Instruction Manual

Mink

Claw Vacuum Pumps

MM 1104 BV, MM 1144 BV, MM 1102 BV, MM 1142 BV

VACUUM APP

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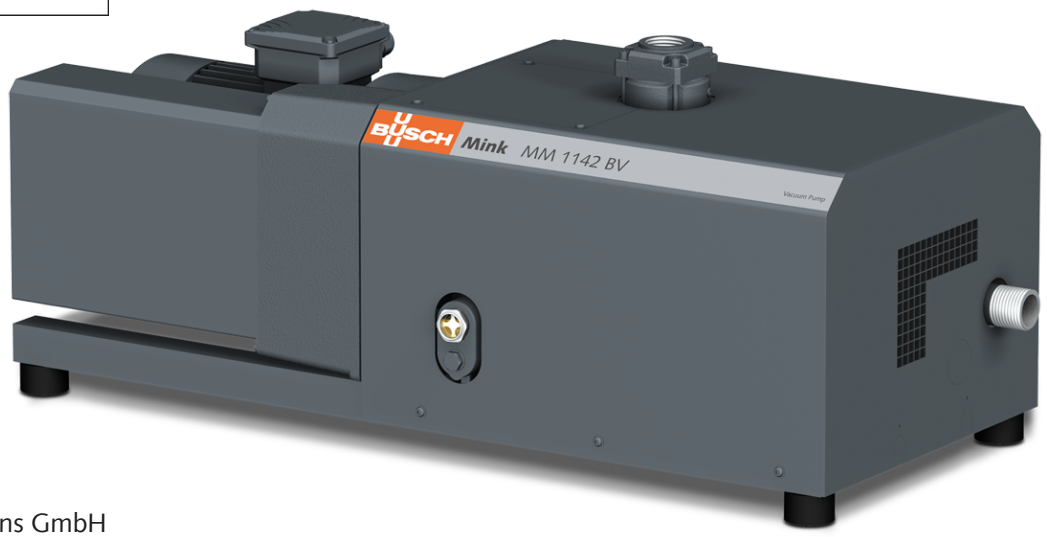

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Germany

0870138061/A0004_en / Original instructions / Modifications reserved

02/05/2019

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1 Safety

Prior to handling the machine, this instruction manual should be read and understood. If anything needs to be clarified, please contact your Busch representative.

Read this manual carefully before use and keep for future reference.

This instruction manual remains valid as long as the customer does not change anything on the product.

The machine is intended for industrial use. It must be handled only by technically trained personnel.

Always wear appropriate personal protective equipment in accordance with the local regulations.

The machine has been designed and manufactured according to state-of-the-art methods. Nevertheless, residual risks may remain. This instruction manual highlights potential hazards where appropriate. Safety notes and warning messages are tagged with one of the keywords DANGER, WARNING, CAUTION, NOTICE and NOTE as follows:

DANGER

... indicates an imminent dangerous situation that will result in death or serious injuries if not prevented.

WARNING

... indicates a potentially dangerous situation that could result in death or serious injuries.

CAUTION

... indicates a potentially dangerous situation that could result in minor injuries.

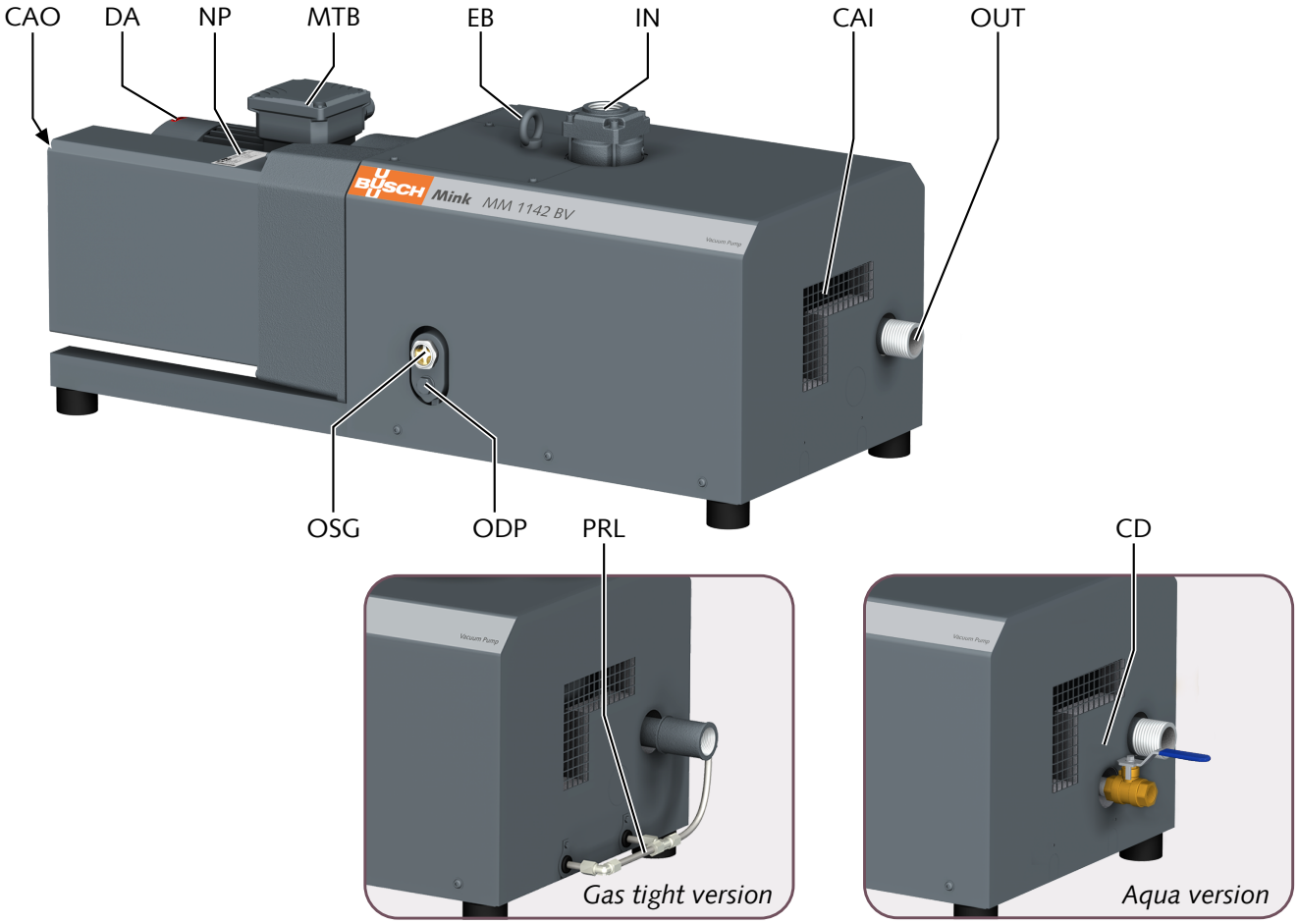
NOTICE

... indicates a potentially dangerous situation that could result in damage to property.

