

COBRA

Dry Screw Vacuum Pumps
NS 0600 C

Instruction Manual

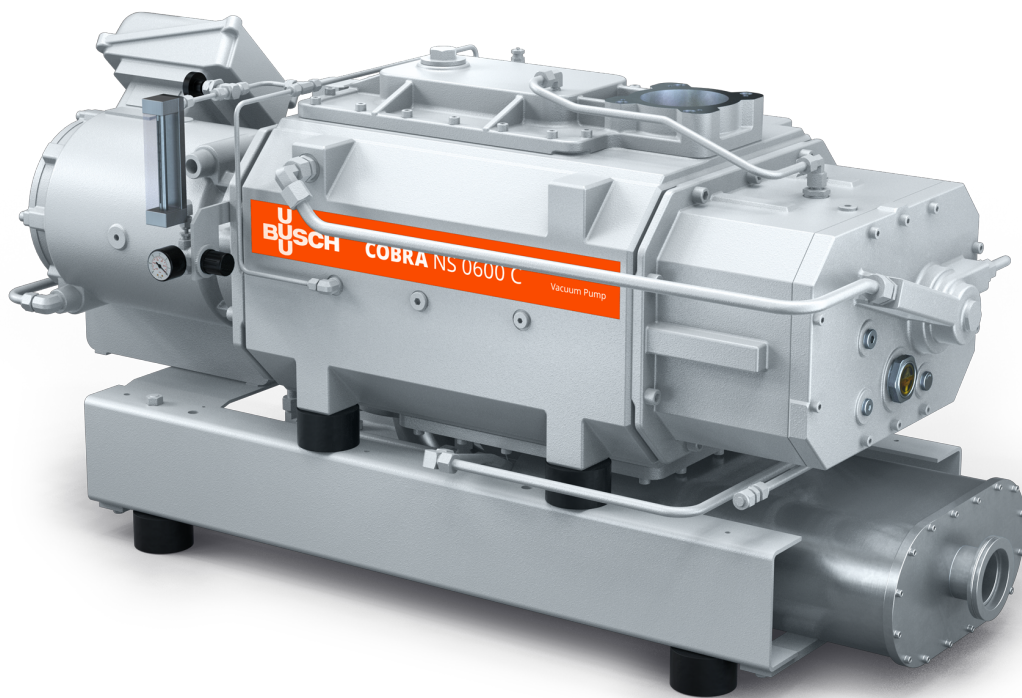


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1 Safety

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

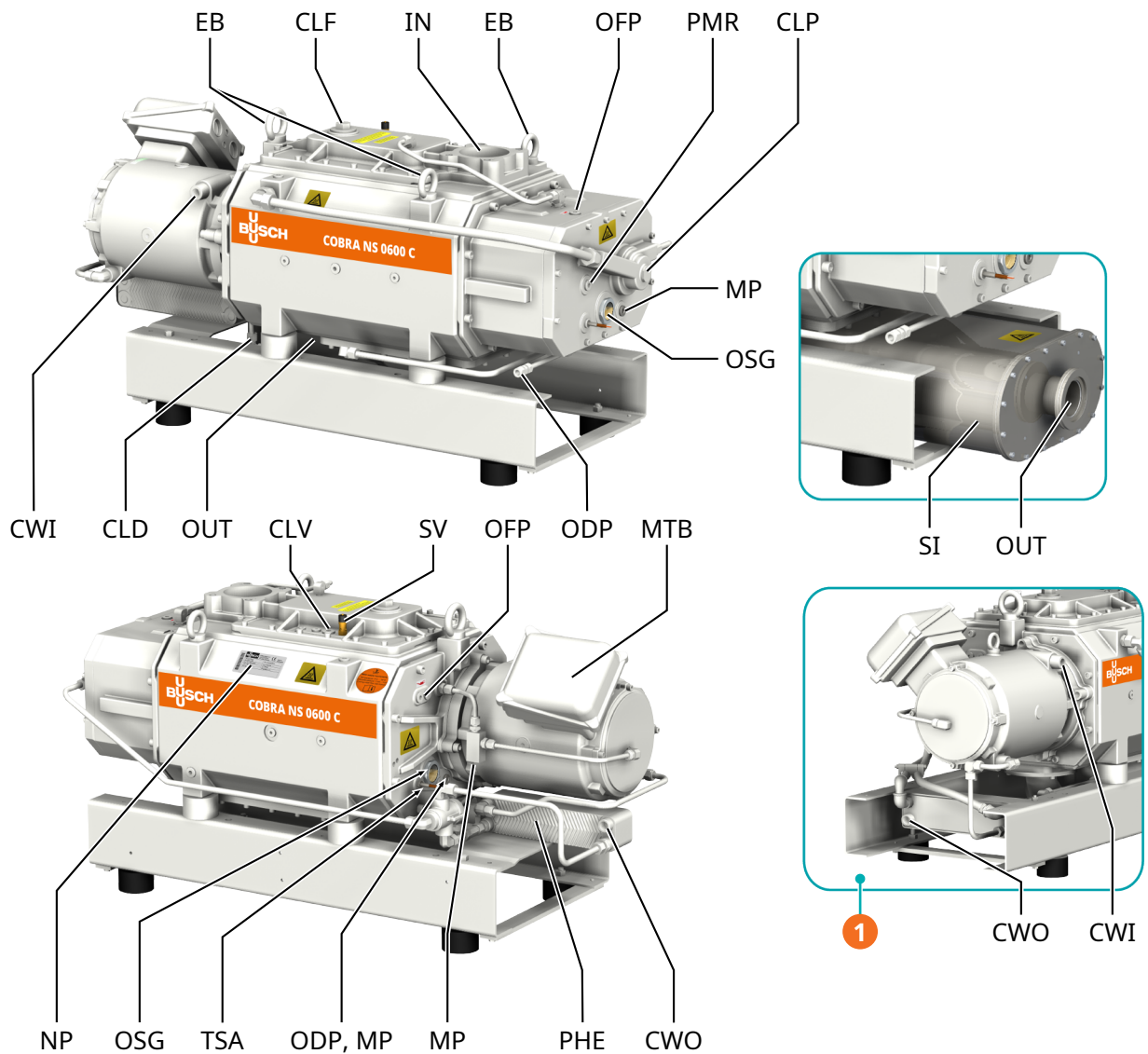
... indicates a potentially dangerous situation that could result in damage to property.



NOTE

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

2 Product Description



| Description | | | |
|-------------|--------------------------------|--|--|
| 1 | COBRA NS 0600 C Helium version | | |

| Description | | | |
|-------------|------------------------------------|-----|--|
| IN | Suction connection (Inlet) | OUT | Discharge connection (Outlet) |
| CLD | Cooling liquid drain plug | CLF | Cooling liquid fill plug |
| CLP | Cooling liquid pump | CLV | Cooling liquid vent plug |
| CWI | Cooling water inlet | CWO | Cooling water outlet |
| EB | Eye bolt | MP | Magnetic plug |
| MTB | Motor terminal box | NP | Nameplate |
| ODP | Oil drain plug | OFF | Oil fill plug |
| OSG | Oil sight glass | PHE | Plate heat exchanger |
| PMR | Plug for manual rotation of rotors | SI | Silencer |
| SV | Safety valve | TSA | Resistance thermometer (Oil temperature) |

NOTE

Technical term.

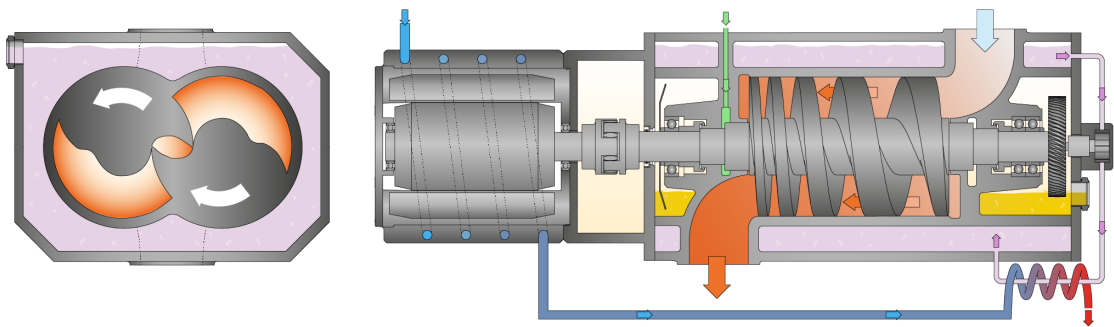
In this instruction manual, we consider that the term 'machine' refers to the 'vacuum pump'.

NOTE

Illustrations.

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

2.1 Operating Principle



The machine works on the one-stage, twin-screw pump principle.

Two screw rotors rotate inside the cylinder. The pumped medium is trapped between the cylinder and screw chambers, compressed, and transported to the gas outlet. During the compression process, the two screw rotors do not come into contact with each other or with the cylinder. There is no need for a lubrication or an operating fluid in the compression chamber.

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, non-ignitable 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.

For suction of up to 100% of helium gas, a specific machine execution is available. This helium version can be identified on the nameplate (NP) of the machine, with the code "L" in the 9th digit. Example: "NS 0600 C TL3".

