

MINK

Claw Compressors
MA 0018 A

Instruction Manual

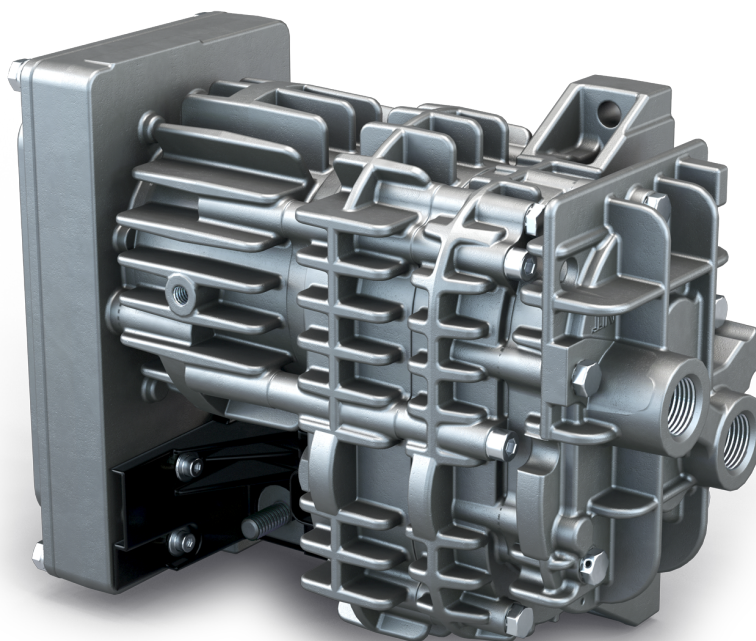


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1 Safety

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

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

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

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

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

The machine has been designed and manufactured according to state-of-the-art methods. Nevertheless, residual risks may remain, as described in the following chapters and in accordance with the chapter *Intended Use* [→ 5]. 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.



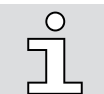
CAUTION

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



NOTICE

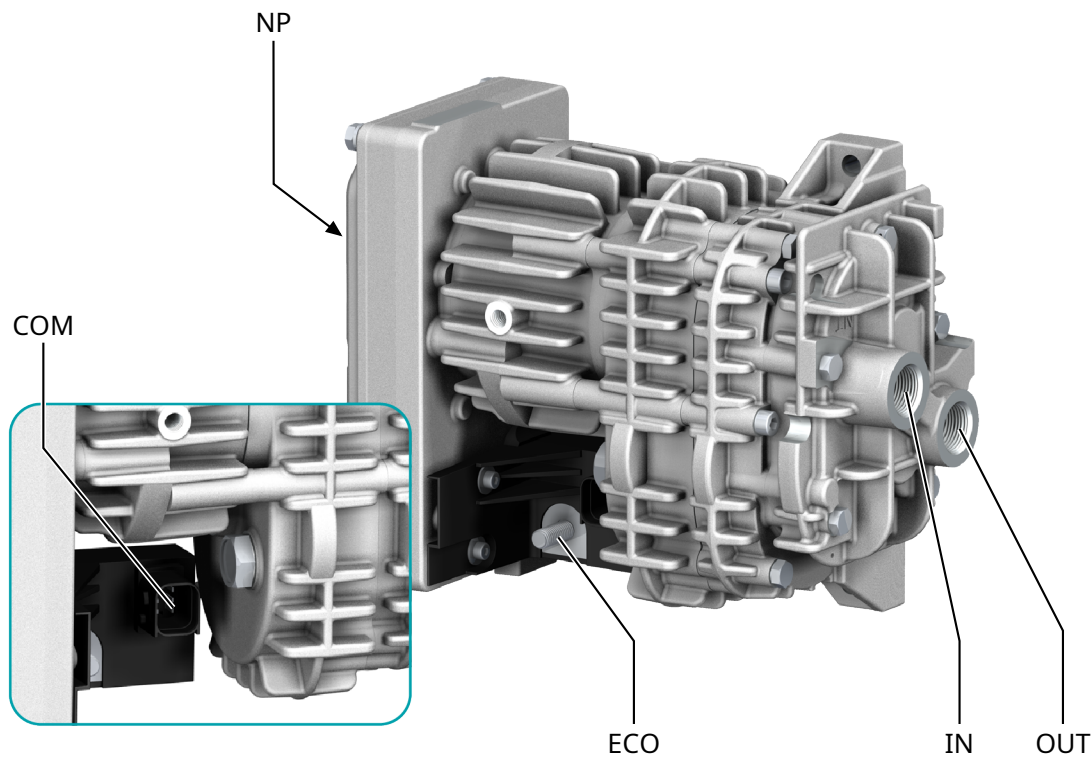
... indicates a potentially dangerous situation that could result in damage to property.



NOTE

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

2 Product Description



Description			
COM	6-pole HDSCS connector (CAN)	ECO	Electrical connection (+V _{Batt})
IN	Inlet connection	NP	Nameplate
OUT	Pressure connection		

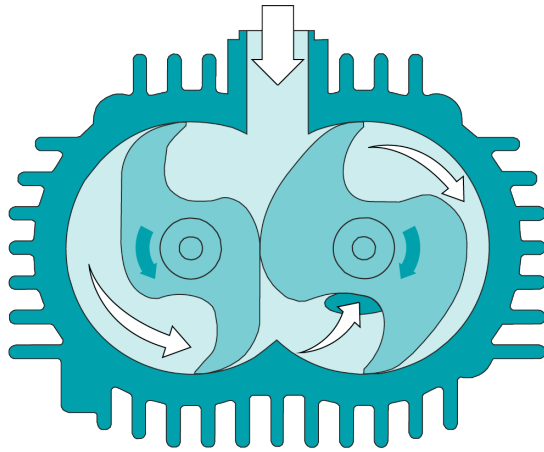
NOTE

Technical term.
In this instruction manual, we consider that the term ‘machine’ refers to the ‘compressor’.

NOTE

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

2.1 Operating Principle



The machine works on the claw principle.

2.2 Intended Use



WARNING

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

Risk of injuries!

Risk of damages to the machine!

Risk of damages to the environment!

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

The machine is intended for the compression of air and other dry, non-aggressive, non-toxic and non-explosive gases.

Conveying of other media leads to an increased thermal and/or mechanical load on the machine and is permissible only after a consultation with Busch.

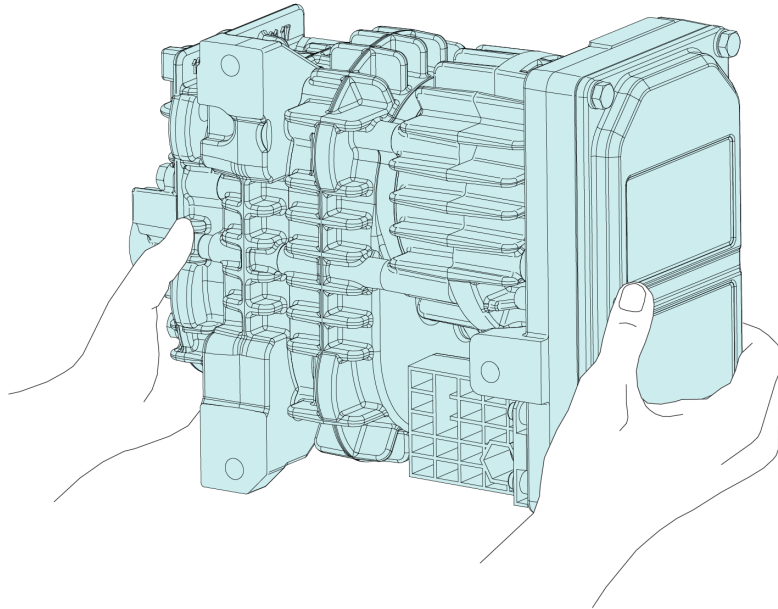
The machine is intended for the placement in a non-potentially explosive environment.

The machine is suitable for continuous operation.

Permitted environmental conditions, see *Technical Data* [→ 39].

3 Transport

- To find out the weight of the machine, refer to the chapter *Technical Data* [→ 39] or the nameplate (NP).



- Check the machine for transport damage.

If the machine is secured to a base plate:

- Remove the machine from the base plate.

4 Storage

- Seal all apertures with adhesive tape or reuse provided caps, if not connected to a system.

