

# R5

Oil-Lubricated Rotary Vane Vacuum Pumps  
RA 0520 A

## 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 in accordance with the 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

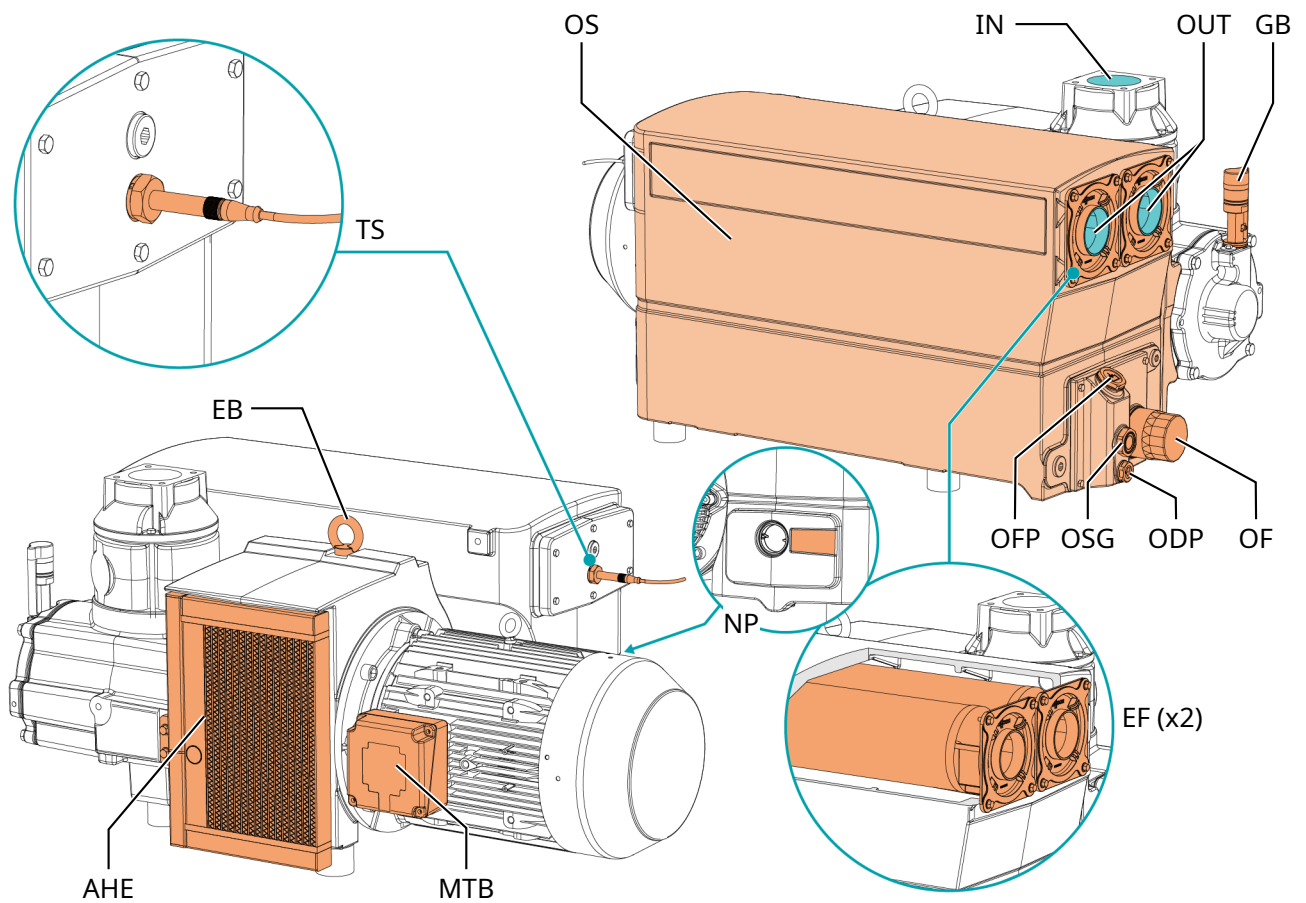
... indicates a potentially dangerous situation that could result in damage to property.



## NOTE

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

## 2 Product Description



| Description |                            |     |                               |
|-------------|----------------------------|-----|-------------------------------|
| IN          | Suction connection (Inlet) | OUT | Discharge connection (Outlet) |
| AHE         | Air-oil heat exchanger     | EB  | Eye bolt                      |
| EF          | Exhaust filter             | GB  | Gas ballast valve             |
| MTB         | Motor terminal box         | NP  | Nameplate                     |
| ODP         | Oil drain plug             | OF  | Oil filter                    |
| OFP         | Oil fill plug              | OS  | Oil separator                 |
| OSG         | Oil sight glass            | TS  | Temperature Switch "Gas"      |

### **i** NOTE

**Technical term.**

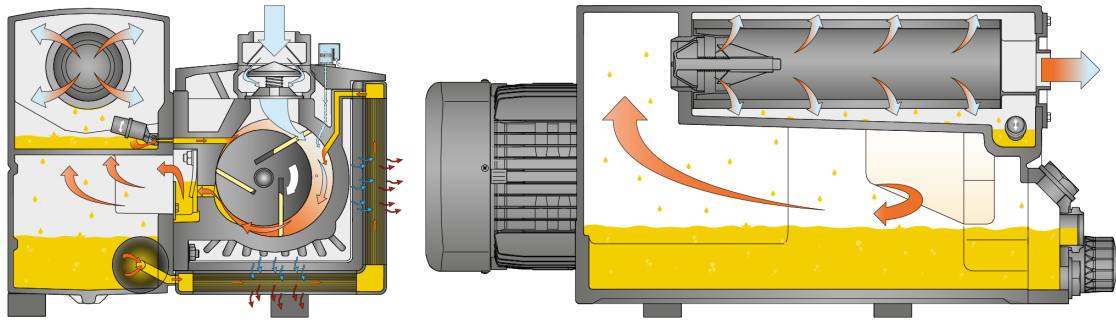
**In this instruction manual, we consider that the term 'machine' refers to the 'vacuum pump'.**

### **i** NOTE

**Illustrations**

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

## 2.1 Operating Principle



The machine works on the rotary vane principle.

The oil seals the gaps, lubricates the vanes and takes away compression heat.

The oil filter cleans the circulating oil.

Exhaust filters separate the oil from the discharged gas.

## 2.2 Intended Use



### WARNING

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

**Risk of injuries!**

**Risk of damage to the machine!**

**Risk of damage 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 capable of maintaining ultimate pressure, see Technical Data.

The machine is suitable for continuous operation.

Permitted environmental conditions, see Technical Data.

## 2.3 Start Controls

The machine comes without start controls. The control of the machine is to be provided in the course of installation.

The machine can be equipped with a starter unit or a variable speed drive.

## 2.4 Standard Accessories

### 2.4.1 Temperature Switch "Gas"

The temperature switch "Gas" monitors the gas temperature of the machine.

The machine must be stopped when the gas reaches 110 °C, see *Wiring Diagram Temperature Switch "Gas"* [→ 18].

## 2.5 Optional Accessories

### 2.5.1 Gas Ballast Valve

The gas ballast valve mixes the process gas with a limited quantity of ambient air to counteract the condensation of vapor inside the machine.

The gas ballast valve has an influence on the ultimate pressure of the machine, see Technical Data.

### 2.5.2 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.

The clamped design makes it easy to adjust the position to the installation and the o-ring sealing guarantees the tightness.

### 2.5.3 Temperature Switch "Oil"

The temperature switch monitors the oil temperature of the machine.

It has two switch points.

Depending on the oil type, the machine must be stopped when the oil reaches a certain temperature, see *Oil* [→ 35].

### 2.5.4 Resistance Thermometer "Oil"

The resistance thermometer monitors the oil temperature of the machine.

Depending on the oil type, warning and trip signals must be set, see *Oil* [→ 35].

