

COBRA

Dry Screw Vacuum Pumps
NX 0450 A, NX 0650 A
Air-Cooled Version (ACV)

Instruction Manual

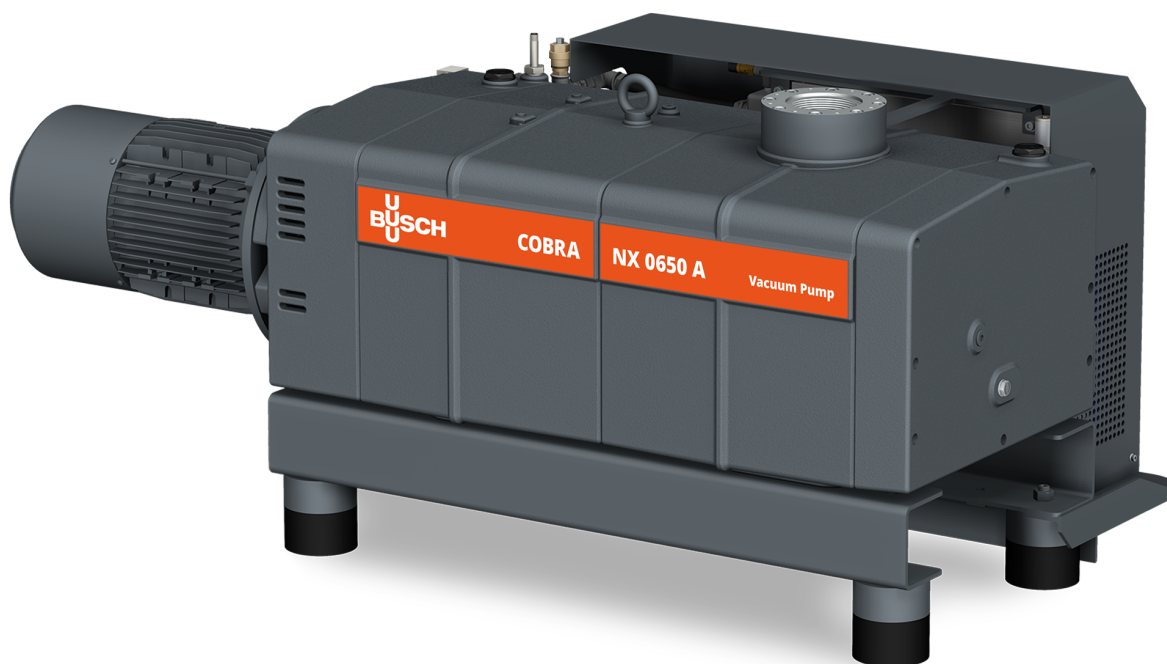


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1 Safety

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

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

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

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

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

The machine has been designed and manufactured in accordance with the state-of-the-art methods. Nevertheless, residual risks may remain, as described in the following chapters and in accordance with the chapter *Intended Use* [→ 6].

This instruction manual highlights potential hazards where appropriate. Safety notes and warning messages are tagged with one of the keywords DANGER, WARNING, CAUTION, NOTICE and NOTE as follows:



DANGER

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



WARNING

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



CAUTION

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



NOTICE

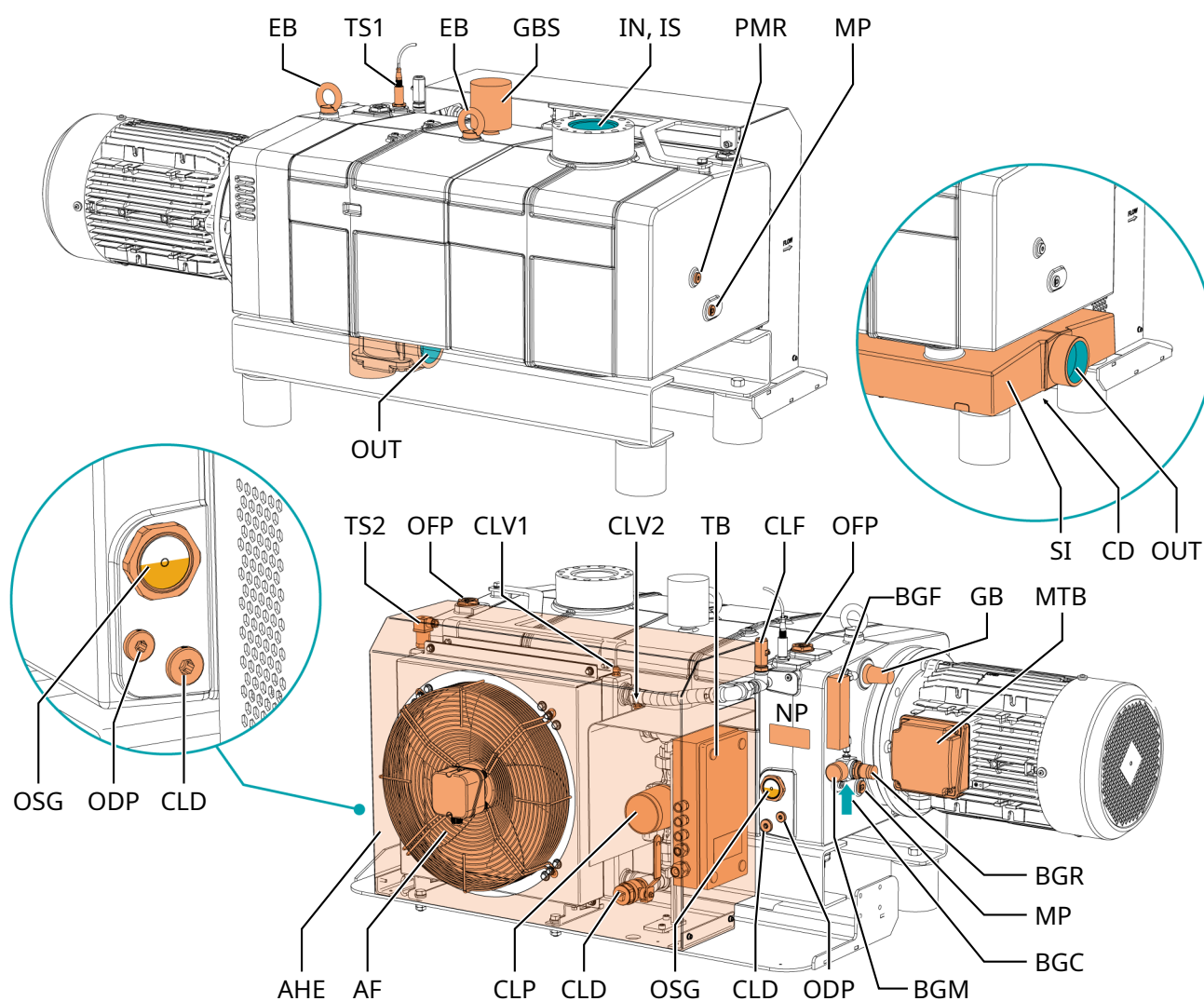
... indicates a potentially dangerous situation that could result in damage to property.



NOTE

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

2 Product Description



Description

IN	Suction connection (Inlet)	OUT	Discharge connection (Outlet)
AHE	Air-water heat exchanger	AF	Axial fan
BGC	Barrier gas connection	BGF	Barrier gas flow meter
BGM	Barrier gas manometer	BGR	Barrier gas pressure regulator
CD	Condensate drain	CLD	Cooling liquid drain plug
CLF	Cooling liquid fill plug	CLV1	Cooling liquid vent valve (heat exchanger)
CLV2	Cooling liquid vent plug (machine)	CLP	Cooling liquid pump
EB	Eye bolt	GB	Gas ballast valve
GBS	Gas ballast silencer (NX 0650 A only)	IS	Inlet screen
MP	Magnetic plug	MTB	Motor terminal box
NP	Nameplate	ODP	Oil drain plug
OFP	Oil fill plug	OSG	Oil sight glass
PMR	Plug for manual rotation of rotors	SI	Silencer
TB	Terminal box (cooling system)	TS1	Temperature switch (machine)
TS2	Temperature switch (cooling system)		

NOTE

Technical term.

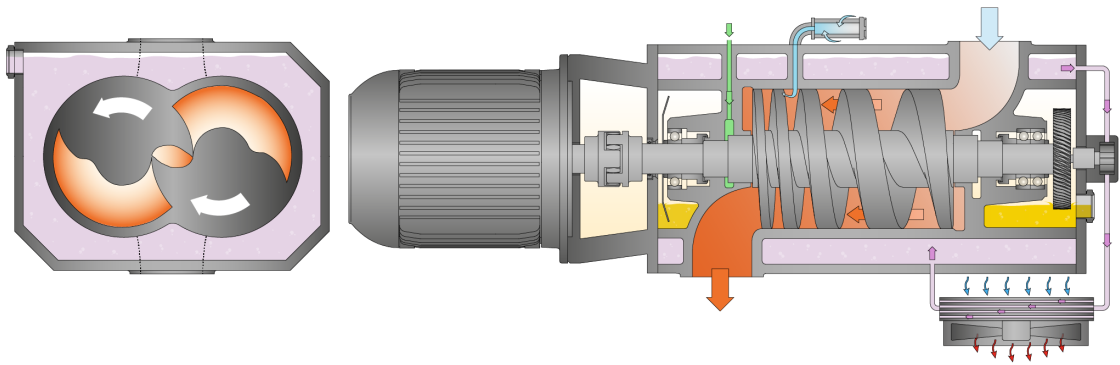
In this instruction manual, we consider that the term 'machine' refers to the 'vacuum pump'.

