VACUUM SOLUTIONS

Part of the BUSCH GROUP

COBRA

Dry Screw Vacuum Pumps
NX 0950 A Water-Cooled Version (WCV)

Instruction Manual



SERVICE AND SPARE PARTS, INSTRUCTION MANUALS ... WWW.BUSCHVACUUM.COM/SERVICE-CONTACT

VACUUM APP

CE UK CA

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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, contact your manufacturer representative.

Read this instruction 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:



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



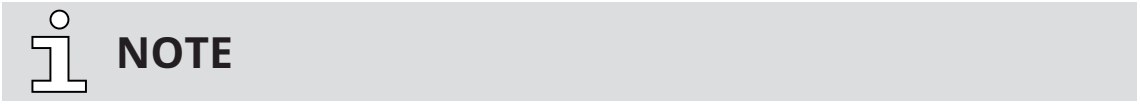
... indicates a potentially dangerous situation that could result in death or serious injuries.



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

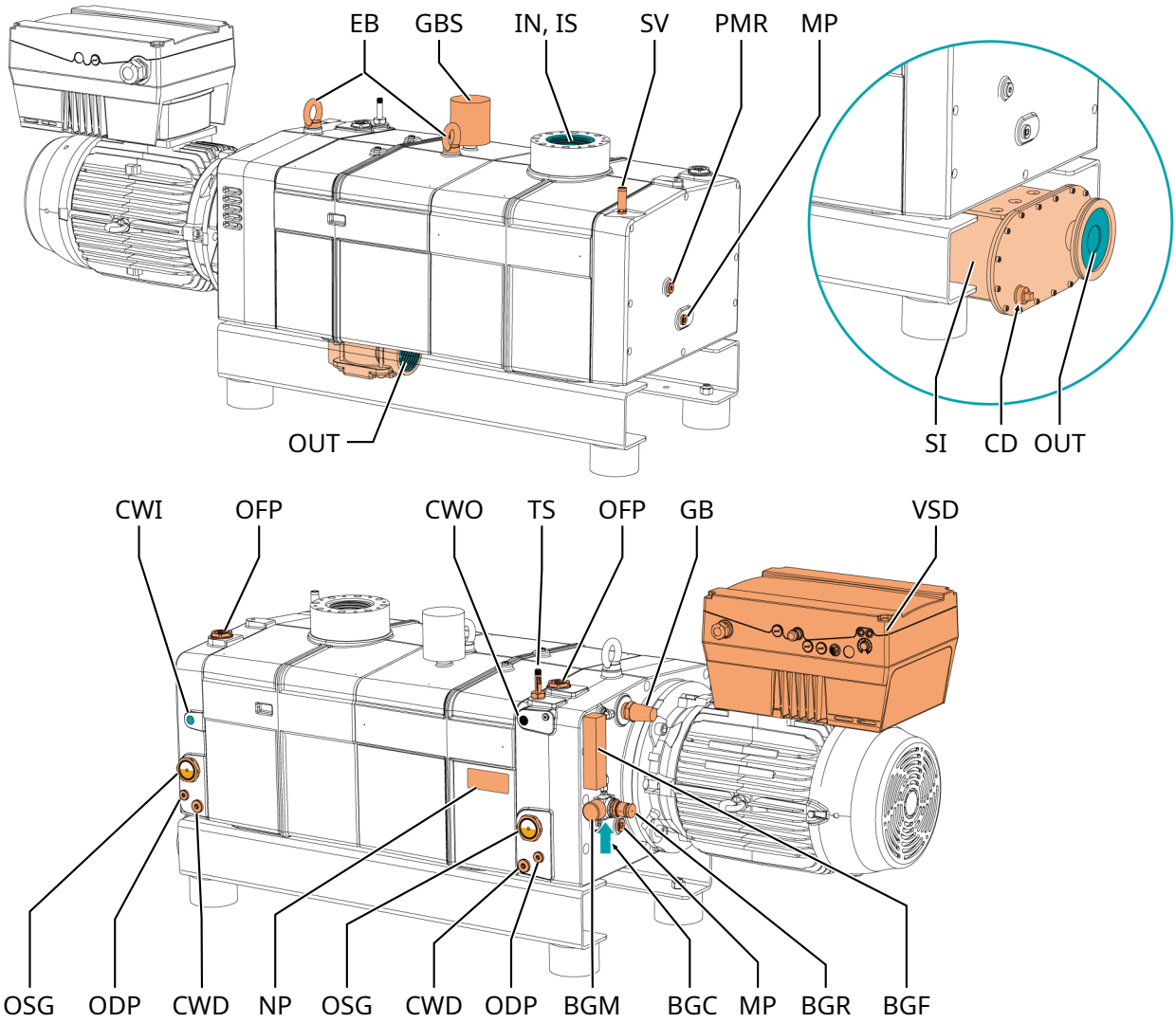


... indicates a potentially dangerous situation that could result in damage to property.



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

2 Product Description



Description			
IN	Inlet connection	OUT	Exhaust connection
BGC	Barrier gas connection	BGF	Barrier gas flow meter
BGM	Barrier gas manometer	BGR	Barrier gas pressure regulator
CD	Condensate drain	CWD	Cooling water drain plug
CWI	Cooling water inlet	CWO	Cooling water outlet
EB	Eye bolt	GB	Gas-ballast valve
GBS	Gas-ballast silencer	IS	Inlet screen
MP	Magnetic plug	NP	Name plate
ODP	Oil drain plug	OFP	Oil fill plug
OSG	Oil sight glass	PMR	Plug for manual rotation of rotors
SI	Silencer	SV	Safety valve
TS	Temperature switch	VSD	Variable Speed Drive

NOTE

Technical term.

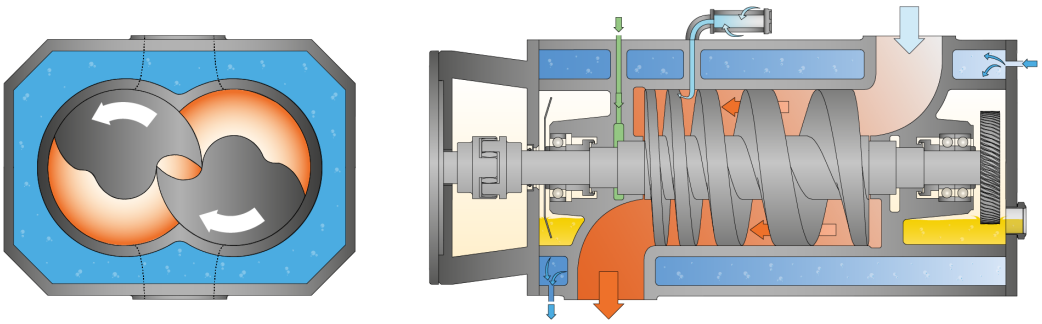
In this instruction manual, we consider that the term 'machine' refers to the 'vacuum pump'.

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 the manufacturer.

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

The machine is capable of maintaining ultimate pressure, see *Technical Data* [➔ 46].

The machine is suitable for continuous operation.

Permitted environmental conditions, see *Technical Data* [➔ 46].

NOTICE

Chemical compatibility of the process gases with the machine component materials.

Risk of corrosion inside the compression chamber which can reduce performance and its lifetime!

- Check if the process gases are compatible with those following materials:
  - Cast iron
  - Steel
  - Fluor elastomer (FKM/FPM)
- Contact your Busch representative for further advice and information.

2.3 Start Controls

The machine is equipped with a variable speed drive.

2.4 Standard Features

2.4.1 Water Cooling

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

If the machine is equipped with a plate heat exchanger (PHE):

- See optional *Cooling System with Plate Heat Exchanger* [➔ 8].

2.4.2 Temperature Switch

The temperature switch monitors the cooling water temperature of the machine.

The temperature switch has one switch point:

Switch point T = 70°C	Trip, the machine must be stopped, pin 1+2 (see *Electrical Connection of the Monitoring Devices* [➔ 28]).

NOTE

This temperature monitoring device must be electrically connected.

- For more information, see *Electrical Connection of the Monitoring Devices* [➔ 28].

2.4.3 Sealing Systems

The machine is equipped with labyrinth seals on the motor side and inlet 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* [➔ 8].

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* [➔ 46].

2.5.2 Silencer

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

2.5.3 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.

2.5.4 Cooling System with Plate Heat Exchanger

The machine can optionally be equipped with a cooling system featuring a plate heat exchanger (PHE).

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

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

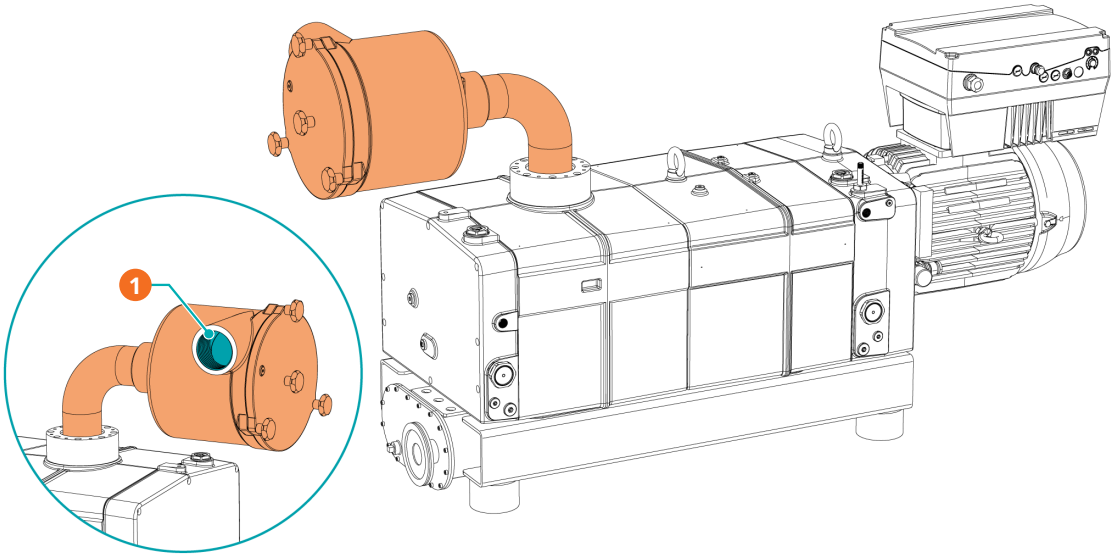
The cooling liquid pump (CLP) allows a recirculating flow in the cooling liquid chamber.

The motor of the cooling liquid pump must be electrically connected, see *Electrical Data of the Cooling Liquid Pump (Option)* [➔ 28].

For more information, see *Cooling Water Connection* [➔ 16].

2.5.5 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.