If the machine is to be stored for more than 2 months:

- Make sure that the inside of the process chamber will be kept dry and dust free at ambient temperature.
- Make sure the machine is stored in a horizontal position..
- Before restarting the machine after a long period of machine shutdown, it is recommended to maintain as described in chapter *Oil Draining* [→ 19].
- After storage for more than 2 years, check the machine for oil leaks - visual inspection.

5 Installation

5.1 Installation Conditions



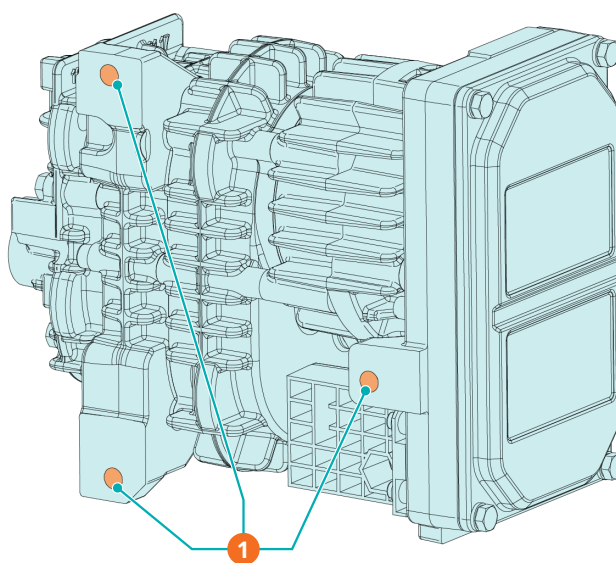
NOTICE

Use of the machine outside of the permitted installation conditions.

Risk of premature failure!

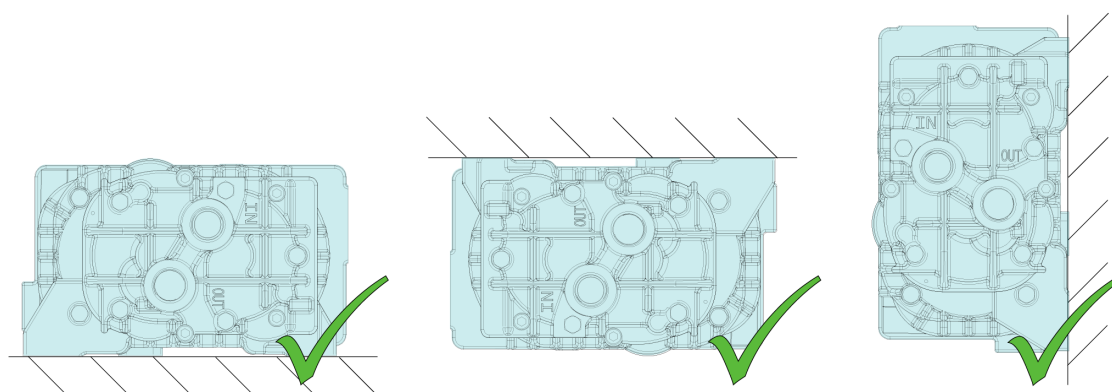
Loss of efficiency!

- Take care that the installation conditions are fully complied with.



Description

1	Fixing points		
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- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the *Technical Data* [→ 39].
- Make sure that the machine surface is clean from dust and dirt to guarantee an efficient cooling.
- Make sure that the installation space or location is protected from weather and lightning.

- Make sure that the installation space or location is vented such that sufficient cooling of the machine is provided.
- We strongly recommend to install the product at the top level of the fluid circuit to avoid the stagnation of condensates inside the compression stage.
- Make sure that all provided covers, guards, hoods, etc. are mounted.



WARNING

Vibration level.

Risk of premature failure!

- Make sure the product is protected from external shocks. Regarding vibration level, please contact your Busch representative to discuss the corresponding levels.

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

- Contact your Busch representative, the motor should be derated or the ambient temperature limited.

5.2 Connecting Lines / Pipes



WARNING

Unprotected connection.

Risk of severe injury!

- Do not put hand or fingers in the connection.
- Remove all protective covers before installation.
- Make sure that the connection lines cause no stress on the machine's connection; if necessary use flexible joints.
- Make sure that the line size of the connection lines over the entire length is at least as large as the connections of the machine.
- Make sure that no dust or other particles can enter into the machine.

In case of long connection lines it is advisable to use larger line sizes in order to avoid a loss of efficiency. Seek advice from your Busch representative.

- Make sure that the connections are "face sealed" and not "thread sealed" to ensure tightness.

5.2.1 Suction Connection



WARNING

Unprotected connection.

Risk of severe injury!

- Do not put hand or fingers in the 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):

- G1/2

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

- Make sure that the gas is drawn without obstruction.

5.2.2 Discharge Connection



WARNING

Unprotected connection.

Risk of severe injury!

- Do not put hand or fingers in the connection.



NOTICE

Discharge gas flow obstructed.

Risk of damage to the machine!

- Make sure that the discharged gas will flow without obstruction. Do not shut off or throttle the discharge line.

Connection size(s):

- G1/2

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

6 Electrical Connection



DANGER

Live wires.

Risk of electrical shock.

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

CURRENT PROTECTION OF THE CUSTOMER INSTALLATION:



DANGER

Missing current protection.

Risk of electrical shock.

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



NOTICE

Electromagnetic compatibility.

- Make sure that the motor of the machine will not be affected by electric or electro- magnetic disturbance from the mains, if necessary seek advice from Busch.
- Make sure that the EMC of the machine is compliant with the requirements of your supply network system, if necessary provide further interference suppression (EMC of the machine, see *EU Declaration of Conformity* [→ 40] or *UK Declaration of Conformity* [→ 41]).

6.1 Machine delivered with a Variable Speed Drive



DANGER

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

Risk of electrical shock!

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



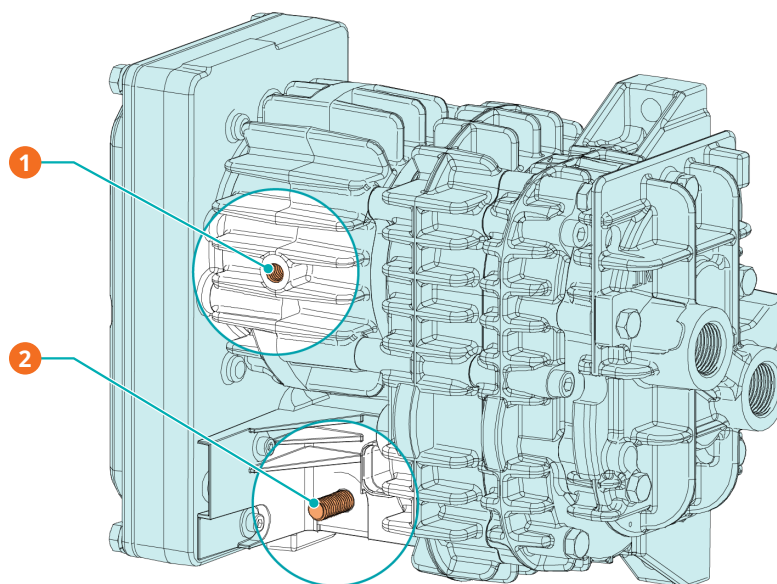
DANGER

Maintenance work without disconnecting the variable speed drive.

Risk of electrical shock.

- Disconnect and isolate the variable speed drive before attempting any work on it.
- Make sure that the power supply corresponds to the specification on the wiring diagram supplied with the machine.
- Make sure that the power supply for the drive is compatible with the data on the nameplate of the variable speed drive.

