

# MINK

Claw Vacuum Pumps  
MV 0310 B

## Instruction Manual



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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, as described in the following chapters and in accordance with the chapter *Intended Use* [→ 6]. 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.

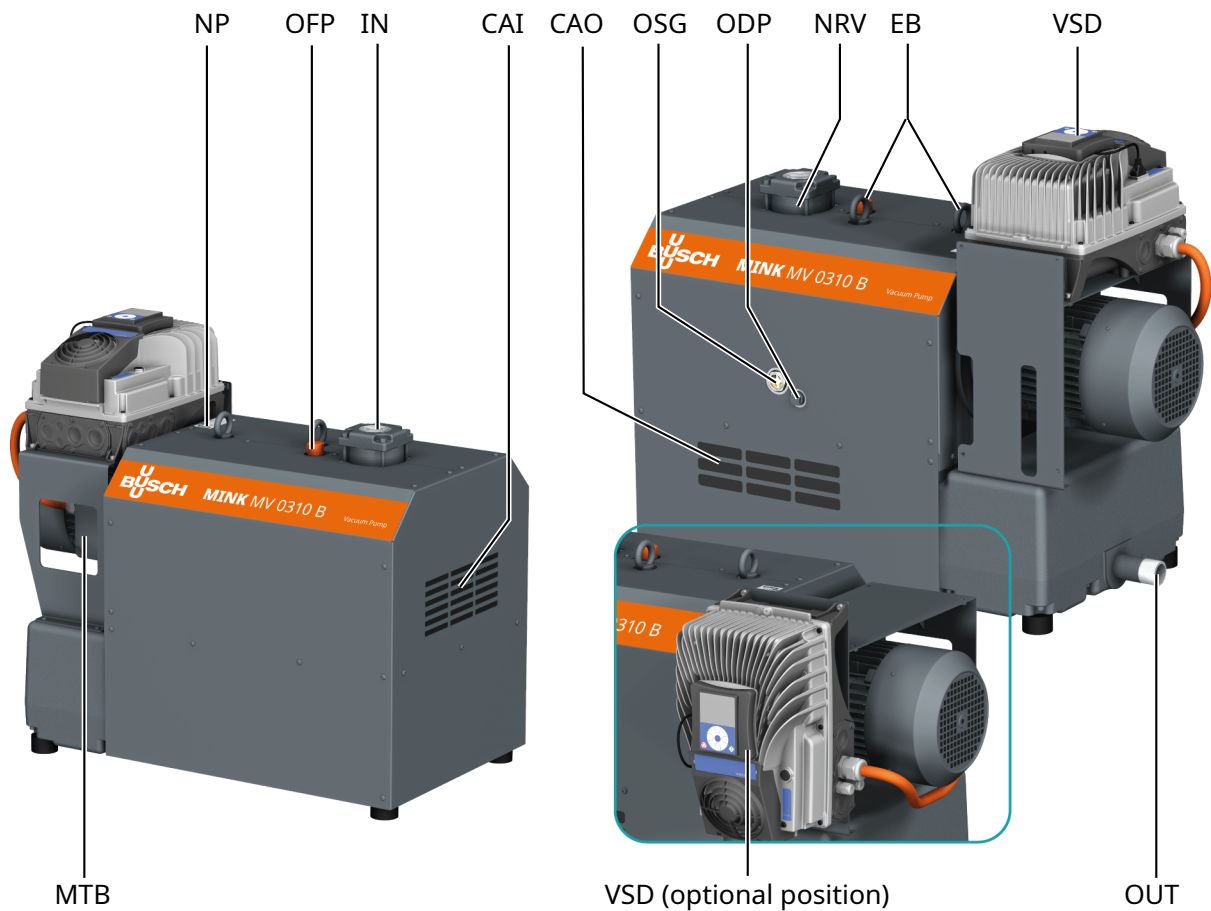


## NOTE

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

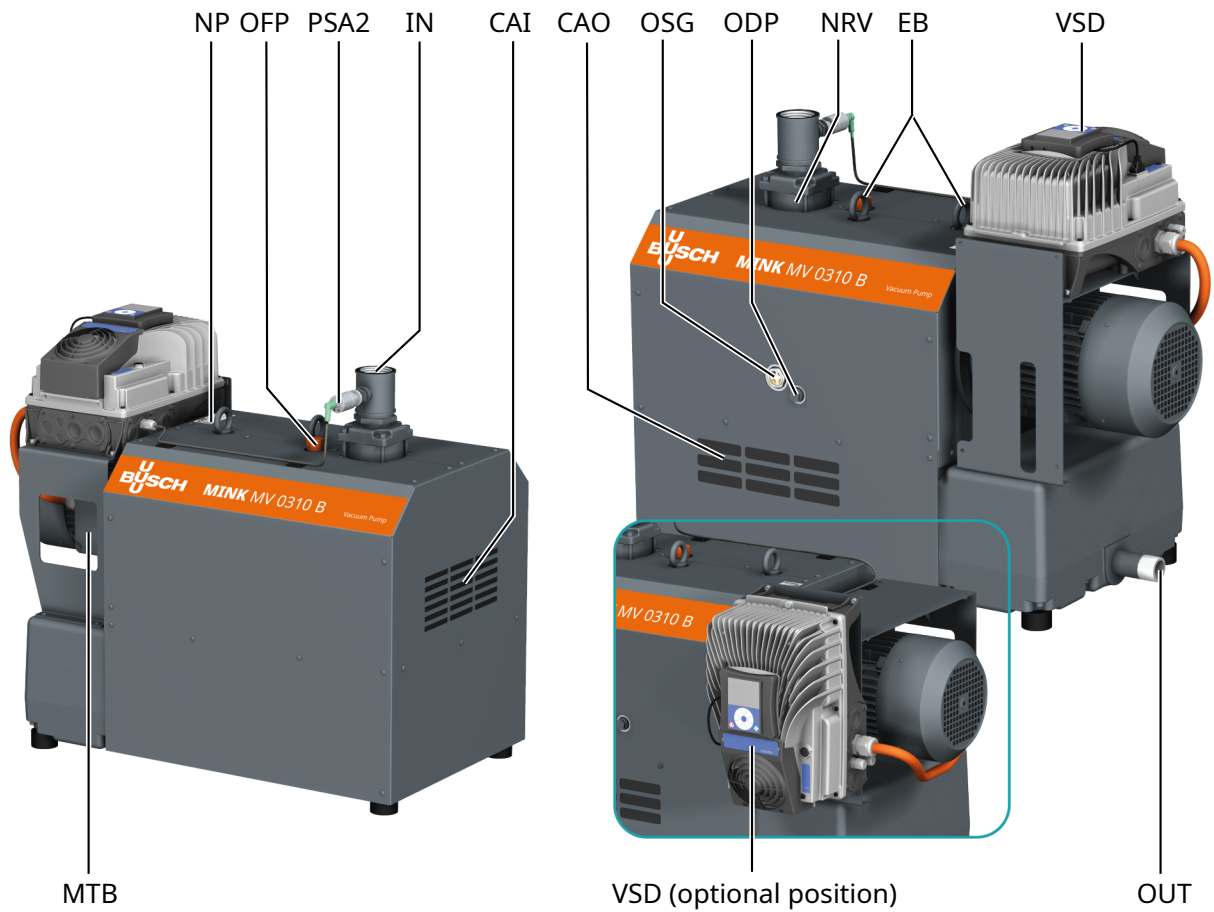
## 2 Product Description

Version: Speed Control



| Description |                                |     |                               |
|-------------|--------------------------------|-----|-------------------------------|
| IN          | Suction connection             | OUT | Discharge connection          |
| OFF         | Oil fill plug (=Venting valve) | ODP | Oil drain plug                |
| CAI         | Cooling air inlet              | CAO | Cooling air outlet            |
| OSG         | Oil sight glass                | NRV | Non-return valve (integrated) |
| MTB         | Motor terminal box             | VSD | Variable speed drive          |
| EB          | Eye bolt                       | NP  | Nameplate                     |

**Version: Pressure Control**



| Description |                                |      |  |
|-------------|--------------------------------|------|--|
| IN          | Suction connection             | OUT  | Discharge connection                                 |
| OFP         | Oil fill plug (=Venting valve) | ODP  | Oil drain plug                                       |
| CAI         | Cooling air inlet              | CAO  | Cooling air outlet                                   |
| OSG         | Oil sight glass                | NRV  | Non-return valve (integrated)                        |
| MTB         | Motor terminal box             | VSD  | Variable speed drive                                 |
| EB          | Eye bolt                       | NP   | Nameplate  |
| PSA2        | Pressure transmitter 2         | PSA1 | Pressure transmitter 1 (not shown) delivered loosely |

**i NOTE**

**Technical term.**

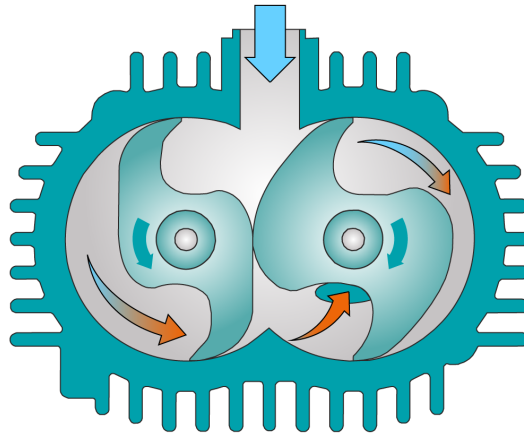
**In this instruction manual, we consider that the term 'machine' refers to the 'vacuum pump'.**

**i NOTE**

**Illustrations**

**In this instruction manual, the illustrations may differ from the machine appearance.**

## 2.1 Operating Principle



The machine works on the claw principle.