Description			
1	Connection size: G3'		

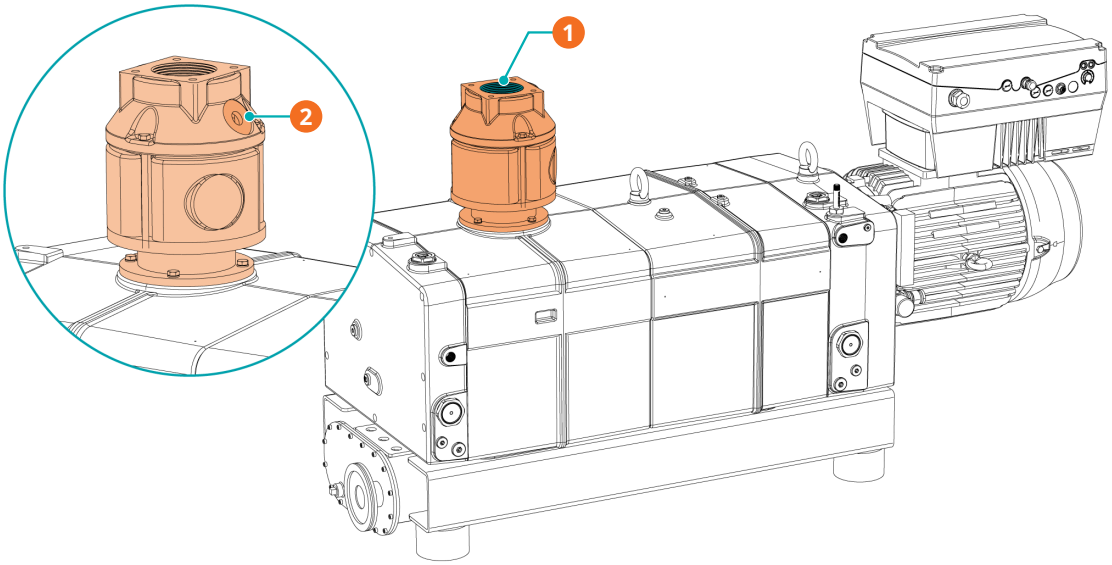
2.5.6 Inlet Check Valve

In order to avoid reverse rotation after switching off, the machine can be equipped with an inlet check valve.

The inlet check valve also prevents fast venting of the connected vacuum system.

The inlet check valve can also be equipped with a pressure sensor. Contact your Busch representative for further advice and information.

Pressure sensor range and accuracy	
Range: 0-1600 mbar	Accuracy: +/- 9.6 mbar



Description			
1	Connection size: G3'	2	Connection size: G1/2

3 Transport and Handling



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.

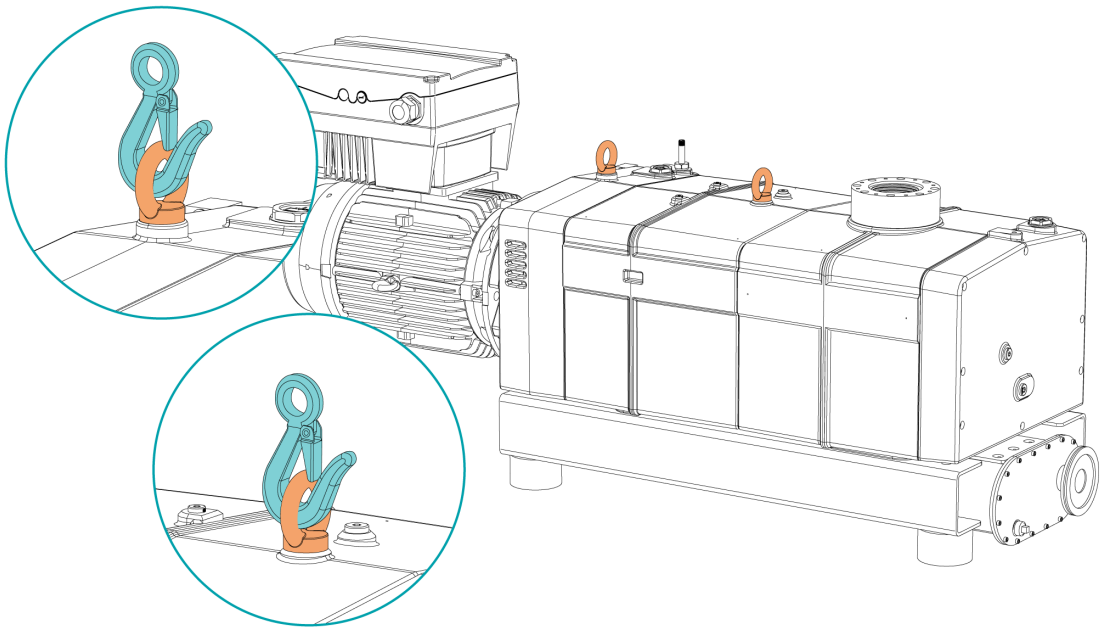
NOTICE

If the machine is already filled with oil.

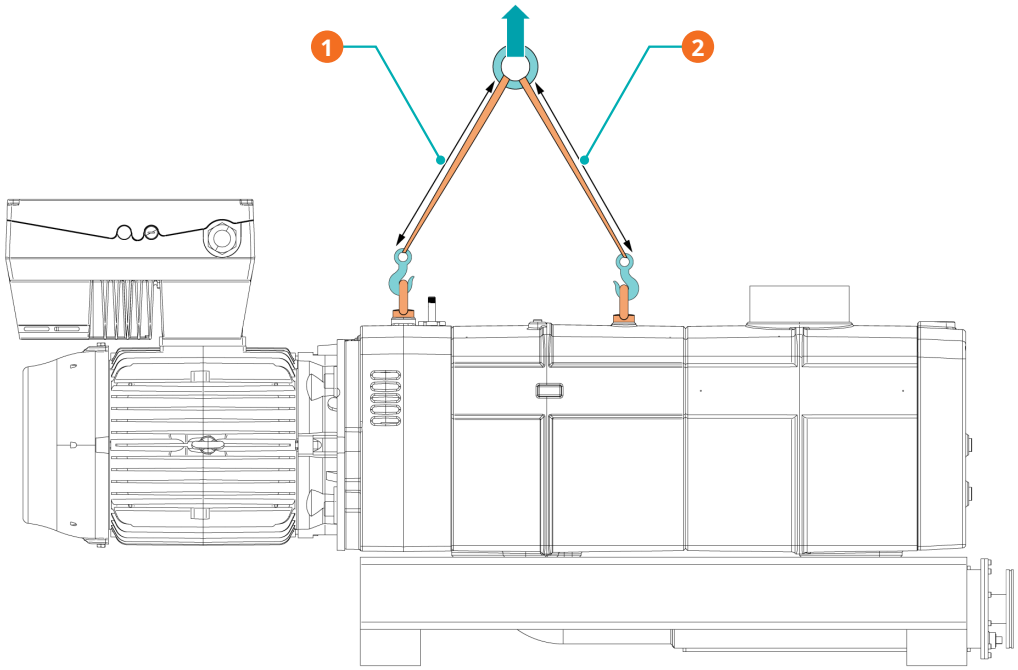
Tilting a machine already filled with oil can cause a large amount of oil to ingress into the cylinder.

- Drain the oil before each transport or always transport the machine horizontally.

- To find out the weight of the machine, refer to the chapter *Technical Data* [➔ 46] or the name plate (NP).
- Make sure that the eye bolt(s) (EB) is/are in faultless condition, fully screwed in and tightened by hand.



- Make sure that each of the slings used to lift the machine has a minimum length of 400 mm.
- Make sure that the length of each sling is exactly the same.



Description			
1	Minimum length: 400 mm	2	Minimum length: 400 mm

- Check that the machine has not been damaged during transport.

If the machine is mounted and secured on a transport support (pallet):

- Remove the machine from the transport support before installation.

4 Storage

- Seal hermetically all apertures with the caps provided with the machine, or with adhesive tape if the caps are no longer available.
- Store the machine indoors, in a dry place, away from dust and vibrations and if possible, in original packaging, preferably at temperatures between 5 ... 55 °C.

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

- Seal hermetically all apertures with the caps provided with the machine, or with adhesive tape if the caps are no longer available.
- Wrap the machine in a corrosion inhibitor film.
- Store the machine indoors, in a dry place, away from dust and vibrations and if possible, in original packaging, preferably at temperatures between 5 ... 55 °C.

NOTICE

Long storage time (over 12 months).

Risk of damage to the machine!

- Due to a long storage time, the capacitors of the variable speed drive can lose efficiency because of electrochemical processes. In the worst case, it can lead to a short-circuit and therefore to a damage to the variable speed drive of the machine.
- Connect the machine every 18 months for 60 minutes to the mains.

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* [➔ 46].
- 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 cooling air inlets and outlets of the motor and variable speed drive (VSD) fans are not covered or obstructed and that the cooling air flow is not affected adversely in any other way.
- Make sure that the oil sight glass (OSG) remains easily visible.
- Make sure that enough space remains for maintenance work.
- Make sure that the machine is placed or mounted horizontally, a maximum deviation of 1° in any direction is acceptable.
- Check the oil level, see *Oil Level Inspection* [➔ 34].

If the machine is equipped with a plate heat exchanger (PHE):

- Check the cooling liquid level, see *Cooling Liquid Level Inspection* [➔ 34].
- Make sure that the cooling water complies with the requirements, see *Cooling Water Connection* [➔ 16].

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

- Contact your manufacturer representative, the motor must be derated or the ambient temperature limited.

5.2 Connecting Lines / Pipes

- Remove all protective covers before installation.
- Make sure that the connecting lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines at the inlet and exhaust connections.
- Make sure that the diameter of the connecting lines over the entire length is at least as large as the connections of the machine.

In case of long connecting lines:

- Use larger diameters to avoid a loss of efficiency.
- Contact your manufacturer representative for more information.

5.2.1 Inlet Connection



WARNING

Unprotected inlet connection.

Risk of severe injury!

- Do not put hand or fingers in the inlet 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) at the inlet of the machine.

Connection size(s):

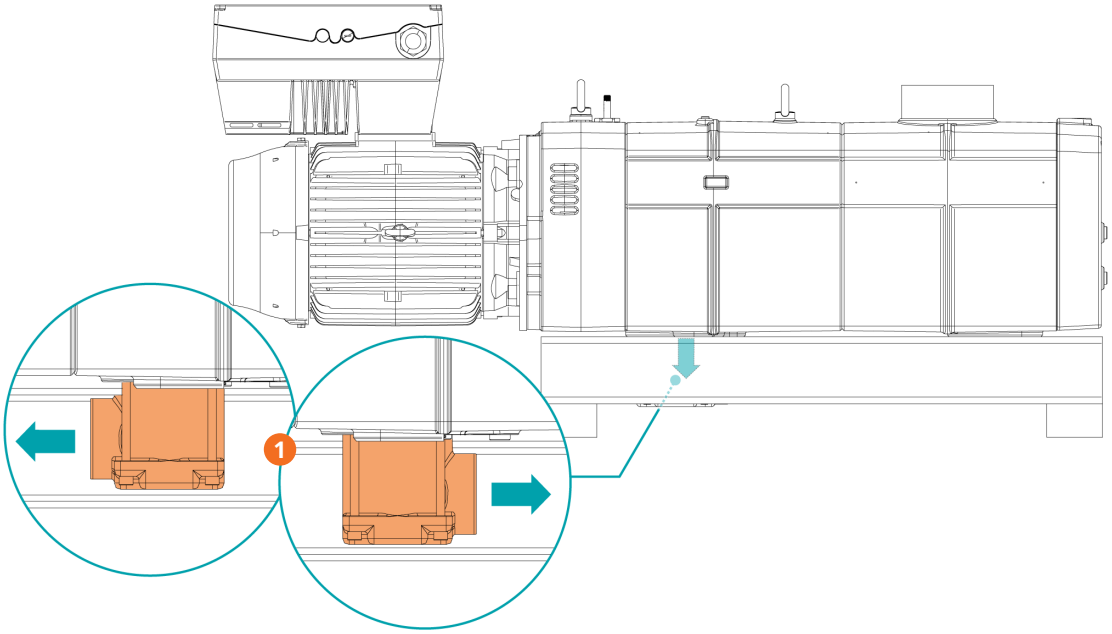
- G3”
- ISO DN100, DIN 28404

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

- Busch recommends the installation and use of an isolation valve to prevent the machine from running backwards.
- Busch also recommends not opening the isolation valve until at least the minimum machine speed has been reached.

