

Mounting instructions

VacuStar WR 2500 / WR 3100 / WR 4000



Dok-ID: 5040 / MA / EN

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Prior to installing the VacuStar WR and putting it into operation you must have read and understood these instructions. These instructions are only valid together with the operating instructions, they do not replace them!

Translation of the Original Assembly Instructions

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1 General

1.1 Information on the assembly instructions

These assembly instructions provide important information about installation and start-up of the VacuStar WR. A precondition for safe operation is the observance of all specified safety and handling instructions.

Furthermore, all local accident prevention regulations and general safety regulations valid for the application area of the VacuStar WR must be observed.

You must have read and understood the mounting instructions before you start installing the machine and put it into operation! It is a product component and must be kept in direct proximity of the VacuStar WR, well accessible to the personnel at all times. All safety instructions of the operating instructions must additionally be observed.

General

1.2 Pictogram explanation

Warning notes

Warning notes are characterised by pictograms in these mounting instructions. The warning notes are marked by signal words expressing the extent of the hazard.

It is absolutely essential to observe the notes and to proceed with caution in order to prevent accidents as well as bodily injuries and property damage.



DANGER!

points to an immediately dangerous situation, which can lead to death or serious injuries if it is not avoided.



WARNING!

... points to an immediately dangerous situation, which can lead to death or serious injuries if it is not avoided.



CAUTION!

... points to a potentially dangerous situation, which can lead to minor or light injuries if it is not avoided.



ATTENTION!

... points to a potentially dangerous situation, which may lead to property damage if it is not avoided.



Safety note ATEX!

Only for VacuStar WR with Ex-approval.

This icon shows the special conditions that must be observed according to the approvals when conveying explosive gases and gas mixtures.

Hints and recommendations



NOTE!

... highlights useful hints and recommendations as well as information for an efficient and trouble-free operation.

1.3 Limitation of Liability

See operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000" for information about limitation of liability.

1.4 Copyright protection

See operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000" for information about limitation of liability.

1.5 Spare parts

See operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000" for information about limitation of liability.

1.6 Warranty conditions

The warranty conditions are included in the sales documentation as a separate document.

1.7 Customer Service

Our customer service can be contacted for any technical advice. Information about the responsible contact person can be retrieved by telephone, fax, E-mail or via the Internet at any time, refer to manufacturer's address on page 2.

1.8 Declaration of Incorporation

Declaration of incorporation (pursuant to EC Machinery Directive 2006/42/EC and "The supply of Machinery (Safety) Regulations 2008") see page 41.

1.9 ATEX / UKEX Declaration of Conformity

Declaration of conformity (pursuant to ATEX-directive 2014/34/EU and "UK Government Guidance") see page 43.

Safety

2 Safety

2.1 Intended use

The liquid-ring compressor vacuum pumps of the VacuStar WR model range have been developed for installation in a superordinate system. The manufacturer of the overall system must assess the new risks resulting from the installation. These risks must be included in the operating instructions of the system. The VacuStar WR is exclusively intended for the compression or extraction of air or filtered water vapour saturated air.

The VacuStar WR in the explosion proof design complies with Directive 2014/34/EU (ATEX) and is suitable for conveying explosive gases and gas mixtures of explosion group IIB, temperature class T5 from explosive zone 1 and zone 2 areas. No explosive atmosphere is allowed in the area around the VacuStar WR. The VacuStar WR may only be opened when it is stopped and when there is no explosive atmosphere around it.

Marking of the VacuStar WR:



II 2G c k IIB T5 (i),

no potentially explosive external atmosphere.

In temperature class T5, the gas temperature is limited to 95 °C, and must be secured.

Device category, temperature class and explosion group of all attachments that are not contained in the scope of delivery of CVS engineering GmbH (such as temperature sensors and pressure switches) must comply with the requirements of the Directive 2014/34/EU.

2.2 Proper operation

The intended use is chiefly defined by the data in "Tab. 1: General data Tab. 1" (page 14).



If explosive gases and gas mixtures are conveyed, the following guidelines must be observed:

- 2014/34/EC
Devices and protection systems for the proper use in explosive environments
- 99/92/EC
Health protection and safety of the employees in potentially explosive areas

All specifications in these installation and operating instructions have to be strictly complied with (technical data, ATEX regulations, etc.)

All types of claims due to damage arising from improper use are excluded. The operator alone shall be responsible for any damage arising from improper use.

2.3 Acceptance and monitoring

The VacuStar WR itself is not subject to any acceptance and monitoring obligation.

2.4 Operator's responsibility

See operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000" for information about the responsibility of the operating company.

2.5 Requirements placed upon the specialised staff

The mounting instructions specify the following qualification requirements for the different fields of activity:

- **Specialists**
are due to their technical training, knowledge and experience and their knowledge of the pertinent regulations able to carry out the work assigned to them and to independently recognize potential hazards.
- **Electrical specialists**
are, due to their technical training, knowledge and experiences and their knowledge of the relevant standards and regulations, able to work on electrical systems and to independently recognize possible hazards.

Safety

2.6 Personal protective equipment

See "VacuStar WR 2500 / WR 3100 / WR 4000" operating instructions for information about personal protective equipment.

2.7 Occupational safety and special risks

Observe all safety instructions in the operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000", Chapter "Occupational safety and special risks".

3 Technical data

3.1 Dimensions of VacuStar WR 2500 / WR 3100

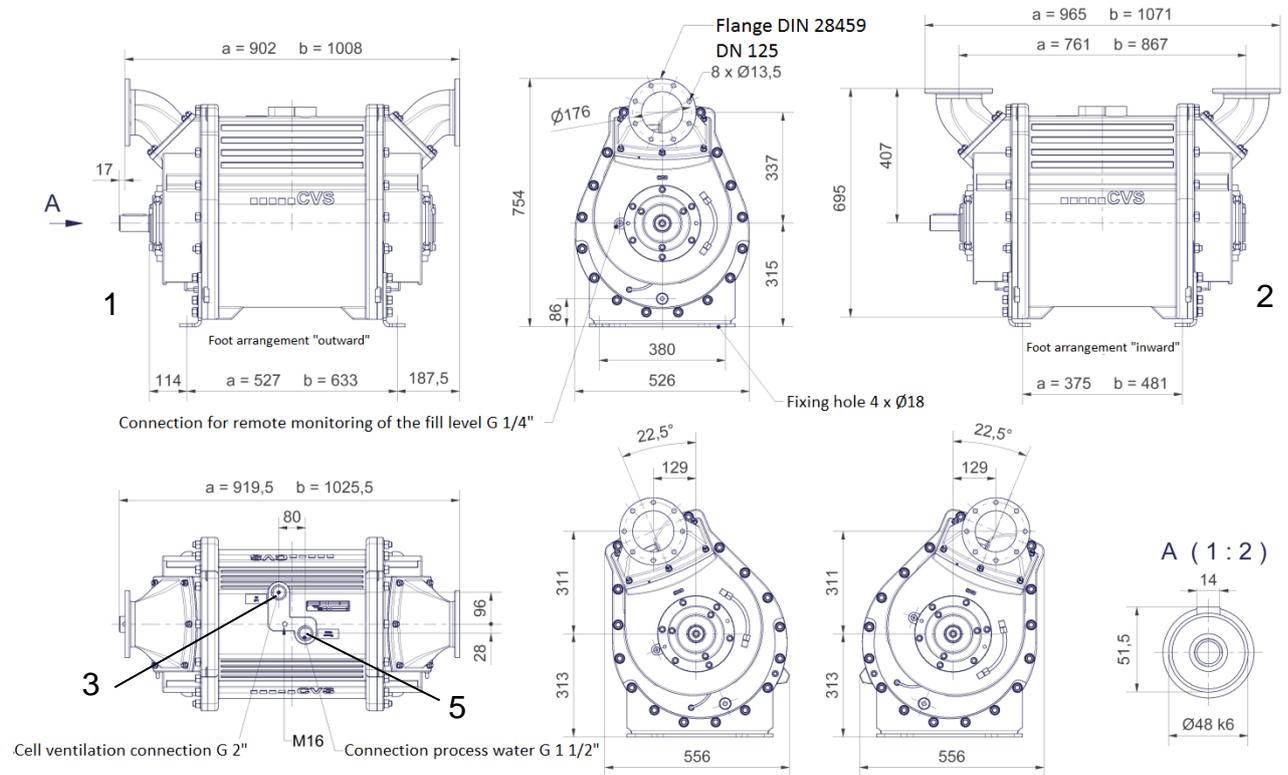
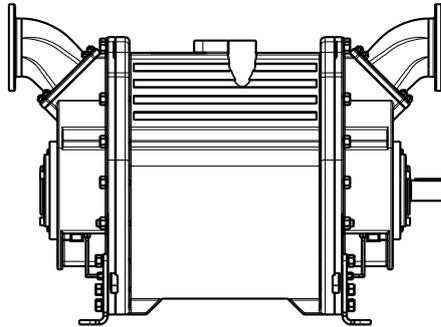


