Operating instructions

VacuStar WR 2500 / WR 3100 / WR 4000

Doc-ID: 5041 / BA / EN
Release: Rev. 04 / 28/03/2023

The operating instructions must be read by the VacuStar WR operator before start-up!

Translation of the original operating manual

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Contents

1 General

1.1 Information regarding the operating instructions

These operating instructions provide important information on how to deal with 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.

Carefully read the operating instructions before starting any work! It is a product component and must be kept in direct proximity of the VacuStar WR, well accessible to the personnel at all times.

When passing the VacuStar WR on to third parties, the operating instructions must also be handed over.

1.2 Pictogram explanation

Warning notes

Warning notes are characterised by pictograms in these operating 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 pictogram denotes the special conditions that must be observed according to the approvals when operating the VacuStar WR in potentially explosive areas.

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

All specifications and notes in these operating instructions were compiled with consideration to the valid standards and regulations, the state of the art as well as to our long-standing knowledge and experience.

The manufacturer is not liable for damages caused by:

- Non-observance of the operating instructions
- Improper use
- Deployment of non-trained personnel
- Arbitrary modifications
- Technical changes
- Use of non-approved spare and wear parts

The actual scope of supply may differ from the explanations and illustrations described in this manual in case of special designs, if additional order options are made use of, or due to latest technical changes.

Incidentally, the responsibilities agreed upon in the delivery contract, the general terms and conditions as well as the manufacturer's conditions of delivery and the statutory provisions valid at the time of contract conclusion shall apply.

Warranty

The manufacturer guarantees the correct functioning of the applied process technology and the performance parameters identified. The warranty period commences on the date the VacuStar WR is delivered to the customer.

Wear parts

Wear parts are all components coming into immediate contact with the material to be processed (e.g. bearings, shaft sealing rings, etc.).

These components are excluded from the warranty and any claims for defects as far as wear and tear damage is concerned.

1.4 Copyright protection

Surrendering the operating instructions to third parties without written permission of the manufacturer is not permitted.

NOTE!

Content details, texts, drawings, pictures and other illustrations are protected by copyright and are subject to industrial property rights. Any improper use shall be liable to prosecution.

Any type and form of duplication also of extracts as well as the exploitation and/or communication of the contents are not permitted without the manufacturer’s written declaration of consent.

1.5 Spare parts

WARNING!
Risk of injury by incorrect spare parts!
Incorrect or defective spare parts can result in damage, malfunctions or total failure and also impair safety.
Therefore:
– Use only the manufacturer's original spare parts.

Procure spare parts from authorised dealers or directly from the manufacturer. Refer to page 2 for address.
A list of spare and wear parts can be found in the enclosure.

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.

2 Safety

2.1 Intended use

The liquid-ring compressor vacuum pumps of the VacuStar WR series are 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.
Labelling of the VacuStar WR on the rating plate:

II 2G ck IIB T5 (i),
no potentially explosive external atmosphere.
In temperature class T5, the gas temperature is limited to 95 °C, and must be secured.

2.2 Proper operation

The following criteria in essence define the proper operation:

- Technical Data in Tab. 2
- Solids may not be sucked into VacuStar WR.

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

Only use VacuStar WR for the intended use.
All specifications in these 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

The VacuStar WR is used for industrial purposes. The operator of the VacuStar WR is therefore subject to the legal obligations concerning occupational safety.
The provisions valid at the place of installation as well as the safety and accident prevention regulations of the Institution for statutory accident insurance and prevention must be observed. The operator must in particular:

- inform himself on the valid industrial safety regulations.
- determine the additional hazards that arise from the special working conditions at the VacuStar WR's place of installation by means of a hazard assessment.
- implement the necessary rules of conduct for operation of the VacuStar WR at the place of installation by means of user instructions.
- check at regular intervals during the VacuStar WR's entire period of use whether the user instructions correspond to the current state of the body of rules and regulations.
- adapt the operation instructions, if necessary, to the new regulations, standards, and operating conditions .
- clearly regulate the responsibilities for installing, operating, maintaining and cleaning the VacuStar WR.
- ensure that all employees working on or with the VacuStar WR have read and understood the operating instructions. In addition he must at regular intervals train the employees in how to deal with the VacuStar WR and inform them about potential hazards.