- Make sure that the connecting lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines at the inlet and exhaust connections.

5.2.2 Exhaust Connection



Description			
1	Exhaust variants without silencer		

NOTICE

Exhaust gas flow obstructed.

Risk of damage to the machine!

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

Connection size(s):

At the machine exhaust connection:

- G3”, horizontal (orientable 180°)
- ISO DN100, DIN 28404, vertical (without exhaust elbow)

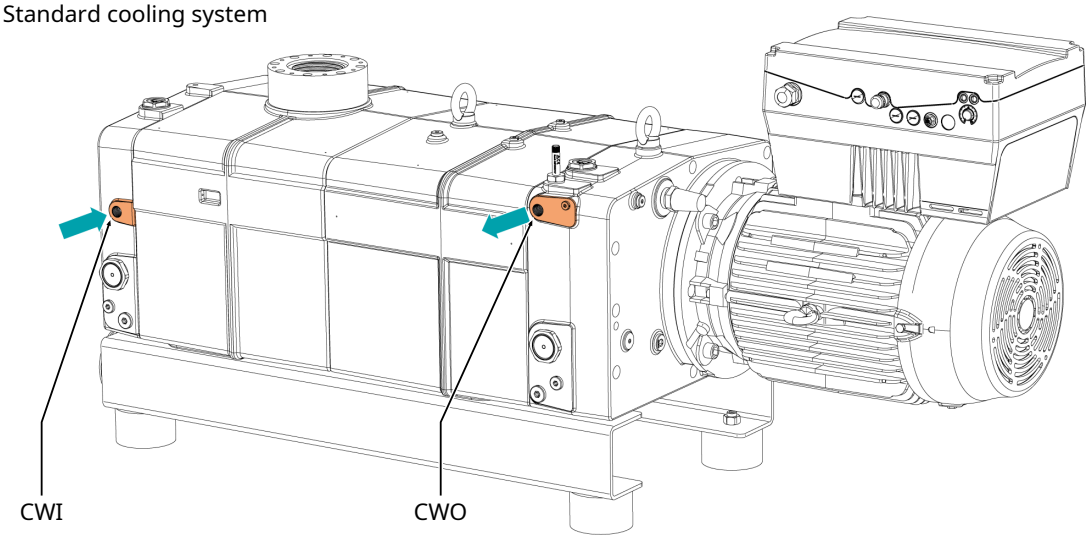
At the silencer (SI) exhaust connection (optional):

- ISO DN100, DIN 28404, horizontal

- Make sure that the connecting lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines at the inlet and exhaust connections.
- Make sure that the counter pressure (also called “back pressure”) at the exhaust connection (OUT) does not exceed the maximum allowable exhaust pressure, see *Technical Data* [➔ 46].

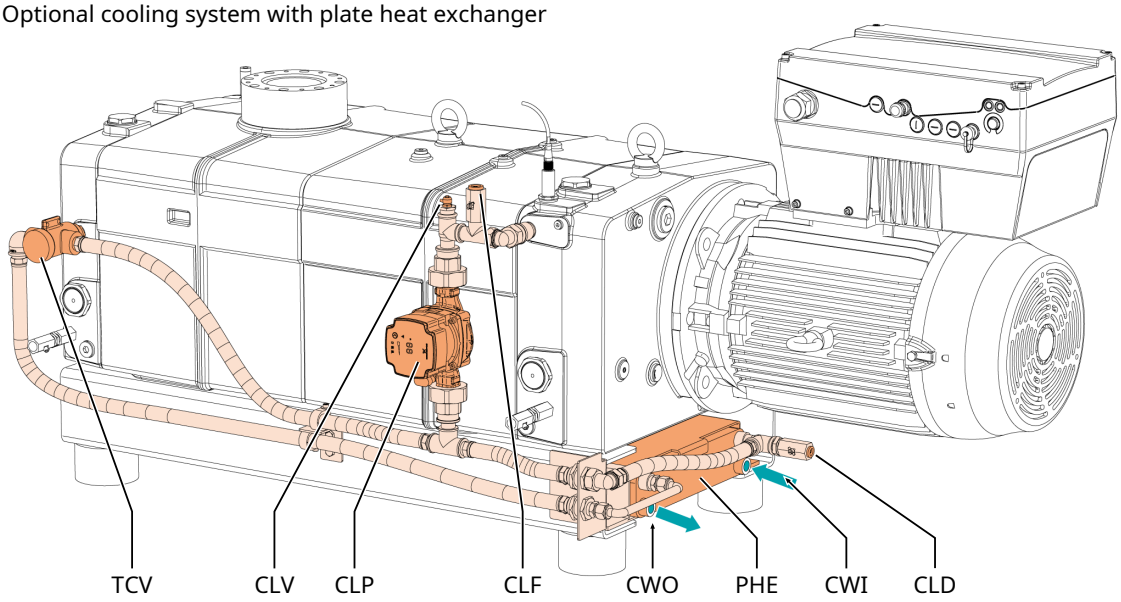
5.2.3 Cooling Water Connection

Standard cooling system



Description			
CWI	Cooling water inlet	CWO	Cooling water outlet

Optional cooling system with plate heat exchanger



Description			
CWI	Cooling water inlet	CWO	Cooling water outlet
CLD	Cooling liquid drain valve and plug	CLF	Cooling liquid filling plug
CLP	Cooling liquid pump	CLV	Cooling liquid vent valve
PHE	Plate heat exchanger	TCV	Temperature control valve

NOTICE

Optional cooling system with plate heat exchanger.

Water supply capacity and temperature differ from those of a standard cooling system!

- See the following cooling water requirements table.
- See also *Filling Cooling Liquid* [➔ 20].

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

Connection size(s):

- G ½", ISO 228-1 (CWI / CWO)

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

Supply capacity	l/min	8 ... 16
Supply capacity with optional plate heat exchanger	l/min	8 ... 12
Water pressure	bar (g)	1 ... 6
Supply temperature	°C	+10 ... +30
Supply temperature with optional plate heat exchanger	°C	+5 ... +30
Required pressure differential across supply and return	bar (g)	≥ 1

Cooling water supply temperature in Fahrenheit degrees:

- +50 ... +86 °F

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

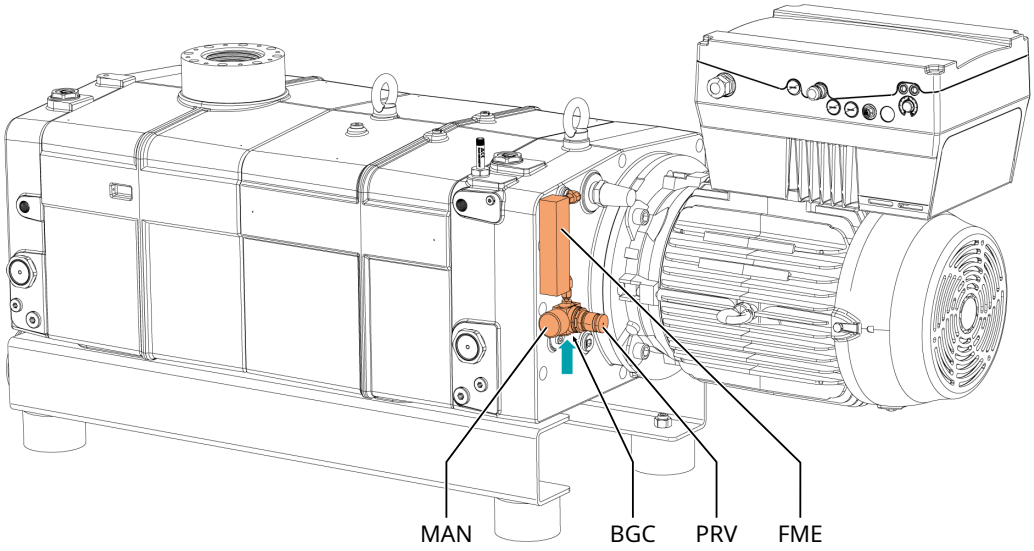
Hardness	mg/l (ppm)	< 90
Properties	Clean & clear	
PH value	7 ... 8	
Particle size	µm	< 200
Chloride	mg/l	< 100
Electrical conductivity	µS/cm	≤ 100
Free chloride	mg/l	< 0.3
Materials in contact with the cooling water	Stainless steel and cast iron	

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)



Description			
BGC	Barrier gas connection	FME	Flow meter
MAN	Manometer	PRV	Pressure regulating valve

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

Connection size:

- G1/4", ISO 228-1
- 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)	15 ... 20
Air quality (only for air)	Acc. to ISO 8573-1	Class 5.4.4.

5.3 Filling Oil

NOTICE

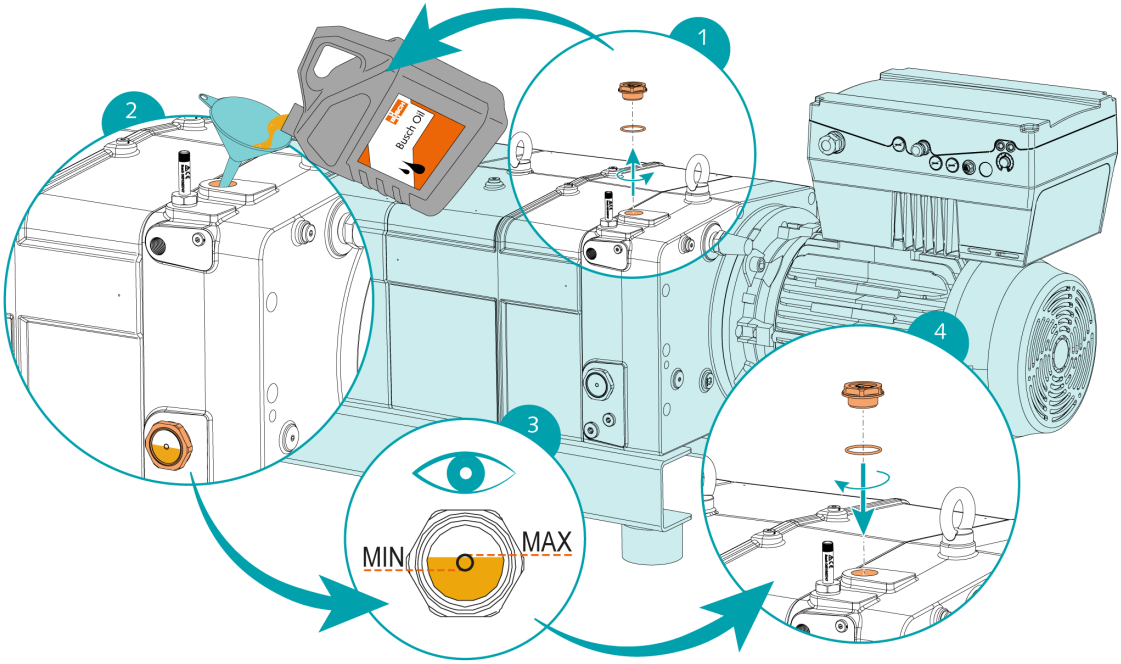
Use of inappropriate oil.