Fig. 1: Dimensions of VacuStar WR 2500 / WR 3100, shown here is WR 3100

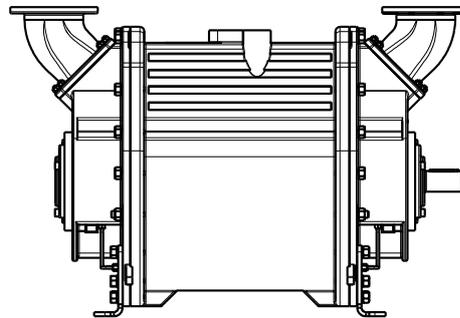
- | | | | |
|---|----------------------------|---|-----------------------------------|
| a | VacuStar WR 2500 | b | VacuStar WR 3100 |
| 1 | Foot arrangement "outward" | 3 | Cell ventilation connection G1 ½" |
| 2 | Foot arrangement "inward" | 5 | Process water connection G1 ½" |

The horizontal and vertical flange arrangements can be combined with each other.

B-side	
WR2500 WR3100	WR4000
Pressure connection	
R: 950 080-00	950081-00
L: 950 075-00	950076-00
Suction connection	
R: 950 075-00	950076-00
L: 950 080-00	950081-00



A-side	
WR2500 WR3100	WR4000
Suction connection	
R: 950 080-00	950081-00
L: 950 075-00	950076-00
Pressure connection	
R: 950 075-00	950076-00
L: 950 080-00	950081-00



Pressure connection	
R: 950 075-00	950076-00
L: 950 080-00	950081-00
Suction connection	
R: 950 080-00	950081-00
L: 950 075-00	950076-00

Suction connection	
R: 950 075-00	950076-00
L: 950 080-00	950081-00
Pressure connection	
R: 950 080-00	950081-00
L: 950 075-00	950076-00

Fig. 4: Connection variants for suction and pressure line

- A Drive side
- B Opposite side

- R Sense of rotation, viewed on the drive shaft right (clockwise)
- L Sense of rotation, viewed on the drive shaft left (anticlockwise)

Example:

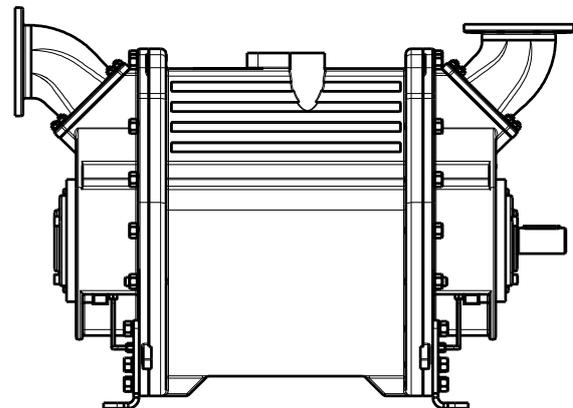
VacuStar WR rotating clockwise (R)

A-side:

Suction connection vertical → No. 950 075-00

B-side:

Pressure connection horizontal → No. 950 080-00



Technical data

3.4 Technical data

General data	Unit	WR 2500	WR 3100	WR 4000
Nominal operating vacuum ¹⁾	[mbar]	400		
Angular momentum on the drive shaft	[kgm ²]	1.40	1.80	3.9
Weight without water filling	[kg]	175	192	298
Permissible inclination to the side	[°]	22 (see Fig. 1, Fig. 2)		
Permissible inclination in longitudinal direction	[°]	5		
Process liquid	–	Water-glycol mixture		

Tab. 1: General data

Permissible working range	Unit	WR 2500	WR 3100	WR 4000
Input speed	[1/min]	800 to 1600		800 to 1300
Suction temperature ¹⁾	[°C]	-20...+60		
Outlet temperature	[°C]	max. 65		
Geodetic height ¹⁾	[m]	0...1000		
Maximum operating vacuum ⁴⁾	[mbar]	130		
Maximum final overpressure with direct drive ³⁾	[bar]	1.5	1.5	1.0
Maximum final overpressure with V-belt drive ³⁾	[bar]	1.0	0.5	0.5

1) Consult CVS for suction temperature and/or altitudes outside the permissible working range.

2) Excess pressure = 0 bar, suction and ambient temperature = 20 °C

3) Vacuum = 0 mbar, suction and ambient temperature = 20 °C

4) Process water temperature = 20 °C

Tab. 2: Permissible working range

VacuStar WR performance data vacuum operation	Unit	WR 2500	WR 3100	WR 4000
Suction pressure: 400 mbar ^{1), 2)}				
Speed	[1/min]	1600		1300
Maximum intake volume flow ^{1), 2), 3)}	[m ³ /h]	2500	3100	4063
Coupling power ^{1), 2), 3)}	[kW]	73	88	117
Intake volume flow ^{1), 2)}	[m ³ /h]	2016	2427	3521
Coupling power ^{1), 2)}	[kW]	61	76	107.5
Sound pressure level at 7 m distance at 400 mbar	[dB(A)]	70	72	73

1) Excess pressure = 0 bar, suction and ambient temperature = 20 °C

2) Process water temperature = 20 °C

3) Water vapour saturated air = 55 °C

Tab. 3: Performance data vacuum operation

VacuStar WR performance data pressure operation	Unit	WR 2500	WR 3100	WR 4000
Excess pressure: 0.5 bar ^{1), 2)}				
Coupling power	[kW]	77	94	131.5
Intake volume flow	[m ³ /h]	1936	2469	3496
Sound pressure level at 7 m distance at 0.5 bar excess pressure	[dB(A)]	70	72	73

1) Vacuum = 0 mbar, suction and ambient temperature = 20 °C

2) Process water temperature = 20 °C

Tab. 4: Performance data pressure operation

Technical data

VacuStar WR process water circulation		Unit	WR 2500	WR 3100	WR 4000
Dissipated heat in vacuum operation ^{1), 4)}	200 / 400 mbar at speed	[kW]	48 / 42 1500 1/min	60 / 52 1500 1/min	81 / 72 1200 1/min
	200 / 400 mbar at speed		55 / 47 1600 1/min	68 / 59 1600 1/min	95 / 84 1300 1/min
Dissipated heat in pressure operation ^{2), 4)}	0.5 / 1.5 bar _g at speed	[kW]	41 / 80 1500 1/min	50 / 92 1500 1/min	66 / 100 1200 1/min
	0.5 / 1.5 bar _g at speed		46 / 90 1600 1/min	56 / 103 1600 1/min	79 / 128 1300 1/min
Maximum process water inlet temperature VacuStar WR		[°C]	55		
pH value		–	5...8		
Pipe dimension		[inch]	R1 ½		
Radiator surface A _{radiator} ³⁾		[m ²]	0.16	0.32	0.43
Water supply volume in the reservoir min.		[l]	approximately 300	approximately 400	approximately 550
Total volume water reservoir min.		[l]	approximately 450	approximately 600	approximately 800
Process water circulating quantity in vacuum operation at 400 mbar ¹⁾		[l/min]	70...90	70...90	70...90