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

In order to avoid solids from entering, the machine is equipped with an inlet screen (IS).

In order to avoid reverse rotation after switching off, the machine is equipped with a non-return valve (NRV).

## 2.2 Intended Use



### WARNING

**In case of foreseeable misuse outside the intended use of the machine.**

**Risk of injuries!**

**Risk of damages to the machine!**

**Risk of damages to the environment!**

- Make sure to follow all instructions described in this manual.

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 designed for indoor installation, in case of outdoor installation, ask your Busch representative in order to take specific precautions.

The machine is not capable of maintaining ultimate pressure.

- The minimum allowed ultimate pressure is to be read from the nameplate of the machine.
- By means of process control and/or vacuum relief valves it must be made sure that the minimum allowed ultimate pressure will not be underrun.

The machine is suitable for continuous operation.

**Note:** The non-return valve (NRV) shouldn't be used as a non-return or shut off valve for the System. The non-return valve is only to protect the pump.

If the machine needs to be maintained after shutdown:

- Provide an additional manual or automatic operated non-return valve in the suction line.

Permitted environmental conditions, see *Technical Data* [→ 36].

## 2.3 Standard Features

### 2.3.1 Vacuum Relief Valve

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

If the machine operates with a variable speed drive using the pressure control mode, the ultimate pressure is limited electronically by the variable speed drive and the pressure control.

### 2.3.2 Pressure Monitoring

Only for the version: **Pressure Control**

The pressure transmitter (PSA) is to detect high inlet pressure.

The additional pressure transmitter (PSA) is to detect high process gas pressure.

## 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.

## 3 Transport



### WARNING

Suspended load.

**Risk of severe injury!**

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

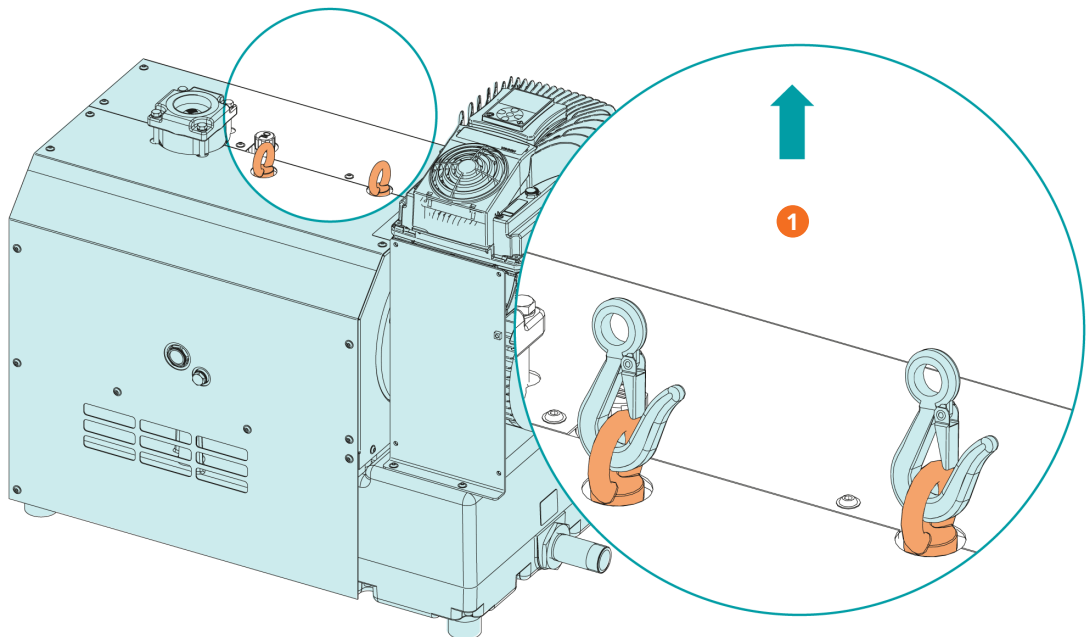


### WARNING

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 shown.
- To find out the weight of the machine, refer to the chapter *Technical Data* [→ 36] or the nameplate (NP).
- Make sure that the eye bolt(s) (EB) is/are in faultless condition, fully screwed in and tightened by hand.



#### Description

|   |                               |
|---|-------------------------------|
| 1 | Use both transport eye bolts! |
|---|-------------------------------|

- 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

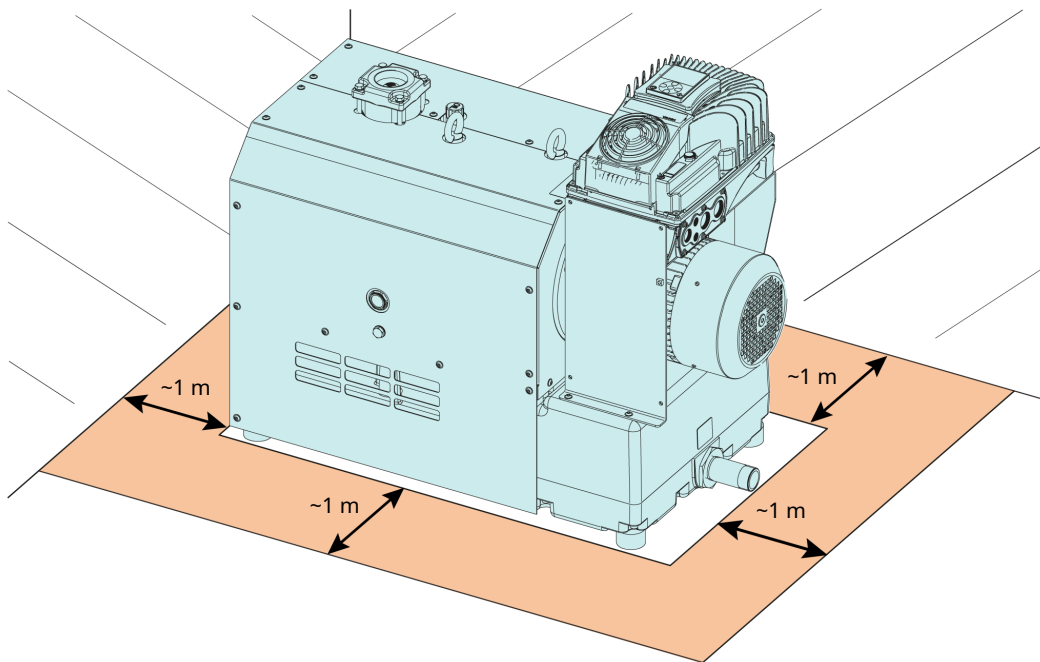
#### NOTICE

**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.



- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the *Technical Data* [→ 36].
- Make sure that the environmental conditions comply with the protection class of the motor and the electrical elements.
- Make sure that the installation space or location is protected from weather and lightning.
- 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 deviation of 1° in any direction is acceptable.
- Check the oil level, see *Oil Level Inspection* [→ 28].
- 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



### WARNING

#### Rotating Parts.

#### Risk of severe injury!

- Do not operate the machine without suction / discharge connection installed.

- Remove all protective covers before installation.
- Make sure that the connection lines cause no stress on the connection of the machine; 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 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.



### NOTICE

#### Flow of potential condensate from the piping to the vacuum pump.

#### Risk of damage to the machine!

- Make sure that the vacuum pump suction and exhaust connection pipes are installed in such a way as to prevent the flow of potential condensate from the piping to the vacuum pump.
- Busch recommends the use of the optional horizontal inlet filter and the water separator to collect the condensate and prevent it from flowing into the pump.

### 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(s):

- G2 – without inlet filter (IF)
- G2 ½ - with inlet filter (IF)

Depending on the specific configuration ordered, other connection dimensions may apply.

## 5.2.2 Discharge Connection

### ! NOTICE

**Discharge gas flow obstructed.**

**Risk of damage to the machine!**

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

Connection size(s):

- R1 1/4

Depending on the specific configuration ordered, other connection dimensions may apply.