In addition, it is the operator's responsibility to ensure that:

- the machine is always in a technically perfect condition.
- the machine is maintained in accordance with specified maintenance intervals.
- all safety equipment is regularly checked for completeness and correct functioning.

2.5 Operating personnel

2.5.1 Requirements

WARNING!
Risk of injury in case of inadequate qualification!
Improper handling can lead to considerable bodily injuries and property damage.
Therefore:
– Have any activities only carried out by the individuals designated for that purpose.

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

- **Instructed persons**
  have been instructed during instructions provided by the operator with regard to the work assigned to them and possible hazards arising from improper conduct.
- **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.

2.6 Personal protective equipment

When handling the VacuStar WR, it is necessary to wear personal protective equipment, in order to minimise health hazards.

- Before carrying out any work, properly don the necessary protective equipment such as gloves, safety goggles, etc. and wear during work.

2.7 Occupational safety and special risks

The remaining risks that result from the hazard analysis are specified in the following section.
Observe the safety notes listed here and the warning notes in the other chapters of these instructions to reduce health hazards and to avoid dangerous situations.

Assembly of the VacuStar WR

The relevant dangerous spots on the VacuStar WR are identified by these pictograms:

DANGER!
General danger pictogram!
… denotes general dangerous situations for individuals. Non-observance of the safety instructions can result in severe injuries or death.

DANGER!
Explosion protection pictogram!
… denotes regulations and information that need to be observed in potentially explosive areas. Explosion protection class, temperature ranges , etc. must be observed!

DANGER!
Danger of burns!
… denotes the presence of a hot surface.

Hazard notes and occupational safety

For your own safety and that of the machine, the following information must be observed and complied with:

Improper operation

DANGER!

Danger due to improper operation!

- Only use VacuStar WR in a perfect technical condition. Malfunctions that are relevant for safety have to be promptly eliminated.
- Conversions of the VacuStar WR are not permissible and can impair safety.
- Never bridge any safety equipment or put it out of operation.
- Any work on the VacuStar WR and/or on electrical equipment must be carried out by specialised staff.
- Repair and maintenance work may only be carried out when the VacuStar WR is stationary. For this, the VacuStar WR must be secured against restarting!
- The VacuStar WR may not be under pressure or in a state of vacuum while work is being carried out on it.
  Close shut-off valve on the vehicle side and vent the pipe between VacuStar WR and shut-off valve or manually relieve excess pressure at safety valve. Observe pressure gauge!
- The drive's protective equipment may only be removed when the VacuStar WR is stationary and has to be correctly refitted after completion of work.
- Only dismantle accidental contact protection after VacuStar WR and pressure pipe have cooled down.
- It is an environmental protection requirement that any liquids arising during maintenance work (e.g. cooling oil, cooling water, etc.) are collected and disposed of in an environmentally compatible manner.

- The machine may only be opened for maintenance and repair work by specialised staff if the VacuStar WR is stationary and no potentially explosive atmosphere is present.

Moving components

WARNING!

Risk of injury by moving components!

Powered rotating components can cause the most serious injuries!

Therefore during operation:

– It is absolutely forbidden for persons to stay in the hazard area or in the immediate vicinity!
– Do not put safety devices and/or functions out of operation and do not render them inoperative or bypass them.
– Never reach into open outlets and inlets or into running equipment.

Before entering the hazard area:

– Switch off power supply and secure against restarting.
– Wait for standstill of lagging components.
– Wait for automatic dissipation and/or discharge of residual energies (compressed air).

Compressed air

WARNING!

Risk of injury due to compressed air!

Pneumatic energies can cause the most serious injuries.

In the case of damage to individual components, air can be discharged under high pressure and injure e.g. the eyes.

Therefore:

– Before starting any work, first depressurise pressurised components. Pay attention to accumulators. Accumulator pressure must also be completely relieved.
– Do not change pressure settings beyond the maximum values.