1) Excess pressure 0 bar

2) Vacuum 0 mbar

3) Based on a radiator of a specific cooling capacity $P_{spec} = 3.5 \text{ kW} / (\text{m}^2 \cdot \text{°C})$

$$P_{spec} = P_{ab} / [(t_{water} - t_{air in}) \cdot A_{radiator}]$$

Heat to be dissipated for operation with water vapour saturated air on request

Tab. 5: Process water circulation

4 Design and function

4.1 Design

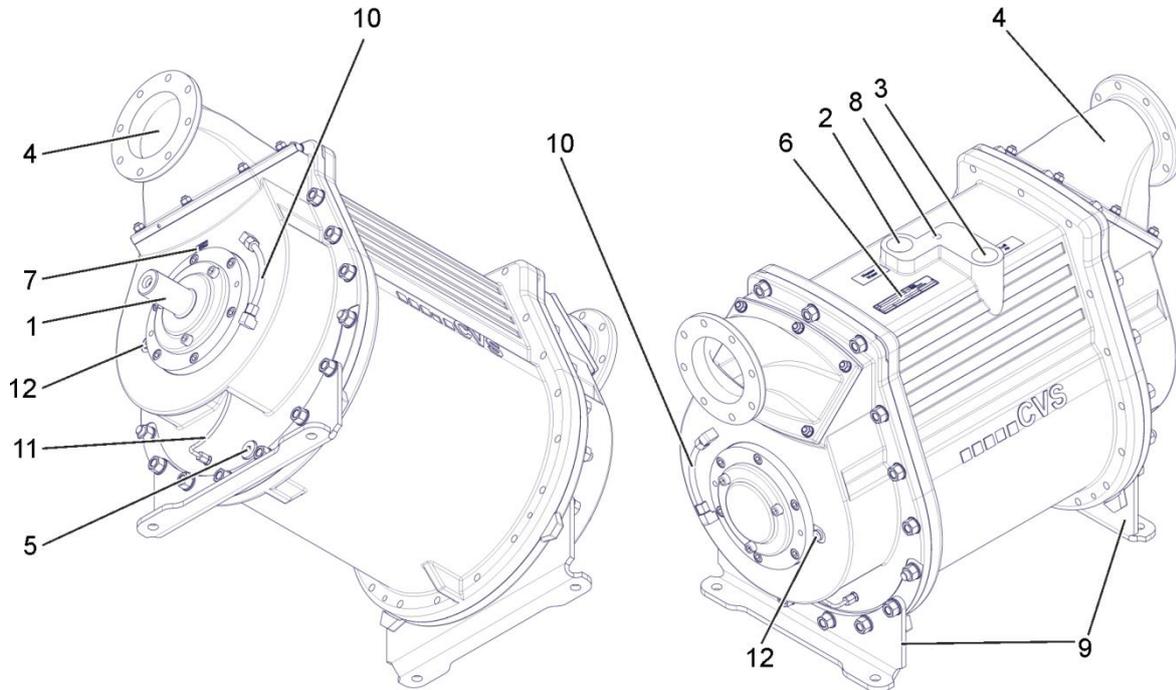


Fig. 5: Design

- | | | | |
|---|---|----|-----------------------------------|
| 1 | Drive shaft | 6 | Rating plate |
| 2 | Connection process water | 7 | Rotation arrow |
| 3 | Cell ventilation connection | 8 | Thread for eye bolt |
| 4 | Connecting flange for pressure or suction connection (flange DIN 28459) | 9 | Fixing foot |
| 5 | Process water draining | 10 | Water level indicator |
| | | 11 | Liquid supply for slide ring seal |
| | | 12 | Manuel fill level inspection |

4.2 Function

VacuStar WR

The liquid ring pump works according to the positive displacement principle. At a sufficiently high speed, a rotating liquid ring is formed in the casing. In conjunction with the impeller, cells form that are separated from each other and steadily grow (sucking) or shrink (compressing) with each revolution.

Design and function

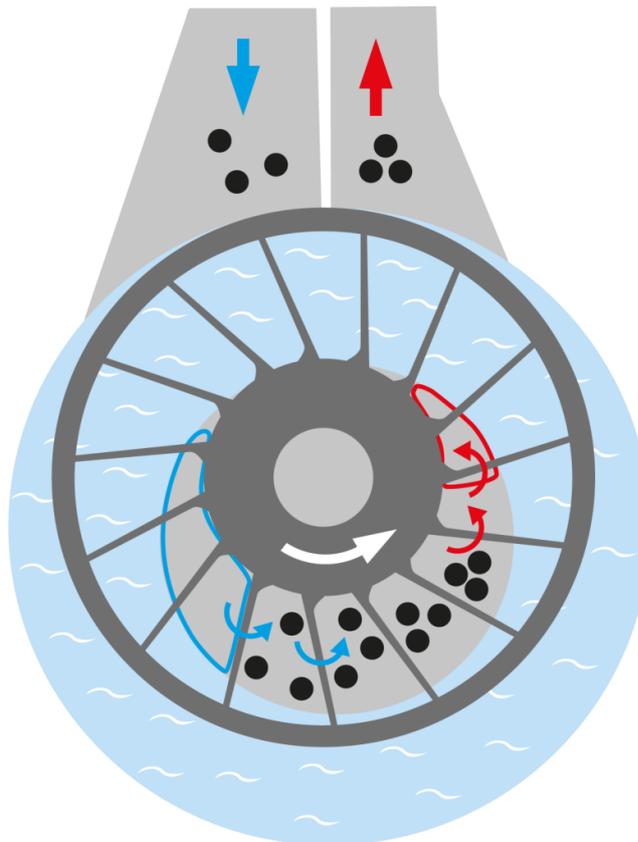


Fig. 6: Functional principle

Lubrication

All moving parts are without contact. The lubrication of the VacuStar WR is limited to the impeller bearing. The bearings are fitted with a permanent grease filling.

Cooling

The unit is cooled by the process water and/or the liquid ring. A radiator in the process water circulation dissipates the heat to the environment.

Shaft sealing

Maintenance-free slide ring seals separate the working space from the bearings and/or the atmosphere.

Sense of rotation

The unit is always driven from the A-side. The VacuStar WR is optionally available with clockwise or anticlockwise sense of rotation.

Connecting flanges

Location (A-side or B-side) and direction (horizontal or vertical) of suction and pressure flange are variable. Fig. 4 (page 13) shows a diagram of the flange allocations.

Drive

The VacuStar WR can be powered via:

- Articulated shaft
- V-belt
- Flexible coupling

See page 35.

Process water circulation and cell ventilation

In addition to the drive and the suction and pressure lines, other components are required to operate a liquid ring pump (see page 24, Fig. 8).

- Water circulation with reservoir and radiator.
The air flowing through the VacuStar WR absorbs humidity from the liquid ring, and is 100% saturated when it exits. Only the water drops are separated in the reservoir. The steam component is dissipated to the environment.

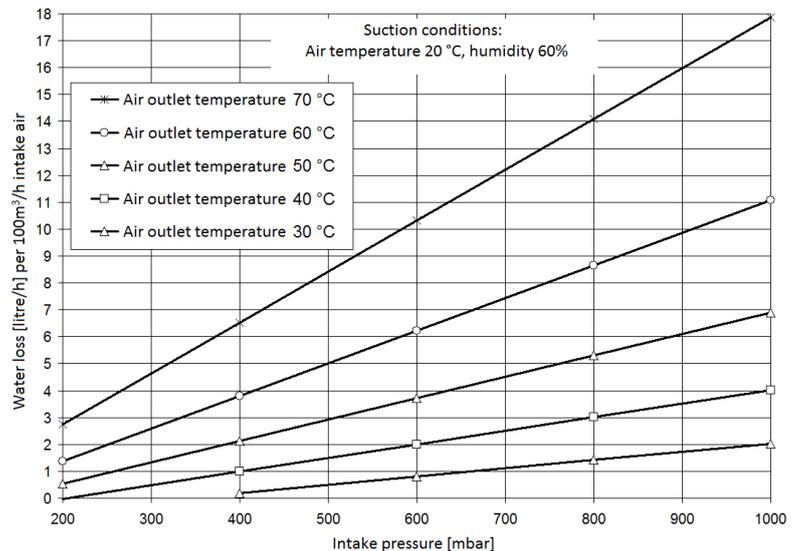


Fig. 7: Process water delivery

Fig. 7 shows the process water delivery from the reservoir for an intake volume flow of 100 m³/h as a function of intake pressure and process water temperature.