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

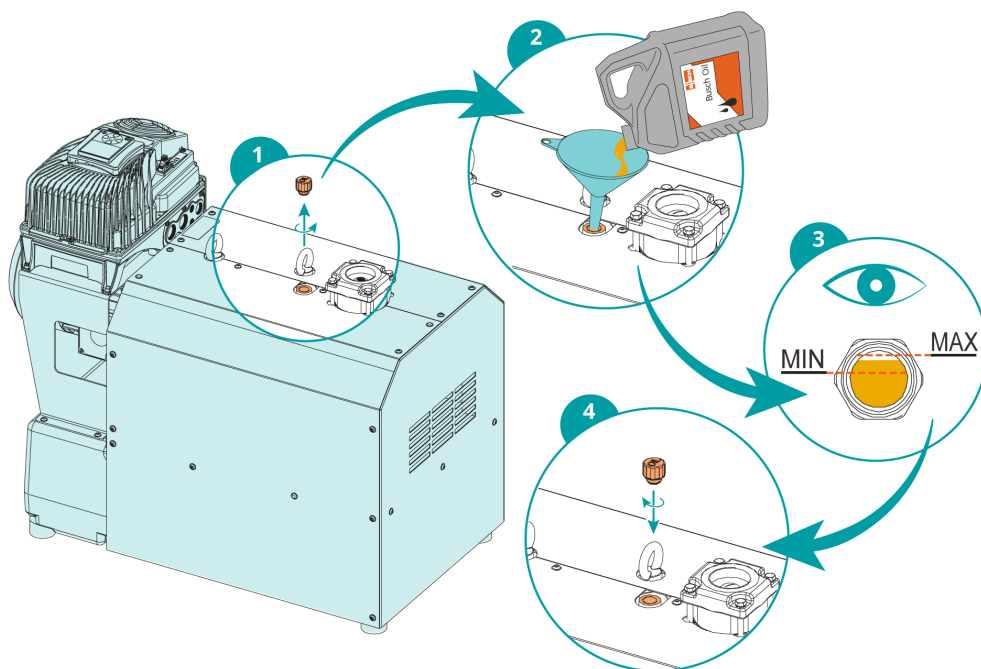
**Use of an inappropriate oil.**

**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* [→ 36] and *Oil* [→ 37].



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.

## 6 Electrical Connection



### DANGER

**Live wires.**

**Risk of electrical shock.**

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

#### CURRENT PROTECTION OF THE CUSTOMER INSTALLATION:



### DANGER

**Missing current protection.**

**Risk of electrical shock.**

- Current protection according to EN 60204-1 must be insured by the customer on its installation.
- The electrical installation must comply with the applicable national and international standards.



### NOTICE

**Electromagnetic compatibility.**

- 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.
- Make sure that the EMC of the machine is compliant with the requirements of your supply network system, if necessary provide further interference suppression (EMC of the machine, see *EU Declaration of Conformity* [→ 38] or *UK Declaration of Conformity* [→ 39]).

## 6.1 Machine delivered with a Variable Speed Drive



### NOTICE

**Incorrect connection.**

**Risk of damage to the variable speed drive!**

- The wiring diagrams given below are typical. Check the connection instructions/diagrams.
- Make sure that the power supply for the drive is compatible with the data on the nameplate of the variable speed drive.
- If the machine is equipped with a power connector, install a residual current protective device to protect persons in case of isolation default.
  - Busch recommends installing a type B residual protective device suitable for the electrical installation.
- If the variable speed drive is not equipped with a lockable disconnect switch, provide it on the power line so that the machine is completely secured during maintenance tasks.
- Provide an overload protection according to EN 60204-1.
- Connect the protective earth conductor.

## 6.2 Wiring Diagram Three-Phase Motor

**NOTICE**

**Incorrect direction of rotation.**

**Risk of damage to the machine!**

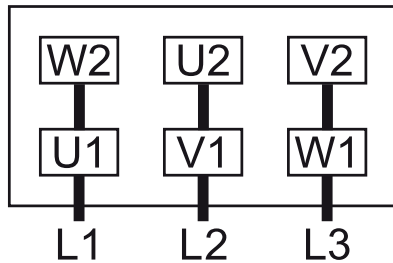
- Operation in the wrong direction of rotation can destroy the machine in a short time! Prior to start-up, ensure that the machine is operated in the right direction.

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

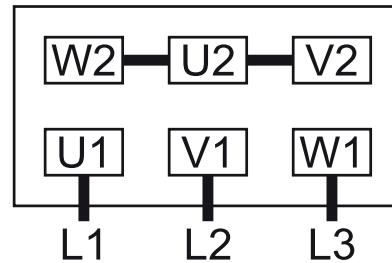
If the rotation of the motor must be changed:

- Switch any two of the motor phase wires.

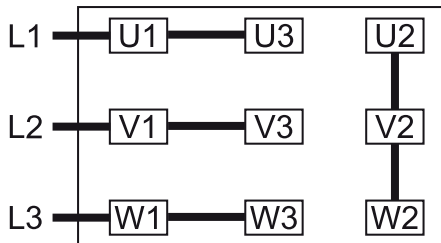
Delta connection (low voltage):



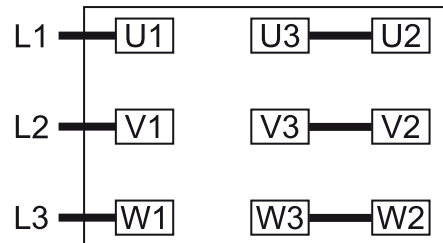
Star connection (high voltage):



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



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



## 6.3 Wiring Diagram Variable Speed Drive (VSD)

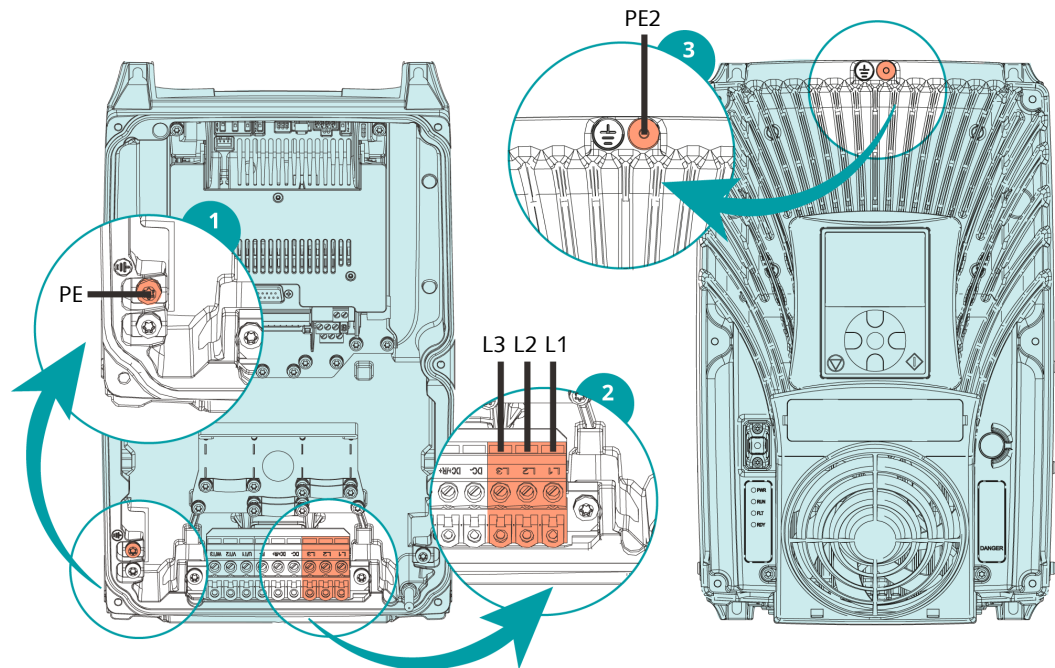


### CAUTION

The machine can start immediately when power is supplied.

**Risk of inadvertent start-up!**

- Make sure that a start-up will not lead to a dangerous situation.



The leakage current exceeds 3.5 mA (AC). According to EN 61800-5-1 an additional protective earth conductor (PE2) must be provided:

- Connect the additional protective earth conductor (PE2). Use at least the same cross section as for PE.

# 7 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 to wear hearing protection.
- Make sure that the *Installation Conditions* [→ 10] are met.
- Start the machine.