Safety

Signposting

WARNING!
Risk of injury by illegible pictograms!
Labels and signs can become dirty or unrecognisable in the course of time.
Therefore:
– Always keep safety, warning and operating instructions in a well legible condition.
– Immediately replace damaged or obliterated signs or labels.

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 eye bolts provided for that purpose.
See page 19, Fig. 1, pos. 8

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.

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.
– Work on the electrical system, on individual electrical components and on the connections may only be carried out by electrical specialists.

Maintenance and troubleshooting

WARNING!

Risk of injury due to improper maintenance and troubleshooting!

Improper maintenance and troubleshooting can lead to serious bodily injuries or property damage. Therefore:

- Maintenance work and troubleshooting work may only be carried out by sufficiently qualified and instructed personnel.
- Protect VacuStar WR from being restarted, switch off drives!
- Before starting any work, provide for sufficient space and freedom of movement during assembly.
- Pay attention to tidiness and cleanliness in the assembly area! Loosely stacked or scattered components and tools are accident sources.

If components must be replaced:

- Pay attention to correct installation of spare parts.
- Properly reassemble all fastening elements.
- Observe screw tightening torques.
- Before restarting, ensure that all covers and protective devices are correctly installed and function correctly.
- After completion of maintenance work and troubleshooting, check correct functioning of safety equipment.

3 Technical data

General data	Unit	WR 2500	WR 3100	WR 4000
Nominal operating vacuum [1)]	[mbar]	400		
Weight without water filling	[kg]	175	192	298
Permissible inclination in longitudinal direction	[°]	5		
Process liquid	–	Water-glycol mixture		

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

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

Technical data

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)]	[m³/h]	2500	3100	4063
Coupling power [1), 2), 3)]	[kW]	73	88	117
Intake volume flow [1), 2)]	[m³/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	[m³/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

VacuStar WR process water circulation	Unit	WR 2500	WR 3100	WR 4000
Maximum process water inlet temperature VacuStar WR	[°C]	55		
pH value	–	5…8		
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 kW / (m² • °C)