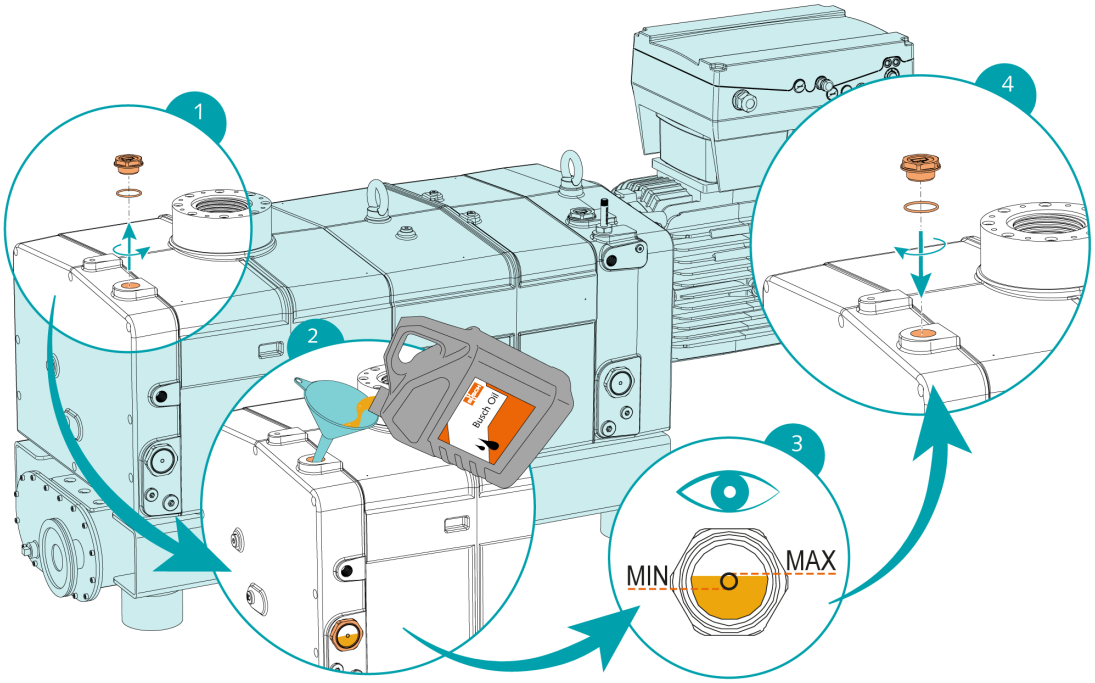
Risk of premature failure!

Loss of efficiency!

- Use only a type of oil previously approved and recommended by the manufacturer.

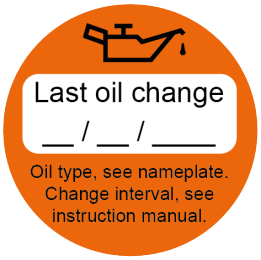
- For information on oil type and filling capacities, see the *Technical Data* [➔ 46] and *Oil* [➔ 47] chapters.





When oil filling is complete:

- Note the date of the oil change on the sticker.



If there is no sticker on the machine:

- Order it from your Busch representative (article number 0565 568 959).

5.4 Filling Cooling Liquid

This step must be performed only if the machine is equipped with a plate heat exchanger (PHE).

The machine is already filled with cooling liquid before shipping.

If this is not the case:

- Fill the machine with cooling liquid following the following procedure.

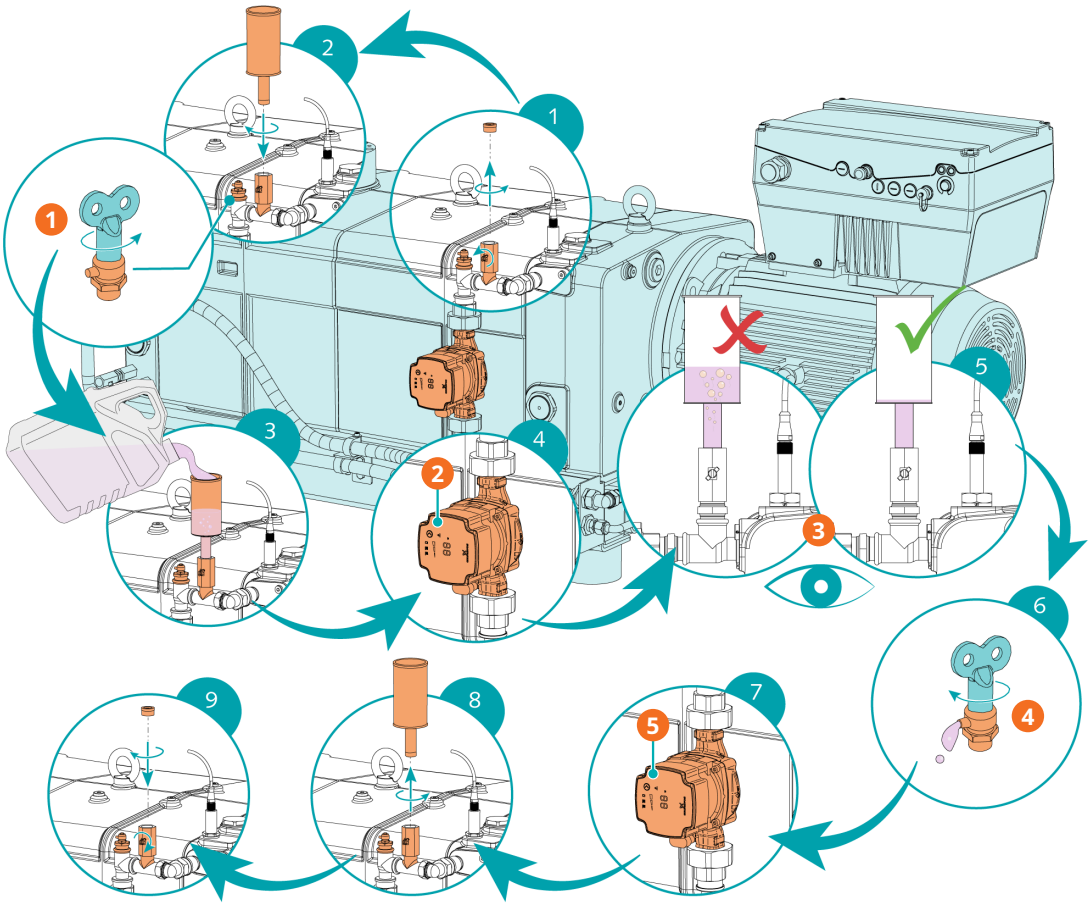
For type and quantity of cooling liquid, see *Cooling Liquid* [➔ 47] and *Technical Data* [➔ 46].

NOTICE

Changing the factory settings of the cooling liquid pump (CLP).

Risk of damage to the machine!

- Do not change the factory settings of the cooling liquid pump. If necessary, contact your Busch representative.



Description			
1	Step 2: Open the cooling liquid vent valve (CLV)	2	Step 4: Start (plug in) the cooling liquid pump (CLP)
3	Step 5: Vent air from the cooling system and resume cooling liquid filling	4	Step 6: Close the cooling liquid vent valve (CLV) when the cooling liquid is spilling out
5	Step 7: Stop (unplug) the cooling liquid pump (CLP)		

6 Electrical Connection



DANGER

Live wires.

Risk of electrical shock!

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

INSTALLATION(S) CURRENT PROTECTION:



DANGER

Missing current protection.

Risk of electrical shock!

- Provide current protection in accordance with EN 60204-1 on your 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, contact your Busch representative for more information.
- 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* [➔ 48] or *UK Declaration of Conformity* [➔ 49]).

6.1 Machine delivered with a Variable Speed Drive (VSD)



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 before starting any work.



CAUTION

When wiring a variable speed drive for power or signal connections purpose.

Risk of electrical short-circuits and irreversible damage to the variable speed drive due to metallic foreign bodies (e.g. copper wire) falling into the variable speed drive!

Make sure to follow the following instructions to ensure proper operation of the machine and the variable speed drive, and not to void the warranty!

- Lay/unlay cables with the variable speed drive cover closed, and not on top of the variable speed drive.
- Once the cables have been prepared, open the variable speed drive cover, and connect the cables.
- If necessary, contact Busch for advice and information.

NOTICE

The admissible motor speed exceeds the recommendation.

Risk of damage to the machine!

- Check the admissible motor speed range, see *Technical Data* [➔ 46].

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

Incorrect connection.

Risk of damage to the variable speed drive!

- The wiring diagrams below are examples only. Refer to the connection instructions and diagrams of the variable speed drive.

- Make sure that the power supply for the drive is compatible with the data on the name plate 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 (VSD) 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 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 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), see *Electrical Connection of the Variable Speed Drive* [➔ 24].

6.2 Electrical Connection of the Variable Speed Drive

The following applies to machines equipped with an on-board variable speed drive (VSD).

CAUTION

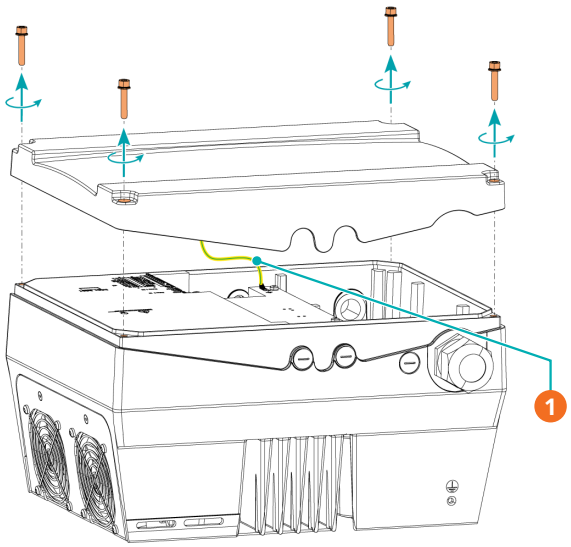
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Make sure to follow the following instructions to ensure proper operation of the machine and the variable speed drive, and not to void the warranty!