NOTE

... indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.

2 Product Description



The machine appearance may differ from the illustration.

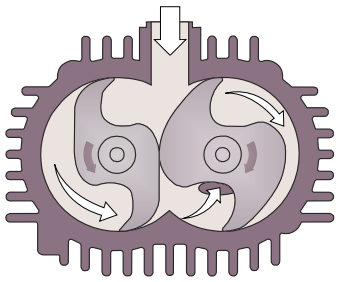
IN	Suction connection	ODP	Oil drain plug
OUT	Discharge connection	CAI	Cooling air inlet
OSG	Oil sight glass	CAO	Cooling air outlet
NP	Nameplate	CD	Condensate drain
MTB	Motor terminal box	EB	Eye bolt
DA	Directional arrow	PRL	Pressure relief line

NOTE

Technical term.

In this instruction manual, we consider that the term ‘machine’ refers to the ‘vacuum pump’.

2.1 Operating Principle



The machine works on the claw principle.

The Mink MM is fully air-cooled thanks to an integrated fan in the drive unit.

2.2 Application

The machine is intended for the suction of air and other dry, non-aggressive, non-toxic and non-explosive gases.

Conveying of other media leads to an increased thermal and/or mechanical load on the machine and is permissible only after a consultation with Busch.

The machine is intended for the placement in a non-potentially explosive environment.

The machine is capable of maintaining ultimate pressure, see Technical Data [▶ 22].

The machine is suitable for continuous operation.

Permitted environmental conditions, see Technical Data [▶ 22].

2.3 Design Options

The design options described in the following chapters might be combined.

Please refer to the nameplate (NP) to identify the corresponding design option of your machine.

Design option	Codification	Example
Standard (no design option)	0	MM 1104 BV**0**
Gas tight version	G	MM 1104 BV**G**
Aqua version	A	MM 1104 BV**A**

2.3.1 Gas Tight Version

⚠ WARNING

Media potentially dangerous.

Risk of poisoning!

Risk of infection!

- Wear appropriate personal protective equipment in case of high concentration of the medium in the ambient atmosphere of the machine.

The gas tight version is a design option for applications where the process gas remains in the machine and does not escape to the environment.

It is a very important feature for applications where gases potentially dangerous to human health are not allowed and the concentration of the process gas must not exceed the admissible values of the ambient atmosphere of the machine.

This machine is specifically equipped with:

- pressure relief lines
- collecting lines
- shaft seal rings.

Requirements for a proper functioning:

Ambient pressure	The gas tight machine requires an ambient pressure at the gas discharge during the whole operation range of +/- 200 hPa (mbar), unless otherwise specified on the nameplate.
Leakage rate	The machine is not absolutely gas tight. The leakage rate of the machine described in this manual is of 0.1 hPa l/s (mbar l/s) at a suction pressure of 250 mbar. It can considerably increase up to prohibited pressure values at the gas inlet/outlet due to used shaft seal rings or clogged pressure relief lines.
Ambient environment	Closed air cooling systems are not suitable and therefore prohibited. • Make sure that the machine is sufficiently vented (see Installation Conditions [▶ 8]).

2.3.2 Aqua Version

The Aqua version is a design option for conveying condensable vapours (water).

This machine is specifically equipped with:

- corrosion protection coating
- condensate drain (CD) in the internal silencer.

2.4 Optional Accessories

2.4.1 Inlet Filter

The inlet filter protects the machine against dust and other solids in the process gas. The inlet filter is available with a paper or polyester cartridge.

2.4.2 Vacuum Relief Valve

The ultimate pressure is limited by a vacuum relief valve. The vacuum relief valve is adjusted ex-works to the minimum permitted ultimate pressure (see nameplate).

3 Transport

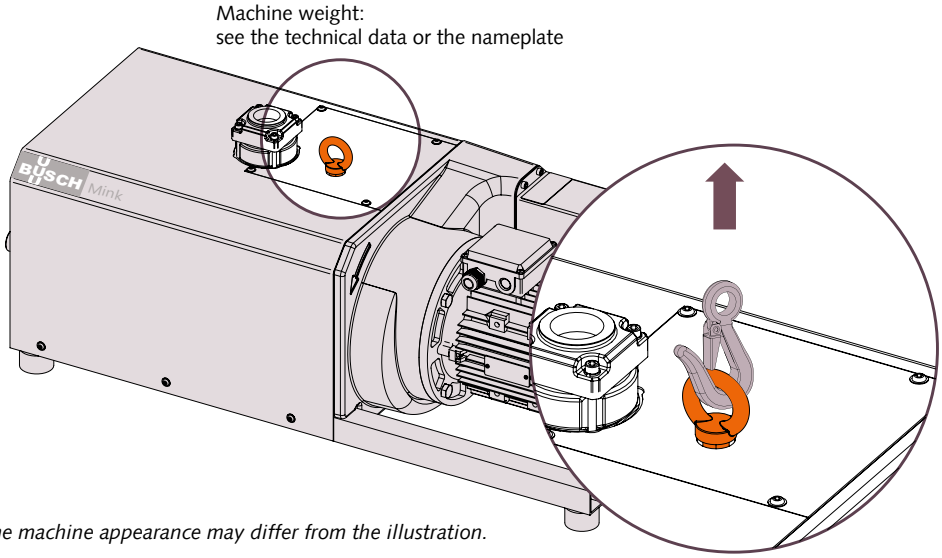
WARNING

Suspended load.

Risk of severe injury!

- Do not walk, stand or work under suspended loads.

- Make sure that the eyebolt (EB) is in faultless condition, fully screwed in and tightened by hand.



The machine appearance may differ from the illustration.

WARNING

Lifting the machine using the motor eye bolt.

Risk of severe injury!

- Do not lift the machine using the eye bolt fitted to the motor. Only lift the machine as previously shown.

- Check the machine for transport damage.

If the machine is secured to a base plate:

- Remove the machine from the base plate.

4 Storage

- Seal all apertures with adhesive tape or reuse provided caps.

If the machine is to be stored for more than 3 months:

- Wrap the machine in a corrosion inhibiting film.
- Store the machine indoors, dry, dust free and if possible in original packaging preferably at temperatures between 0 ... 40 °C.

5 Installation

5.1 Installation Conditions

WARNING

Gas tight version:
The machine is not absolutely gas tight, possible leakages of dangerous media.

Risk of poisoning!

Risk of infection!

- Make sure that the ambient atmosphere of the machine is sufficiently ventilated. Closed air cooling systems are not suitable and therefore prohibited.