Typical process water loss calculation:

- Type : VacuStar WR 3100
- Intake pressure: 400 mbar
- Intake volume flow according to Tab. 3: 2427 m³/h
- Process water output temperature: 50 °C
- Water loss for intake pressure and process water outlet temperature according to Fig. 7: 2.1 l/h per 100 m³/h intake air

Design and function

$$\text{Process water loss} = 2,1 \cdot \frac{2427}{100} = 50,97 \text{ l/h}$$

In operation with cell ventilation, the process water loss is increased as a function of the additional air throughput.

- Cell ventilation:

As the vacuum increases, the amount of process water that is removed from the working space decreases due to the decreasing air mass.

At a higher vacuum, auxiliary air is fed through a ventilation line. This maintains a safe operation.

5 Transport and storage

5.1 Safety notes for transport

Improper transport



Danger!

Danger by falling down or tilting of the VacuStar WR!

The weight of the VacuStar WR may injure a person and cause serious bruising!

Therefore:

- Depending on the dead weight and size of the VacuStar WR, use a pallet on which the VacuStar WR can be moved by means of a fork lift.
- For lifting the VacuStar WR, use suitable lifting gear (slings, etc.) that is designed for the weight of the VacuStar WR.
- When putting the slings in position, take care to avoid putting stress on individual components.
- Only use the provided attachment points with eye bolts.

Please also observe all safety instructions in the operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000", Chapter "Occupational safety and special risks".

5.2 Transport

The VacuStar WR fastened on a pallet must be transported by means of a fork lift or suitable lifting gear. The lifting gear must be designed for the weight of the VacuStar WR.

For future transports:

- Seal all open connections with protective caps (prevents penetration of dirt and water)
- Secure against vibrations
- Drain all process and operating media
- Securely fasten the VacuStar WR prior to transport (e.g. screw it onto a pallet)
- Transport and put down the VacuStar WR with a fork lift or secure with straps and lift with suitable lifting gear.

Transport and storage

5.3 Storage

Storage of packages

Store packages under the following conditions:

- Do not store outdoors.
- Store dry and dust free.
- Do not expose to aggressive media.
- Protect against solar irradiation.
- Avoid mechanical vibrations.
- Storage temperature: $-10\dots+60\text{ }^{\circ}\text{C}$
- Relative humidity: max. 95%, non-condensing
- If storage lasts longer than 3 months, regularly check the general condition of all parts and of the packaging. If necessary, brush up or recondition the preservation.

6 Installation and assembly

6.1 Safety

Safety



WARNING!
Risk of explosion!

Only use components that are suitable for the zone in which the unit is used when you install the unit in an explosive atmosphere. An equipotential bonding must be installed between the equipment and the vehicle.

The safety equipment described in our mounting instructions and installation instructions are mandatory for a safe operation of the VacuStar WR in explosive areas.

Electrical system



DANGER!
Mortal danger due to electric current!

There is mortal danger in case of contact with live components.

Activated electrically driven components can start to move uncontrolled and cause severest injuries.

Therefore:

- Switch off the electric power supply before commencing any work and secure against restarting.
- Only skilled electricians are allowed to carry out any work on the electric systems, on electric components and connections.

Dirt and lying about items



CAUTION!
Risk of tripping from dirt and objects lying around!

Contamination and discarded items can lead to slipping and tripping, resulting in substantial injuries.

Therefore:

- Always keep the working area clean.
- Remove objects that are not required.
- Mark tripping points with yellow-and-black tape.

Please also observe all safety instructions in the operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000", Chapter "Occupational safety and special risks".

Installation and assembly

6.2 Installation example

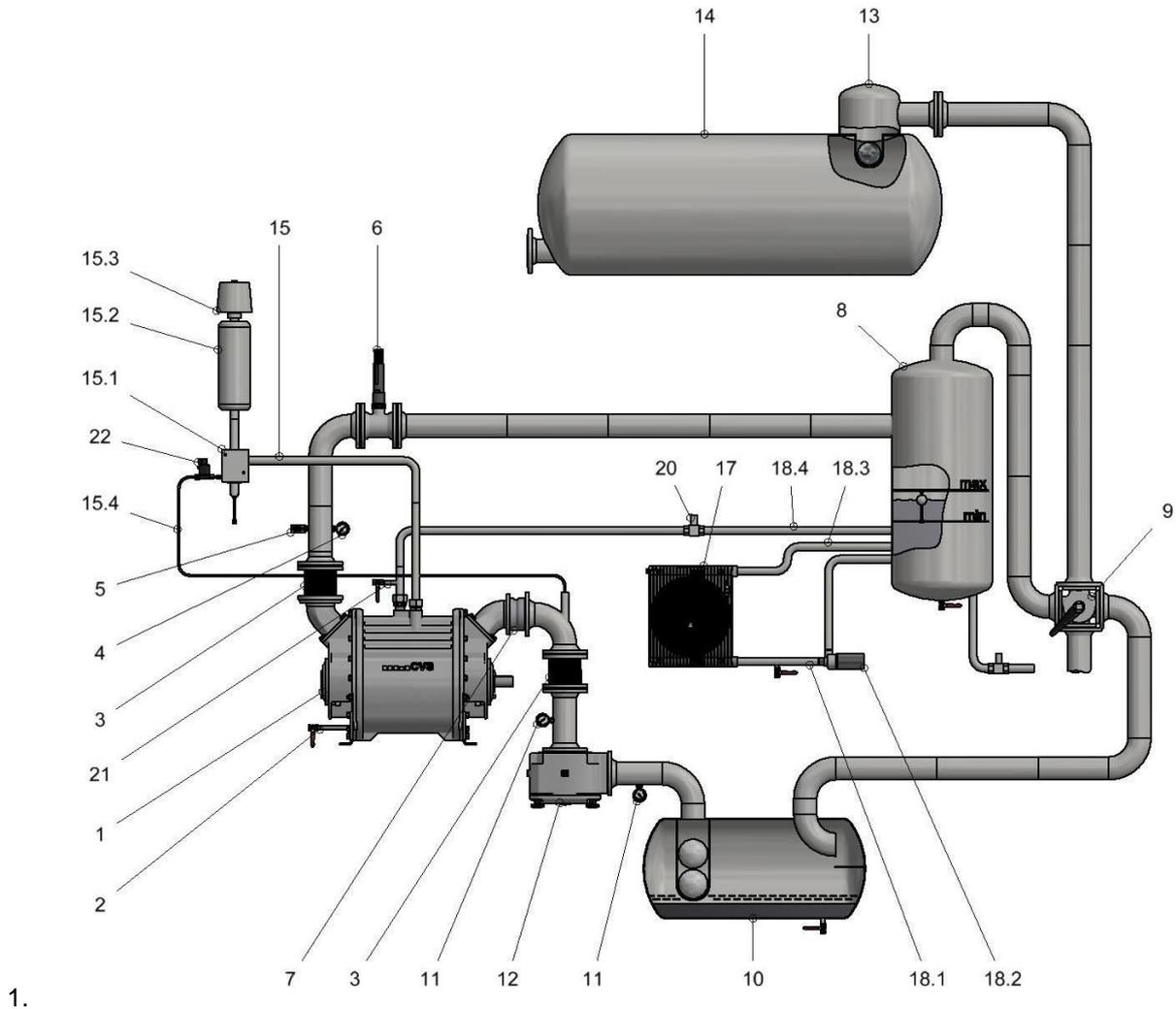


Fig. 8: Typical installation

- | | | |
|------------------------------------|--|---|
| 1 VacuStar WR | 11 Vacuum meter | 18 Process water cooling in the bypass flow |
| 2 Dehydration | 12 Vacuum suction filter | 18.1 Reservoir pipe – radiator |
| 3 Compensator | 13 Safety dome with float valve | 18.2 Circulating pump |
| 4 Pressure gauge | 14 Vehicle tank | 18.3 Radiator pipe – reservoir |
| 5 Thermometer / temperature switch | 15 Cell ventilation from atmosphere | 18.4 Reservoir pipe – VacuStar WR |
| 6 Safety valve | 15.1 Cell ventilation valve | 20 Water stop valve |
| 7 Non-return valve for VacuStar WR | 15.2 Muffer | 21 T-piece to fill the VacuStar WR with process water |
| 8 Process water reservoir | 15.3 Air filter | 22 Shut-off valve in the control line |
| 9 Changeover four-way cock | 15.4 Cell ventilation valve control line | |
| 10 Safety tank | 17 Process water radiator | |



NOTE!