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 soft-starter or a variable speed drive (not included in the scope of supply).

2.4 Standard Features

2.4.1 Water Cooling

The machine is cooled by a cooling liquid circuit in the cylinder cover and cylinder.

The cooling liquid pump (CLP) allows a recirculating flow in the cooling liquid chamber.

The cooling liquid is cooled by a plate heat exchanger (PHE) which must be connected to the water main.

The water cooled motor is connected in series to the plate heat exchanger.

2.4.2 Resistance Thermometer (TSA)

The resistance thermometer monitors the A-side oil temperature of the machine. A second resistance thermometer might be installed to monitor the exhaust gas temperature.

Warning and trip signals must be set, see *Wiring Diagram Resistance Thermometer* [→ 22].

2.4.3 Sealing Systems

The machine is equipped with labyrinth seals on the motor side and suction side.

Sealing systems prevent the process gas going to the bearings chambers.

Depending on the application, the sealing systems efficiency can be improved with a barrier gas system, see *Barrier Gas System* [→ 7].

2.5 Optional Accessories

2.5.1 Silencer

A silencer at the discharge connection (OUT) can be provided to reduce the exhaust gas noise.

2.5.2 Barrier Gas System

The barrier gas system allows the supply of compressed air or nitrogen into the motor side shaft seals to improve the sealing efficiency.

This device is available either with or without nitrogen panel.

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.

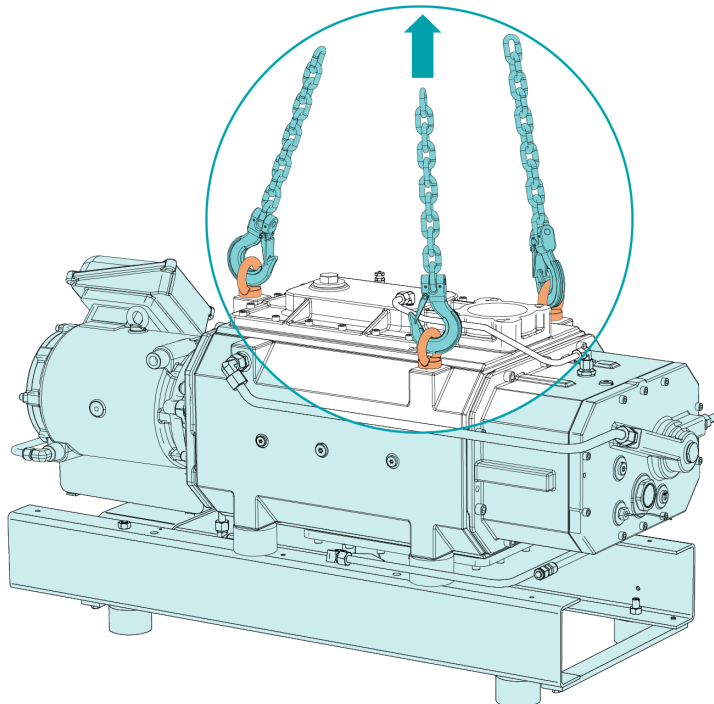


NOTICE

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.

- 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 5 ... 55 °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.

- 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 vented such that sufficient cooling of the machine is provided.
- 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* [→ 26].
- Check the cooling liquid level, see *Cooling Liquid Level Inspection* [→ 28].
- Make sure that the cooling water complies with the requirements, see *Cooling Water Connection* [→ 12].

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.

Connection size(s):

- DN100 ISO-K, DIN 28404 or DN100 ISO-F, DIN 28404

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

- Busch recommends the installation of an isolation valve in order to prevent the machine from turning backwards.
- 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



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):

At the machine discharge connection:

- DN100 ISO-K, DIN 28404 or DN100 ISO-F, DIN 28404

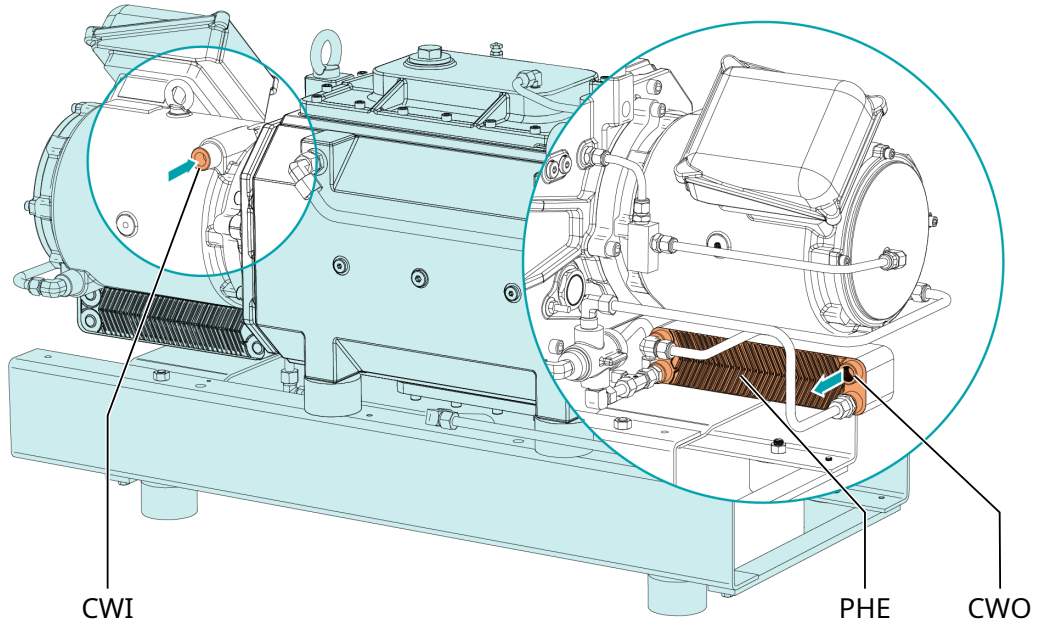
At the silencer (SI) discharge connection:

- DN63 ISO-K

- 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 counter pressure (also called “back pressure”) at the discharge connection (OUT) does not exceed the maximum allowable discharge pressure, see Technical Data.

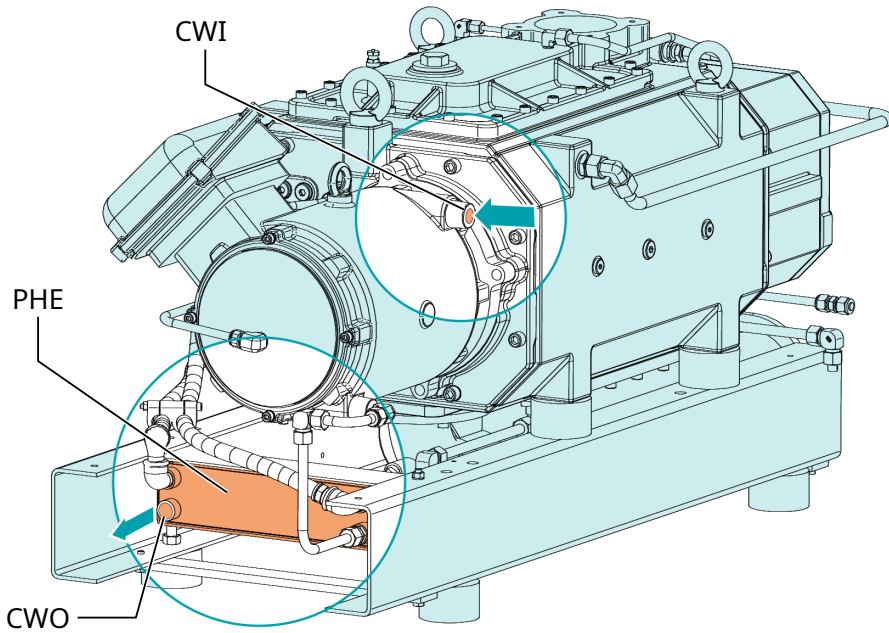
5.2.3 Cooling Water Connection

Standard version



| Description | | | |
|-------------|----------------------|-----|----------------------|
| CWI | Cooling water inlet | CWO | Cooling water outlet |
| PHE | Plate heat exchanger | | |

Helium version



| Description | | | |
|-------------|----------------------|-----|----------------------|
| CWI | Cooling water inlet | CWO | Cooling water outlet |
| PHE | Plate heat exchanger | | |

- Connect the cooling water connections (CWI / CWO) to the water supply.