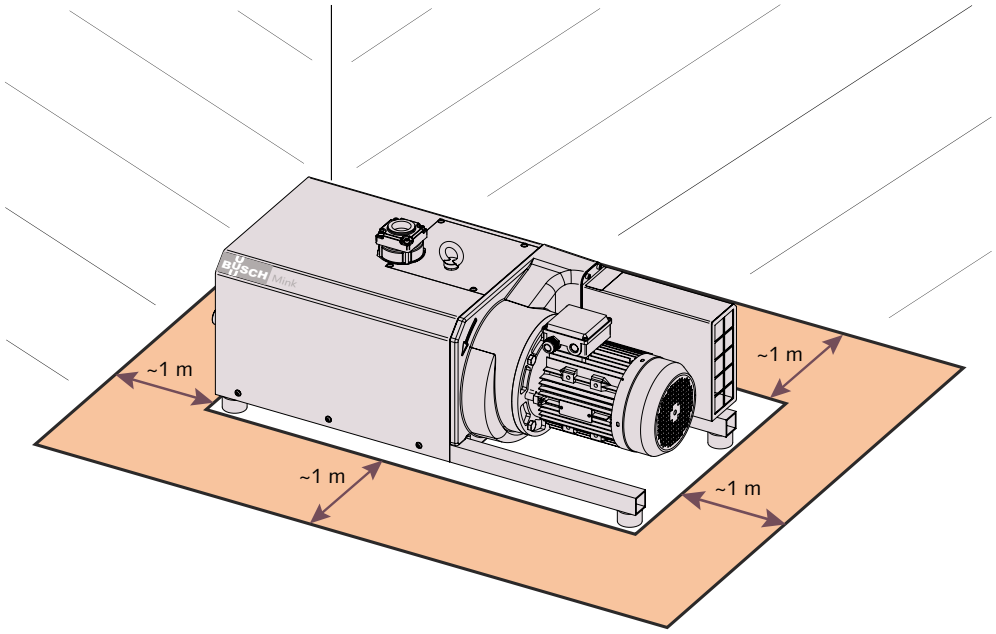
NOTICE

Use of the machine outside of the permitted installation conditions.

Risk of premature failure!

Loss of efficiency!

- Take care that the installation conditions are fully complied with.



Other values may apply after Busch approval

- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the Technical Data [▶ 22].
- Make sure that the environmental conditions comply with the protection class of the motor and the electrical instruments.
- Make sure that the installation space or location is vented such that sufficient cooling of the machine is provided.
- Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way.
- Make sure that the oil sight glass (OSG) remains easily visible.
- Make sure that enough space remains for maintenance work.

- Make sure that the machine is placed or mounted horizontally, a maximum of 1° in any direction is acceptable.
- Check the oil level, see Oil Level Inspection [▶ 14].
- Make sure that all provided covers, guards, hoods, etc. are mounted.

If the machine is installed at an altitude greater than 1000 meters above sea level:

- Contact your Busch representative, the motor should be derated or the ambient temperature limited.

5.2 Connecting Lines / Pipes

- Remove all protective caps before installation.
- Make sure that the connection lines cause no stress on the machine's connection; if necessary use flexible joints.
- Make sure that the line size of the connection lines over the entire length is at least as large as the connections of the machine.

In case of very long connection lines it is advisable to use larger line sizes in order to avoid a loss of efficiency. Seek advice from your Busch representative.

5.2.1 Suction Connection

NOTICE

Ingress of foreign objects or liquids.

Risk of damage to the machine!

If the inlet gas contains dust or other foreign solid particles:

- Install a suitable filter (5 micron or less) upstream from the machine.

Connection size:

– G1 1/4

Depending on the specific order, other connection dimensions may apply.

5.2.2 Discharge Connection

Connection size:

– G1 for MM 1104 BV, MM 1144 BV

– R1 for MM 1102 BV, MM 1142 BV

Depending on the specific order, other connection dimensions may apply.

- Make sure that the discharged gas will flow without obstruction. Do not shut off or throttle the discharge line or use it as a pressurised air source.

Unless the aspirated air is discharged to the environment right at the machine:

- Make sure that the discharge line either slopes away from the machine or provide a liquid separator or a siphon with a drain cock, so that no liquids can flow back into the machine.

5.3 Filling Oil

NOTICE

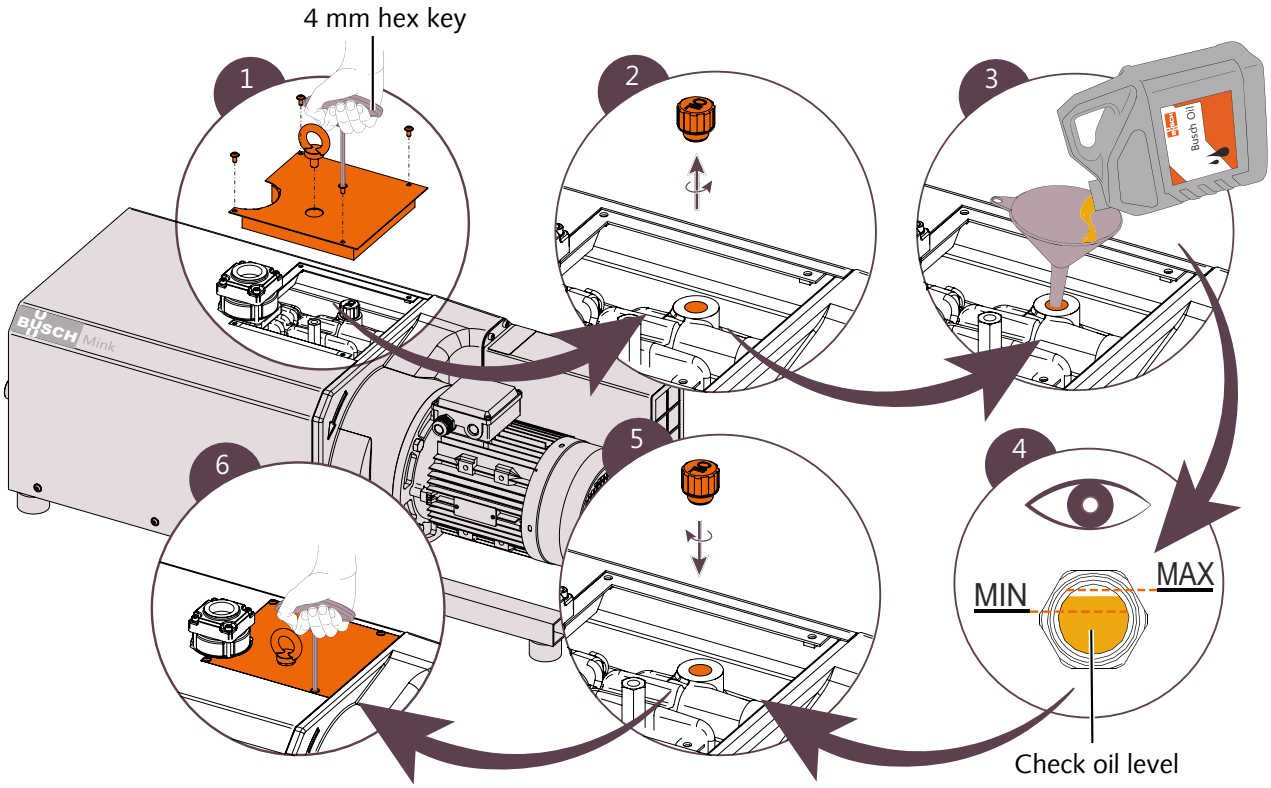
Use of an inappropriate oil.