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.

The machine is capable of maintaining ultimate pressure, see Technical Data.

The machine is suitable for continuous operation.

Permitted environmental conditions, see Technical Data.

! 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 life-time!

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

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 variable speed drive (option).

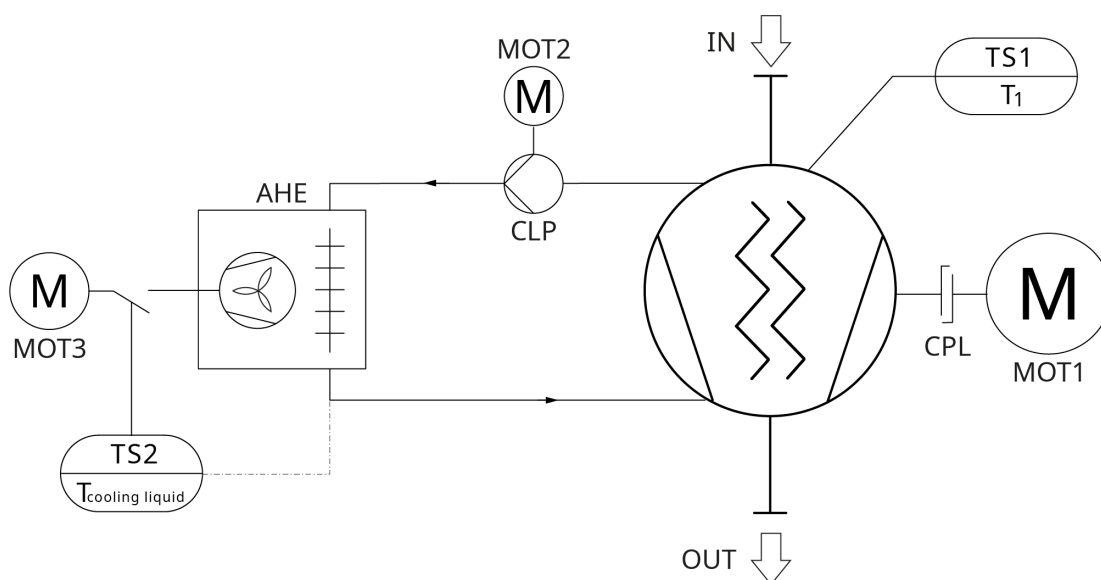
2.4 Standard Features

2.4.1 Air 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 an air-water heat exchanger (AHE).



Description			
IN	Suction connection (Inlet)	OUT	Discharge connection (Outlet)
AHE	Air-water heat exchanger	CLP	Cooling liquid pump
CPL	Coupling	MOT1	Motor (Machine)
MOT2	Motor (Cooling liquid pump)	MOT3	Motor (Air-water heat exchanger)
TS1	Temperature switch (Machine)	TS2	Temperature switch (Cooling system)

2.4.2 Temperature Switch

The temperature switch monitors the cooling liquid temperature of the machine.
The temperature switch has one switch point:

Switch point 1 (T ₁)	Trip, the machine must be stopped
----------------------------------	-----------------------------------

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* [→ 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.

2.5.2 Silencer

A silencer at the discharge connection (OUT) can be provided 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.

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.

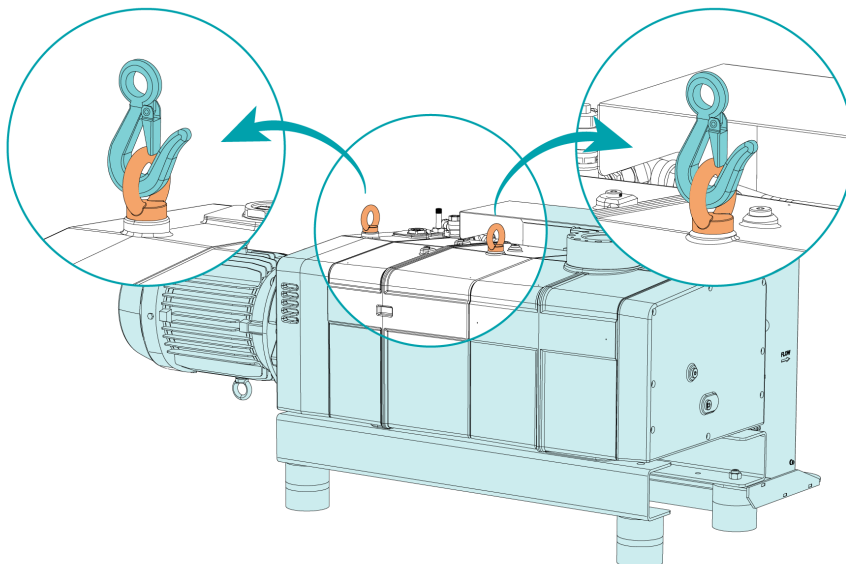


NOTICE

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.



- 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.
- 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 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.

5 Installation

5.1 Installation Conditions



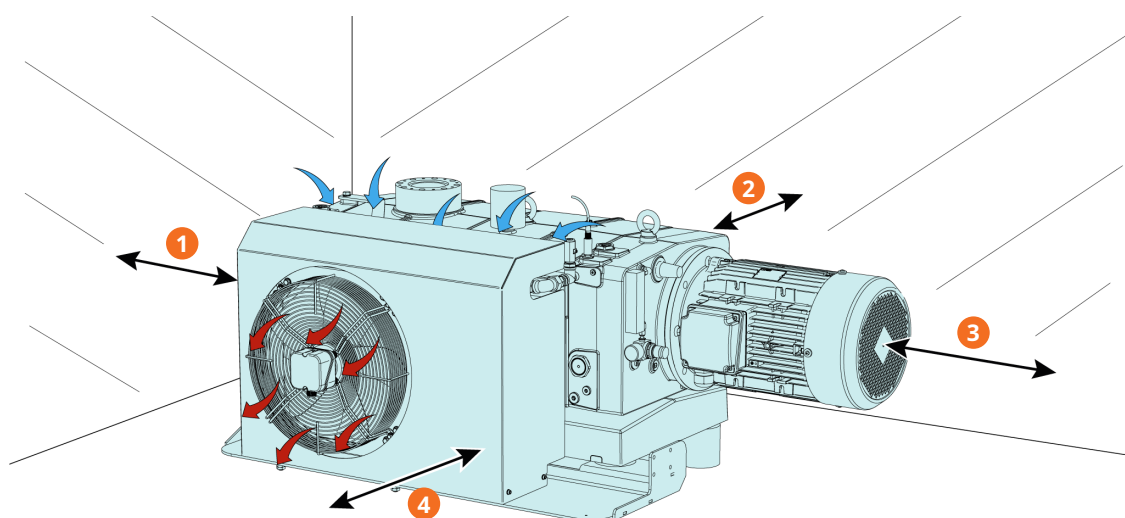
NOTICE

Use of the machine outside of the permitted installation conditions.

Risk of premature failure!

Loss of efficiency!

- Make sure that the installation conditions are fully respected.



Description

1	~20 cm	2	~20 cm
3	~50 cm	4	~50 cm

- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the Technical Data.
- Make sure that the environmental conditions comply with the protection class of the motor and the electrical elements.
- Make sure that the installation space or location is vented such that sufficient cooling of the machine is provided.
- Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way.
- Make sure that the oil sight glass (OSG) remains easily visible.
- Make sure that enough space remains for maintenance work.
- Make sure that the machine is placed or mounted horizontally, a maximum deviation of 1° in any direction is acceptable.
- Check the oil level, see *Oil Level Inspection* [→ 30].
- Check the cooling liquid level, see *Cooling Liquid Level Inspection* [→ 30].

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

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

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

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.

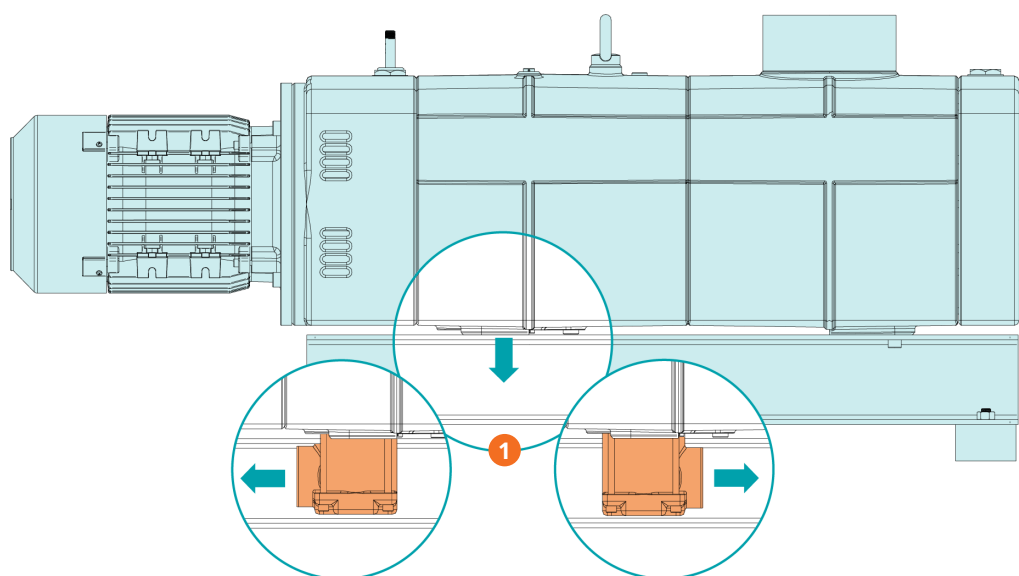
Connection size(s):

- G3"
- ISO DN100, 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 lines on the suction and discharge connections.