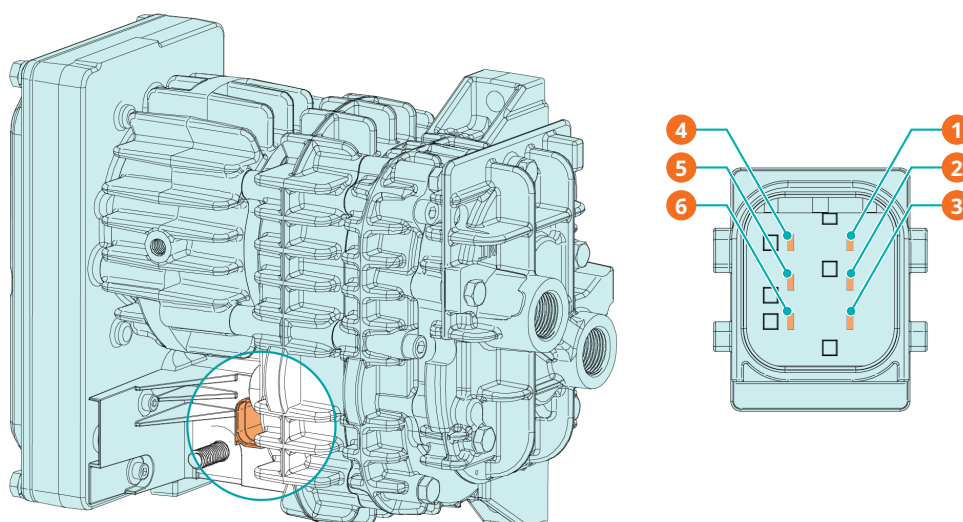
- If the machine is equipped with a power connector, install a residual current protective device to protect persons in case of isolation default.
- If the variable speed drive is not equipped with a lockable disconnect switch, provide it on the power line so that the machine is completely secured during maintenance tasks.
- Provide an overload protection according to EN 60204-1.
- Connect the protective earth conductor.
- Electrically connect the machine to the main power supply.



Description

1	-V Batt (M8 thread)	2	+V Batt (M8 thread)
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6.2 Version with Analog Speed Control



Description

1	0 ... 5 V (= 0 ... 6600 rpm)	2	-
---	------------------------------	---	---

Description			
3	-	4	-
5	-	6	-

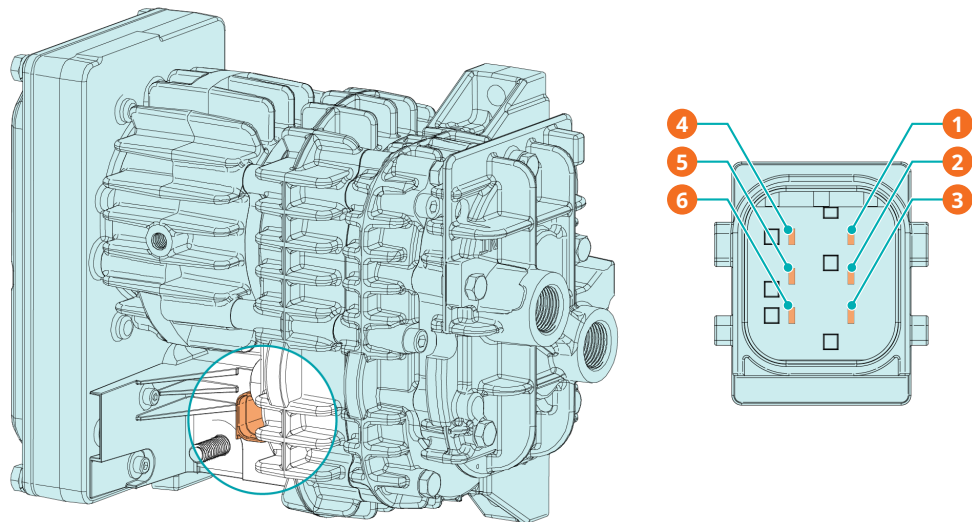
6.3 Version with CAN-Communication

 **NOTE**

If KL15 cable (pin 1 of the CAN connector) and CAN cable are longer than 30 meters.

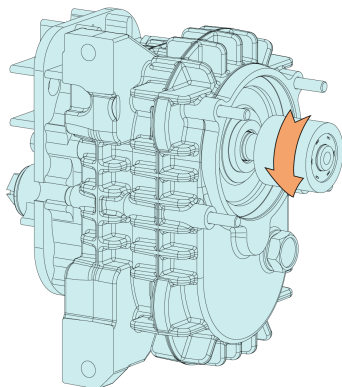
Risk of electromagnetic disturbances!

- Make sure that the length of each cable does not exceed 30 meters.



Description			
1	KL15 (20-32VDC)	2	CAN H
3	CAN L	4	+5V supply for Mass Flow Sensor (optional)
5	SENT for Mass Flow Sensor (optional)	6	GND for Mass Flow Sensor (optional)

6.4 Motor Rotation Direction



7 Commissioning



NOTICE

Lubricating a dry running machine (compression chamber).

Risk of damage to the machine!

- Do not lubricate the compression chamber of the machine with oil or grease.



CAUTION

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

Risk of burns!

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



CAUTION



Noise of running machine.

Risk of damage to hearing!

If persons are present in the vicinity of a non noise insulated machine over extended periods:

- Make sure that ear protection is being used.
 - Make sure that the installation conditions (see *Installation Conditions* [→ 8]) are met.
 - Switch on the machine.
 - Make sure that the operating conditions comply with the *Technical Data* [→ 39].
- 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 Standard Version

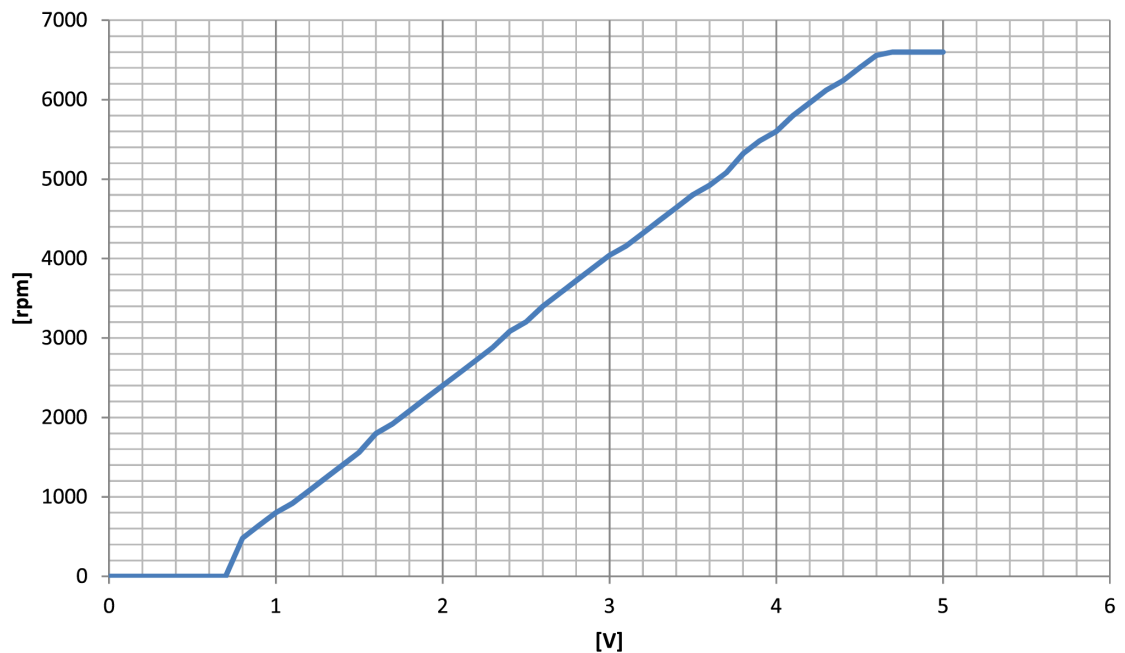
The machine starts automatically with maximum speed as soon as electrical power is supplied.

7.2 Version with Analog Speed Control

The electronic is automatically activated as soon as electrical power is supplied.

The speed can be controlled by a potentiometer connected to terminal 1 (KL15) on the HDSC connector (CON).

Observe the following diagram to adjust the speed.



7.3 Version with CAN-Communication

The CAN communication and protocol are based on the following standards:

- ISO 11898 for hardware,
- SAE J1939 as vehicle standard for the software.

The CAN address coding is using the Intel protocol with Little Endian format.

The machine is controlled via CAN communication (see *CAN Protocol* [→ 36]). The CAN control message send all necessary signals and reference values to the machine.

There are two different operating modes.

The speed control mode controls the speed of the machine.

The mass flow control mode controls the speed of the machine depending on the mass flow. For mass flow control mode, the machine must be equipped with an air mass flow sensor. In case of a failure of the air mass flow sensor the machine switches automatically to speed control mode.

Terminal 1 (KL15)



NOTE

The KL15 must be powered with the same voltage as the +Vbatt (20-32VDC with a nominal voltage of 24VDC).

High voltage level on terminal 1 (KL15) switches on the internal power supply of the machine. After switching on, the machine waits 10 seconds for a valid CAN control message before a CAN failure will be detected.

In case of a voltage level below 1.2V on terminal 1 (KL15) the machine decelerates to a speed of 1800 min⁻¹. After 10 seconds the machine stops. After further 2.5 seconds the internal power supply of the machine switches off.