Connection size:

- G1/2, ISO 228-1 (CWI / CWO)

- Make sure that the cooling water complies with the following requirements:

| | | |
|---|---------|------------|
| Supply capacity | l/min | 8 |
| Water pressure | bar (g) | 1.5 ... 5 |
| Supply temperature | °C | +5 ... +30 |
| Required pressure differential across supply and return | bar (g) | ≥ 1.5 |

- To reduce the maintenance effort and ensure a long product lifetime, we recommend the following cooling water quality:

| | | |
|---|-------------------------|-------|
| Hardness | mg/l (ppm) | < 90 |
| Properties | Clean & clear | |
| PH value | 7 ... 9 | |
| Particle size | µm | < 200 |
| Chloride | mg/l | < 100 |
| Electrical conductivity | µS/cm | ≤ 100 |
| Free chloride | mg/l | < 0.3 |
| Materials in contact with the cooling water | Stainless steel, copper | |



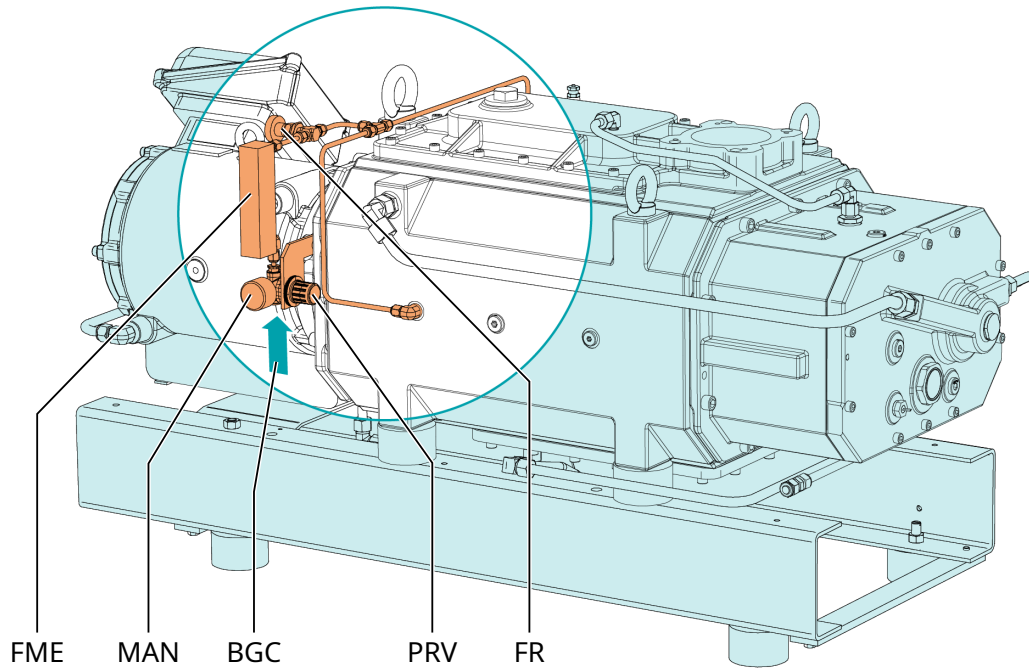
NOTE

Water hardness unit conversion.

1 mg/l (ppm) = 0.056 °dh (german degree) = 0.07 °e (english degree) = 0.1 °fH (french degree)

5.2.4 Barrier Gas System Connection (Optional)

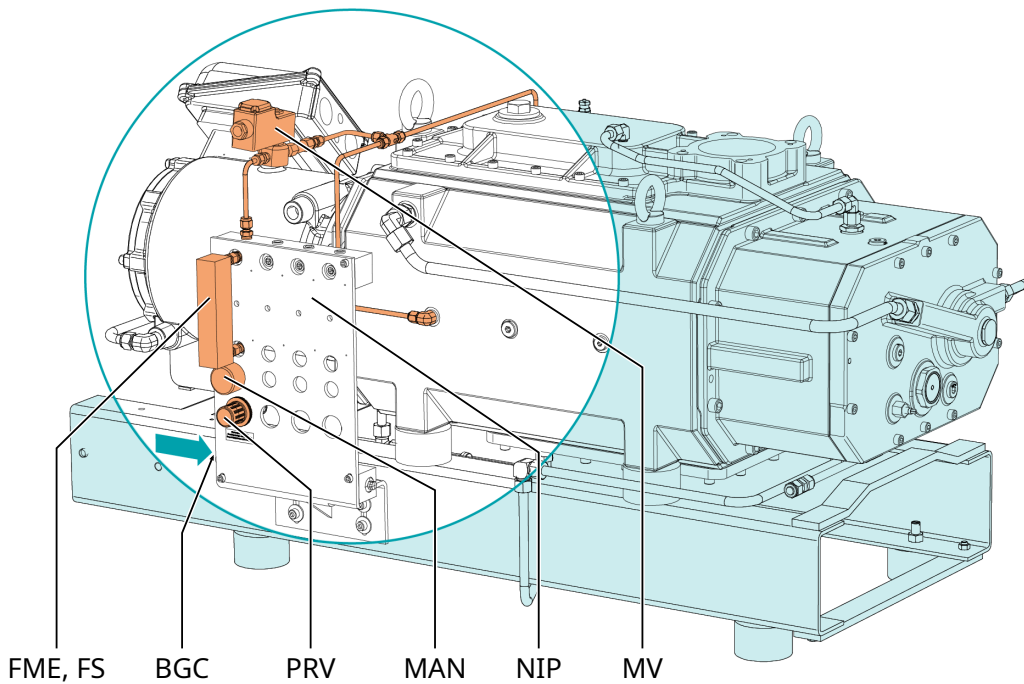
Without nitrogen panel



Description

| | | | |
|-----|---------------------------|-----|------------|
| BGC | Barrier gas connection | FME | Flow meter |
| FR | Flow regulator | MAN | Manometer |
| PRV | Pressure regulating valve | | |

With nitrogen panel



Description

| | | | |
|-----|------------------------|-----|------------|
| BGC | Barrier gas connection | FME | Flow meter |
| FS | Flow switch | MAN | Manometer |

| Description | | | |
|-------------|---------------------------|-----|----------------|
| MV | Solenoid valve | NIP | Nitrogen panel |
| PRV | Pressure regulating valve | | |

- Connect the barrier gas connection (BGC) to the gas supply.

Connection size:

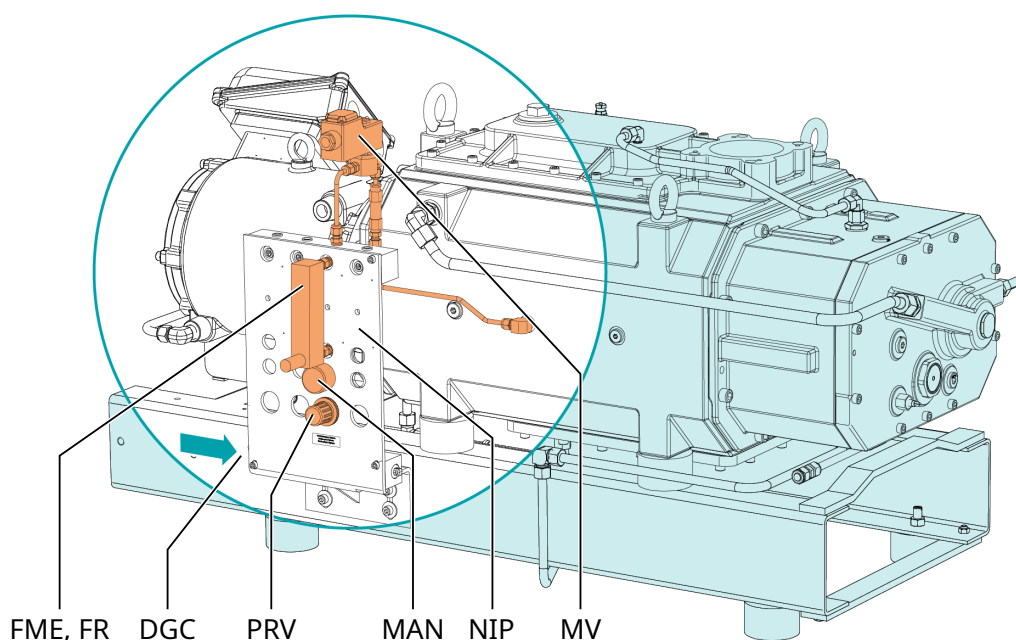
- G1/4, ISO 228-1

Version with nitrogen panel:

- Electrically connect the solenoid valve (MV), see *Wiring Diagram Solenoid Valve* [→ 22].
- Electrically connect the flow switch (FS) of the flow meter, see *Wiring Diagram Flow Switch* [→ 22].
- Make sure that the gas complies with the following requirements:

| | | |
|---|---------------------------------|--------------|
| Gas type | Dry nitrogen or air | |
| Gas temperature | °C | 0 ... 60 |
| Maximum gas pressure | bar (g) | 13 |
| Recommended pressure setting at the pressure regulating valve (PRV) | bar (g) | 3 |
| Filtration | µm | 5 |
| Recommended flow rate | SLM (standard liter per minute) | 3,5 ... 5,5 |
| Air quality (only for air) | Acc. to ISO 8573-1 | Class 5.4.4. |

5.2.5 Dilution Gas System Connection (Optional)



| Description | | | |
|-------------|---------------------------|-----|----------------|
| DGC | Dilution gas connection | FME | Flow meter |
| FR | Flow regulator | MAN | Manometer |
| MV | Solenoid valve | NIP | Nitrogen panel |
| PRV | Pressure regulating valve | | |

- Connect the dilution gas connection (DGC) to the gas supply.

Connection size:

- G1/4, ISO 228-1

- Electrically connect the solenoid valve (MV), see *Wiring Diagram Solenoid Valve* [→ 22].