5.2.2 Discharge Connection



Description

1	Discharge variants (without silencer)
---	---------------------------------------



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):

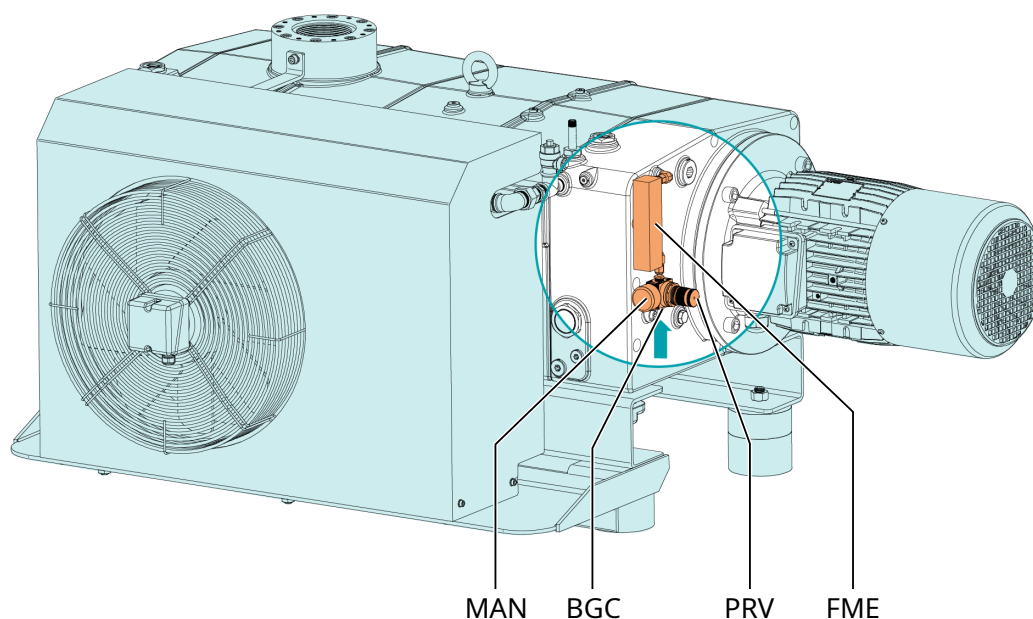
At the machine discharge connection:

- G2" for NX 0450 A, horizontal (orientable 180°)
- G3" for NX 0650 A, horizontal (orientable 180°)
- DN63 ISO-K, DIN 28404 for NX 0450 A, vertical (without discharge elbow)
- ISO DN100, DIN 28404 for NX 0650 A, vertical (without discharge elbow)

At the silencer (SI) discharge connection (Optional):

- G2 for NX 0450 A, G3 for NX 0650 A, horizontal
- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines 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 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)	NX 0450 A: 10 ... 15 - NX 0650 A: 15 ... 20
Air quality (only for air)	Acc. to ISO 8573-1	Class 5.4.4.

5.3 Filling Oil

! NOTICE

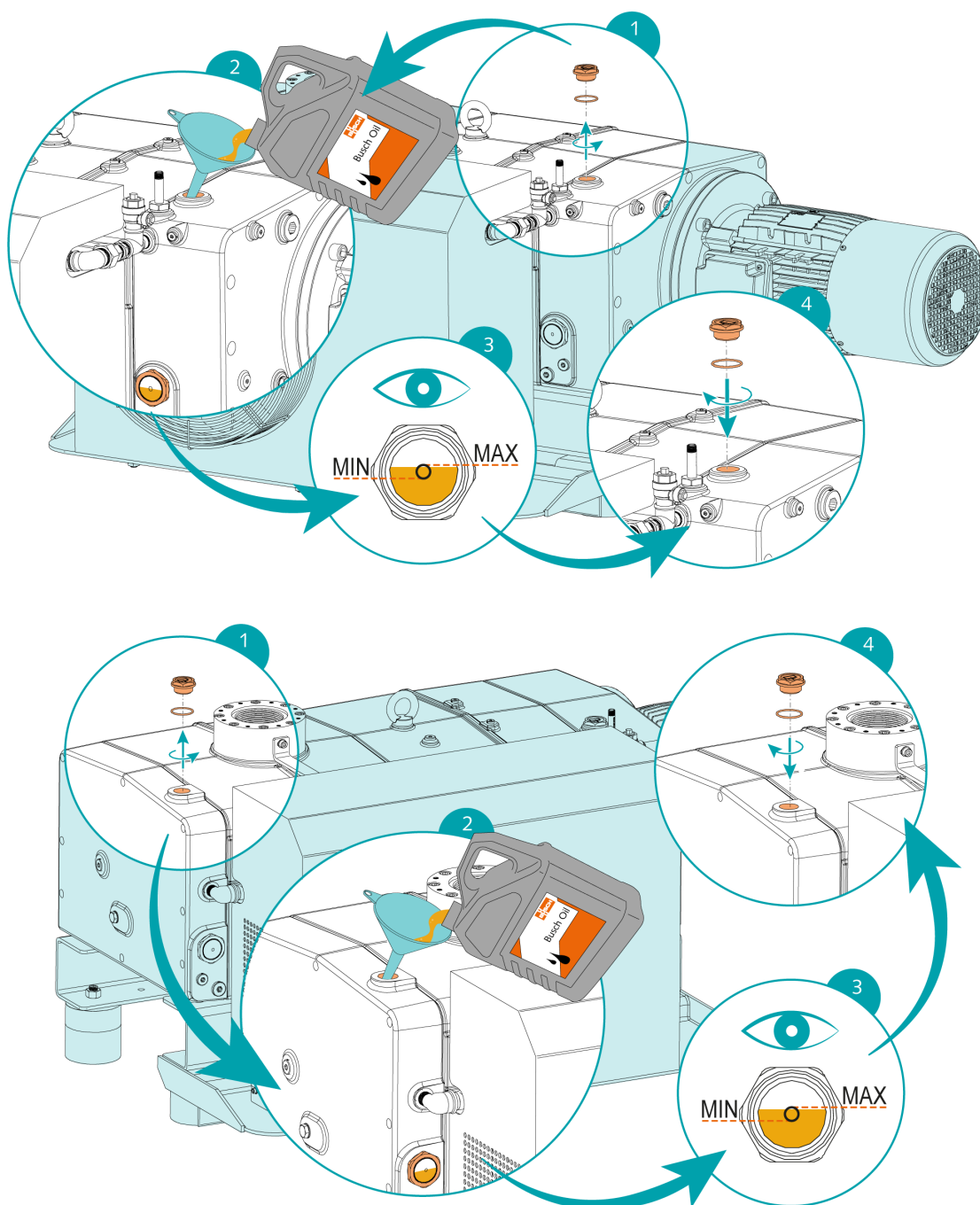
Use of an inappropriate oil.

Risk of premature failure!

Loss of efficiency!

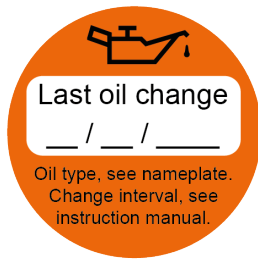
- Only use an oil type which has previously been approved and recommended by Busch.

For oil type and oil capacity see Technical Data and *Oil* [→ 44].



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.

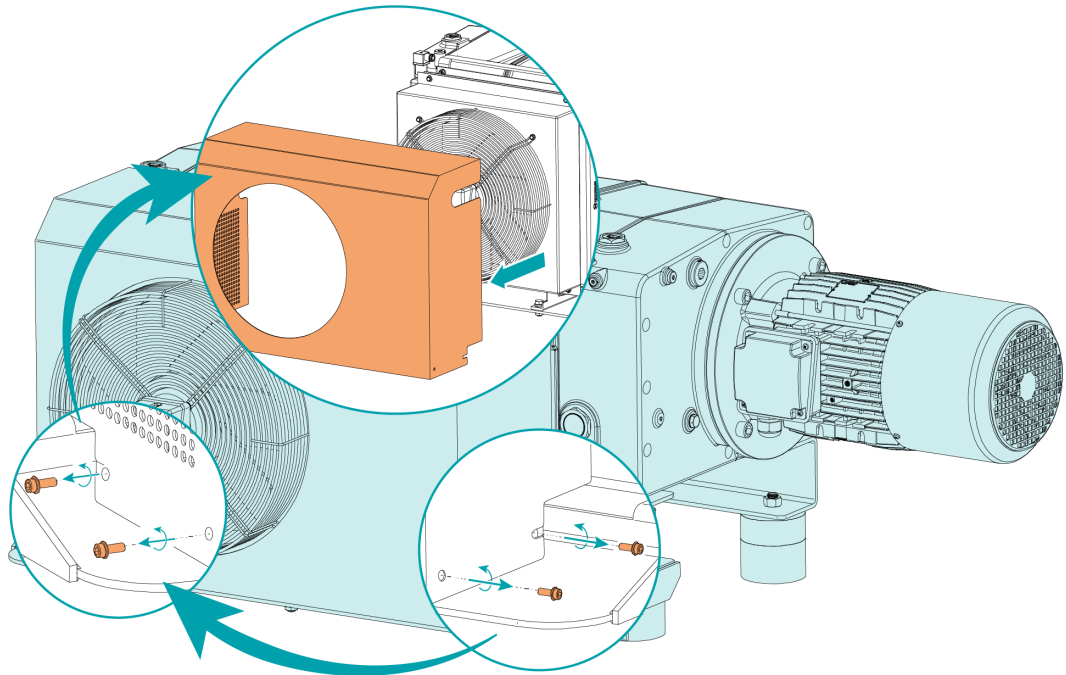
5.4 Cooling System Cover Removal



NOTE

Before filling or changing the cooling liquid and electrically connecting the cooling system.