## NOTICE

**Frequent starts and stops by connecting and disconnecting from the power supply.**

**Risk of damage to the machine!**

Starting the machine by connecting and disconnecting the power supply is permitted max. 1x per minute. Between disconnecting and connecting at least 10 seconds must have been passed. If the process requires more frequent starts/stops of the machine:

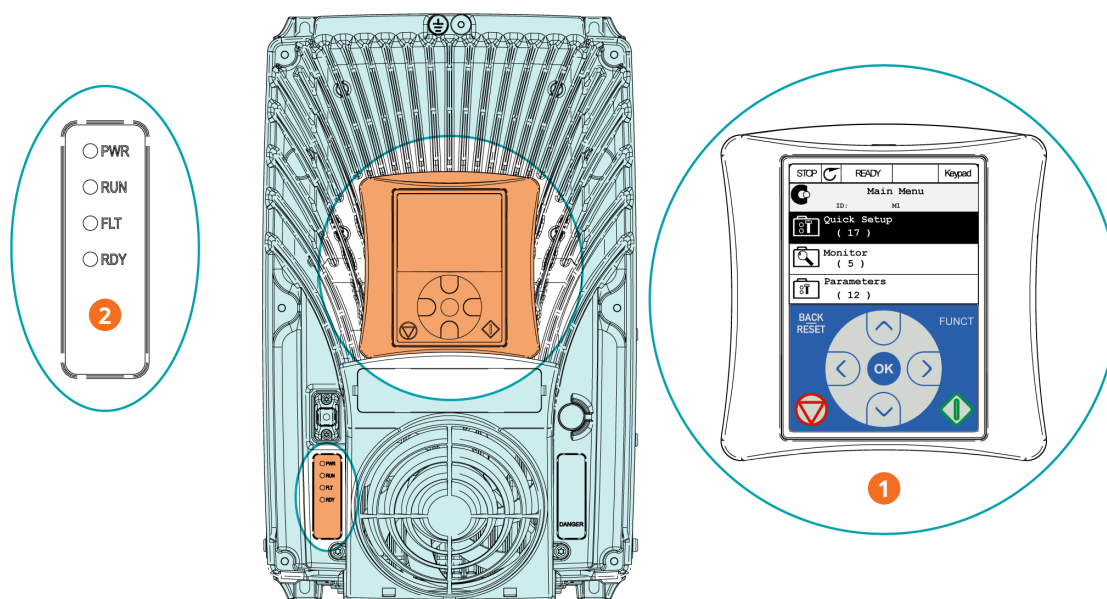
- Use the digital start signal.
- Maximum permissible number of starts by using the digital signal: unlimited

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.



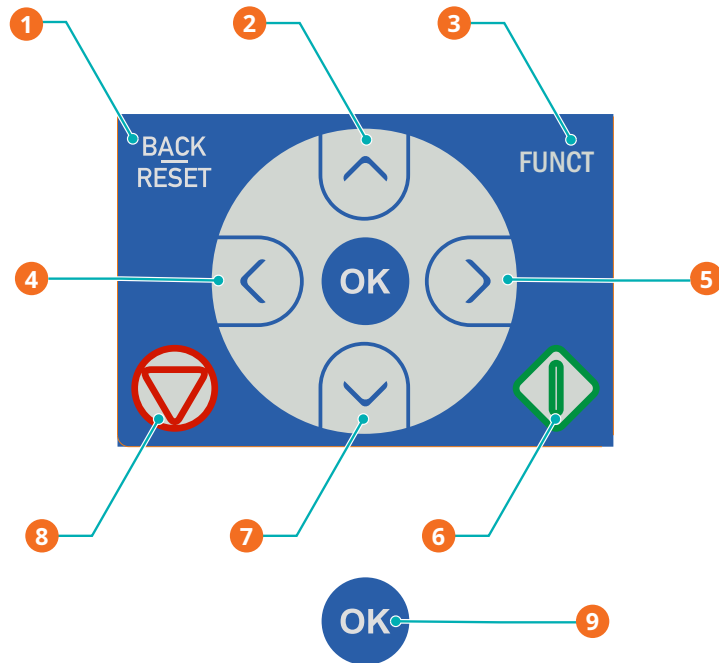
## 7.1 Variable Speed Drive Overview



| Description |              |
|-------------|--------------|
| 1           | Control unit |
| 2           | LED display  |

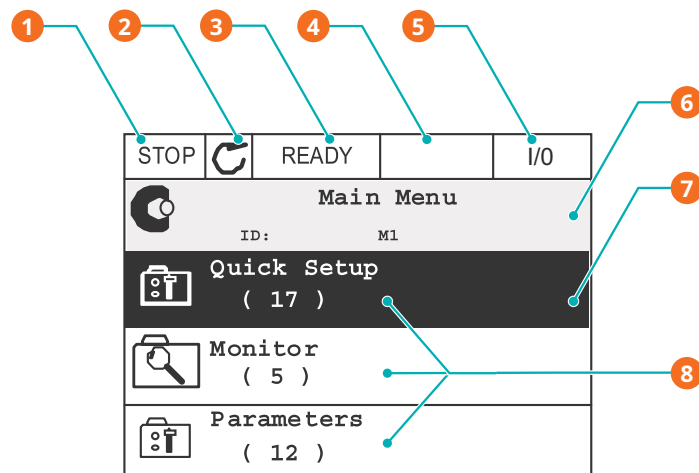
| LED | Description   |
|-----|---|
| PWR | Lights when the machine is connected to the power supply.   |
| RUN | Lights during operation of the machine.   |
| FLT | Lights when a fault occurs.   |
| RDY | Lights when the machine is ready for operation and no faults occur.<br>Blinks in case of a warning. |

## Key Overview



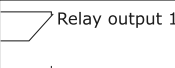
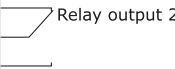
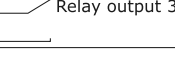
| Description |   |   |                                |
|-------------|---|---|--------------------------------|
| 1           | Move backward in menu; Exit edit mode; Reset faults with long press | 2 | Scroll menu up; increase value |
| 3           | Change control place; Access control page; Change direction         | 4 | Mover cursor left              |
| 5           | Move cursor right   | 6 | Start button                   |
| 7           | Scroll menu down; decrease value                                    | 8 | Stop button                    |
| 9           | Enter active level/item; Confirm selection                          |   |                                |

## Display Overview



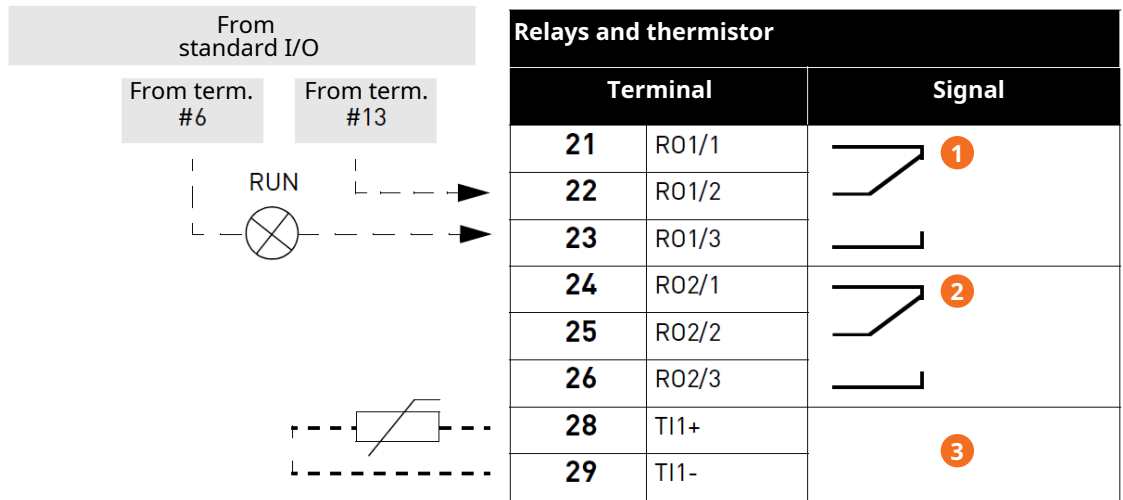
| Description |   |   |  |
|-------------|---|---|--|
| 1           | Status field STOP/RUN                     | 2 | Direction  |
| 3           | Status field<br>READY/NOT READY/FAULT     | 4 | ALARM  |
| 5           | Control place:<br>PC/I/O/KEYPAD/FIELDBUS  | 6 | Location field<br>(Parameter ID number<br>and current menu location) |
| 7           | Activated group/item<br>Press OK to enter | 8 | Number of items in the group   |

