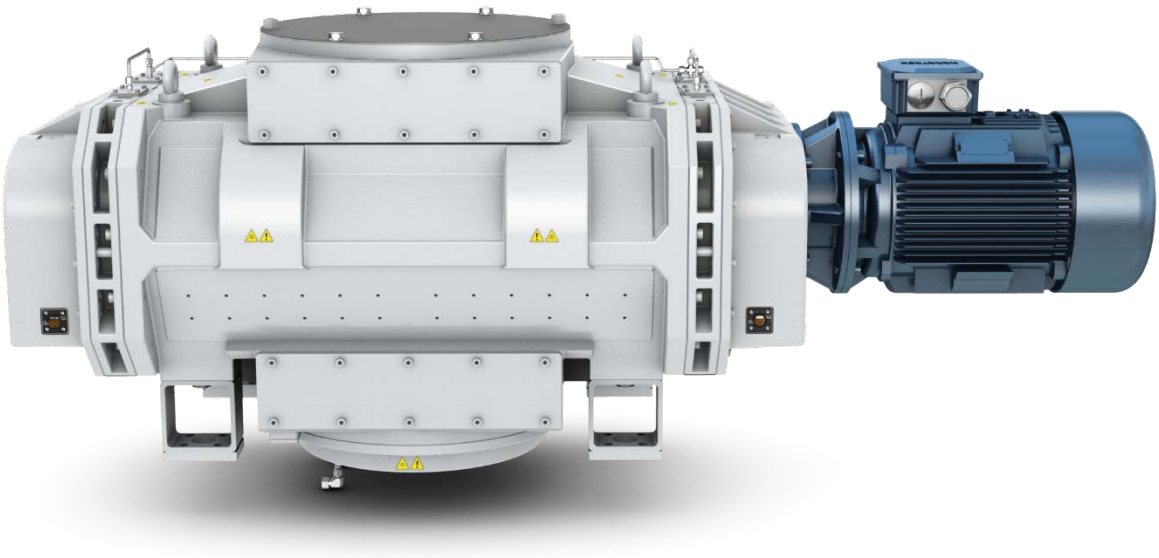
RUVAC WA 40000

Mechanical Booster

Installation and Operating Instructions 300692481_002_C0



Description	Item number
RUVAC WA 40000 IEC Bare Shaft	11740000V04
RUVAC WA 40000 IEC 400V 3PH 30KW	11740000V
RUVAC WA 40000 IEC 400V 3PH 30KW ATEX 2 Inside	11740000V11

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P200-50-003
Issue A

Material Declaration

In accordance with the requirements of the Chinese regulatory requirement on the Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products Order No. 32 (also known as 'China RoHS2') and SJ/T 11364 Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products:

Product	Product Label	Meaning
All pumps in the list below		This product contains hazardous substances in at least one of the homogeneous materials used which are above the limit requirement in GB/T 26572 as detailed in the declaration table below. These parts can safely be used for the environmental protection use period as indicated.

Pump Type	**Pump Size**
Mechanical Booster	RUVAC WA 40000

材料成份声明
Materials Content Declaration

部件名称 Part name	危险物质 Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
铸铝 Cast Aluminum	X	O	O	O	O	O
电机内的铜零件 Brass component in motor.	X	O	O	O	O	O

O: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。

O: Indicates that the hazardous substance contained in all the homogeneous materials for this part is below the limit requirement in GB/T 26572.

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

NOTE: These products are EU RoHS complaint, the following Exemptions apply:
6(b) Lead as an alloying element in aluminium containing up to 0.4% by weight
6(c) Copper alloys containing up to 4% lead by weight

Packaging Information

Pallet & Over shipper	Protection Pieces	Support Braces
		
Recyclable Natural Wood	Recyclable Polypropylene	Recyclable Mild Steel

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Associated publications

Publication title	Publication number
Vacuum pump and pumping system safety	300314311_002_C0

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1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the RUVAC WA 40000 Booster pumps. The RUVAC WA 40000 Booster pumps must be used as specified in this manual.

Read this manual before installing and operating the pump. Important safety information is highlighted as WARNING and CAUTION instructions; these instructions must be obeyed. The use of WARNINGS and CAUTIONS is defined below.

WARNING

Warnings are given where failure to observe the instruction could result in injury or death to people

CAUTION

Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment or process.

The following IEC warning labels may appear on the pump:

Warning - refer to accompanying documentation.

Warning - risk of electrical shock.

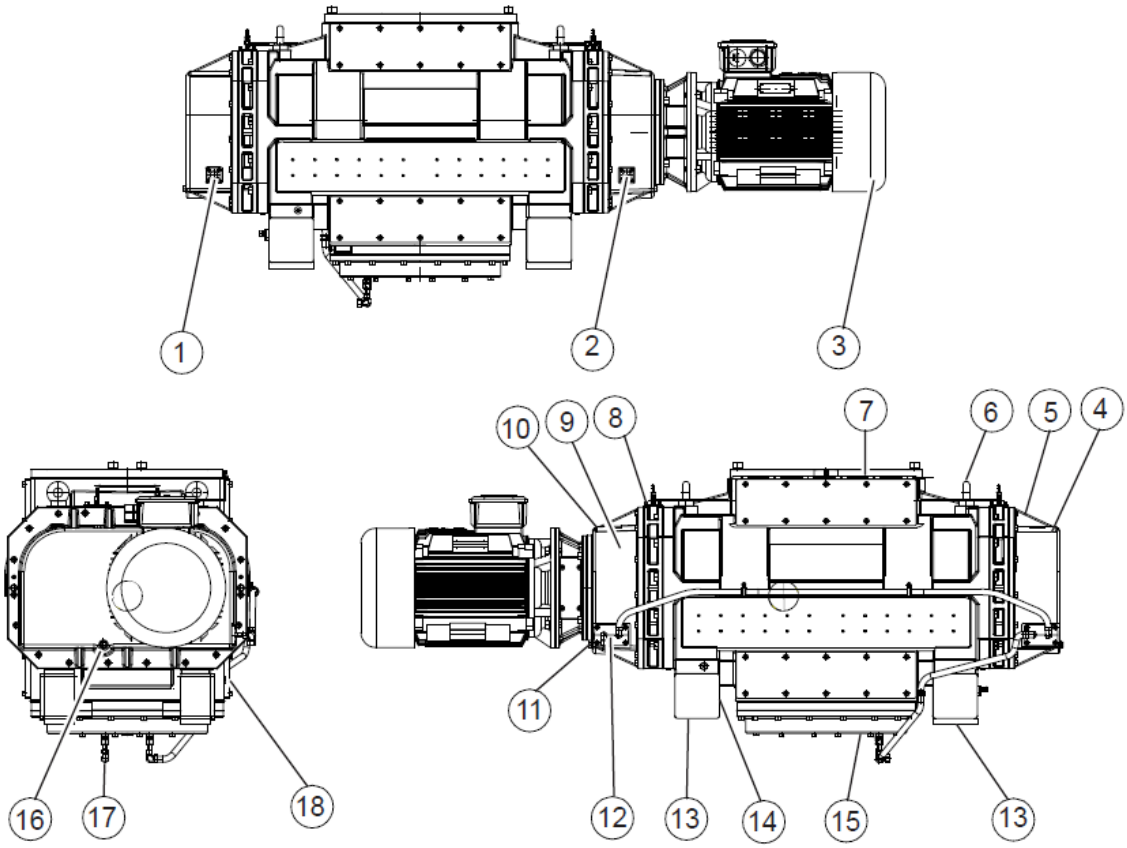
Warning - hot surfaces.

The units used throughout this manual conform to the SI international system of units of measurement.

1.2 Description

The RUVAC WA 40000 Vacuum Booster Pump is a large direct drive mechanical booster pump with a nominal capacity of 44300m^3h^{-1} @ 66Hz (40000 m^3h^{-1} @ 60Hz). It is designed to operate reliably for long periods with minimal requirements for maintenance.
The RUVAC WA 40000 is intended for use in large capacity vacuum pumping systems. It must be backed by suitable backing pump(s): It is not suitable for use without such backing pumps.