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

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

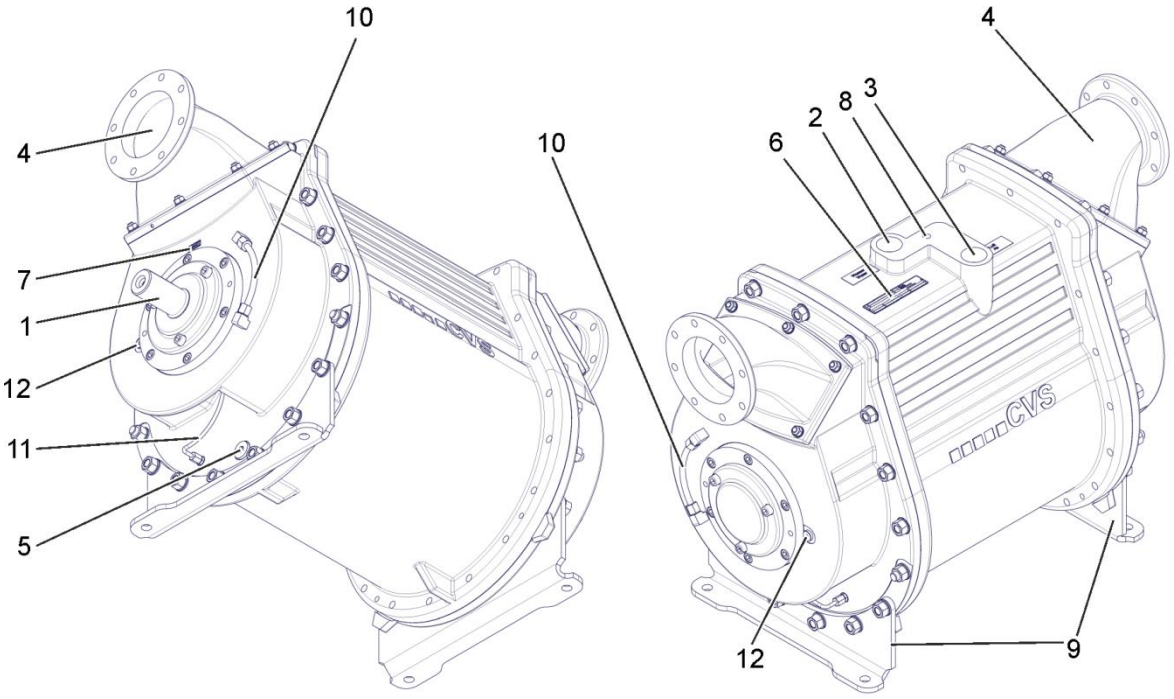

Fig. 1: Design

1 Drive shaft
2 Connection process water
3 Cell ventilation connection
4 Connecting flange for pressure or suction connection (flange DIN 28459)
5 Process water draining
6 Rating plate
7 Rotation arrow
8 Thread for eye bolt
9 Fixing foot
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.

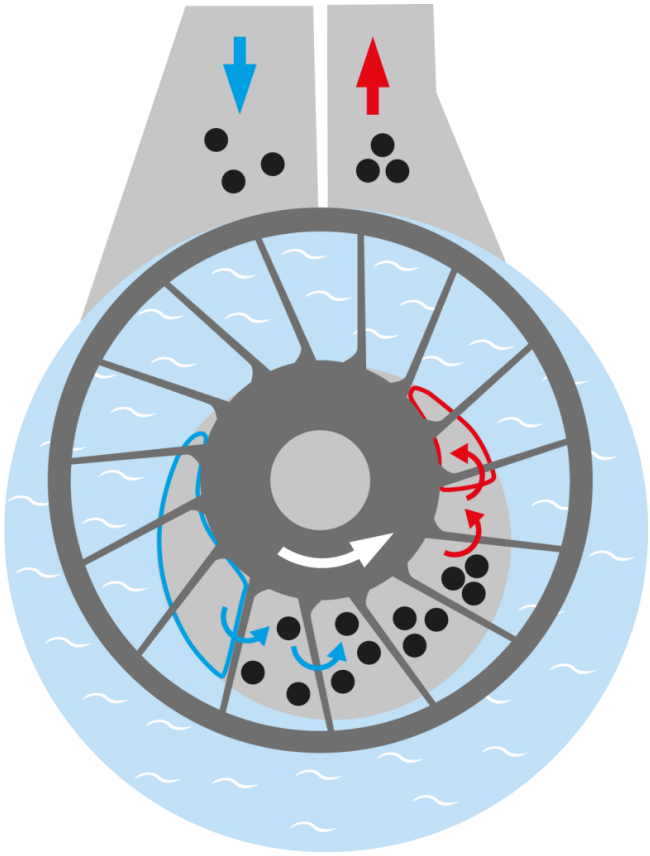

Fig. 2: Functional principle

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

See rotation arrow page 19, Fig. 1, pos. 7.

Process water circulation and cell ventilation

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

Process water consumption

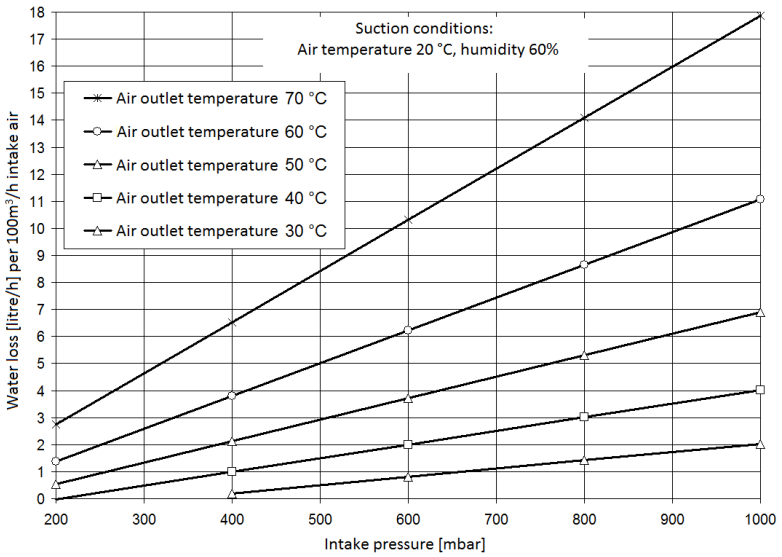

Fig. 3: Process water delivery

Fig. 3 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. 3:
2.1 l/h per 100 m³/h intake air

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

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

4.3 Control and display elements

Depending on the installation situation, different display elements such as pressure gauge, temperature gauge and negative pressure display are mounted.

