

Operating instructions

DUPLEX / TRIPLEX

Vacuum systems

VRD 2072

VRD 3108



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2 Safety

Before commissioning of the vacuum system, read these operating instructions with care. Please contact your contact person from Busch if there are any questions.

Keep the operating instructions so that you can use them for reference at a later time if necessary.

These operating instructions remain valid as long as the customer does not make any changes to the product.

The vacuum system is intended for industrial use. It must only be operated by technically trained specialists.

Always wear personal protective equipment in accordance with local regulations.

The vacuum system has been designed and produced according to state-of-the-art methods. Nevertheless, a residual risk remains in operation. Potential dangers are highlighted in these operating instructions. Safety and warning notes are marked as follows, with the words DANGER, WARNING, CAUTION, ATTENTION and NOTE:



DANGER

... Indicates a threatening hazard. Failure to observe safety instructions will result in death or serious injury.



WARNING

... Indicates a potential hazard. Failure to observe safety instructions may result in death or serious injury.



CAUTION

... Indicates a potential hazard. Failure to observe safety instructions may result in slight injury.

ATTENTION!

... Indicates a potential hazard. Failure to observe safety instructions may result in property damage.



NOTICE

... Indicates helpful advice and recommendations as well as information for efficient and smooth operation.

2.1 Safety devices

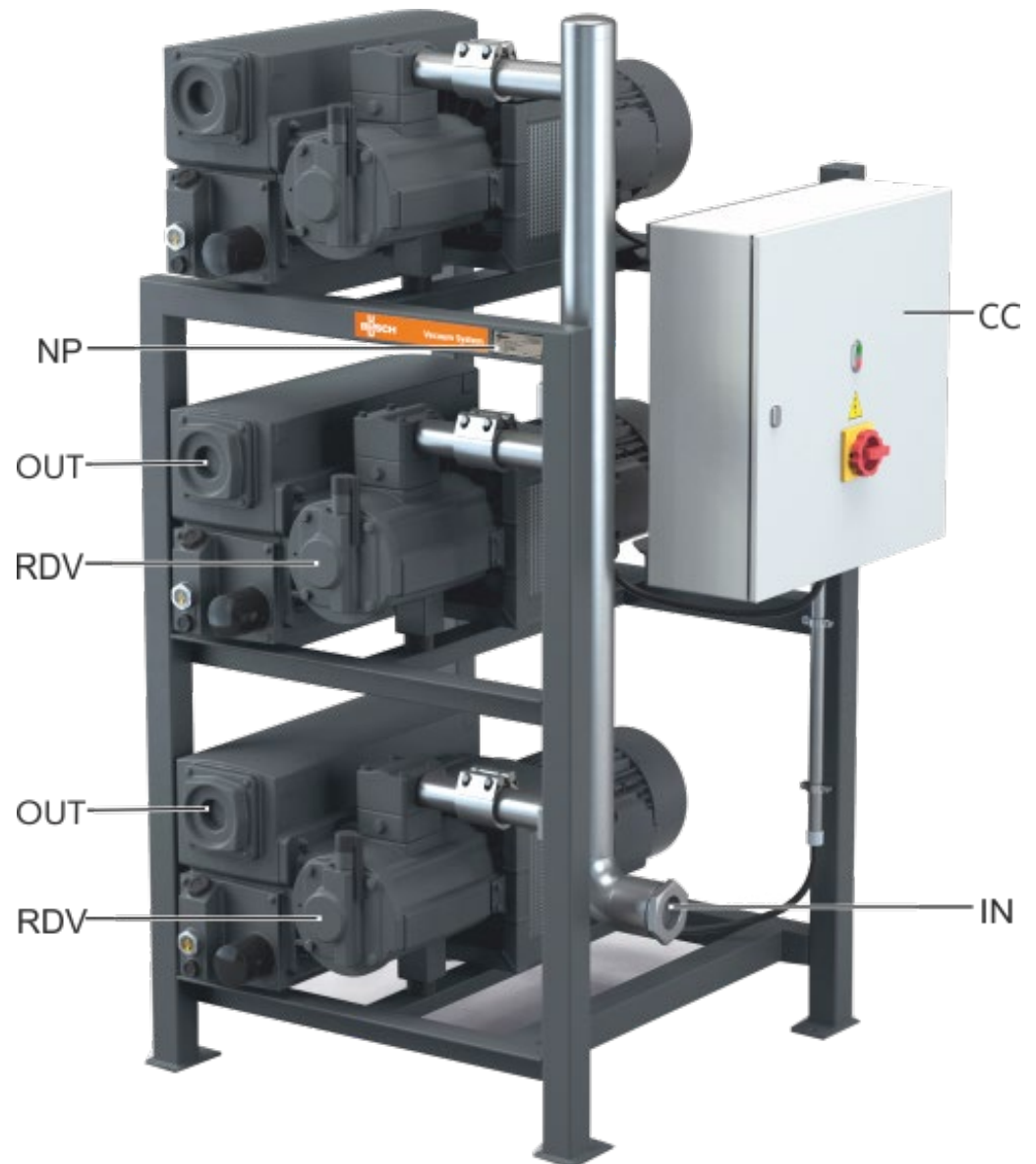
The motor of the rotary vane vacuum pump is safeguarded by a motor protection switch. If an overload occurs the vacuum system is shut down.

2.2 Emergency information

In an emergency case, the vacuum system can be switched off with the main switch of the switch and control cabinet, which has the function of an emergency-stop switch.

3 Product description

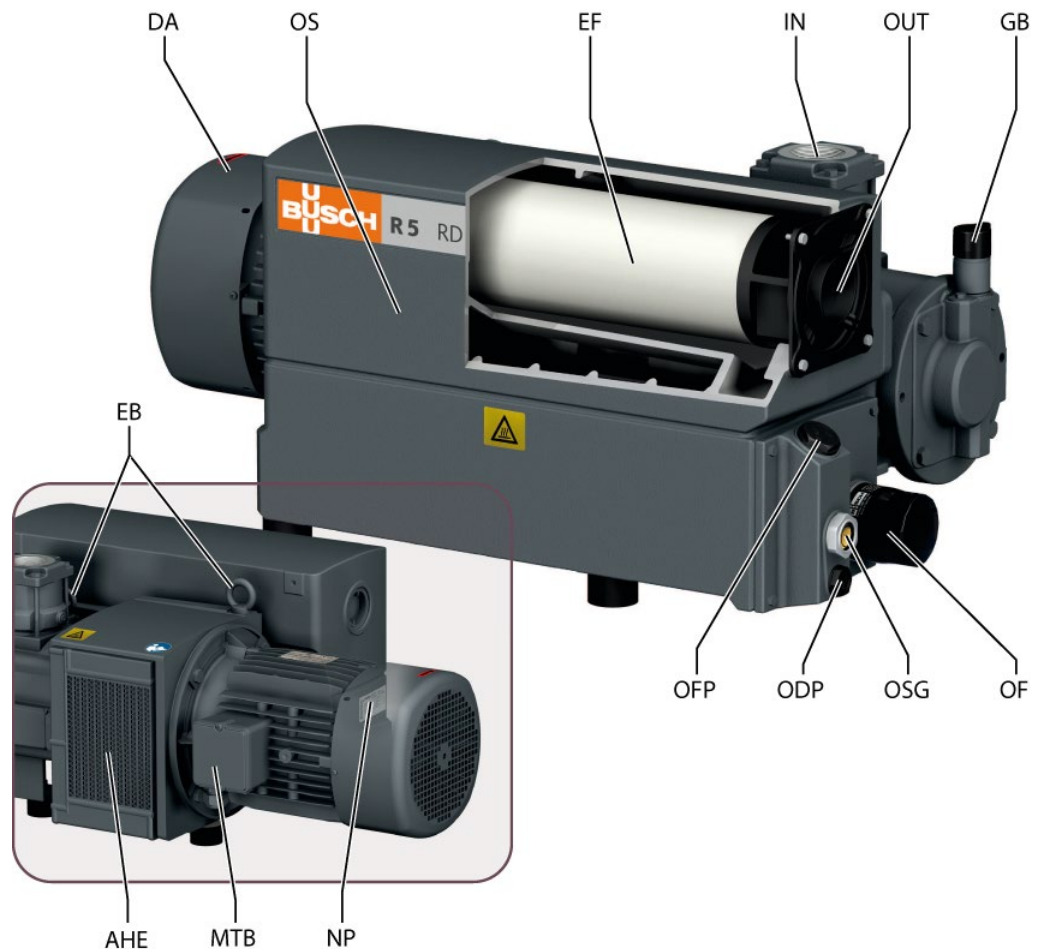
3.1 View vacuum system VRD (TRIPLEX)



IN	Gas inlet	RDV	Rotary vane vacuum pump RD
OUT	Gas outlet	CC	Switch and control cabinet
NP	Name plate		

Fig. 1 : View vacuum system VRD (TRIPLEX)

3.2 View of the rotary vane vacuum pump RD



AHE	Air-oil heat exchanger	DA	Rotation direction arrow motor
EB	Eye bolt	EF	Exhaust filter
GB	Gas ballast valve	IN	Suction connection
MTB	Motor terminal box	NP	Name plate
ODP	Oil drain plug	OF	Oil filter
OFF	Oil fill plug	OS	Oil separator
OSG	Oil sight glass	OUT	Gas outlet

Fig. 2 : View of the rotary vane vacuum pump type R5 RD 0360 A

3.3 Setup

The vacuum system DUPLEX / TRIPLEX VRD consists of two or three rotary vane vacuum pumps of the type R 5 RD 0360 A. These are arranged horizontally one above the other in a base frame and connected on the suction side to a collecting line.

The strainer installed in the suction flange prevents the ingress of dirt particles into the vacuum pump.

The gas ballast valve is used for the addition of a limited quantity of ambient air to the process gas, to counteract the condensation of vapor in the vacuum pump.

The vacuum system is completely piped and the electrical components are wired on a switch and control cabinet.

3.4 Function principle

3.4.1 Vacuum system VRD

The switch and control cabinet is installed on the vacuum system. The rotary vane vacuum pumps are activated with soft-starters to avoid excessive mains loads. When switched on, the first rotary vane vacuum pump starts immediately, the other rotary vane vacuum pumps are switched on one after the other with a time offset of 10 s.

Gas delivery is effected by the one-stage rotary vane vacuum pumps. Pressure gas is exhausted against the atmosphere.

3.4.2 Rotary vane vacuum pump R5 RD

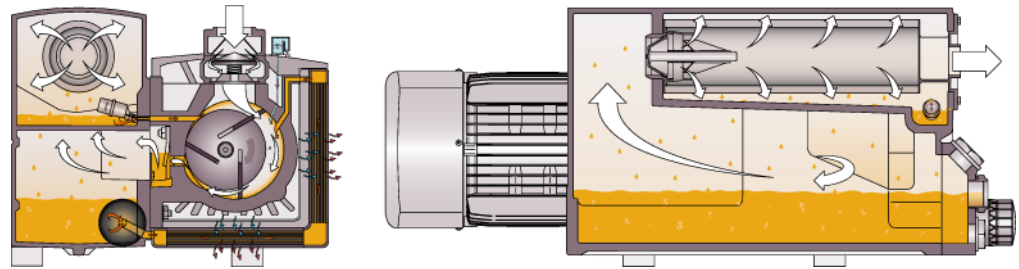


Fig. 3 : Operating principle of the rotary vane vacuum pump R5 RD

The vacuum pump R5 RD works according to the rotary vane principle. The oil seals the spaces, lubricates the sliders and discharges the compression heat. The oil filter cleans the circulating oil. Then the exhaust filters separate the oil from the discharged gas.