- Remove the cooling system cover.



5.5 Filling Cooling Liquid

The machine is already dispatched with cooling liquid.

If it is not the case:

- Electrically connect the cooling system, see *Electrical Connection of the Cooling System* [→ 24].
- Fill in the machine with cooling liquid according to the following procedure.

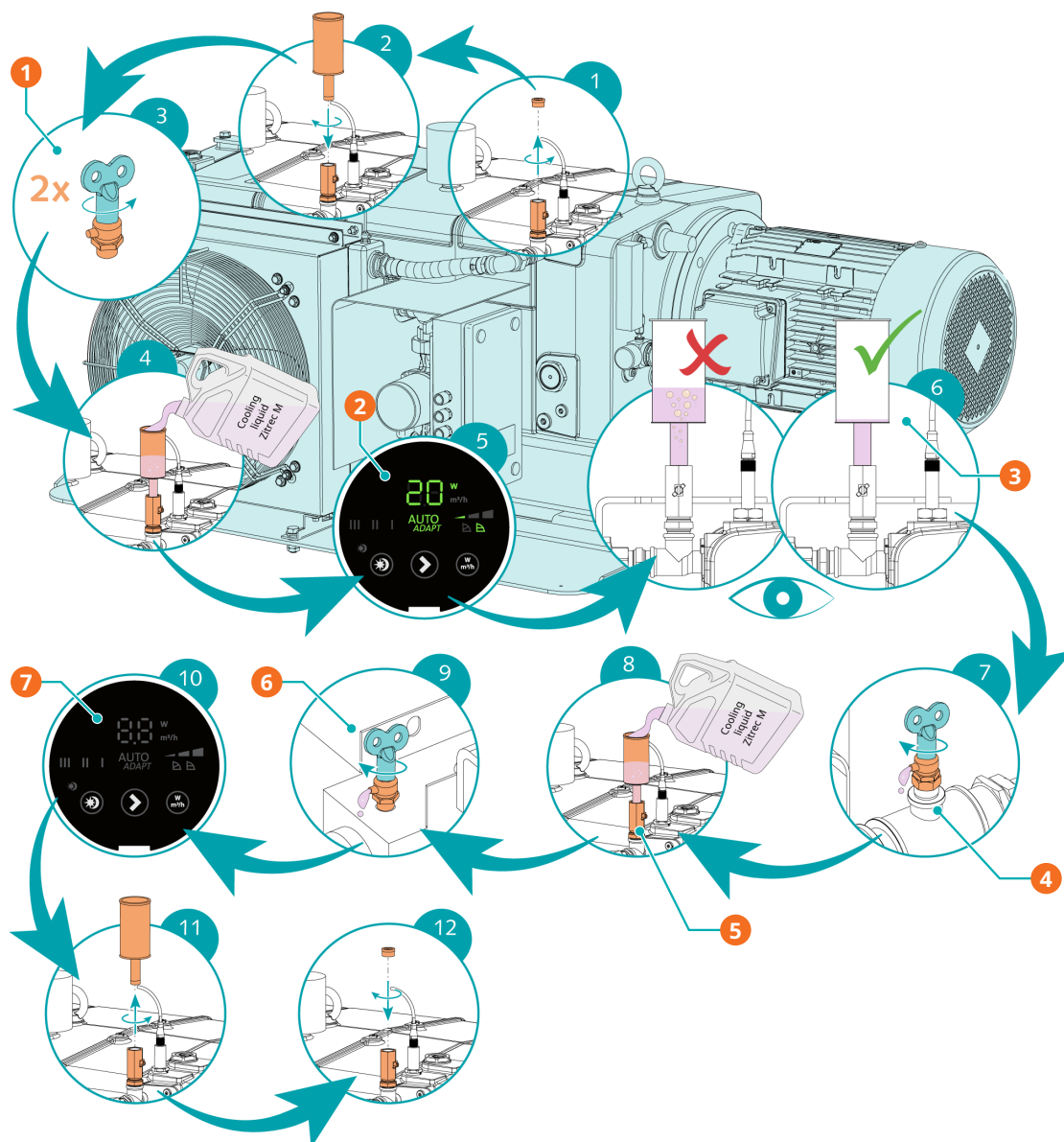
For cooling liquid type and cooling liquid capacity see Technical Data and *Cooling Liquid* [→ 43].

i NOTE

The illustration below shows the vacuum pump COBRA NX 0650 A.

For the vacuum pump COBRA NX 0450 A, invert the order of cooling liquid vent valve closings.

- First close CLV1.
- Then close CLV2.



Description			
1	Step 3: Open the cooling liquid vent valves (CLV1, CLV2)	2	Step 5: Switch on the cooling liquid pump (CLP)
3	Step 6: Vent air from the cooling system	4	Step 7: Close the cooling liquid vent valve (CLV2) when the cooling liquid is spilling out
5	Step 8: Resume cooling liquid filling	6	Step 9: Close the cooling liquid vent valve (CLV1) when the cooling liquid is spilling out
7	Step 10: Switch off 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* [→ 45] or *UK Declaration of Conformity* [→ 46]).

6.1 Machine delivered without Variable Speed Drive



DANGER

Live wires.

Risk of electrical shock!

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



NOTE

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

Contact your Busch representative for further advice and information.

- 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 Machine delivered with a Variable Speed Drive (Option)



DANGER

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

Risk of electrical shock!

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



DANGER

Maintenance work without disconnecting the variable speed drive.

Risk of electrical shock!

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



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.
- Make sure that the power supply for the drive is compatible with the data on the nameplate of the variable speed drive.
- If the machine is equipped with a power connector, install a residual current protective device to protect persons in case of a defective insulation.
 - Busch recommends installing a type B residual protective device suitable for the electrical installation.
- If the variable speed drive is not equipped with a lockable disconnect switch, provide it on the power line so that the machine is completely secured during maintenance tasks.
- Provide an overload protection according to EN 60204-1.
 - Busch recommends installing a C-curve circuit breaker.
- Connect the protective earth conductor.
- Electrically connect the Variable Speed Drive (VSD).

! NOTICE

The admissible motor speed exceeds the recommendation.

Risk of damage to the machine!

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

! NOTICE

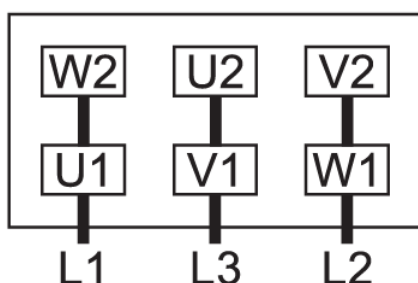
Incorrect connection.

Risk of damage to the variable speed drive!

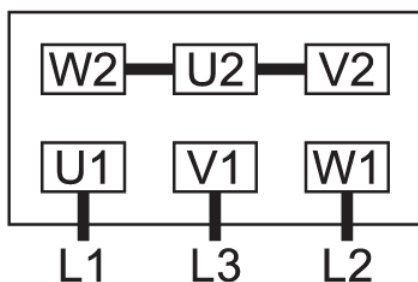
- The wiring diagrams given below are typical. Check the connection instructions/diagrams.

6.3 Wiring Diagram Three-Phase Motor (Pump Drive)

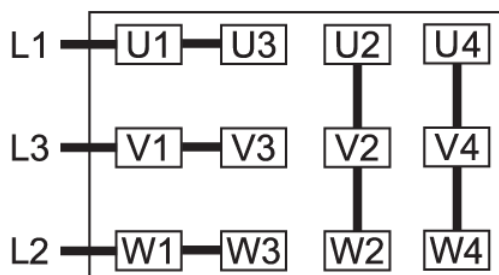
Delta connection (low voltage):



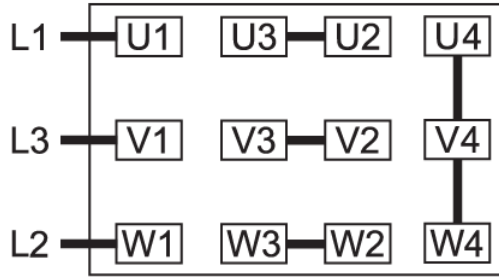
Star connection (high voltage):



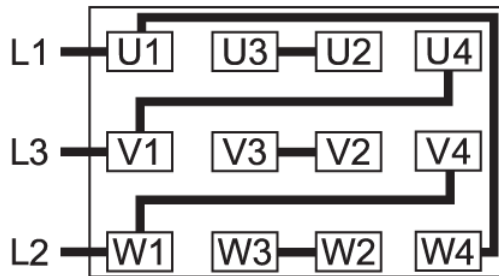
Double star connection, multi-voltage motor with 12 pins (low voltage):



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



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



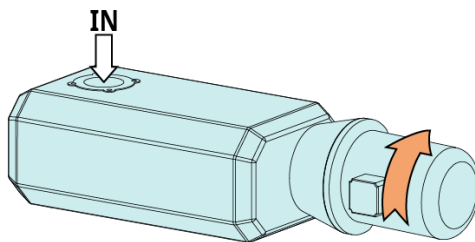
NOTICE

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.
- 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.