Risk of premature failure!

Loss of efficiency!

- Only use an oil type which has previously been approved and recommended by Busch.

For oil type and oil capacity see Technical Data [▶ 22] and Oil [▶ 22].



The oil level should stay constant over the lifetime of the oil. If the level does fall, this indicates a leak and the machine requires repair.

5.4 Electrical Connection

DANGER

Live wires.

Risk of electrical shock.

- Electrical installation work must only be executed by qualified personnel.

- Make sure that the power supply for the motor is compatible with the data on the nameplate of the motor.
- The electrical installation must comply with applicable national and international standards.

- Provide a lockable disconnect switch on the power line so that the machine is completely secured during maintenance tasks.
- Provide an overload protection according to EN 60204-1 for the motor.
- Make sure that the motor of the machine will not be affected by electric or electromagnetic disturbance from the mains; if necessary seek advice from Busch.
- Connect the protective earth conductor.
- Electrically connect the motor.

NOTICE

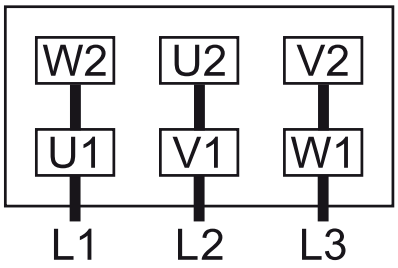
Incorrect connection.

Risk of damage to the motor!

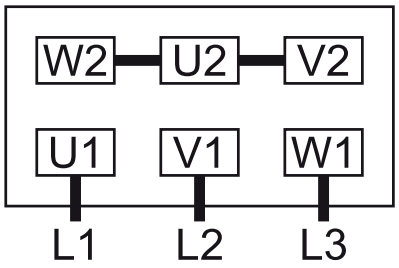
- The wiring diagrams given below are typical. Check the inside of the terminal box for motor connection instructions/diagrams.

5.4.1 Wiring Diagram Three-Phase Motor

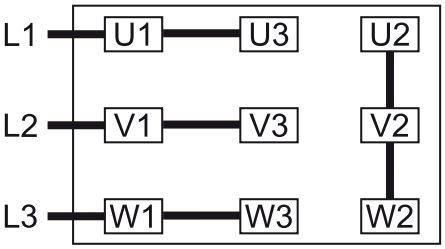
Delta connection (low voltage):



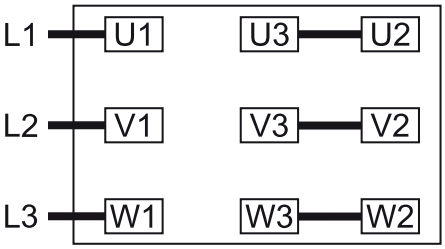
Star connection (high voltage):



Double star connection, multi-voltage motor with 9 pins (low voltage):



Star connection, multi-voltage motor with 9 pins (high voltage):



NOTICE

Incorrect direction of rotation.

Risk of damage to the machine!

- Operation in the wrong direction of rotation can destroy the machine in a short time! Prior to start-up, ensure that the machine is operated in the right direction.

- Determine the intended direction of rotation with the arrow (stuck on or cast).
- Jog the motor briefly.

If the rotation of the motor must be changed:

- Switch any two of the motor phase wires.

6 Commissioning

NOTICE

Lubricating a dry running machine (compression chamber).

Risk of damage to the machine!

- Do not lubricate the compression chamber of the machine with oil or grease.

CAUTION

During operation the surface of the machine may reach temperatures of more than 70°C.

Risk of burns!

- Avoid contact with the machine during and directly after operation.

CAUTION

Noise of running machine.

Risk of damage to hearing!

If persons are present in the vicinity of a non noise insulated machine over extended periods:

- Make sure that ear protection is being used.

- Make sure that the installation conditions (see Installation Conditions [▶ 8]) are met.
- Switch on the machine.
- Make sure that the maximum permissible number of starts does not exceed 12 starts per hour. Those starts should be spread within the hour.
- Make sure that the operating conditions comply with the Technical Data [▶ 22].

As soon as the machine is operated under normal operating conditions:

- Measure the motor current and record it as reference for future maintenance and troubleshooting work.

6.1 Conveying Condensable Vapours

Water vapour within the gas flow is tolerated within certain limits. The conveyance of other vapours shall be agreed upon with Busch.

The Aqua version is a design option for conveying condensable vapours (water).

If condensable vapours are to be conveyed:

Before process:

- Warm up the machine for approximately half an hour.

After process:

- Operate the machine for approximately another half an hour.
- Regularly drain condensate from the silencer with the drain cock.

7 Maintenance

WARNING

Machines contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

CAUTION

Hot surface.

Risk of burns!

- Prior to any action requiring touching the machine, let the machine cool down first.

NOTICE

Using inappropriate cleaners.

Risk of removing safety stickers and protective paint!

- Do not use incompatible solvents to clean the machine.

CAUTION

Failing to properly maintain the machine.

Risk of injuries!

Risk of premature failure and loss of efficiency!

- Respect the maintenance intervals or ask your Busch representative for service.

- Shut down the machine and lock against inadvertent start up.
- Vent the connected lines to atmospheric pressure.

If necessary:

- Disconnect all connections.

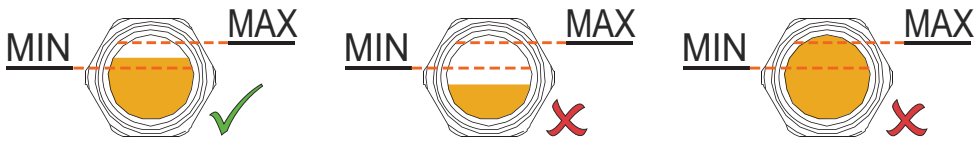
7.1 Maintenance Schedule

The maintenance intervals depend very much on the individual operating conditions. The intervals given below are desired to be considered as starting values which should be shortened or extended as appropriate. Particularly harsh applications or heavy duty operation, such as high dust loads in the environment or in the process gas, other contamination or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

Interval	Maintenance work
Monthly	In case of an inlet filter being installed: • Check the inlet filter cartridge, replace if necessary.
Every 3 months	• Check the oil level, see Oil Level Inspection [▶ 14].
Every 6 months	• Clean the machine from dust and dirt.
Gas tight version only Every 5000 hours, at the latest after 2 years	Depending on the requirements in terms of gas tightness: • Replace sealing rings (contact Busch).
Gas tight version only Every 10000 hours, at the latest after 2 years	• Check that pressure lines are not clogged, see Pressure Relief Lines Maintenance (Gas Tight Version Only) [▶ 17].
Every 20000 hours	• Change the oil. The change interval of 20000 operating hours is valid for Busch approved oils only. The change interval depends very much on the operating conditions. Borderline operation may reduce the change interval down to approximately 5000 operating hours. Other oils may reduce the change interval.
Every 6 years	• Have a major overhaul on the machine (contact Busch).