3.4.3 Gas ballast valve

The vacuum pumps are equipped with a gas ballast valve. The gas ballast valve is used for the addition of a limited quantity of ambient air to the process gas, to counteract the condensation of vapor in the vacuum pump. The gas ballast valve reduces the final pressure of the vacuum pump, see "Technical data" in chap. 15.

3.5 Intended use

The vacuum system was designed for conveying air and other dry, non-aggressive, non-toxic and non-explosive gases.

Conveying any other media leads to increased thermal and/or mechanical stress of the vacuum system and is only permitted in coordination with Busch.

The vacuum system is designed for operation in a non-hazardous area. The vacuum system can be operated continuously at final pressure and is suitable for continuous operation at up to 100 mbar. The permitted ambient conditions can be found in the technical data (chap. 15).

The vacuum system is designed for indoor use; for outdoor installation, contact Busch to make special arrangements if necessary.

4 Transport

WARNING

Danger of severe injury!

Suspended load.

- Never walk, stand or work below suspended loads.

WARNING

Hazard from vacuum system falling or tipping over!

The weight of the vacuum system can kill a person or cause severe crushing.

- The vacuum system can be moved with a forklift or lift truck.
Observe the center of gravity and the lifting points; these are indicated in the scale drawings, see chap. 13.

ATTENTION!

Damage to the vacuum system!

If the vacuum system is already filled with oil.

- Drain the oil before transport if transport in horizontal orientation is not possible.

The vacuum system is packed in a wooden crate. It protects the system from damage during transport.

The vacuum system is packed in a wooden structure and can be moved using a forklift.

- Unpack the vacuum system as near to the installation site as possible.
- Check scope of delivery for completeness.
- Check the vacuum system for transport damage.
- Dispose of packing material as required by current regulations.

⚠ WARNING**Danger of severe injury!**

Lift the vacuum system by devices of the individual components.

- Do not lift the vacuum system by devices of the individual components, e.g. the vacuum pump, motor, etc.
- Only lift the vacuum system as presented.

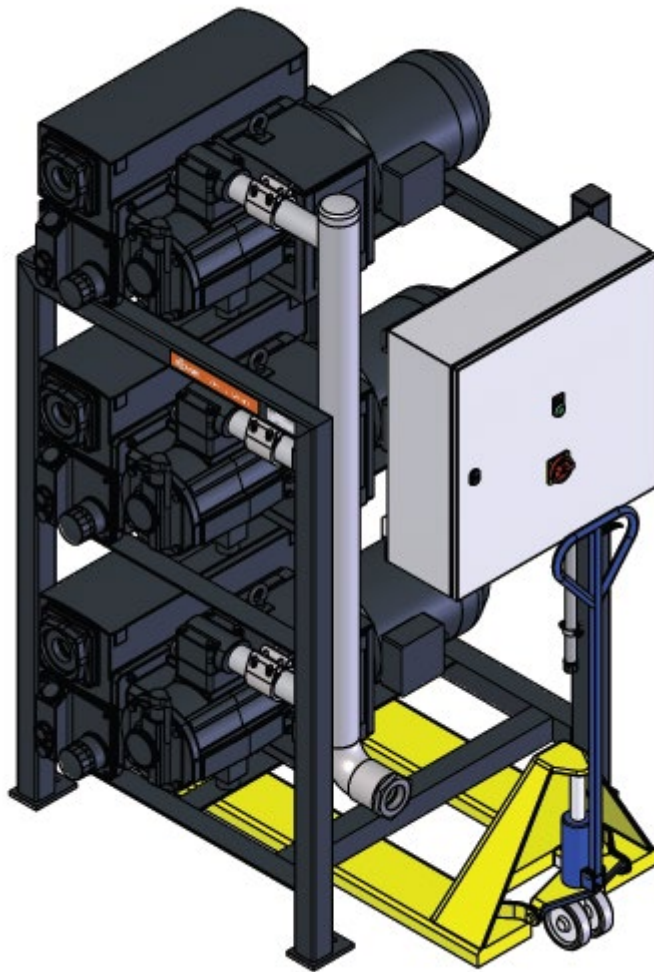


Fig. 4 : Transport of the vacuum system with a lift truck

The vacuum pump can be lifted by the eye bolts.

WARNING

Danger of severe injury!

Suspended load.

- Never walk, stand and work below suspended loads!
- The eye bolts (EB) must be in perfect condition and completely screwed into the machine and hand-tightened!

ATTENTION!

Damage to the vacuum system!

If the vacuum pump is already filled with oil.

Tilting a vacuum pump that is already filled with oil can cause large amounts of oil to enter the cylinder. If the vacuum pump is started while there are excessive amounts of oil in the cylinder, this will damage the sliders, resulting in a total damage of the vacuum pump.

- Drain the oil before transport if transport in horizontal orientation is not possible.

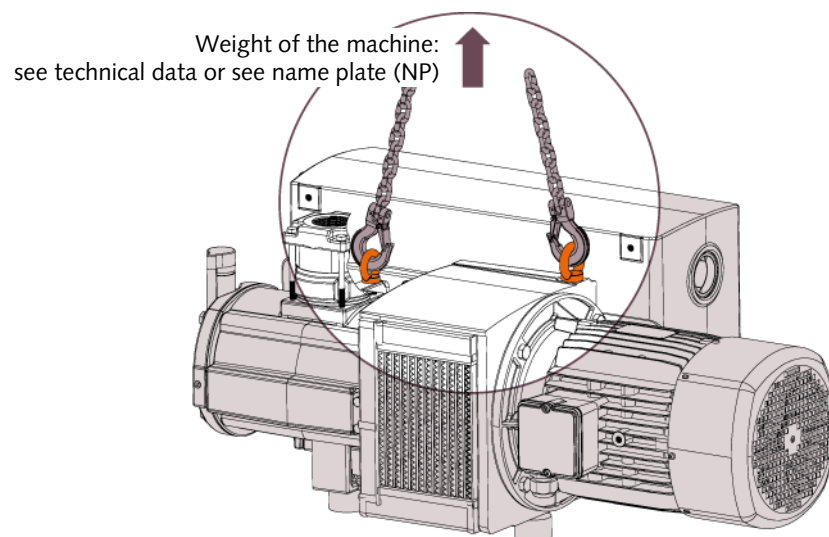


Fig. 5 : Transport of the vacuum pump on the eye bolts

5 Storage

ATTENTION!

Danger of damage to the vacuum pump drive!

Long storage periods may cause capacitors in the drive to be weakened by electrochemical condensation. In the most detrimental case, this may cause short-circuit and thereby destruction of the drive.

- The vacuum pump should therefore be connected to the power supply for 30 minutes every 18 months.

Proceed as follows for storage:

- Close all openings with the protective caps included in the scope of delivery (penetration of dirt and water is prevented)

If storage for more than 3 months is intended:

- Secure loose cables
- Drain all process and operating media
- Clean and dry the vacuum system (Prior to storing make absolutely sure that all parts are clean, drained and dry)
- Where necessary use oil for conservation
- Wrap the vacuum system in corrosion-inhibiting film.
- Store the vacuum system in a protected, dry and dust-free room at a temperature between 0 and 40 °C.

6 Installation

6.1 Installation

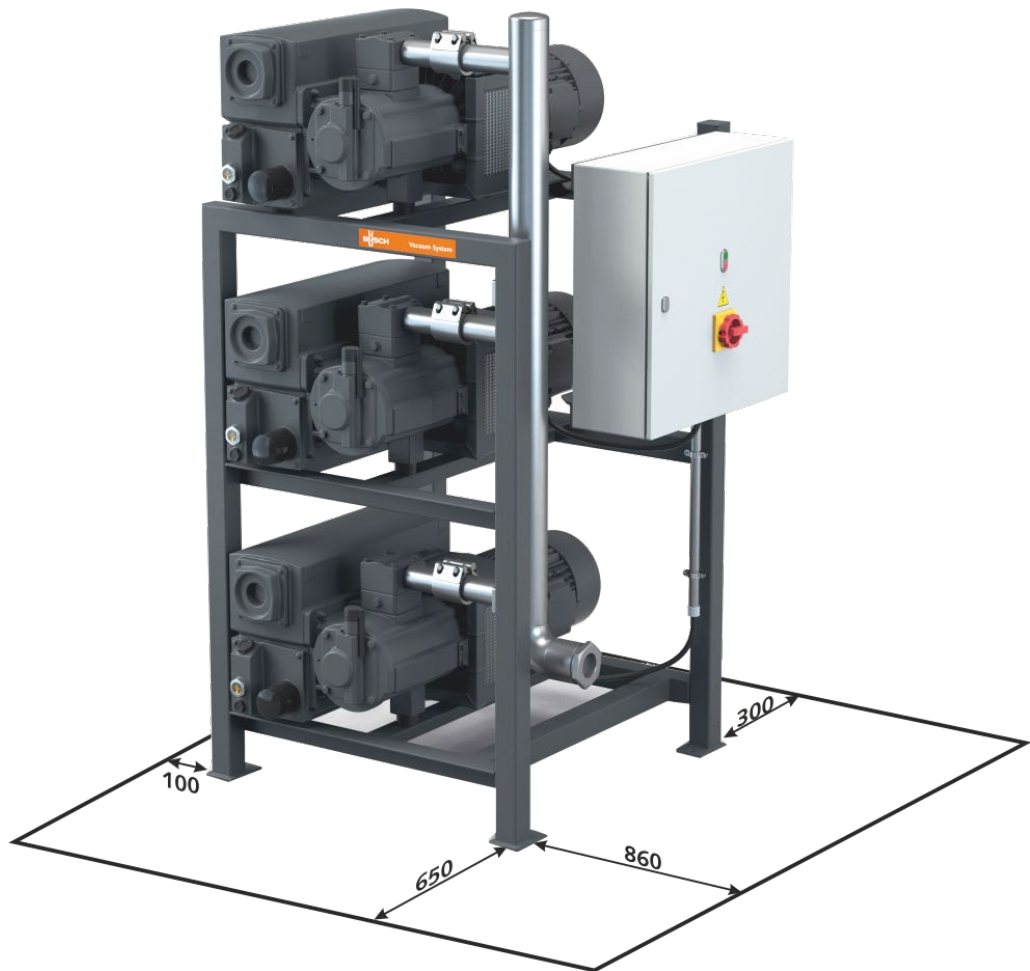


Fig. 6 : Installation environment

- Ensure that the vacuum system is set up horizontally (deviation 1° max.) and anchor it in the ground with four bolts if necessary.
- Technical data must be complied with.
- The ambience conditions must meet the protection class of the vacuum pump.
- The installation site must be vented so that sufficient cooling of the vacuum system is ensured.
- Ensure that the ventilation openings (inlets and outlets) are not covered and that the cooling air can flow unhindered.
- Sufficient space for maintenance work must be ensured.
- Visibility of the oil sight glass (OSG, Fig. 2) must be ensured at all times.
- Check the oil level and top up oil if necessary (for more information, see topping up with oil (chap. 7.1.1)).
- Ensure that all covers, safety devices, etc. are installed.