5 Transport and storage

5.1 Safety notes for transport

See chapter 2.7 "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.

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 to +60 °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 Start-up and operation

6.1 Safety

See chapter 2.7 "Occupational safety and special risks".

6.2 Start-up

Works prior to initial start-up

The following points must be checked prior to initial start-up or after a lengthier standstill:

- Fill in process water (clean drinking water) up to the maximum mark on the reservoir. Ventilate process water circulation. Add antifreeze according to manufacturer's specifications.
- Fill process water directly at the VacuStar WR up to half full (half shaft) (see page 19, Fig. 1, pos.10 "Process water indicator"). The water stop valves in the process water inlets avoid filling the VacuStar WR from the process water reservoir.
- Make sure that the line cross-sections of suction and pressure lines are free inside.

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. (see page 19, Fig. 1, pos. 10)

Start-up

Proceed as follows during start-up:

- Open shut-off devices (if available)
- Start the VacuStar WR drive
- Check operating data

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
- Pay attention to abnormal noises and leaks during operation. If necessary, switch off VacuStar WR.
- Check function of installed cell ventilation; the VacuStar WR must run smoothly when the suction valve is closed.

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 positive working pressure at the pressure gauge (permissible pressure see Tab. 4, page 18).
- Check the operating vacuum at the vacuum meter (permissible vacuum see Tab. 3, page 18).

Inspections, if explosive gases and gas mixtures are conveyed.

DANGER!

There is mortal danger in case of insufficient inspections!

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 system 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.

6.3 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. Tank may not be under pressure then.

6.4 Inspections to be performed at standstill

Inspections: Process water – liquid level

The permanent water loss leads to a low process water level in the system.
Prior to every start check the fill level in the reservoir of the VacuStar WR.

Check of the process water – pH value

- 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 XXXX, XXXX) must be checked (using litmus paper, for example) at regular intervals according to the operation experience.

Safety valve inspection

The safety valve is no regulating device!
The operational capability must be checked on start-up and later at weekly intervals.
The safety valve must be secured against misadjustment. Blocking or manipulating the safety valve can have penal consequences if it gives rise to an accident. Any warranty claims shall also be forfeited in such a case.
A maximum pressure pursuant to rating plate is permissible. Depending on the type of drive, this may according to the table Technical data on page 3 lower.

Inspection of the ventilating valve

A ventilating valve can be installed on the suction side to secure the installation. When the set vacuum is reached, the ventilating valve opens and admits atmospheric auxiliary air into the system.

Check of the non-return valve in the suction line of the VacuStar WR

The non-return valve is maintenance-free, but is subject to wear like all other moving parts. We recommend a visual inspection every 6 months. In this connection, the non-return valve must be dismantled, cleaned, freed of deposits and checked for freedom of motion.
Worn out non-return valves must be replaced!

Start-up and operation

Inspection of cell ventilation

For a save operation the VacuStar WR must be equipped with a cell ventilation (see page 19, Fig. 1, pos. 3). If there is a ventilation from the atmosphere the suction filter sucks fresh air. The filter must be cleaned weekly and replaced in case of visible damage.

Inspection of the VacuStar WR drive

For this, observe the instructions of the installer regarding the drives in use (e.g. hydraulic motor, V-belt drive).

7 Maintenance

7.1 Safety

See chapter 2.7 "Occupational safety and special risks".