### 2.5.5 Level Switch

The level switch monitors the oil level.

The machine must be stopped when the oil level is too low.

### 2.5.6 Exhaust Pressure Switch

The pressure switch monitors the pressure in the oil separator.

The machine must be stopped when the gas reaches a certain pressure, see *Wiring Diagram Exhaust Pressure Switch (Optional)* [→ 20]

### 2.5.7 Variable Speed Drive

The machine can optionally be equipped with a Variable Speed Drive (VSD). A variable speed drive increases the pumping speed of the machine and saves energy. For more information contact your Busch representative.

## 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.

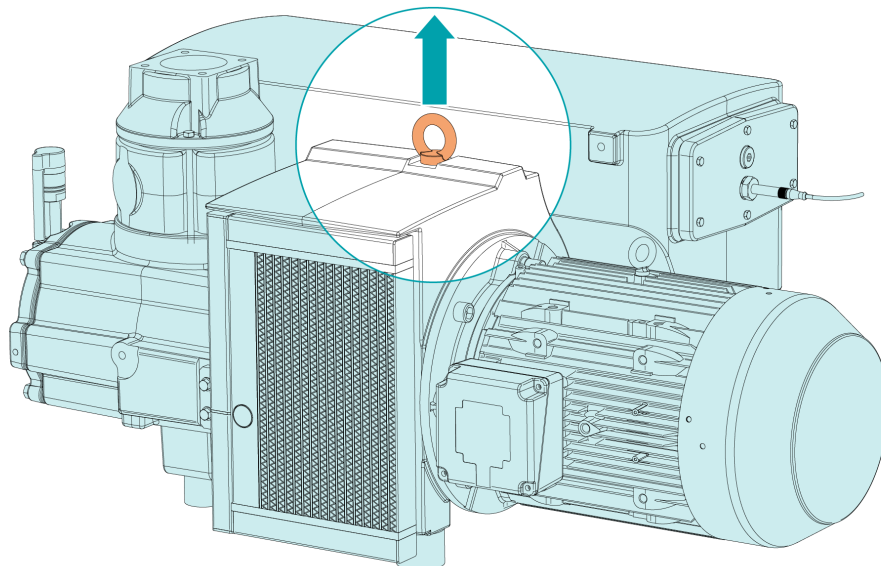


### NOTICE

**In case the machine is already filled with oil.**

**Tilting a machine that is already filled with oil can cause large quantities of oil to ingress into the cylinder. Starting the machine with excessive quantities of oil in the cylinder will immediately break the vanes and ruin the machine!**

- Drain the oil prior to every transport or always horizontally transport the machine.
- To find out the weight of the machine, refer to the chapter Technical Data or the nameplate (NP).
- Make sure that the eye bolt(s) (EB) is/are in faultless condition, fully screwed in and tightened by hand.



- 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, in a dry and dust free environment and if possible, in original packaging, preferably at temperatures between 0 ... 40 °C.

# 5 Installation

## 5.1 Installation Conditions

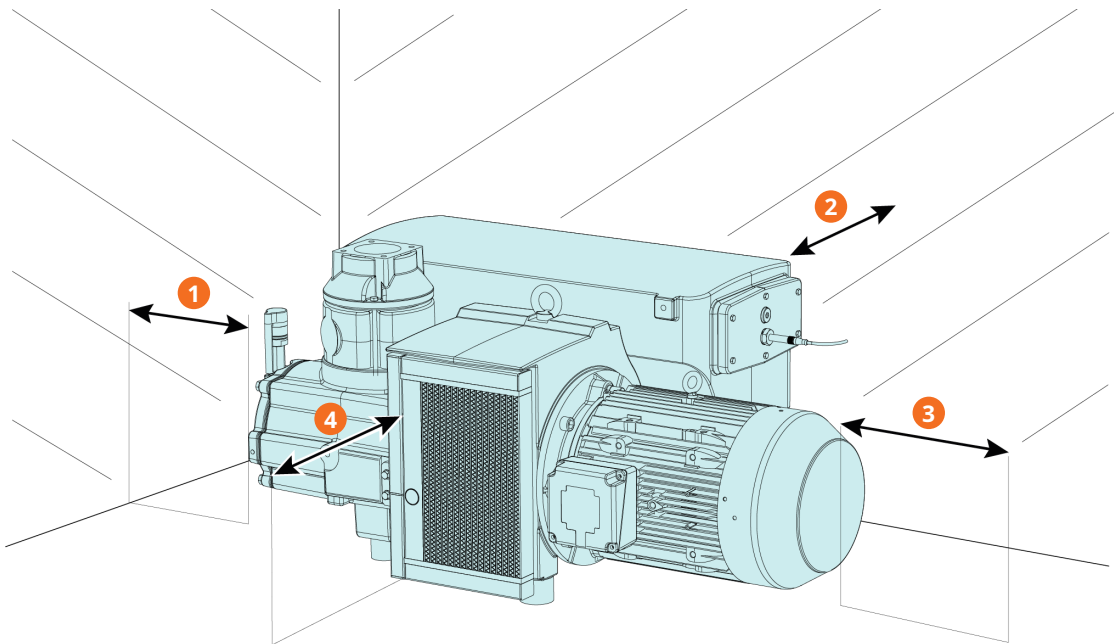
**! NOTICE**

**Use of the machine outside of the permitted installation conditions.**

**Risk of premature failure!**

**Loss of efficiency!**

- Make sure that the installation conditions are fully respected.



| Description |            |   |        |
|-------------|------------|---|--------|
| 1           | Min. 70 cm | 2 | ~10 cm |
| 3           | ~50 cm     | 4 | ~50 cm |

- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the Technical Data.
- 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.
  - Even 0.5° in longitudinal direction, in case of a level switch is being used in.

- Check the oil level, see *Oil Level Inspection* [→ 25].
- 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.

If the machine is equipped with monitoring devices or sensors:

- Make sure that the monitoring devices are correctly connected and integrated into a control system such that operation of the machine will be inhibited if the safety limit values are exceeded, see *Electrical Connection of the Monitoring Devices* [→ 18].

## 5.2 Connecting Lines / Pipes

- Remove all protective covers before installation.
- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible joints on the suction and discharge connections.
- 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.

### 5.2.1 Suction Connection



#### WARNING

**Unprotected suction connection.**

**Risk of severe injury!**

- Do not put hand or fingers in the suction connection.



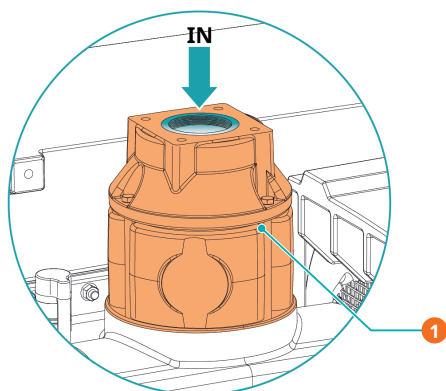
#### NOTICE

**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.



#### Description

|   |                                               |  |  |
|---|-----------------------------------------------|--|--|
| 1 | Suction connection with vertical inlet flange |  |  |
|---|-----------------------------------------------|--|--|

Connection size(s):

- G3"
- 3" NPT

If the machine is used as part of a vacuum system:

- Busch recommends the installation of an isolation valve in order to prevent the oil from flowing back to the vacuum system.
- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible joints on the suction and discharge connections.

## 5.2.2 Discharge Connection



### CAUTION

**The discharge gas contains small quantities of oil.**

**Risk to health!**

If air is discharged into rooms where persons are present:

- Make sure that sufficient ventilation is provided.



### 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):

- G3" (with optional exhaust flange)
- 3" NPT (with optional exhaust flange)

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.
- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible joints on the suction and discharge connections.