6.2 Connection lines/pipes

ATTENTION!

Danger of damage to the vacuum system from foreign bodies in the pipes.

- Remove all foreign matter (welding beads, filings, etc.) from the pipelines! This may be done by flushing or blowing through pipelines.
- The client must ensure that the pipework at the inlet is clean.
- If the sucked gas contains dust or other solids, install a filter (separation efficiency up to 5 micrometers) upstream of the vacuum pump inlet to protect the vacuum system.

ATTENTION!

Vacuum system can be damaged by tensile or compressive stresses on pipeline connections!

- If stresses could occur, use compensators to connect pipelines.

! ATTENTION!

Condensate damages vacuum pumps!

- Lay the piping on the intake and pressure sides at an angle to prevent accumulated condensation from entering the vacuum pump.

The line cross-section of the connection lines must have at least the same cross-section as the connections of the vacuum system across the entire length.

In case of very long connection lines, it is recommended to use lines with larger cross-sections to avoid loss of efficiency. Please contact your contact person from Busch.

6.2.1 Gas inlet

WARNING

Danger of severe injury!

Open gas inlet!

- Never insert your hand or fingers into the gas inlet!

Connect the suction-side tubing to the gas inlet of the vacuum system (IN, Fig. 1).

NOTICE

Before initial start-up check the pipelines to the vacuum system for leaks. Rectify any leaks.

Dimensions see scale drawings in the appendix.

6.2.2 Gas outlet

CAUTION

Health risk!

The discharged gas contains small amounts of oil.

Ensure sufficient ventilation in the installation room when the air is routed into rooms where there are people.

- Connect the gas outlet line to the gas outlet of the vacuum pump if necessary. Dimensions, see scale drawing in the appendix (connection size: flange with thread G 2").
- Ensure that the discharged gas can flow off unhindered. Never close the gas outlet line, do not throttle it and do not use it as a compressed air source.

If the air taken in is not discharged to the environment in the direct proximity of the vacuum system, observe the following:

- Place the gas outlet line dropping towards the vacuum system or install a liquid separator or a siphon with a drain valve so that no liquid can flow back into the vacuum system.

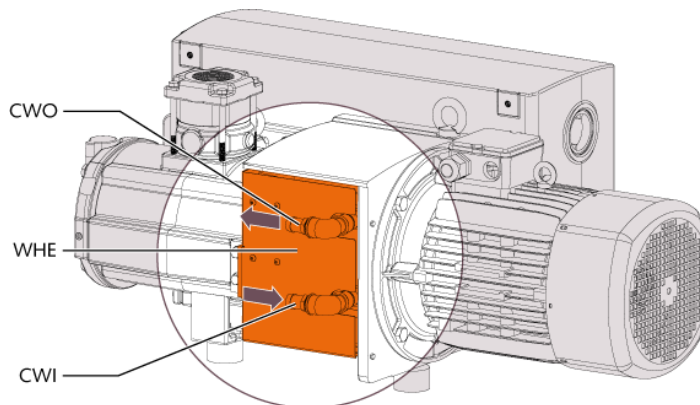


Fig. 7: Gas outlet

6.2.3 Cooling water connection (optional)

- Connect the cooling water line to the cooling water inlet of the vacuum pump (CWI, fig. 8).
- Connect the cooling water line to the cooling water outlet of the vacuum pump (CWO, fig. 8).

Connection size: 19 mm hose (CWI/CWO).



CWI	Cooling water supply	WHE	Oil/water heat exchanger
CWO	Cooling water drain		

Fig. 8 : Cooling water connection

Regarding the cooling water, the following prerequisites must be met:

Supply capacity	l/min.	2.5
Water pressure	bar	2 ... 6
Supply temperature	°C	+5 ... +35
Required differential pressure between the inlet and return	bar	≥ 1

We recommend the following water qualities to keep the maintenance effort limited and extend the service life of the product:

Hardness	mg/l (ppm)	<90
Properties	pure and clear	
pH value		7-8
Particle size	µm	<200
Chlorine	mg/l	<100
Electrical conductivity	µS/cm	≤100
Free chlorine	mg/l	<0.3
Materials in contact with cooling water	Rust-free steel, copper and cast iron	

NOTICE

Conversion of the unit for water hardness.

1 mg/l (ppm) = 0.056 °dh (German degree) = 0.07 °e (English degree)
= 0.1 °fH (French degree).

6.3 Electrical connection



DANGER

Danger from electric shock!

Electric shock will cause death or serious injury.

- All live lines must be powered down before the electrical installation!
- Before any electrical work, ensure that the vacuum pump is disconnected from the power supply and secured against accidental activation.
- Electrical installation work must only be performed by trained specialists.

ATTENTION!

Incorrect rotation of drive motors can seriously damage the vacuum system!

Switch vacuum pumps briefly on and off again to check the rotational direction of the motor. The rotational direction is marked by a direction of rotation arrow on the motor.

If the direction is wrong, reverse two connection phase poles.

6.3.1 Connection of the power supply

ATTENTION!

Danger of damage to the vacuum system.

Wrong connection.

Wire the vacuum system according to the circuit diagram in the switch and control cabinet.

Procedure:

- Ensure that the power supply for the vacuum system corresponds to the specifications in the circuit diagram.
- Ensure that the vacuum system is not impaired by electrical or electromagnetic impulses of the power supply. Contact Busch if necessary.
- Connect the switch and control cabinet to the power supply (for connection values, see chap. 14).

ATTENTION!

Danger of damage to the motor

Wrong rotating direction.

- Operation in the wrong rotating direction may damage the vacuum system after a very brief time. Ensure that the rotating direction is correct before commissioning.

- Use the glued-on/cast-in arrow to determine the intended rotating direction.
- Switch on the vacuum pump for a fraction of a second.
- Observe the fan wheel and determine the rotating direction just before standstill.

To change the rotating direction:

- Swap any two phases of the power supply.

7 Start-up

7.1 Indication and control elements



DANGER

Danger from electric shock!

Electric shock will cause death or serious injury.

- Before commissioning, ensure that all electrical lines are covered and that the terminal box is closed!



CAUTION

Burn hazard!

The surface of the vacuum pump may reach operating temperatures in excess of 70 °C in operation.

Do not touch the vacuum pump during and directly after operation.



ATTENTION!

Insufficient familiarity with the indicators and operating controls may result in damage to the vacuum system.

Wrong operation.

- Operating staff must be familiar with the indicating and operating elements.



ATTENTION!

Operation of the vacuum pump without oil will cause severe damage to it quickly.

- The vacuum system is not filled with oil at delivery. Before start-up, the vacuum pumps have to be filled with oil and the oil level must be checked.

7.1.1 Topping up with oil

For information on the oil type and oil volume, see the technical data (chap. 15) and oil (chap. 16).

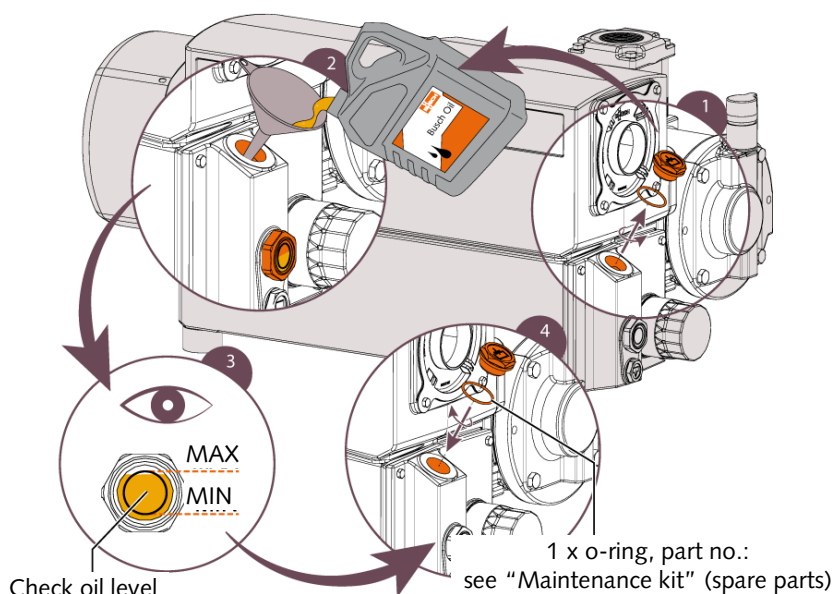


Fig. 9 : Topping up oil

7.1.2 Display and control elements at the switching and control cabinet

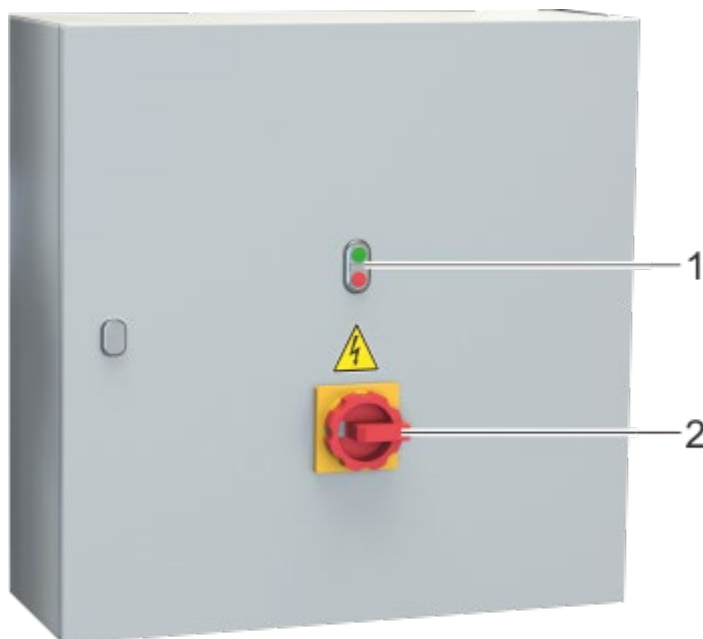


Fig. 10 : Switch and control cabinet

1. Double pushbutton (I / O)
Double pushbutton for switching on and off the vacuum system
2. Main switch
Switch on and off the entire vacuum system

7.1.3 Indicators and control elements on the vacuum system

The indicating devices are as follows:

- Oil sight glass (OSG, Fig. 2) at the vacuum pump

7.2 Operation

CAUTION

Burn hazard!

The surface of the vacuum pump may reach operating temperatures in excess of 70 °C in operation.

Do not touch the vacuum pump during and directly after operation.

CAUTION

Danger of hearing damage.

Noise development of the running vacuum pump.

Use hearing protection near the vacuum pump.

- Ensure that the installation conditions (chap. 6.1) are met.
 - The permitted maximum number of starts (12) per hour must not be exceeded.
- When the vacuum pump is operated under normal operating conditions, proceed as follows:
- Measure the motor current and record it for reference purposes for future maintenance work and for troubleshooting.
 - After a few minutes of vacuum operation, check the oil level and top up oil if necessary.

Starting the Vacuum System

- Set the main switch (fig. 10) to "ON".
- Press the double pushbutton ("I", fig. 10) on the switch and control cabinet.
- The vacuum pumps switch on one after the other. The vacuum system is in operation.