6.4 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 Temperature Switch

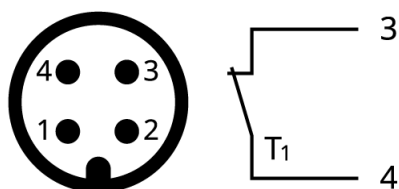
CE version

Part no.: 0651 563 762

Connector: M12x1, 4-pin

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

Switch point: $T_{\text{trip}} = T_1 \blacktriangleright$ pin 3 + 4



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

UL version

Part no.: 0651 211 928

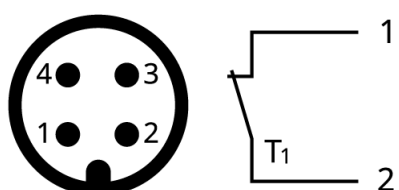
Connector: M12x1, 4-pin

Electrical data:

$U \leq 120 \text{ V AC/DC (50 Hz)}$; $I = 1 \text{ A}$

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

Switch point: $T_{\text{trip}} = T_1 \blacktriangleright$ pin 1 + 2



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

6.5 Electrical Connection of the Cooling System



DANGER

Live wires.

Risk of electrical shock!

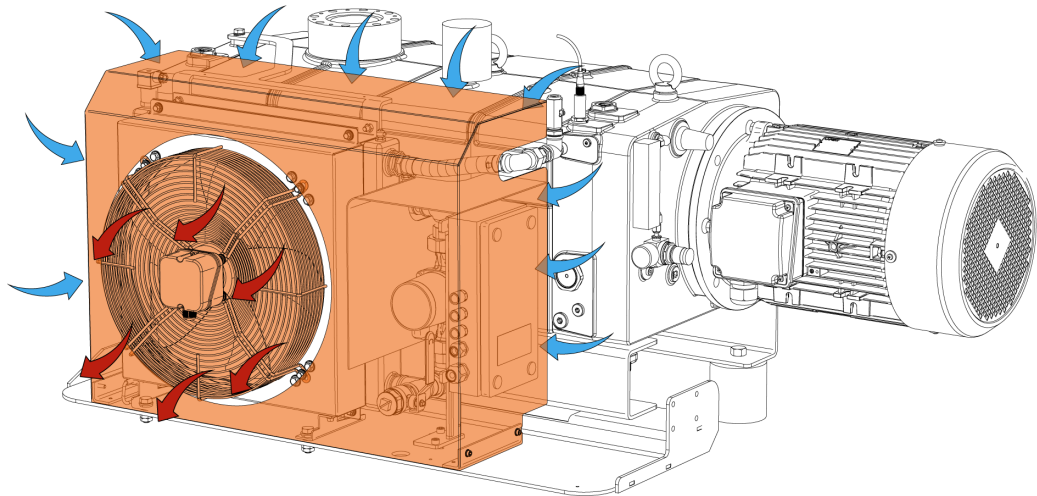
- Electrical installation work must only be executed by qualified personnel.
- Make sure that the power supply for the motor is compatible with the data on the nameplate of the motor.
- Provide an overload protection according to EN 60204-1 for the fan motor.
- Electrically connect the cooling system, according to the wiring diagram, see *Wiring Diagram Cooling System* [→ 25].
- Make sure that the cooling system is in operation when the machine is started.



NOTE

In operation, the fan only starts as soon as a certain operating temperature is reached.

- Make sure that the air flow blows in the right direction according to the following illustration.



If the rotation of the motor must be changed:

- Switch any two wires of the cooling system power supply.

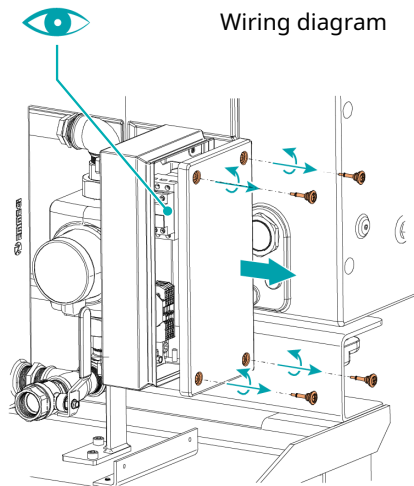
6.5.1 Wiring Diagram Cooling System



NOTE

The wiring diagram of the cooling system might be specific to the order.

- Please refer to the specific wiring diagram supplied inside the terminal box (TB).



7 Commissioning



CAUTION

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

Risk of burns!

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



CAUTION



Noise of running machine.

Risk of damage to hearing!

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

- Make sure to wear hearing protection.



NOTICE

The machine can be shipped without oil.

Operation without oil will ruin the machine in short time!

- Prior to commissioning, the machine must be filled with oil, see *Filling Oil* [→ 15].



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* [→ 16].



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* [→ 11] are met.

If the machine is equipped with a barrier gas system:

- Turn on the barrier gas supply.
- Adjust the barrier gas pressure.
- Make sure that the cooling system is in operation (axial fan (AF) and cooling liquid pump (CLP)). The setting of the cooling liquid pump does not matter. All settings are allowed.
- 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.
- After a few minutes of operation, perform an *Oil Level Inspection* [→ 30].
- After a few minutes of operation, perform a *Cooling Liquid Level Inspection* [→ 30].

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

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

7.1 Conveying Condensable Vapors



CAUTION

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.

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.

- Ensure that the barrier gas system (dry compressed air) is connected. Check the volume flow on the barrier gas flow meter (BGF), see *Barrier Gas System Connection (Optional)* [→ 14].
- 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 via the silencer on the pressure side. Install pipes connected on the outlet side with a gradient away from the vacuum pump. In the case of rising exhaust pipes, provide a condensate trap (e.g. "dead leg") with drain.
- Water vapor within the gas flow is tolerated within certain limits. The conveyance of other vapors shall be agreed upon 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 prior to commencing 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

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.

If the machine is equipped with a barrier gas system:

- Close the barrier gas 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 individually shortened or extended as appropriate.

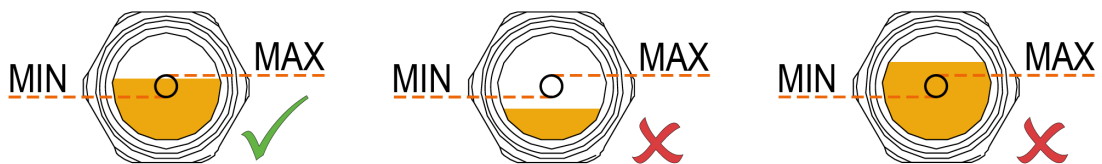
Particularly harsh applications or heavy duty operation, such as high dust loads in the environment or in the process gas, other contamination or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

Interval	Maintenance work
Monthly	<ul style="list-style-type: none"> • Check the oil level, see <i>Oil Level Inspection</i> [→ 30]. • Check the cooling liquid level, see <i>Cooling Liquid Level Inspection</i> [→ 30]. • 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. • Clean the inlet screen, see <i>Cleaning the Inlet Screen</i> [→ 31].
Yearly If one or more of these accessories are installed.	<ul style="list-style-type: none"> • Check the filter of the gas ballast valve (GB) and clean it if necessary, see <i>Cleaning the Gas Ballast Filter (Optional)</i> [→ 32]. • 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.

Interval	Maintenance work
Every 8500 hours or after 1 year	<ul style="list-style-type: none"> Change the oil of the gear and bearing housings (both sides), see <i>Oil Change</i> [→ 32]. Change the cooling liquid, see <i>Cooling Liquid Change</i> [→ 35]. Clean the magnetic plugs (MP).
Every 25000 hours or after 4 years	<ul style="list-style-type: none"> Have a major overhaul on the machine (contact Busch).

8.2 Oil Level Inspection

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

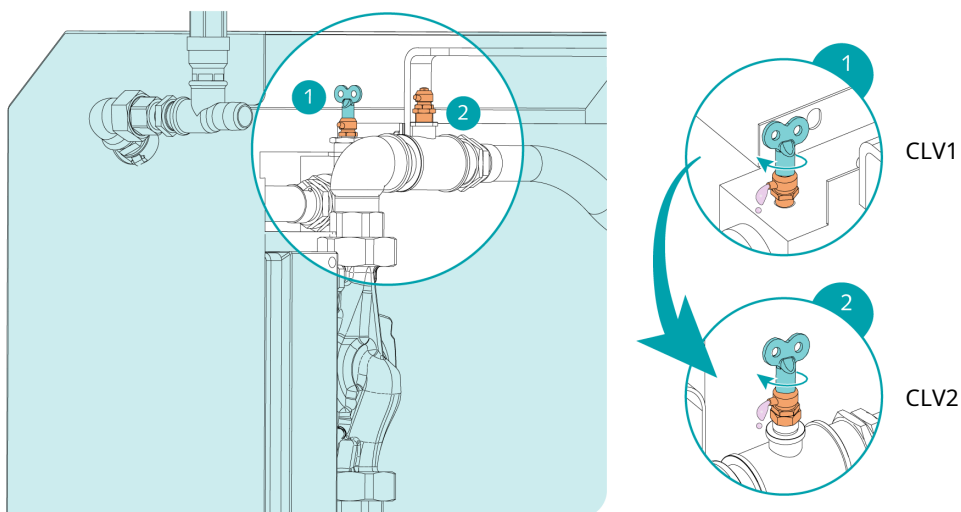


- Fill up if necessary, see *Filling Oil* [→ 15].

