VACUUM SOLUTIONS

Operating instructions

SIMPLEX

Vacuum systems
VO 0040 – 0080 B

CE

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1 Contents

1.1 Table of contents

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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, the vacuum system can be switched off with the main switch of the motor protection switch, which has the function of an emergency-stop switch.

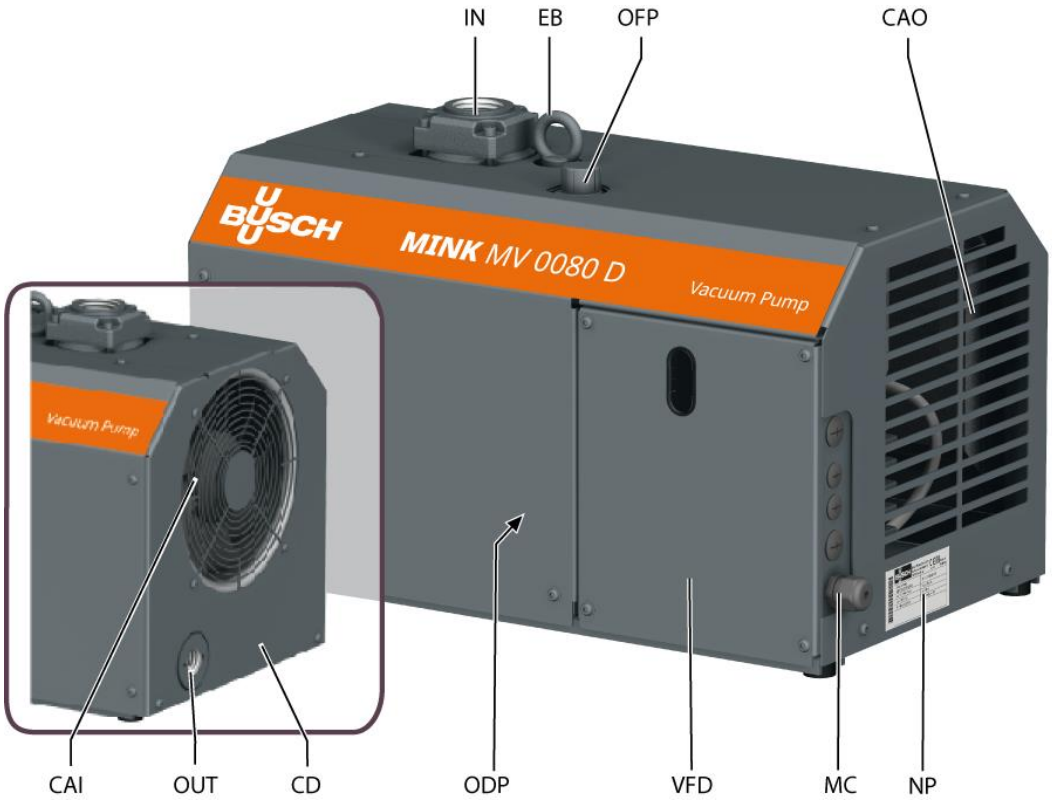
3 Product description

3.1 View vacuum system VO

IN	Gas inlet	CC	Motor protection switch
OUT	Gas outlet	AF	Air filter
CVP	Claw-type vacuum pump MV	VV	Venting valve
NP	Name plate	PT	Pressure transmitter
PG	Vacuum gauge	VST	Vacuum vessel
LED	LED frequency converter		

Fig. 1: View vacuum system VO

3.2 View of the claw-type vacuum pump MV



IN	Suction connection	CAO	Cooling air outlet
OUT	Gas outlet	VFD	Frequency controlled drive
OFP	Oil filler plug (oil dipstick)	CD	Condensate drain (aqua version)
ODP	Oil drain plug (under the cover)	MC	Connection supply voltage
CAI	Cooling air inlet	EB	Eye bolt
NP	Name plate		

Fig. 2: View claw vacuum pump Mink type MV

3.3 Setup

The vacuum system SIMPLEX VO consists of a single-stage claw vacuum pump type MV with integrated frequency converter for the drive. The vacuum pump is mounted on a vacuum vessel.

The intake-side air filter and the strainer installed in the suction flange prevent the ingression of dirt particles in the vacuum pump.

A pressure transmitter for pressure control is installed at the vacuum tank. The pressure in the vacuum tank can be read using a vacuum meter.

Inlet and delivery side of vacuum system are completely piped. The motor is wired to a motor protection switch.

The vacuum system is also available as a movable version with four rollers and a sliding bracket.

3.4 Function principle

3.4.1 Vacuum system VO

The single-stage claw vacuum pump evacuates a vacuum tank (VST, fig. 1), which serves as a vacuum reservoir. The compressed gas of the vacuum pump is ejected against the atmosphere.

An air filter is installed between the vacuum pump and the vacuum vessel. The delivered gas passes from the vacuum vessel to the air filter through to the vacuum pump. The air filter is used to separate dust and other solid foreign substances from the extraction medium.

After switching on the main switch, the vacuum pump switches on. Via the pressure transmitter installed in the vacuum vessel, the rotation speed of the motor is controlled by the frequency converter depending on the pressure. If no vacuum is needed for some period (adjustable), the vacuum pump will switch itself off. When the set target pressure is exceeded, the vacuum pump will switch on again automatically.

3.4.2 Claw-type vacuum pump MV

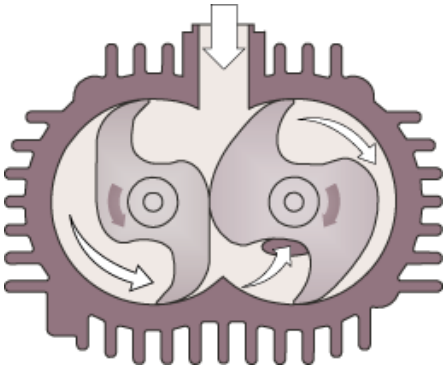


Fig. 3: Operating principle of the claw vacuum pump MV

The claw vacuum pump MV operates according to the claw principle.

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 40 mbar. The permitted ambiance 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.

- Use a pallet appropriate to the weight and size of the system on which it can be moved by a forklift truck. Or lift the vacuum system using slings and suitable lifting gears with a forklift or lift truck to move it or remove the pallet.
- Take care to avoid strain on the pipe work and vacuum pumps while placing the slings.
- 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!

The vacuum system is already filled with gear oil at delivery.

- 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.

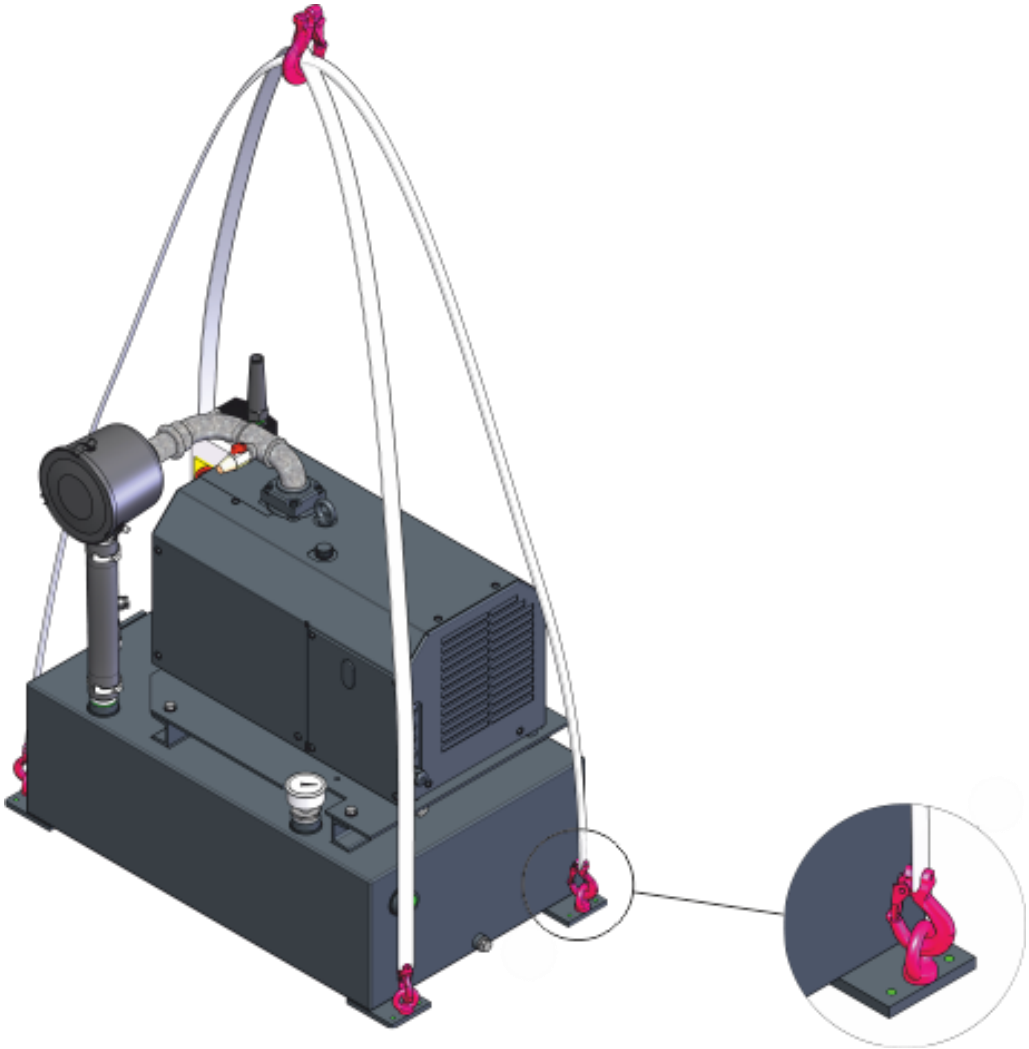


Fig. 4: Transport of the vacuum system

Screw four M10 eye bolts (not included in the scope of delivery) into the holes on the feet of the vacuum vessel (see fig. 4). Pass slings through the openings of the eye bolts and thus lift the vacuum system with a crane or a forklift.

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!
- Do not lift the vacuum pump on an eye bolt of the motor. Lift the vacuum pump only as shown.