## 5.3 Filling Oil



### NOTICE

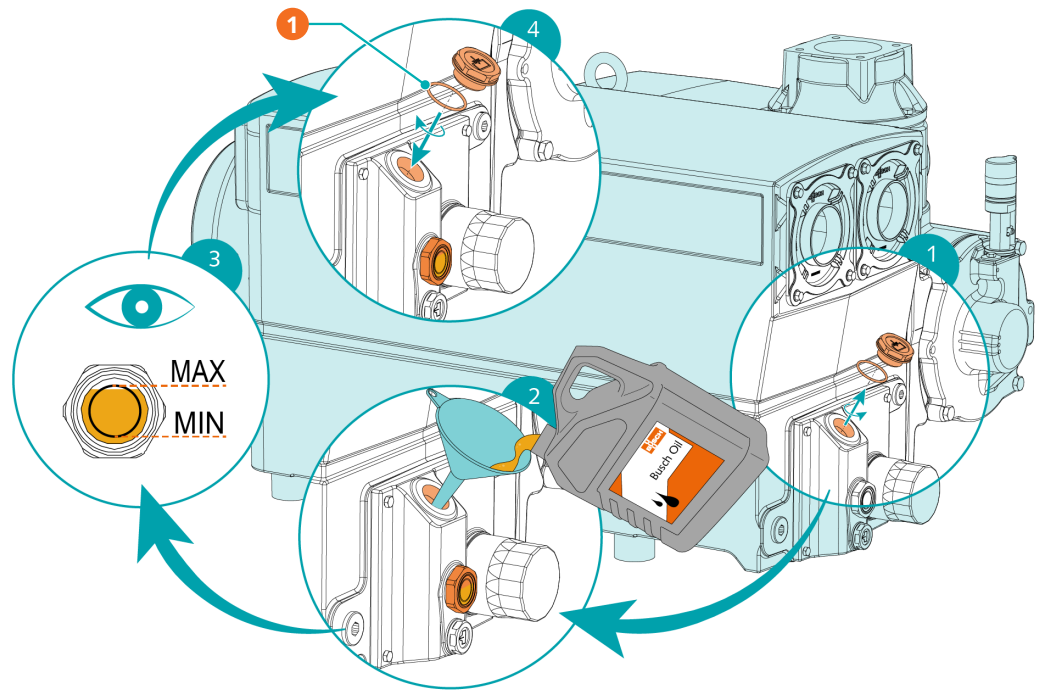
**Use of an inappropriate oil.**

**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 and *Oil* [→ 35].



| Description |                                                    |
|-------------|----------------------------------------------------|
| 1           | 1x O-ring, see "Service kit" (chapter Spare Parts) |

## 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 in accordance with EN 60204-1 must be provided by the customers on their installation(s).
- 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* [→ 36] or *UK Declaration of Conformity* [→ 37]).

### 6.1 Machine delivered with a Control Box (Option)



### 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 control box.
- If the machine is equipped with a power connector, install a residual current protective device to protect persons in case of a defective insulation.
  - Busch recommends installing a type B residual protective device suitable for the electrical installation.
- If the control box 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.
- Electrically connect the control box.



## NOTICE

**Incorrect connection.**

**Risk of damage to the control box and motor!**

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

## 6.2 Machine delivered without Control Box or Variable Speed Drive (VSD)





## DANGER

**Live wires.**

**Risk of electrical shock.**

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



## NOTE

**The operation with variable speed, i.e. with a variable speed drive or a soft starter unit, is allowed as long as the motor is capable and the permitted motor speed range is respected (see Technical Data).**

**Seek advice from your Busch representative.**

- Make sure that the power supply for the motor is compatible with the data on the nameplate of the motor.
- If the machine is equipped with a power connector, install a residual current protective device to protect persons in case of a defective insulation.
  - Busch recommends installing a type B residual protective device suitable for the electrical installation.
- Provide a lockable disconnect switch or an emergency stop switch on the power line so that the machine is completely secured in case of an emergency situation.
- 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.
  - Busch recommends installing a D-curve circuit breaker.
- 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.

## 6.3 Machine delivered with a Variable Speed Drive (Option)



### DANGER

**Live wires. Carry out any work on the variable speed drive and motor.**

**Risk of electrical shock!**

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



### DANGER

**Maintenance work without disconnecting the variable speed drive.**

**Risk of electrical shock.**

- Disconnect and isolate the variable speed drive before attempting any work on it. High voltages are present at the terminals and within the variable speed drive for up to 10 minutes after disconnection of the electrical supply.
- Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals prior to commencing any work.
- 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 a defective insulation.
  - 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.
  - Busch recommends installing a C-curve circuit breaker.
- Connect the protective earth conductor.
- Electrically connect the Variable Speed Drive (VSD).



### NOTICE

**The admissible motor speed exceeds the recommendation.**

**Risk of damage to the machine!**

- Check the admissible motor speed range, see Technical Data.



### NOTICE

**Incorrect connection.**

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

- The wiring diagrams given below are typical. Check the connection instructions/diagrams.



# 6.4 Wiring Diagram Three-Phase Motor

**NOTICE**

**Incorrect direction of rotation.**

**Risk of damage to the machine!**

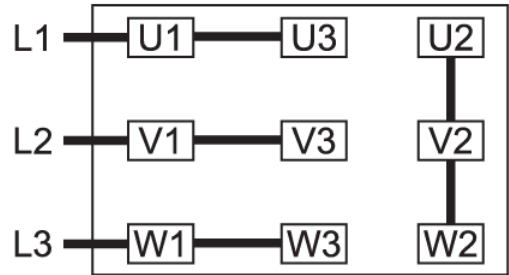
- Operation in the wrong direction of rotation can destroy the machine in a short time! Prior to start-up, ensure that the machine is operated in the right direction.

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

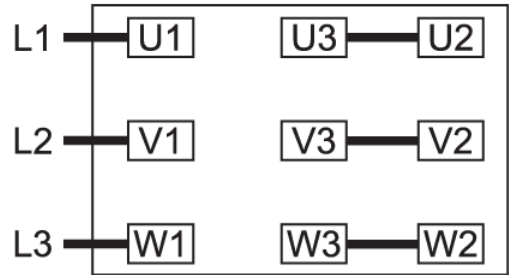
If the rotation of the motor must be changed:

- Switch any two of the motor phase wires.

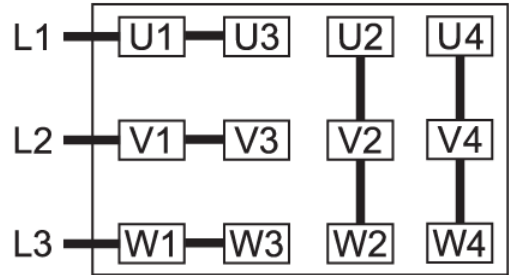
Double star connection, multi-voltage motor with 9 pins (low voltage):



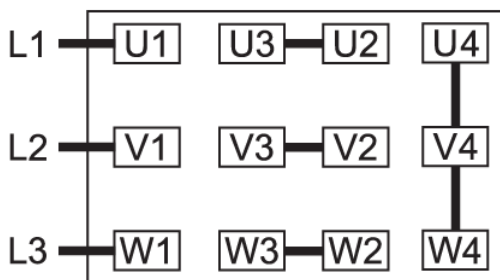
Star connection, multi-voltage motor with 9 pins (high voltage):



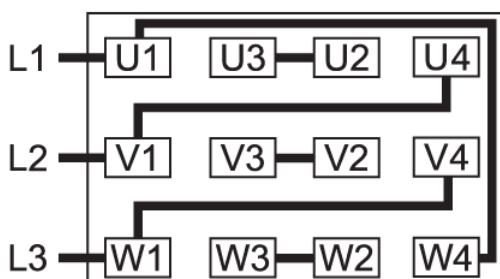
Double star connection, multi-voltage motor with 12 pins (low voltage):



Star connection, multi-voltage motor with 12 pins (high voltage):



Delta connection, multi-voltage motor with 12 pins (middle voltage):



## 6.5 Electrical Connection of the Monitoring Devices



### WARNING

The electrical connection of the monitoring devices fitted as standard on the machine (not optional) is mandatory to ensure the safety of the machine and the users.