Fig. 8 shows the example of a complete system with ideal design.

6.3 Necessary work

Installation requires the following activities:

- Installing all components on the vehicle side.
- Installing VacuStar WR with suction and pressure lines.
- Installing safety and monitoring equipment.
- Connecting the VacuStar WR with the process water circulation.
- Connecting the drive with VacuStar WR. Observe sense of rotation and speed range.

6.4 Assembly of the VacuStar WR

Fixing options for the VacuStar WR

- Four screws at the feet of the VacuStar WR secure the VacuStar WR to the vehicle.
- To adjust the unit in the best possible way to the installation conditions, the feet of the VacuStar WR can be rotated clockwise or anticlockwise by one screw pitch. See page 11, Fig. 1 and page 12, Fig. 2

Checking the function before the installation

- Check the rotor shaft function. Rotating the rotor shaft with your hand must be possible.

Requirements placed upon installation point and attachment

- The attachment points on the vehicle must feature a sufficient load capacity and rigidity.
- The attachment points for the feet of the VacuStar WR must be on the same level.

Requirements upon the installation location

- Protected against dirt, gravel impact and splashing water.
- offer sufficient space for accidental contact protection.
- offer sufficient space for the connections of the suction and pressure lines.
- ensure good legibility of the instruments.
- Accessible for maintenance and repair work (e.g. for replacing the air filter, or for checking the safety and non-return valve).

Installation and assembly

Assembly

Use the following screws for securing the VacuStar WR:

Model	Screw	Solidity	Torque
WR 2500 / 3100	M16	8.8	190 Nm
WR 4000	M24	8.8	680 Nm

Tab. 6: Fastening screws

6.5 Compensators

Compensators in suction and pressure lines

Vacuum- and pressure-proof compensators must be installed in the suction and pressure lines to delimit the socket forces and to isolate the impact sound. Selection according to the protection pressure and - with ATEX - the explosion pressure shock resistance. Temperature resistance up to 100 °C.

6.6 Lines and containers

Suction and pressure line

As required, the suction line and the pressure line can be installed at the A-side or at the pressure side and in vertical or horizontal direction (see page 11, Fig. 1 and page 12, Fig. 2).

Fig. 4 (Page 13) shows the allocations of the flanges for all possible combinations.

The lines must satisfy the following requirements:

- Corrosion-proof
- Pressure resistance or explosion pressure shock resistance for ATEX
- Nominal diameter according to the following table:

VacuStar WR	DN suction and pressure line
WR 2500	DN 125 (5")
WR 3100	DN 125 (5")
WR 4000	DN 150 (6")

Tab. 7: DN suction and pressure line

- The lines must not have any reaction force on the VacuStar WR. Support the lines adequately.
- Place suction lines rising towards the VacuStar WR. The condensate must be able to be drained.
- Remove dirt, welding remainders, rust, etc. before you put the unit into operation.

Process water line

Depending on the pipe routing, a line cross-section of R1/2"…R2" results.

To avoid overfilling the VacuStar WR, a solenoid valve (flow when the VacuStar WR is started, stop when it is switched off) is installed in the process water inlet.

Cell ventilation

See page 24, chapter 6.2.

- The cell ventilation line is fed via the cell ventilation valve from the atmosphere. Installing a sound absorber is necessary to reduce the flow noise. An air filter prevents the penetration of dirt.

VacuStar WR	Inside diameter cell ventilation line up to a line length of 2.5 m
WR 2500	min 27 mm
WR 3100	min 52 mm
WR 4000	min 68 mm

Tab. 8: Inside diameter

Reservoir

There must always be a water supply available in the VacuStar WR. This is required for generating the liquid ring during the start and to ensure the lubrication of the slide ring seal.

Variant I (see page 24, chapter 6.2): The liquid level is above the line connection of the VacuStar WR.

- At minimum water content in the reservoir and open process water line, the water level must not be below the connection of the VacuStar WR lines.
- A water stop valve must be installed in the process water inlet to avoid overfilling the VacuStar WR at standstill.



ATTENTION!

The slide ring seal will be damaged when the machine runs dry, without liquid. Before it is started, the liquid ring pump must always be filled approximately half with liquid.

Variant II: The liquid level is below the line connection of the VacuStar WR.

- Depending on the line routing, installing a water circulation pump in the process water line may be necessary to support the circulation. Please contact CVS for the rating of the pump.

Installation and assembly



CAUTION!

No gross iron-containing particles (≥ 0.2 mm) must be carried into the VacuStar WR via the intake or the industrial water.

6.7 Safety equipment

The following safety equipment must be installed:

- Safety valve
- Monitoring the compression end temperature
- Non-return valve always at the suction side
- Vacuum suction filter
- Protection against contact.
- Shut-off valve in the control line

6.7.1 Safety valve

Risk of explosions



DANGER!

Risk of injury by explosions!

Explosions can cause severe injuries!

Therefore:

- Install the safety valve as instructed. Observe the manufacturer's instructions.
- Only use the safety valve for its intended purpose.
- Never block the safety valve.

The German accident prevention regulations require a non-lockable safety valve to be installed after the VacuStar WR at the pressure side. This valve must be selected such that it prevents the pressure to exceed the highest permissible operating pressure by more than 10 %. It must be identified with a TÜV component test number and be equipped with a manual venting element.

Assembly

1. Install the safety valve immediately after the pressure pipe joint.
2. The nominal opening pressure may not exceed the maximum permissible final overpressure (refer to Tab. 2) or the permissible system pressure, provided the latter is lower.

6.7.2 Monitoring the end temperature

A suitable measuring instrument must be installed that switches the VacuStar WR off when the maximum permissible temperature is reached.

Assembly

1. Install the temperature sensor in the line after the pressure pipe joint.
2. Connect the temperature sensor to the superordinate vehicle controller.



CAUTION!

- The temperature sensor connection must be intrinsically unbreakable.
- The maximum shutdown temperature is 95 °C

6.7.3 Non-return valve

When a vacuum is applied and the VacuStar WR is stopped, the non-return valve prevents the air and the process water from flowing back into the suction line.

The non-return valve must be installed immediately before the suction flange.

6.7.4 Vacuum suction filter

An adequate filter (filter mesh < 0.5 mm) is required to prevent solid matters from being sucked in.

Assembly

Install the vacuum filter into the suction line upstream from the VacuStar WR. Observe the flow direction.



CAUTION!

For explosion-proof VacuStar WR, use only filters that are resistant to the explosion pressure shock. Such filters can be purchased from CVS for the VacuStar WR 2500 and WR 3100.

6.7.5 Protection against contact

Rotating or hot parts of the system must be equipped with a protection against contact.

Please note that the German accident prevention regulations do not allow a maximum surface temperature of 80 °C to be exceeded.

Installation and assembly

Observe DIN EN ISO 13857, for example, for the distances and the layout of the protective grid.

6.7.6 Cell ventilation valve

Assembly

The VacuStar WR has been prepared for operation with cell ventilation. The connection is located at the top next to the process water connection.

Observe the following points during installation:

1. Install cell ventilation valve vertically.
2. Install the fresh air lines between the VacuStar WR and cell ventilation valve.
3. Install the control line between the connection at the suction socket and the cell ventilation valve.
4. Set an opening pressure of 200...300 mbar with the VacuStar WR running at the setting screw.
5. Check the full stroke. Full stroke = 27 mm.