- Make sure that the gas complies with the following requirements:

| | | |
|---|---------------------------------|----------|
| Gas type | Dry nitrogen | |
| Gas temperature | °C | 0 ... 60 |
| Maximum gas pressure | bar (g) | 13 |
| Recommended pressure setting at the pressure regulating valve (PRV) | bar (g) | 2.5 |
| Filtration | µm | 5 |
| Recommended flow rate | SLM (standard liter per minute) | 30 |

5.3 Filling Oil

! NOTICE

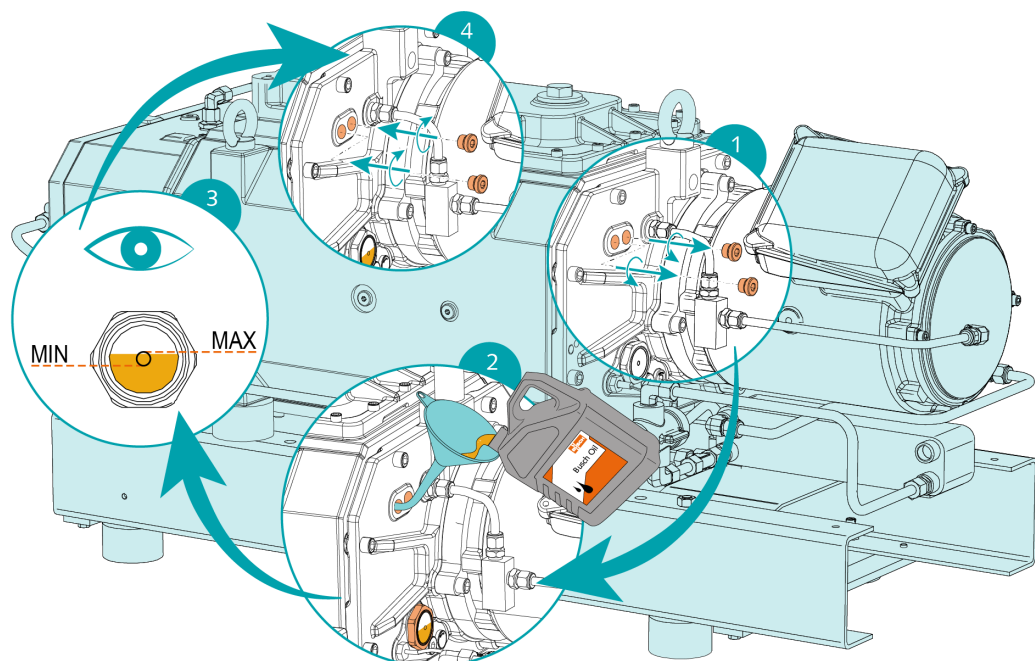
Use of an inappropriate oil.

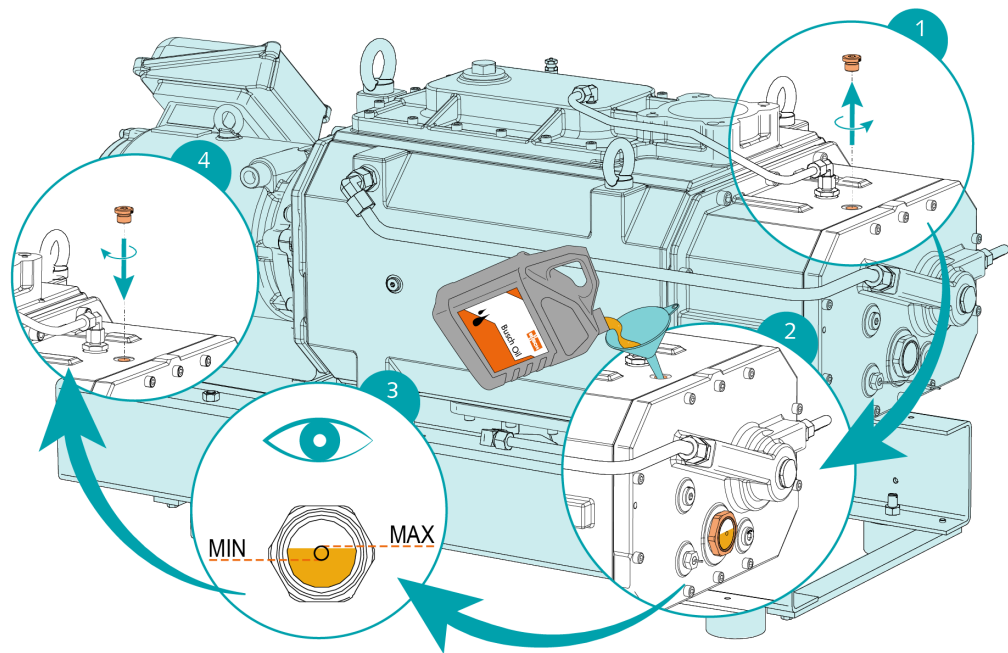
Risk of premature failure!

Loss of efficiency!

- Only use an oil type specified on the machine nameplate.

For oil type and oil capacity see Technical Data and Oil.





When the oil filling is achieved:

- Write down the oil change date on the sticker.

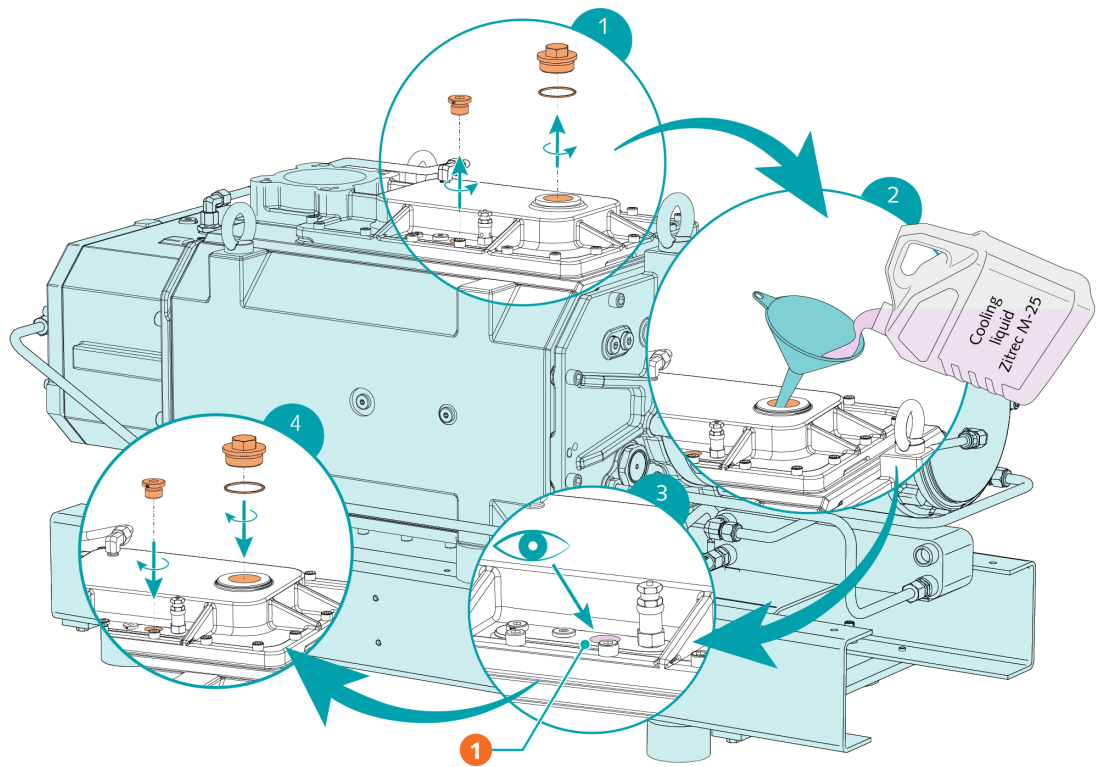


If there is no sticker (part no. 0565 568 959) on the machine:

- Order it from your Busch representative.

5.4 Filling Cooling Liquid

For cooling liquid type and cooling liquid capacity see Technical Data and *Cooling Liquid* [→ 38].



Description

| | | | |
|---|--|--|--|
| 1 | Fill up to the top of the vent orifice | | |
|---|--|--|--|

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* [→ 40] or *UK Declaration of Conformity* [→ 41]).

6.1 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.
- 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.
- Connect the protective earth conductor.
- Electrically connect the motor.

NOTICE

The motor frequency is below 20 Hz.

Risk of damage to the machine!

- The motor nominal speed must always be higher than 1200 min⁻¹ (20 Hz).

NOTICE

The admissible motor nominal speed exceeds the recommendation.

Risk of damage to the machine!

- Check the admissible motor nominal speed (n_{max}) on the nameplate of the machine (NP).
- Make sure to comply with it.
- Consult the Technical Data to get more information.

NOTICE

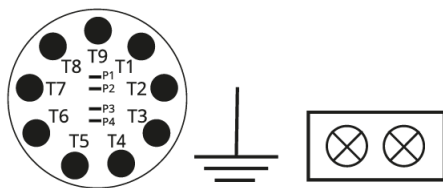
Incorrect connection.

Risk of damage to the motor!