## 7.1.1 Overview I/O Connection

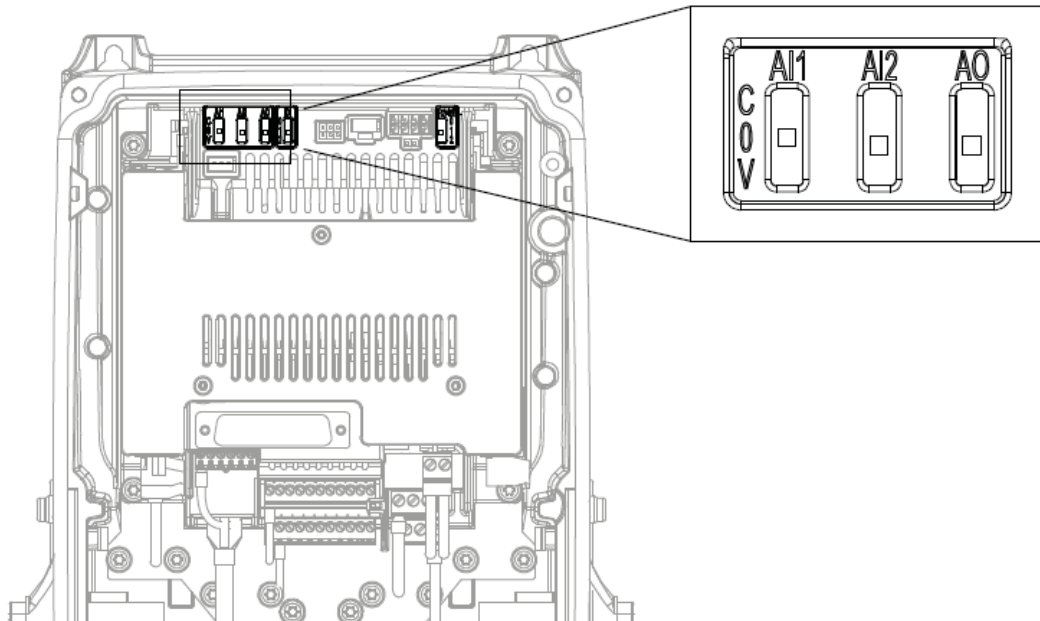
| Standard I/O board |          |  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
|--------------------|----------|--|--|---|-----|------------|------|------|----------------|--------|------|----------------|------|--------|----------------|--------|--------|----------------|
| Terminal           | Signal   | Description  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 1                  | +10Vref  | Reference output   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 2                  | AI1+     | Analogue input 1 +   | Frequency reference<br>(default 0...10V)   |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 3                  | AI1-     | Analogue input 1 -   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 4                  | AI2+     | Analogue input 2 +   |  | Frequency reference<br>(Default 4...20mA) |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 5                  | AI2-     | Analogue input 2 -   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 6                  | 24Vout   | 24V auxiliary voltage  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 7                  | GND      | I/O ground   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 8                  | DI1      | Digital input 1  | Start forward  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 9                  | DI2      | Digital input 2  | Start reverse *  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 10                 | DI3      | Digital input 3  | External fault   |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 11                 | CM       | Common for DI1-DI6   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 12                 | 24 V out | 24V auxiliary voltage  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 13                 | GND      | I/O ground   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 14                 | DI4      | Digital input 4  | <table border="1"> <thead> <tr> <th>DI4</th> <th>DI5</th> <th>Freq. ref.</th> </tr> </thead> <tbody> <tr> <td>Open</td> <td>Open</td> <td>Analog input 1</td> </tr> <tr> <td>Closed</td> <td>Open</td> <td>Preset Freq. 1</td> </tr> <tr> <td>Open</td> <td>Closed</td> <td>Preset Freq. 2</td> </tr> <tr> <td>Closed</td> <td>Closed</td> <td>Preset Freq. 3</td> </tr> </tbody> </table> | DI4                                       | DI5 | Freq. ref. | Open | Open | Analog input 1 | Closed | Open | Preset Freq. 1 | Open | Closed | Preset Freq. 2 | Closed | Closed | Preset Freq. 3 |
| DI4                | DI5      | Freq. ref.   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| Open               | Open     | Analog input 1   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| Closed             | Open     | Preset Freq. 1   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| Open               | Closed   | Preset Freq. 2   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| Closed             | Closed   | Preset Freq. 3   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 15                 | DI5      | Digital input 5  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 16                 | DI6      | Digital input 6  | Fault reset  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 17                 | CM       | Common for DI1-DI6   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 18                 | AO1+     | Analogue output 1 +  | Output frequency<br>0...20mA)  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 19                 | AO1-     | Analogue output 1 -  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 30                 | +24 Vin  | 24V auxiliary input voltage  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| A                  | RS485    | Serial bus, negative   | Modbus RTU   |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| B                  | RS485    | Serial bus, positive   |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 21                 | RO1/1 NC |  Relay output 1 | RUN  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 22                 | RO1/2 CM |  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 23                 | RO1/3 NO |  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 24                 | RO2/1 NC |  Relay output 2 | FAULT  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 25                 | RO2/2 CM |  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 26                 | RO2/3 NO |  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 32                 | RO3/2 CM |  Relay output 3 | READY  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |
| 33                 | RO3/3 NO |  |  |   |     |            |      |      |                |        |      |                |      |        |                |        |        |                |

\* Selectable signals via DIP-Switch between voltage and current

I/O terminal signals for relay and thermistor terminals and connection example.



## 7.1.2 DIP-Switch



| DIP-Switch | Description  | Standard |
|------------|--|----------|
| AI1        | C = Analog input 1 operates in current mode (2 ... 20 mA)<br>0 = Analog input 1 located in test mode<br>V = Analog input 1 operates in voltage mode (2 ... 10 V)                                       | V        |
| AI2        | C = Analog input 2 operates in current mode (2 ... 20 mA)<br>0 = Analog input 2 located in test mode<br>V = Analog input 2 operates in voltage mode (2 ... 10 V)                                       | C        |
| AO1        | C = Analog output operates in current mode (2 ... 20 mA)<br>0 = Analog output located in test mode<br>V = Analog output operates in voltage mode (2 ... 10 V)  | C        |
| DI         | 0 = Digital input is isolated by grounding<br>1 = Common grounding of digital input is connected to 24 V<br>2 = Common grounding of digital input is connected to ground                               | 2        |
| RS 485     | 0 = Connection resistance 120 Ohm is connected<br>1 = Pull-Up and Pull-Down resistance of 10k Ohm for bias voltage is connected<br>2 = No timing settings and no bias voltage resistance are connected | 2        |

## 7.1.3 Speed Control

### NOTICE

Changing of any other parameters than described below.

**Risk of damage to the machine!**

- Do not change any other parameter than described below.

**NOTE: VSD parameter settings for speed control T434170442**

### NOTICE

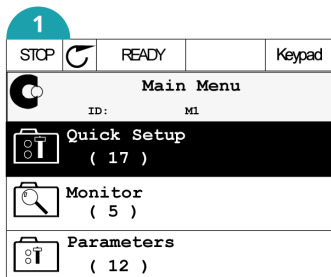
Motor speed exceeds the permitted motor speed range.

**Risk of damage to the machine!**

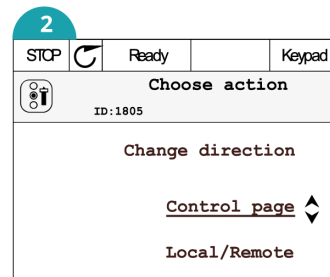
- Check the *Technical Data* [→ 36] for permitted motor speed range.
- Make sure to comply with it.

#### Change Values

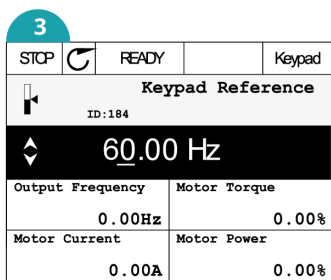
Range of settings: 20 Hz ... 60 Hz



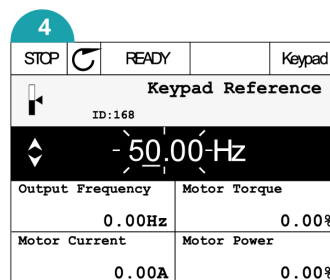
FUNCT



OK



OK



OK

## 7.1.4 Pressure Control

### **NOTICE**

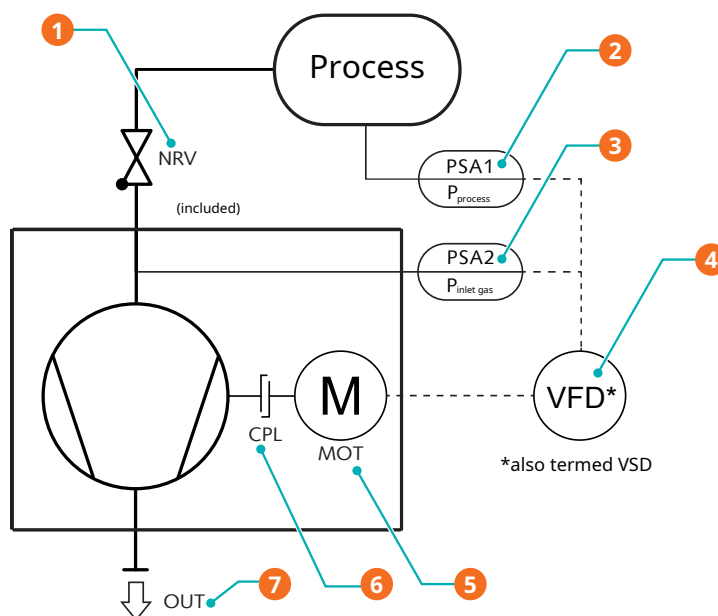
Changing of any other parameters than described below.

**Risk of damage to the machine!**

- Do not change any other parameter than described below.