Figure 1 - Components of the RUVAC WA 40000 pump



1	Oil level sight glass (NDE)
2	Oil level sight glass (DE)
3	Motor
4	Non-drive end cover
5	Oil filler plug (NDE)
6	Eye bolt (x4)
7	Inlet
8	Seal purge inlet
9	Drive end cover
10	Oil filler plug (DE)
11	Oil drain plug (DE)
12	Cooling water outlet

13	Mounting feet (X4)
14	Earth stud
15	Outlet
16	Oil drain plug (NDE)
17	Cooling water inlet
18	Service inspection plate

Note:
Refer to Figure 2 for the mounting feet configurations of the pumps.

1.3 Application

The RUVAC WA 40000 is safe to handle non-flammable gases and vapours within the normal operating parameters of the pumps as defined in this manual. The standard version of the RUVAC WA 40000 (covered by this manual) is not suitable for hazardous area installation. For this kind of application, please consult application specialists from your supplier or your local sales representative who can assist on product selection.
The materials of construction are specified in Section 2.10. Before using the pump, ensure that these materials are compatible with the gases and vapours which will be pumped or which may exist in the external atmosphere.

Ensure that the pump is suitable for the application. If there are doubts as to the suitability of the pump, contact your supplier or your local sales representative for advice.

1.4 Normal operation

WARNING

A booster must always be used in conjunction with a backing pump. Never attempt to operate it alone.

WARNING

Booster pumps have dry pumping mechanisms that are designed to run with small clearances between the rotors and stators. It is recommended that an inlet screen is fitted to protect the pump from ingress of dust or larger particles that could cause damage.

WARNING

The pump is intended for generating a vacuum only. For example, if an overpressure occurs in the pump, the system must be protected by an overpressure safety valve.

1.5 Abnormal operation

WARNING

The pump is not allowed to run faster than the defined maximum rotational speed at any time. (Refer to the Section 2.3).

WARNING

Misuse of the booster as described below is strictly prohibited.

- Pumping flammable gases.
- Pumping hydrocarbon oxides.
- Pumping pyrophoric gases.
- Pumping gases that tend to self-decompose, or that are chemically unstable.
- Pumping peroxides or oxygen enriched atmospheres.
- Pumping of, or use in the presence of, dust atmospheres both inert and explosive.
- Use in ambient conditions other than those specified in Section 2.1.
- Use of the RUVAC WA 40000 booster in excess of the limits defined in this manual.
- Gas shock loads such as rapid opening of the foreline inlet against atmospheric pressure.

2 Technical data

2.1 Operating and storage conditions

Note:

For operation between -20 °C and 5 °C (-4 and 41 °F), we recommend that the RUVAC WA 40000 pump is operated continuously except when shutdown is necessary for maintenance purposes. Note also the cooling water requirements given in Section 2.4.

Adequate thermal protection against overheating is recommended, RUVAC WA 40000 is provided with a PT100 probe for measuring exhaust gas temperature, contact local sales representative for advice.

The RUVAC WA 40000 bare shaft pumps are designed to be functional at altitude up to 3000 m. Whereas motors are derated if the altitude exceeds 1000 m above sea level, contact local sales representative for advice.

There is a wide range of backing pumps which are suitable for use with the RUVAC WA 40000 pumps. If necessary, contact your local sales representative for advice.

Table 1 - Operating and storage conditions

Ambient operating temperature range	-20 to 40 °C, -4 to 104 °F
Ambient storage temperature range	-20 to 80 °C, -4 to 176 °F
Maximum ambient operating humidity	90%
Maximum operating altitude	See note above
Protection degree (as defined by IEC 529)	IP55
Recommended backing pumps	See Note above
Thermal protection again pump overheating (T – Exhaust gas temperature, Non drive end)	T>220°C, WARNING T>220°C for >8 min, ALARM & Shutdown T>230°C, ALARM & Shutdown

2.2 Critical backing pressure

WARNING

If an isolation valve is fitted between the RUVAC WA 40000 pump and the backing pump, interlock the operation of the valve with the operation of the RUVAC WA 40000 pump, so that closure of the valve results in shutdown of the RUVAC WA 40000 pump.

2.3 Performance

Table 2 - Performance data: safe area RUVAC WA 40000 pumps

Maximum rotational speed	3960 r min^{-1} (66Hz) 3960 r.p.m.
Minimum rotational speed (for correct pump lubrication)	540 r min^{-1} (9 Hz) 540 r.p.m.
Displacement (swept volume) at 3960 r.p.m.	44300 m^3 h^{-1} 26074 cfm
Minimum backing pumping speed at the pump outlet	7000 m^3 h^{-1} 4125 cfm
Maximum Motor Power (2 pole, IEC flange) (2 pole, NEMA flange)	30 kW 40 hp
Maximum continuous inlet gas temperature	60 °C 140 °F

2.4 Cooling water supply and seal purge gas supply

Table 3 - Cooling water supply data

Maximum supply pressure	9 bar gauge, 9 x 10^5 Pa, 130 psi
Permissible temperature range	5°C (41°F) to 40°C (104°F)
Minimum cooling water flow rate	10 l min^{-1}, 2.6 US gal min^{-1} at 40°C
Water quality specification	Particle size≤0.2mm
	TDS≤1500mg/l
	Specific conductivity≤2000µS/cm
	Hardness≤250mg/l $CaCO_3$
	pH 7~9
Minimum pressure drop required between booster water inlet and outlet	1 bar

Table 4 - Seal purge gas supply data

Purge gas pressure range	0.3 ~ 0.5 bar.g (5 ~ 7psig)
Minimum flow rate	4 slm
Purge gas inlet connection	Refer to Section 2.8
Purge gas supply quality	ISO8573

2.5 Mechanical data

Table 5 - Mechanical data

Dimensions	See Figure 2
Mass	2020 kg Bareshaft 2260 kg with motor fitted

2.6 Lubrication data

Table 6 - Lubrication data

Recommended oil	Gear Box Oil 4 litres - Mobil SHC 629	
Capacities	**Drive end cover** 3.35 litres, 0.88 US gal	**Non drive end cover** 3.55 litres, 0.94 US gal

2.7 Electrical data

The RUVAC WA 40000 pump is supplied either as a bareshaft booster, or with a 30 kW 2-pole motor fitted. In either case, the motor must be connected to a suitable Variable Frequency Drive. Refer to the motor rating plate for details of the electrical supply voltage, frequency and full load current, and the motor terminal box for electrical connection details.
If fitting a motor to a bareshaft booster, refer to the Instruction manual supplied with the motor.
Ensure that the electrical installation of RUVAC WA 40000 pump conforms to local and national safety requirements, refer to Section 3.4.

2.8 Connections

Table 7 - Connections data

Process inlet*	DN500 PN6, 645mm OD
Outlet*	ISO250, 335mm OD
HV40000 Adaptor flange (Exhaust outlet) see figure 3	ISO250 / DIN.300
Cooling water inlet / Outlet	½" BSP
Seal purge	¼" BSP

*Connections to the customers system will be achieved through the use of adaptors to achieve compatible inlet and outlet interfaces.

2.9 Noise and vibration data

WARNING

The noise and vibration data values given below are maximum values for the booster in isolation. The actual values will depend on the installation, motor fitted and the operating conditions. As these pumps are used in a system and not in isolation, it is recommended that the user carry out an assessment to determine if and what Personal Protection Equipment (PPE) may be required.