- Lay/unlay cables with the variable speed drive cover closed, and not on top of the variable speed drive.
- Once the cables have been prepared, open the variable speed drive cover, and connect the cables.
- If necessary, contact Busch for advice and information.

- Make sure that the power supply for the drive is compatible with the data on the name plate of the variable speed drive.
- Make sure that the motor of the machine will not be affected by electric or electromagnetic disturbance from the mains. If necessary, contact Busch for advice and information.
- Remove the cover from the variable speed drive. The cover is connected to the PE terminals with a PE cable. Do not interrupt this cable.



Description			
1	PE cable		

- Connect the mains cable as shown in the chapter *Wiring Diagram Variable Speed Drive (VSD)* [➔ 25].

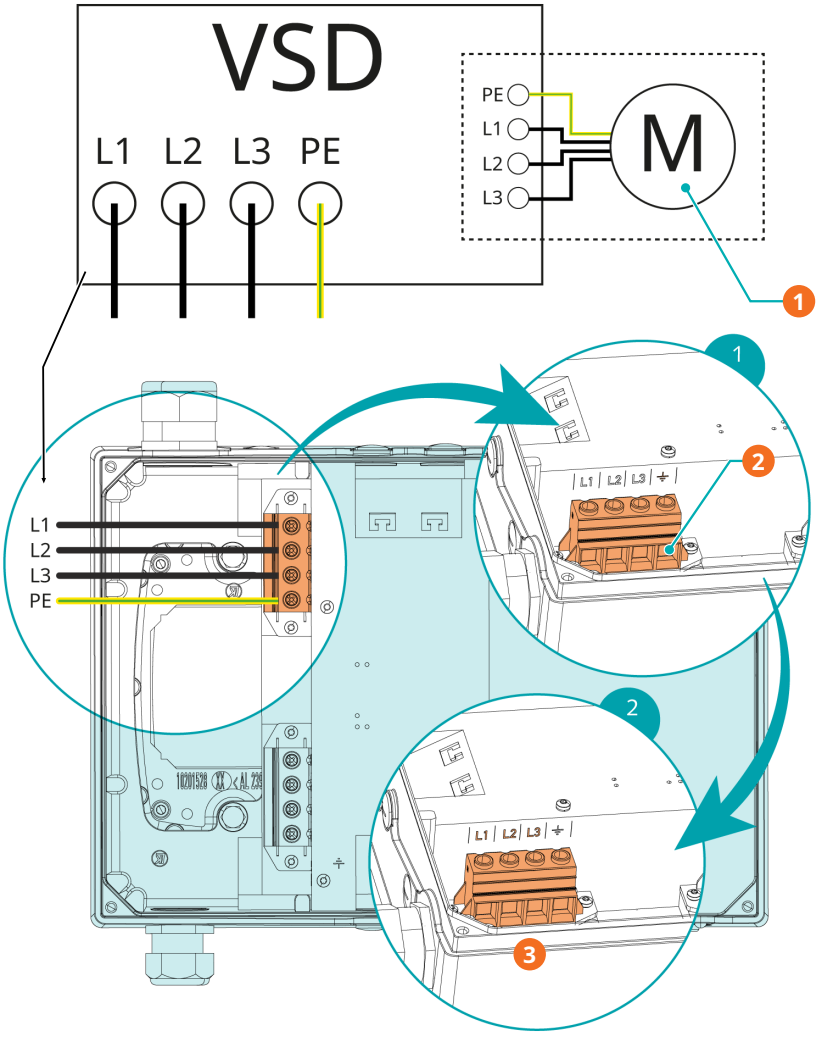
6.3 Wiring Diagram Variable Speed Drive (VSD)

CAUTION

The machine will start immediately when power is supplied.

Risk of inadvertent start-up!

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



Description			
1	Motor already wired	2	Connect PE
3	Connect L1, L2, L3		

6.4 Start / Stop Connection

The following applies to machines equipped with an on-board variable speed drive (VSD).

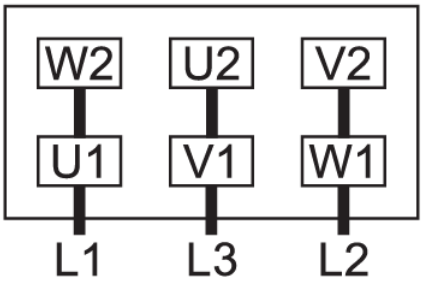
- The Variable Speed Drive (VSD) is delivered with preset factory parameters. Please refer to the specific wiring diagram supplied inside the variable speed drive.
- For the connection of the control cables, install a cable in a bore hole at the terminal box (TB). Use EMC cable fittings if required.
- These parameters can be changed according to the specific document “Pump Control Instructions, art. no.: 0870208958”. Contact your local Busch agency or your Busch representative to check if your machine is a custom or a standard one.

6.5 Wiring Diagram Three-Phase Motor (Pump Drive)

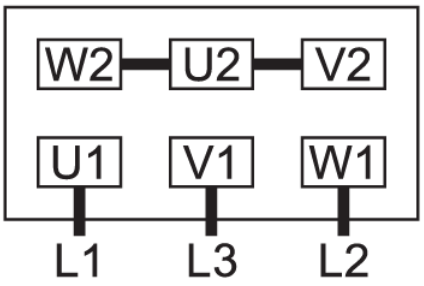
The following applies to machines not equipped with an on-board variable speed drive and on which an external speed drive can be installed.

- Make sure that you select the correct speed drive according to the motor specifications.
- Connect the motor to your external variable speed drive according to the manufacturer's operating instructions.
- Connect the motor cables as shown in the following wiring diagram.

Delta connection (low voltage):



Star connection (high voltage):



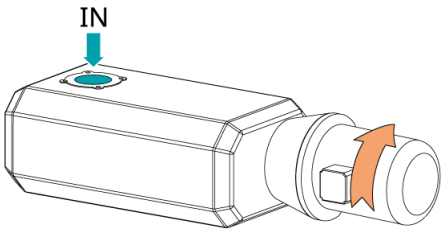
NOTICE

Incorrect rotation direction.

Risk of damage to the machine!

- Operating the machine in the wrong direction of rotation can destroy it very quickly! Before starting, make sure that the motor of the machine is rotating in the correct direction.

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



- Jog the motor briefly.
- Watch the fan wheel of the motor and determine the direction of rotation just before the fan wheel stops.

If the rotation of the motor must be changed:

- Switch any two of the motor phase wires.

6.6 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.

6.6.1 Wiring Diagram Temperature Switch

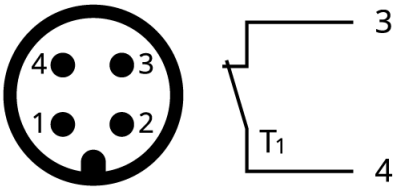
CE version

Article number: 0651 563 762

Connector: M12x1, 4-pin

Electrical data: U = ≤ 250 V AC/DC (50/60 Hz); I = ≤ 1 A

Switch point: $T_{trip} = T_1$ ► pin 3 + 4



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

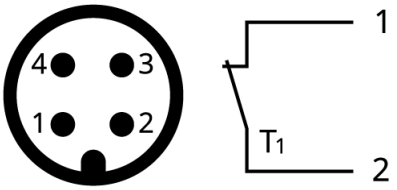
UL version

Article number: 0651 211 928

Connector: M12x1, 4-pin

Electrical data:
U = ≤ 120 V AC/DC (50 Hz); I = 1 A
U = ≤ 250 V AC/DC (60 Hz); I = 1 A

Switch point: $T_{trip} = T_1$ ► pin 1 + 2



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

6.7 Electrical Data of the Cooling Liquid Pump (Option)

If the machine is equipped with a cooling system featuring a plate heat exchanger (PHE) - Option.

- CE approved, 1~ 230 VAC +/-10% (50/60 Hz), 0.045 kW.

7 Commissioning



CAUTION

In operation, the surface of the machine may reach temperatures over 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 is normally shipped without oil.

Operation without oil will ruin the machine in short time!

- Before commissioning, the machine must be filled with oil, see *Filling Oil* [➔ 18].

If the machine is equipped with a plate heat exchanger (PHE):

NOTICE

The machine is normally shipped without cooling liquid.

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

- Before commissioning, the machine must be filled with cooling liquid, see *Filling Cooling Liquid* [➔ 20].

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* [➔ 13] are met.
- Open the water supply.

If the machine is equipped with a barrier gas system:

  - Open the barrier gas supply.
  - Adjust the barrier gas pressure.

- Start the machine.

- Make sure that the maximum permissible number of starts does not exceed 6 starts per hour. Those starts should be spread within the hour.
- Make sure that the operating conditions comply with the *Technical Data* [➔ 46].

If the machine is equipped with a plate heat exchanger (PHE):

- After a few minutes of operation, perform a *Cooling Liquid Level Inspection* [➔ 34].
- After a few minutes of operation, perform an *Oil Level Inspection* [➔ 34].

As soon as the machine is used 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

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.

- Observe the following when conveying condensable vapors, e.g. water vapors:

START

- Close the isolation valve*
- Start the machine
- Warm up the machine for 30 minutes (WARM-UP MODE)
- Open the isolation valve* and perform the process
- Close the isolation valve*
- Dry the machine (SHUT-DOWN MODE)
- Wait 30 minutes
- Stop the machine

END

* Not included in the scope of delivery.

- Limit the flow rate with cold cooling water (<20°C):
  - 8 ... 12 l/min
- Make sure that the barrier gas system (dry compressed air) is connected.
  - Check the volume flow on the barrier gas flow meter (BGF).
  - For more information, see *Barrier Gas System Connection (Optional)* [➔ 18].
- Make sure that the air gas ballast (GB) is mounted and open.
  - If the gas-ballast filter is dirty, it must be cleaned periodically (unscrew and wash out).
- Make sure that no liquid can enter the machine through the silencer on the pressure side. Install the connecting lines on the outlet side, orienting them a gradient away from the vacuum pump. If the exhaust lines are oriented upwards, provide a condensate separator (e.g. "dead leg") with a drain port.
- The presence of water vapor in the gas flow is tolerated within certain limits. The conveyance of other vapors must be agreed with Busch.

8 Maintenance



DANGER

Live wires.

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 before starting any work.



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

Hot liquids.

Risk of burns!

- Before draining liquids, let the machine cool down first.

CAUTION

Failing to properly maintain the machine.

Risk of injuries!

Risk of premature failure and loss of efficiency!

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

NOTICE

Using inappropriate cleaners.

Risk of removing safety stickers and protective paint!

- Do not use incompatible solvents to clean the machine.

- Stop the machine and lock it to prevent accidental start-up.
- Close the water supply.

If the machine is equipped with a barrier gas system:

- Close the barrier gas supply.

- Vent the connected lines to atmospheric pressure.

If necessary:

- Drain the cooling water through cooling water drain plugs (CWD).
- Disconnect all connections.