**NOTE: VSD parameter settings for pressure control T434212213**

**Piping and Instrumentation Diagram**



| Description |                          |
|-------------|--------------------------|
| 1           | Non-return valve         |
| 2           | Pressure transmitter 1   |
| 3           | Pressure transmitter 2   |
| 4           | Variable-frequency drive |
| 5           | Motor                    |
| 6           | Coupling                 |
| 7           | Discharge connection     |



## Change Values

1

|                       |       |        |
|-----------------------|-------|--------|
| STOP                  | READY | Keypad |
| Main Menu<br>ID: M1   |       |        |
| Quick Setup<br>( 17 ) |       |        |
| Monitor<br>( 5 )      |       |        |
| Parameters<br>( 12 )  |       |        |

FUNCT

2

|                          |       |        |
|--------------------------|-------|--------|
| STOP                     | READY | Keypad |
| Choose action<br>ID:1805 |       |        |
| Change direction         |       |        |
| Control page             |       |        |
| Local/Remote             |       |        |

OK

3

|                            |                   |        |
|----------------------------|-------------------|--------|
| STOP                       | READY             | Keypad |
| Keypad Reference<br>ID:167 |                   |        |
| 190.00 mbar                |                   |        |
| Output Frequency           | Motor Torque      |        |
| 0.00Hz                     | 0.00%             |        |
| Motor Current              | Motor Shaft Power |        |
| 0.00A                      | 0.00%             |        |

OK

4

|                            |                   |        |
|----------------------------|-------------------|--------|
| STOP                       | READY             | Keypad |
| Keypad Reference<br>ID:167 |                   |        |
| 200.00 mbar                |                   |        |
| Output Frequency           | Motor Torque      |        |
| 0.00Hz                     | 0.00%             |        |
| Motor Current              | Motor Shaft Power |        |
| 0.00A                      | 0.00%             |        |

OK

### 7.1.4.1 Parameter settings for exact pressure control

#### PID Control Settings

##### P3.13.1.1 PID Gain

If the value of the parameter is set to 100% a change of 10% in the error value causes the controller output to change by 10%.

Preset value: 400%

##### P3.13.1.2 PID Integration Time

If this parameter is set to 1.00 second a change of 10% in the error value causes the controller output to change by 10%/s.

Preset value: 0,5 s.

#### Nominal Values

##### P3.13.2.1 Keypad SP 1

Setting the nominal value in mbar.

Preset value: 400 mbar

#### Sleep Settings

Sleep will put the machine to sleep-mode when the pressure level is steady.

##### P3.13.5.1 SP 1 Sleep Frequency

This function will put the drive into sleep mode if the set point is reached and the output frequency stays below the sleep limit for a longer time than set in the sleep delay

Preset value: 20,2 Hz

- do not set the value below 20,2 Hz, otherwise sleep-mode will be disabled.

##### P3.13.5.2 SP 1 Sleep Time Delay

Time of working at minimum frequency, before entering sleep-mode condition.

Preset value: 5s

##### P3.13.5.3 SP 1 Sleep Wake-Up Limit

Defines the PID feedback error limit for the wake-up function. The drive exits from sleep-mode if the Error exceeds this value.

Preset value: 10,0 mbar

## 7.2 Conveying Condensable Vapors

Use the machine in Aqua version for conveying water vapor or other condensable vapors. The machine in Aqua version is able to convey up to 100% saturated water vapor.

The conveyance of other vapors than water vapor shall be agreed upon with Busch.

- Make sure that any condensate from the suction side will not enter the non-operating machine.
- Before process:
  - Warm up the machine by running the machine for 30 minutes.
- After process:
  - During process condensate may occur in the machine. To remove the condensate from the machine, convey dry air at 400 mbar with the machine's maximum speed for 30 minutes, after the process and at least once a day.

## 8 Maintenance



### DANGER

**Live wires.**

**Risk of electrical shock.**

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



### 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.



### CAUTION

**Failing to properly maintain the machine.**

**Risk of injuries!**

**Risk of premature failure and loss of efficiency!**

- Maintenance work must only be executed by qualified personnel.
- Respect the maintenance intervals or ask your Busch representative for service.



### NOTICE

**Using inappropriate cleaners.**

**Risk of removing safety stickers and protective paint!**

- Do not use incompatible solvents to clean the machine.

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

If necessary:

- Disconnect all connections.

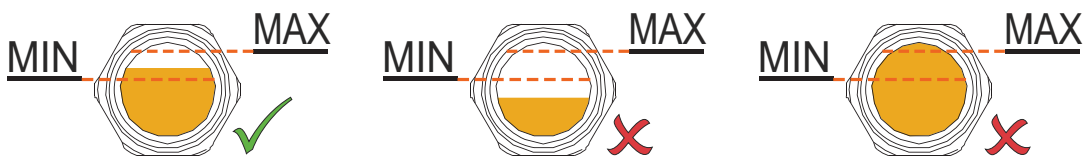
## 8.1 Maintenance Schedule

The maintenance intervals depend very much on the individual operating conditions. The intervals given below are 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           | <ul style="list-style-type: none"> <li>Check the inlet screen, clean if necessary.</li> </ul> In case of an inlet filter (IF) being installed: <ul style="list-style-type: none"> <li>Check the inlet filter cartridge, replace if necessary.</li> </ul>  |
| Every 3 months    | <ul style="list-style-type: none"> <li>Check the oil level, see <i>Oil Level Inspection</i> [→ 28].</li> </ul>  |
| Every 6 months    | <ul style="list-style-type: none"> <li>Clean the machine from dust and dirt.</li> </ul> In case of a coupling (CPL) being installed: <ul style="list-style-type: none"> <li>Check the coupling (CPL) for backlash and wear.</li> </ul>  |
| Every 20000 hours | <ul style="list-style-type: none"> <li>Change the oil.</li> </ul> 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     | <ul style="list-style-type: none"> <li>Have a major overhaul on the machine (contact Busch).</li> </ul>   |

## 8.2 Oil Level Inspection

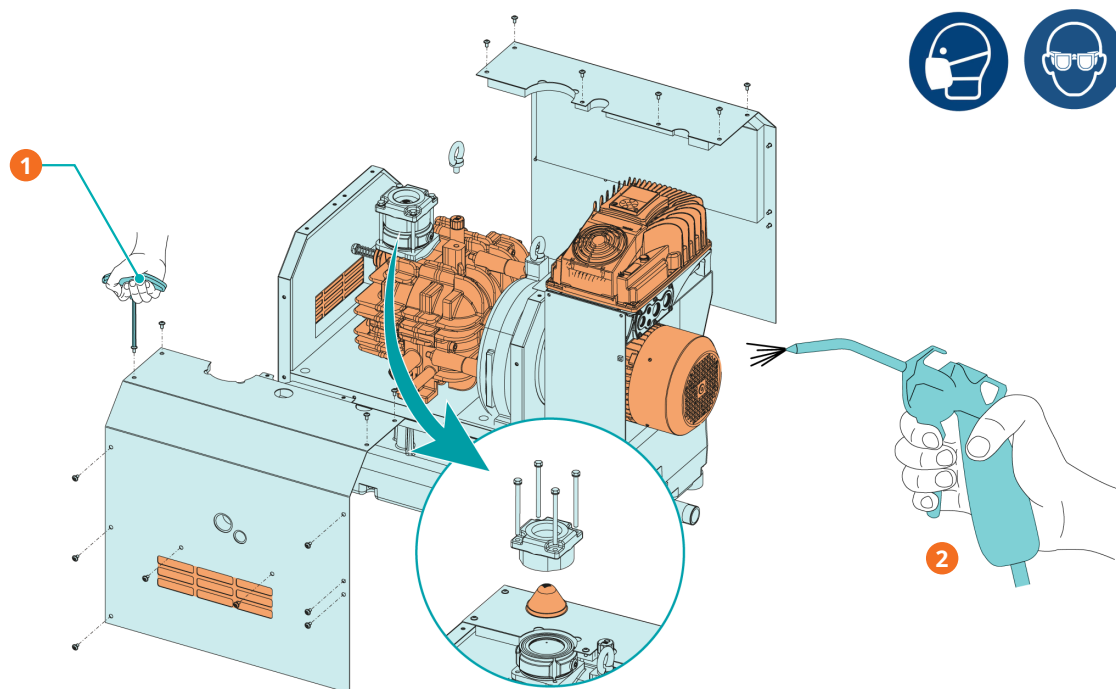
- Shut down the machine.
- When the machine is stopped, wait 1 minute before checking the oil level.



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* [→ 12].