Table 8 - Noise and vibration data

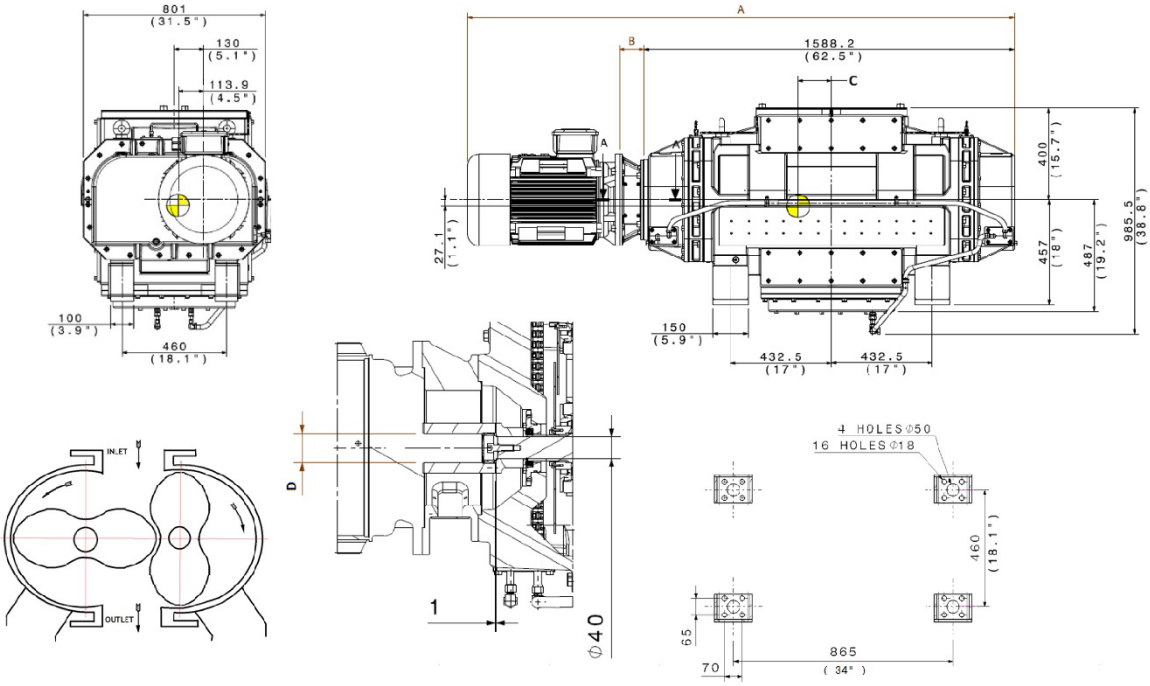
	RUVAC WA 40000
Sound pressure level (at Ultimate pressure, Inlet closed)	80 dB(A) 95 dB(A)
Sound power level (at Ultimate pressure, Inlet closed)	< 4 mm s^{-1}
Vibration level	< 0.16-inch s^{-1}

2.10 Materials of construction

Table 9 - Construction materials data

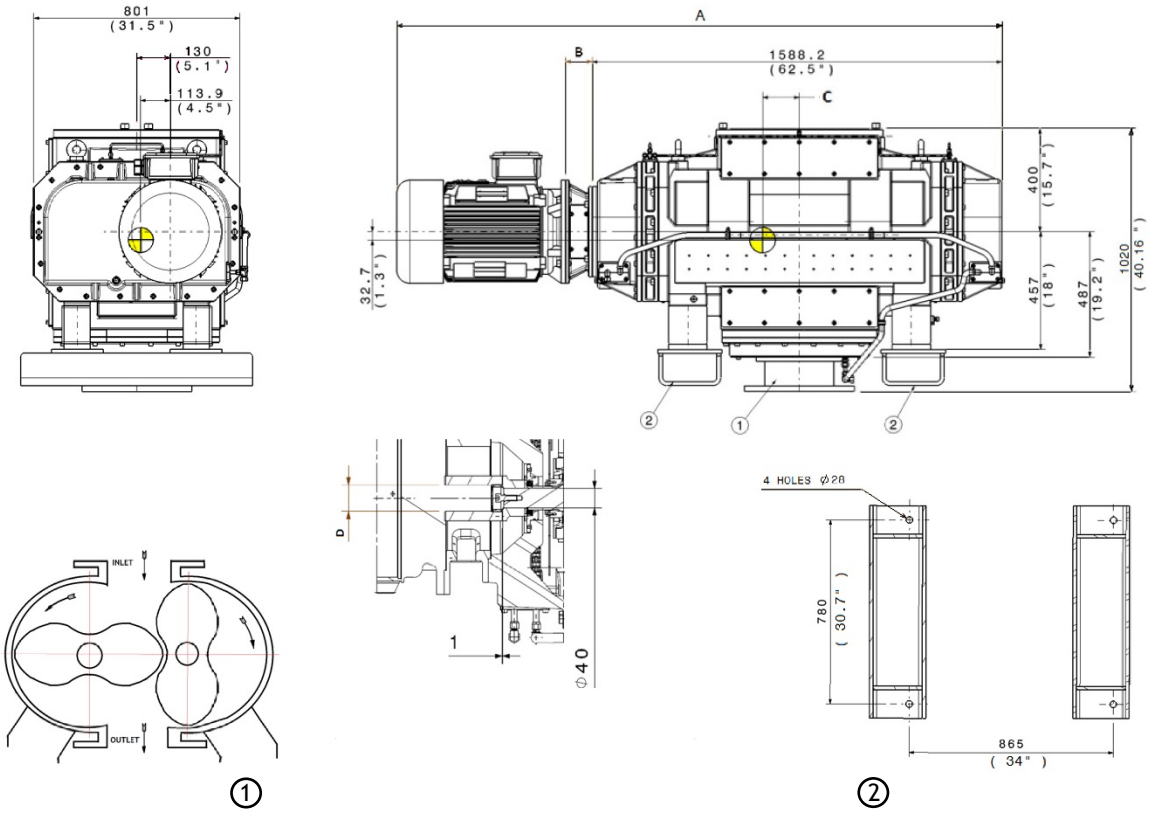
Cooling coils, Cooling Plates, Aftercooler	Cast Aluminum with stainless steel pipes
End Covers	Cast Aluminum
Stator, head plates	SG cast iron
Lobes	SG iron
Shaft	Steel
Bearings	High carbon chrome steel
Shaft seals	PTFE
O-ring seal	Fluoro-elastomer

Figure 2 - RUVAC WA 40000 dimensions: mm (inch)



Unit	Motor size	A mm (inch)	B mm (inch)	C mm (inch)	D Shaft Ø
RUVAC WA 40000 Bare shaft	N/A	N/A	104 (4.1)	14.8 (0.6)	IEC: 55.0 NEMA: 47.625 (1.875”)
RUVAC WA 40000 motorized	30 kW	2344.2 (92.3)	104 (4.1)	142.2 (5.6)	

Figure 3 - RUVAC WA 40000 dimensions with retrofit adaptor to HV40000: mm (inch)



1	Adaptor flange
2	Adaptor frame

Note:
HV40000 Adaptor flange and Adaptor frame are available as a spare KIT (A30800721), contact your sales representative for more details.

Unit	Motor size	A mm (inch)	B mm (inch)	C mm (inch)	D Shaft Ø
RUVAC WA 40000 Bare shaft	N/A	N/A	104 (4.1)	14.8 (0.6)	IEC: 55.0 NEMA: 47.625 (1.875”)
RUVAC WA 40000 motorized	30 kW	2344.2 (92.3)	104 (4.1)	142.9 (5.6)	

3 Installation

CAUTION

Liability or warranty claims will not be accepted if the installation includes any modifications or additions to the pump without the prior written approval, or if the pump is incorrectly installed.

3.1 Installation safety

WARNING

Obey the safety instructions listed below and take note of appropriate precautions while installing the pump. Failure to follow the instructions can cause injury to people and damage to equipment.

- Only a trained and competent engineer may carry out the installation of the RUVAC WA 40000 pump. For advice contact your local customer centre.
- Disconnect the other components in the pumping system from the electrical supply so that they cannot be operated accidentally.
- Ensure that the cooling air flow through the pump motor cooling fan cannot be obstructed.
- Ensure that all electrical cables, purge gas pipelines and cooling water pipelines are safely positioned, secured and routed, so that they do not present a trip hazard.
- Leak test the system after installation work is complete and seal any leaks found to prevent leakage of hazardous substances out of the system and leakage of air into the system.

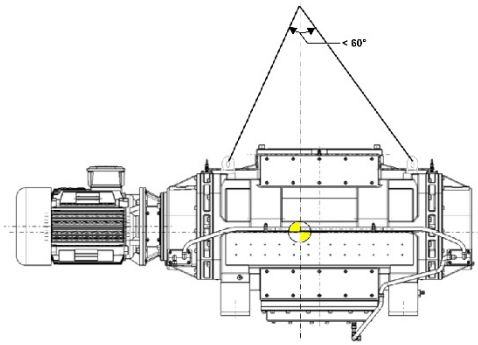
3.2 Unpack and inspect

WARNING

Use suitable lifting equipment to move the pump. Failure to follow the instructions can cause injury to people or damage the pump. Refer to section 2.5 for the mass of the pump.