### NOTE

To prevent potential nuisance alarms, Busch recommends that the control system is configured with a time delay of at least 20 seconds.

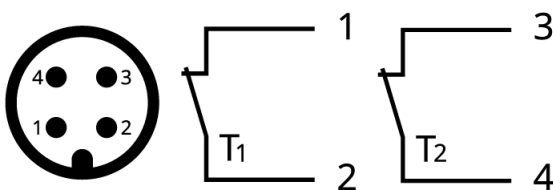
### 6.5.1 Wiring Diagram Temperature Switch "Gas"

Part no.: 0651 566 632

Connector: M12x1, 4-pin

Electrical data:  $U = \leq 250 \text{ V AC/DC (50/60 Hz)}$ ;  $I = \leq 1 \text{ A}$

Switch point:  $T_1$ , pin 1 + 2 = 110 °C



1 = Brown; 2 = White; 3 = Blue; 4 = Black

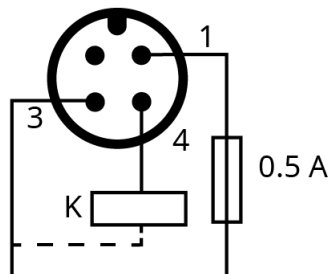
## 6.5.2 Wiring Diagram Level Switch (Optional)

**Part no.:** 0652 567 576

**Connector:** M12x1, 4-pin

**Electrical data:**  $U = 10 - 30 \text{ V DC}$ ; I consumption:  $< 15 \text{ mA}$ ; I output max:  $150 \text{ mA}$

**Switch point:** Pin 1 = low level



1 = Brown: Supply +24V DC; 3 = Blue: Supply 0V DC; 4 = Black: Signal low level

**NOTE:** For this device, the recommended time delay to prevent nuisance alarms can be up to 240 seconds.

## 6.5.3 Wiring Diagram Temperature Switch "Oil" (Optional)

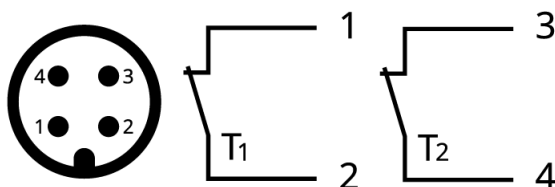
**Part no.:** 0651 566 632

**Connector:** M12x1, 4-pin

**Electrical data:**  $U = \leq 250 \text{ V AC/DC (50/60 Hz)}$ ;  $I = \leq 1 \text{ A}$

**Switch point:**  $T_1$  pin 1 + 2 =  $110 \text{ }^\circ\text{C}^*$  /  $T_2$  pin 3 + 4 =  $130 \text{ }^\circ\text{C}^*$

\* The switch point value depends on the oil type, see chapter *Oil* [→ 35].



1 = Brown; 2 = White; 3 = Blue; 4 = Black

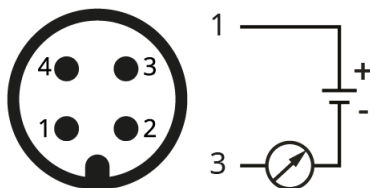
## 6.5.4 Wiring Diagram Resistance Thermometer (Optional)

**Part no.:** 0651 566 842

**Connector:** M12x1, 4-pin

**Electrical data:**  $U = 10 \dots 35 \text{ VDC}$ ;  $4 \dots 20 \text{ mA}$  ▶  $0 \dots 150 \text{ }^\circ\text{C}$

**Warning / trip signals:** see *Oil* [→ 35]



1 = Brown; 3 = Blue

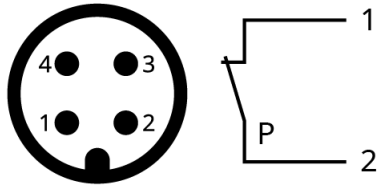
## 6.5.5 Wiring Diagram Exhaust Pressure Switch (Optional)

**Part no.:** 0653 566 736

**Connector:** M12x1, 4-pin

**Electrical data:**  $U = \leq 250 \text{ V AC/DC (50/60 Hz)}$ ;  $I = \leq 4 \text{ A}$

**Switch point:** P pin 1 + 2 = 0.6 bar (overpressure)



1 = Brown; 2 = White

## 7 Commissioning



### 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 people are present in the vicinity of a machine that is not insulated from noise for extended periods of time:

- Make sure to wear hearing protection.



### NOTICE

**The machine can be shipped without oil.**

**Operation without oil will ruin the machine in short time!**

- Prior to commissioning, the machine must be filled with oil, see *Filling Oil* [→ 12].
- Make sure that the *Installation Conditions* [→ 10] are met.
- Start 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.

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

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

## 7.1 Conveying Condensable Vapors



### CAUTION

While draining the condensate, the discharged gas and liquid may reach temperatures above 70°C.

#### Risk of burns!

- Avoid direct contact with the gas stream and liquid.



### CAUTION



Noise of running machine.

#### Risk of damage to hearing!

If people are present in the vicinity of a machine that is not insulated from noise for extended periods of time:

- Make sure to wear hearing protection.

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

If condensable vapors are to be conveyed:

#### START

- Close the isolation valve\*
- Warm up the machine for 30 minutes
- Open the isolation valve\* and perform the process
- Close the isolation valve\*
- Wait 30 minutes

#### END

\* Not included in the scope of delivery.

## 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!**

- Before doing anything that requires touching the machine, let it 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.

If the machine is equipped with a variable speed drive:



## DANGER

**Live wires. Carry out any work on the variable speed drive and motor.**

**Risk of electrical shock!**

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



## DANGER

**Maintenance work without disconnecting the variable speed drive.**

**Risk of electrical shock.**

- Disconnect and isolate the variable speed drive before attempting any work on it.  
High voltages are present at the terminals and within the variable speed drive for up to 10 minutes after disconnection of the electrical supply.
- Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals prior to commencing any work.

## 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.

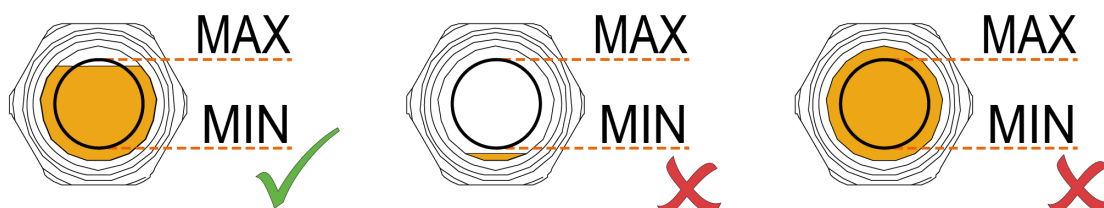
| Maintenance work                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Interval                              |                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Normal application                    | Harsh application                       |
| <ul style="list-style-type: none"> <li>• Check the oil level, see <i>Oil Level Inspection</i> [→ 25].</li> </ul>                                                                                                                                                                                                                                                                                                                                                                      | Daily                                 |                                         |
| <ul style="list-style-type: none"> <li>• Check the machine for oil leaks. In case of leaks, have the machine repaired (contact Busch).</li> </ul> <p>If an inlet filter is installed:</p> <ul style="list-style-type: none"> <li>• Check the inlet filter cartridge, replace if necessary.</li> </ul>                                                                                                                                                                                 | Monthly                               |                                         |
| <ul style="list-style-type: none"> <li>• Change the oil*, the oil filter* (OF) and the exhaust filter (EF).                             <ul style="list-style-type: none"> <li>• <b>Harsh applications:</b> Open the service cover to check/clean the oil sump of the oil separator (OS).</li> </ul> </li> <li>• Clean the machine and air heat exchanger from dust and dirt (see <i>Air Heat Exchanger Cleaning</i> [→ 28]).</li> <li>• Clean the gas ballast valve (GB).</li> </ul> | Max. after 4000 hours or after 1 year | Max. after 2000 hours or after 6 months |
| <ul style="list-style-type: none"> <li>• Contact Busch for an inspection. If required, overhaul the machine.</li> </ul>                                                                                                                                                                                                                                                                                                                                                               | Every 5 years                         |                                         |

\* Service interval for synthetic oil, shorten the interval when using mineral oil, contact Busch Service



## 8.2 Oil Level Inspection

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



- Fill up if necessary, see *Oil Filling* [→ 12].