8.1 Maintenance Schedule

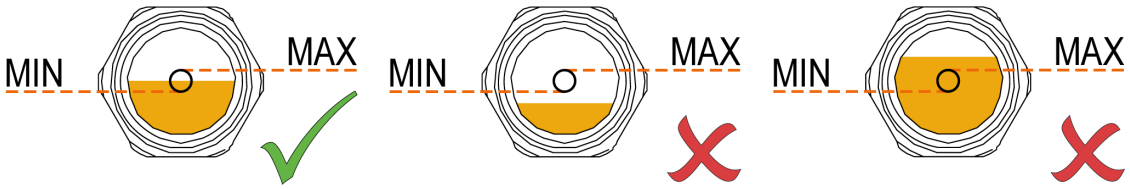
The maintenance intervals depend very much on the individual operating conditions. The intervals given below are considered as starting values which should be individually shortened or extended as appropriate.

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	• Check the oil level, see *Oil Level Inspection* [➔ 34]. • If the machine is equipped with a plate heat exchanger (PHE), check the cooling liquid level, see *Cooling Liquid Level Inspection* [➔ 34]. • Check the machine for oil leaks. In case of leaks, have the machine repaired (contact Busch).
Yearly	• Carry out a visual inspection and clean the machine from dust and dirt. • Check the electrical connections and the monitoring devices. • Clean the inlet screen, see *Inlet Screen Cleaning* [➔ 34].
Yearly If one or more of these accessories are installed.	• Check the filter of the gas-ballast valve (GB) and clean it if necessary, see *Gas-Ballast Filter Cleaning (Optional)* [➔ 35]. • Check the silencer (SI) and clean it if necessary. • Check the inlet filter, replace the filter cartridge if necessary. • Check and clean the inlet check valve.
Every 8500 hours or after 1 year	• Change the oil of the gear and bearing housings (both sides), see *Oil Change* [➔ 36]. • If the machine is equipped with a plate heat exchanger (PHE), change the cooling liquid, see *Cooling Liquid Change* [➔ 39]. • Clean the magnetic plugs (MP).
Every 25000 hours or after 4 years	• Carry out a major overhaul on the machine (contact Busch).

8.2 Oil Level Inspection

- Stop the machine.
- Wait 1 minute.
- Check the oil level.

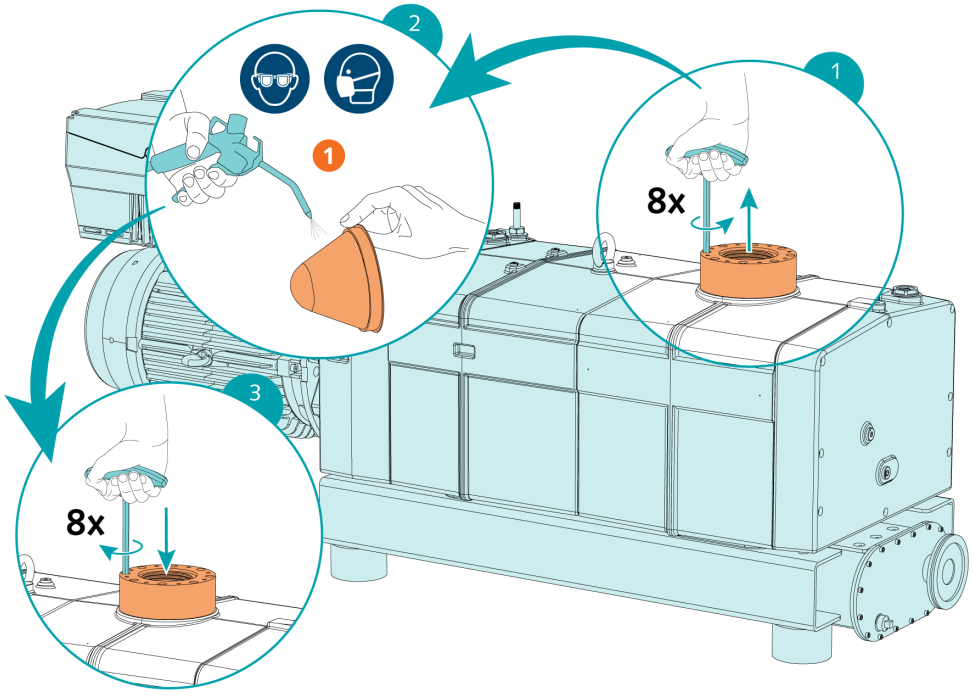


- Fill up if necessary, see *Filling Oil* [➔ 18].

8.3 Cooling Liquid Level Inspection

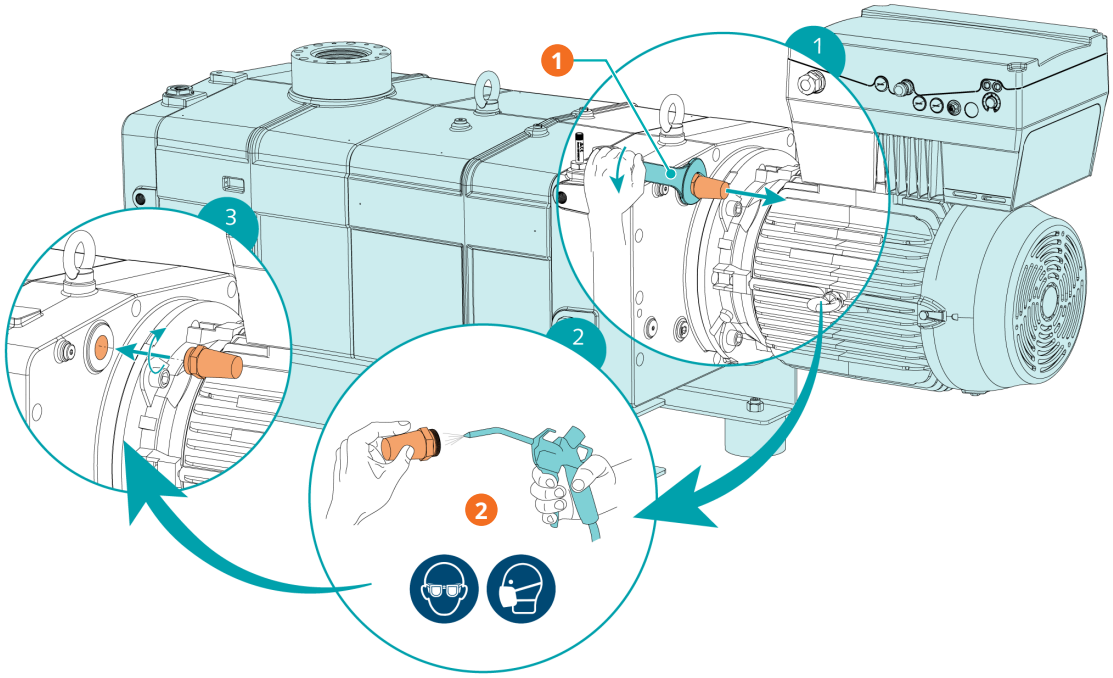
- Stop the machine.
- Let the machine cool down.
- Open the cooling liquid vent valve (CLV).
- Check if the liquid level reaches the top of the valve.
- Fill up if necessary, see *Filling Cooling Liquid* [➔ 20].
- Close the cooling liquid vent valve (CLV) when the cooling liquid is spilling out.

8.4 Inlet Screen Cleaning



Description			
1	Use compressed air and wear protective eyewear and mask		

8.5 Gas-Ballast Filter Cleaning (Optional)



Description			
1	36 mm wrench	2	Use compressed air and wear protective eyewear and mask

8.6 Oil Change

NOTICE

Use of inappropriate oil.

Risk of premature failure!

Loss of efficiency!

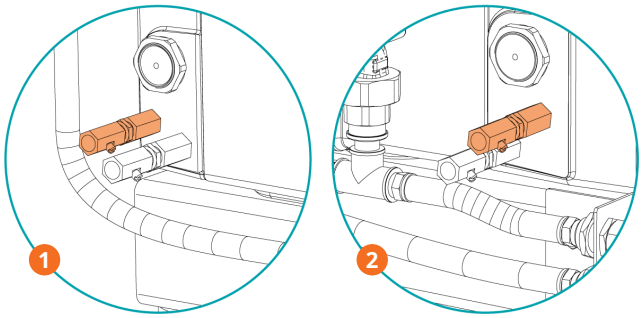
- Use only a type of oil previously approved and recommended by the manufacturer.

NOTE

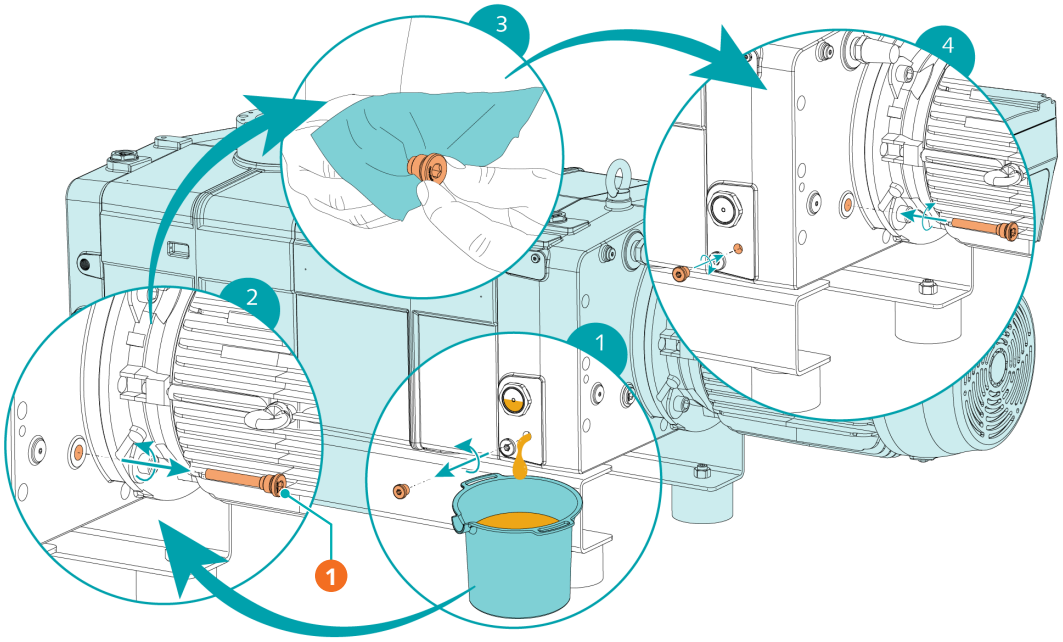
Machine equipped with a cooling system featuring a plate heat exchanger (PHE) – Option:

Oil drain plugs (ODP) are replaced by oil drain valves (ODV) at the inlet and motor sides.