1. Use a suitable fork lift truck or pallet truck to move the pump, on its pallet, close to the place of installation.
2. Remove all packing materials.
3. Use suitable lifting gear to remove the RUVAC WA 40000 pump from its pallet.
4. Ensure the sling centre is in line with centre of gravity which is indicated on Figure 2 and Figure 3 Refer to Figure 4.

Figure 4 - Sling Centre and Centre of Gravity



3.3 Mechanical installation

3.3.1 Locate the pump

WARNING

Use suitable lifting equipment to move the pump. Failure to follow the instruction can cause injury or can damage the pump. Refer to Section 2.5 for the mass of the pump.

Ensure that when the pump is in its required operating location, all of the mounting feet (on the pump or base frame) are flat on the mounting platform to within 0.2 mm m^{-1} (0.0026-inch ft^{-1}).

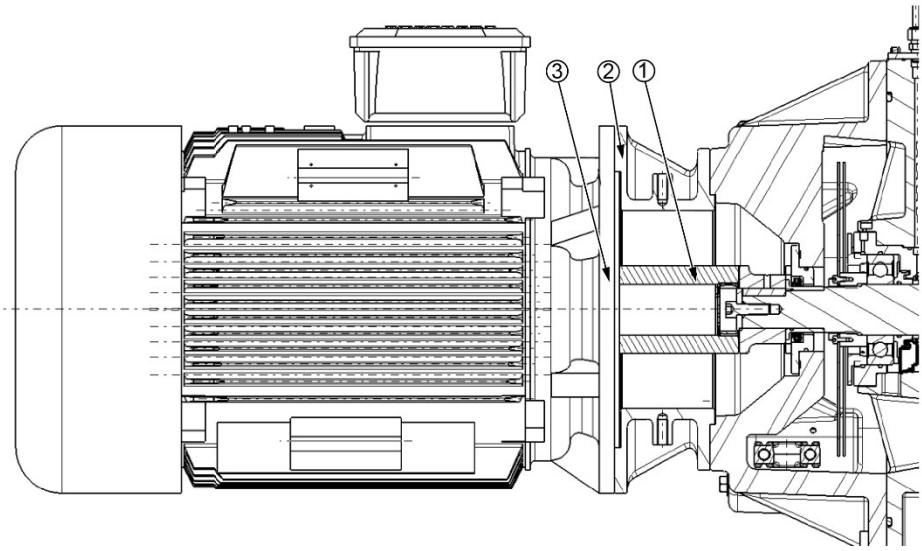
Use the following procedure to locate the RUVAC WA 40000 pump:

1. Use suitable lifting equipment to move the RUVAC WA 40000 pump into its required operating location: use the appropriate method for the pump, as described in Section 3.2.
2. Fit suitable bolts through the fixing holes in the mounting feet, to secure the pump in position. Refer to Figure 2 for fixing details.
3. Disconnect the lifting equipment from the pump.

3.3.2 Motor installation for bareshaft variant

- Choose an appropriate motor to be installed onto RUVAC WA 40000 according to related mechanical parts size. Refer to Figure 5 for mechanical parts size.

Figure 5 - Pump Motor and Drive Coupling Size



Model	Item 1	Item 2	Item 3
RUVAC WA 40000 IEC B-SHAFT	Coupling Half drive – IEC: φ55mm	Motor Mounting Flange – IEC	IEC Motor Frame Size: 200L IM: B5
RUVAC WA 40000 NEMA B-SHAFT	Coupling Half drive – NEMA: φ47.625mm (1.875”)	Motor Mounting Flange – NEMA	NEMA Motor Frame: 324TS D-flange
RUVAC WA 40000 IEC 400V 3PH 30KW	Coupling Half drive – IEC: φ55mm	Motor Mounting Flange – IEC	IEC Motor Frame Size: 200L IM: B5

3.4 Motor electrical connections

WARNING

Obey the safety instructions given below while making the electrical connections. Failure to follow the instructions can cause injury to people.

- The RUVAC WA 40000 is designed to be fitted with a 30kW 2-pole Motor and must to be connected to variable frequency drive, set to run at a frequency of 66Hz to achieve optimum pumping performance. (Note: Motors driven by variable frequency drives are out of scope of IEC60034-30 which specifies efficiency classes for single speed electric motors.)
- Ensure that the electrical installation of the RUVAC WA 40000 pump conforms to your local and national safety requirements. It must be connected to a suitably rated fused and protected electrical supply and a suitable earth (ground) point.

3.4.1 Connect the electrical supply

WARNING

Obey the safety instructions given below when making the electrical connections. Failure to follow the instructions can cause injury to people or damage to the pump/motor.

- Provide suitable strain relief on the electrical supply cable to both drive and motor. If the instruction is not followed, the cable (or wires in the cable) may get disconnected from the drive or the pump motor and it can cause injury or death by electric shock.
- Connect the electrical supply to the drive through a contactor which has a manual reset control.
- Connect the electrical supply so that it is automatically switched off if the backing pump stops. If the instruction is not followed, the RUVAC WA 40000 pump may overheat if it continues to operate when the backing pump is stopped.
- You must be able to isolate and lock out the electrical supply to the RUVAC WA 40000 pump and its variable frequency drive.

3.4.2 Connect the motor thermistors

CAUTION

The RUVAC WA 40000 pump motor is equipped with thermistors, do not operate RUVAC WA 40000 pump motor without thermal protection. Failure to follow the instructions can cause injury or can damage the pump/motor.

Connect the thermistor terminals in the motor to a suitable control circuit, to shut down the RUVAC WA 40000 pump system if the motor temperature is too high.

3.4.3 Connect the PT 100

CAUTION

The RUVAC WA 40000 pump is equipped with PT100 thermal protection, do not operate RUVAC WA 40000 pump without PT100 thermal protection. Failure to follow the instructions can cause injury or can damage the pump.

Connect the PT100 thermal sensor to a suitable control circuit, to shut down the RUVAC WA 40000 pump system if the exhaust gas temperature exceeds the limits given in Table 1 .
PT100 sensor is mounted under the pump, and is a 4-wire type sensor. For detailed technical information for PT 100 refer to Table 10. Use the PT 100 Sensor with suggested specifications only. Contact local sales representative for advice.

Table 10 - PT 100 - Technical information

	PT 100
Supplier	Endress and Hauser or Equivalent
Thermocouple type	TST310- B1A1A4D4B1A
Insert diameter / Calibration	6 mm / W/0
Insertion length (NL)	100 mm
Insert material	-50/+400 oC, MgO, 316 L
RTD class / Wiring	1 x PT100A / 4-Wire
Process connection	Compression fitting G ¼", 316, Ferrule 316
Length of extension (L)	4000 mm
Wire / Sheath / Application	PTFE, Silicon, 4-Wire max. 180 oC
Connection cable	Flying leads
Ingress rating	IP 65
Compression fitting type	TA 50- GB
Additional option	Not needed

3.5 Earth (ground) connection

Note:

We recommend to connect the booster pump to a suitable factory/plant earth (ground).

3.6 Connect the cooling water pipelines

Note:

Refer to Section 2.4 for the cooling water requirements.

Connect the cooling water pipelines as follows:

1. Refer to Figure 1. Connect the cooling water supply pipeline to the cooling water inlet 17.
2. Connect the cooling water return pipeline to the cooling water outlet 12.

Refer to Section 2.4 for the pressure drop and flow rate requirement. Do not allow the cooling water supply pressure to go above the maximum pressure stated in Section 2.4.

3.7 Check the direction of rotation

WARNING

Obey the safety instructions given below. Failure to follow the instructions can cause injury to people or damage to the pump/motor.

