at 20 °C (68 °F)	**mbar (Torr)**	5×10^{-5} (3.8 x 10-5)	3×10^{-7} (2.3 x 10-7)
at 100 °C (212 °F)	**mbar (Torr)**	8.5×10^{-4} (6.4 x 10-4)	6×10^{-4} (4.5 x 10-4)
Density at 15 °C (59 °F)	**g/ml**	0.92	1,89 [3]
Pour point	**°C (°F)**	-35 (-31)	-40 (-40)
Middle molecular weight	**g/mol**	No known	2500

Ordering Information	ANDEROL® 2100 HTCL	NC 1/14
1 litre (1.06 qt)	**Part No. 200 14 333**	**Part No. 177 38**

Please note that the technical data stated are only typical data. Slight variations from batch to batch must be expected.
The technical data stated here can not be taken as assured properties

1) Resistance to decomposing is very much dependent on the share of acrylonitrile in the NBR

2) **Caution:** Perfluorinated polyether will, when being decomposed at temperatures over 290 °C (554 °F), release toxic and corrosive gases
For this reason open fires must be avoided in the workspace where PFPE is being used. Do not smoke in the workspace where PFPE is being used

3) at 20 °C (68 °F)

Only available for purchase in North and South America

Application Data	HE-200	HE-1600
Type of oil	Paraffin-base mineral oil, core faction, free of additives	Perfluorinated polyether PFPE
Examples of areas of application and process media	Standard oil for Leybold USA For pumping air, chemically inert permanent gases (noble gases, for example), water vapor, solvent vapors in the case of laboratory pumps operated with cold traps	For pumping strong oxidants like oxygen, O_2, ozone O_3, nitrogen oxides NOx and sulphur oxides (SO_2, SO_3) as well as reactive substances like halogens (for example fluorine F_2, chlorine Cl_2), hydrogen halides (for example hydrogen chloride HCl, hydrogen bromide HBr), uranium hexafluoride UF_6 and conditionally Lewis acids (for example, boron trichloride BCl_3)
Remarks	The ultimate pressures stated in operation of the pump with HE-200 (except for the PFPE pumps) Service life may be extended through the use of an oil filter	Use only correspondingly modified pumps. For operation with PFPE we recommend the exclusive use of such pump types which are equipped with a split-pole motor Mixing with other types of oil must be absolutely avoided
Elastomer compatibility **FPM (Viton)** **NBR (Perbunan) [1]** **EPDM**	 Suited Conditionally suited Not suited	 Suited Suited Suited

Technical Data		HE-200	HE-1600
Viscosity at 40 °C (104 °F)	**mm^2/s**	58	–
Viscosity at 20 °C (68 °F)	**mm^2/s**	–	140
Viscosity at 100 °C (212 °F)	**mm^2/s**	9	
Viscosity at 99 °C (210 °F)	**mm^2/s**	–	7
Flash point	**°C (°F)**	224 (435)	Not known [2]
Vapor pressure at 100 °C (212 °F)	**mbar (Torr)**	3.9×10^{-4} (2.9×10^{-4})	2.7×10^{-4} (2.0×10^{-4})
Pour point	**°C (°F)**	-10 (14)	-40 (40)
Middle molecular weight	**g/mol**	480	3000

Ordering Information	HE-200	HE-1600
1.0 litre (1 qt)	**Part No. 98 198 006**	**–**
3.8 litres (1 gal)	**Part No. 98 198 007**	**–**
18.9 litres (5 gal)	**Part No. 98 198 008**	**–**
208 litres (55gal)	**Part No. 98 198 010**	**–**
0.9 kg (2 lbs)	**–**	**Part No. 898 564-1**
1.8 kg (4 lbs)	**–**	**Part No. 898 564-2**
7.2 kg (16 lbs)	**–**	**Part No. 898 564-4**

Please note that the technical data stated are only typical data. Slight variations from batch to batch must be expected.
The technical data stated here can not be taken as assured properties

[1] Resistance to decomposing is very much dependent on the share of acrylonitrile in the NBR

[2] **Caution:** Perfluorinated polyether will, when being decomposed at temperatures over 290 °C (554 °F), release toxic and corrosive gases
For this reason open fires must be avoided in the workspace where PFPE is being used. Do not smoke in the workspace where PFPE is being used

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Leybold vacuum

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