## 8.3 Oil and Oil Filter Change

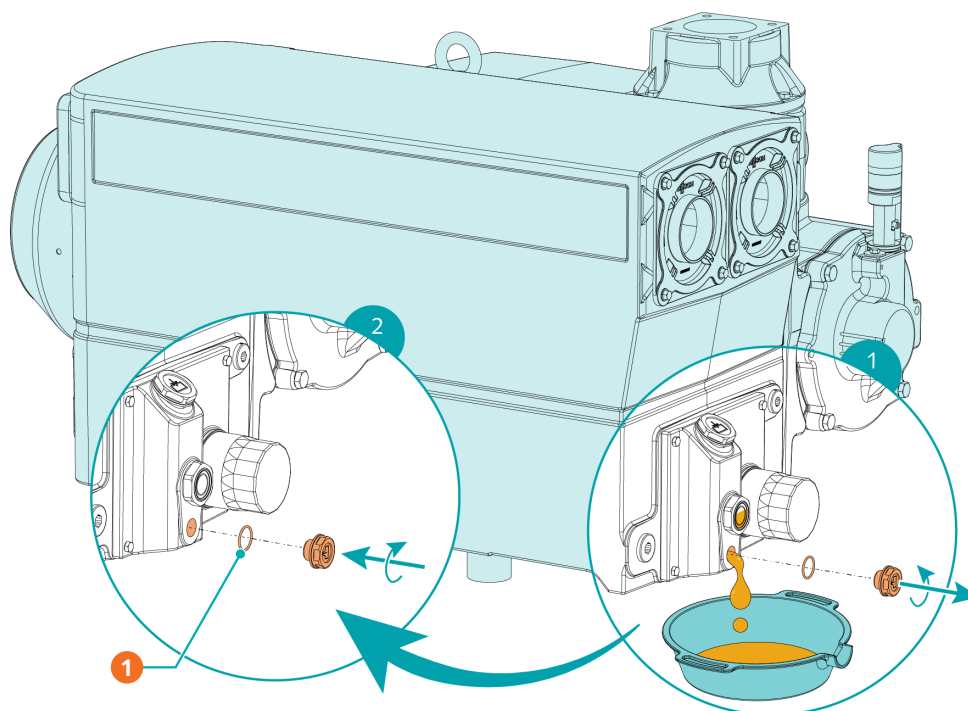
### ! NOTICE

Use of an inappropriate oil.

Risk of premature failure!

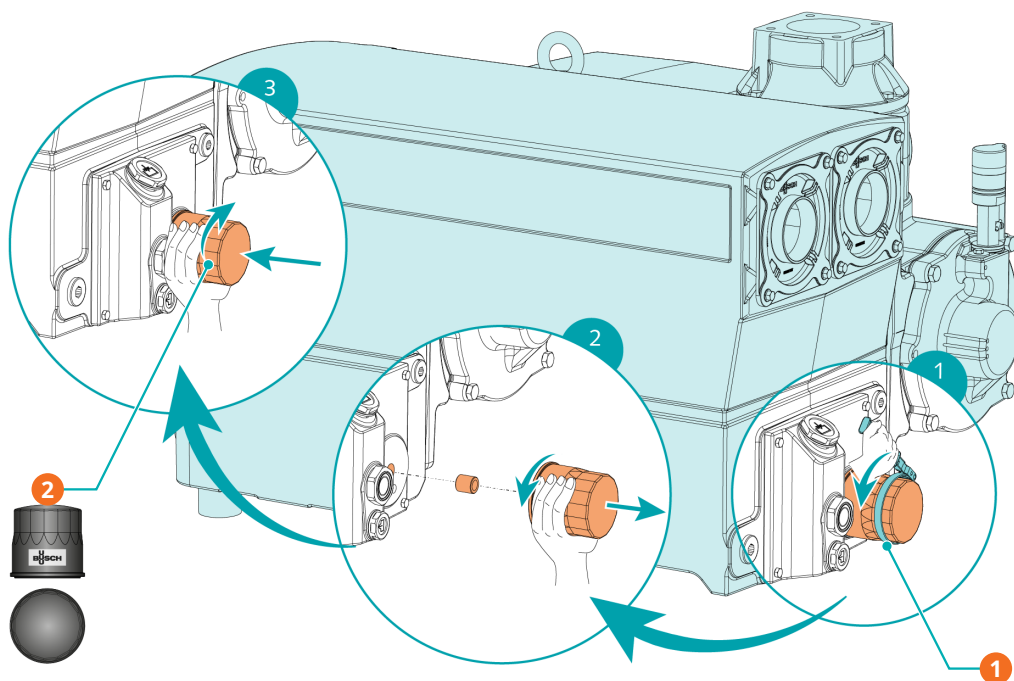
Loss of efficiency!

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



#### Description

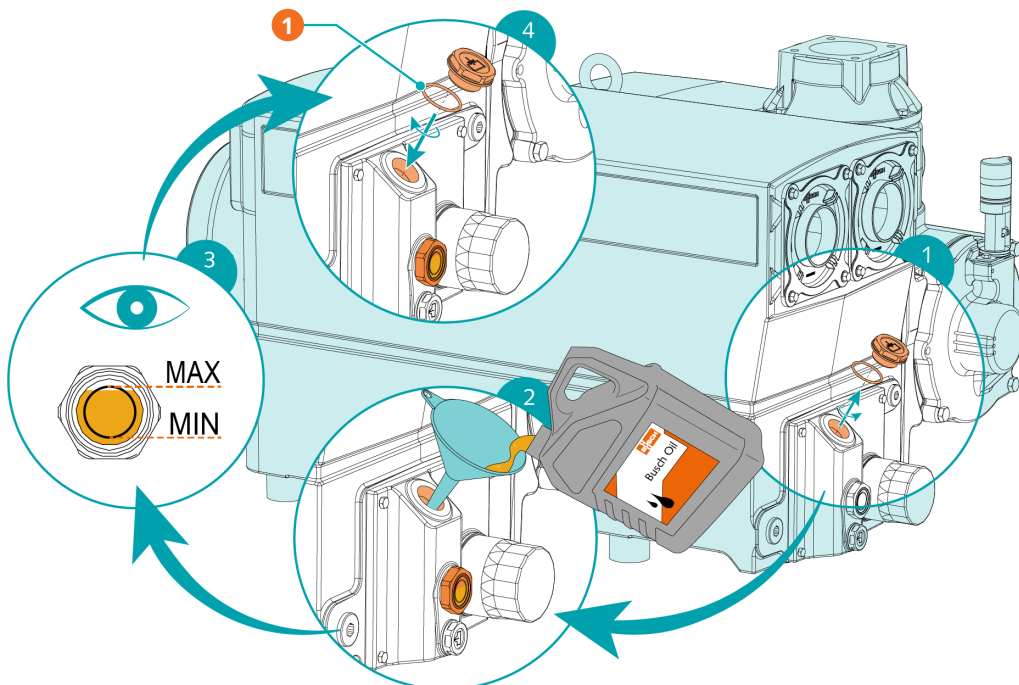
|   |                                                    |  |  |
|---|----------------------------------------------------|--|--|
| 1 | 1x O-ring, see "Service kit" (chapter Spare Parts) |  |  |
|---|----------------------------------------------------|--|--|