Stopping the vacuum system

- Press the double pushbutton ("O", fig. 10) on the switch and control cabinet.
- The motor switches off.
- Set the main switch (fig. 10) to the "OFF" position.

7.3 Conveying condensing vapors

A certain quantity of water vapor within the gas flow is tolerated.

For information, see technical data (chap. 15).

Contact Busch to get information on transporting other vapors.

Note the following when conveying condensing vapors:

- Start the vacuum system, all vacuum pumps must be running.
- Close the shut-off valve on the suction side (not part of the scope of delivery)
- Allow the vacuum pumps to warm up (approx. 30 min.) so that no condensate can form in the suction chamber.
- Open the shut-off valve on the suction side and start your process
- Close the shut-off valve on the suction side after the end of the process
- The vacuum pumps must now run for approx. 30 min. to remove any moisture that may be present.
- Switch off the vacuum system.

8 Maintenance

WARNING

Hazard from running vacuum pump!

There is a severe threat for life and limb depending on the repair and maintenance work to be carried out if the vacuum pump is running.

Only carry out any repair or maintenance work if:

- the vacuum pump is not running
- the vacuum pump is disconnected from the electrical supply and secured against unintentional start-up
- vacuum system is not under pressure!
- hot surfaces are cooling down!
- Cooling water supply is interrupted (only version with oil/water heat exchanger)

Disconnect the vacuum system from the process and make sure that there is ambient pressure in the vacuum system! Procedure: Close inlet side shut-off devices (not included in the scope of delivery) and open vent valves slowly (not included in the scope of delivery).

WARNING

Danger from vacuum pump contaminated with hazardous material!

There is a danger of poisoning!

- Ventilate the vacuum pumps before they are maintained

8.1 Maintenance plan

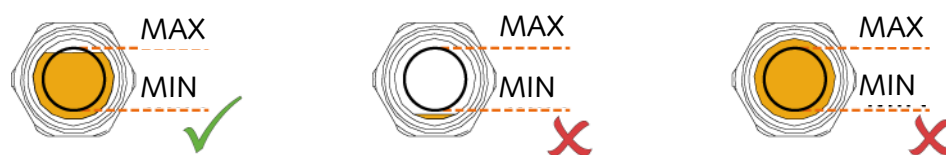
The maintenance intervals strongly depend on the individual operating conditions. The intervals specified below are to be considered reference values and should be individually shortened or extended. Especially at high stress, e.g. in case of high dust load in the environment or the process gas, or in case of other contamination or ingress of process material, it may be necessary to shorten the maintenance intervals a lot.

Interval	Maintenance task
Rotary vane vacuum pump R5 RD	
daily	<ul style="list-style-type: none"> • Check the oil level, see chap. 8.2.
Monthly	<ul style="list-style-type: none"> • Check the vacuum pump for escaping oil. Have the vacuum pump repaired by Busch if there are any leaks.
Normal use: after max. 4,000 operating hours or after one year at the latest Highly demanding purpose: after max. 2,000 operating hours or after no more than half a year	<ul style="list-style-type: none"> • Clean the vacuum pump and the air heat exchanger from dust and impurities. • Clean the filter of the gas ballast valve (GB, fig. 2) • Replace the oil*, the oil filter* (OF, fig. 2, chap. 8.3) and exhaust filters (EF, fig. 2, chap. 8.4). <p>*Maintenance interval for synthetic oil. Shorten the maintenance interval if mineral oil is used. Contact the Busch Service.</p>
Every 5 years	<ul style="list-style-type: none"> • Perform a general overhaul of the vacuum pump (inform Busch).
Switch and control cabinet	
Every 8000 hrs. or, at the latest, after 1 year	<ul style="list-style-type: none"> • Check switch function, check for broken wires.

8.2 Check oil level

Proceed as follows:

- Switch off the vacuum system.
- Wait 1 minute after switching off the vacuum pumps, before checking the oil level.



Top up with oil if necessary.

8.3 Oil and oil filter change

! ATTENTION!

Operation of the vacuum pump without oil will cause severe damage to it quickly.

- Only use oils approved by Busch.
For information to the oil type and oil volume, see the technical data (chap. 15) and oil (chap. 16).