CAN Status Message (Actual Values)

One second after startup, the machine sends every 50 ms a CAN status message with actual values. If the machine receives a CAN control message before the first second after startup the machine sends the CAN status message immediately.

Power-On Bit

After startup a power-on bit is set in the CAN status frame for one second. The power-on bit can be used to identify unexpected resets/restarts.

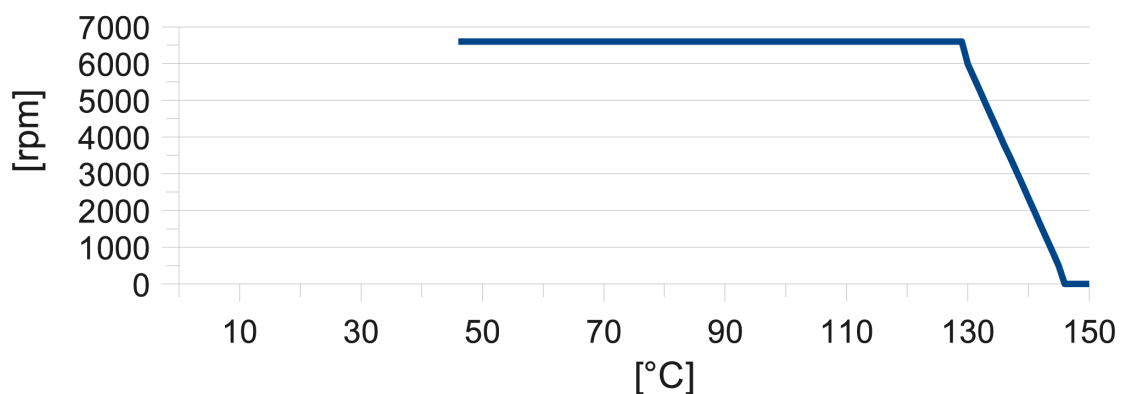
Loss of CAN Communication

If a loss of CAN communication occurs the reference value for mass flow will be set to 100 g/min. A loss of CAN communication will be detected if no valid CAN control message have been received for 500 ms. As soon as the CAN communication is available again the machine switches to normal operation immediately.

Speed reduction by temperature

The maximum speed of the machine depends on the electronic temperature to ensure safe operation of the machine at any temperatures.

The machine will reduce the speed if the electronic temperature is too high even if the reference speed value is higher than the actual speed. The speed reduction resulted from the electronic temperature is indicated by the sixth bit in the CAN status frame. There will be no indication on the sixth bit if the actual speed limited by the electronic temperature complies with the maximum speed.



Loss of air mass flow sensor

At loss of the air mass flow sensor, the software switches automatically into the speed control mode with the predefined speed pre-control value.

Without or in case of loss of air mass flow sensor, the actual air temperature (given by the CAN Actual Values) is 214°C by default.

The loss of air mass flow sensor is visible in the CAN Status bit (see CAN Protocol). This failure is automatically reset as soon as new values are received from the air mass flow sensor. Without air mass flow sensor, the bit 2 of the diagnostics is automatically set to 1.

Over current protection

The electronics is protected against a blocked rotor or overload by an overcurrent protection. If an overcurrent is detected the motor stops immediately. The bit 7 "overcurrent" in the CAN Status frame is set for about 2 seconds.

One second after the stop of the motor the electronic tries to restart the motor automatically. If the overcurrent error occurs one more time, the motor stops again and the error bit in the can status frame stays on.

Plausibility check

A blocked rotor cannot be detected under all conditions by an overcurrent detection. Therefore, an additionally plausibility check is implemented.

The plausibility check checks different ratios inside the motor controller. If a plausibility check error occur the motor stops immediately and the bit 5 "plausibility error" in the CAN Status frame is set. The timing for the error bit and the restart is identical to the overcurrent protection.

Electronic limits

Status and diagnostic	Bit number	Limit
Wrong voltage	4	24 V motor ► 35 V
Temperature limit	6	130 ... 145 °C ► rotation speed decrease >145 °C ► motor off
Overload	6 and 7	700 W

8 Maintenance



DANGER

Live wires.

Risk of electrical shock.

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



WARNING



Machines contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.



CAUTION

Hot surface.

Risk of burns!

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



CAUTION

Failing to properly maintain the machine.

Risk of injuries!

Risk of premature failure and loss of efficiency!

- Maintenance work must only be executed by qualified personnel.
 - Respect the maintenance intervals or ask your Busch representative for service.
 - Shut down the machine and lock against inadvertent start up.
 - Provide a lockable disconnecting switch in the power line to ensure that the machine is completely secured against inadvertent start up during the whole maintenance procedure.
 - Disconnect the power supply.
 - Vent the connected lines to atmospheric pressure.
- If necessary:
- Disconnect all connections.
 - Separate special waste from the machine.
 - Dispose of special waste in compliance with applicable regulations.
 - Dispose of the machine as scrap metal.

8.1 Maintenance Schedule

The maintenance intervals depend very much on the individual operating conditions. The intervals given below are considered as starting values which should be shortened or extended as appropriate. Particularly harsh applications or heavy duty operation, such as high dust loads in the environment or in the process gas, other contamination or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

Interval	Maintenance work
Every 12000 hours or after 6 years	Replace the machine.

8.2 Oil Draining

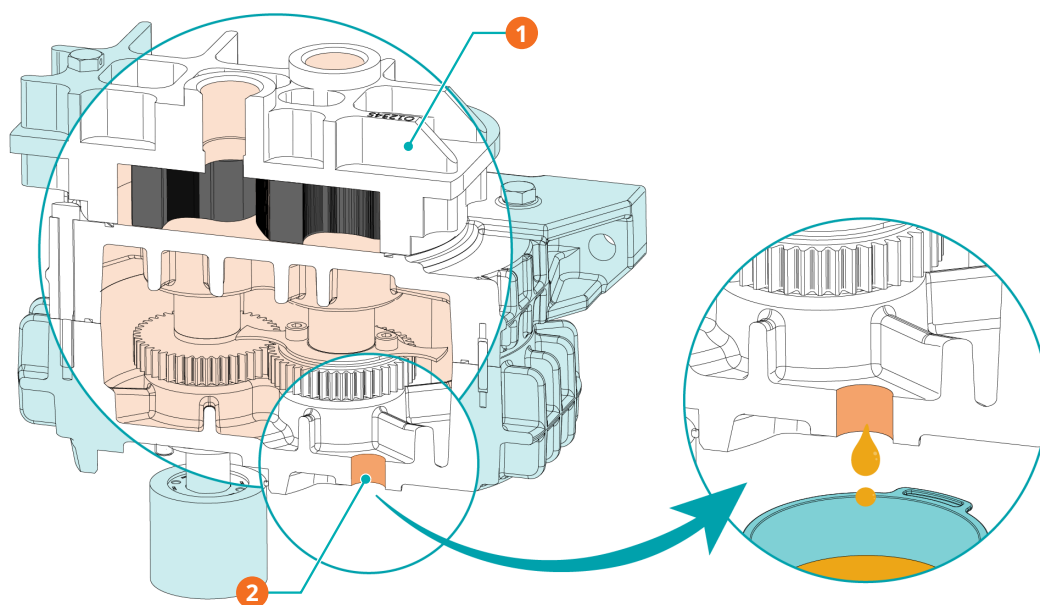
8.2.1 Overall Information

i NOTE

Oil draining.

Recommendation.

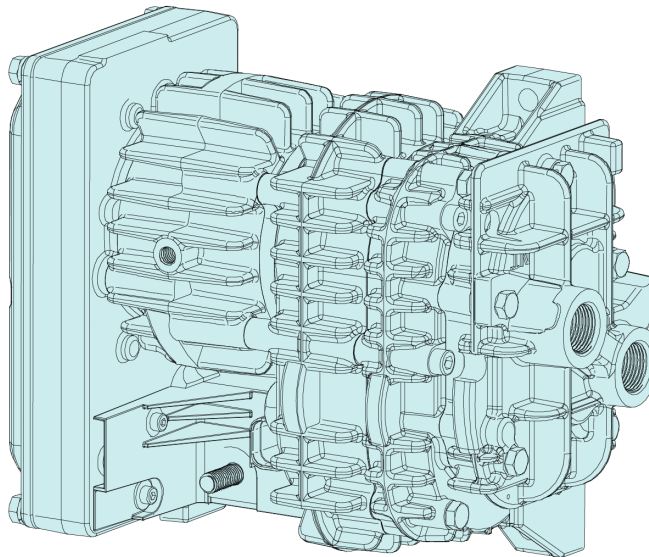
- There is no ideal angle to put the gear for oil draining. We would recommend to move the gearbox several times from standard "vertical position" to a 90° position. The remaining oil must be the lowest possible.
- The illustration below shows the internal ribs and explains that there will always remain some oil inside.