**Description**

|   |                                                      |   |                                                                                        |
|---|------------------------------------------------------|---|----------------------------------------------------------------------------------------|
| 1 | Remove the used oil filter with an oil filter wrench | 2 | 1x oil filter (OF), see "Service kit" (chapter Spare Parts - Busch genuine spare part) |
|---|------------------------------------------------------|---|----------------------------------------------------------------------------------------|

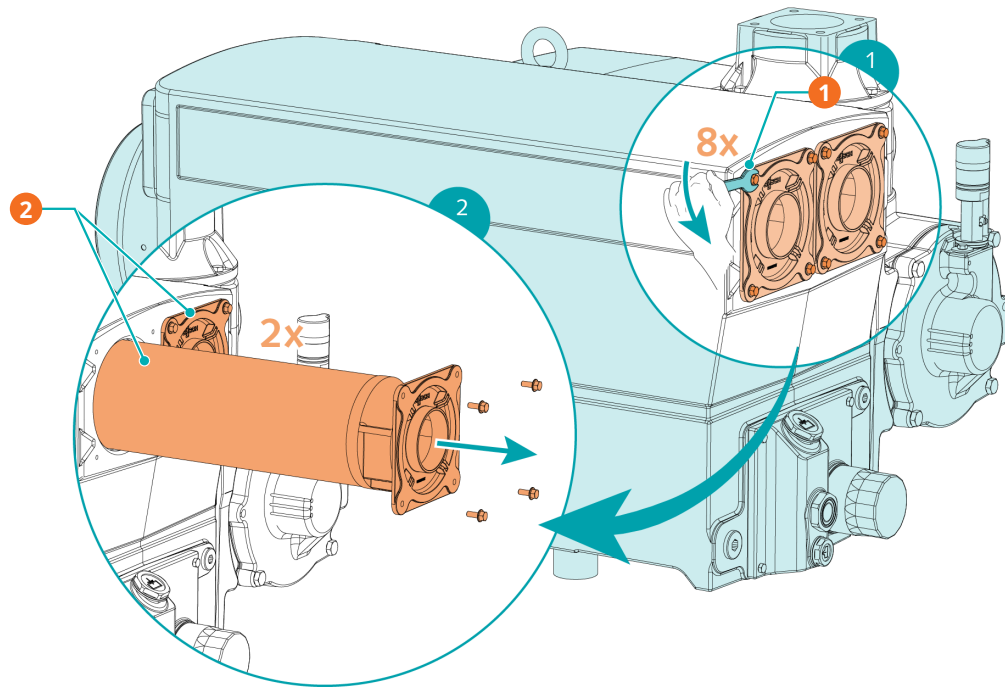
For oil type and oil capacity see Technical Data and Oil [→ 35].



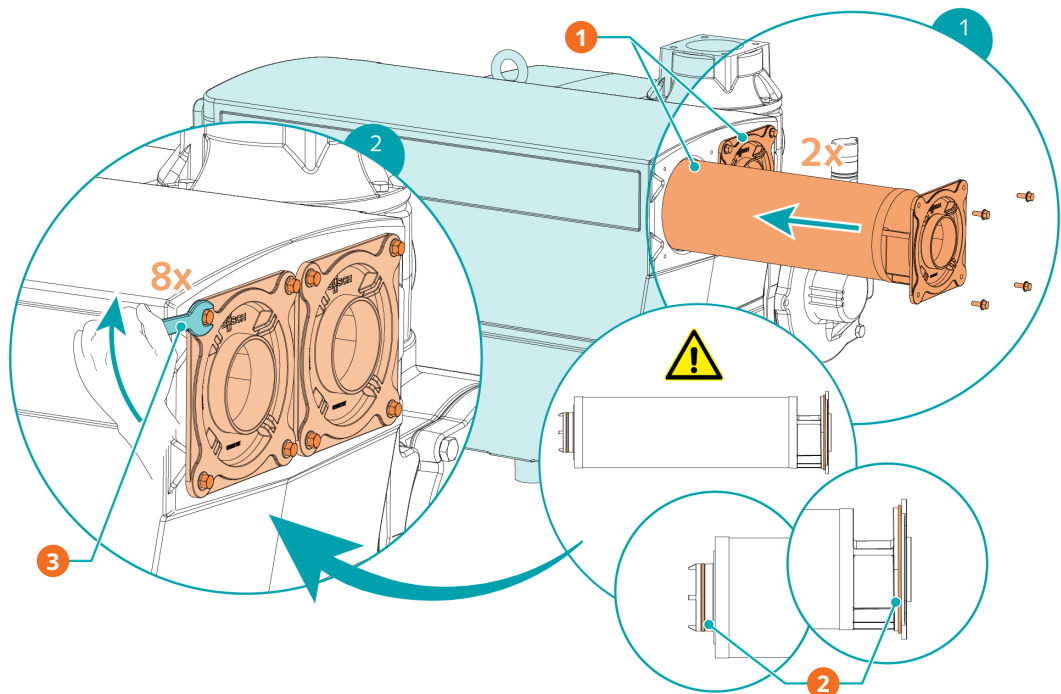
**Description**

|   |                                                    |  |  |
|---|----------------------------------------------------|--|--|
| 1 | 1x O-ring, see "Service kit" (chapter Spare Parts) |  |  |
|---|----------------------------------------------------|--|--|

## 8.4 Exhaust Filter Change



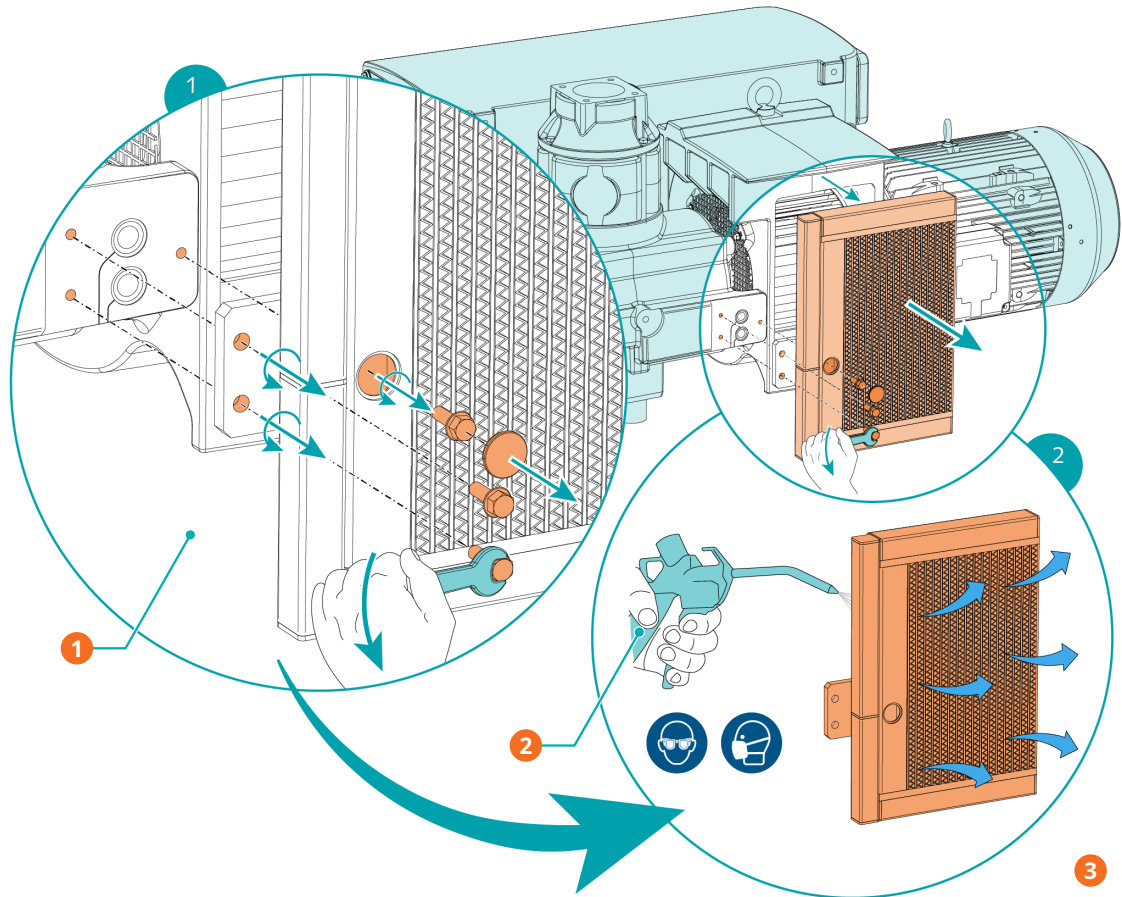
| Description |              |   |                        |
|-------------|--------------|---|------------------------|
| 1           | 10 mm wrench | 2 | 2x exhaust filter (EF) |