ATEX note

When transporting explosive gases and gas mixtures, the control and fresh air lines must be explosion and shock-proof (11.6 barg).

Cell ventilation valve, muffler and suction filter can be purchased from CVS

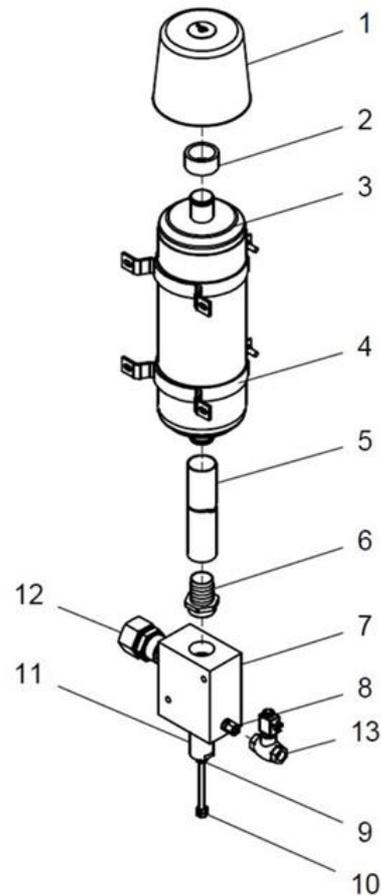


Fig. 9: Cell ventilation valve with muffler and air filter

- 1 Air filter (installed vertically)
- 2 Hose adapter
- 3 Muffler (installed horizontally or vertically)
- 4 Muffler holder
- 5 Connection line, max. length 1 m (not included in scope of delivery)
- 6 Hose stub
- 7 Cell ventilation valve (installed vertically)
- 8 Screw connection, connection control line (recommended pipe diameter: 10 x 1 mm)
- 9 Locknut
- 10 Adjustment nut for the adjustment and tuning of the oil pressure
- 11 Spring cage
Caution: Spring is under pressure. Prior to removing the spring cage, the springs must be completely relaxed with the set screw.
- 12 Connection R1 1/2" fresh air line to VacuStar WR, max. length 300 mm
- 13 Shut-off valve

Installation and assembly

6.7.7 Display and monitoring equipment



CAUTION!

All display and monitoring devices in a system that is used for conveying explosive material must comply with the Directive 2014/34/EC (ATEX) with respect to equipment category, temperature class and explosion group.

Vacuum meter, pressure gauge, temperature sensor, and flow monitor must be installed for the safety of the VacuStar WR. The process water supply in the reservoir must also be monitored. We also recommend the installation of a speed counter and a level switch for the water level at start of the pump.

Designation	Monitoring parameters	Place of installation	Measuring range
Vacuum meter	Operating vacuum	Intended location, immediate in front of the inlet	0...1000 mbars
Pressure gauge	Positive working pressure	Immediately after the pressure pipe joint of the VacuStar WR	0...2.0 bars
Temperature sensor	Compression end temperature	After the pressure flange	Up to approximately 120 °C
Flow monitor	Process water inlet	Water supply line upstream of the process water connection of the VacuStar WR	–
Water level indicator	Water level in VacuStar WR at standstill	Exists ex-factory on both lids	Only for visual inspection
Speed counter (option)	Speed	Drive shaft WR 2500 / WR 3100 WR 4000	800...1600 min ⁻¹ 800...1300 min ⁻¹

Tab. 9: Display and monitoring equipment

6.7.8 Shut-off valve in the control line

A shut-off valve must be installed in the control line in order to avoid reversing of the VacuStar WR when the tank is evacuated at deactivation.



NOTE!

The shut-off valve must be connected in the control line in parallel to the ancillary drive!

6.8 Additional components of the system

6.8.1 Safety tank

Requirements

The safety tank protects the VacuStar WR from sucking in liquids. It must comply with the following requirements:

- Passing air must not hit the liquid surface directly
- Sufficiently large settling chamber
- Drain cock at the deepest point of the tank

Assembly

Install the safety tank at the deepest point of the system.

Functional check

The functional check of the safety tank must satisfy the following requirements:

- The separated water must remain in the safety tank during suction operation.
- In atmospheric suction (pressure operation), the liquid ring pump must not suck in more than 1 litre of liquid per hour.

6.9 Safety dome

Requirement

The safety dome on the vehicle tank must be equipped with a float valve and a baffle.

The baffle prevents the liquid from being entrained when the liquid sloshes.

Installation and assembly

6.10 Cooling water system



ATTENTION!

- The maximum permissible cooling water temperature is 60 °C.
- When dimensioning the components, you must take extreme temperatures in the summer and coolant additives into account. See page 16, Tab. 5.

The following figure shows a diagram of the radiator arrangement. Also see page 24, Fig. 8.

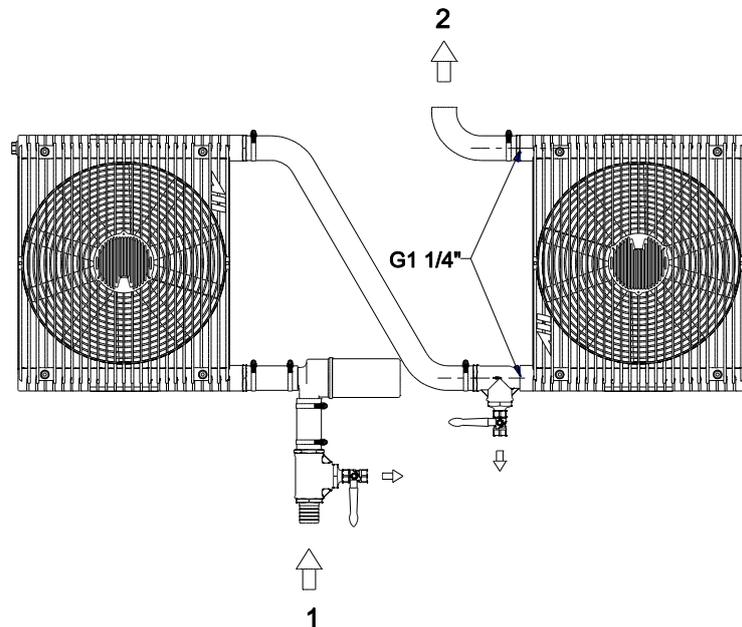


Fig. 10: Radiator arrangement

- 1 Process water inlet from the reservoir
- 2 Process water outlet to the reservoir

Assembly

Observe the following points during installation:

- Operate the radiator in the bypass flow if possible.
- Ask CVS engineering for the circulating cooling water quantity
- Install the radiator stress-free on rubber elements.
- Install the cooling water pump at the lowest point.
- Use hoses that are temperature-resistant up to 100 °C.
- Add antifreeze compound for ambient temperatures below 0 °C.
- Recommended delivery rate of the water pump 5,200 l/h at 0.2 bar pressure loss



NOTE!

In order to prevent introduction of deposits or dirt particles into the VacuStar WR with the industrial water, we recommend installing a coarser filter depending on the chosen cooler.

6.11 Drive



CAUTION!

Drive and coupling of a system that is used for conveying explosive material must comply with the Directive 2014/34/EC (ATEX) with respect to equipment category, temperature class and explosion group.



ATTENTION!

- Selection and design are within the responsibility of the system builder.
- Do not route axial forces into the VacuStar WR shaft when installing drive components.
- Do not tap couplings or other connection components onto the shaft, but slide them on.
- Always slide additional components such as V belt pulleys as far onto the shaft of the VacuStar WR as possible.
- Check the torque and the sense of rotation.

The VacuStar WR is driven via:

- V-belt
- Articulated shaft
- Flexible coupling

where drives such as lorry P.T.O, electric motors, hydraulic motors or diesel engine are possible.

Installation and assembly

6.11.1 V belt drive



ATTENTION!

The maximum permitted transverse force (FQ) at the drive shaft due to the belt pull must not exceed the following values:

VacuStar WR 2500 / WR 3100 FQ= 9300 N
 VacuStar WR 4000 FQ= 12500 N

Observe the design, installation and inspection instructions of the manufacturer.