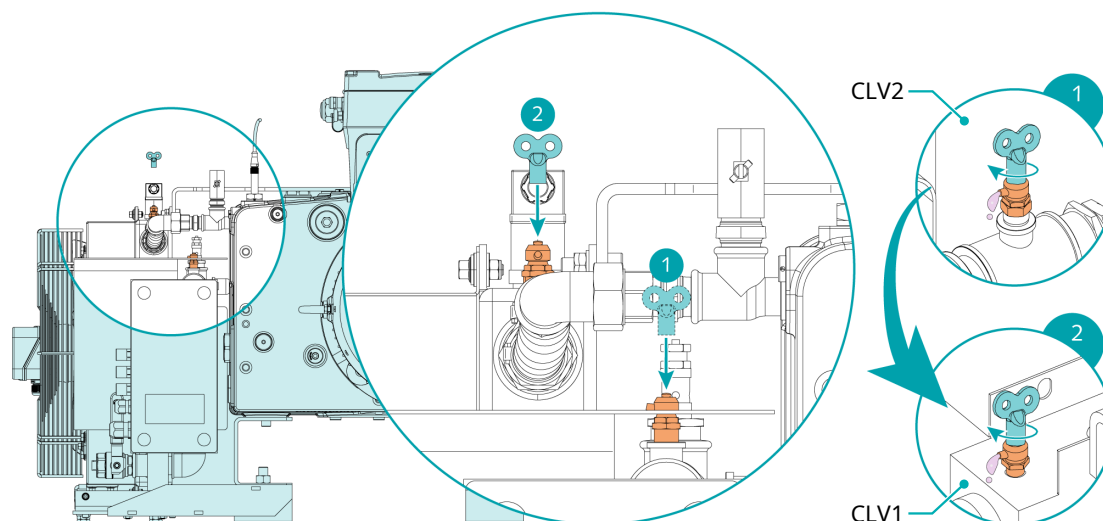
8.3 Cooling Liquid Level Inspection

- Stop the machine.
- Let the machine cool down.
- Open the cooling liquid vent valves (CLV1 – CLV2).
- Fill up if necessary, see *Filling Cooling Liquid* [→ 16].
- Close the cooling liquid vent valves (CLV1 – CLV2) in the following order when the cooling liquid is spilling out.

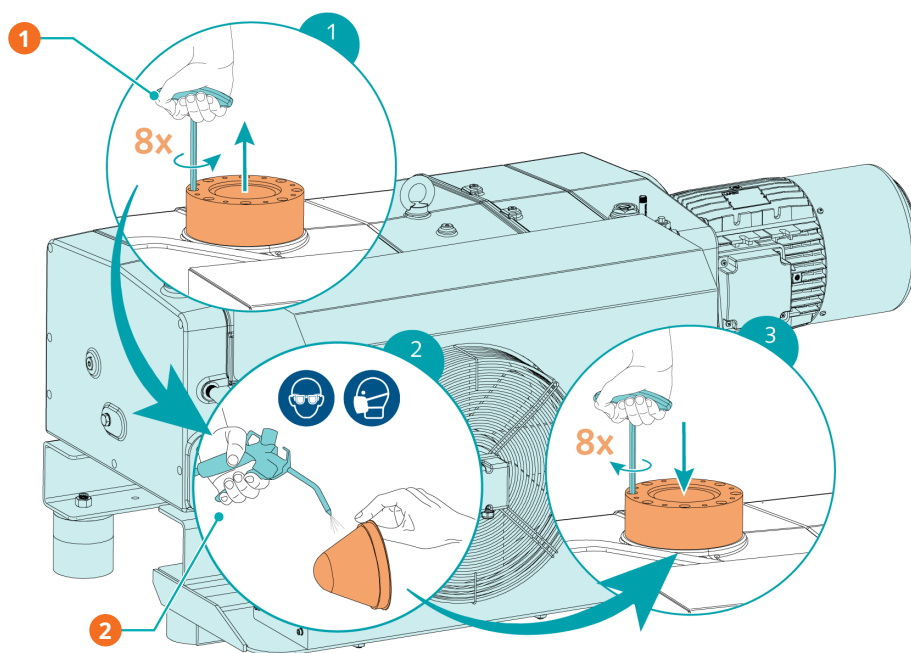
NX 0450 A



NX 0650 A



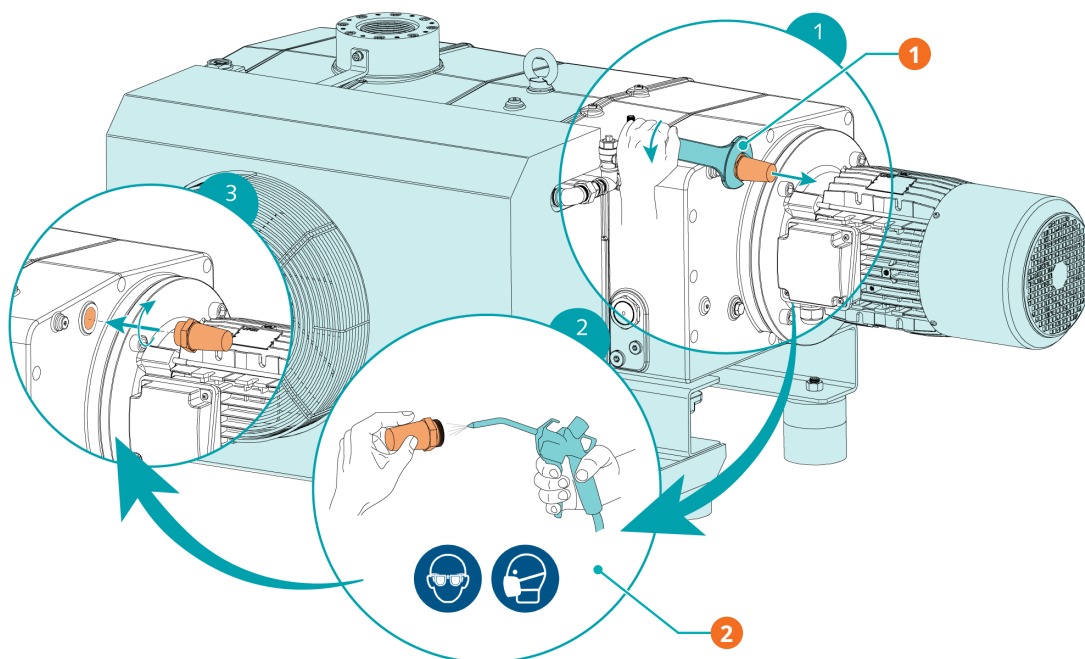
8.4 Cleaning the Inlet Screen



Description

1	Use a hexagonal key	2	Use compressed air and wear protective eyewear and mask
---	---------------------	---	---

8.5 Cleaning the Gas Ballast Filter (Optional)



Description

1	Use a 36 mm wrench	2	Use compressed air and wear protective eyewear and mask
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8.6 Oil Change



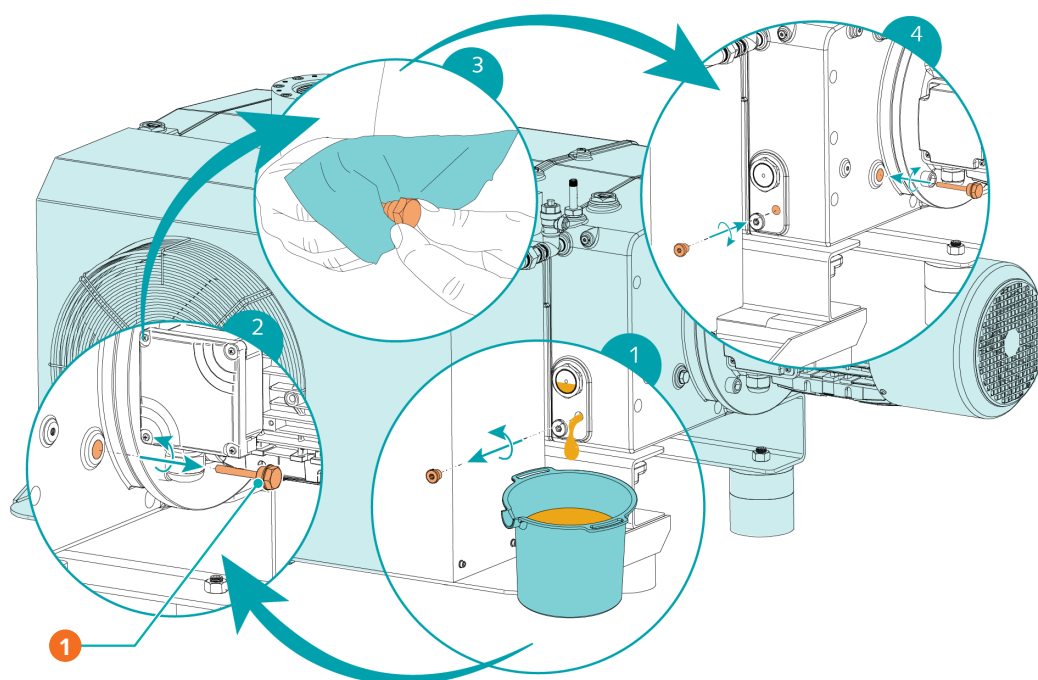
NOTICE

Use of an inappropriate oil.