Description

1	Internal view of the gearbox	2	Oil output
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- The illustration below shows the "vertical position" for oil refilling.



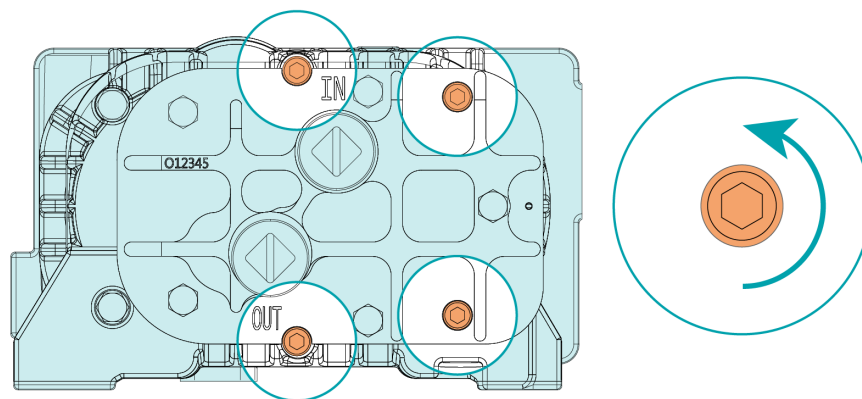
8.2.2 Draining Procedure

! NOTICE

Oil draining procedure.

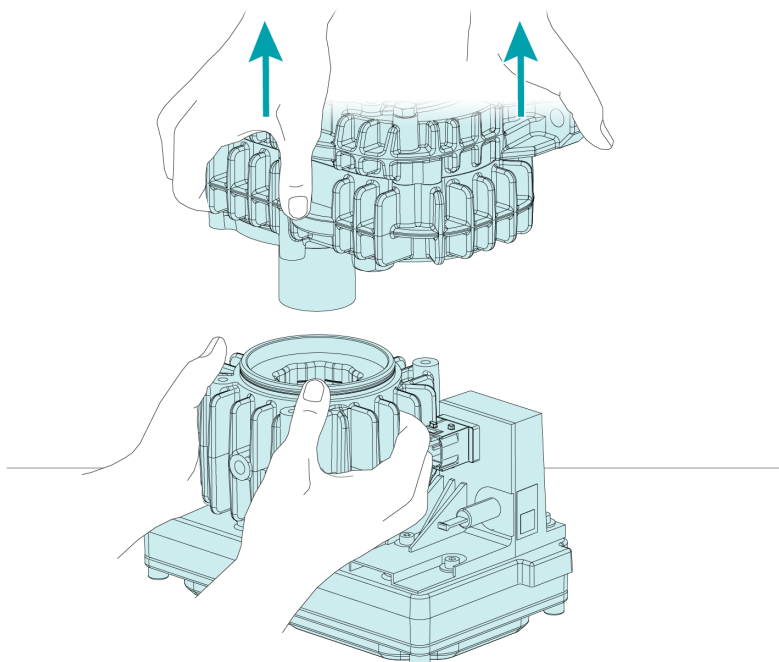
Risk of damage to the machine!

- Before proceeding the oil draining, make sure that the cylinder of your machine has four access holes to the motor screws. If not, do not proceed the oil draining and contact your Busch representative.
- Remove the machine from the system.
- Use an M5 hexagonal tool to unscrew the four motor screws directly accessible through the four access holes of the cylinder.



Removing the motor

- Hold the motor while pulling up the stage (because of the resistance coming from the rotor's magnetic force).



Draining the 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.

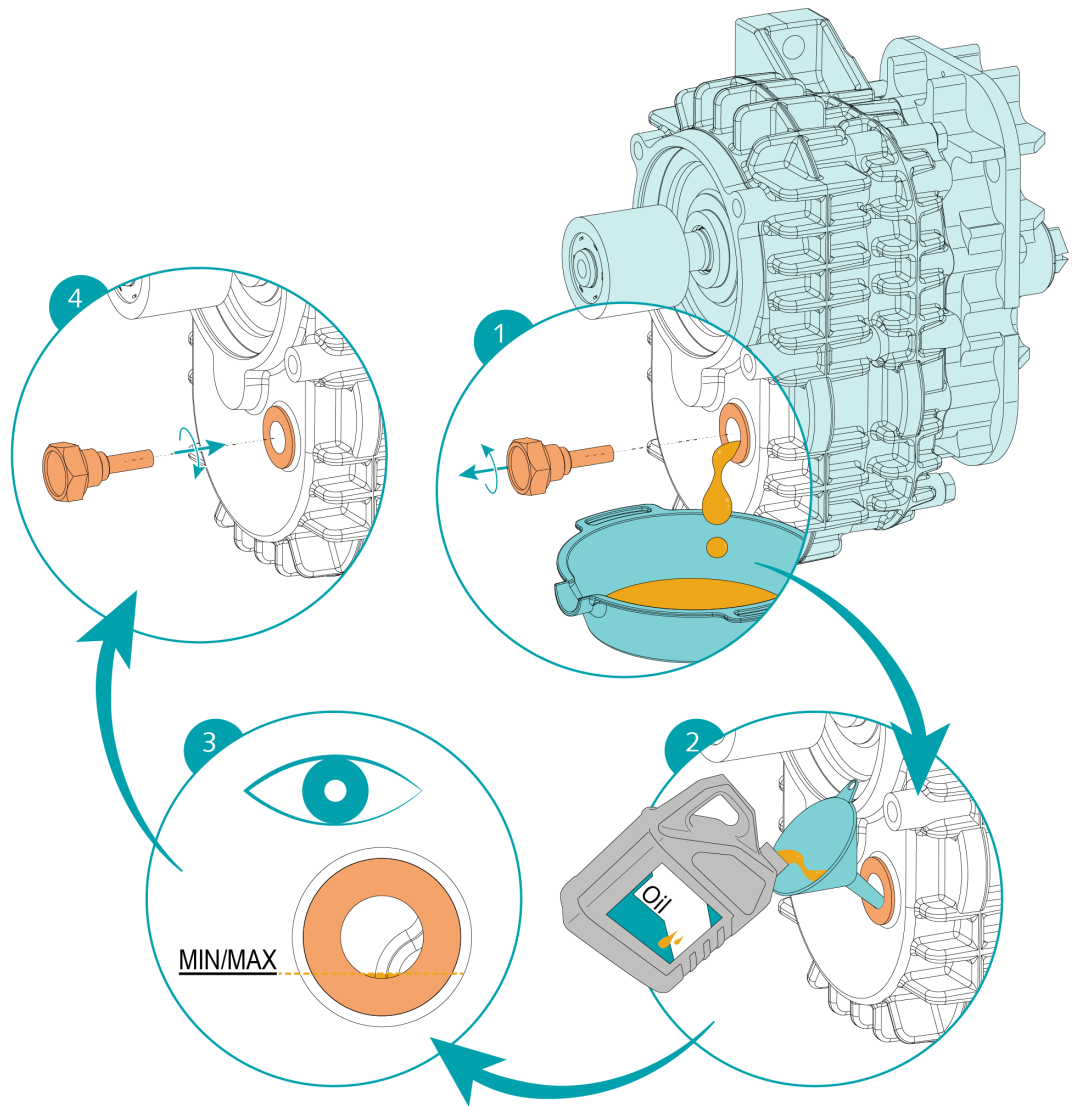


NOTE

Oil draining.

Recommendation.

- There is no ideal angle to put the gear for oil draining. We would recommend to move the gear-box several times from standard "vertical position" to a 90° position. The remaining oil must be the lowest possible.



As shown in the illustration above:

- 1. Remove the oil filling plug and drain the oil.
- 2-3. With the machine in vertical position, refill with the new oil until the oil level is close to the lower edge of the oil draining/filling hole. The amount of oil required to refill is approximately 90 ml (see *Service Kit and Oil Type* [→ 26] for the oil type to be used to refill).
- 4. Replace the old oil filling plug by the new one from the Service Kit (see *Service Kit and Oil Type* [→ 26] for the service kit part number to be ordered) and tighten it with a **7 Nm screwing torque**.