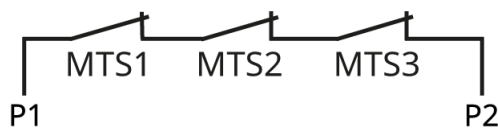
- The wiring diagrams given below are typical. Check the inside of the terminal box for motor connection instructions/diagrams.

6.2 Wiring Diagram Three-Phase Motor (Pump Drive)

Motor connectors:



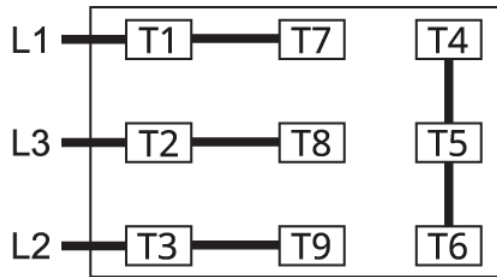
Connection of motor temperature switches (Recommended):



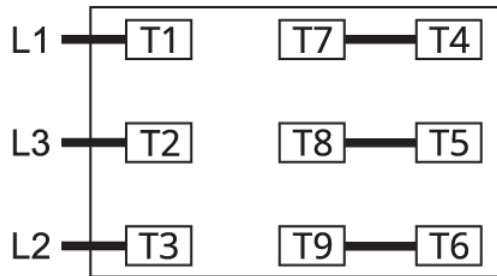
MTS = Motor temperature switch (In motor coil)

Control voltage: ≤ 250 V - **Max current:** 1.6 A

Double star connection (low voltage):



Star connection (high voltage):



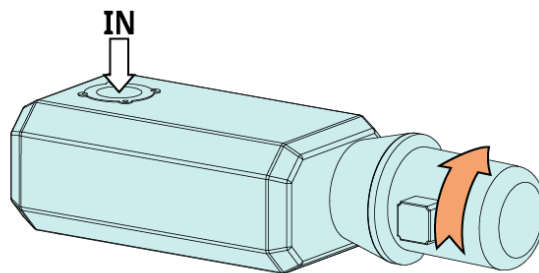
! NOTICE

Incorrect direction of rotation.

Risk of damage to the machine!

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

The intended rotation direction of the motor is defined by the illustration below:



- Jog the motor briefly.
- With a phase rotation tester, check if the wiring corresponds to the correct direction of rotation.

If the rotation of the motor must be changed:

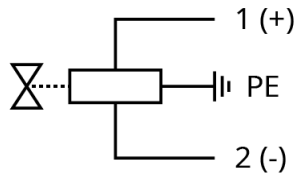
- Switch any two of the motor phase wires.

6.3 Wiring Diagram Solenoid Valve (Optional)

Part no.: 0654 000 092

$U = 24 \text{ VDC}$; $P_{\text{max}} = 8 \text{ W}$

Contact: Normally closed



6.4 Electrical Connection of the Monitoring Devices

NOTE

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

6.4.1 Wiring Diagram Resistance Thermometer

Part no.: PT100: 0651 543 954

Supplier reference: PT100: Albert Balzer AG ref.: TFE/ BDAE

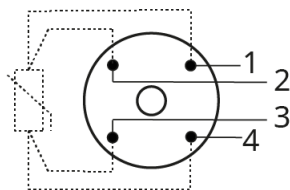
P&ID position: TSA

Electrical data (PT100): $U_i = 30 \text{ VDC}$; $I_i = 100 \text{ mA}$; $P_i = 0.1 \dots 0.75 \text{ W}$

Warning signal: A warning signal can be set prior the trip signal.

Trip signal: $T_{\text{trip}} (\text{TSA+}/0104) = 80^\circ\text{C}$ (A side)

Wiring without transmitter:



1 and 2 = Red; 3 and 4 = White

6.4.2 Wiring Diagram Flow Switch

Part no.: No Busch reference (Integrated into the flow meter)

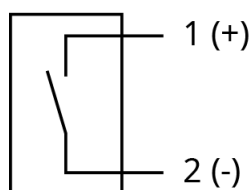
Supplier reference: Pepperl+Fuchs RC15-14-N3

Electrical data: $U = 5 \dots 25 \text{ V}$; $I = 1 \dots 3 \text{ mA}$

Switching element function: NAMUR, bistable

Contact: Normally open

Switch point: 3 SLM ► min. volume flow



1 = Brown; 2 = Blue

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.

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*.

NOTICE

The machine can be shipped without cooling liquid.

Operation without cooling liquid will ruin the machine in short time!

- Prior to commissioning, the machine must be filled with cooling liquid, see *Filling Cooling Liquid* [→ 18].

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.

- Make sure that the *Installation Conditions* [→ 10] are met.
- Turn on the water supply.

Make sure that the machine does not contain a potentially explosive atmosphere. In case of doubt, the machine must be purged by an inert gas.

- Turn on the barrier gas supply.
- Adjust the barrier gas pressure and volume flow.
- Start the machine.
- Make sure that the maximum permissible number of starts does not exceed 2 starts per hour. Those starts should be spread within the hour.
- Make sure that the operating conditions comply with the Technical Data.
- After a few minutes of operation, perform an *Oil Level Inspection* [→ 26].
- After a few minutes of operation, perform a *Cooling Liquid Level Inspection* [→ 28].

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 Conveying Condensable Vapors



CAUTION

Draining the condensate while operating and/or venting the machine.

The discharged gases and/or liquids may reach temperatures above 70°C!

Risk of burns!

- Avoid direct contact with the flow of gases and/or liquids.

The machine, equipped either with a gas ballast valve or a dilution gas system, is suitable for the conveyance of condensable vapors within the gas flow.

If condensable vapors are to be conveyed:

START

- Open the gas ballast valve* or the dilution gas system* (solenoid valve)
- Warm up the machine for 30 minutes
- Open the inlet valve
- Perform the process
- Close the inlet valve
- Wait 30 minutes
- Close the gas ballast valve* or the dilution gas system* (solenoid valve)

END

* Optional accessories

- Continuously drain condensate from the condensate drain plug (CD) of the silencer (SI) (Optional).

8 Maintenance



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.



WARNING



The machine is 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.
- Turn off the water supply.
- Vent the connected lines to atmospheric pressure.

If necessary:

- Disconnect all connections.

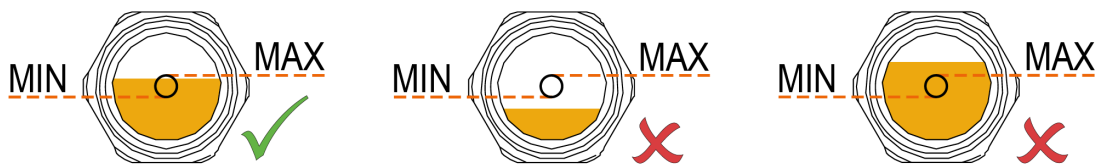
8.1 Maintenance Schedule

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"> • Check the oil level, see <i>Oil Level Inspection</i> [→ 26]. • Check the cooling liquid level, see <i>Cooling Liquid Level Inspection</i> [→ 28]. • Check the machine for oil leaks. In case of leaks, have the machine repaired (Contact Busch). |
| Yearly | <ul style="list-style-type: none"> • Carry out a visual inspection and clean the machine from dust and dirt. • Check the electrical connections and the monitoring devices. |
| Every 1000 hours. | <ul style="list-style-type: none"> • Check the silencer (SI) and clean it if necessary. |
| Every 5000 hours or after 1 year | <ul style="list-style-type: none"> • Change the cooling liquid, see <i>Cooling Liquid Change</i> [→ 31]. • Clean the magnetic plugs (MP). |
| Every 16000 hours or after 4 years | <ul style="list-style-type: none"> • Change the oil of the gear and bearing housings (both sides), see <i>Oil Change</i> [→ 28]. • Have a major overhaul on the machine (contact Busch). |

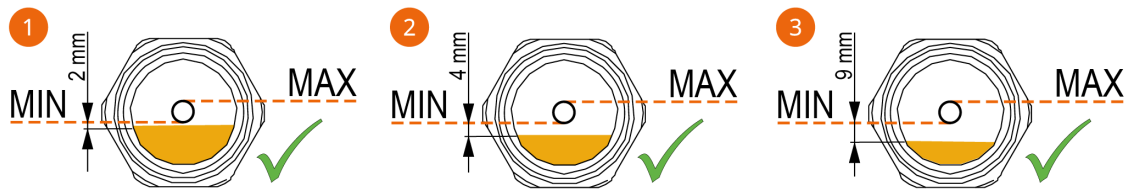
8.2 Oil Level Inspection

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



- Fill up if necessary, see *Oil Filling*.

8.2.1 Oil Level, Machine Operating



- Check the oil level while the machine is running.

The minimum oil level depends on the following guidelines:

- According to the nameplate,
- On the oil sight glass at the suction side (OSG).

1) 50Hz operation, $n_{max} = 3000 \text{ min}^{-1}$ / 60Hz operation, $n_{max} = 3600 \text{ min}^{-1}$

During the operation, the oil level must not be more than 3 mm under the oil level target circle.

2) 60Hz operation, $n_{max} = 3600 \text{ min}^{-1}$

During the operation, the oil level must not be more than 5 mm under the oil level target circle.