| Description |                                                                                            |   |                                         |
|-------------|--------------------------------------------------------------------------------------------|---|-----------------------------------------|
| 1           | 2x exhaust filter (EF), see "Service kit" (chapter Spare Parts - Busch genuine spare part) | 2 | Check 2x O-ring on both exhaust filters |
| 3           | 10 mm wrench / max. admissible torque: 4Nm                                                 |   |                                         |

## 8.5 Air Heat Exchanger Cleaning

- Make sure that the machine is oil drained before cleaning the air heat exchanger (see *Oil and Oil Filter Change* [→ 25]).
- Run the machine without oil and at atmospheric pressure for a maximum of 1 minute to drain the radiator.
- Make sure to protect the open hydraulic connections to avoid contamination.



| Description |                                                                                                                                           |   |                                                         |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------------------|
| 1           | In addition to the screws, 3x O-rings (not illustrated), see "Service kit" (chapter Spare Parts)                                          | 2 | Use compressed air and wear protective eyewear and mask |
| 3           | After cleaning, reassemble the exchanger with 3 new O-rings and the 3 screws tightened with a 13 mm wrench / max. admissible torque: 20Nm |   |                                                         |

## 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!**

- Before doing anything that requires touching the machine, let it 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.
- Remove the exhaust filters.
- Remove the oil filter.
- 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 parts kit | Description                              | Part no.     |
|-----------------|------------------------------------------|--------------|
| Service kit     | Includes parts necessary for maintenance | 0992 242 247 |

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.



## DANGER

Live wires. Carry out any work on the variable speed drive and motor.

Risk of electrical shock!

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



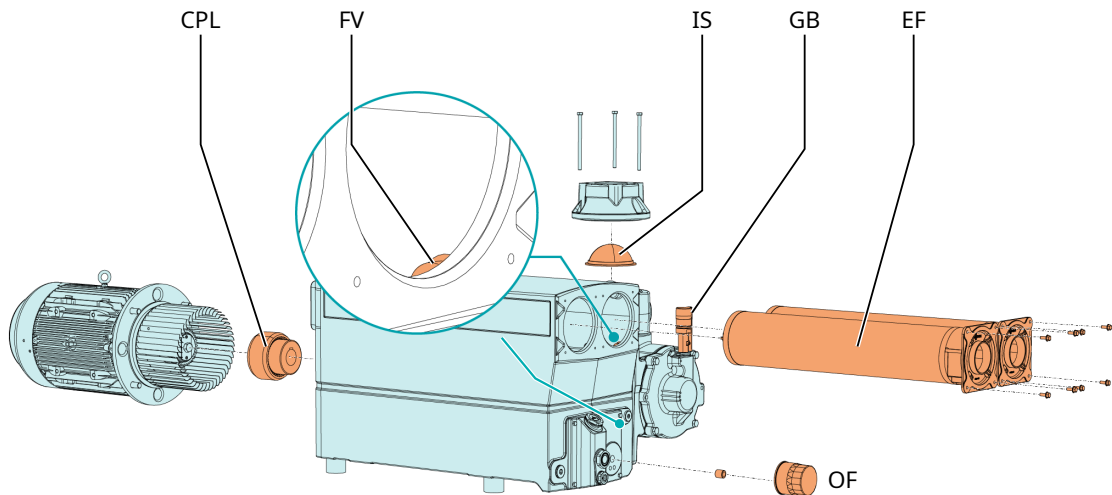
## CAUTION

Hot surface.

Risk of burns!

- Before doing anything that requires touching the machine, let it cool down first.

Illustration showing parts that may be involved during troubleshooting:



| Problem                     | Possible Cause                                      | Remedy                                                                          |
|-----------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------|
| The machine does not start. | The motor is not supplied with the correct voltage. | <ul style="list-style-type: none"> <li>• Check the power supply.</li> </ul>     |
|                             | The motor is defective.                             | <ul style="list-style-type: none"> <li>• Replace the motor.</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. | Oil level too low.                                             | <ul style="list-style-type: none"> <li>• Top up oil.</li> </ul>                                                                                                                                                                            |
|                                                                          | The inlet screen (IS) is partially clogged.                    | <ul style="list-style-type: none"> <li>• Clean the inlet screen (IS).</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>                                                                                                                                                            |
|                                                                          | Stuck vanes.                                                   | <ul style="list-style-type: none"> <li>• Repair the machine (contact Busch).</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> <li>• Check the cooling fan.</li> </ul>                                                                                                               |
|                                                                          | Ambient temperature too high.                                  | <ul style="list-style-type: none"> <li>• Observe the permitted ambient temperature.</li> </ul>                                                                                                                                             |
|                                                                          | Oil level too low.                                             | <ul style="list-style-type: none"> <li>• Top up oil.</li> </ul>                                                                                                                                                                            |
|                                                                          | The exhaust filters (EF) are partially clogged.                | <ul style="list-style-type: none"> <li>• Replace the exhaust filters (EF).</li> </ul>                                                                                                                                                      |
| The machine fumes or expels oil droplets through the gas discharge.      | The exhaust filters (EF) are partially clogged.                | <ul style="list-style-type: none"> <li>• Replace the exhaust filters (EF).</li> </ul>                                                                                                                                                      |
|                                                                          | An exhaust filter (EF) with o-ring is not fitted properly.     | <ul style="list-style-type: none"> <li>• Ensure the correct position of the exhaust filters (EF) and the o-rings.</li> </ul>                                                                                                               |
|                                                                          | The float valve (FV) does not work properly.                   | <ul style="list-style-type: none"> <li>• Check the float valve and the oil return line, repair if necessary (contact Busch).</li> </ul>                                                                                                    |
| The oil is black.                                                        | Oil change intervals are too long.                             | <ul style="list-style-type: none"> <li>• Flush the machine (contact Busch).</li> </ul>                                                                                                                                                     |
|                                                                          | The inlet filter (optional) is defective.                      | <ul style="list-style-type: none"> <li>• Replace the inlet filter.</li> </ul>                                                                                                                                                              |
|                                                                          | The machine runs too hot.                                      | <ul style="list-style-type: none"> <li>• See problem "The machine runs too hot".</li> </ul>                                                                                                                                                |
| The oil is emulsified.                                                   | The machine sucked in liquids or significant amounts of vapor. | <ul style="list-style-type: none"> <li>• Flush the machine (contact Busch).</li> <li>• Clean the filter of the gas ballast valve (GB).</li> <li>• Modify the operational mode (see <i>Conveying Condensable Vapors</i> [→ 22]).</li> </ul> |
| The power consumption of the machine has increased.                      | The exhaust filters (EF) are partially clogged.                | <ul style="list-style-type: none"> <li>• Replace the exhaust filters (EF).</li> </ul>                                                                                                                                                      |
|                                                                          | Oil level too high.                                            | <ul style="list-style-type: none"> <li>• Drain the oil overfill to correct the oil level.</li> </ul>                                                                                                                                       |