Follow the figures

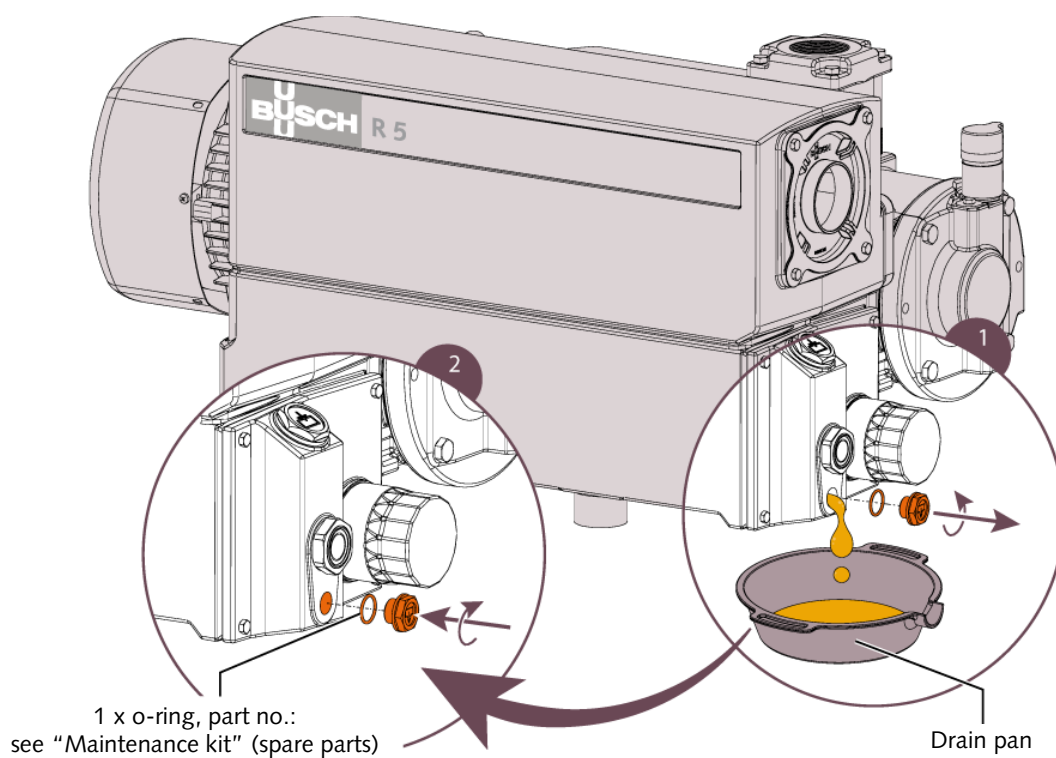


Fig. 11 : Drain oil

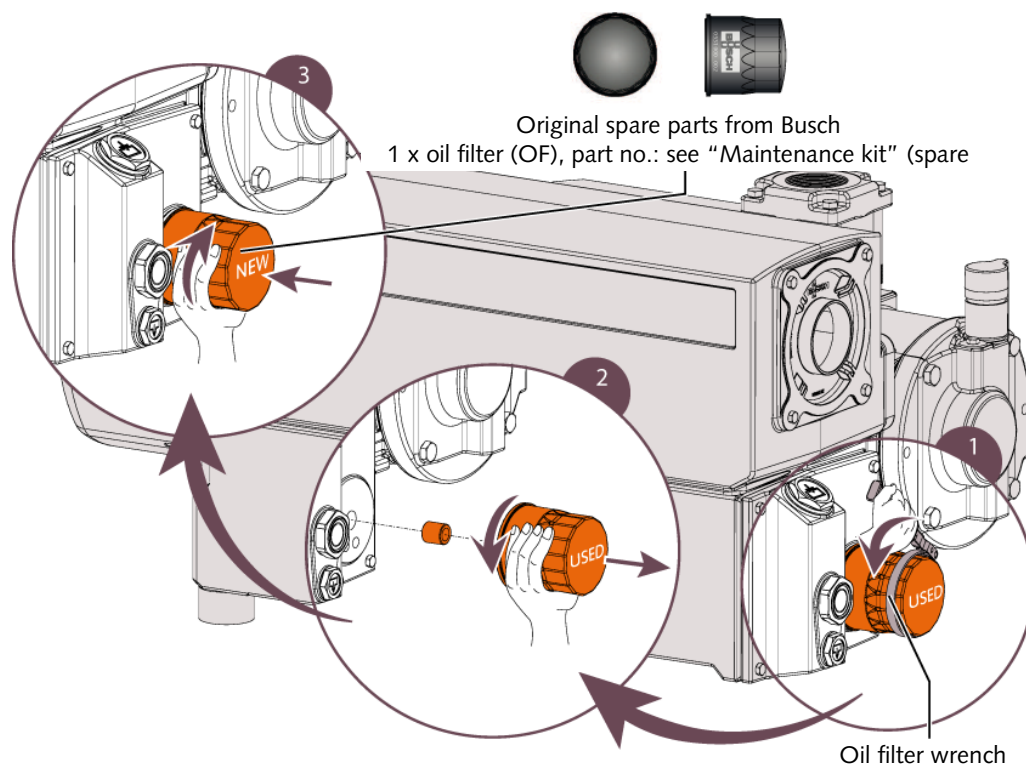


Fig. 12 : Replacing the oil filter

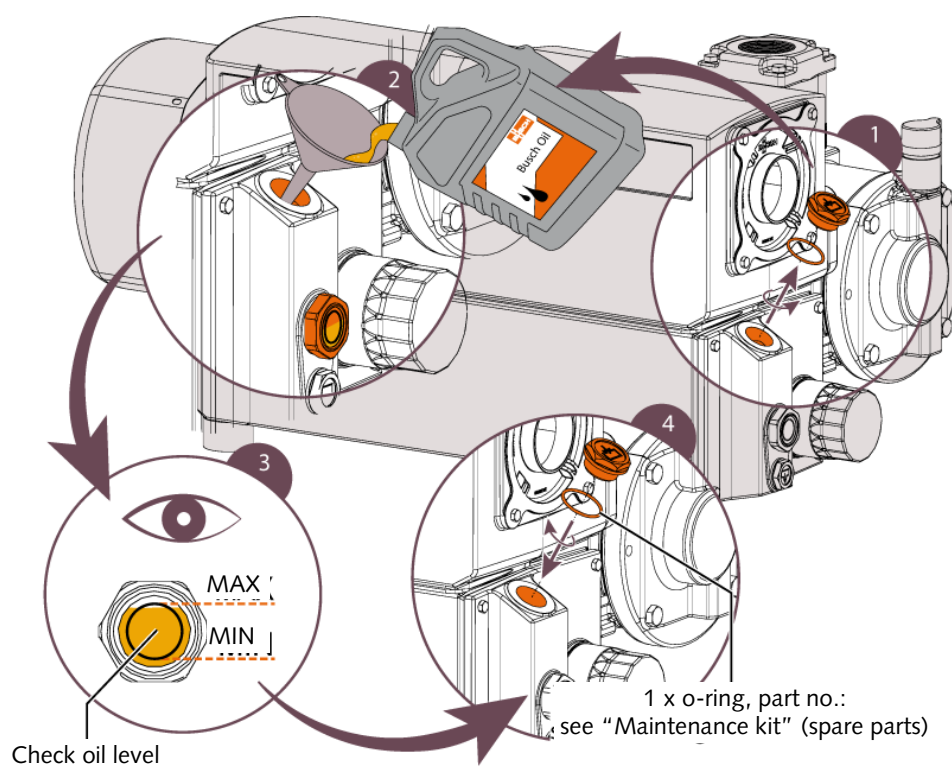


Fig. 13 : Filling in oil

8.4 Replacing the exhaust filters

Follow the figures

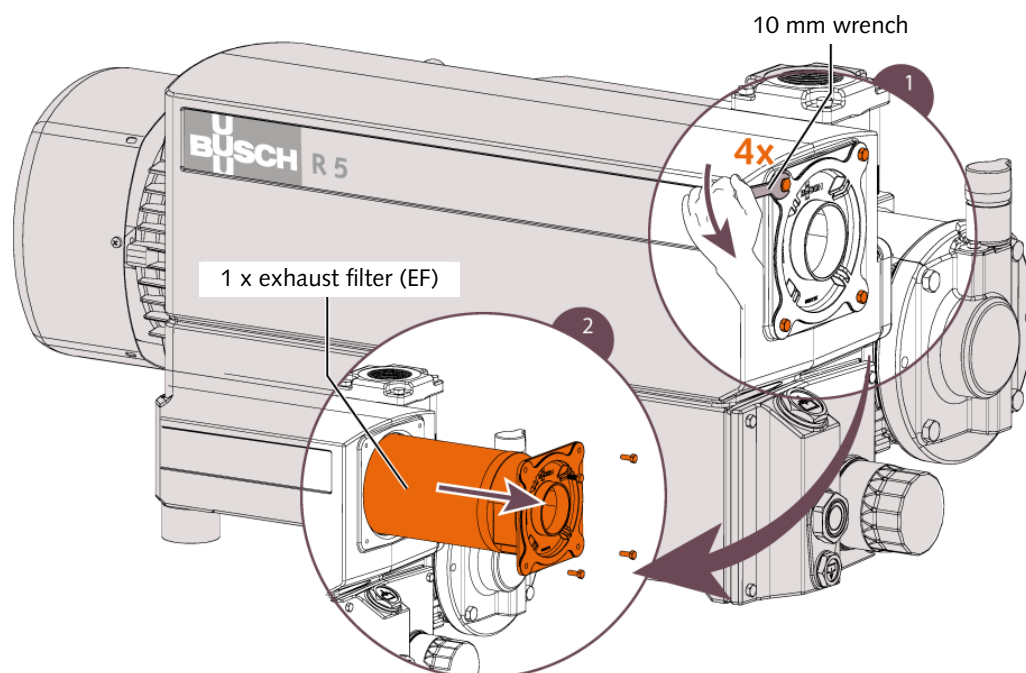


Fig. 14 : Remove the exhaust filter

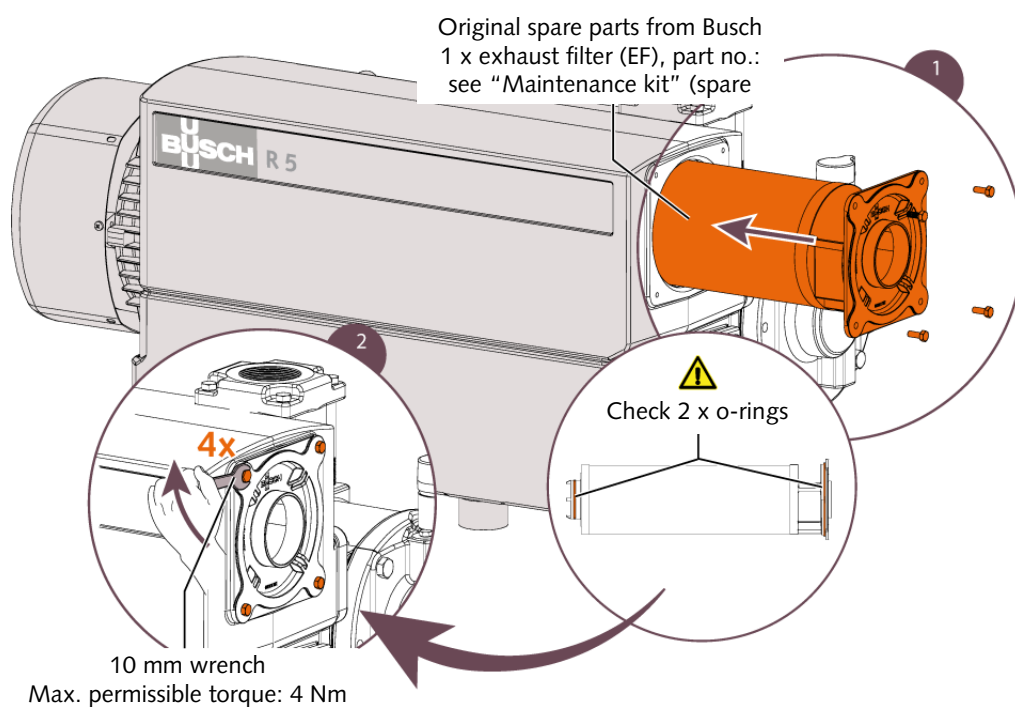


Fig. 15 : Insert and tighten the new exhaust filter

8.5 Cleaning the air heat exchanger

Proceed as follows:

- Drain the oil from the vacuum pump before cleaning the air heat exchanger (see chap. 8.3)

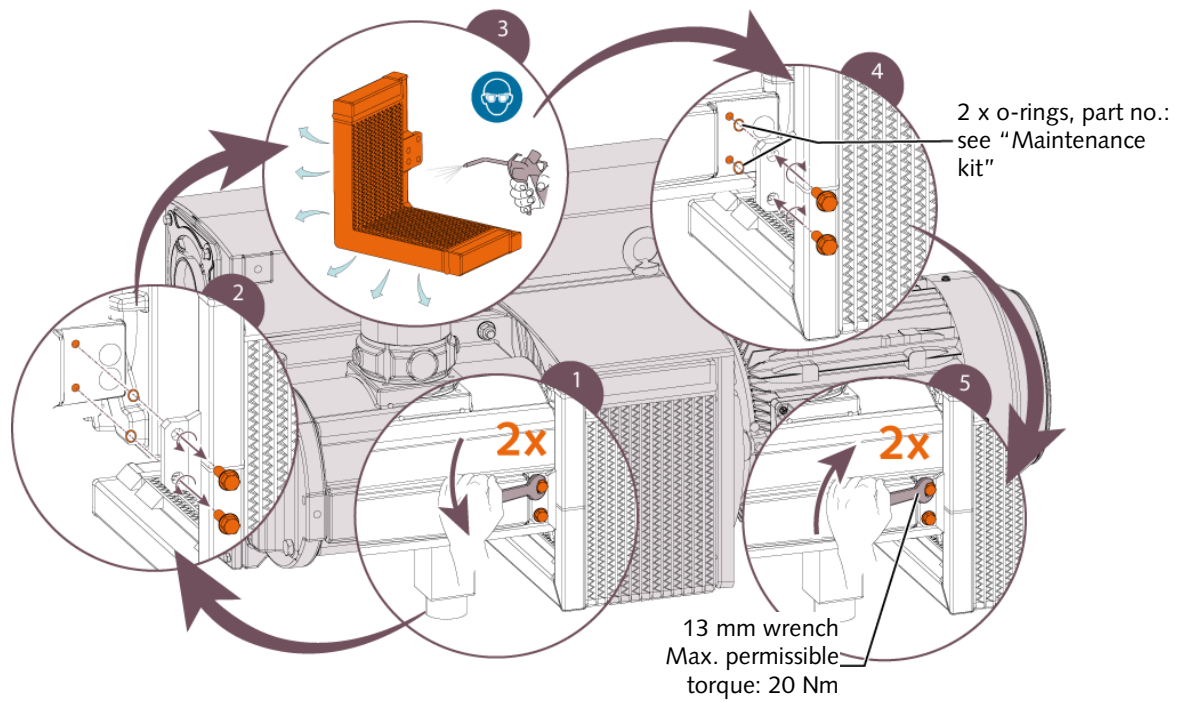


Fig. 16 : Cleaning the air heat exchanger

9 Troubleshooting

DANGER

Electric shock danger.

Live wires.

- Electrical installation work must only be performed by qualified specialists.

WARNING

Hazard from running vacuum pump!

There is a severe threat for life and limb depending on the repair and maintenance work to be carried out if the vacuum pump is running.

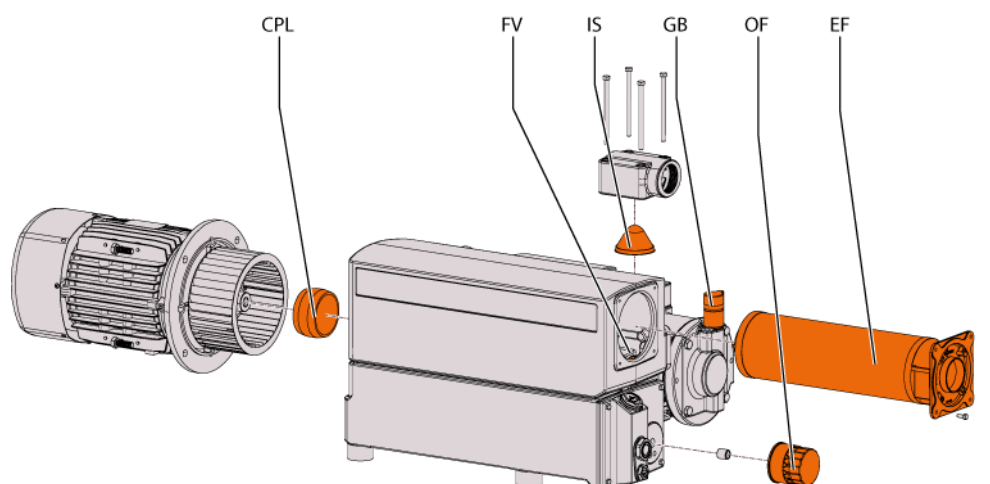
Only carry out any repair or maintenance work if:

- the vacuum pump is not running
- the vacuum pump is disconnected from the electrical supply and secured against unintentional start-up
- vacuum system and pipes are not under pressure,
- hot surfaces are cooled down,
- Cooling water supply is interrupted (only version with oil/water heat exchanger).

Disconnect the vacuum system from the process and make sure that there is ambient pressure in the vacuum system! Procedure: Close inlet side shut-off devices (not included in the scope of delivery) and open vent valves slowly (not included in the scope of delivery).

9.1 General faults

The figure shows the components that are relevant for troubleshooting.