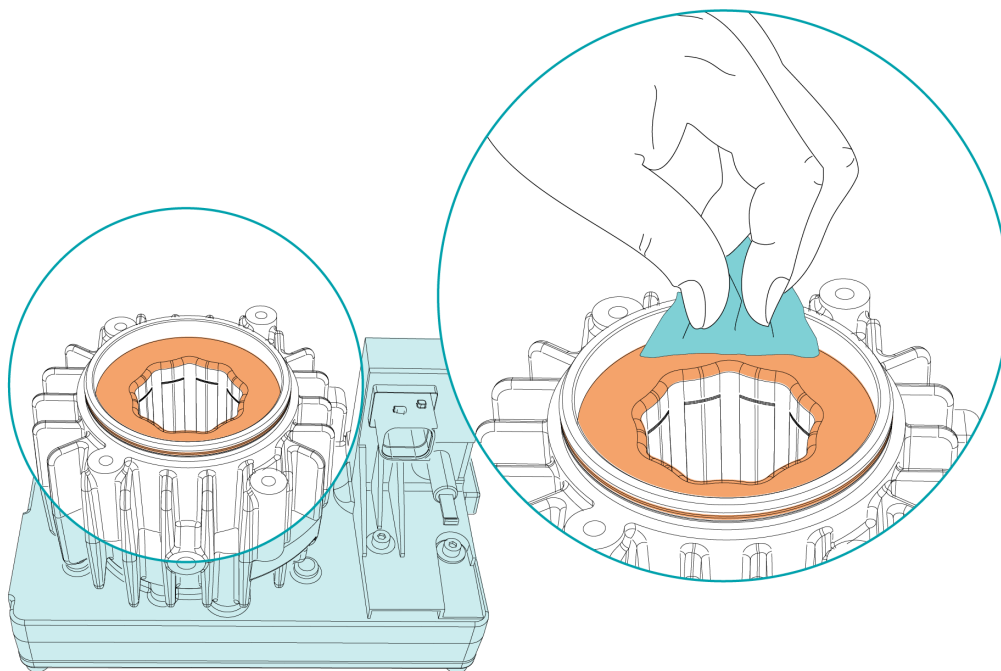
- Check the surface cleanliness for oil traces.

NOTICE

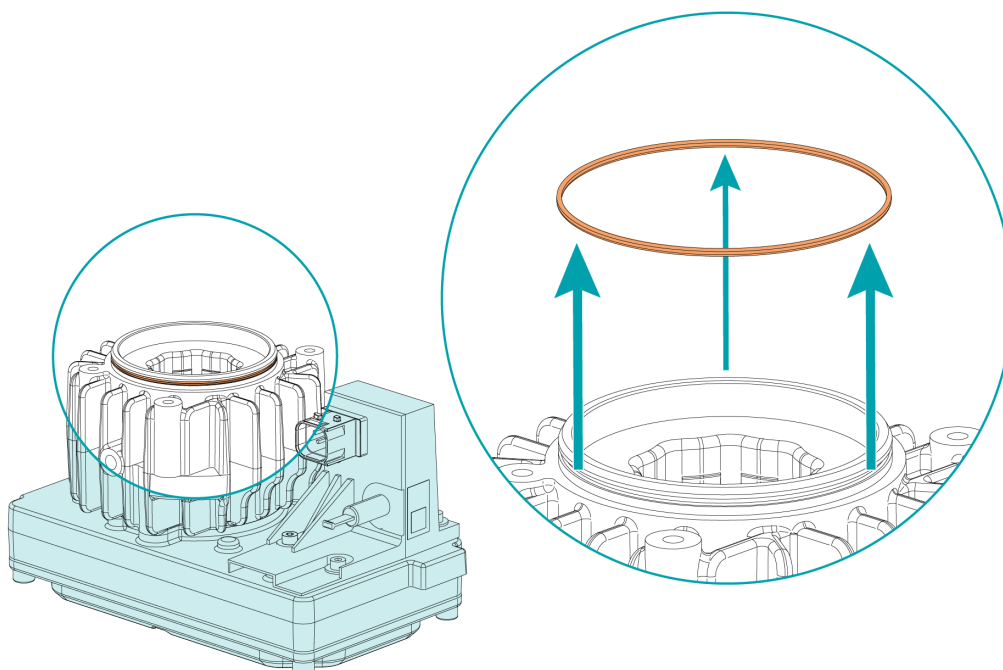
Cleaning the surface.

Risk of damage to the machine!

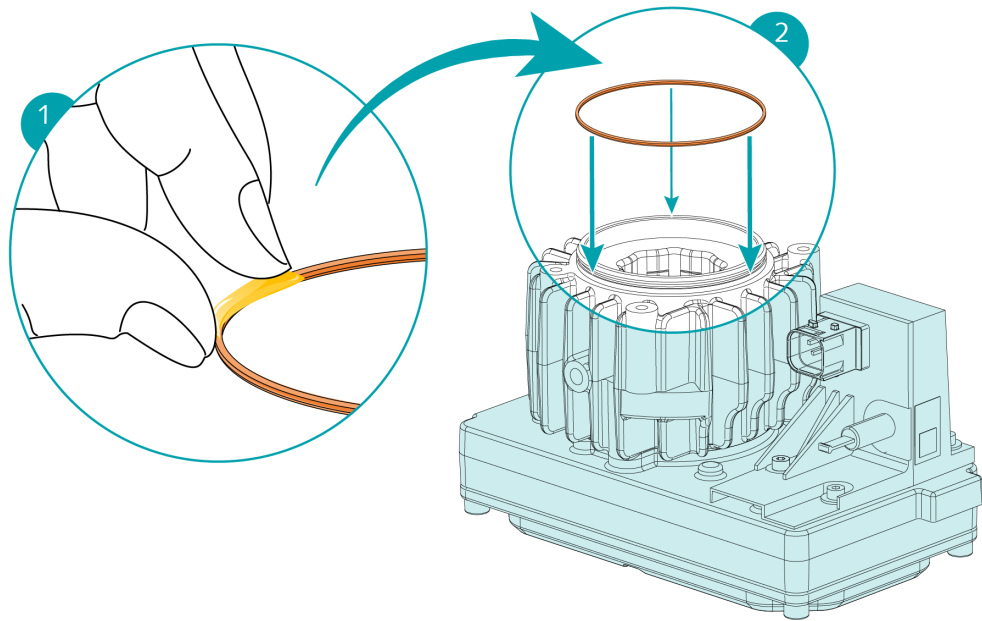
- Do not use any solvent or liquid. Use only clean and dry paper or tissue!



- Remove the existing O-Ring carefully to avoid damaging the groove.



- Make sure there is no burr on machined surfaces (chamfer, groove, flange surface, etc.).
- Replace the old motor nose O-ring by the new one delivered in the kit.
Put grease on it then place it correctly in its groove.