- Only a trained and competent engineer may carry out the installation of the RUVAC WA 40000 pump. For advice contact your local customer centre.
- Correct rotational direction is indicated by label on the pump and motor.
- Blank the inlet or connect the RUVAC WA 40000 pump to the vacuum system before checking the direction of pump rotation. If the instruction is not followed, there is danger of objects being trapped in the rotating pump rotors.
- Ensure that you do not come into contact with the shaft, the coupling or the drive system while operating the pump. Failure to follow the instruction can cause injury to personnel by the rotating components.

After connecting the drive/transmission or the electrical supply to the pump motor, check the direction of rotation of the pump as follows:

1. Check the motor fan rotational direction to see if it's correct as label indicated. If necessary (that is, to make it easier to see the pump drive shaft), temporarily remove any guard over the drive coupling (If fitted).
2. Also Refer to Figure 2 watch the pump drive shaft or the coupling while starting up the pump (refer to Section 4.2), then shut down the pump (refer to Section 4.3) after two seconds or so.
3. Check that the pump drive shaft or coupling rotated correctly in the expected direction.
4. If the direction of rotation was incorrect
   - Check the installation of the drive and transmission system and reconfigure as appropriate.
5. Perform the direction of rotation check from Step 1 again, to ensure that the pump now rotates in the correct direction.
6. If guard over the drive coupling is removed (as in Step 1 above), refit the guard.

3.8 Connect the pump inlet and outlet

WARNING

Obey the safety instructions given below. Failure to follow the instructions can cause injury to people or damage to the pump.

- Only a trained and competent engineer may carry out the installation of the RUVAC WA 40000 pump. For advice contact your local customer centre.
- Do not exceed the maximum vertical force limit of 1000N on the pump inlet and outlet flanges. Failure to follow the instructions may result in leakage of process gases from the pump, or damage to the pump.
- Use a flexible connection in the pipeline from the vacuum system to the RUVAC WA 40000 pump to minimize vibration and stress in the system pipelines
- If an isolation valve is fitted between the RUVAC WA 40000 pump and the backing pump, interlock the operation of the valve with the operation of the RUVAC WA 40000 pump, so that closure of the valve results in shutdown of the RUVAC WA 40000 pump.
- Ensure the backing pump and exhaust extraction/abatement systems comply with the critical backing pressure requirements of Section 2.2 and Section 2.3.

3.9 Commission the RUVAC WA 40000 pump

Only a trained and competent engineer may carry out the installation of the RUVAC WA 40000 pump. For advice contact your local customer centre.

- Ensure that any isolation valves in the pump inlet pipeline is in the correct ‘closed’ positions.
- Ensure that any isolation valves in the pump outlet pipelines is in the correct ‘open’ positions.
- Ensure that any other components in the system pipelines (such as filters) have been correctly installed and configured for operation.
- Start up the RUVAC WA 40000 pump: refer to Section 4.2.
- Operate the RUVAC WA 40000 pump, with no gas load, for at least 120 minutes. During this time:

  Check Operating conditions are as specified in Section 2.
- Continue to operate the pump with a representative gas load, and check that the pump operates correctly and provides the required performance. If necessary, refer to Section 5.9 if any fault conditions occur.
- Shutdown the RUVAC WA 40000 pump, refer to Section 4.3.

The pump is now ready for normal operation when required.

4 Operation

CAUTION

No liability or warranty claims will be accepted if the pump is used on applications or in a way prohibited or not specified in this manual.

4.1 Operational safety

WARNING

Obey the safety instructions and precautions listed below. Failure to follow the instructions can cause injury or death to people, or damage to the pump.

WARNING

Ensure that the cooling air flow around the pump motor is not restricted. If the air flow is restricted, the motor will get hotter than normal during pump operation. This may result in reduced reliability and/or damage and/or the risk of the thermistors/ thermostats, if fitted and connected, to shut down the system.

- Do not expose any part of your body to vacuum. Failure to follow the instruction can cause injury.
- Do not operate the pump with the pump inlet or outlet ports, or service inspection ports open to the atmosphere. If the instruction is not followed, fingers or other parts of your body or clothing may get trapped, and it can cause injury by the rotating mechanisms in the pump.
- During operation parts of the RUVAC WA 40000 pump can become very hot. Do not touch the pump during operation.
- Do not operate the pump with any guards removed from the pump drive shaft, the coupling/belt or the drive system (where fitted). If the instruction is not followed, your fingers or other parts of your body or clothing may get trapped, and it can cause injury by the rotating components.
- Never disconnect any of the connecting pipelines (for example, the pipeline connected to the inlet) when the pump is operating.
- Do not attempt to use the RUVAC WA 40000 pump to pump liquids. The RUVAC WA 40000 pumps are not designed for this application.
- Wear suitable ear defenders. The pump can be noisy during operation (refer to Section 2.9).

4.2 Start-up

4.2.1 Pre-start checks

WARNING

Ensure that the correct grade of oil is used and that the oil levels in the RUVAC WA 40000 pump are correct. If an incorrect oil is used or if an oil level is incorrect, pump performance may be affected and the pump may be damaged.

- Check that the oil levels are correct (refer to section 5.4) and that the oil filler plugs are tightened.
- Check that there are no visible oil or water leaks.
- Check that the RUVAC WA 40000 pump is correctly installed, especially after initial installation and maintenance.

4.2.2 Start-up

- Ensure that any isolation valves in the pump inlet and outlet pipelines are in the correct positions.
- Switch on the cooling water supply.
- Check that there is an adequate flow of cooling water at the correct pressure (see Section 2.4).
- Check the water connections for leaks.
- Close the backing pump air admittance valve (if fitted).
- Switch on the seal purge gas supply:
- Check that the parameter of the seal purge gas supply is correct (see Section 2.4) and adjust if necessary.
- Switch on the backing pump and open the backing valve (if fitted).
- Switch on the electrical supply to start the RUVAC WA 40000 pump.
- Allow the RUVAC WA 40000 pump to run for approximately 120 minutes to achieve normal operating temperature.
- Slowly open the pump inlet isolation valve (if fitted).

4.3 Shutdown

- Close the pump inlet isolation valve (if fitted).
- Leave the RUVAC WA 40000 pump operating for sufficient time such that the pump is thoroughly purged of any hazardous substances.
- Switch off the motor electrical supply or disengage the drive and transmission system to stop the RUVAC WA 40000 pump.
- Open the backing pump air admittance valve (if fitted) and switch off the backing pumps.
- Refer to the relevant pump instruction manuals when shutting down the backing pumps.
- Switch off the cooling water supply and seal purge gas supply.

5 Maintenance

5.1 Safety information

WARNING

Obey the safety instructions given below and take note of appropriate precautions. Failure to follow the instructions can cause injury to people and damage to equipment.

WARNING

Condensation from cooling surface in some environments, or lubricating oil spillages can cause a slip hazards. Failure to follow instructions could lead to injury.

- A suitably trained and supervised technician must maintain the pump. Obey your local and national safety requirements.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the gases pumped/compressed by the system in which the pump is installed.
- Make sure to verify that pump internal pressure is completely equalized to atmospheric pressure.
- Allow the pump to cool to a safe temperature before starting maintenance work.
- Isolate the RUVAC WA 40000 pump from the electrical supply/drive system so that it cannot be operated accidentally.
- Recheck the pump rotation direction (see Section 3.7) if the motor electrical supply or drive and transmission system has been disconnected and then reconnected.
- Take care to protect inlet/outlet port sealing faces from damage.
- Do not reuse seals/gaskets if they are damaged.
- Check the leak tightness of the system connections after maintenance work is completed if the pump inlet or outlet joints are connected or disconnected. The leak tightness of the system connections must be in accordance with the requirements of the applications.
- The RUVAC WA 40000 pump will be contaminated with the process gases that have been pumped. Take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

5.2 Maintenance plan

The plan in Table 11 details the maintenance operations necessary to maintain the RUVAC WA 40000 pump in normal operation. Instructions for each operation are given in the section shown.

More frequent maintenance may be required if the RUVAC WA 40000 pump is used to pump corrosive or abrasive gases and vapours. If necessary, adjust the maintenance plan according to your experience.

While maintaining the pump, use recommended spares: refer to Section 7.3.