FV Float valve

EF Exhaust filter

IS Intake screen

GB Gas ballast valve

CPL Clutch

OF Oil filter

Fig. 17 : Vacuum pump with components relevant for troubleshooting

9.2 Failure table and measures

Problem	Possible cause	Remedy
The vacuum pump does not start up.	The required voltage is not pending at the motor.	Check the power supply. Switch on the main switch.
	The motor is defective.	Replace the motor.
	The coupling (CPL, fig. 17) is defective.	• Replace the coupling (CPL, fig. 17).
	Motor protection switch has triggered	• Turn the motor protection switch (101Q1, 101Q2, 101Q3) to position "0" and then to position "1".
	Fuse has triggered.	• Check fuse (100F1).
Problem	Possible cause	Remedy
The required pressure cannot be built up on the intake connection.	The intake screen (IS, fig. 17) is partially clogged	• Clean the intake screen (IS, fig. 17).
	Inner components are worn or damaged	• Have the vacuum pump repaired (Busch Service)
	The oil level is too low	• Top up oil.
	Leak in piping system	Locate and repair leakage.
High noise development during operation of the vacuum pump	The bearings are defective.	• Have the vacuum pump repaired (Busch Service).
	The coupling (CPL, fig. 17) is worn.	Replace the coupling (CPL, fig. 17).
	The sliders are stuck.	Have the vacuum pump repaired (Busch Service).
High heat development during operation of the vacuum pump	The cooling is insufficient.	• Clean the vacuum pump from dust and contamination. • Check the cooling water inlet (version with oil-water heat exchanger)
	The ambient temperature is too high.	• Observe admissible ambient temperature.
	The fan does not run or turns in the wrong direction.	• Check electrical connection.
	The oil level is too low.	Top up oil.
	The exhaust filters (EF, fig. 2 and 17) are partially clogged.	Replace the exhaust filters (EF, fig. 2 and 17).

Problem	Possible cause	Remedy
Vapors or oil drops escape from the gas outlet of the vacuum pump.	The exhaust filters (EF, fig. 2 and 17) are partially clogged.	<ul style="list-style-type: none"> • Replace the exhaust filters (EF, fig. 2 and 17).
	Exhaust filters (EF, fig. 2 and 17) and o-rings are not installed properly.	<ul style="list-style-type: none"> • Determine the proper position of the exhaust filters (EF, fig. 2 and 17) and o-rings.
	The float valve (FV, fig. 17) does not work properly.	<ul style="list-style-type: none"> • Check the float valve. • Let the vacuum pump repaired by Busch.
The oil is black.	The periods between the oil changes are too long.	<ul style="list-style-type: none"> • Flush the vacuum pump. Please contact your contact person from Busch for this.
	There is a high heat development during operation of the vacuum pump.	<ul style="list-style-type: none"> • See "High noise development during operation of the vacuum pump".
The oil is emulsified.	Liquids or large amounts of vapors have been sucked into the vacuum pump.	Flush the vacuum pump. Please contact your contact person from Busch for this.
		Clean the filter of the gas ballast valve (GB, fig. 2 and 17).
		Change the operating mode (see Transport of condensing vapors (chap. 7.3)).

To solve any problems that are not listed in the section on troubleshooting, talk to your Busch contact.

10 Spare parts and accessories

10.1 Spare parts

ATTENTION!

Risk of premature failure.

Loss of efficiency when using non-Busch genuine spare parts.

- The exclusive use of Busch genuine spare parts and consumables is recommended for the correct functioning of the machine and to validate the warranty.

Spare part	Description	Part number
Maintenance kit RD 0360 A	Includes all spare parts required for maintenance	0992 573 694
Vacuum pump oil VM100	Package size 1 liter	0831 000 060
Vacuum pump oil VM100	Package size 5 liter	0831 000 059

If further spare parts are needed, proceed as follows:

- Request the detailed spare parts list from your Busch contact.

The list of Busch companies around the world (at the time these operating instructions are issued) can be found on the reverse.

10.2 Accessories

Accessory	Description	Part number
Suction line for DU- PLEX vacuum sys- tems	Connecting line for two DUPLEX vac- uum systems	0947S03120
Suction line for TRI- PLEX vacuum sys- tems	Connecting line for two TRIPLEX vac- uum systems	0947S03160

11 Repair

Observe the following notes if the vacuum pump is returned to Busch.

Proceed as follows when the vacuum pump was used to transport gas contaminated with foreign substances hazardous to health:

- Decontaminate the vacuum pump and indicate the contamination status based on a "Conformation declaration".

Busch accepts only vacuum pumps that include a completed and legally signed "Contamination declaration".

The form can be downloaded from www.buschvacuum.com.

12 Decommissioning and disposal

12.1 Stop operating vacuum system

- Disconnect the vacuum system from the power supply.
- Vent all connected pipes to atmospheric pressure.
- Disconnect all connections.

If the vacuum system has to be stocked, observe following:

- For more information, see storage (chap. 5).

Version with oil/water heat exchanger:

- Interrupt the water supply (only version with oil/water heat exchanger).
- Disconnect the water supply (only version with oil/water heat exchanger).
- Blow the cooling water supply free with compressed air.

12.2 Disassembly and disposal

- Drain the oil.
- Remove the exhaust filters.
- Remove the oil filter.
- Remove all electrical components.
- Separate the hazardous waste from the vacuum pump.
- Dispose of hazardous waste according to the applicable legal provisions.
- Dispose of the vacuum system as waste metal and electronic scrap.

13 Dimensions sheets

Dimensions of the vacuum system DUPLEX VRD 2072

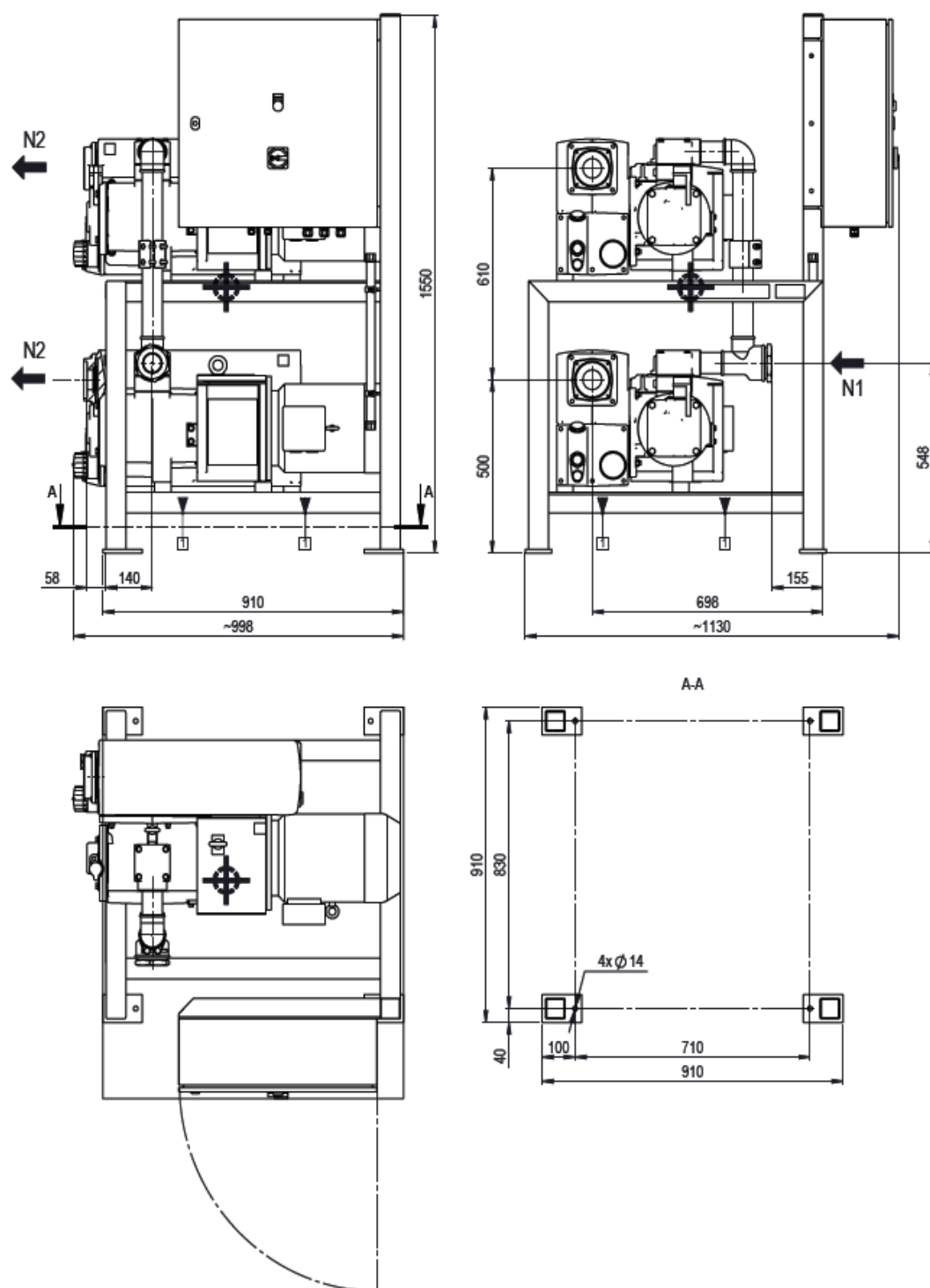


Fig. 18 : Dimensions of the vacuum system DUPLEX VRD 2072



Center of gravity



Lifting point

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 3" / G 2", female thread	ISO 228-1
N2	Gas outlet	G 2", female thread	ISO 228-1

Tab. 1: Connections of the vacuum system DUPLEX VRD 2072

Dimensions of the vacuum system DUPLEX VRD 2072 (water-cooled version)

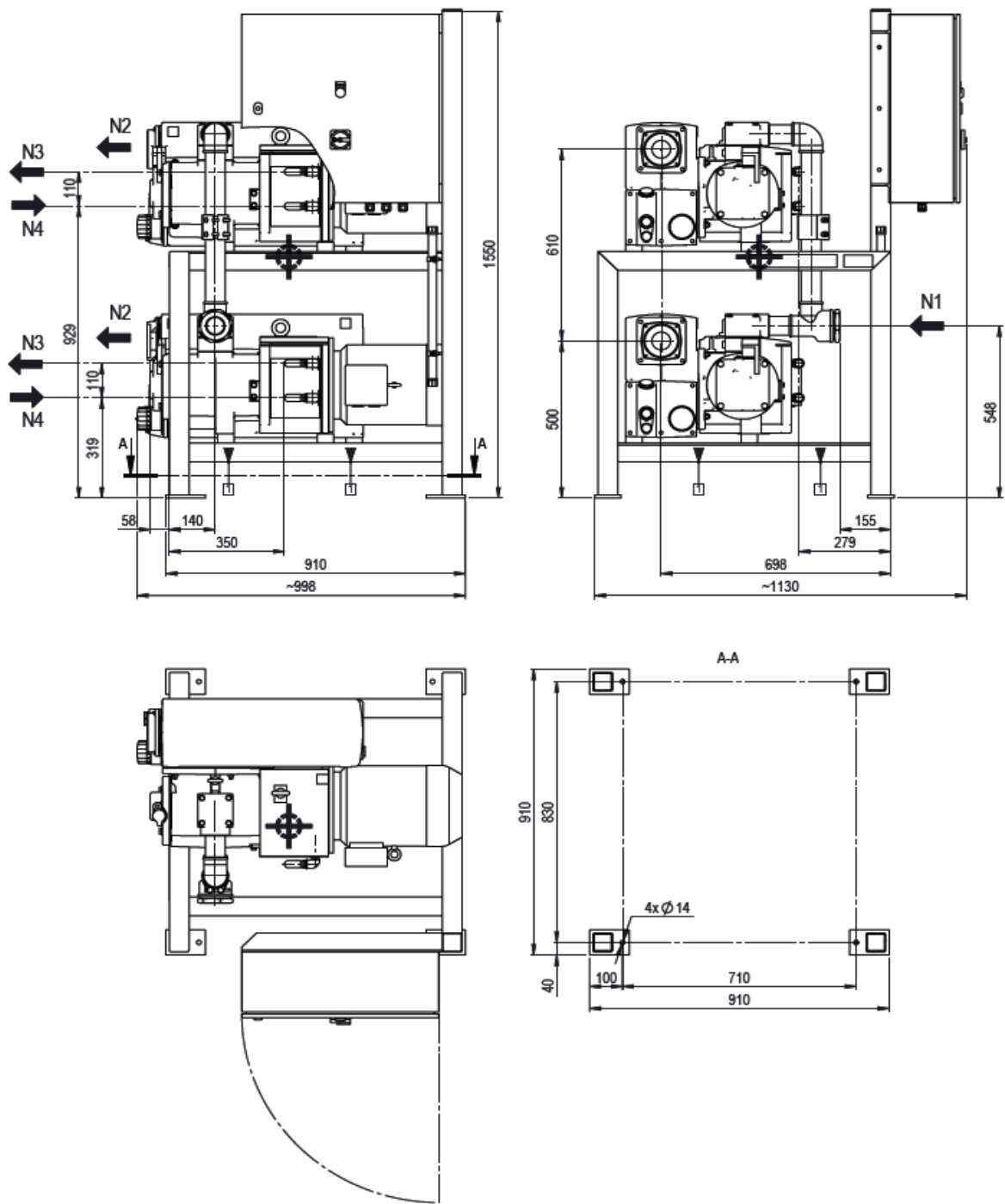


Fig. 19 : Dimensions of the vacuum system DUPLEX VRD 2072 (water-cooled version)