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

# 13 Technical Data

| RA 0520 A                                                            |                      |                           |
|----------------------------------------------------------------------|----------------------|---------------------------|
| Nominal pumping speed<br>(50Hz / 60Hz)                               | m <sup>3</sup> /h    | 430 / 520                 |
|                                                                      | ACFM                 | 254 / 306                 |
| Ultimate pressure<br>(without gas ballast valve)                     | hPa (mbar) abs.      | 0.1                       |
|                                                                      | TORR                 | 0.075                     |
| Ultimate pressure<br>(with gas ballast valve)                        | hPa (mbar) abs.      | 0.5                       |
|                                                                      | TORR                 | 0.375                     |
| Nominal motor speed<br>(50Hz / 60Hz)                                 | min <sup>-1</sup>    | 1000 / 1200               |
|                                                                      | RPM                  |                           |
| Permitted motor speed range                                          | min <sup>-1</sup>    | 1000 ... 1200             |
|                                                                      | RPM                  |                           |
| Nominal motor rating<br>(50Hz / 60Hz)                                | kW                   | 11 / 12.5                 |
|                                                                      | HP                   | 15                        |
| Power consumption at 100 mbar –<br>75 TORR (50Hz / 60Hz)             | kW                   | 7.3 / 9.0                 |
|                                                                      | HP                   | 9.8 / 12.0                |
| Power consumption at ultimate<br>pressure (50Hz / 60Hz)              | kW                   | 3.3 / 3.9                 |
|                                                                      | HP                   | 4.5 / 5.3                 |
| Noise level (ISO 2151)<br>(50Hz / 60Hz)                              | dB(A)                | 74 / 76                   |
| Water vapor tolerance max. (with<br>gas ballast valve) (50Hz / 60Hz) | hPa (mbar)           | 14.6 / 21.3               |
|                                                                      | TORR                 | 10.9 / 16.0               |
| Water vapor capacity (with gas bal-<br>last valve) (50Hz / 60Hz)     | kg / h               | 20.9 / 76.7               |
|                                                                      | Lbs. / h             | 46.08 / 169.09            |
| Max. allowable pressure in the oil<br>mist separator                 | hPa (mbar) abs.      | 1600                      |
|                                                                      | TORR                 | 1200                      |
| Max. allowable gas inlet tempera-<br>ture                            | °C                   | ≤50 hPa (mbar) abs. ► 150 |
|                                                                      | °F                   | ≤37.5 torr ► 302          |
|                                                                      | °C                   | >50 hPa (mbar) abs. ► 80  |
|                                                                      | °F                   | >37.5 torr ► 176          |
| Ambient temperature range                                            | °C                   | 5 ... 40                  |
|                                                                      | °F                   | 41 ... 104                |
| Ambient pressure                                                     | Atmospheric pressure |                           |
| Oil capacity                                                         | L                    | 11                        |
|                                                                      | qts.                 | 11.6                      |
| Weight approx.                                                       | Kg                   | 420                       |
|                                                                      | Lbs.                 | 930                       |

# 14 Oil

|                                                    | VM 100       | VSC 100       | VSB 100       |
|----------------------------------------------------|--------------|---------------|---------------|
| ISO-VG                                             | 100          | 100           | 100           |
| Oil type                                           | Mineral oil  | Synthetic oil | Synthetic oil |
| Part number 1 L packaging                          | 0831 000 060 | 0831 168 356  | 0831 168 351  |
| Part number 5 L packaging                          | 0831 000 059 | 0831 168 357  | 0831 168 352  |
| Part number 10 L packaging                         | -            | 0831 210 162  | -             |
| Part number 20 L packaging                         | 0831 166 905 | 0831 168 359  | 0831 168 353  |
| Warning signal<br>Oil temperature [°C]             | 90           | 110           | 110           |
| Switch point / Trip signal<br>Oil temperature [°C] | 110          | 130           | 130           |

In case of unfavorable ambient temperature, other oil viscosities may be used. Please consult your Busch representative for more details.

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

## Oil suitability

- **Oil VM 100:** Standard oil for operating temperatures <90°C.
- **Oil VSB 100:** Suitable for food applications (H1); heavy duty cycle operation.
  - Compliant with kosher and halal standards.
- **Oil VSC 100:** Suitable for harsh applications.

# 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

**Ateliers Busch S.A.  
Zone Industrielle  
CH-2906 Chevenez**

declares that the machine: R5 RA 0520 A

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

Chevenez, 01.03.2023



**Christian Hoffmann, General Manager**

# 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

**Ateliers Busch S.A.  
Zone Industrielle  
CH-2906 Chevenez**

declares that the machine: R5 RA 0520 A

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

Chevenez, 01.03.2023



**Christian Hoffmann, General Manager**

# Notes

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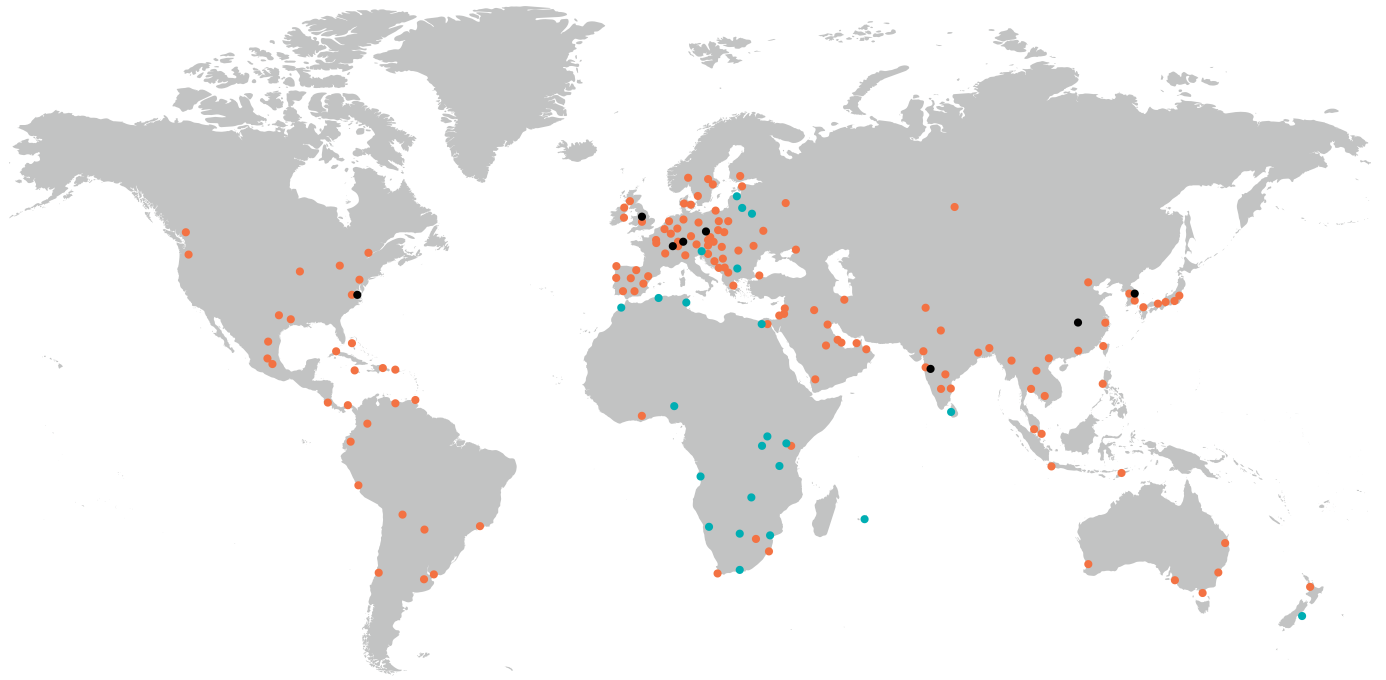
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A large grid of small dots for taking notes, consisting of approximately 30 columns and 40 rows of dots.

# 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

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