## 8.3 Cleaning from Dust and Dirt



| Description |   |
|-------------|---|
| 1           | 4 mm hex key                                      |
| 2           | Clean the ventilation grid, fans and cooling fins |

## 8.4 Oil Change

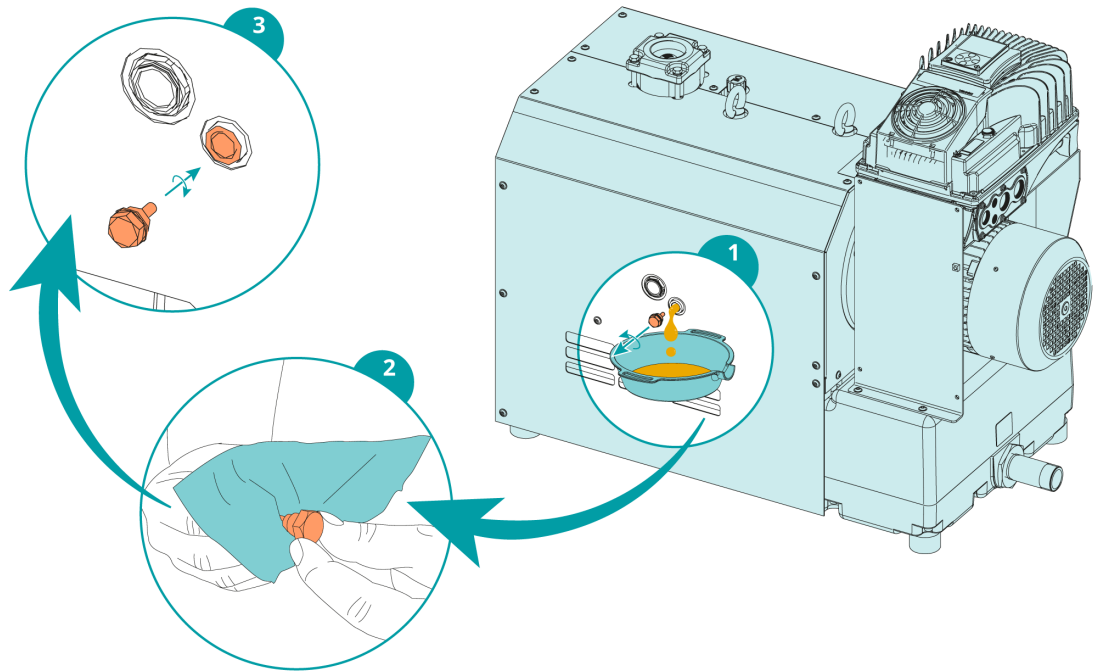
### **!** NOTICE

**Use of an inappropriate oil.**

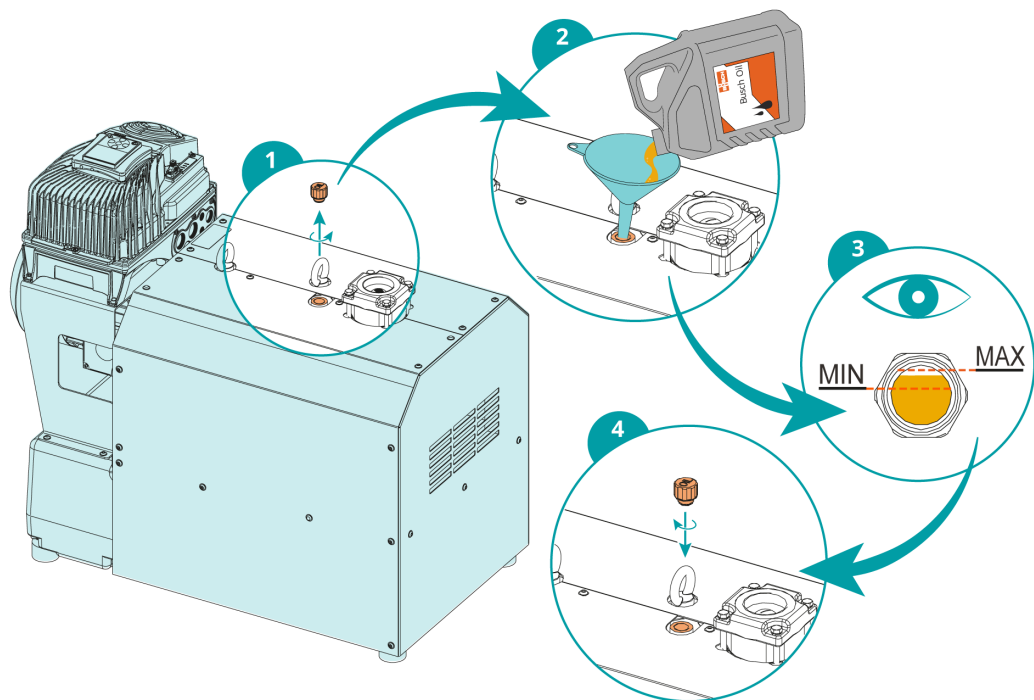
**Risk of premature failure!**

**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* [→ 36] and *Oil* [→ 37].



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.

## 9 Overhaul



### 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.



### NOTICE

**Improper assembly.**

**Risk of premature failure!**

**Loss of efficiency!**

- Any dismantling of the machine that goes beyond anything that is described in this manual should be done by Busch authorized technicians.

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](http://www.buschvacuum.com)).

## 10 Decommissioning



### 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.

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

If the machine is going to be stored:

- See *Storage* [→ 9].

### 10.1 Dismantling and Disposal

- Drain and collect the oil.
- Make sure that no oil drips onto the floor.
- Separate special waste from the machine.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the machine as scrap metal.



# 11 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 (OSG)          |                                | 0583 000 001 |
| Seal ring                      | For oil sight glass            | 0480 202 576 |
| Oil drain plug (ODP)           | Includes appropriate seal ring | 0415 134 870 |
| Inlet flange lower part        | Includes non-return valve      | 0916 000 670 |
| Inlet screen (IS)              |                                | 0534 000 041 |
| Inlet filter cartridge         | Paper                          | 0532 000 004 |
| Inlet filter cartridge         | Polyester                      | 0532 121 864 |

If other parts are required:

- Contact your Busch representative.

# 12 Troubleshooting



## DANGER

Live wires.

Risk of electrical shock.

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

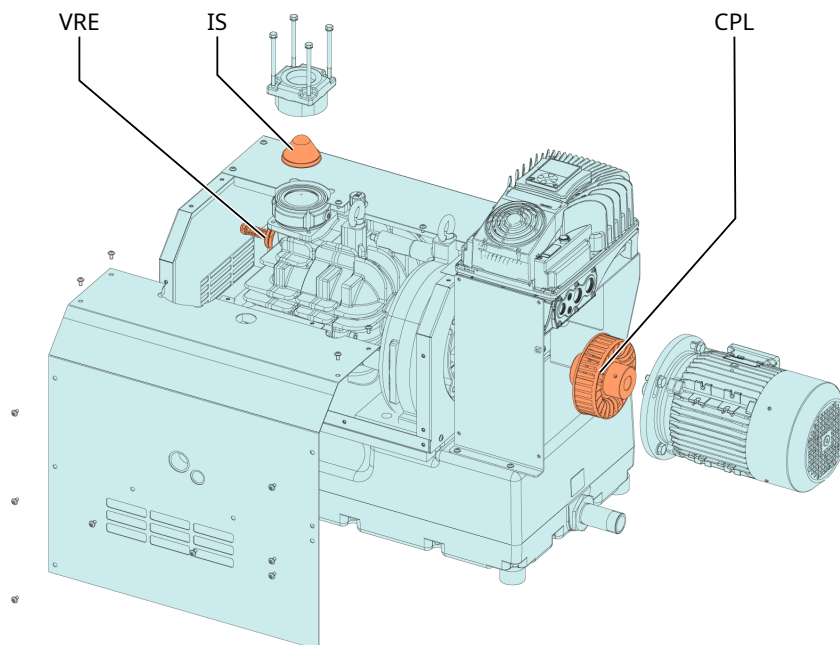


## CAUTION

Hot surface.

Risk of burns!

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



| Description |                     |     |          |
|-------------|---------------------|-----|----------|
| IS          | Inlet screen        | CPL | Coupling |
| VRE         | Vacuum relief valve |     |          |

| Problem                     | Possible Cause   | Remedy   |
|-----------------------------|--|--|
| The machine does not start. | The variable speed drive (VSD) is not supplied with the correct voltage. | <ul style="list-style-type: none"> <li>• Check the power supply.</li> </ul>                              |
|                             | The motor or the variable speed drive (VSD) is defective.                | <ul style="list-style-type: none"> <li>• Replace the motor or the variable speed drive (VSD).</li> </ul> |
|                             | The coupling (CPL) is defective.   | <ul style="list-style-type: none"> <li>• Replace the coupling (CPL).</li> </ul>                          |

| <b>Problem</b>   | <b>Possible Cause</b>                                       | <b>Remedy</b>   |
|--|---|---|
| The machine does not reach the usual pressure on the suction connection. | The inlet screen (IS) is partially clogged.                 | <ul style="list-style-type: none"> <li>• Clean the inlet screen (IS).</li> </ul>  |
|  | The vacuum relief valve (VRE) is misadjusted or defective.  | <ul style="list-style-type: none"> <li>• Replace the vacuum relief valve (VRE)</li> </ul>   |
|  | The inlet filter cartridge (optional) is partially clogged. | <ul style="list-style-type: none"> <li>• Replace the inlet filter cartridge.</li> </ul>   |
|  | Internal parts are worn or damaged.                         | <ul style="list-style-type: none"> <li>• Repair the machine (contact Busch).</li> </ul>   |
| The machine runs very noisily.   | Worn coupling (CPL).  | <ul style="list-style-type: none"> <li>• Replace the coupling (CPL).</li> </ul>   |
|  | Oil level too low.  | <ul style="list-style-type: none"> <li>• Top up oil.</li> </ul>   |
|  | Defective bearings.   | <ul style="list-style-type: none"> <li>• Repair the machine (contact Busch).</li> </ul>   |
| The machine runs too hot.  | Insufficient cooling.                                       | <ul style="list-style-type: none"> <li>• Remove dust and dirt from the machine .</li> </ul>   |
|  | The cooling fan's rotation direction is incorrect.          | <ul style="list-style-type: none"> <li>• Check the rotation direction of the cooling fan, see Machine delivered with a Variable Speed Drive.</li> </ul> |
|  | Ambient temperature too high.                               | <ul style="list-style-type: none"> <li>• Observe the permitted ambient temperature, see <i>Technical Data</i> [→ 36].</li> </ul>                        |
|  | Temperature of the process gases at the inlet too high.     | <ul style="list-style-type: none"> <li>• Observe the permitted gas inlet temperature, see <i>Technical Data</i> [→ 36].</li> </ul>                      |
|  | Oil level too low.  | <ul style="list-style-type: none"> <li>• Top up oil.</li> </ul>   |

For resolution of problems not listed in the troubleshooting table, please contact your Busch representative.