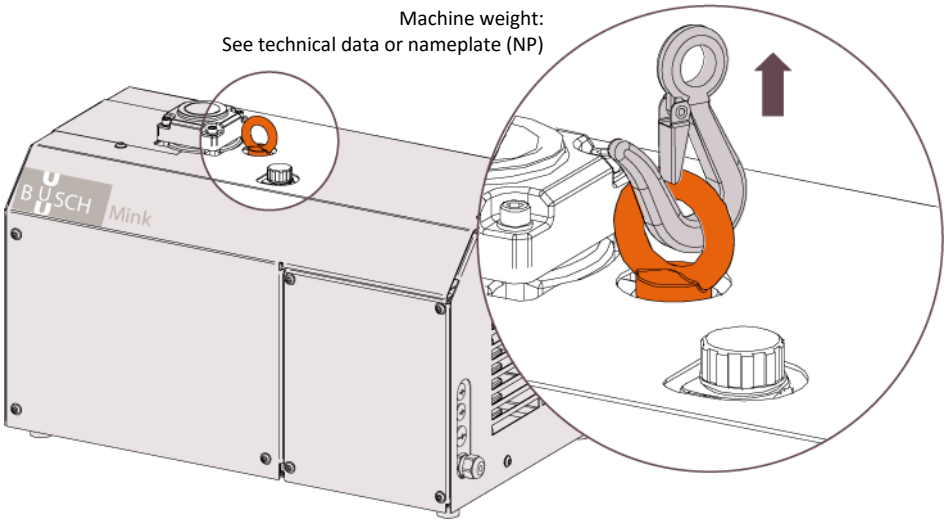


Fig. 5: Transport of the vacuum pump on the eye bolts

Check the vacuum pump for transport damage.

If the vacuum pump is fixed on a base plate, remove it.

5 Storage

ATTENTION!

Danger of damage to the vacuum pump drive!

Long storage periods may cause capacitors in the drive to be weakened by electro-chemical 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

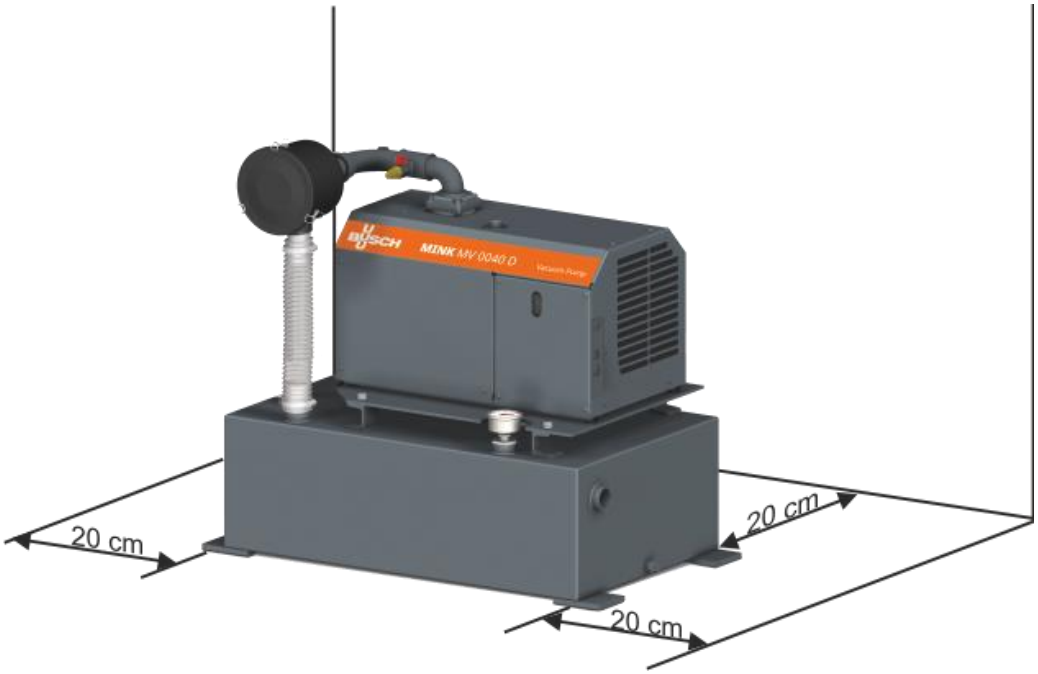


Fig. 6: Installation environment

- 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 ambiance 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.
- The visibility of the display elements (PG, fig. 1) must be ensured.
- 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.

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 pipeline 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

- Connect the gas outlet line to the gas outlet openings of the vacuum pump if required. Dimensions, see scale drawing in the appendix; connection size of thread: G 3/4“.
- 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

6.3 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. Wait for another 60 seconds after the LED displays switch off.
- 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.

ATTENTION!

Over voltage damages the vacuum system.

During a high-voltage test, the frequency inverter must be disconnected due to danger of destroying the power semi-conductors. The frequency inverter has already been subjected to a high-voltage test with special test process in the final inspection.

6.3.1 Connection of the power supply

CAUTION

Danger due to accidental starting of the vacuum pump!

The vacuum pump starts up when the main switch is actuated.

Make sure that starting the vacuum pump does not lead to a dangerous situation.

ATTENTION!

Danger of damage to the vacuum system.

Wrong connection.

- Wire the vacuum system according to the wiring diagram chap. 14.2.

Procedure:

- Ensure that the power supply for the vacuum system corresponds to the specifications in the circuit diagram.
- Ensure that the EMC class of the vacuum pump meets the requirements of your mains grid; if necessary, provide additional interference suppression measures (for EMC class of the vacuum pump, see technical data (chap. 15).
- We recommend using 16 A fuses of type gG/gL (IEC 60269-1). Ensure that the trigger time does not exceed 0.4 seconds.

If you want to use a fault-current circuit breaker:

- Use an all-current-sensitive fault-current circuit breaker (type B).
- The synchronous motor and the frequency inverter have very high efficiency. High reactive power may be displayed on some mains grids, but this does not affect the very high efficiency of the vacuum pump drive.

- Ensure that the vacuum system is not impaired by electrical or electromagnetic impulses of the power supply. Contact Busch if necessary.
- Connect the maintenance switch 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 already filled with oil at delivery. The oil level must be checked and, if necessary, topped up before commissioning.

7.1.1 Topping up with oil

For oil type and oil quantity, see Technical data (chap. 15) and Oil (chap. 16).

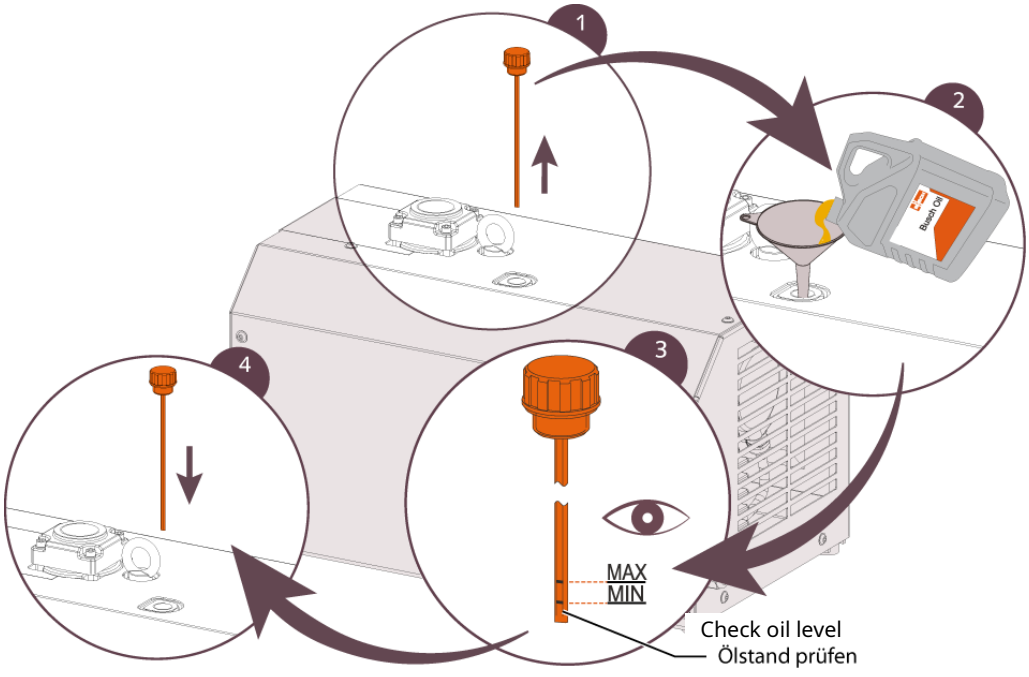


Fig. 8: Topping up oil

7.1.2 Indicators and control elements on the motor protection switch

Fig. 9: Motor protection switch

The vacuum system is switched on by way of the main switch at the motor protection switch (100Q1). The main switch has an undervoltage trigger for protection against residual voltage when using a pluggable power supply.

7.1.3 Indicators and control elements on the vacuum system

The indicating devices are as follows:

- **Vacuum gauge (PG, fig. 1)**
  indicate the pressure in the vacuum vessel.
- **Venting valve (VV, fig. 1)**
  The vacuum system is vented to atmospheric pressure via this valve for maintenance work.
- **LED display on the vacuum pump (LED, fig. 1)**
  indicates the states of the frequency converter

7.1.4 LED display at the vacuum pump

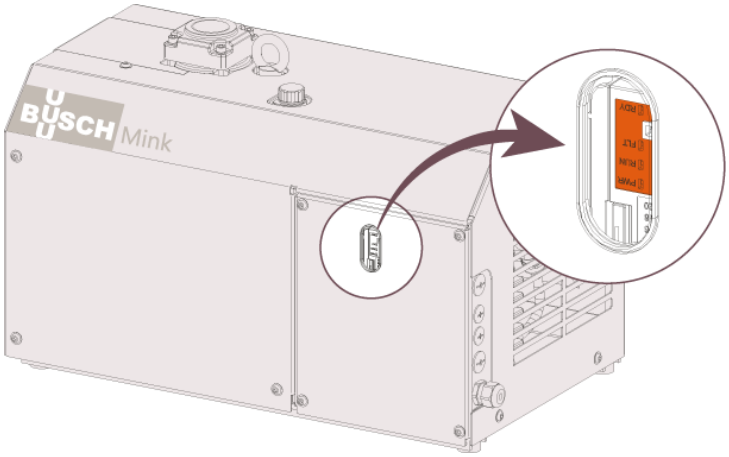


Fig. 10: LED displays at the vacuum pump

LED	Description
PWR	Lights up when the vacuum pump is supplied with power.
RUN	Lights up when the vacuum pump is in operation.
FLT	Lights up when the vacuum pump is in a fault condition. Flashes when the maintenance interval is reached (every 8000 operating hours). The maintenance counter can be reset via terminal 14 (digital input 4) of the control unit. Error code: see chapter 9.1 “Troubleshooting” in the document “Instructions for pump control”, art. no. 0870 166 596
RDY	Lights up when the vacuum pump is ready and there is no fault pending. Flashes when a warning is active.