3) 50Hz operation, $n_{max} = 3000 \text{ min}^{-1}$

During the operation, the oil level must not be more than 10 mm under the oil level target circle.

8.3 Oil Color Inspection



WARNING

Oil "YLC 250 B" contaminated chemically or by foreign bodies.

Risk of explosion!

If the oil becomes dark:

- Contact your Busch representative without delay.

- Make sure that the oil is either light or transparent.

If the oil becomes dark or looks different from the initial color:

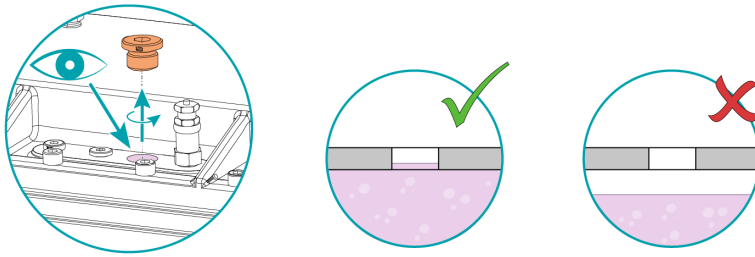
- Change the oil immediately, see *Oil Change* [→ 28].



You can consult your Busch representative in order to find out why this color change has occurred.

8.4 Cooling Liquid Level Inspection

- Shut down the machine.
- Let the machine cool down.



- Fill up if necessary, see *Filling Cooling Liquid* [→ 18].

8.5 Oil Change

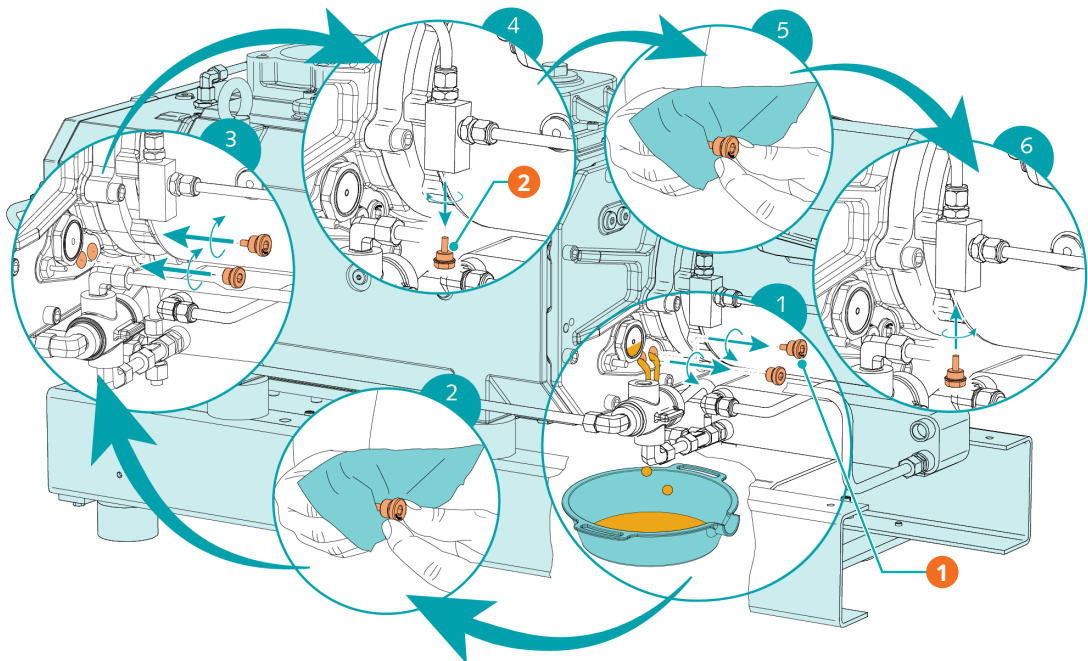
! NOTICE

Use of an inappropriate oil.

Risk of premature failure!

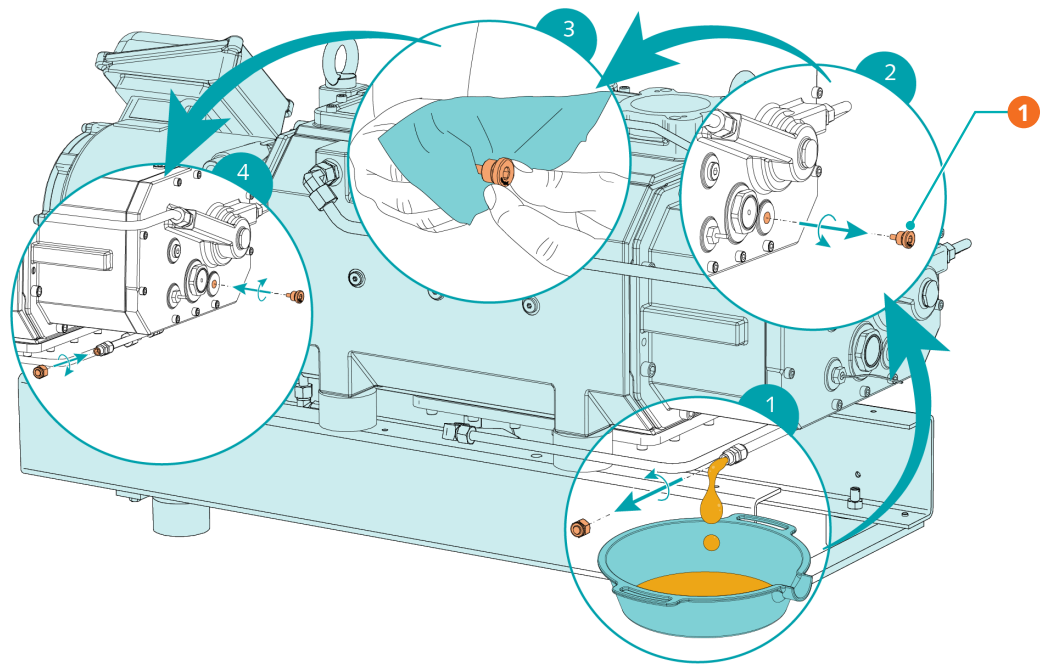
Loss of efficiency!

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



Description

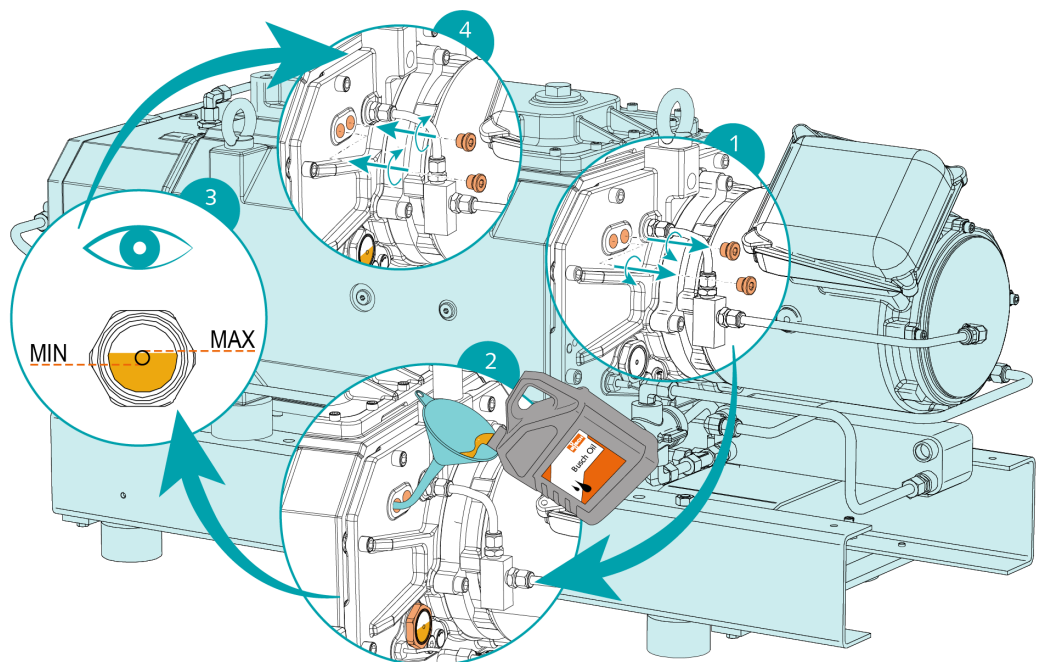
| | | | |
|---|---------------|---|---------------|
| 1 | Magnetic plug | 2 | Magnetic plug |
|---|---------------|---|---------------|