7.2 Oil Level Inspection

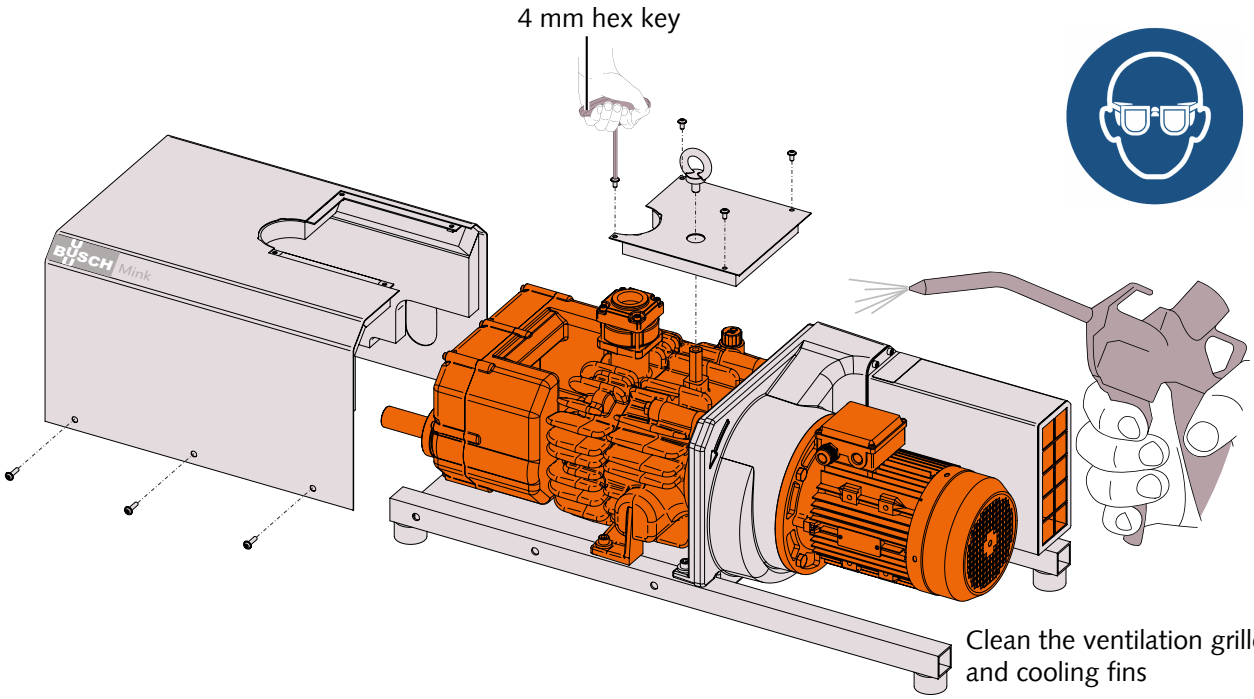
- Shut down the machine.
- When the machine is stopped, wait 1 minute before checking the oil level.



The oil level should stay constant over the lifetime of the oil. If the level does fall, this indicates a leak and the machine requires repair.

- Fill up if necessary, see Oil Filling [▶ 10].

7.3 Cleaning from Dust and Dirt



7.4 Oil Change

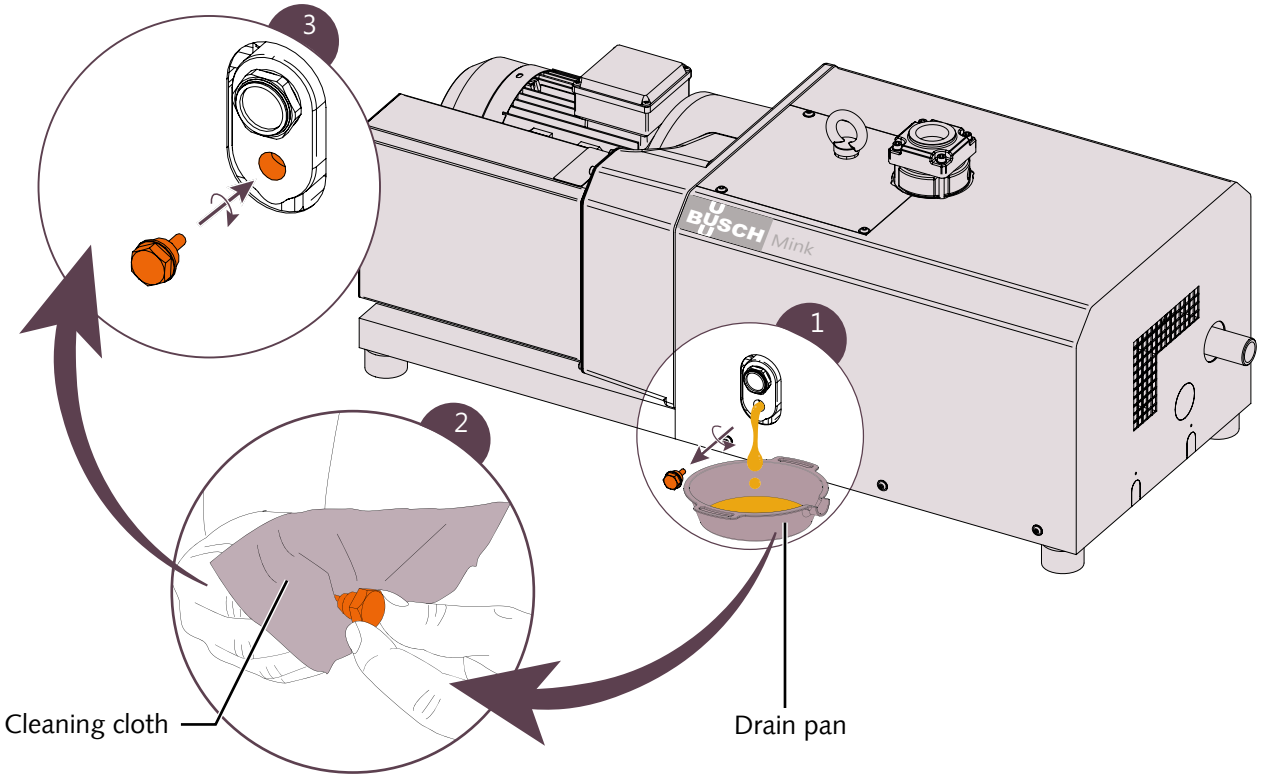
NOTICE

Use of an inappropriate oil.