7.1.5 DIP switches

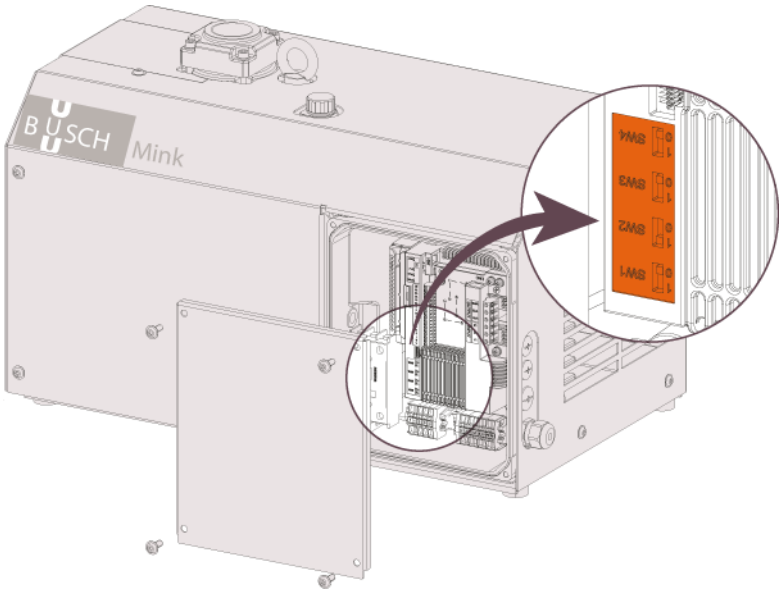


Fig. 11: DIP switch on the vacuum pump

The DIP switches are used to make the following settings:

DIP switches	Description	Standard
SW4	No function	0
SW3	0 = Analog input 2 operates in current mode (4 – 20 mA) 1 = Analog input 2 operates in voltage mode (2 – 10 V)	0
SW2	0 = Analog input 1 operates in current mode (4 – 20 mA) 1 = Analog input 1 operates in voltage mode (2 – 10 V)	0
SW1	0 = Digital inputs are connected to ground 1 = Digital inputs are disconnected from ground	0

NOTICE

Settings of the DIP switches see circuit diagram chap. 14.2.

7.1.6 Manual operating unit (option)

Display and operating elements on the manual operating unit

The vacuum system VO can be optionally operated via the manual operating unit (see separate instructions parameter description 0870 166 596)

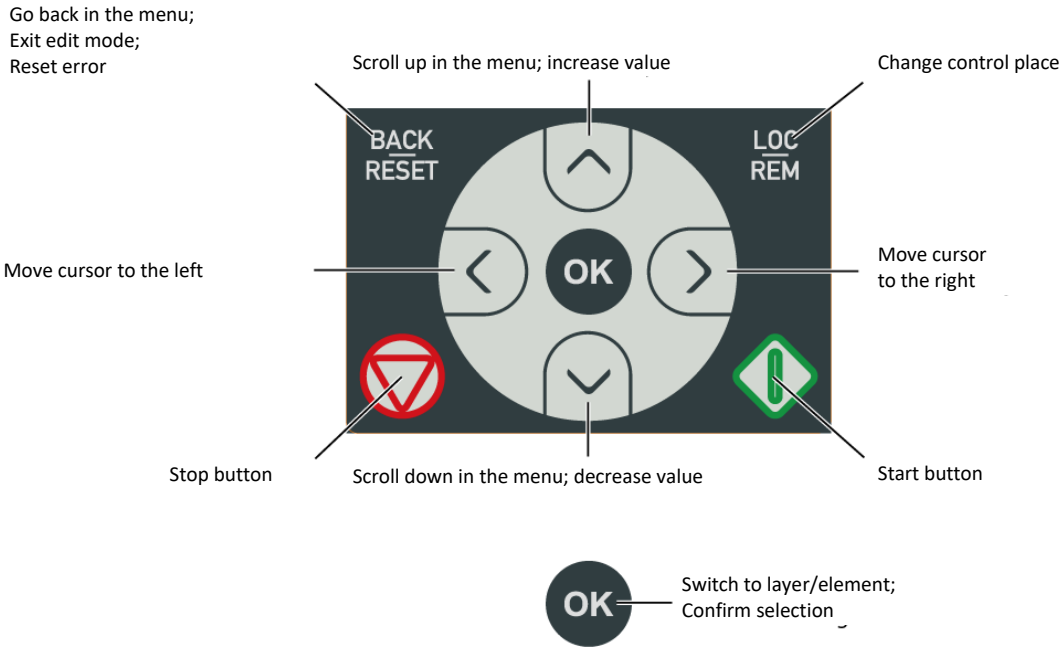


Fig. 12: Display of the manual operating unit

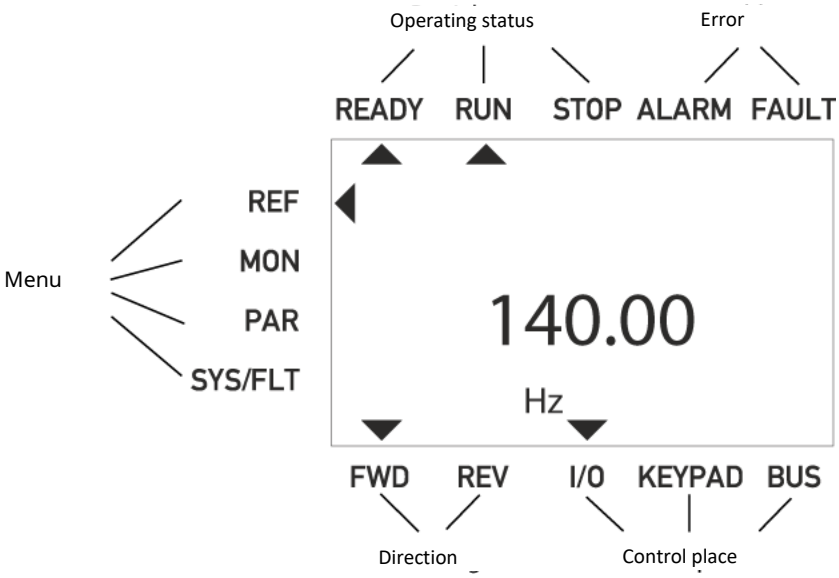


Fig. 13: Display overview

Connection of the manual operating unit to vacuum pump

DANGER

Danger from electric shock!
Electric shock will cause death or serious injury.

- Before any electrical work, ensure that the vacuum pump is disconnected from the power supply and secured against accidental activation. Wait for another 60 seconds after the LED displays switch off.
- Electrical installation work must only be performed by trained specialists.

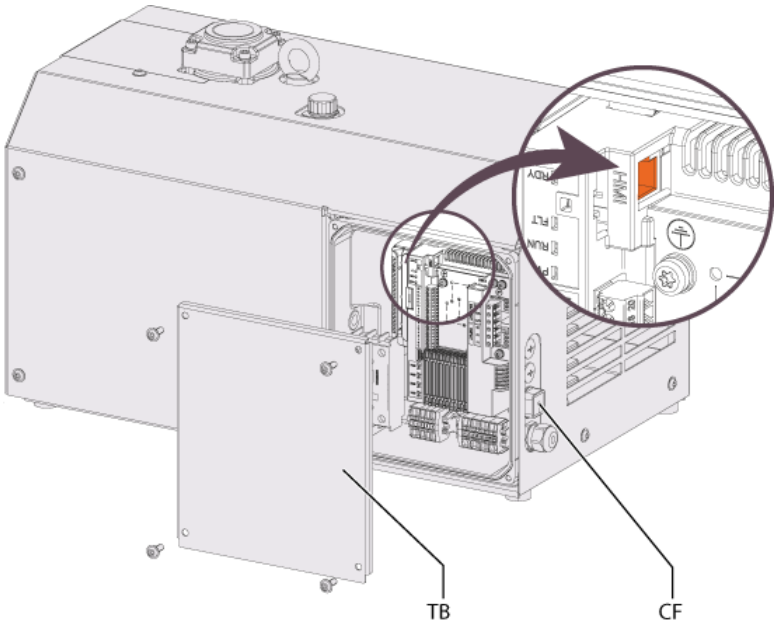


Fig. 14: Connection of the operating unit to vacuum pump

The operating unit is connected to the RJ-45 jack (HMI).

Proceed as follows:

- Open the lid of the terminal box
- Pull the keypad cable through the cable guide (CF) provided.
- Screw in cable guide
- Connect the connection part of the keypad to the interface provided for this purpose on the vacuum pump (HMI).
- Close the cover of the terminal box (TB).

7.1.7 Measuring and control facilities and settings

The vacuum system is equipped with a pressure transmitter in the vacuum tank for pressure-dependent control of the vacuum pump.

Designation	Function	Measuring range	Set value
Pressure transmitter in the vacuum vessel	Pressure-dependent control of the vacuum pump	0 – 1 bar abs. 4 – 20 mA	set value

Tab. 1: Switching values

The target value can be set via the parameter 12.2 of the frequency inverter. Setting requires the parameterization kit or the manual operating unit.
Factory settings of the target value: 100 mbar (10%).

7.1.8 Parameter settings

The parameters are set on the manual operating unit.

Parameter	Description	Set to
P3.7	Measuring margin of the pressure transmitter 100 % = 0 ... 1,000 mbar 50 % = 0 ... 500 mbar 10 % = 0 ... 100 mbar	100%
P12.1	Target value source 0 = internal setting (P12.2) 1 = analog input 1 2 = analog input 2 3 = field bus	0
P12.2	Target pressure in % 50 % = 500 mbar 10 % = 100 mbar 5 % = 50 mbar	10% Value may deviate due to specific customer specification!
P12.7	PID controller P reinforcement	500 %
P12.8	PID controller I time	0.3 s
P12.13	Shut off delay	20 s
P12.14	Level of the switch-on delay	1%

Tab. 2: Parameter settings (factory settings)

Explanations of the settings can be found in the document “Instructions for pump control”, art. no. 0870 166 596.

NOTICE

When installing a new vacuum pump, the parameter settings of the vacuum pump must be changed to the values according to table 2.

7.2 Operation

ATTENTION!

Danger of damage to the vacuum pump.

Frequent starting/stopping by switching the power supply on/off.

Starting the vacuum pump by switching the power supply on/off is permitted at most once per minute (max. 60 x hour). At least 10 seconds must pass between switching off and on again. If the process requires more frequent starting/stopping of the vacuum pump, this must be done via the digital start signal.

The number of starts per hour through a digital signal is not limited.

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 fulfilled.
- The permitted maximum number of starts (60) per hour must not be exceeded.
- 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 (100Q1, fig. 9) to “ON”.
- The vacuum pump starts immediately and switches on and off depending on the pressure. The vacuum system is in operation.

Stopping the vacuum system

- Set the main switch (100Q1, fig. 9) to “OFF”.
- The motor switches off.

7.3 Pressure control

With pressure control, the vacuum pump will adjust the revolutions of the vacuum pump depending on the deviation of the actual value from the target pressure.

If the actual value is above the target pressure, the vacuum pump revolutions are increased. If the actual value drops below the target pressure, the vacuum pump revolutions are reduced.