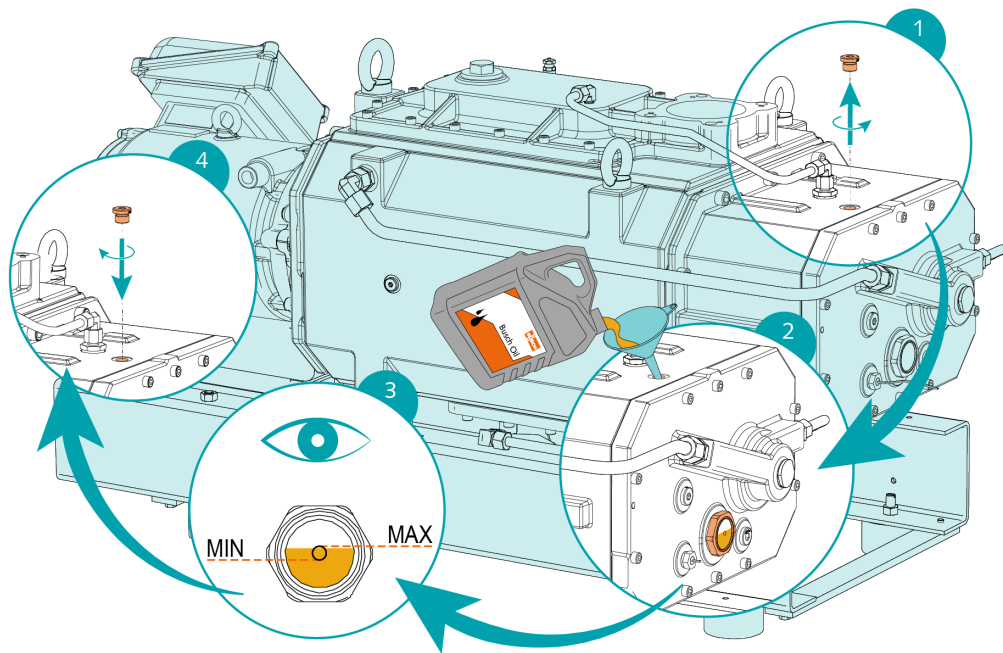


Description

| | | |
|---|---------------|--|
| 1 | Magnetic plug | |
|---|---------------|--|

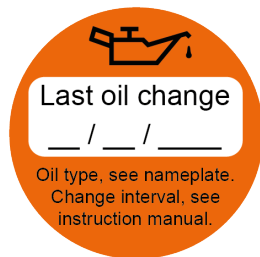
For oil type and oil capacity see Technical Data and Oil.





When the oil filling is achieved:

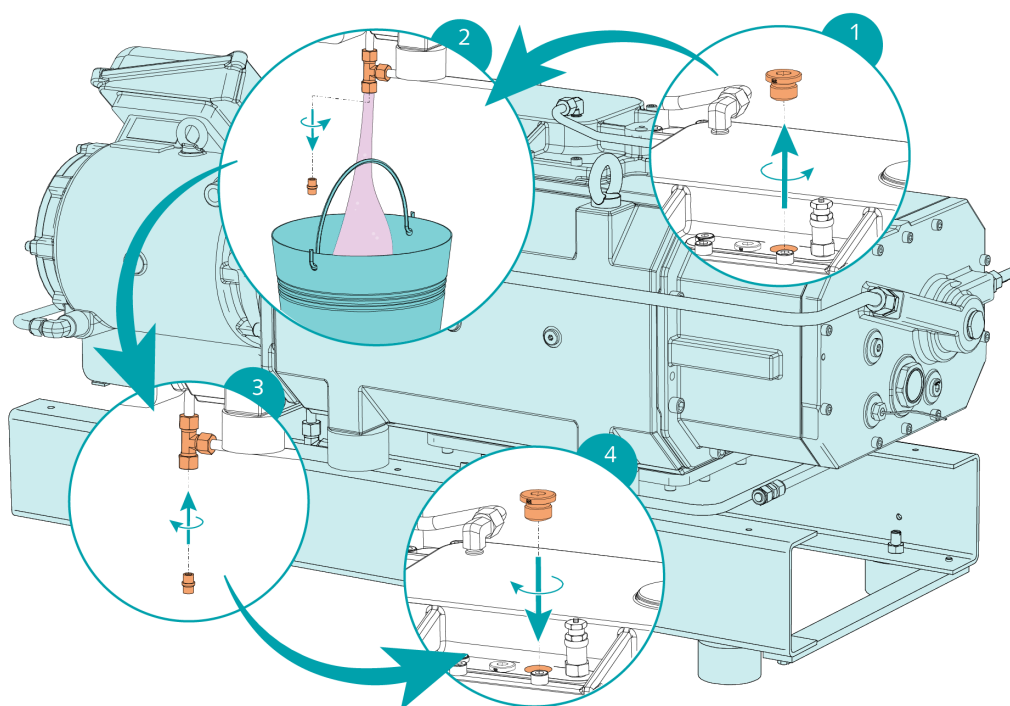
- Write down the oil change date on the sticker.



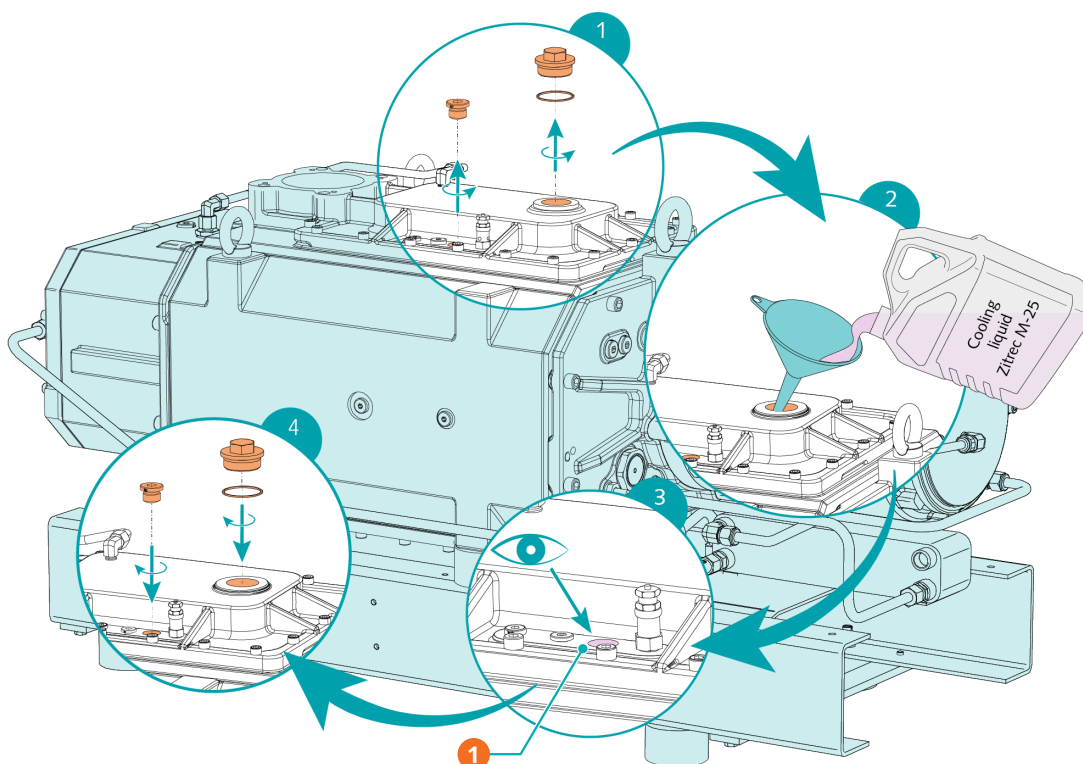
If there is no sticker (part no. 0565 568 959) on the machine:

- Order it from your Busch representative.

8.6 Cooling Liquid Change



For cooling liquid type and cooling liquid capacity see Technical Data and *Cooling Liquid* [→ 38].



Description

- | | |
|---|--|
| 1 | Fill up to the top of the vent orifice |
|---|--|

9 Overhaul



WARNING



The machine is 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 machine accompanied by a signed, fully completed and legally binding "declaration of contamination", downloadable from the following link: buschvacuum.com/declaration-of-contamination.

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.
- Turn off the water supply.

Make sure that the machine does not contain a potentially explosive atmosphere.
In case of doubt, the machine must be purged by an inert gas:

- Close the barrier gas supply.
- Vent the connected lines to atmospheric pressure.
- Disconnect all connections.

If the machine is 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.
- Drain and collect the cooling liquid.
- Make sure that no cooling liquid 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.
-

There are no standard spare parts kits available for this product.

If you require Busch genuine parts:

- 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!