Personal protective equipment

The following must be worn during all maintenance work:

- Safety working clothing
- Protective gloves
- Safety shoes
- Safety goggles

Environmental protection

Observe the following information with regard to environmental protection during maintenance:

- Remove emerging, used or excessive grease at all lubricating points that are manually supplied with lubricant and dispose of in accordance with valid local regulations.

7.2 Maintenance schedule

The following describes the maintenance work that is necessary for an optimum, trouble-free operation. Maintenance intervals must be observed.
If increased wear of individual components or functional groups is determined during regular inspections, the operator has to reduce the required maintenance intervals on the basis of the actual signs of wear.
Changes compared to normal operation (increased power consumption, temperatures, vibrations, noises, etc. or response of monitoring systems) lead to the assumption that the functions are impaired. These then have to be subjected to an inspection by specialised staff.
In case of queries regarding the maintenance work and intervals: contact the manufacturer (service address → page 2).
For maintenance schedule refer to next page.

Maintenance

Table maintenance schedule

Interval	Maintenance work	To be carried out by
Weekly	Check safety valve	Operator
	Check water stop valve	
	Clean cooling unit / process water cooler	
	Clean VacuStar WR	
	Clean vacuum filter	
	Clean cell ventilating filter, replace if damaged	
	Check V-belt tension and re-tension if necessary	
Monthly	Check fastening screws and tighten if necessary	Operator
quarterly	Check cell ventilation valve	Specialised staff
Half-yearly	Check non-return valve of VacuStar WR	Specialised staff
5000 hrs. or 3 years	Replace permanent grease filling	Specialised staff
15,000 h (10,000h)	Replace roller bearings	Specialised staff
15,000 h (10,000h)	Replace shaft sealing rings	Specialised staff
15,000 h (10,000h)	Replace slide ring seal	Specialised staff

Values in ( ) apply to WR 4000

NOTE!

Greater contamination of the industrial water may be discharged by draining approx. 5 litres of industrial water at the drainage hose, item 5, during operation.

7.3 Performance of maintenance work

Cleaning the VacuStar WR

Carrying out cleaning work:

1. Switch off system and secure against restarting.

WARNING!

Risk of injury due to compressed air!

Pneumatic energies can cause the most serious injuries.

In the case of damage to individual components, air can be discharged under high pressure and injure e.g. the eyes.

Therefore:

– Before starting any work, first depressurise pressurised components. Pay attention to accumulators. Accumulator pressure must also be completely relieved.

2. Remove soiling appropriately. Observe the following:
   - Do not use aggressive cleaning agents.
   - After cleaning work, check that all previously opened covers and safety equipment are correctly installed and function correctly.

Clean process water radiator

Clean radiator cooling fins, cooling air must have a free-flow through the radiator cooling fins. Cleaning: Radiator

Action after lengthy standstill

See chapter 6.4

Maintenance

Lubrication of roller bearings

Replace permanent grease filling of the roller bearings either after 5,000 hrs or 3 years. Prior to a replacement, remove old grease and clean bearings. If grease is replaced (approx.30g per bearing) fill the bearing entirely, but the free space in the bearing housing only up to approx.30 – 40%.

Replace roller bearings

Replace roller bearings after 15,000 hrs (10,000 h for WR 4000) and fill them with grease accordingly if newly installed.

Shaft sealing rings

After 15,000 hrs (10,000 h for WR 4000) replace the shaft sealing rings situated between bearings and slide seal rings as well as the shaft sealing ring situated between bearings and drive shaft together with the roller bearings.

Slide ring seal

Replace slide ring seals together with the bearings after 15,000 hrs (10,000 h for WR 4000).

Cleaning suction filter

Clean the suction filter depending on accumulated dirt or specification in the maintenance schedule.

Disassembly:

Release the cross-handle (1) to open the suction filter. 5 cross-handles (1) must be released in the pressure-right design. Remove the lid (2), hexagon nut (5), washer and filter element (4).

Cleaning:

- Wash the lid (1) and housing (3) with cleaning agents.
- Wash the coarse filter element (4) with cleaning agents and blow it out with compressed air from the inside outwards.
- Blow the fine filter element (4) out carefully with compressed air from the inside outwards.
- Do not tap out the filter element (4). Check for damage after cleaning. Replace damaged filter elements.