Center of gravity



Lifting point

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 3" / G 2", female thread	ISO 228-1
N2	Gas outlet	G 2", female thread	ISO 228-1
N3	Cooling water drain	Hose connection, outer Ø 19 mm	
N4	Cooling water supply	Hose connection, outer Ø 19 mm	

Tab. 2: Connections of the vacuum system DUPLEX VRD 2072 (water-cooled version)

Dimensions of the vacuum system TRIPLEX VRD 3108

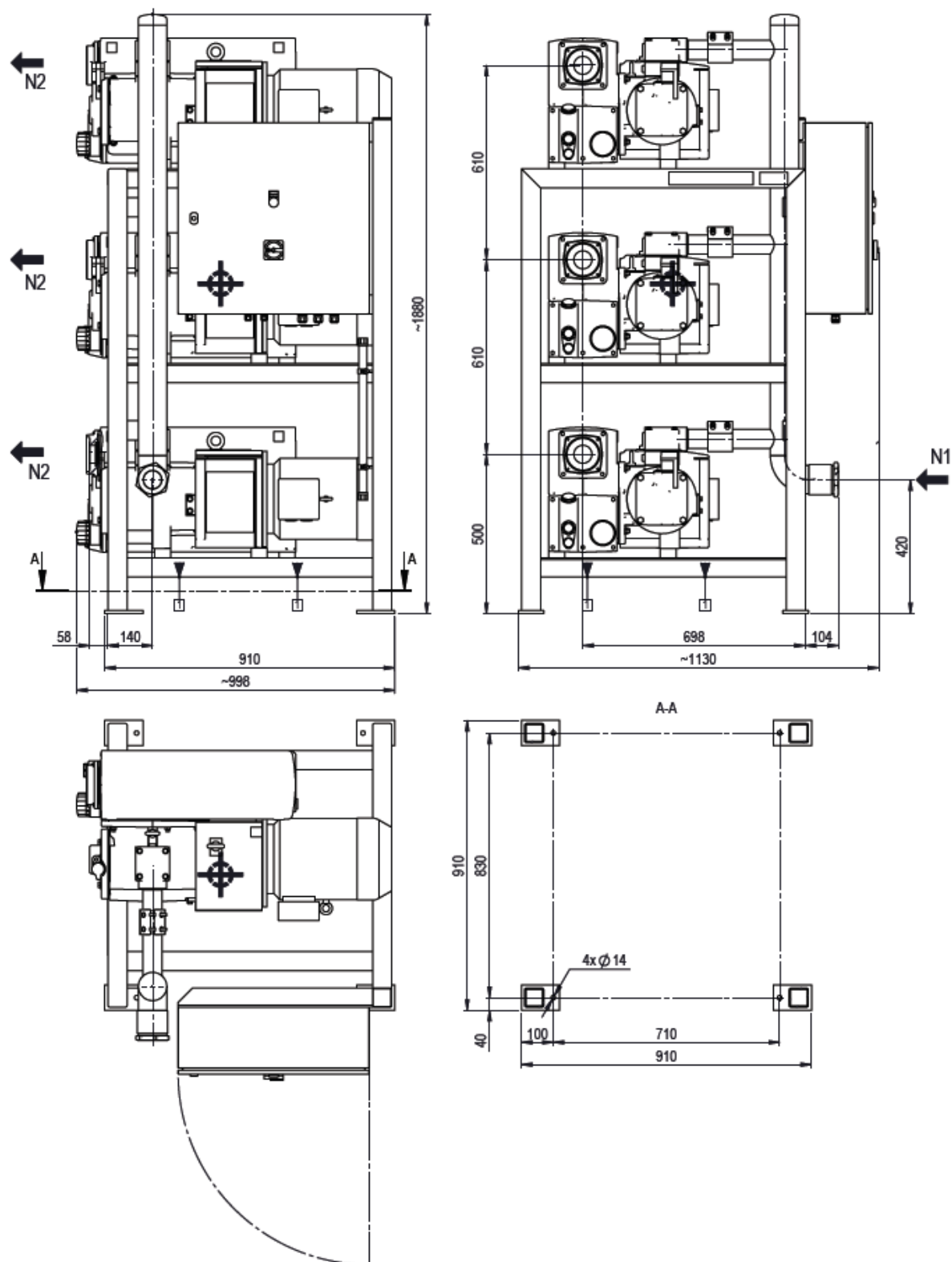


Fig. 20 : Dimensions of the vacuum system TRIPLEX VRD 3108

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 3" / G 2", female thread	ISO 228-1
N2	Gas outlet	G 2", female thread	ISO 228-1

Tab. 3: Connections of the vacuum system TRIPLEX VRD 3108

Dimensions vacuum system DUPLEX VRD (connecting line)

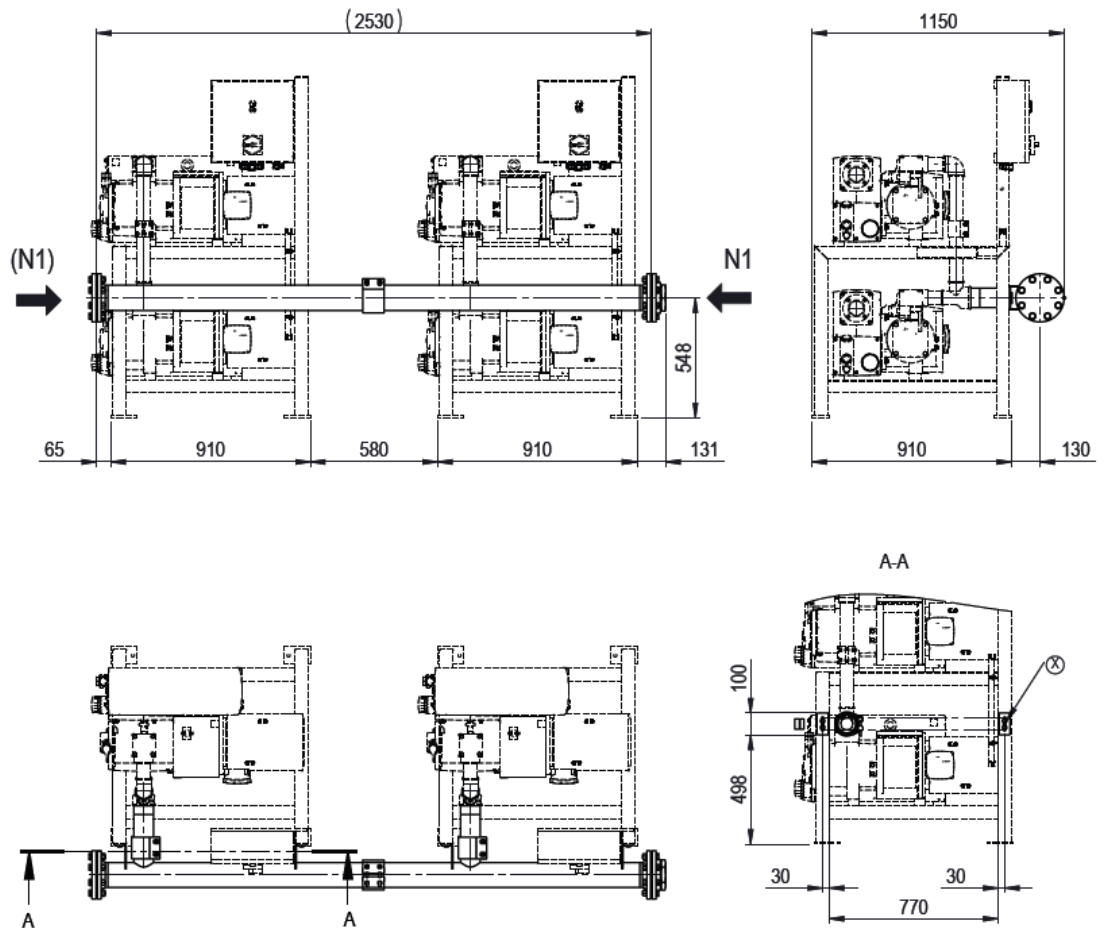


Fig. 21 : Dimensions vacuum system DUPLEX VRD (connecting line)

Pos.	Designation	Connection	Standard
N1	Gas inlet	DN 100 PN 16, G 3", female thread	EN 1092-1 / 11 ISO 228-1
N2	Gas outlet		

Tab. 4: Connections of the vacuum system DUPLEX VRD (connecting line)

Detail X: The holes on the base frame for attaching the connecting line must be done by the customer. Four blind rivet nuts (M10) are required per base frame.