The following belt pulleys can directly be installed on the shaft end of the VacuStar WR:

VacuStar WR V-belt drive	Unit	WR 2500	WR 3100	WR 4000
V belt profile	–	XPB		
Smallest pulley diameter	[mm]	280		315
Number of belts in pressure operation	–	5	5	6
Permissible final overpressure in pressure operation	[bar]	1.0	0.5	0.5
Number of belts in vacuum operation	–	5	5	6

Tab. 10: Belt pulleys

Assembly

- Select V-belt drive according to Table (Tab. 10).
- Align the V belt pulleys accurately to each other.
- Install V-belt pulleys (e.g. with Taper-Lock clamping bushes) and V-belt with pretension according to the manufacturer specifications.

6.11.2 Articulated shaft drive



ATTENTION!

Observe the design, installation and inspection instructions of the manufacturer.

Keep the bending radius of the articulated shafts as small as possible. Observe the specifications of the manufacturer of the articulated shafts.

6.11.3 Drive via flexible coupling and hydraulic motor

**ATTENTION!**

Observe the design, installation and inspection instructions of the manufacturer.

The hydraulic motor is installed to the VacuStar WR via an intermediate flange. The power is transmitted via a flexible coupling.

Components that match the VacuStar WR type can be ordered from CVS.

Start-up

7 Start-up

7.1 Safety during start-up

Start-up, operation



WARNING!

Risk of injury due to improper start-up and operation

Improper start-up and operation can lead to serious bodily injuries or property damage.

Therefore:

- Have all work during initial operation exclusively performed by the manufacturer's employees or by his authorised representatives or by trained personnel.
- Start-up and operation may only be performed by adequately qualified personnel that has been authorised and instructed by the operator.
- Before the start of any work, ensure that all covers and protective devices are correctly installed and function correctly.
- Never override any protective equipment during operation.
- Pay attention to tidiness and cleanliness in the working area! Loosely stacked or scattered components and tools are accident sources.

Please also observe all safety instructions in the operating instructions "VacuStar WR 2500 / WR 3100 / WR 4000", Chapter "Occupational safety and special risks".

7.2 Start-up

Inspection prior to initial start-up

The following points must be checked prior to initial start-up:

- Inspect the VacuStar WR and the entire system
- Check the pipes for continuity and residues (remove blanks if there are any)
- Check the operating data on the rating plate.
- Check whether the rotor shaft can be rotated by hand.
- Check the function of the water stop valve (water supply and/or cell ventilation).
- Check the sense of rotation (switch briefly on/off). Observe the arrow for the sense of rotation.
- Fill in **process water (clean drinking water)** up to the maximum mark on the reservoir. Bleed the circuit. Add antifreeze according to manufacturer's specifications.



ATTENTION!

Risk of damaging the slide ring seal!

The slide ring seal will be damaged when the machine runs dry, without liquid.

Therefore:

- Before the unit is started, the liquid ring pump must always be approximately half full (shaft centre) with liquid (refer to page 17, Fig. 5, pos. 10).

- Check the function of the safety valve (see page 28 ff, chapter 6.7.1.).
- Check the attachment screws. (see page 25, chapter 6.4.)

Start-up

Proceed as follows during start-up:

- Open shut-off devices (if installed).
- Start the VacuStar WR drive.
- Check the operating data.
- Check the function of the installed cell ventilation.

The VacuStar WR must run smoothly when the suction valve is closed.

Start-up

Inspections during operation

The following inspections have to be carried out during operation:

- The liquid level in the reservoir must not be lower than the minimum mark during operation.
- Always turn the four-way cock until it hits the stop. Intermediate positions are not permitted
- Check whether pressure or vacuum builds up.
- Pay attention to abnormal noises and leaks during operation. If necessary, switch off VacuStar WR.
- Drain the condensate at the safety trap. Vessel may not be in a state of vacuum when condensate is drained.

Checking the operating data:

- The speed must be between:
800...1600 min⁻¹ (WR 2500 / WR 3000) or
800...1300 min⁻¹ (WR 4000).
- The cooling water outlet temperature (return flow to radiator) may be max. 60 °C.
- Check the positive working pressure at the pressure gauge (permissible pressure see Tab. 4, page 15).
- Check the operating vacuum at the vacuum meter (permissible vacuum see Tab. 3, page 15).



CAUTION!

The following points must be observed when explosive gases and gas mixtures are conveyed:

- Prior to every start of the VacuStar WR and during operation:
 - Check the process liquid levels (VacuStar WR and reservoir).
 - Check for leaks
- Listen for abnormal noise during the suction process. Switch off the VacuStar WR if necessary.
- Check the VacuStar WR at regular intervals (daily) for signs of overheating and exceptional deformations. If necessary, switch off the VacuStar WR or do not put it into operation.

7.3 Switching off

To switch off the VacuStar WR, proceed as follows:

- Switch off drive for the VacuStar WR
- Close the shut-off valves (if installed)
- Drain the safety tank. Vessel may not be in a state of vacuum when condensate is drained.

7.4 Inspections to be performed

pH value of the process water

- Depending on the conveyed medium, the steady water delivery can lead to an increased concentration of harmful substances and thus to a change in the pH value.
- The permissible pH value (see page 16, Tab. 5) must be checked (using litmus paper, for example) at regular intervals according to the operation experience.



Declaration of Incorporation

8 Declaration of Incorporation

**Einbauerklärung im Sinne der Maschinenrichtlinie
2006/42/EG Anhang II 1B - Originaleinbauerklärung
Declaration of Incorporation according to the
EC Machinery Directive 2006/42/EC Annex II 1B
– Original Declaration of Incorporation**

**Hersteller /
Manufacturer** CVS engineering GmbH
Großmattstraße 14
D-79618 Rheinfelden

**Bevollmächtigter für die Zusammenstellung der
relevanten technischen Unterlagen /
Authorised person for compilation of the
relevant technical documents:** Fabian Blum
Großmattstraße 14
D-79618 Rheinfelden

**Kurzbeschreibung &
Produkt** Flüssigkeitsring-Kompressor-Vakuumpumpe für Druck- und Vakuumbetrieb
Liquid-ring compressor vacuum pump for pressure and vacuum operation
VacuStar WR 2500*, WR 3100*, WR 4000

Schraubenkompressor für den Druckbetrieb
Screw compressor for pressure operation
SKL 700, SKL 1100, SKL 700 LS, SKL 1100 LS, SKL 1200 C, SKL 1500

**Short description &
Products:** Drehschieberkompressor für Druck- und Vakuumbetrieb
Rotary vane compressor for pressure and vacuum operation
VacuStar W900*, W1300*, W1600*

Drehschieberkompressor für Druckbetrieb
Rotary vane compressor for pressure operation
RKL 160

Drehschieberkompressor für Druck- und Vakuumbetrieb
Rotary vane compressor for pressure and vacuum operation
VacuStar L400

**Seriennummer/
Serial number** siehe Typenschild / see type plate

Der Hersteller erklärt, dass das oben genannte Produkt eine unvollständige Maschine im Sinne der Maschinenrichtlinie ist. Das Produkt ist ausschließlich zum Einbau in eine Maschine oder unvollständige Maschine vorgesehen und entspricht daher noch nicht allen Anforderungen der Maschinenrichtlinie. Folgende grundlegenden Anforderungen der Maschinenrichtlinie für dieses Produkt sind angewandt und eingehalten: 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.4, 1.3.7, 1.5.5, 1.5.7, 1.5.8, 1.5.9, 1.6.1, 1.7.1, 1.7.2, 1.7.3, 1.7.4 Die speziellen technischen Unterlagen gemäß Anhang VII Teil B wurden erstellt. Der Bevollmächtigte für das Zusammenstellen der technischen Unterlagen verpflichtet sich, die Unterlagen auf begründetes Verlangen an die einzelstaatlichen Stellen zu übermitteln. Die Übermittlung erfolgt postalisch in Papierform oder in elektronischer Form. Die Inbetriebnahme des Produkts ist so lange untersagt, bis festgestellt wurde, dass die Maschine, in die das oben genannte Produkt eingebaut wird, allen grundlegenden Anforderungen der Maschinenrichtlinie entspricht. Die oben mit "*" markierten Produkte erfüllen die Anforderungen der folgenden einschlägigen Richtlinien:
- ATEX-Richtlinie 2014/34/EU des Europäischen Parlaments und Rates