NOTE!

Pay attention during cleaning that no liquid, dirt or other objects get into the VacuStar WR.

Assembly:

- Inserting the filter element (4)
- Install the washer and the hexagon nut (5). Press the filter element (4) well against the housing (3) and tighten the hexagon nut (5) manually. Turn the nut (5) by about 0.5 to 1 turn onwards with a wrench.
- Installing the round seal (6) at the lid (2)
- Insert the lid (2) into the housing (3). Tighten the cross-handle (1) or cross-handles (1) well manually.

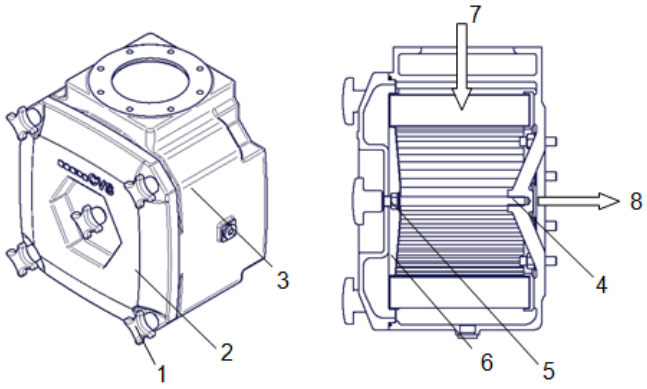

Fig. 4: Suction filter

1	Star handle	5	Hexagon nut
2	Lid	6	Round seal ring
3	Casing	7	Air inlet (dirt side)
4	Filter element	8	Air exit (clean side)

8 Malfunctions

This chapter describes possible causes of malfunctions and troubleshooting tasks.
Reduce the maintenance intervals if similar malfunctions occur repeatedly due to above-average intensive use so intervals correspond to the actual load.
Contact the manufacturer in case of malfunctions that cannot be repaired with the aid of the following information (→ p. 2)!

8.1 Safety

See chapter 2.7 "Occupational safety and special risks".

Personnel

- The trouble shooting work described at this point can be carried out by the operator, unless otherwise indicated.
- Some work may only be carried out by specially trained specialised staff or exclusively by the manufacturer himself. This is specifically pointed out in the description of the individual malfunctions.
- Only electrical specialists may carry out work on the electrical system.
- Components and parts may only be replaced by specialised staff.

Personal protective equipment

See chapter 2.6.

Environmental protection

See chapter 7.1.

Conduct in the case of malfunctions

The following basically applies:

1. Immediately trigger an emergency-stop in case of malfunctions constituting an immediate danger for individuals or material assets.
2. Switch of all power supplies and secure against restarting.
3. Inform person in charge at the place of installation.
4. Depending on the type of malfunction, have the cause determined and eliminated by responsible and authorised specialised personnel.

8.2 Recommissioning after corrective action

After corrective action or trouble shooting:

1. Reset emergency stops.
2. Acknowledge error message or malfunction at the control system.
3. Ensure that nobody is staying in the hazard area.
4. Start in accordance with the instructions in chapter „start-up“.

8.3 Malfunction table

Malfunction:	Possible cause	Corrective action	Execution
VacuStar WR's delivery rate decreases	Vacuum filter soiled	Clean vacuum filter	Operator
	Leaky suction line/ fittings	Look for leaky spots and eliminate leak	Specialised staff
	Speed too low	Correct speed	Operator
	Process water quantity too low	Fill process water up to max.filling rate.	Operator
	Process water temperature too high	Check re-cooling or water quantity	Specialised staff
	Non-return valve does not fully open	Check non-return valve, if necessary clean or replace	Specialised staff
Abnormal noise emission	VacuStar WR is not sufficiently aligned.	Align the VacuStar WR precisely.	Specialised staff
	Bearing defective	Replace bearing (or have it replaced)	
	Speed incorrect	Maintain speed range	Operator
	Pressure incorrect	Maintain nominal pressure	Operator
	Pressure incorrect	Maintain nominal vacuum, check exhaust system and clean if necessary	Operator
	Process water temperature too high	Check re-cooling or water quantity	Specialised staff
	process water highly contaminated with particles	replace process water	Specialised staff
	Foreign bodies in the VacuStar WR	Remove foreign matter. Flush VacuStar WR	Specialised staff
	Non-return valve rattles	Check non-return valve	Specialised staff