At extended operation at the minimum speed, the vacuum pump will drop into stand-by mode, which means that the vacuum pump will switch off and start again independently once the actual value is by 1% above the target pressure.

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!
- Disconnect the vacuum system from the process and make sure that there is ambient pressure in the vacuum system! Procedure: Close the shut-off device on the inlet side (not included in the scope of delivery) and slowly open the venting valve (VV, fig. 1).

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 ingression of process material, it may be necessary to shorten the maintenance intervals a lot.

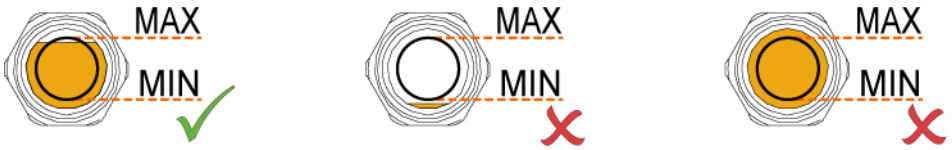
Interval	Maintenance task
Claw-type vacuum pump MV	
Monthly	• Check the air filter insert of the air filter (AF, fig. 1) and replace it if necessary (chap. 8.5).
Every 3 months	• Check the oil level (chap. 8.2)
Every 6 months	• Clean the vacuum pump from dust and impurities (chap. 8.3)
Every 8000 hrs. or, at the latest, after 1 year	• Replace the gear oil (chap. 8.48.3). After the oil change, reset the maintenance counter via terminal 14 (digital input 4) of the control unit. • Check the suction strainer (IS, chap. 0) and clean it if necessary.
Every 6 years	• Perform a general overhaul of the vacuum pump (inform Busch).
Switch and control cabinet	
Every 8000 hrs. or, at the latest, after 1 year	• Check the parts in contact with the medium for corrosion • Check switch function, check for broken wires.

8.2 Check oil level

Proceed as follows:

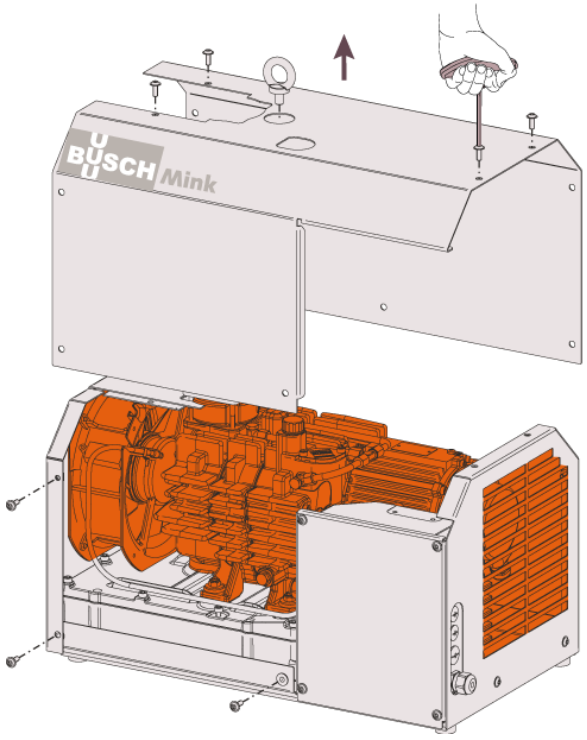
- Switch off the vacuum system.
- Wait 1 minute after switching off the vacuum pumps, before checking the oil level.

The oil level should be constant over the entire service life. If the oil level drops, the gear box is leaking and the vacuum pump needs to be repaired.



Top up with oil if necessary (chap. 0).

8.3 Clean vacuum system from dust and dirt



Clean fan grids
and cooling fins

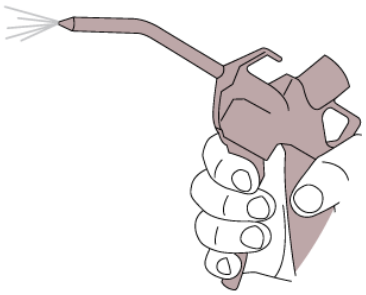


Fig. 15: Clean vacuum pump

8.4 Oil 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).

NOTICE

The oil level should be constant over the entire service life. If the oil level drops, the gear box is leaking and the vacuum pump needs to be repaired.

Follow the figures

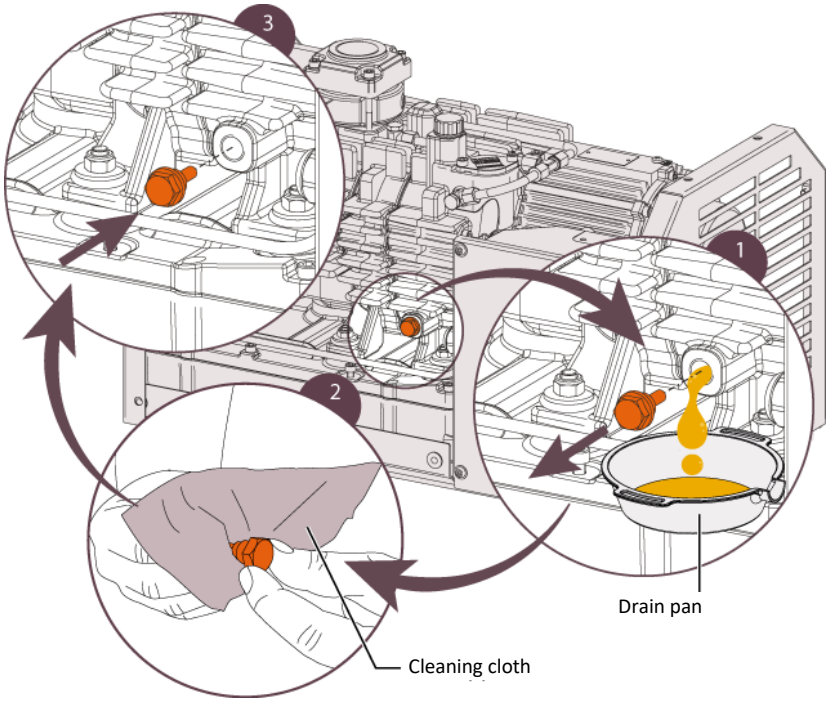


Fig. 16: Drain oil

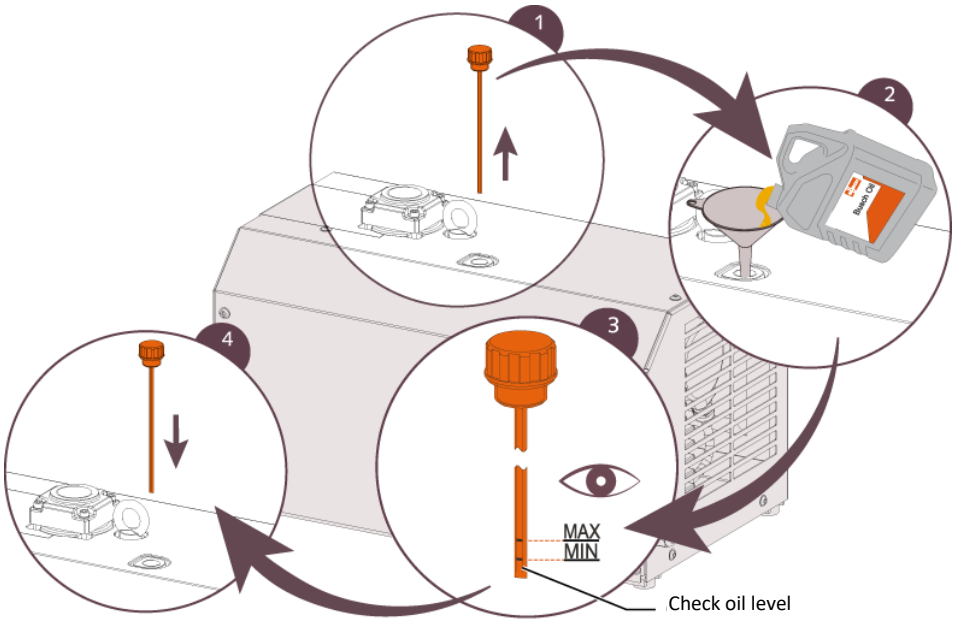


Fig. 17: Filling in oil

8.5 Changing of the air filter element

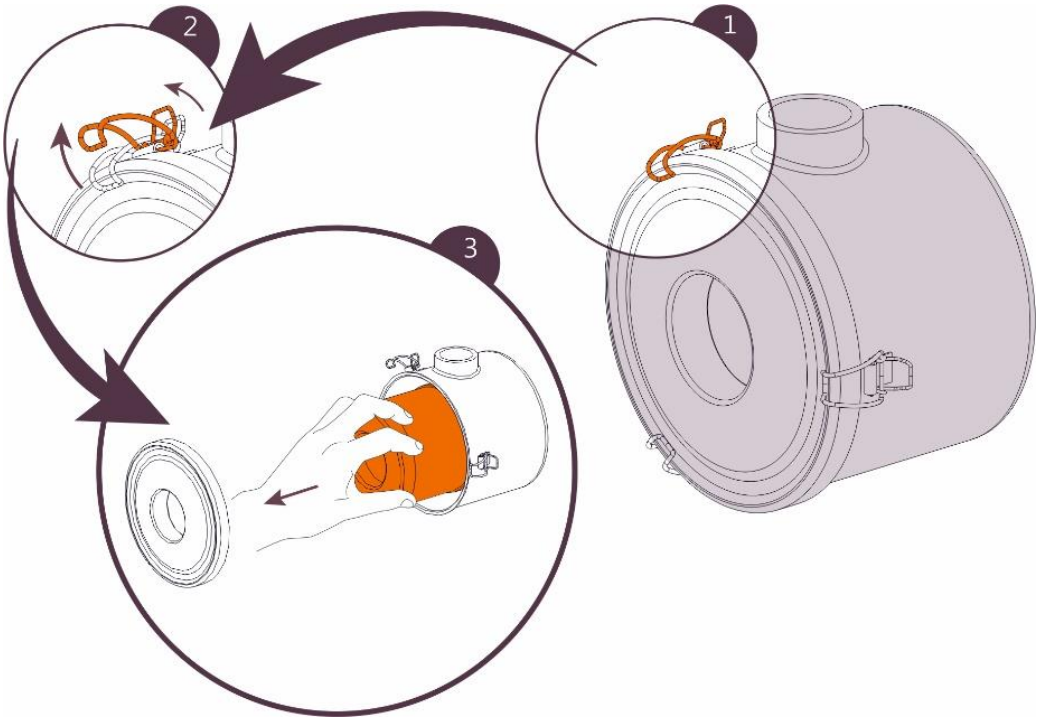


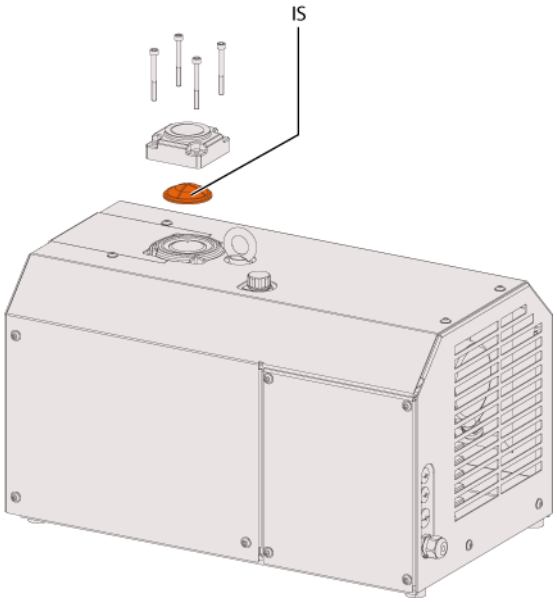
Fig. 18: Cleaning of the air filter element

Proceed as follows:

- Open the quick clamps and remove the filter insert
- Insert a new filter.
  Original spare part from Busch: Parts no. 0532 000 003

8.6 Check and clean suction strainer

A suction strainer is installed in the gas inlet to protect the vacuum pump.