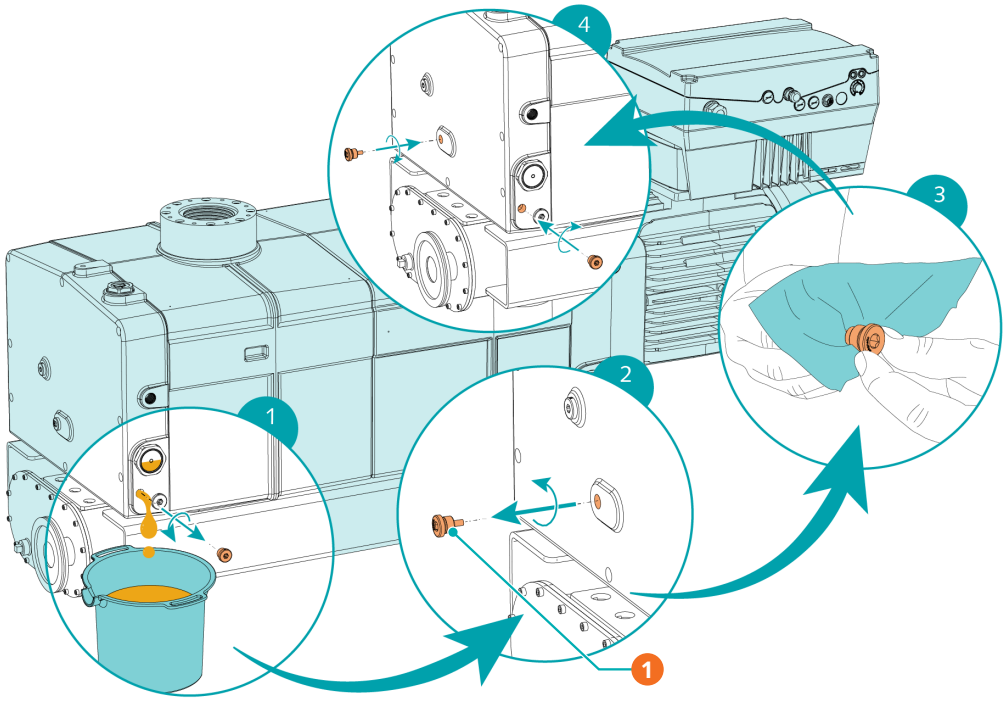
- The oil drain valves are highlighted in orange below (1 = inlet side; 2 = motor side).



→

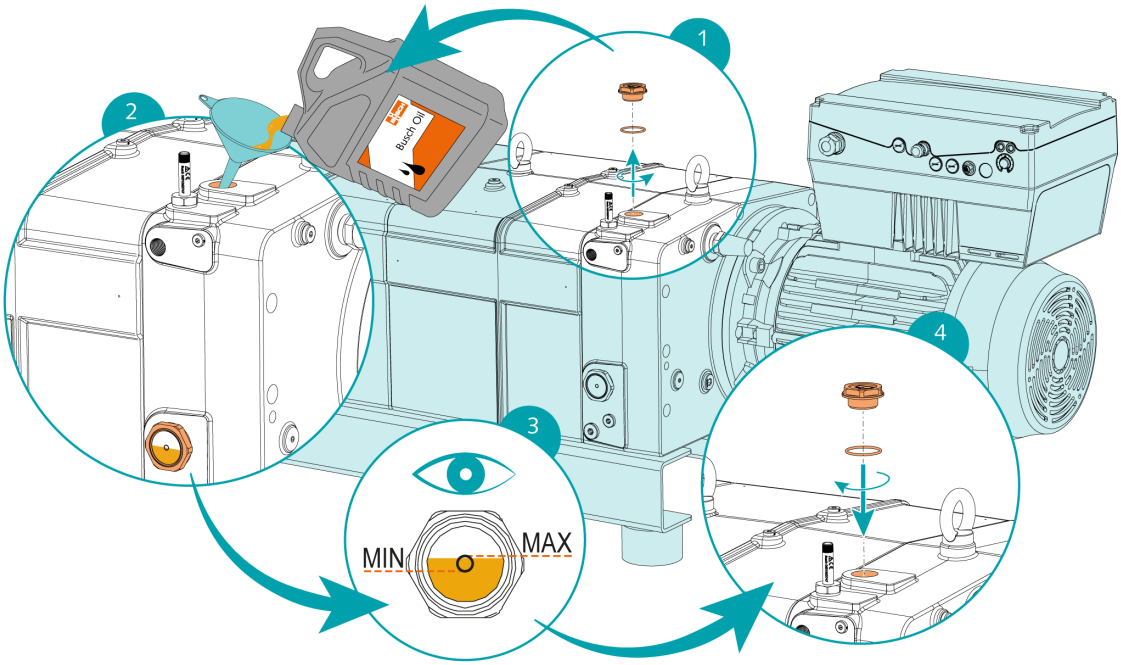


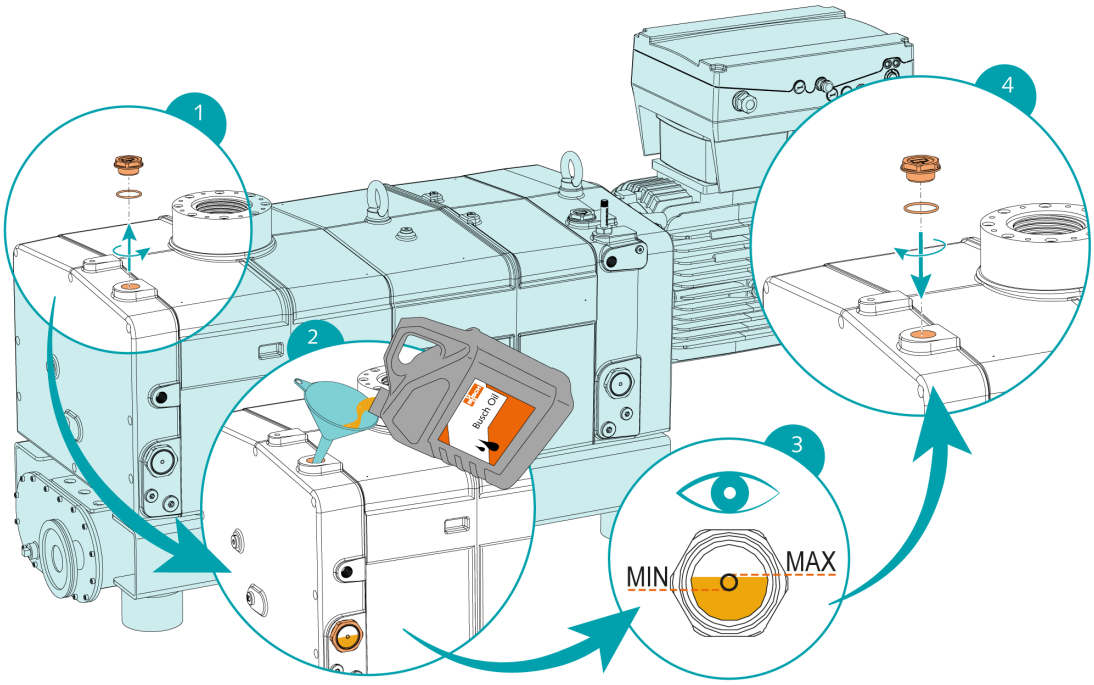
Description			
1	Magnetic plug		



Description			
1	Magnetic plug		

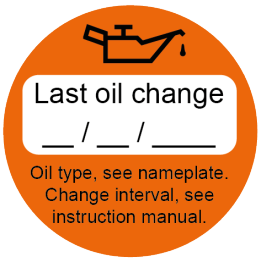
- For information on oil type and filling capacities, see the *Technical Data* [➔ 46] and *Oil* [➔ 47] chapters.





When oil filling is complete:

- Note the date of the oil change on the sticker.

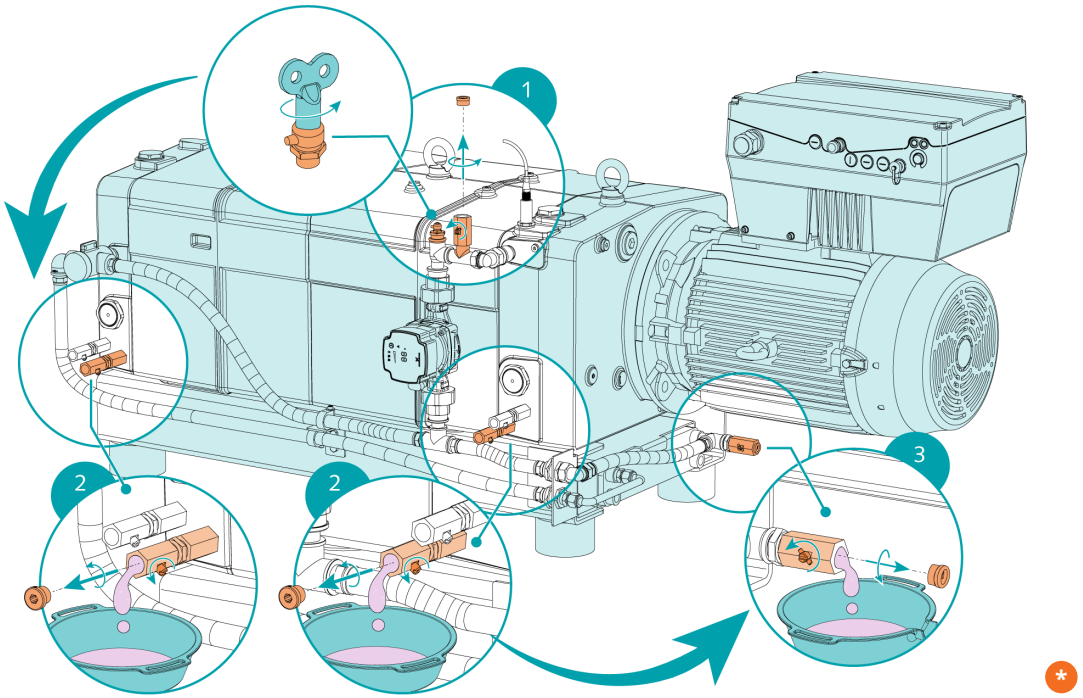


If there is no sticker on the machine:

- Order it from your Busch representative (article number 0565 568 959).

8.7 Cooling Liquid Change

This step must be performed only if the machine is equipped with a plate heat exchanger (PHE).