Table 11 - Maintenance plan

Operation	Frequency	Refer to Section
Check the end cover oil levels	Weekly	5.4
Inspect the system installation - all water, N2, pipelines	Monthly	5.5
Change the oil	8000 hourly	5.6
Clean and inspect aftercooler	Yearly (Depends on application)	
Overhaul the pump - strip down and rebuild	3 Yearly	5.7 & 5.8
Maintain the motor - regreasing motor bearings	In accordance with motor lubrication label.	
Maintain the motor - replace motor bearing	Check together with pump overhaul, 3 yearly, replaced if needed.	

5.3 Inspect the oil level

1. Refer to Figure 1. Look at the oil level sight glasses (2, 1) on the drive end cover (9) and non-drive end cover (4):
   - If the sight glass is dirty, use a suitable cloth to wipe it clean.
   - If the sight glass is damaged (that is, scratched, cracked or corroded), or if there are signs of oil leakage from the sight glass, you must replace it: contact your supplier or your local sales representative.
   - The oil level should be between the minimum and maximum marks.
   - If the oil levels are below the minimum level mark, continue as per Section 5.4 to add more oil.
   - If the oil level is above the maximum level mark, drain oil from the pump until the level is correct: refer to Section 5.6.

5.4 Top up the end cover oil level

WARNING

Turn off the seal purge. Allow the pressure in the end covers to reach to atmospheric pressure. To remove an oil filter plug, undo it slowly to allow the pressure in the end cover to equalize to atmospheric pressure, then fully undo and remove the oil filler plug. If the instruction are not followed, hot oil can get ejected from the end cover and cause injury.

WARNING

Ensure that the correct grade of oil is used and that the oil levels in the RUVAC WA 40000 pump are correct. If an incorrect oil is used or if an oil level is incorrect, pump performance may be affected and the pump may be damaged.

1. If the pump is operating, shut the pump down (refer to Section 4.3) and allow the pump to cool to a safe temperature.
2. Carefully remove the oil filler plug (10) from the filler port on the top of the drive end cover (9): refer to the Warning at the start of Section 5.4.
3. Pour new oil of the correct type (see Section 2.6) through the filler port and into the end cover until the oil-level reaches the maximum level mark. If the oil level goes above the maximum level mark, drain oil from the pump until the level is correct: refer to Section 5.6.
4. Refit the oil filler plug (10) to the filler port on the top of the drive end cover (9).

5.5 Inspect the system installation

Use the following procedure to inspect the system connections:

- Inspect all the system pipelines and connections and check that they are not damaged or corroded and that they are sufficiently leak tight. Repair or replace any damaged or corroded component and seal any leak found.
- If drive/transmission system is installed, inspect the drive/transmission system and adjust, repair or replace as necessary: refer to the manufacturer's instructions supplied with the drive/transmission system.
- Inspect all of the cooling water pipelines and connections and check that they are not damaged or corroded and that they do not leak. Repair or replace any damaged or corroded component and seal any leak found.
- Inspect all of the electrical cables; check that they are not damaged and have not overheated. Replace any cables that are damaged or have overheated. Check that all the electrical connections are secure; tighten any loose connections.

5.6 Change the oil

WARNING

Turn off the seal purge. Allow the pressure in the end covers to reach to atmospheric pressure. To remove an oil filler plug, undo it slowly to allow the pressure in the end cover to equalize to atmospheric pressure, then fully undo and remove the oil filler plug. If the instructions are not followed, hot oil may be ejected from the end cover and cause injury.

WARNING

Ensure that you do not come into contact with the used pump oil. The end cover oil may be hot and can cause injury.

5.6.1 Drive end cover

1. Refer to Figure 1. Carefully remove the oil filler plug (10) from the filler port on the top of the drive end cover (9): refer to the Warning at the start of Section 5.6
2. Place a suitable container under the oil drain plug (11) on the drive end cover (9). The container must have a maximum capacity as specified in Table 6.
3. Remove the oil drain plug (11) from the end cover, and allow the oil to drain from the end cover into the container.
4. Refit the oil drain plug (11) to the drive end cover (9).
5. Dispose of the oil: refer to Section 6.2.
6. Fill the drive end cover with new oil of the correct type and grade.

5.6.2 Non-drive end cover

1. Refer to Figure 1. Carefully remove the oil filler plug (5) from the filler port on the top of the non-drive end cover (4), refer to the Warning at the start of Section 5.6.
2. Place a suitable container under the oil drain plug (16) on the non-drive end cover (4). The container must have a maximum capacity as specified in Table 6.
3. Remove the oil drain plug (16) from the end cover, and allow the oil to drain from the end cover into the container.
4. Refit the oil drain plug (16) to the non-drive end cover (4).
5. Dispose of the oil: refer to Section 6.2.
6. Fill the non-drive end cover with new oil of the correct type and grade.

5.7 Replace the pump motor

5.7.1 Remove the pump motor

WARNING

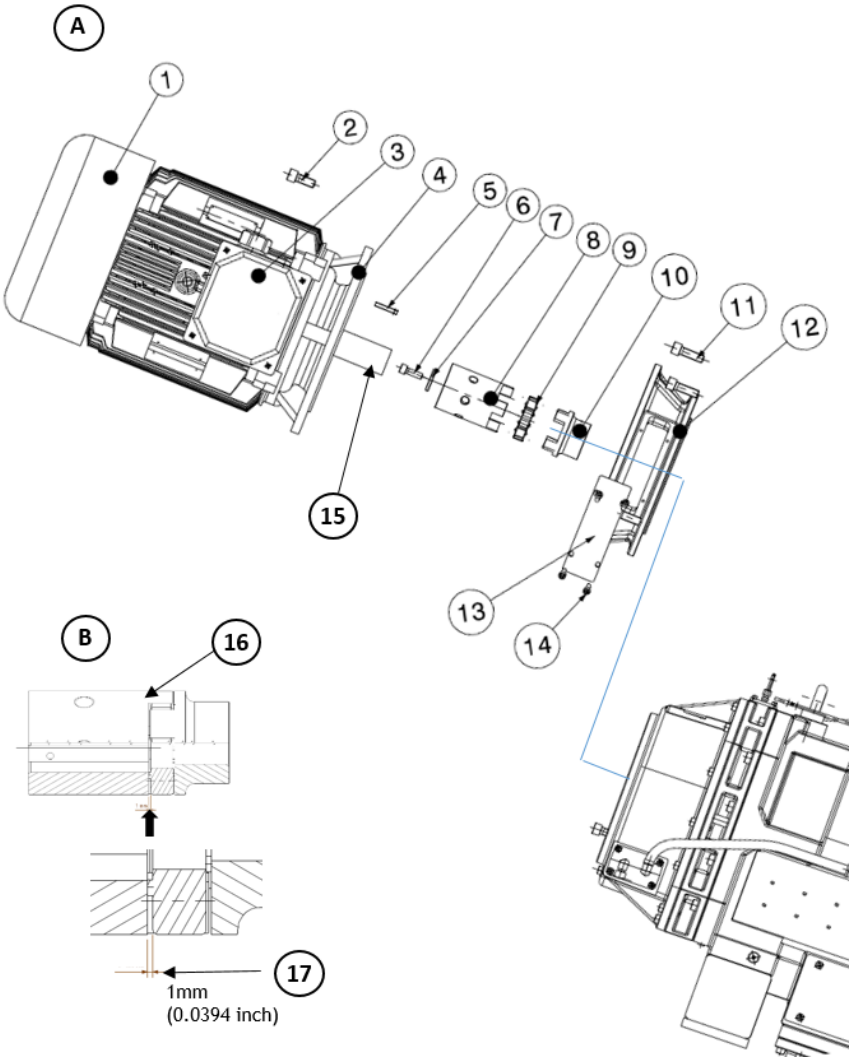
Ensure that the electrical supply cable is isolated from the electrical supply before starting work.
If not, there is a risk of injury or death by electric shock.

WARNING

Ensure that the pump motor cannot fall when removing it. The pump motor is heavy and can cause injury to people if it falls.

Use the following procedure to remove the pump motor. Ensure that the pump motor is adequately supported throughout and does not fall: the masses of the pump motors are given in Section 2.5 .