IS	Intake screen

Fig. 19: Installing the intake screen

9 Troubleshooting

DANGER

Danger from electric shock!
Electric shock will cause death or serious injury.

- Before any electrical work, ensure that the vacuum pump is disconnected from the power supply and secured against accidental activation. Wait for another 60 seconds after the LED displays switch off.
- Electrical installation work must only be performed by trained 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,
- Disconnect the vacuum system from the process and make sure that there is ambient pressure in the vacuum system! Procedure: Close the shut-off device on the inlet side (not included in the scope of delivery) and slowly open the venting valve (VV, fig. 1).

9.1 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.
	Start release is missing	• Apply signal to digital input 1 (terminal 8).
Main switch 100Q1 cannot be switched on	No or too-low mains voltage	• Check mains voltage, see circuit diagram for permissible or required mains voltage
The required pressure cannot be built up on the intake connection.	The suction strainer (IS, fig. 19) is partially clogged	• Clean the suction strainer (IS, fig. 19).
	The air filter insert (fig. 18) is clogged	• Replace the air filter insert.
	The venting valve (VV, fig. 1) is open.	• Close the venting valve.
	Too-low speed	• Check target value and change if necessary (parameter 12.2)

Problem	Possible cause	Remedy

The required pressure cannot be built up on the intake connection.	Inner components are worn or damaged	• Have the vacuum pump repaired (Busch Service)
	Leak in piping system	• Locate and repair leakage.
The pressure control does not work	The rotating speed control is set	• Switch to pressure control at the digital input 2 (terminal 9)
	The target pressure is too low: The vacuum pump runs at the max. speed and does not reach the target value	• Increase the pressure target (parameter 12.2).
	Target pressure too high: The vacuum pump does not start up, since the target pressure is above the actual value	• Reduce the pressure target (parameter 12.2).
	Pressure transmitter is defective	• Replace pressure transmitter
	Cable disruption on the pressure transmitter	• Check the cable and replace if necessary.
High noise development during operation of the vacuum pump	The bearings are defective.	• Have the vacuum pump repaired (Busch Service).
	The oil level is too low	• Top up oil.
High heat development during operation of the vacuum pump	The cooling is insufficient.	• Clean the vacuum pump from dust and contamination.
	The ambiance temperature is too high.	• Observe admissible ambiance temperature.
	The fan does not run or turns in the wrong direction.	• Check electrical connection.
	The temperature of the process gases at the gas inlet is too high	• Observe the permissible gas inlet temperature, see technical data.
	The oil level is too low	• Top up oil.

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

9.2 Fault messages at the manual operating unit

If one or several errors occur, the name of the error will start to flashing in the display.
The last 10 errors are saved in the order of occurrence.
Selecting an error and pushing the OK button will display details on the error.

The error remains active until it is reset with the BACK/RESET button or with a reset signal at terminal 10 of the control unit.

(see separate instructions from the parameter description 0870 0166 596)

9.3 Resetting error

⚠ CAUTION

Danger due to accidental starting of the vacuum pump!

The vacuum pump may start up independently after error reset.

Make sure that starting the vacuum pump does not lead to a dangerous situation.

An error is signaled when the LED “FLT” lights up (see LED display (fig. 10) and, if connected, by the lack of a ready-for-operation signal (terminal 20 of the control unit).

- Before resetting an error, determine and remove its cause.
- Reset the error by disconnecting and reconnecting the power supply for at least 10 seconds or a digital signal at the terminal 10 of the control unit.

10 Spare parts and accessories

10.1 Spare parts

ATTENTION!

There is a risk of premature failure of the vacuum system.

Loss of efficiency when using non-original (non-Busch) spare parts.

- We recommend using only original spare parts and consumables from Busch to ensure proper functioning of the vacuum system and to fulfill all warranty and guarantee-related requirements.

Spare part	Description	Part number
Maintenance set	Contains all spare parts needed for maintenance, except for gear oil.	0992 165 840
Gear oil	Busch VSB 100, container size 1 liter	0831 168 351
Gear oil	Busch VSB 100, container size 5 liter	0831 168 352
Filter cartridge	Air filter insert (paper) for intake filter	0532 000 003
Pressure transmitter	Measuring range 0 – 1 bar abs., 4 – 20 mA	0656 S02 440
Pressure gauge	Measuring range -1 – 0 bar	0545 000 002

If further spare parts are required, ask your Busch contact for the detailed spare parts list.
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

10.2.1 Parametrization Kit

The parametrization kit contains a connection cable for connection to the computer and a software on a USB stick for setting and displaying parameters of the vacuum pump drive (see separate instructions pf parameter descriptions 0870 166 596).

The parameterizing kit is intended for:

- The parametrization of the frequency converter
- The control
- The display of various values
- The storage of parameter sets

Parts no. 0940 165 961

10.2.2 Manual operating unit

The manual operating unit is intended for simple operation of the vacuum pump and parameter settings in the field (see separate instructions, parameter description 0870 166 596).

The manual operating unit is intended for:

- The parametrization of the frequency converter
- The control
- The display of various values

Parts no. 0940 165 962

10.2.3 Field bus option card

The vacuum pump can be retrofitted using field bus option cards with different bus systems. Also consult your Busch branch.

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).

12.2 Disassembly and disposal

- Drain the oil.
- Remove the air 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 vacuum system VO 0040 B AAA G3XX

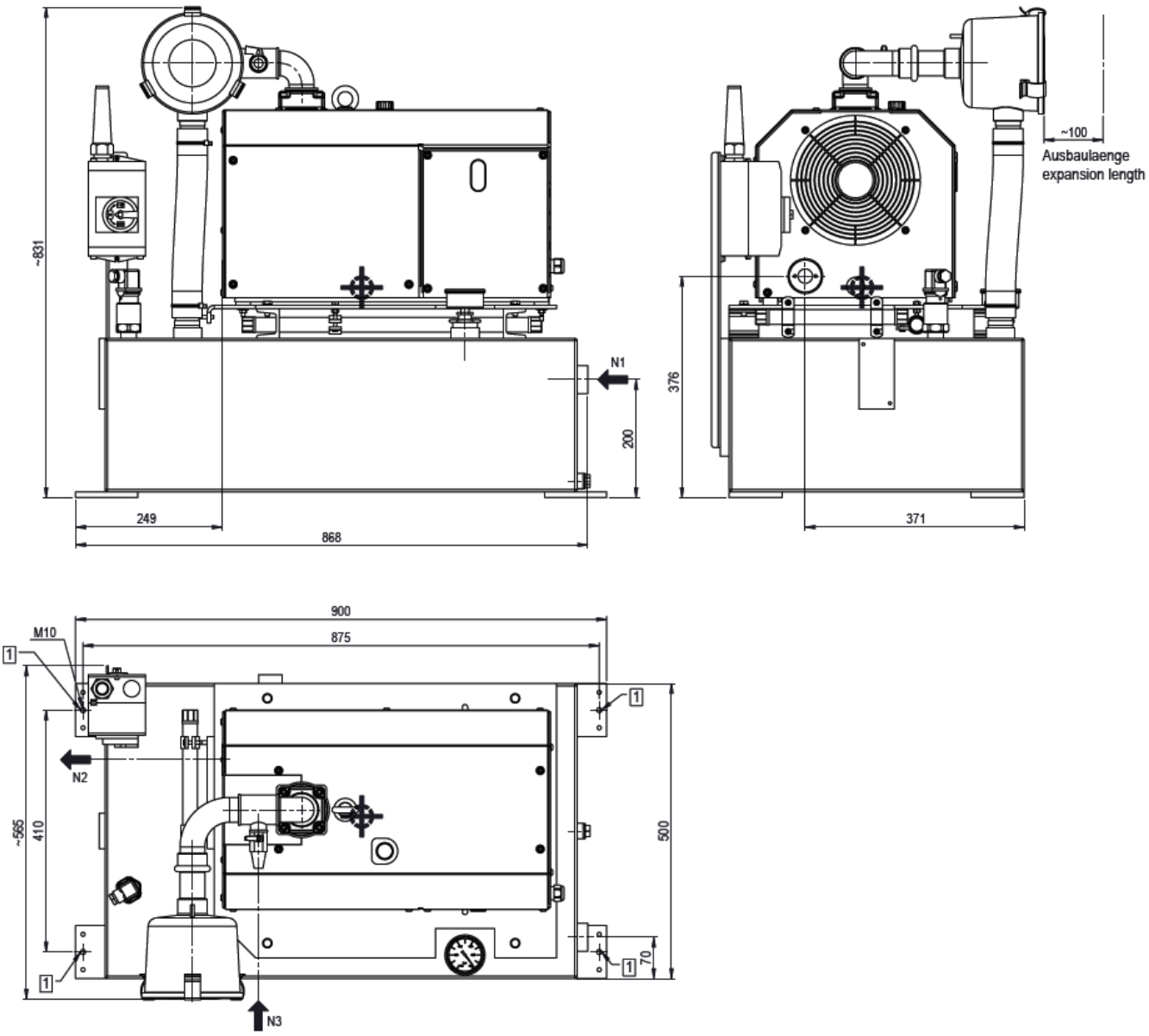


Fig. 20: Dimensions vacuum system VO 0040 B AAA G3XX

⌖	Center of gravity	1	Lifting point

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 1 1/4“, female thread	ISO 228-1
N2	Gas outlet	G 3/4", female thread	ISO 228-1
N3	Venting valve		

Tab. 3: Connections vacuum system VO 0040 B AAA G3XX

Dimensions vacuum system VO 0040 B AAA G3AX (mobile)