Description			
*	Put all cooling liquid draining plugs (CLD) back in place once the draining is complete		

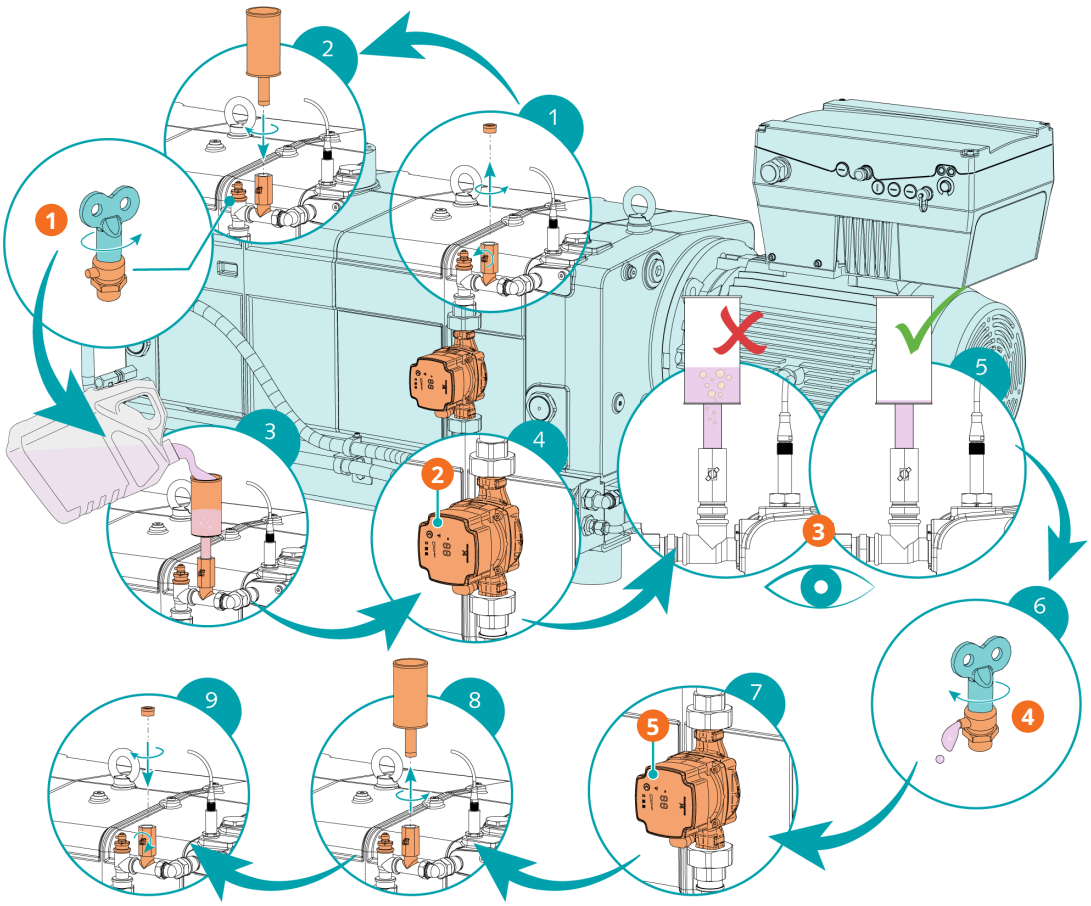
For type and quantity of cooling liquid, see *Cooling Liquid* [➔ 47] and *Technical Data* [➔ 46].

NOTICE

Changing the factory settings of the cooling liquid pump (CLP).

Risk of damage to the machine!

- Do not change the factory settings of the cooling liquid pump. If necessary, contact your Busch representative.



Description			
1	Step 2: Open the cooling liquid vent valve (CLV)	2	Step 4: Start (plug in) the cooling liquid pump (CLP)
3	Step 5: Vent air from the cooling system and resume cooling liquid filling	4	Step 6: Close the cooling liquid vent valve (CLV) when the cooling liquid is spilling out
5	Step 7: Stop (unplug) the cooling liquid pump (CLP)		

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

Incorrect assembly.

Risk of premature failure!

Loss of efficiency!

- Any disassembly of the machine beyond that described in this manual must be carried out by technicians approved by Busch.

If the machine has conveyed gas contaminated with foreign materials which are hazardous to health:

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

The manufacturer 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.



CAUTION

Hot liquids.

Risk of burns!

- Before draining liquids, let the machine cool down first.

- Stop the machine and lock it to prevent accidental start-up.
- Disconnect the power supply.
- Close the water supply.

If the machine is equipped with a barrier gas system:

- Close the barrier gas supply.

- Vent the connected lines to atmospheric pressure.
- Drain cooling water through cooling water drain plugs (CWD).
- Disconnect all connections.

If the machine is to be stored:

- See *Storage* [➔ 12].

10.1 Dismantling and Disposal

- Drain and collect the oil.
- Make sure that no oil drips onto the floor.

If the machine is equipped with a plate heat exchanger (PHE):

- 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!

- Use only Busch genuine spare parts, consumables and supplies to ensure correct operation of the machine and to validate the warranty.

Spare part	Description	Article number
Inlet screen (IS)	Inlet screen	0534 565 893
Inlet filter cartridge	Paper	0532 000 006
Inlet filter cartridge	Polyester	0532 121 865

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

For Busch genuine spare 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.



CAUTION

Hot liquids.

Risk of burns!

- Before draining liquids, let the machine cool down first.

Problem	Possible Cause	Remedy
The machine does not start.	The motor is not supplied with the correct voltage.	• Check the power supply.
	The rotors are jammed or seized.	• Rotors inspection or repair the machine (contact Busch).
	Solid foreign matter has entered the machine.	• Remove the solid foreign matter or repair the machine (contact Busch). • Check the inlet screen (IS) at the inlet connection (IN).
	The temperature switch (TS) reached the switch point.	• Let the machine cool down. • See problem “The machine runs too hot”.
	The motor is defective.	• Replace the motor.

Problem	Possible Cause	Remedy
The machine does not reach the usual pressure at the inlet connection.	Suction or exhaust lines too long or section diameter too small.	• Use larger diameter or shorter lines. • Seek advice from your local Busch representative.
	The inlet screen (IS) is partially clogged.	• Clean the inlet screen (IS), see *Inlet Screen Cleaning* [➔ 34].
	The machine runs in the wrong direction.	• Check the direction of rotation, see *Wiring Diagram Three-Phase Motor (Pump Drive)* [➔ 26].
	Internal parts are worn or damaged.	• Repair the machine (contact Busch).
The machine runs very noisily.	Wrong oil quantity or unsuitable oil type.	• Use one of the recommended oils in the correct quantity, see Oil.
	Defective gears, bearings or coupling element.	• Repair machine (contact Busch).
The machine runs too hot.	Insufficient cooling.	• Make sure to comply with the cooling water requirements, see *Cooling Water Connection* [➔ 16].
	Ambient temperature too high.	• Observe the permitted ambient temperature, see *Technical Data* [➔ 46].
	Temperature of the process gases at the inlet too high.	• Observe the permitted gas inlet temperature, see *Technical Data* [➔ 46].
	Oil level too low.	• Top up oil.
The machine runs too hot and is equipped with a plate heat exchanger (PHE) – Option.	See possible causes above and below	• See possible remedies above and below
	Insufficient cooling.	• Make sure the plate heat exchanger (PHE) is not clogged. Replace if it is. • Make sure the cooling liquid level is correct, see *Cooling Liquid Level Inspection* [➔ 34]. Top up the cooling liquid if the level is too low.
	The cooling liquid pump is defective.	• Contact Busch
The oil is black.	Oil change intervals are too long.	• Drain the oil and fill in new oil, see *Oil Change* [➔ 36].
	The machine runs too hot.	• See problem "The machine runs too hot".

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

13 Technical Data

		NX 0950 A
Pumping speed (72 Hz)	m^3/h	950
	ACFM	560
Ultimate pressure without gas ballast	hPa (mbar) abs.	≤ 0.01
	Torr	≤ 0.0075
Ultimate pressure with gas ballast	hPa (mbar) abs.	≤ 0.05
	Torr	≤ 0.0375
Nominal motor rating	kW	18.5
	hp	25
Nominal motor speed (72 Hz)	min^{-1}	4320
	rpm	
Maximum intensity	A	35
Circuit breaker (MCCB)	A	C-50 (SCCR 10kA @ 400V)
Sound pressure level (ISO 2151) KpA = 3 dB	dB(A)	≤ 75
Ambient temperature	°C	5 ... 40
	°F	41 ... 104
Maximum allowable counter pressure at exhaust connection	hPa (mbar) rel.	200
	Torr	150
Maximum allowable gas inlet temperature according to the inlet pressure	°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	
Ambient pressure		Atmospheric pressure
Cooling water requirements	See *Cooling Water Connection* [➔ 16]	
Oil capacity - Inlet side	l	1.0
	qts.	1.05
Oil capacity - Motor side	l	1.0
	qts.	1.05
Cooling liquid capacity approx. (with PHE only)	l	48
	qts.	51
Weight approx.	kg	900
	lbs.	1984

14 Cooling Liquid

	CLA 25 (Ready-to-use)
Article number 5 L packaging	2000 241 757
Article number 20 L packaging	2000 241 738

CLA 25 cooling liquid is ready-to-use and requires no additional water.

For more information, contact your Busch representative.

15 Oil

Name	ISO-VG	Oil type	1 L packing	5 L packing	10 L packing	20 L packing
VSC 100	100	Synthetic	0831 168 356	0831 168 357	-	0831 168 359

16 EU Declaration of Conformity

This Declaration of Conformity and the CE-markings affixed to the name plate 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: vacuum pump COBRA NC 0950 A; COBRA NX 0950 A

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

- 'Machinery Directive' 2006/42/EC, if the serial number is less than or equal to CHM127029999 (until January 19, 2027).
- 'Machinery Regulation' (EU) 2023/1230, if the serial number is greater than or equal to CHM127030000 (from January 20, 2027). The conformity assessment has been carried out according to internal production control procedure (Module A), in accordance with the requirements of the 'Machinery Regulation'.
- '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)
- 'Cyber Resilience Act' [1)], Regulation (EU) 2024/2847, if the serial number is greater than or equal to CHM127480000 (from December 11, 2027). The conformity assessment has been carried out according to internal production control procedure (Module A), in accordance with the requirements of the 'Cyber Resilience Act'.

and comply(-ies) with the following harmonized standards, common specifications or other technical specifications:

Standard	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN 1012-2 : 1996 + A1 : 2009	Vacuum pumps - Safety requirements - Part 2
EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN ISO 2151 : 2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
EN IEC 63000 : 2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
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
EN IEC 62443-3-3 : 2019	Industrial communication networks - Network and system security - Part 3-3: System security requirements and security levels

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, 2026.10.01



Christian Hoffmann, General Manager

Ateliers Busch S.A.

[1)] The **'Cyber Resilience Act'** regulation is applicable if the machine is delivered ex-factory with digital elements containing programmable or digital functions, such as a control box, a VSD (Variable Speed Drive), an OTTO IoT Box, a Busch PLC (Programmable Logic Controller) ...

17 UK Declaration of Conformity

This Declaration of Conformity and the UKCA-markings affixed to the name plate 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: vacuum pump COBRA NC 0950 A; COBRA NX 0950 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 2012

and comply(-ies) with the following designated standards, common specifications or other technical specifications:

Standard	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN 1012-2 : 1996 + A1 : 2009	Vacuum pumps - Safety requirements - Part 2
EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
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EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments
EN IEC 62443-3-3 : 2019	Industrial communication networks - Network and system security - Part 3-3: System security requirements and security levels

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, 2026.10.01



Christian Hoffmann, General Manager

Ateliers Busch S.A.

Notes

BUSCH GROUP

The Busch Group is one of the world's largest manufacturers of vacuum pumps, vacuum systems, blowers, compressors and gas abatement systems. Under its umbrella, the group houses two well-known brands: Busch Vacuum Solutions and Pfeiffer Vacuum+Fab Solutions. Together, they offer solutions to a wide range of industries. A global network of highly competent local teams in 44 countries ensures that expert, tailor-made support is always available near you. Wherever you are. Whatever your business.



- Busch Group companies
- Busch Group production sites
- Busch Group service centers
- Busch Group local representatives

www.buschvacuum.com

www.pfeiffer-vacuum.com

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