Dimensions vacuum system TRIPLEX VRD (connecting line)

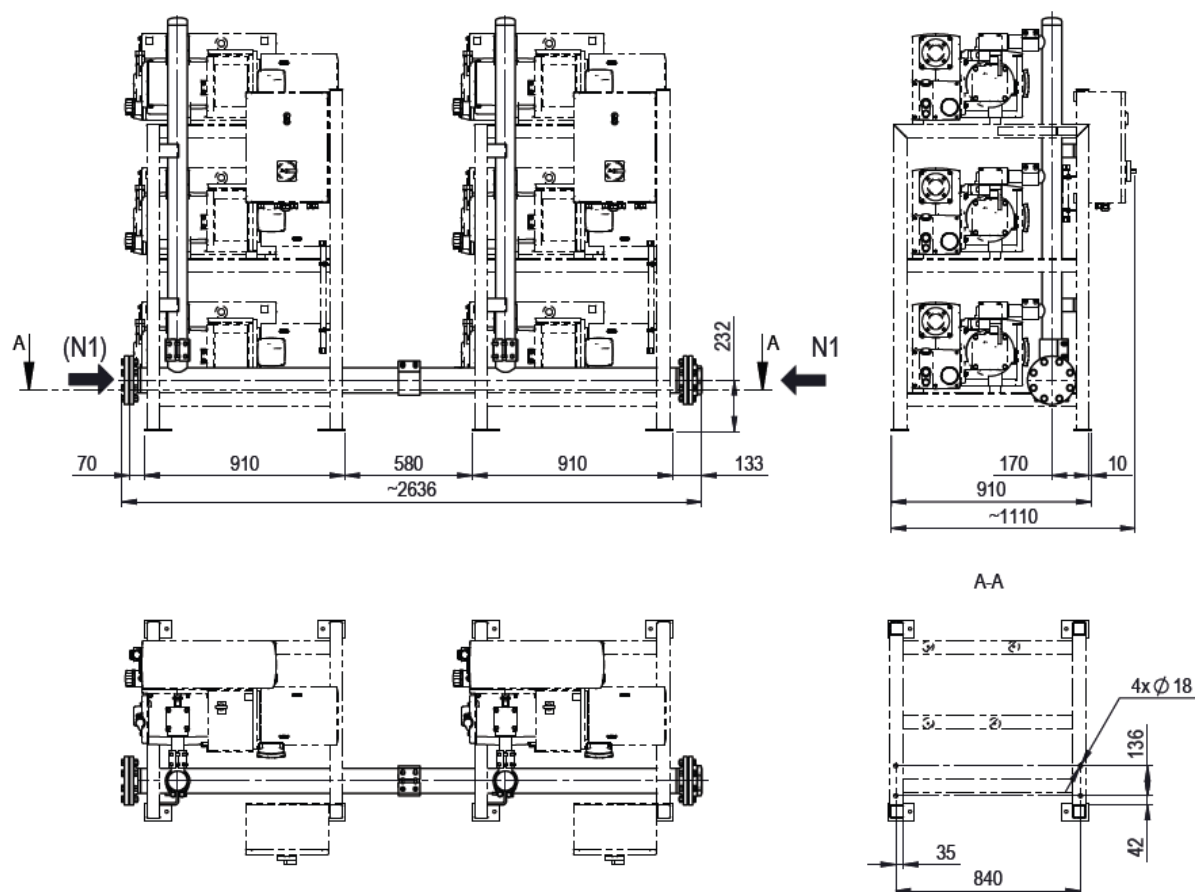


Fig. 22 : Dimensions vacuum system TRIPLEX VRD (connecting line)

Pos.	Designation	Connection	Standard
N1	Gas inlet	DN 100 PN 16, G 3", female thread	EN 1092-1 / 11 ISO 228-1
N2	Gas outlet		

Tab. 5: Connections of the vacuum system TRIPLEX VRD (connecting line)

The holes on the base frame for attaching the connecting line must be done by the customer. Four holes (Ø18) are required per base frame.

14 Connection values of the vacuum system VRD

14.1 Connection values

Vacuum system type	Voltage	Control voltage	Frequency	Power consumption	Max. permissible pre-fuse
VRD 2072	190 – 230 V*	24 VDC	50 Hz	11.0 kW	80 A
	380 – 400 V				50 A
	200 – 230 V*		60 Hz	13.2 kW	80 A
	400 – 480 V				50 A
VRD 3108	190 – 230 V*	24 VDC	50 Hz	16.5 kW	125 A
	380 – 400 V				63 A
	200 – 230 V*		60 Hz	19.8 kW	125 A
	400 – 480 V				63 A

Tab. 6: Connecting values of the vacuum systems VRD

! ATTENTION!

Damage to the drives.

- *Before commissioning, check the motor circuits (double star / triangle) in the motor terminal board of the rotary vane vacuum pumps, see circuit diagram in the switch and control cabinet.

14.2 Signal exchange

The following signals are available to the user (see circuit diagram in the switch and control cabinet):

- Status message of the vacuum system in operation – potential-free message
- Status message vacuum system failure – potential-free message
- External signal – vacuum system ON / OFF

15 Technical data

Designation	Unit	DUPLEX VRD 2072	TRIPLEX VRD 3108
Rated intake capacity (50/60 Hz)	m³/h	600/720	900/1080
Final pressure of the gas ballast closed Final pressure of the gas ballast open	hPa (mbar) abs.	0.1 0.5	
Rated output motor (50 / 60 Hz)	kW	2 x 5.5/6.6	3 x 5.5/6.6
Connected load switch and control cabinet (50 / 60 Hz)	kW	11.0 – 13.2	16.5 – 19.8
Sound-pressure level according to EN ISO 2151 (50 / 60 Hz)	dB(A)	73/75	75/77
Max. water vapor compatibility with gas ballast valve (50 / 60 Hz)	hPa (mbar)	24/125	
Water vapor capacity with gas ballast valve (50 / 60 Hz)	kg/h	5/30	
Ambient temperature range	°C	See oil (chap. 16)	
Max. admissible pressure in the oil mist separator	hPa (mbar) abs.	1600	
Max. permissible gas inlet temperature	°C	≤50 hPa (mbar) → 150 >50 hPa (mbar) → 80	
Ambient pressure		Atmospheric pressure	
Oil volume	l	2 x 7	3 x 7
Oil type		See oil (chap. 16)	
Weight	kg	505	735

16 Oil

	VM 100	VSC 100	VSB 100
ISO-VG	100	100	100
Oil type	Mineral oil	Synthetic oil	Synthetic oil
Ambience temperature range [°C]	5 ... 35	5 ... 40	5 ... 40
Part number 1 l packaging	0831 000 060	0831 168 356	0831 168 351
Part number 5 l packaging	0831 000 059	0831 168 357	0831 168 352

Check the name plate (NP, fig. 2) to see which oil the vacuum pump was filled with.

17 EU Declaration of conformity

This EU declaration of conformity and the CE marking on the name plate apply to the machine in the scope of the delivery by Busch. The manufacturer is solely responsible for issuing this declaration of conformity.

If the machine is integrated into a higher-level machine system, the manufacturer of this system (if applicable, the company operating the system) must issue a declaration of conformity for the higher-level machine or system and affix the CE marking.

Manufacturer **Dr. Ing. K Busch GmbH**
Schauinslandstr. 1
DE-79689 Maulburg

Declaration for vacuum system(s) of type: **VRD 2072, VRD 3108**

with serial number from **2021 ... to 2022 ...**

was/were produced according to the following EU standards:

- "Machinery directive" 2006/42/EG
- "Directive on electromagnetic compatibility" 2014/30/EU
- "RoHS2 Directive" 2011/65/EU, 2017/2102, Restriction of the use of certain hazardous substances in electrical and electronic devices

and according to the corresponding standards.

Standard	Name of the standard
EN ISO 12100:2010	Safety of machinery – General principles for design, risk assessment and risk reduction
EN ISO 13857:2019	Safety of machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs
EN 1012-1:2010 EN 1012-2:1996+A1:2009	Compressors and vacuum pumps – Safety requirements – Parts 1 and 2
EN ISO 2151:2008	Acoustics – Noise test code for compressors and vacuum pumps – Engineering method (grade 2)
EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
EN IEC 61000-6-2:2019	Electromagnetic compatibility (EMC) – Generic standards – Immunity standard for industrial environments
EN 61000-6-4:2007+A1:2011	Electromagnetic compatibility (EMC) – Generic standards – Emission standard for industrial environments
EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

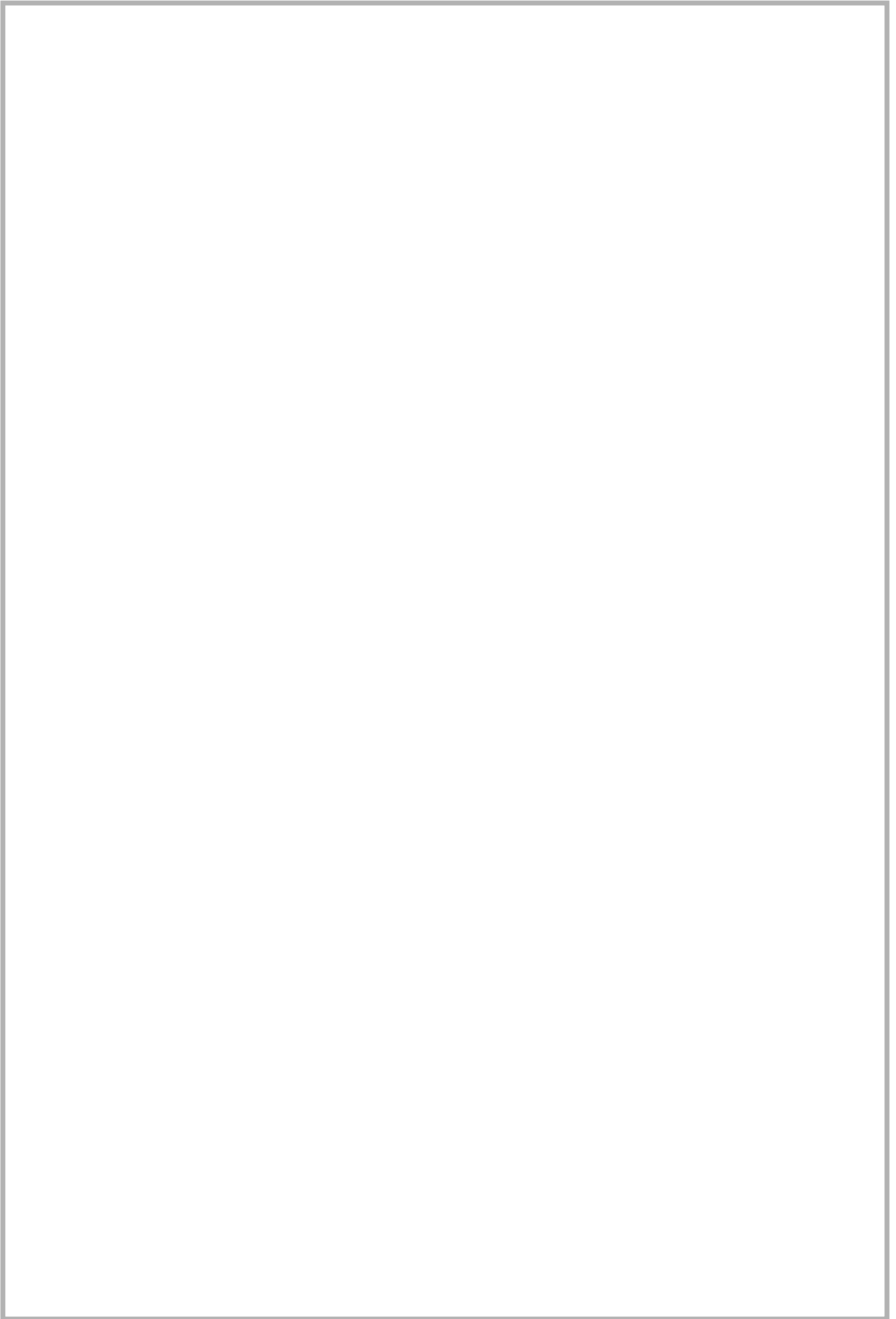
Person authorized to compile the technical data:

Klaus Digeser
 Dr. Ing K. Busch GmbH
 Schauinslandstr. 1
 DE-79689 Maulburg

Maulburg, 02/10/2021



Dr.-Ing Karl Busch, general manager

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