Figure 6 - Pump Motor and Drive Coupling



1	Motor
2	Bolts (4 off)
3	Motor terminal box
4	Motor flange
5	Key
6	Bolt (1 off)
7	Washer
8	Coupling Half - Drive
9	Coupling Spider
10	Coupling Half - Driven
11	Bolts (4 off)
12	Motor Mounting Flange
13	Motor mounting flange side plate
14	Bolts (4 off)
15	Motor shaft
16	Coupling Half - Drive

- Ensure that the electrical supply cable is isolated from the electrical supply.
- Refer to Figure 6. Remove the cover from the pump motor terminal box (3), then disconnect the electrical supply cable from the terminal box (3).
- Fit slings and suitable lifting equipment to support the pump motor (1), then remove the fixing bolts (2) which secure the pump motor flange (4) to the motor mounting flange (12).
- Use the lifting equipment to move the pump motor (1) away from the pump, then carefully lower the pump motor, so that it rests on the floor in an upright orientation (that is, with the coupling half-drive (8) at the top).
- Undo and unlock the set screw in the coupling half-drive (8).
- Use a suitable puller tool to remove the coupling half-drive (8) from the motor shaft (15), then remove the key (5) from the motor shaft (15). Dispose of the key.
- If disposing the pump motor, please in accordance with all local and national safety and environmental requirement.
- Inspect the coupling spider (9). If necessary, replace it.

5.7.2 Fit the new pump motor

WARNING

Ensure that the pump motor cannot fall when fitting it. The pump motor is heavy and can cause injury to people if it falls.

CAUTION

Ensure that the pump motor flange and the coupling housing flange are clean and free of burrs. If not, the pump motor and coupling housing may be misaligned and may damage the pump motor, the pump or the drive coupling when operating the pump.

1. Refer to Figure 6. Inspect the motor shaft (15) of the new pump motor (1). The motor shaft must be free of burrs and dirt. If necessary, clean or refinish the motor shaft.
2. Inspect the motor shaft bore of the coupling half-drive (8). The bore must be free of burrs and dirt. If necessary, clean or refinish the bore.
3. Fit the new key (5), supplied with the new motor into the motor shaft (15).
4. Loosely fit the coupling half-drive (8) onto the motor shaft (15), so to subsequently move it (in Step 14) into the correct position.
5. Inspect the motor mounting flange (12) and the motor flange (4). The flanges must be free of burrs and dirt. If necessary, clean or refinish the flanges.
6. Use suitable lifting equipment to lift the pump motor (1) off the floor and move it close to the pump.
7. If necessary, fit slings around the pump motor (1) and attach suitable lifting equipment to the slings. Use both sets of lifting equipment to turn the pump motor so that it is horizontal, with the pump motor terminal box at the top, and with the coupling half-drive (8) towards the coupling
8. Fit the coupling spider (9) to the coupling half-drive (8).
9. Place the bolts (2) through the fixing holes in the motor flange (4).
10. Undo and remove the four bolts (14) which secure one of the motor mounting flange side plate (13) to the motor mounting flange (12), then remove the motor mounting flange side plate (13).
11. Move the pump motor so that the motor flange (4) locates against the flange of the motor mounting flange (12), and so that the bolt holes in the two flanges are aligned.
12. Use the bolts (2) to secure the pump motor to the motor mounting flange (12).
13. Use the access hole in the motor mounting flange (12) and slide the Coupling Half - Drive (8) on the motor shaft (15) until the gap (17) between the Coupling Half - Drive (8) and the Coupling Half - Driven (10) is correctly set, as shown in detail B.
14. Apply a suitable thread sealant (such as Loctite 243 Nutlock) to the screw of driven hub, then fit the set screw into the drive hub (8) and tighten to a torque of 17Nm (12.5 lbf ft).
15. Check the gap (17) between the drive hub and the driven hub again:
16. If the gap is still correctly set, continue at Step 17.
17. If the gap is not correctly set, loosen the set screw and continue at Step 13 above to set the gap again.
18. Move the motor (1) towards the coupling housing (12) again, and turn the drive hub (8) as necessary (so that it is correctly aligned with the gaps in the coupling insert (9), until the drive hub fully engages in the coupling insert, and the motor flange (4) is fully located against the flange of the coupling housing (12).
19. Tighten all of the fixing bolts (2) to a torque of 150Nm (110 lbf ft).
20. Use the four bolts (14) to secure the coupling cover side plate (13) to the motor mounting flange (12). Tighten the bolts to a torque 17Nm (12.5 lbf ft).

5.7.3 Check the direction of pump rotation

WARNING

Ensure that the direction of rotation of the pump is correct before operating the pump. If not, and the pump direction of rotation is incorrect, the inlet pipeline will be pressurized and may be damaged and there will be a risk of injury to people or explosion of fire.

After fitting the new pump motor, check the direction of pump rotation before operation the pump: use the procedure in Section 3.7.

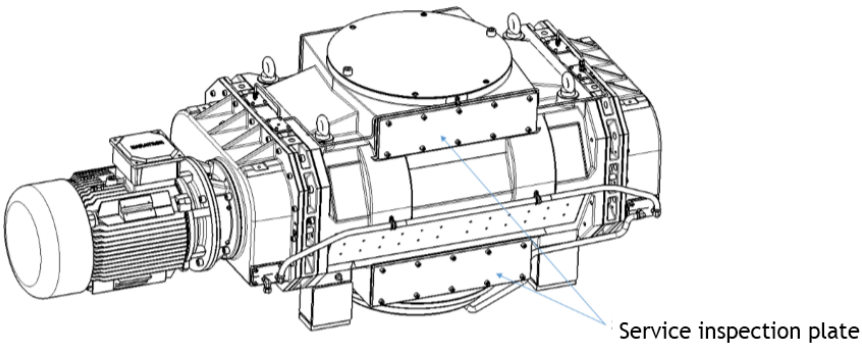
5.8 Overhaul the pump

The RUVAC WA 40000 pump must be regularly serviced, as specified in Table 11. As part of the service, the bearings in the pump must be replaced. The pump seals and the motor coupling insert should also be replaced. It is recommended to contact your supplier or your local sales representative to arrange for a service, unless you are specifically approved and authorized to perform this work yourself.

WARNING

Over a long period of time, fine dust could be accumulated on the after cooler of RUVAC WA 40000 even using a recommended inlet screen. This may affect the cooling effect of after cooler.
Make sure the inspection on after cooler is implemented by regular service. The after cooler can be accessed by removing the lower service plates. See Figure 7.

Figure 7 - Service Plates



5.9 Fault finding

Table 12 provides a guide to fault conditions and their possible causes.

If the fault cannot be rectified call your local Customer Centre for advice.

WARNING

The inspection plates referred to in Table 12 weigh 3.7 Kg and care must be taken when they are removed. Failure to observe this warning could result in injury and damage to the booster.

Note:

If you have been approved to carry out strip down, repair and reassembly of your booster, consult your Local Customer Centre for advice on detailed procedures.

Table 12 - Fault finding

Symptom	Possible Cause	Actions
The booster will not start or seizes in operation.	Has the booster been overloaded?	Confirm that the system design and process parameters comply with the operational specification of the booster (refer to Technical Data section 2)
	Has debris or foreign material entered the booster?	Remove Inspection plates and check for debris (Refer to Operational Safety Section 4.1 and section 5.8)
	The motor is faulty	Refer to the appropriate Motor manual
	The motor coupling is faulty	Remove motor mounting flange side plate and inspect for loose or worn coupling components. Refer to warnings given in “Check the direction rotation” section 3.7
The booster is noisy or has high vibration during operation.	Damage to rotors or stator	Remove Inspection plates and check for visible damage (Refer to Operational Safety Section 4.1 and section 5.8)
	Gear or bearing damage	Check oil levels and that oil color is normal (clear)
The booster overheats (causing PT100 to shut down the pump)	Differential pressure across the booster too high	Check that the system design and process parameters comply with the operational specification of the booster (refer to Technical Data section 2)
	Inverter (VSD) settings incorrect	Check Inverter settings match the motor rating label requirements
	Cooling water supply failure, or water supply temperature/flow inadequate	Check that the cooling supply is correctly connected to the booster (Refer to “Connect the cooling water pipelines Section 3.6) and that the supply conditions meet the requirements of the Technical data section “Cooling water supply” section 2.4
There is oil in the gas stream from the booster.	Oil mist migrated from the system	Check system configuration - oil mist filter
	Oil leakage in to swept volume	Check for falling oil levels in end covers, refer to section 5.4