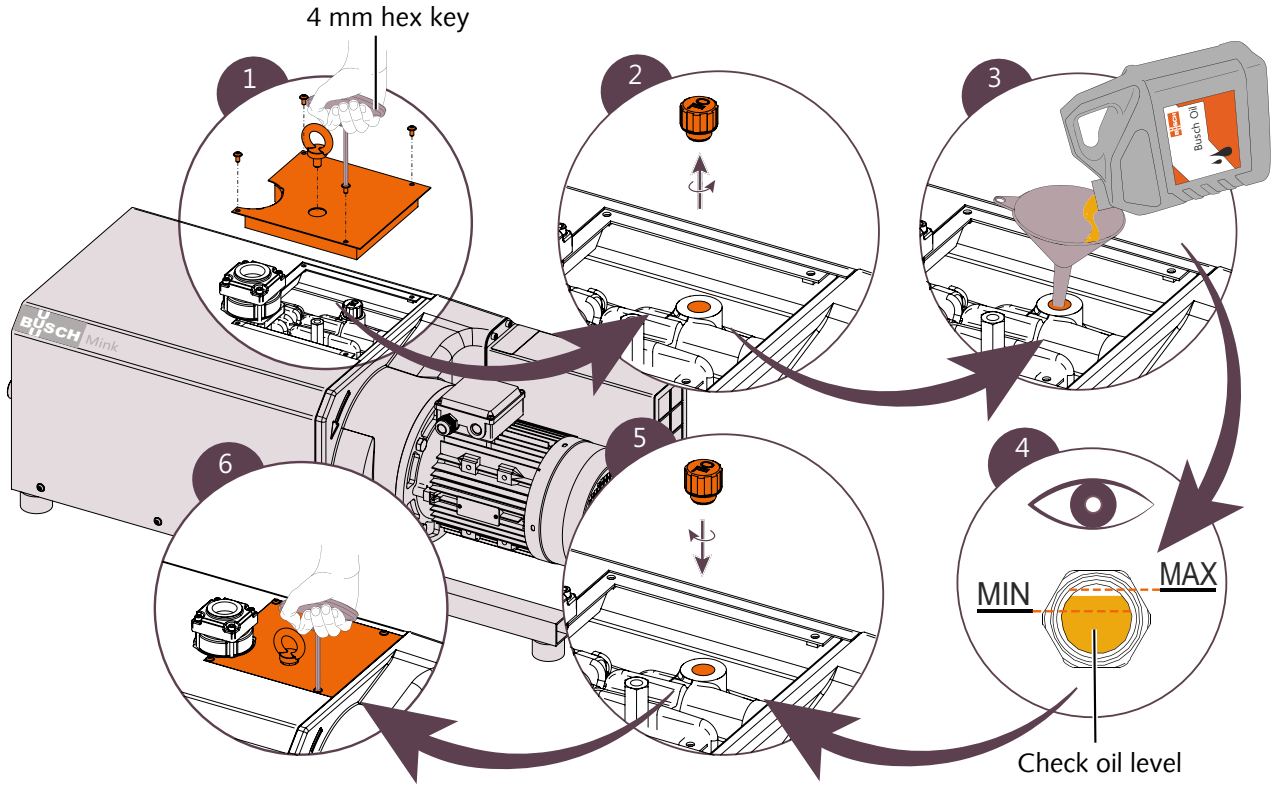
Risk of premature failure!

Loss of efficiency!

- Only use an oil type which has previously been approved and recommended by Busch.



For oil type and oil capacity see Technical Data [▶ 22] and Oil [▶ 22].



The oil level should stay constant over the lifetime of the oil. If the level does fall, this indicates a leak and the machine requires repair.

7.5 Pressure Relief Lines Maintenance (Gas Tight Version Only)

WARNING

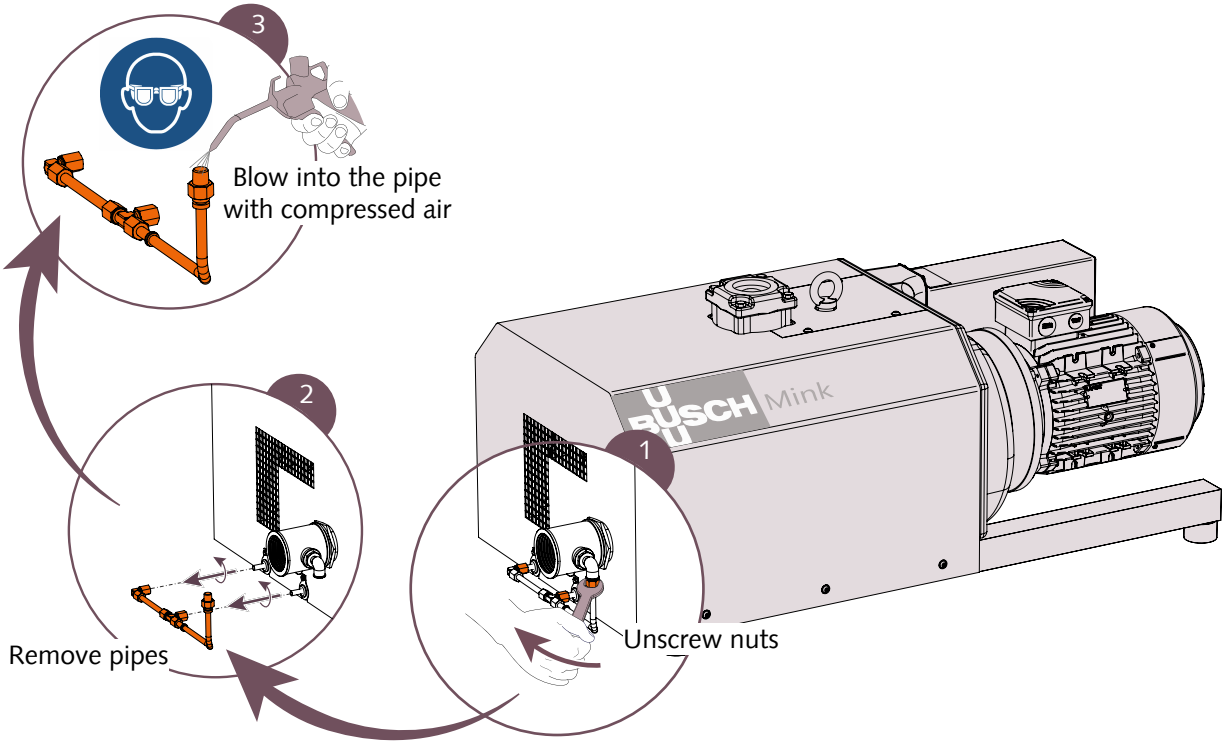
Media potentially dangerous.