Risk of premature failure!

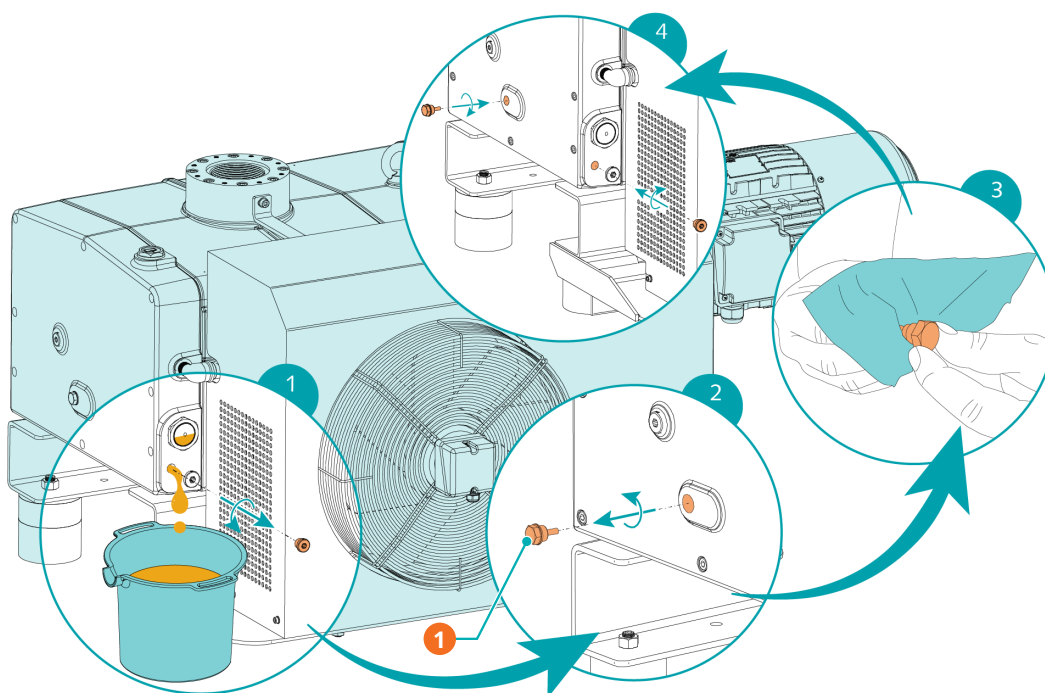
Loss of efficiency!

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



Description

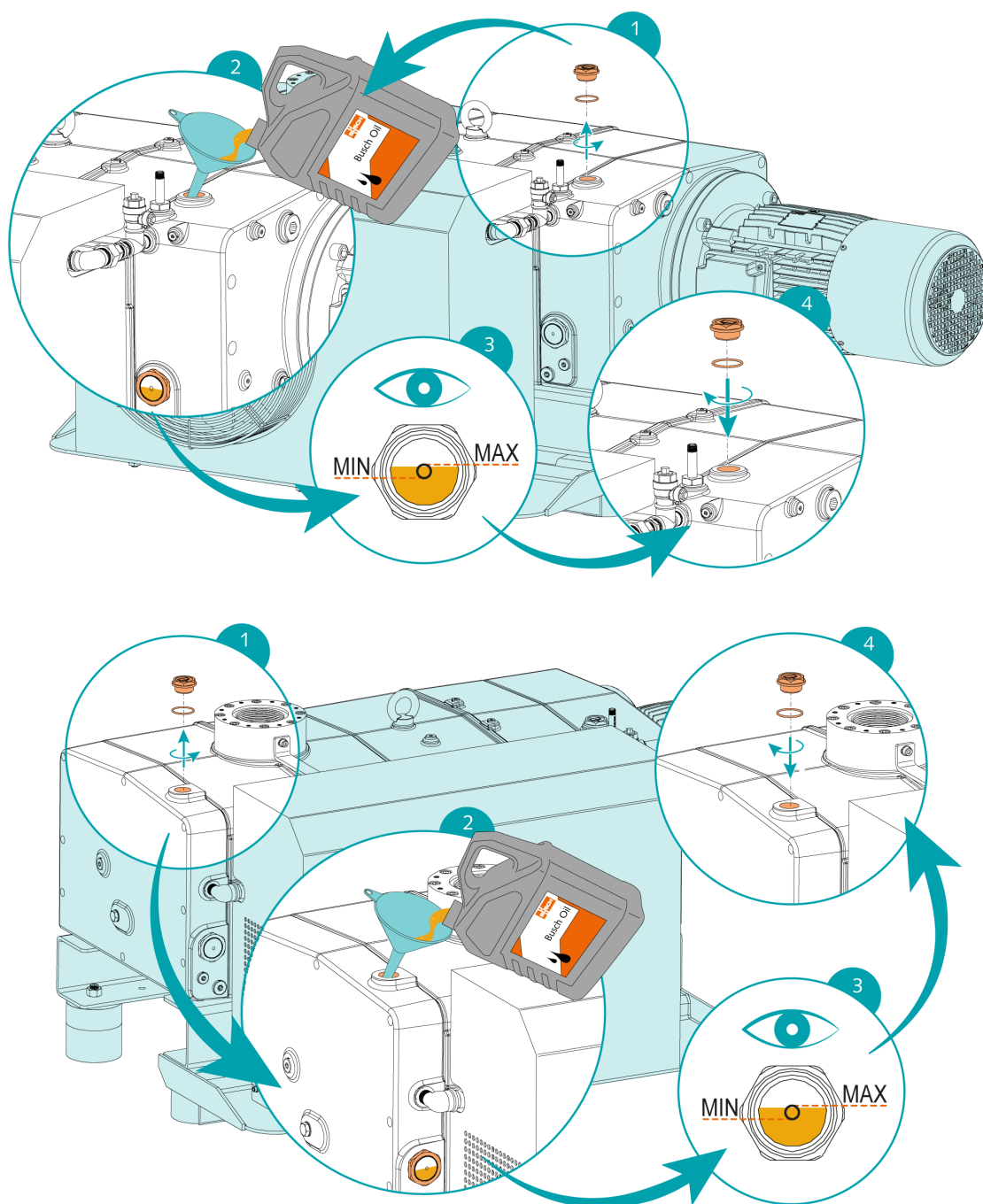
1	Magnetic plug		
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Description

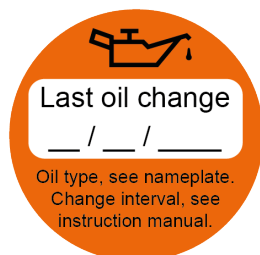
1	Magnetic plug		
---	---------------	--	--

For oil type and oil capacity see Technical Data and Oil [→ 44].



When the oil filling is achieved:

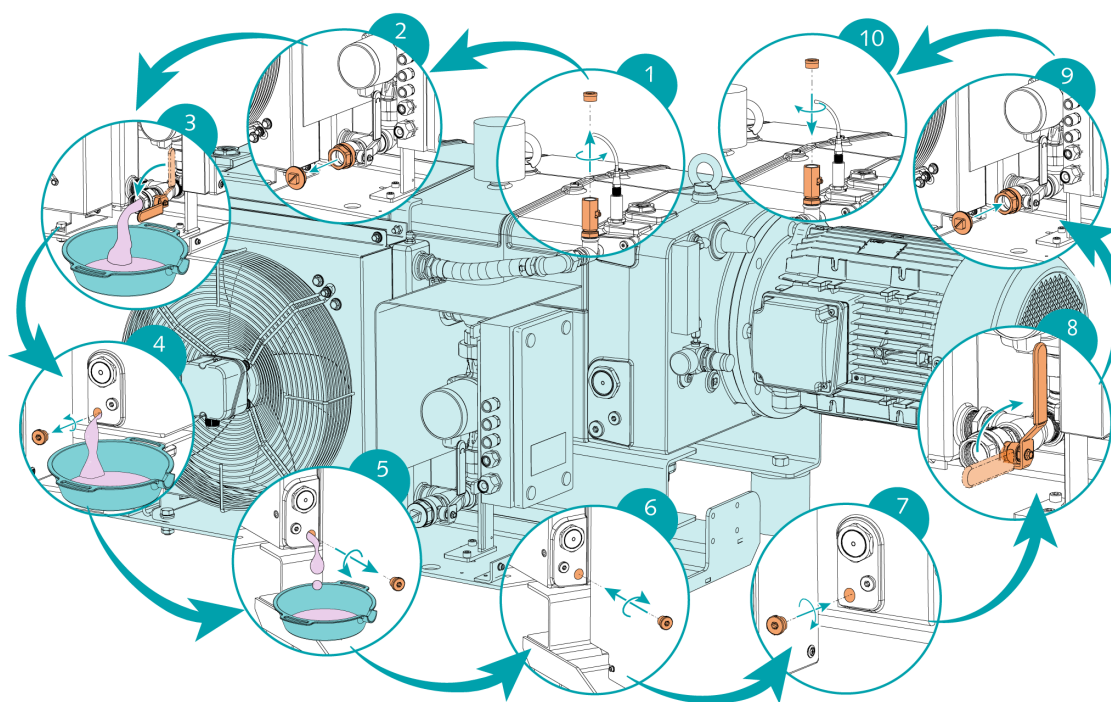
- Write down the oil change date on the sticker.