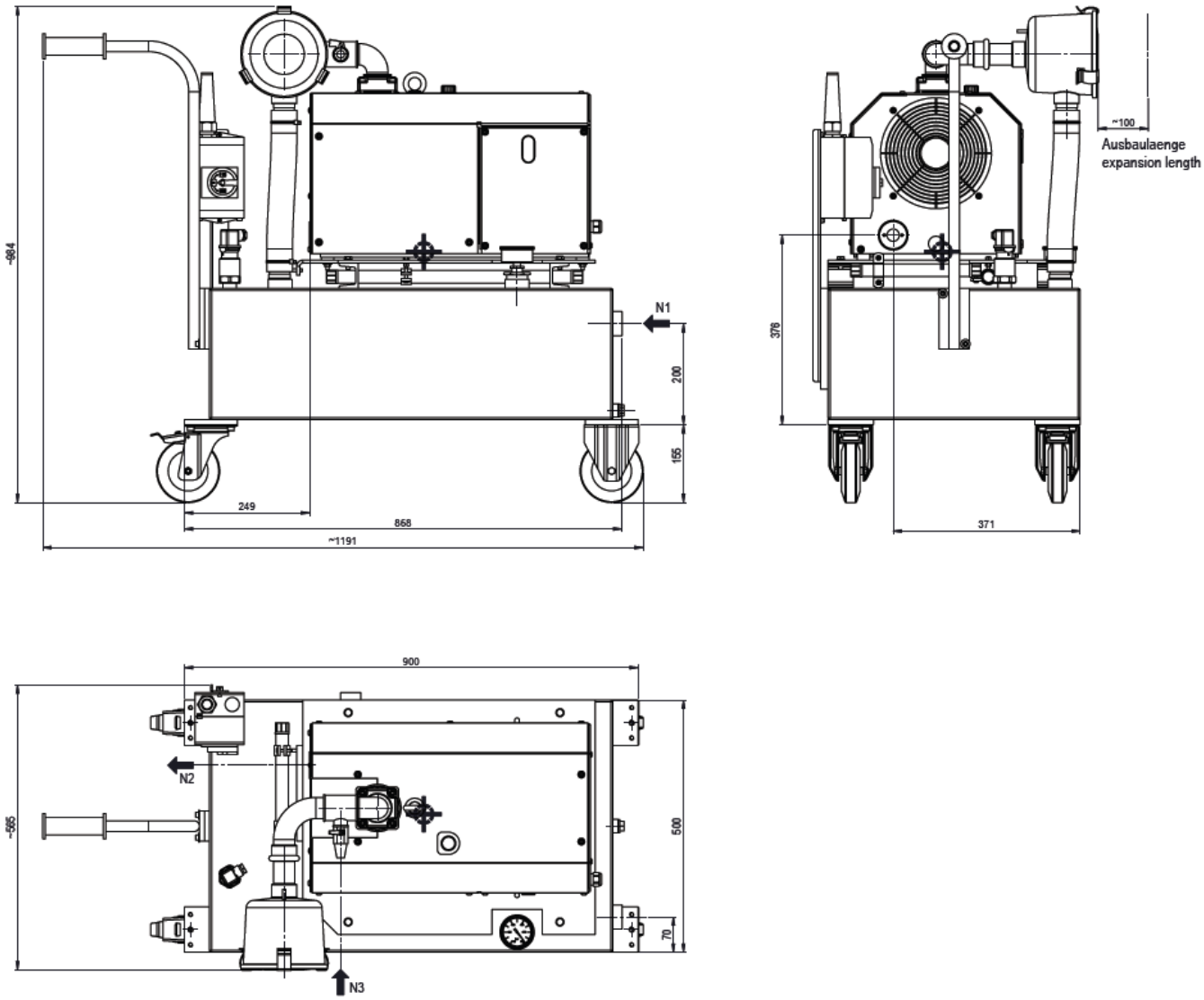


Fig. 21: Dimensions vacuum system VO 0040 B AAA G3AX (mobile)

⌖ Center of gravity

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 1 1/4“, female thread	ISO 228-1
N2	Gas outlet	G 3/4", female thread	ISO 228-1
N3	Venting valve		

Tab. 4: Connections vacuum system VO 0040 B AAA G3AX (mobile)

Dimensions vacuum system VO 0060 B AAA H3XX

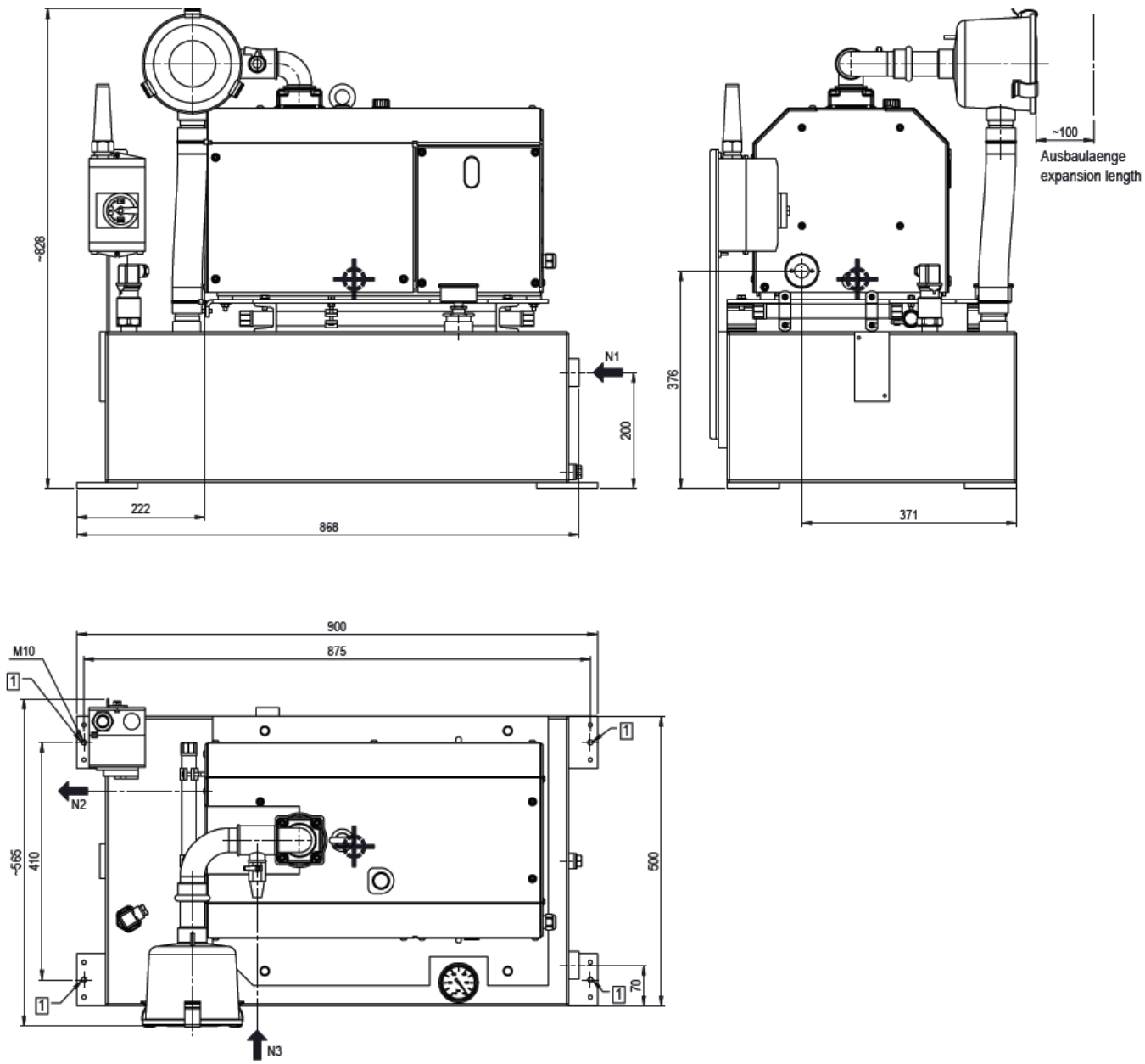


Fig. 22: Dimensions vacuum system VO 0060 B AAA H3XX

⌖	Center of gravity	1	Lifting point

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 1 1/4“, female thread	ISO 228-1
N2	Gas outlet	G 3/4", female thread	ISO 228-1
N3	Venting valve		

Tab. 5: Connections vacuum system VO 0060 B AAA H3XX

Dimensions vacuum system VO 0060 B AAA H3AX (mobile)

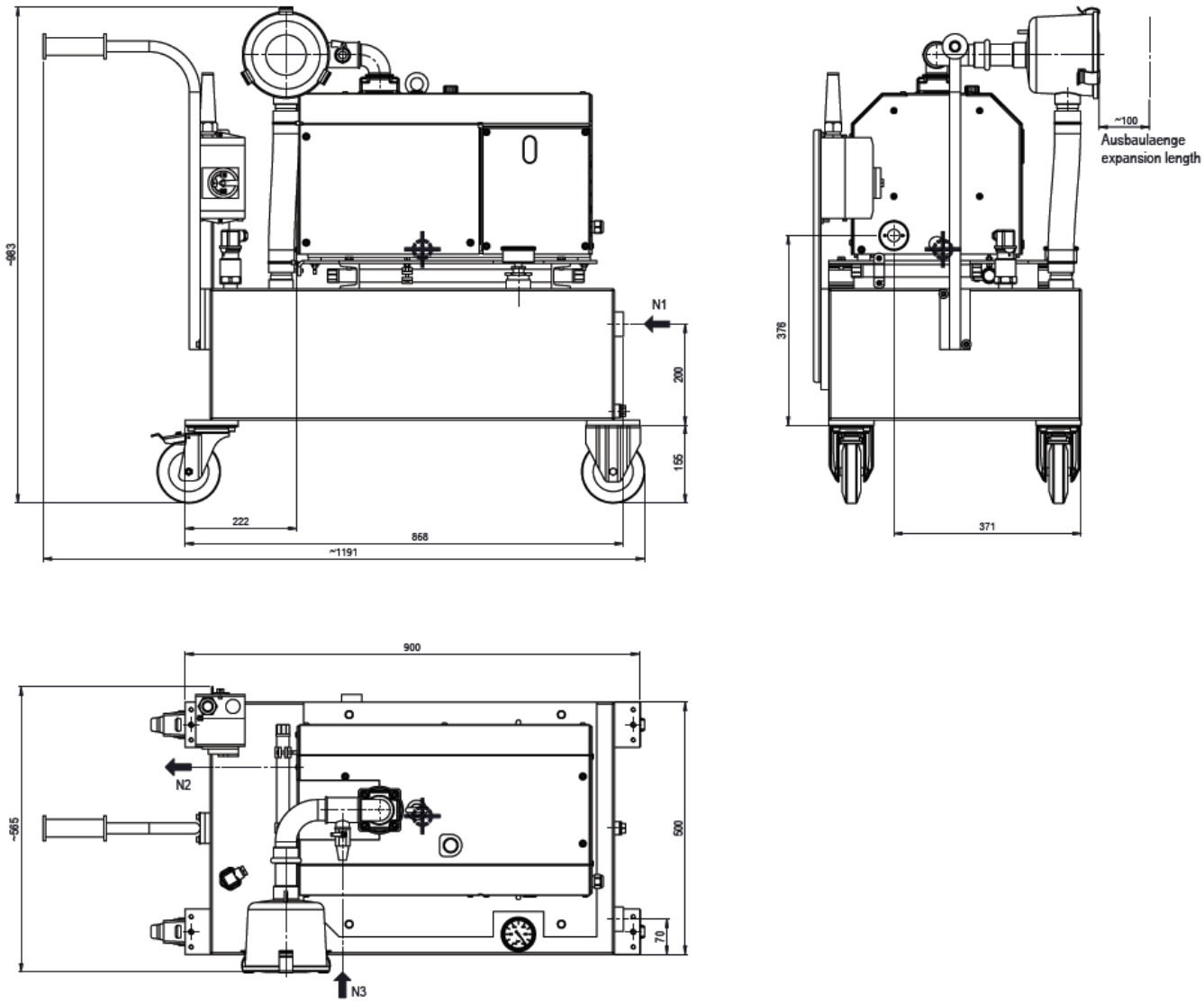


Fig. 23: Dimensions vacuum system VO 0060 B AAA H3AX (mobile)