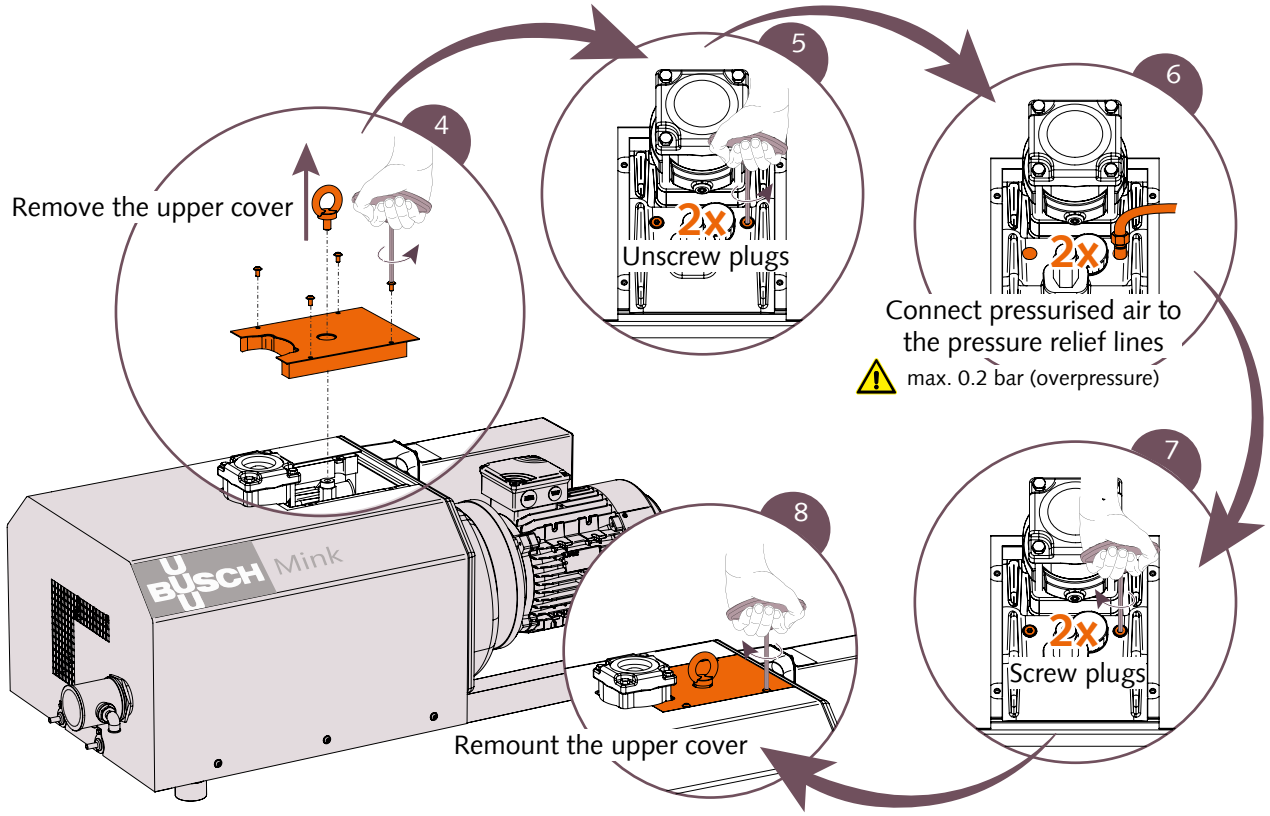
Risk of poisoning!

Risk of infection!

- Wear appropriate personal protective equipment in case of high concentration of the medium in the ambient atmosphere of the machine.

- Check that pressure relief lines (PRL) are not clogged as described in the following illustrations.





NOTICE

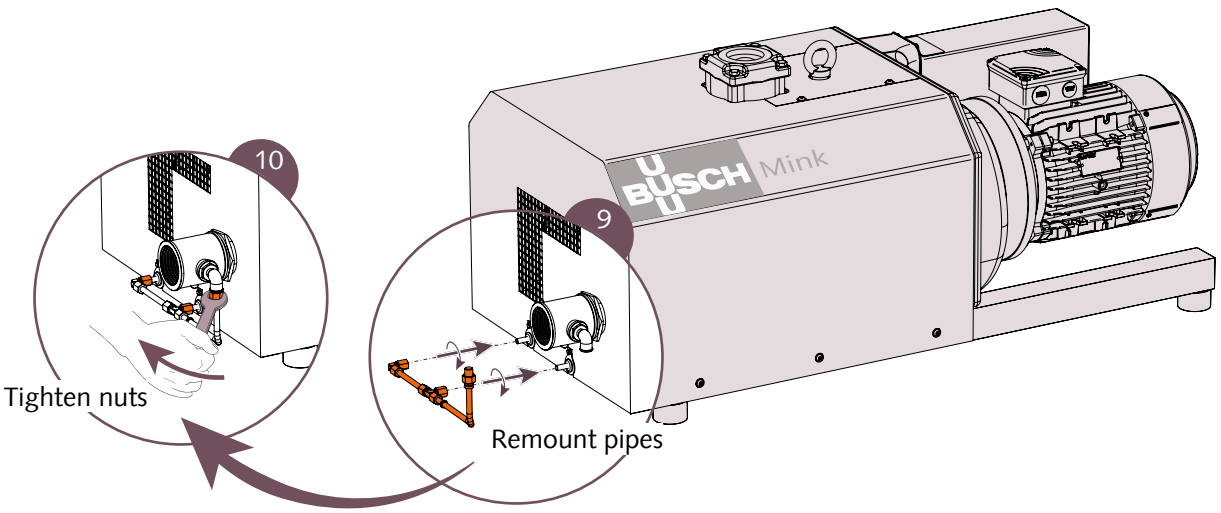
Pressurised air systems supply too high pressure.

Risk of damage to the machine!

- Adjust the pressurised air to 0.2 bar(g) by means of a pressure regulator.

In case of clogged pressure relief lines:

- Remove the clogging or have the machine repaired (contact Busch).



8 Overhaul

NOTICE

Improper assembly.

Risk of premature failure!

Loss of efficiency!

- It is highly recommended that any dismantling of the machine that goes beyond anything that is described in this manual should be done through Busch.

WARNING

Machines contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

In case of the machine having conveyed gas that was contaminated with foreign materials which are dangerous to health:

- Decontaminate the machine as much as possible and state the contamination status in a 'Declaration of Contamination'.