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

- Order it from your Busch representative.

8.7 Cooling Liquid Change



For cooling liquid type and cooling liquid capacity see Technical Data and *Cooling Liquid* [→ 43].

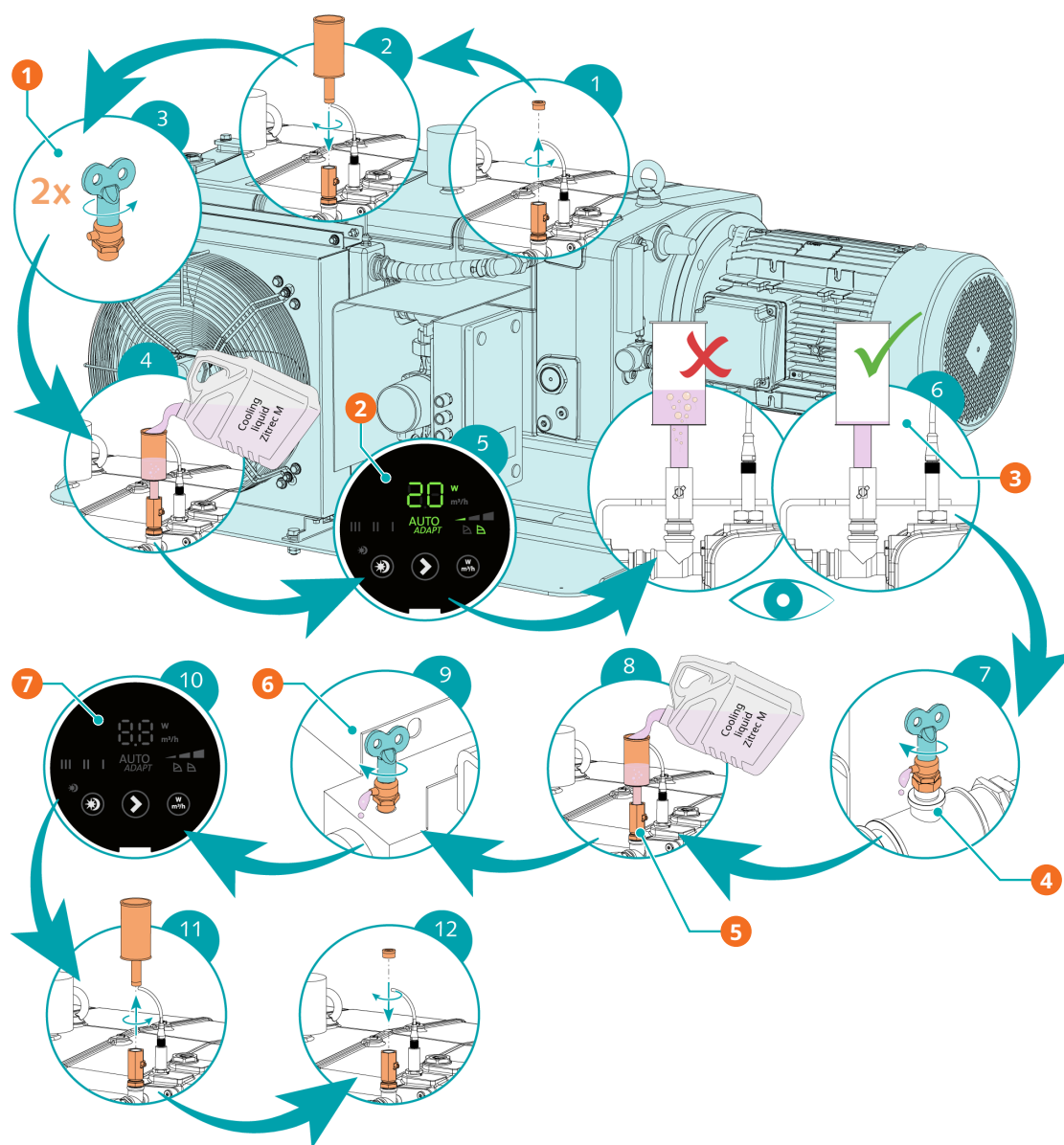


NOTE

The illustration below shows the vacuum pump COBRA NX 0650 A.

For the vacuum pump COBRA NX 0450 A, invert the order of cooling liquid vent valve closings.

- First close CLV1.
- Then close CLV2.



Description			
1	Step 3: Open the cooling liquid vent valves (CLV1, CLV2)	2	Step 5: Switch on the cooling liquid pump (CLP)
3	Step 6: Vent air from the cooling system	4	Step 7: Close the cooling liquid vent valve (CLV2) when the cooling liquid is spilling out
5	Step 8: Resume cooling liquid filling	6	Step 9: Close the cooling liquid vent valve (CLV1) when the cooling liquid is spilling out
7	Step 10: Switch off 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**

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.

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'.

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.

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

If the machine is equipped with a barrier gas system:

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

If the machine is to be stored:

- See *Storage* [→ 10].

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 original spare parts.

Risk of premature failure!

Loss of efficiency!

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

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

For original Busch 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.

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"> • Rotors inspection or 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). • Check the inlet screen (IS) at the suction connection.
	The temperature switch (TS) reached the switch point.	<ul style="list-style-type: none"> • Let the machine cool down. • See problem "The machine runs too hot".
	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.
	The inlet screen (IS) is partially clogged.	<ul style="list-style-type: none"> • Clean the inlet screen (IS), see <i>Cleaning the Inlet Screen</i> [→ 31].
	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> [→ 21].
	Internal parts are worn or damaged.	<ul style="list-style-type: none"> • Repair the machine (contact Busch).
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 <i>Oil</i> [→ 44].
	Defective gears, bearings or coupling element.	<ul style="list-style-type: none"> • Repair machine (contact Busch).

Problem	Possible Cause	Remedy
The machine makes a strange noise.	Air bubbles are present in the cooling system.	<ul style="list-style-type: none"> • Vent air from the cooling system, see <i>Filling Cooling Liquid</i> [→ 16]. • Check that the cooling liquid pump (CLP) is running at speed 1 (approx. 20 W).
The machine runs too hot.	Ambient temperature too high.	<ul style="list-style-type: none"> • Observe the permitted ambient temperature, see Technical Data.
	The heat exchanger (AHE) is dirty or obstructed.	<ul style="list-style-type: none"> • Clean it and make sure that the air flow path is clear of all obstacles.
	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 liquid 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.
	Cooling liquid level too low.	<ul style="list-style-type: none"> • Top up cooling liquid.
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> [→ 32].
	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, contact your Busch representative.

13 Technical Data

		NX 0450 A	NX 0650 A
Pumping speed (50 / 60 Hz)	m ³ /h	350 / 420	650 / 650
Ultimate pressure without gas ballast	hPa (mbar) abs.	≤ 0.1	≤ 0.1
Ultimate pressure (50 / 60 Hz) with gas ballast	hPa (mbar) abs.	≤ 0.5 / ≤ 0.1	≤ 0.5 / ≤ 0.5
Nominal motor rating (50 / 60 Hz)	kW	7.5 / 9.5	12.5 / 15.0
Nominal motor speed (50 / 60 Hz)	min ⁻¹	3000 / 3600	
Sound pressure level (ISO 2151) KpA = 3 dB (50 / 60 Hz)	dB(A)	≤ 72 / ≤ 74	≤ 73 / ≤ 75
Ambient temperature range	°C	Without variable speed drive (ECO-TORQUE) -20 ... 50	
		With variable speed drive (ECOTORQUE) -20 ... 40	
Maximum allowable counter pressure at discharge	hPa (mbar) rel.	200	
Maximum allowable gas inlet temperature according to the inlet pressure	°C	≤ 50 hPa (mbar) abs. : 200	
		> 50 hPa (mbar) abs. : 70	
Relative humidity	at 30°C	90 %	
Ambient pressure		Atmospheric pressure	
Oil capacity - Motor side	l	0.65	1.0
Oil capacity - Suction side	l	0.55	1.0
Cooling liquid capacity approx.	l	30	47
Weight approx.	kg	700	900

14 Cooling Liquid

Zitrec® M-25 (Ready-to-use)	
Part number 5 L packaging	0831 563 469
Part number 20 L packaging	0831 238 761

Zitrec® M-25 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

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

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

declares that the machine: COBRA NC 0450 A; COBRA NX 0450 A; COBRA NC 0650 A; COBRA NX 0650 A

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

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


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

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 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments

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

Busch Dienste GmbH
Schauinslandstr. 1
DE-79689 Maulburg

Chevenez, 01.03.2023



Christian Hoffmann, General Manager

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

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

declares that the machine: COBRA NC 0450 A; COBRA NX 0450 A; COBRA NC 0650 A; COBRA NX 0650 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 that have been used to fulfill those provisions:

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 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments

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

**Busch (UK) Ltd
30 Hortonwood
Telford - UK**

Chevenez, 01.03.2023



Christian Hoffmann, General Manager

Notes

Grid of dots for 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