Center of gravity

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 1 1/4“, female thread	ISO 228-1
N2	Gas outlet	G 3/4", female thread	ISO 228-1
N3	Venting valve		

Tab. 6: Connections vacuum system VO 0060 B AAA H3AX (mobile)

Dimensions vacuum system VO 0080 B AAA I3XX

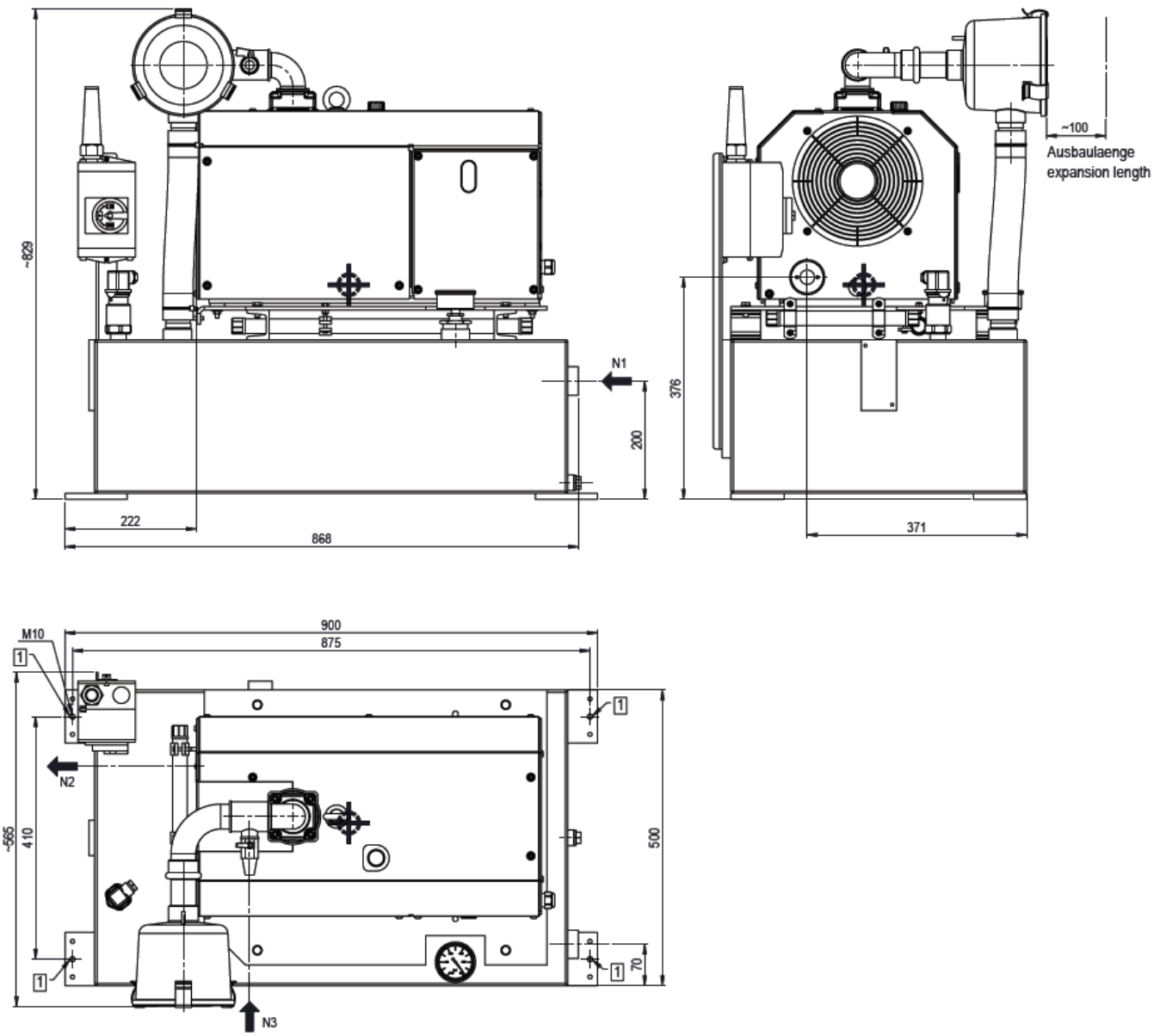


Fig. 24: Dimensions vacuum system VO 0080 B AAA I3XX

⌖	Center of gravity	1	Lifting point

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 1 1/4“, female thread	ISO 228-1
N2	Gas outlet	G 3/4", female thread	ISO 228-1
N3	Venting valve		

Tab. 7: Connections vacuum system VO 0080 B AAA I3XX

Dimensions vacuum system VO 0080 B AAA I3XX(mobile)

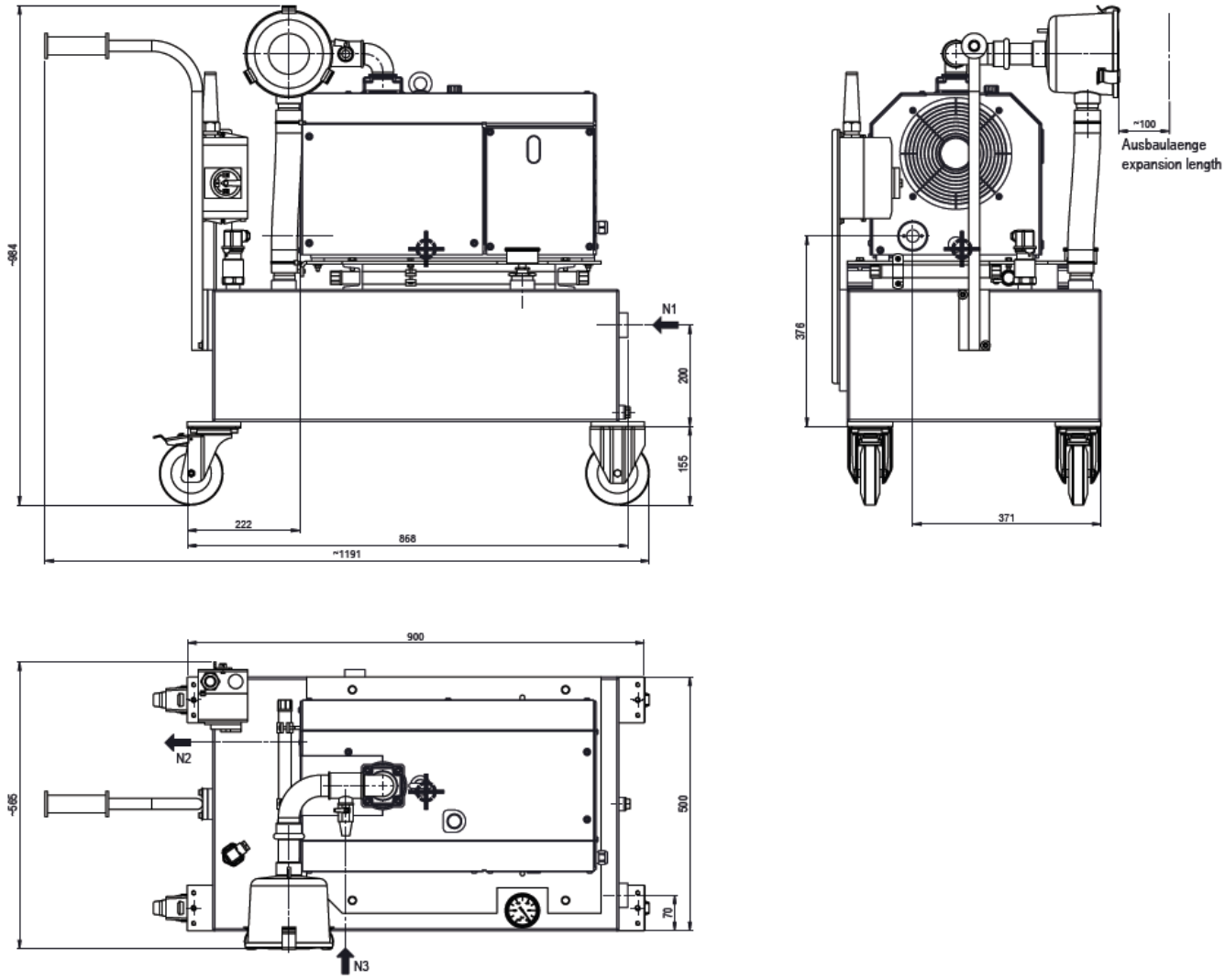


Fig. 25: Dimensions vacuum system VO 0080 B AAA I3XX(mobile)

Center of gravity

Pos.	Designation	Connection	Standard
N1	Gas inlet	G 1 1/4“, female thread	ISO 228-1
N2	Gas outlet	G 3/4", female thread	ISO 228-1
N3	Venting valve		

Tab. 8: Connections vacuum system VO 0080 B AAA I3AX (mobile)

14 Connecting values of the vacuum system VO

14.1 Connection values

Vacuum system type	Voltage	Frequency	Power consumption	Rated current	Max. perm. pre-fuse
VO 0040 B	3 x 380 - 415 V AC / PE	50 Hz	1.3 kW	4.4 A	16 A
VO 0060 B	3 x 380 - 415 V AC / PE	50 Hz	1.7 kW	5.0 A	16 A
VO 0080 B	3 x 380 - 415 V AC / PE	50 Hz	2.1 kW	6.5 A	16 A