Malfunctions

Malfunction:	Possible cause	Corrective action	Execution
	Cell ventilating valve does not open	Check cell ventilating valve	Specialised staff
Operating pressure or operating vacuum is not obtained	Pressure gauge or vacuum gauge do not indicate correctly.	Replace pressure gauge or vacuum meter	Specialised staff
	V-belts are slipping	Check V-belt tension and re-tension if necessary	Operator
	Four way cock in wrong position	Correctly adjust four way cock	Operator
	Process water quantity too low	Fill in correct process water quantity	Operator
Cooling water temperature exceeds 65°C	Too little process water in the system	Fill process water	Operator
	Radiator soiled/ process water chambers in the VacuStar WR are silty	Clean radiator, clean cooling water chambers inside the VacuStar WR	Operator
	Process water quantity too low	Fill in correct process water quantity	Operator
	Defective cell ventilation	Check cell ventilating, if necessary clean or replace	Specialised staff
Silt/ foreign matter in the VacuStar WR	Foreign matter has been sucked over into the VacuStar WR	VacuStar WR / clean lines. Change process water	Operator
Power requirement too high	Speed too high	Maintain speed range	Operator
	Final pressure too high	Maintain nominal pressure, check safety valve	Operator
	Pressure gauge indicates incorrectly	Replace pressure gauge	Operator
Safety valve blows off	Closed valves in the pressure line	Open valves	Operator
	Clogging in pressure system	Eliminate clogging	Operator
	Pressure gauge indicates incorrectly	Replace pressure gauge	Operator
Ventilating valve responds	Closed valves in the suction line	Open valves	Operator
	Suction filter clogged	Clean suction filter, if necessary replace filter cartridge	Operator
	Pressure gauge indicates incorrectly	Replace vacuum meter	Specialised staff

Water escapes from the drain borehole	Slide ring seal is damaged.	Replace seal	Specialised staff

9 Spare parts

We recommend stocking a service package as well as a suction filter cartridge.
The service package comprises all wear parts that are required for a normal repair.

Customer Service
In case of queries regarding the product, spare part orders, repairs, replacement machines and dispatch of fitters, please contact our customer service: Phone: +49 (0)7623 71741-31

Service packages

Model	Service package	Filter cartridge
VacuStar WR 2500 / WR 3100	990 009-SP	432 020-00
VacuStar WR 4000	990 036-SP	432 021-00

Spare and wear parts WR 2500 / WR 3100

Part	Quantity	Article number
bearing grease	400 g	530 010-00
Roller bearings	2	411 126-01
Slide ring seal	2	461 315-00
Shaft sealing rings AS 55x72x8	1	461 105-00
Shaft sealing ring AS 80x100x10	2	461 161-00
Filter cartridge for suction filter 1600 F	1	432 020-00
Filter cartridge for suction filter 1600 G	1	432 021-00

Spare and wear parts WR 4000

Part	Quantity	Article number
bearing grease	400 g	530 010-00
Roller bearings	2	411 133-00
Slide ring seal	2	461 319-00
Shaft sealing ring AS 65x90x10	1	461 133-00
Shaft sealing ring AS 100x120x12	2	461 182-00

10 Decommissioning and disposal

A VacuStar WR that is no longer usable should not be recycled as complete unit, but disassembled into individual components and recycled according to material types. Non-recyclable materials have to be disposed of in an environmentally compatible manner.

- Prior to decommissioning and disposal of the VacuStar WR, it must be completely separated from the surrounding units.
- The disassembly and disposal of the VacuStar WR may only be carried out by specialised staff.
- If hazardous or poisonous material were conveyed, the VacuStar WR must be decontaminated prior to disposal.
- The VacuStar WR has to be disposed of in accordance with the respective country-specific regulations.

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