# 13 Technical Data

| <b>MV 0310 B</b>   |                    |  |
|--|--------------------|--|
| Nominal pumping speed (60Hz)   | m <sup>3</sup> /h  | 345  |
| Ultimate pressure  | hPa (mbar)<br>abs. | see nameplate (NP)   |
| Nominal motor rating (50Hz / 60Hz)                                       | kW                 | 6.0 / 8.0  |
| Nominal motor speed (20Hz ... 60Hz)                                      | min <sup>-1</sup>  | 1200 ... 3600  |
| Noise level (EN ISO 2151) at 400 hPa (mbar) abs. suction pressure (60Hz) | dB(A)              | 72   |
| Ambient temperature range  | °C                 | 0 ... 40*  |
| Gas inlet temperature range  | °C                 | 0 ... 40*  |
| Ambient pressure   |                    | Atmospheric pressure   |
| Installation altitude  |                    | 100% load capacity (no derating) up to 1000 m;<br>Derating 1% / 100 m at 1000...3000 m |
| Permitted stationary vibration: sinusoidal                               |                    | 3 Hz < f < 8.72 Hz: 10 mm<br>8.72 Hz < f < 200 Hz: 3g<br>3M7 acc. IEC 60721-3-3        |
| Oil capacity   | l                  | 1.1  |
| Weight approx.   | kg                 | 330  |
| Supply network   |                    | TN- and TT-network (cannot be used with corner grounded networks)                      |
| Immunity   |                    | EN 61800-3, 1st and 2nd environment  |
| Emissions  |                    | EN 61800-3, category C2 as standard  |

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

# 14 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                    | 3            | 4            |

1 = Single-phase motor; 2 = Three-phase motor; 3 = Standard oil for non-demanding applications; 4 = Food applications (H1); 5 = Anti-corrosion; 6 = Suitable for continuous operation; 7 = Not suitable for continuous operation; 8 = Improved air separation properties; 9 = Light cycle operation; 10 = Heavy duty cycle operation; 11 = Standard application up to 90°C; 12 = Suitable for Harsh application; 13 = Standard application up to 80°C

To know which oil has been filled in the machine, please refer to the nameplate (NP).

# 15 EU Declaration of Conformity

This Declaration of Conformity and the CE-markings 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-marking.

The manufacturer

**Busch Produktions GmbH**  
**Schauinslandstr. 1**  
**DE-79689 Maulburg**

declares that the machine: MINK MV 0310 B

fulfill(s) all the relevant provisions from EU directives:

- 'Machinery' 2006/42/EC
- 'Electromagnetic Compatibility' (EMC) 2014/30/EU
- 'RoHS' 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (incl. all related applicable amendments)

and comply(-ies) with the following harmonized standards that have been used to fulfill those provisions:

| Standards                    | Title of the Standard   |
|------------------------------|---|
| EN ISO 12100 : 2010          | Safety of machinery - Basic concepts, general principles of design  |
| EN ISO 13857 : 2019          | Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs |
| EN 1012-2 : 1996 + A1 : 2009 | Vacuum pumps - Safety requirements - Part 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 for industrial environments             |
| EN IEC 61000-6-4 : 2019      | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments    |

Legal person authorized to compile the technical file and authorized representative in the EU (if the manufacturer is not located in the EU):

Busch Dienste GmbH  
 Schauinslandstr. 1  
 DE-79689 Maulburg

Maulburg, 18.08.2021



**Dr. Martin Gutmann**  
**General Manager**  
**Busch Produktions GmbH**

# 16 UK Declaration of Conformity

This Declaration of Conformity and the UKCA-markings 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 UKCA-marking.

The manufacturer

**Busch Produktions GmbH**  
**Schauinslandstr. 1**  
**DE-79689 Maulburg**

declares that the machine: MINK MV 0310 B

fulfill(s) all the relevant provisions from UK legislations:

- Supply of Machinery (Safety) Regulations 2008
- Electromagnetic Compatibility Regulations 2016
- Restriction of the use of certain hazardous substances in Electrical and Electronic Equipment Regulations 2021

and comply(-ies) with the following designated standards that have been used to fulfill those provisions:

| Standards                    | Title of the Standard   |
|------------------------------|---|
| EN ISO 12100 : 2010          | Safety of machinery - Basic concepts, general principles of design  |
| EN ISO 13857 : 2019          | Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs |
| EN 1012-2 : 1996 + A1 : 2009 | Vacuum pumps - Safety requirements - Part 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 for industrial environments             |
| EN IEC 61000-6-4 : 2019      | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments    |

Legal person authorized to compile the technical file and importer in the UK (if the manufacturer is not located in the UK):

Busch (UK) Ltd  
 30 Hortonwood  
 Telford - UK

Maulburg, 18.08.2021

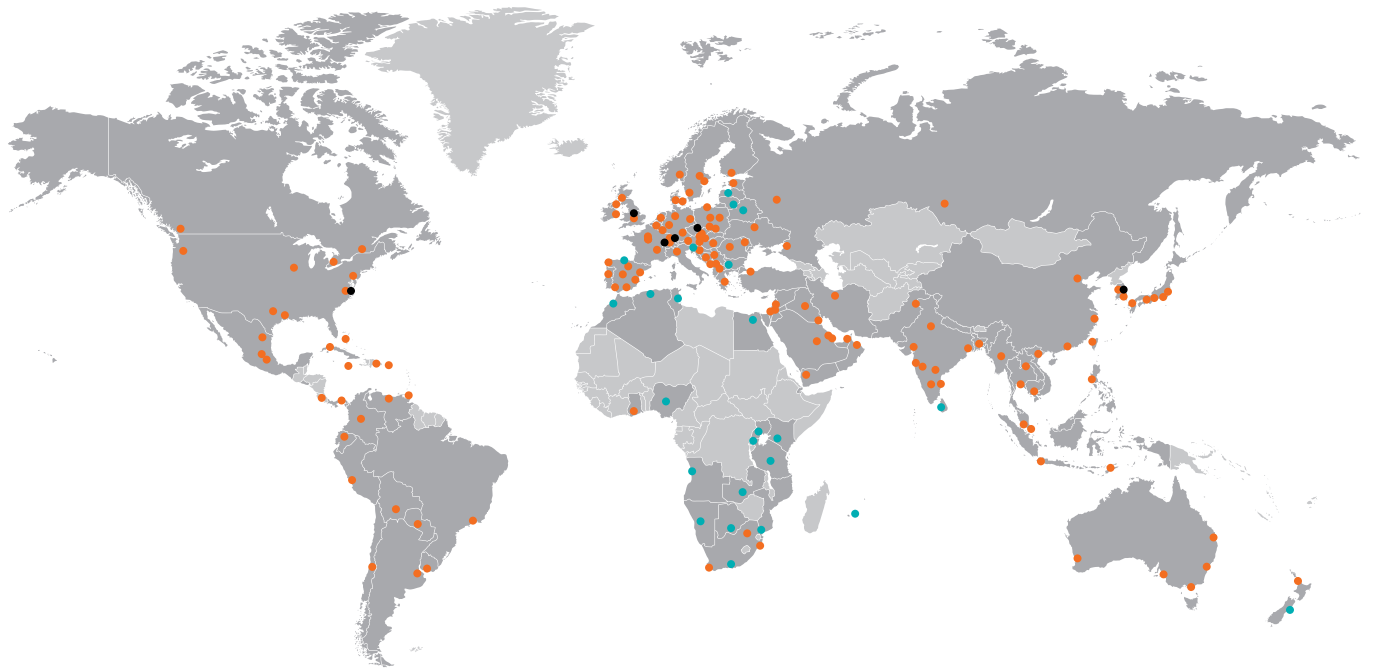


**Dr. Martin Gutmann**  
**General Manager**  
**Busch Produktions GmbH**

# Busch

## Vacuum Solutions

With a network of over 60 companies in more than 40 countries and agencies worldwide, Busch has a global presence. In every country, highly competent local personnel delivers custom-tailored support backed by a global network of expertise. Wherever you are. Whatever your business. We are there for you.



● Busch companies and Busch employees   ● Local representatives and distributors   ● Busch production site

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