Tab. 9: Connecting values of the vacuum systems VO

14.2 Circuit diagram vacuum systems VO

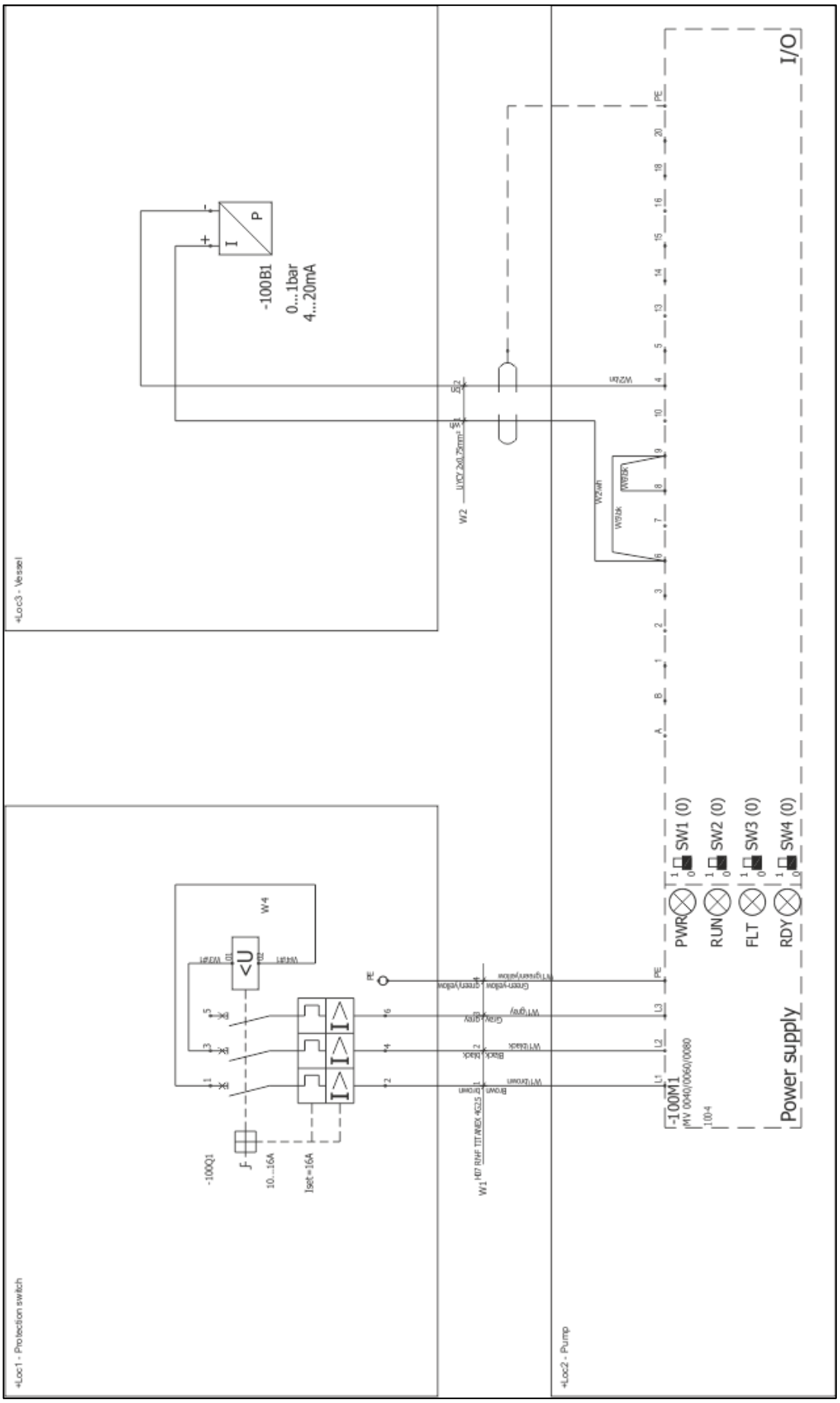


Fig. 26: Circuit diagram vacuum systems VO

14.3 Circuit diagram of the claw vacuum pump MV 0040 D / MV 0060 D / MV 0080 D, 3 phase

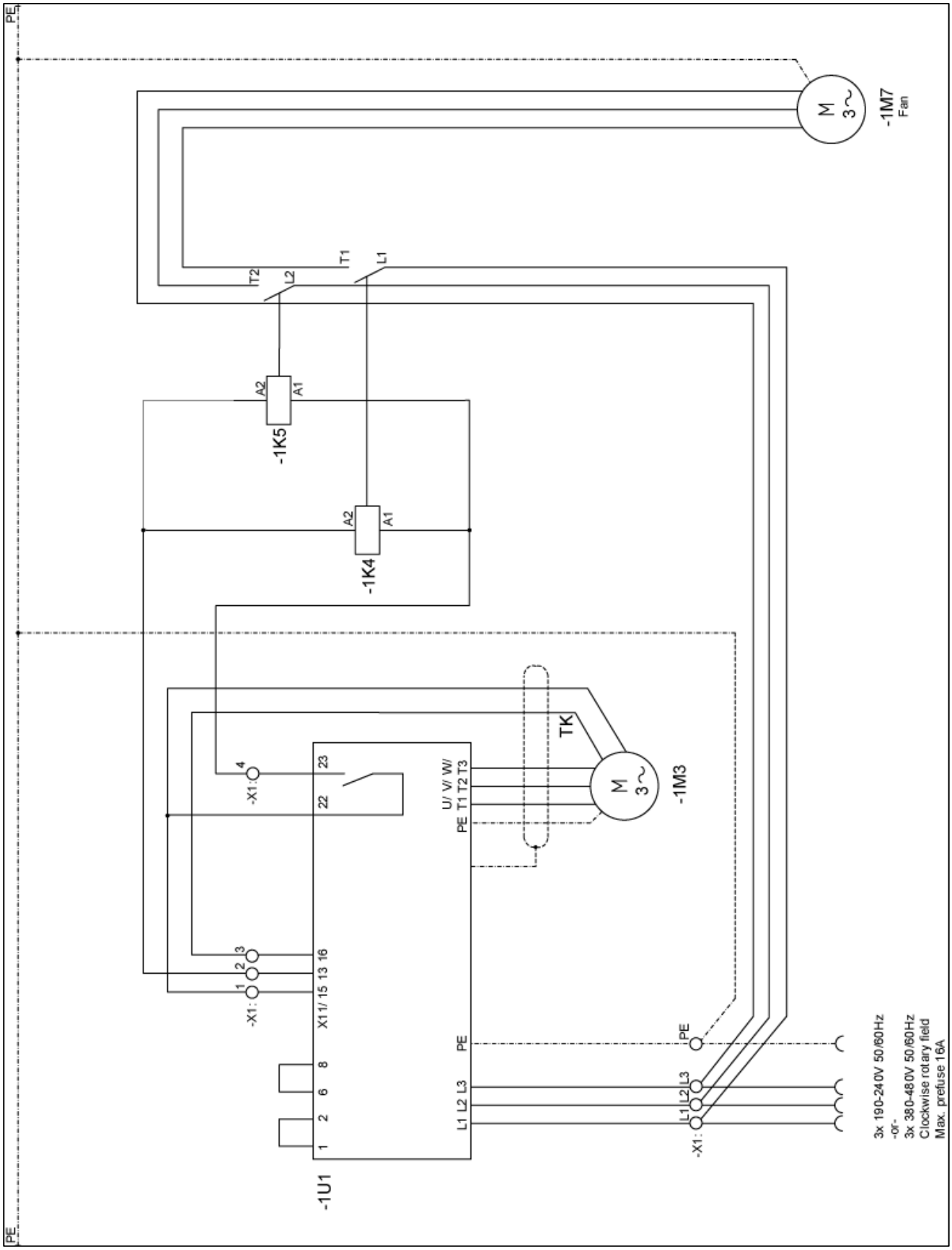


Fig. 27: Circuit diagram MV 0040 D / MV 0060 D / MV 0080 D, 3 phase

14.4 Electrical data of the terminals of the control unit

Terminal		Technical information
20	Digital output	Ready for operation, open collector
18	Analog output	Output frequency 0 V = 0 min^{-1} 10 V = n_{max}
16	Digital input 6	
15	Digital input 5	Free to use
14	Digital input 4	Reset maintenance counter
13	Mass digital output	
5	Mass	
4	Analog input 2	Busch pressure transmitter 4 … 20 mA 0 … 1 bar abs.
10	Digital input 3	Reset failure
9	Digital input 2	Opened = rotation speed control Closed = pressure control
8	Digital input 1	Opened = stop Closed = start
7	Ground of the digital inputs	
6	24 V output	
3	Mass	
2	Analog input 1	Rotation speed control: 0 V / 0 mA = n_{min} = 1,200 min^{-1} 10 V / 20 mA = n_{max} Target value of the pressure control 0 V / 0 mA = 0 bar abs. 10 V / 20 mA = 1 bar abs.
1	10 V output	
A	RS485	
B	RS485	

Tab. 10: Electrical data of the terminals of the control unit

15 Technical data

	Unit	VO 0040 B	VO 0060 B	VO 0080 B
Rated intake capacity (50/60 Hz)	m^3/h	40	60	80
Final pressure	hPa (mbar) abs.	40		
Rated output of motor (50 / 60 Hz) (motor and fan wheel)	kW	1.3	1.7	2.1
Motor nominal rotation speed	min^{-1}	1200 … 4200	1200 … 4200	1200 … 4800
Sound pressure level according to EN ISO 2151 (at 50 Hz)	dB(A)	62	68	71
Ambient temperature range	°C	0 … +40		
Ambient pressure		Atmospheric pressure		
Installation height		100 % power without reduction up to 1,000 m Reduction 1 % / 100 m between 1,000 and 3,000 m		
Permissible stationary oscillations: sinusoidal		3 Hz < f < 8.43 Hz: 7.5 mm 8.43 Hz < f < 200 Hz: 2 g 3M6 according to IEC 60721-3-3		
Oil volume	l	0.6		
Oil type		see oil chap. 16		
Weight	kg	154	159	159
Power supply network		TN and TT network (vacuum system cannot be used in asymmetrically grounded mains)		
Immunity		EN 61800-3, environment classes 1 and 2		
Emissions		Standard according to EN 61800-3 class C2		
Certificates (vacuum pump)		All relevant components are UL, CSA or UR certified		

Tab. 11: Technical data

16 Gear oil

	VSB 100
ISO-VG	100
Oil type	Synthetic oil
Part number 1 l packaging	0831 168 351
Part number 5 l packaging	0831 168 352

Tab. 12: Gear oil

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: **VO 0040 B, VO 0060 B, VO 0080 B**

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:

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Maulburg, 01/07/2021

Dr.-Ing Karl Busch, general manager

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