Symptom	Possible Cause	Actions
Oil level reducing on Drive (motor) end cover	Oil leaking in to motor mounting flange	Remove motor mounting flange side plate to inspect. In case of leakage, for drive shaft seal problem contact your Local Customer Service centre for advice
There is a low volume flow running through the booster.	Inlet filter blocked	Clean or replace the filter
	Inlet pressure too low	Check the inlet pipeline for a blockage, closed valve or other restriction
	Aftercooler/booster outlet blocked	Remove Inspection plates and check for blockage (Refer to Operational Safety Section 4.1)
	Booster worn or damaged	Contact your local Customer Service centre for advice
	Booster unsuitable for the application	Confirm that the system design and process parameters comply with the operational specification of the booster (Refer to Technical Data section 2)
Absorbed power is too high.	Debris or foreign material in booster	Remove Inspection plates and check for debris (Refer to Operational Safety Section 4.1 and section 5.8)
	Aftercooler/booster outlet blocked	Remove Inspection plates and check for blockage (Refer to Operational Safety Section 4.1 and section 5.8)
The booster does not reach its specified ultimate vacuum pressure	Gas leak in inlet or exhaust pipelines	Check pipelines for any valves open to atmosphere, or for leaking connections
	Booster has a gas leak	Check that the oil filler plugs are fitted and tight, and that inlet/outlet flange connections are secure and leak tight (see Figure 1)
	Incorrect purge flow rate	Confirm gas purge pressure/flow is within specified limits (see Section 2.4)
	Booster worn or damaged	Contact your local Customer Service centre for advice
If the cause of the fault cannot be identified or rectified after carrying out the actions above, contact your local Customer Service centre for advice.		

6 Storage and disposal

6.1 Storage

CAUTION

If the pump is stored in temperatures close to, or below, 0 °C (32 °F), drain the cooling water from the pump, or add a suitable anti-freeze to the pump.

6.1.1 Preparation

1. Shutdown the pump as described in Section 4.3.
2. If necessary, disconnect the electrical supply from the pump motor (refer to the Motor Manual supplied with the RUVAC WA 40000 pump) or disconnect the drive and transmission system from the pump drive shaft (refer to the manufacturer's instructions supplied with the transmission system and/or to Section 3.3.2).
3. If necessary, purge your system and the RUVAC WA 40000 pump with dry air, and disconnect the pump from your system pipelines.
4. Disconnect the cooling water supply pipelines from the pump.
5. Place and secure protective covers over the pump inlet, outlet and services connections.
6. If required, use suitable lifting equipment to move the pump to its storage area: refer to section 3.2 and section 3.3.1.
7. If the pump is stored for longer than six weeks, refer to the requirements in Section 6.1.2.
8. Store the pump in clean, dry conditions in a well ventilated place that is free from vibration or shocks.

6.1.2 Long term storage

If the pump is to be stored for longer than six weeks:

1. Drain the oil from the drive end and non-drive end covers: refer to Section 5.6.
2. Fill the drive end and non-drive end covers with a suitable protective oil (see Table 12): use the method in Section 5.6.
3. Turn the pump drive shaft by hand through three or four revolutions, to turn the pump and prevent seizure.
4. Spray a suitable protective oil (see Table 12) through the inlet and into the pump.
5. If required, spray a suitable protective oil (see Table 12) on the outer machined surfaces of the pump e.g. inlet and outlet flanges, to inhibit corrosion.

During storage, every 14 days or less, turn the pump drive shaft by hand through a quarter of a revolution, to turn the pump and prevent seizure or degradation of the bearings. Care should be taken to ensure the shaft is left in a different position every time.

When required for use after storage:

1. Drain the protective oil from the drive end and non-drive end covers, then fill the end covers with new oil: refer to Section 5.6.
2. Use a suitable cleaning solution (such as alcohol or white spirit) to clean the rotors:
   - Moisten a suitable clean, lint free cloth with the cleaning solution.
   - Clean the rotors which are visible through the inlet port.
   - Turn the pump drive shaft as necessary to access the other rotors.

3. Prepare and install the pump as described in Section 3.

Table 13 - Suitable protective oils

External components	Internal components
Rust Ban 324 (Esso)	Mobilarma 523/524 (Mobil)
V Product 9703 (Shell)	Esso Lub MZ 20E/20 (Esso)
Tecrex 39 (Mobil)	Ensis Motor Oil 20 (Shell)

6.2 Disposal

WARNING

Wear the appropriate Personal Protective Equipment (PPE) while handling contaminated oil or contaminated components.

Safely dispose of the pump, used oil, cleaning materials, and any components in accordance with all local and national safety and environmental requirements.

Pump system materials suitable for recycling include cast SG iron, steel, PTFE, stainless steel, brass, aluminum, zinc alloy, nickel, and mild steel.

Take particular care with the following:

- Fluoroelastomers which may have decomposed as the result of being subjected to high temperatures.
- Components which have been contaminated with dangerous process substances.
- Used oil that has been contaminated with dangerous substances.
- Cleaning materials that have been contaminated with dangerous substances.
- Components that have been contaminated with dangerous substances.

7 Service and spares

7.1 Introduction

For information on spares, accessories and servicing contact your local customer centre.
While ordering, please state for each part required:

- Model and Item Number of the equipment
- Serial number (if any)
- Item Number and description of the part

7.2 Service

RUVAC WA 40000 Pump Systems are supported by a worldwide network of customer centres. Your local customer centre can provide engineers to support onsite maintenance, service or repair of the equipment.

For more information about service options, contact your nearest Service Centre.

7.3 Service Spares and Tool Kit

Please contact the Leybold service for information.

Declaration of conformity

Leybold

CE

EU Declaration of Conformity

The manufacturer:	Leybold GmbH Bonner Strasse 498 D-50968 Köln Germany

herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EU Directives. This declaration becomes invalid if modifications are made to the product without agreement of Leybold GmbH.

Product designation:	Vacuum pump
Type designation:	RUVAC WA 40000
Part numbers:	11740000V

The products comply with the following Directives:

2006/42/EC	Machinery Directive

The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Appendix 1 No. 1.5.1 of Machinery Directive 2006/42/EC.

22009/125/EC	Eco Design Directive, following the requirements of Regulation (EC) No. 640/2009 (as amended)
2011/65/EU	Restriction of Certain Hazardous Substances (RoHS) Directive

The following harmonized standards have been applied:

EN 1012-2:1996+A1:2009	Compressors and vacuum pumps - Safety requirements Part 2: Vacuum pumps
EN 60034-1:2017	Rotating electrical machines – Rating and performance

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Cologne, May 29, 2018

Andries Desiron
VP Engineering
Industrial Vacuum Division

Qingdao, May 29, 2018

Bram Claes
General Manager
Product Company Qingdao

Declaration of contamination

EC Declaration of Incorporation

The manufacturer:

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

herewith declares that the following product:

Product designation:	Vacuum pump
Type designation:	ROOTSPUMP RUVAC WA 40000 without motor
Part number:	11740000V04

complies with the following fundamental requirements of the **Machinery Directive (2006/42/EC)**:
Annex I, Paragraph 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, and 1.7.1

and complies with the following Directive:

2011/65/EU	Restriction of Certain Hazardous Substances (RoHS) Directive

The following harmonised standards have been applied:

EN 1012-2:1996+A1:2009	Compressors and vacuum pumps - Safety requirements Part 2: Vacuum pumps

The incomplete machine may only be put into operation after it has been determined that the machine into which the incomplete machine shall be installed complies with the regulations laid down in the EC Machinery Directive (2006/42/EC).
The manufacturer commits himself to make the special documentation on the incomplete machine electronically available to national authorities upon request.
The special engineering documentation belonging to the machine was compiled in accordance with Annex VII Part B.

Documentation officer:

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Cologne, May 29, 2018

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