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

| Problem | Possible Cause | Remedy |
|--|--|---|
| The machine does not start. | The motor is not supplied with the correct voltage. | <ul style="list-style-type: none"> • Check the power supply. |
| | The rotors are jammed or seized. | <ul style="list-style-type: none"> • Turn the screw rotors manually from the rotor access plug (PMR). • Repair the machine (contact Busch). |
| | Solid foreign matter has entered the machine. | <ul style="list-style-type: none"> • Remove the solid foreign matter or repair the machine (contact Busch). • Install an inlet filter if necessary. |
| | A temperature sensor has reached the switch point. | <ul style="list-style-type: none"> • Let the machine cool down. • See problem "The machine runs too hot". |
| | Corrosion in the machine from remaining condensate. | <ul style="list-style-type: none"> • Repair the machine. • Check the process and follow the recommendation in case of <i>Conveying Condensable Vapors</i> [→ 24]. |
| | The motor is defective. | <ul style="list-style-type: none"> • Replace the motor. |
| The machine does not reach the usual pressure on the suction connection. | Suction or discharge lines too long or section diameter too small. | <ul style="list-style-type: none"> • Use larger diameter or shorter lines. • Seek advice from your local Busch representative. |
| | Process deposits on the pumping components | <ul style="list-style-type: none"> • Flush the machine. |
| | The machine runs in the wrong direction. | <ul style="list-style-type: none"> • Check the direction of rotation, see <i>Wiring Diagram Three-Phase Motor (Pump Drive)</i> [→ 20]. |
| | Internal parts are worn or damaged. | <ul style="list-style-type: none"> • Repair the machine (contact Busch). |

| Problem | Possible Cause | Remedy |
|--------------------------------|---|--|
| The machine runs very noisily. | Wrong oil quantity or unsuitable oil type. | <ul style="list-style-type: none"> Use one of the recommended oils in the correct quantity, see Oil. |
| | Defective gears, bearings or coupling element. | <ul style="list-style-type: none"> Repair machine (contact Busch). |
| The machine runs too hot. | Insufficient cooling. | <ul style="list-style-type: none"> Make sure to comply with the cooling water requirements, see <i>Cooling Water Connection</i> [→ 12]. |
| | Ambient temperature too high. | <ul style="list-style-type: none"> Observe the permitted ambient temperature, see Technical Data. |
| | Temperature of the process gases at the inlet too high. | <ul style="list-style-type: none"> Observe the permitted gas inlet temperature, see Technical Data. |
| | The cooling water pump is defective. | <ul style="list-style-type: none"> Repair the machine. |
| | Oil level too low. | <ul style="list-style-type: none"> Top up oil. |
| The oil is black. | Oil change intervals are too long. | <ul style="list-style-type: none"> Drain the oil and fill in new oil, see <i>Oil Change</i> [→ 28]. |
| | The machine runs too hot. | <ul style="list-style-type: none"> See problem "The machine runs too hot". |

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

13 Technical Data

| | | NS 0600 C Standard | NS 0600 C Helium |
|---|-------------------|--|---------------------|
| Pumping speed (50 / 60 Hz) | m ³ /h | 600 / 600 | 350 / 350 |
| | ACFM | 353.1 | 206 |
| Ultimate pressure without gas-bal- last | hPa (mbar) abs. | ≤ 0.01 | ≤ 7.0 |
| | TORR | ≤ 0.0075 | ≤ 5.25 |
| Nominal motor rating (50 / 60 Hz) | kW | 15 / 15 | |
| Nominal motor speed (50 / 60 Hz) | min ⁻¹ | 3000 / 3600 | |
| Noise level (ISO 2151) (50 / 60 Hz) | dB(A) | ≤ 68 / ≤ 68 | |
| Ambient temperature range | °C | 5 ... 50 | |
| | °F | 41 ... 122 | |
| Maximum allowable counter pres- sure at discharge | hPa (mbar) rel. | 200 | 250 |
| Leak rate | mbar·L/s | ≤ 0,0005 | |
| Maximum allowable gas inlet tem- perature according to the inlet pres- sure | °C | ≤ 50 hPa (mbar) abs. : 200 | |
| | | > 50 hPa (mbar) abs. : 70 | |
| | °F | ≤ 37.5 TORR : 392 | |
| | | > 37.5 TORR : 158 | |
| Relative humidity | at 30°C | 90% | |
| | at 86°F | | |
| Cooling water requirements | | See <i>Cooling Water Connection</i> [→ 12] | |
| Oil capacity - Motor side | l | 0.8 | |
| Oil capacity - Suction side | l | 0.8 | |
| Cooling liquid capacity approx. | l | 30 | |
| Weight approx. | kg | 600 | |

14 Cooling Liquid

| Zitrec M [®] (Ready-to-use) | |
|--------------------------------------|--------------|
| Part number 5 L packaging | 0831 563 469 |
| Part number 20 L packaging | 0831 238 761 |

Zitrec[®] M coolant (Cooling liquid) is ready-to-use and requires no additional water.

For more information, visit www.arteco-coolants.com.

15 Oil

| VSC 100 | |
|----------------------------|--------------|
| ISO-VG | 100 |
| Oil type | Synthetic |
| Part number 1 L packaging | 0831 168 356 |
| Part number 5 L packaging | 0831 168 357 |
| Part number 10 L packaging | 0831 210 162 |
| Part number 20 L packaging | 0831 168 359 |

| YLC 250 B | |
|-----------------------------|--------------|
| ISO-VG | 250 |
| Oil Type | Synthetic |
| Part number 0.5 L packaging | 0831 131 400 |
| Part number 1 L packaging | 0831 108 878 |
| Part number 5 L packaging | 0831 108 879 |

To find out which oil needs to be filled into the machine, please refer to the nameplate (NP).

16 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 is determined by the serial number:

Serial number starts with **CHM1...**

Ateliers Busch S.A.
Zone industrielle
2906 Chevenez
Switzerland

Serial number starts with **KRM1...**

Busch Manufacturing Korea, Ltd.
189-51, Soicheon-ro, Majang-myun
Icheon-si, Gyunggi-do, 467-813
Republic of Korea

declares that the machine: COBRA NS 0600 C

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, 02.02.2023

Icheon-si, 02.02.2023




Christian Hoffmann
General Manager
Ateliers Busch S.A.

Seung-hwa Yoo
General Manager
Busch Manufacturing Korea, Ltd

17 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 is determined by the serial number:

Serial number starts with **CHM1...**

Ateliers Busch S.A.
Zone industrielle
2906 Chevenez
Switzerland

Serial number starts with **KRM1...**

Busch Manufacturing Korea, Ltd.
189-51, Soicheon-ro, Majang-myun
Icheon-si, Gyunggi-do, 467-813
Republic of Korea

declares that the machine: COBRA NS 0600 C

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 2012

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, 02.02.2023



Christian Hoffmann
General Manager
Ateliers Busch S.A.

Icheon-si, 02.02.2023



Seung-hwa Yoo
General Manager
Busch Manufacturing Korea, Ltd

Notes

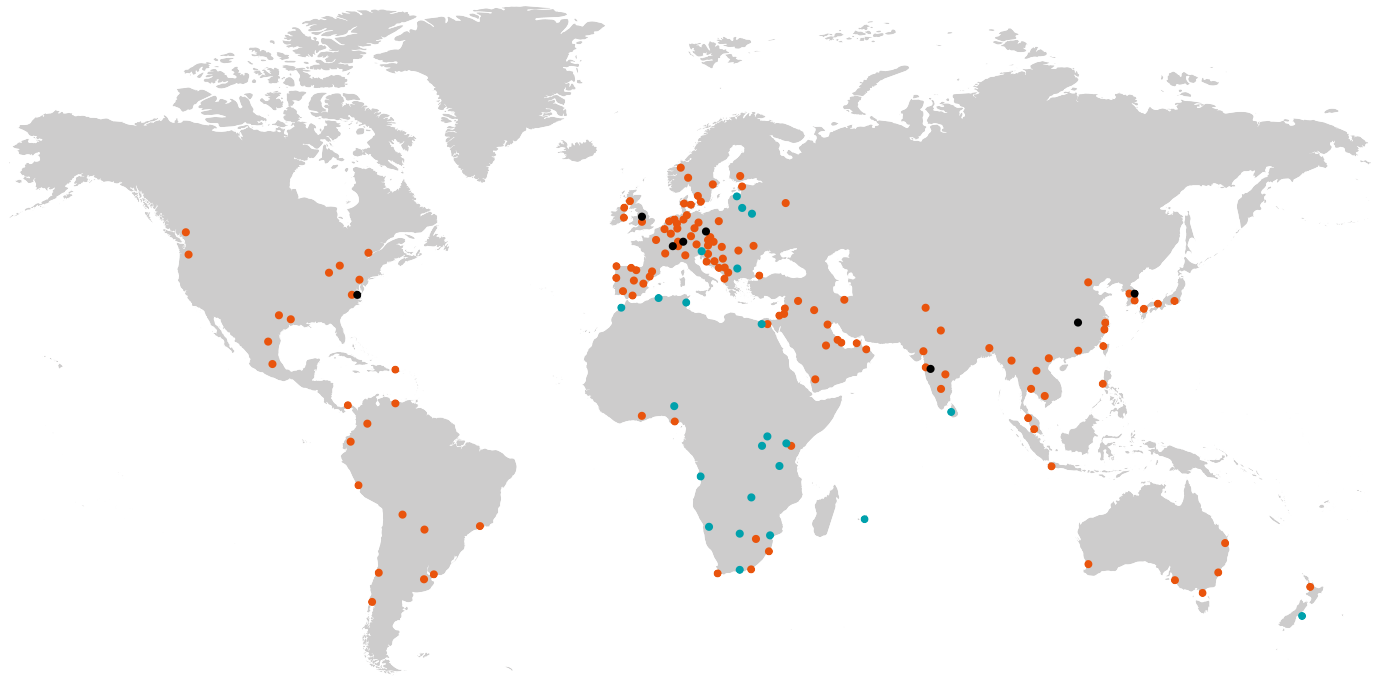
A large grid of small dots, arranged in approximately 30 rows and 40 columns, intended for taking notes. The dots are evenly spaced and cover most of the page area below the title.

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

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