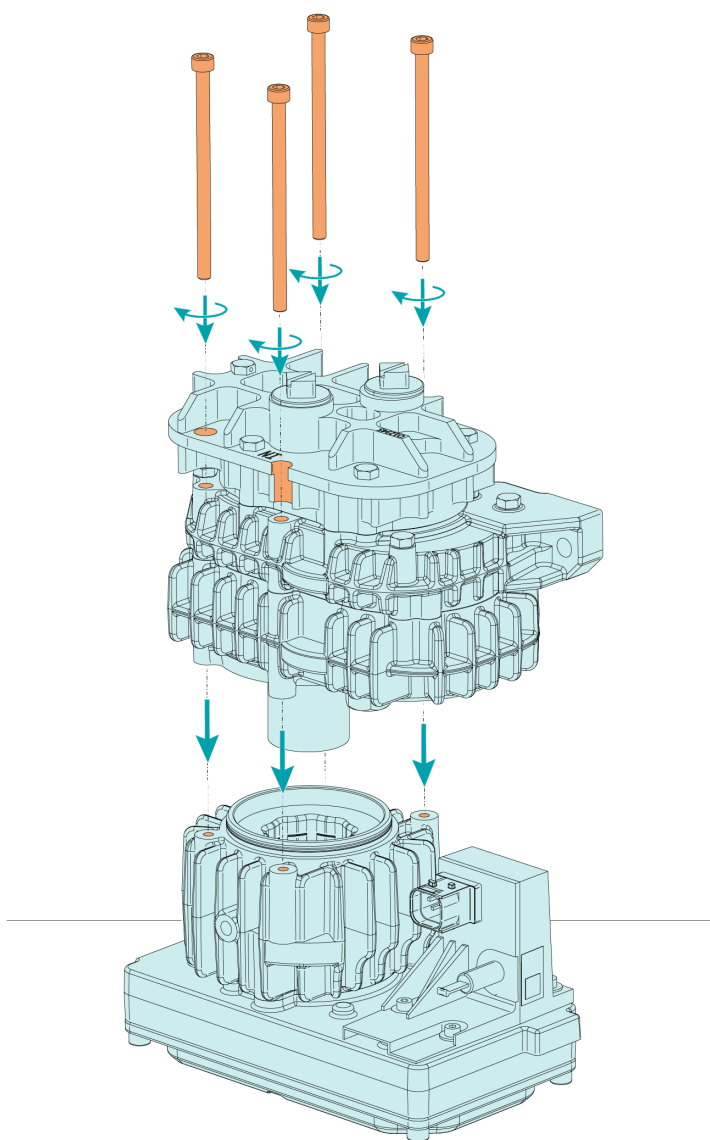
Inserting the stage into the motor

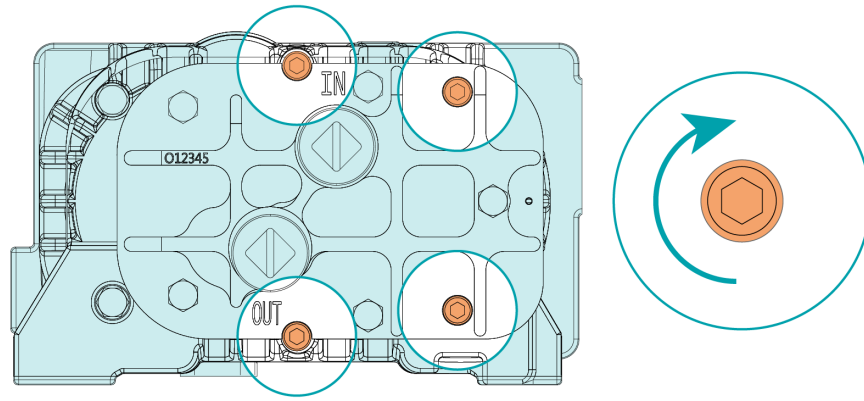
NOTICE

Inserting the stage into the motor.

Risk of damage to the machine!

- Take care and make sure not to shock or bump the stage while inserting it into the motor!
- Insert gently the stage into the motor. Then insert and tighten the four M6 screws with a **5 Nm (+/-10%) screwing torque**.





8.2.3 Service Kit and Oil Type

Service Kit

- Part number: 0990221163
- Content: Oil filling plug + Motor nose O-ring

Oil Type

- Fuchs Renolin Unisyn OL32

Oil has to be purchased locally by sales companies because of oil packaging.

8.3 Machine Stage Replacement



WARNING



Machine Stage Replacement.

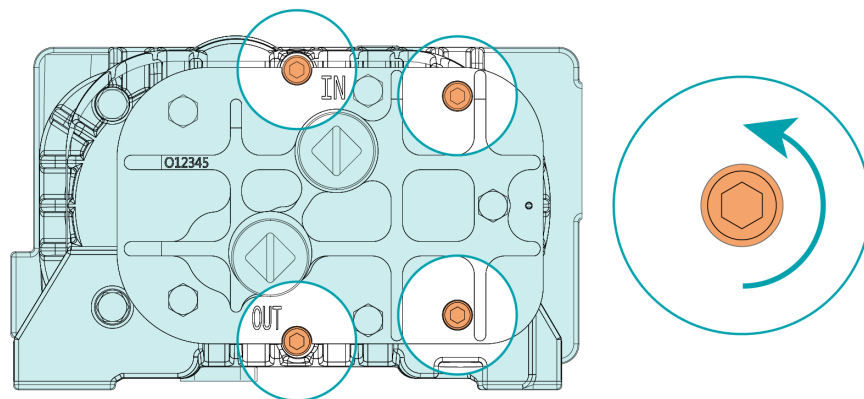
Risk of severe injury!

Risk of damage to the machine!

- The replacement of the machine stage must only be executed by technically trained and qualified Busch personnel

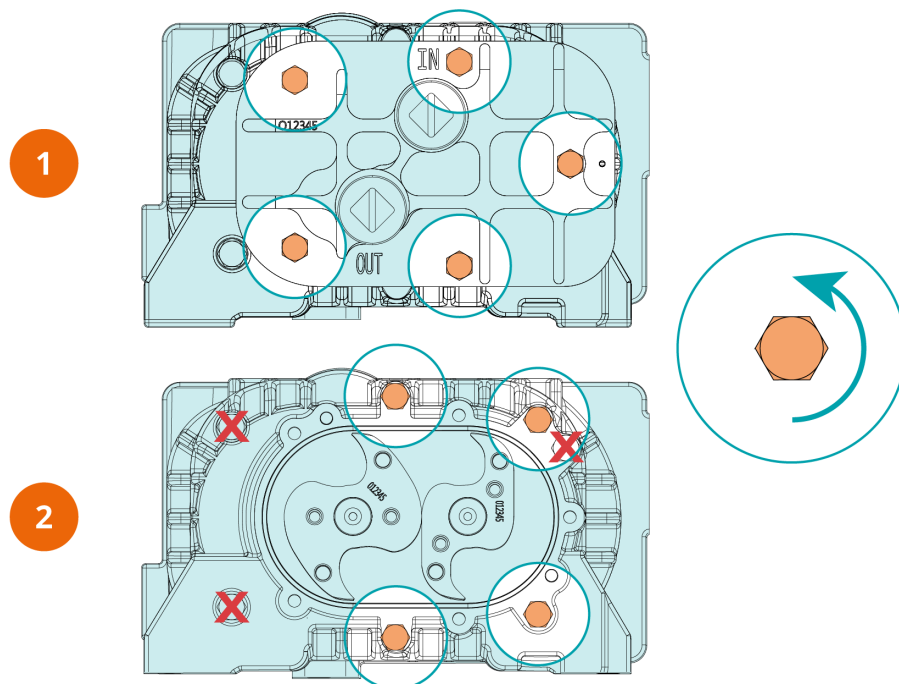
8.3.1 Stage Disassembly

- If the cylinder has four holes for direct access to the motor screws, unscrew them using an M5 hexagonal tool and proceed directly to the **“Removing the motor”** step below.



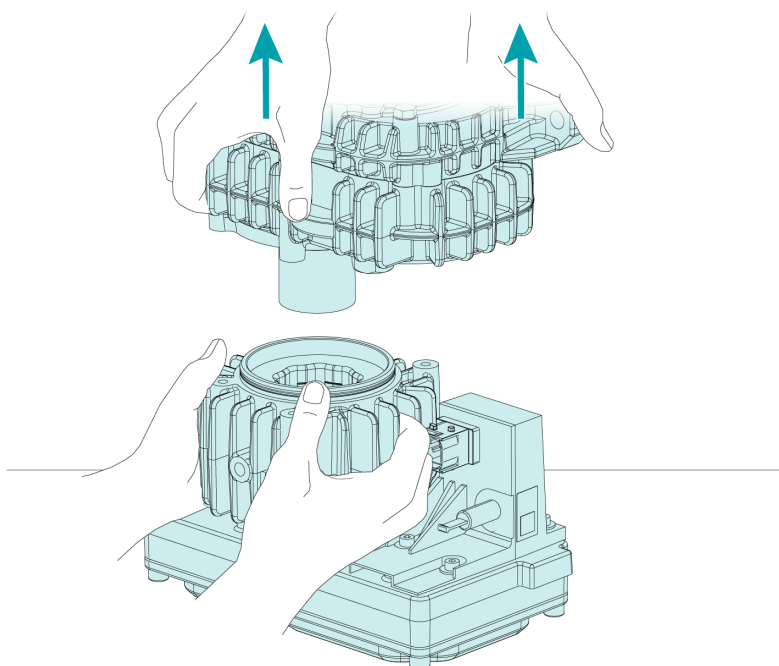
- If not, follow the instructions described as follows:

- If there is any, remove the plumbing (cut the wire) or the blue seal.
- Picture 1: remove the five M6 screws holding the cylinder and remove the cylinder.
- Picture 2: remove the four M6 screws holding the motor. **Do not unscrew the 3 other screws!**



Removing the motor

- Hold the motor while pulling up the stage (because of the resistance coming from the rotor's magnetic force).