The manufacturer declares that the above product is an incomplete machine in the meaning of the machinery directive. The product is only intended for installation in a machine or an incomplete machine and therefore does not meet all requirements of the machinery directive yet. The following basic requirements of the machinery directive for this product have been applied and complied with: 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.4, 1.3.7, 1.5.5, 1.5.7, 1.5.8, 1.5.9, 1.6.1, 1.7.1, 1.7.2, 1.7.3, 1.7.4 The special technical documents have been created according to Annex VII, part B. The person authorised to compile the technical documents commits to submitting the documents to the national offices upon justified request. The submission shall take place on paper in the email or on electronic data carrier. Commissioning of the product is forbidden until it has been determined that the machine into which the above product is installed meets all basic requirements of the machinery directive. The products marked with "*" comply with the requirements of the following directives:
ATEX directive 2014/34/EU of the European parliament and council

Rheinfelden, 10.02.2023

Fabian Blum

Leiter Konstruktion & Entwicklung
Head of Design & Engineering

9 UK Declaration of Incorporation

Declaration of Incorporation according to The Supply of Machinery (Safety) Regulations 2008 Annex II 1B Original Declaration of Incorporation

Manufacturer:	CVS engineering GmbH Großmattstraße 14 D-79618 Rheinfelden
Importer:	CompVac Ltd. Mr. Lee Benton 25, Wharfedale Road Euroway Industrial Estate BD4 6SG Bradford
Authorised person for compilation of the relevant technical documents:	Fabian Blum Großmattstraße 14 D-79618 Rheinfelden
Short description & Products:	Liquid-ring compressor vacuum pump for pressure and vacuum operation VacuStar WR 2500*, WR 3100*, WR 4000* Screw compressor for pressure operation SKL 700, SKL 1100, SKL 700 LS, SKL 1100 LS, SKL 1200 C, SKL 1500 Rotary vane compressor for pressure and vacuum operation VacuStar W900*, W1300*, W1600* Rotary vane compressor for pressure operation RKL 160 Rotary vane compressor for pressure and vacuum operation VacuStar L400
Serial numbers:	See type plate

The manufacturer declares that the above product is an incomplete machine in the meaning of 'The Supply of Machinery (Safety) Regulations 2008'. The product is only intended for installation in a machine or an incomplete machine and therefore does not meet all requirements of 'The Supply of Machinery (Safety) Regulations 2008' yet.

The following basic requirements of 'The Supply of Machinery (Safety) Regulations 2008' for this product have been applied and complied with: 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.4, 1.3.7, 1.5.5, 1.5.7, 1.5.8, 1.5.9, 1.6.1, 1.7.1, 1.7.2, 1.7.3, 1.7.4

The special technical documents have been created according to Annex VII, part B. The person authorised to compile the technical documents commits to submitting the documents to the national offices upon justified request. The submission shall take place on paper in the email or on electronic data carrier.

Commissioning of the product is forbidden until it has been determined that the machine into which the above product is installed meets all basic requirements of 'The Supply of Machinery (Safety) Regulations 2008'.

The products marked with "*" comply with the requirements of the following directives:

- Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016

Rheinfelden, 10.02.2023



Fabian Blum
Head of Design & Engineering
CVS engineering GmbH

ATEX Declaration of conformity

10 ATEX Declaration of conformity

EU-Konformitätserklärung gemäß Richtlinie 2014/34/EU (ATEX)

Declaration of Conformity according to Directive 2014/34/EC (ATEX)

Wir erklären hiermit als Hersteller in alleiniger Verantwortung, dass die nachfolgend beschriebenen Produkte der Richtlinie 2014/34/EU und den harmonisierten Normen entsprechen.

We hereby declare in sole responsibility that the product described below, to which this declaration of conformity refers to, is in conformity with the essential requirements of the standards listed below.

Hersteller / Manufacturer	CVS engineering GmbH Großmattstraße 14 79618 Rheinfelden / Germany
Produkt / Product	VacuStar WR 2500, WR 3100, WR 4000
Kurzbeschreibung / Short description	Flüssigkeitsring-Kompressor-Vakuumpumpe für Druck- und Vakuumbetrieb <i>Liquid-ring compressor vacuum pump for pressure and vacuum operation</i>
Seriennummer / Serial number	see type plate
Kennzeichnung / Marking	 II 2/- G Ex h IIB T5 Gb
Hinterlegungsnummer / Depository number	EPS 23 ATEX 3 074
Benannte Stelle / Designated body	Bureau Veritas Consumer Product Service Germany GmbH, Oehleckerring 40, 22419 Hamburg / Germany
Angewandte harmonisierte Normen / Applied harmonized standards:	<p>EN ISO 80079-36:2016 <i>Explosionsfähige Atmosphären - Teil 36: Nicht-elektrische Geräte für den Einsatz in explosionsfähigen Atmosphären - Grundlagen und Anforderungen</i> <i>Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements</i></p> <p>EN ISO 80079-37:2016 <i>Explosionsfähige Atmosphären - Teil 37: Nicht-elektrische Geräte für den Einsatz in explosionsfähigen Atmosphären - Schutz durch konstruktive Sicherheit "c", Zündquellenüberwachung "b", Flüssigkeitskapselung "k"</i> <i>Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"</i></p> <p>EN IEC 60079-0:2018 <i>Explosionsgefährdete Bereiche - Teil 0: Betriebsmittel - Allgemeine Anforderungen</i> <i>Explosive atmospheres - Part 0: Equipment - General requirements</i></p>
Other standards/ Specifications:	<p>EN 1127-1:2019 <i>Explosionsfähige Atmosphären - Explosionsschutz – Teil 1: Grundlagen und Methodik; Deutsche Fassung EN 1127-1:2019</i> <i>Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology</i></p> <p>TRT 006: 2014-05 <i>Technische Richtlinien Tanks - Explosionsdruckstoßfestigkeit</i> <i>Technical Guidelines Tanks - Explosion Pressure Shock Resistance</i></p>

Rheinfelden, 24.02.2023



i.V. Manfred Wagner
Senior engineer system design
Ex authorized person

11 UKEX Declaration of Conformity



Declaration of Conformity in accordance with UK Government Guidance

Manufacturer:	CVS engineering GmbH Großmattstraße 14 79618 Rheinfelden / Germany
Importer:	CompVac Ltd. Mr. Lee Benton 25, Wharfedale Road Euroway Industrial Estate BD4 6SG Bradford
Product:	VacuStar WR 2500, WR 3100, WR 4000
Short description:	Liquid-ring compressor vacuum pump for pressure and vacuum operation
Serial number:	see type plate
Marking:	 II 2/- G Ex h IIB T5 Gb
Depository number:	EPS 23 UKEX 3 075
Designated body:	(Bureau Veritas Consumer Product Service Germany GmbH, Oehleckerring 40, 22419 Hamburg / Germany)

This declaration is issued under the sole responsibility of the product manufacturer.
The object of the declaration described above is in conformity with the relevant UK Statutory Instruments and their amendments:

**Equipment and Protective Systems
Intended for use in Potentially Explosive Atmospheres
Regulations 2016**

We hereby declare that the product described above, to which this declaration of conformity refers to, is in conformity with the essential requirements of the following standards:

Applied standards:	BS EN ISO 80079-36:2016	Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements
	BS EN ISO 80079-37:2016	Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"
	BS EN IEC 60079-0:2018	Explosive atmospheres - Part 0: Equipment - General requirements
	BS EN 1127-1:2019	Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology

The products comply with the requirements of the following directives:
- The Supply of Machinery (Safety) Regulations 2008

Rheinfelden, 10.02.2023



i.V. Manfred Wagner
Senior engineer system design
Ex authorized person

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