Busch will only accept machines that come with a completely filled in and legally binding signed 'Declaration of Contamination'.
(Form downloadable from www.buschvacuum.com)

9 Decommissioning

- Shut down the machine and lock against inadvertent start up.
- Vent the connected lines to atmospheric pressure.
- Disconnect all connections.

If the machine is going to be stored:

- See Storage [▶ 7].

9.1 Dismantling and Disposal

- Drain the oil.
- Separate special waste from the machine.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the machine as scrap metal.

10 Spare Parts

NOTICE

Use of non-Busch genuine spare parts.

Risk of premature failure!

Loss of efficiency!

- 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 no.
Oil fill plug (=Venting valve)	Includes appropriate seal ring	0543 138 026
Oil sight glass		0583 000 001
Seal ring	For oil sight glass	0480 000 271
Oil drain plug	Includes appropriate seal ring	0415 134 870
Seal ring	For oil drain plug	0482 137 352
Inlet flange lower part	Includes non-return valve	0916 102 518
Inlet screen		0534 000 018

If other parts are required:

- Contact your Busch representative for the detailed spare parts list.

11 Troubleshooting

DANGER

Live wires.

Risk of electrical shock.

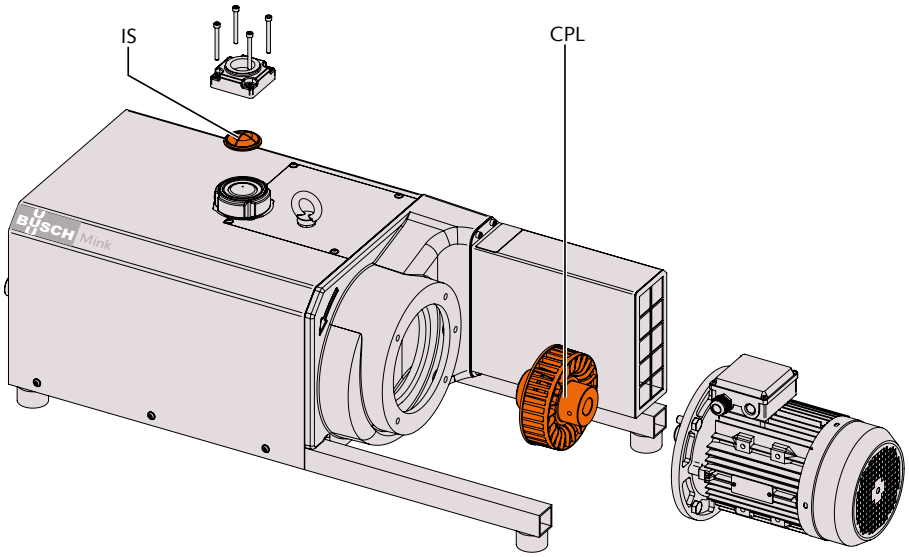
- Electrical installation work must only be executed by qualified personnel.

CAUTION

Hot surface.

Risk of burns!

- Prior to any action requiring touching the machine, let the machine cool down first.



Problem	Possible Cause	Remedy
The machine does not start.	The motor is not supplied with the correct voltage.	• Check the power supply.
	The motor is defective.	• Replace the motor.
	The coupling (CPL) is defective.	• Replace the coupling (CPL).
The machine does not reach the usual pressure on the suction connection.	The inlet screen (IS) is partially clogged.	• Clean the inlet screen (IS).
	The inlet filter cartridge (optional) is partially clogged.	• Replace the inlet filter cartridge.
	Internal parts are worn or damaged.	• Repair the machine (contact Busch).
The machine runs very noisily.	Worn coupling (CPL).	• Replace the coupling (CPL).
	Oil level too low.	• Top up oil.
	Defective bearings.	• Repair the machine (contact Busch).
The machine runs too hot.	Insufficient cooling.	• Remove dust and dirt from the machine.
	Ambient temperature too high.	• Observe the permitted ambient temperature, see Technical Data [▶ 22].
	Temperature of the process gases at the inlet too high.	• Observe the permitted gas inlet temperature, see Technical Data [▶ 22].
	Oil level too low.	• Top up oil.

For the solution of problems not mentioned in the troubleshooting chart contact your Busch representative.

12 Technical Data

		MM 1104 BV	MM 1144 BV	MM 1102 BV	MM 1142 BV
Nominal pumping speed (50Hz / 60Hz)	m³/h	62 / 75	80 / 95	110 / 135	140 / 175
Ultimate pressure	hPa (mbar) abs.	60			
Nominal motor rating (50Hz / 60Hz)	kW	1.5 / 1.7	2.2 / 2.4	3.0 / 3.5 / 1.7	3.5 / 4.8
Nominal motor speed (50Hz / 60Hz)	min^{-1}	1500 / 1800		3000 / 3600	
Permitted motor speed range	min^{-1}	600 … 1800 ► ≥60 hPa (mbar) abs.		600 … 3600 ► 60 hPa (mbar) abs.	
Noise level (EN ISO 2151) at 400 hPa (mbar) abs. suction pressure (50Hz / 60Hz)	dB(A)	66 / 70		75 / 79	
Ambient temperature range	°C	0 … 40*			
Inlet gas temperature range	°C	0 … 40*			
Ambient pressure		Atmospheric pressure			
Oil capacity	l	0.85			
Weight approx. (50Hz / 60Hz)	kg	~180	~185	~180	~185/195

* In case of higher or lower temperatures, please consult your Busch representative.

13 Oil

	VS 150	VSB 100
ISO-VG	150	100
Part number 1 L packaging	0831 164 883	0831 168 351
Part number 5 L packaging	0831 164 884	0831 168 352
Remark	Standard oil for non-demanding applications	Food applications (H1)

14 EU Declaration of Conformity

This Declaration of Conformity and the CE-mark affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer. When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the CE-mark.

The manufacturer

Busch Produktions GmbH
Schauinslandstr. 1
DE-79689 Maulburg

declares that the machine(s): **Mink MM 1104 BV; MM 1144 BV; MM 1102 BV; MM 1142 BV**
has (have) been manufactured in accordance with the European Directives:

- 'Machinery' 2006/42/EC
- 'Electromagnetic Compatibility' 2014/30/EU
- 'RoHS 2' 2011/65/EU, 2017/2102, restriction of the use of certain hazardous substances in electrical and electronic equipment

and following the standards.

Standard	Title of the Standard
EN ISO 12100:2010	Safety of machinery - Basic concepts, general principles of design
EN ISO 13857:2008	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN 1012-1:2010 EN 1012-2:1996 + A1:2009	Compressors and vacuum pumps - Safety requirements - Part 1 and Part 2
EN ISO 2151:2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
EN 60204-1:2006 + A1:2009	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61000-6-2:2005	Electromagnetic compatibility (EMC) - Generic standards. Immunity 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 (1)	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design

(1) In case control systems are integrated.

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