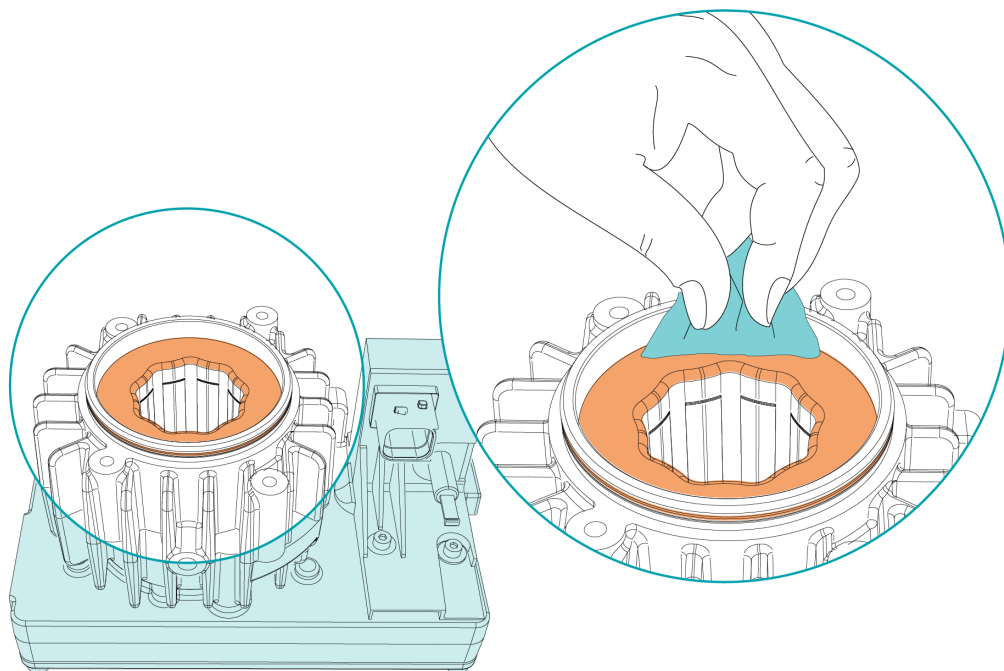
- Check the surface cleanliness for oil traces.

! NOTICE

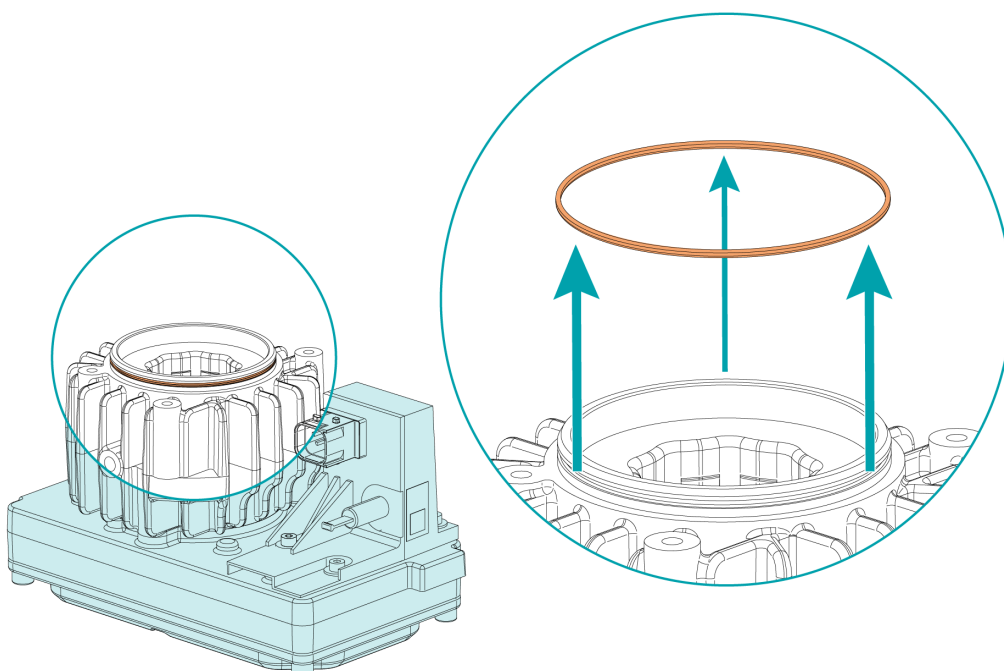
Cleaning the surface.

Risk of damage to the machine!

- Do not use any solvent or liquid. Use only clean and dry paper or tissue!

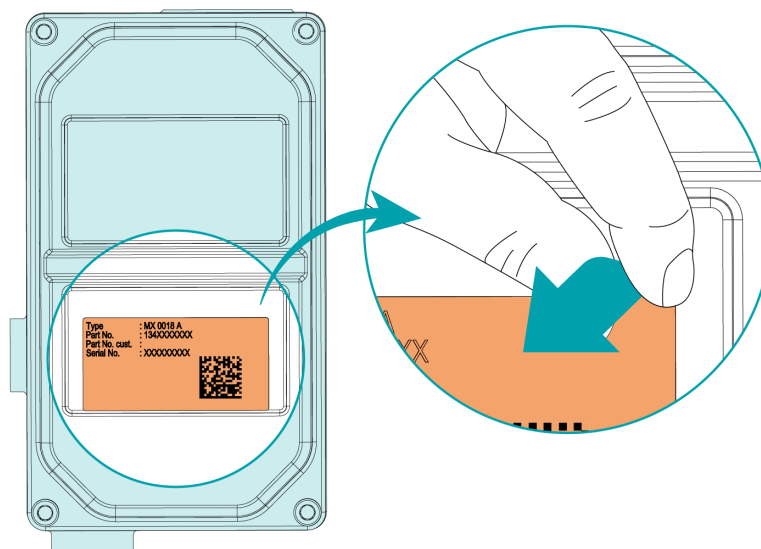


- Remove the existing O-Ring carefully to avoid damaging the groove.



- Make sure there is no burr on machined surfaces (chamfer, groove, flange surface, etc.).

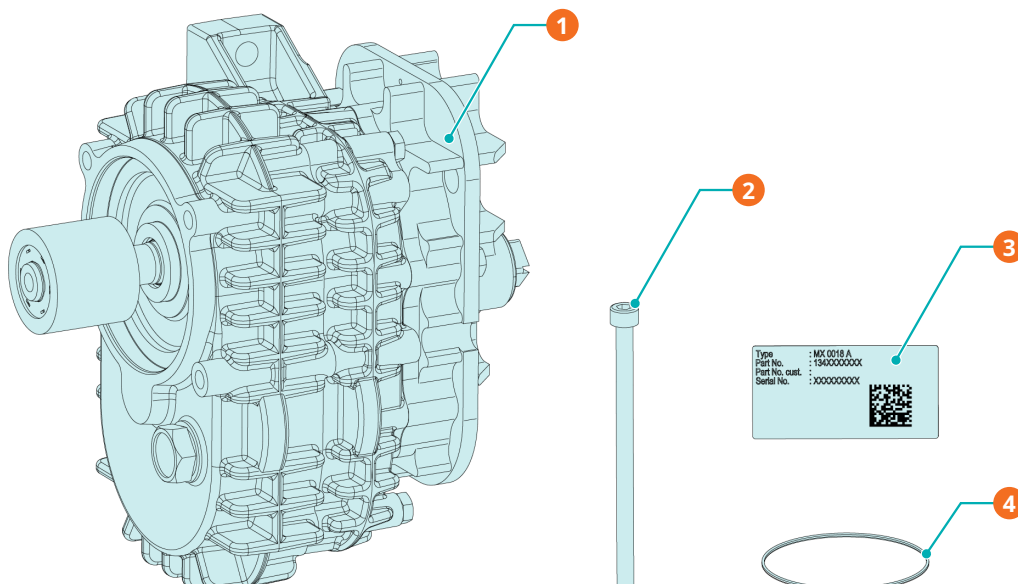
- Peel the label off (located on the backside of the motor). Do not use temperature higher than 100°C to help removing the label.
- Clean up the surface.



- To keep the traceability, report the former serial number in a dedicated file (such as an .xls file for instance) together with the dismantling date. Report as well the new serial number shown on the new identification label, see *Stage Replacement Package* [→ 29]

8.3.2 Stage Replacement Package

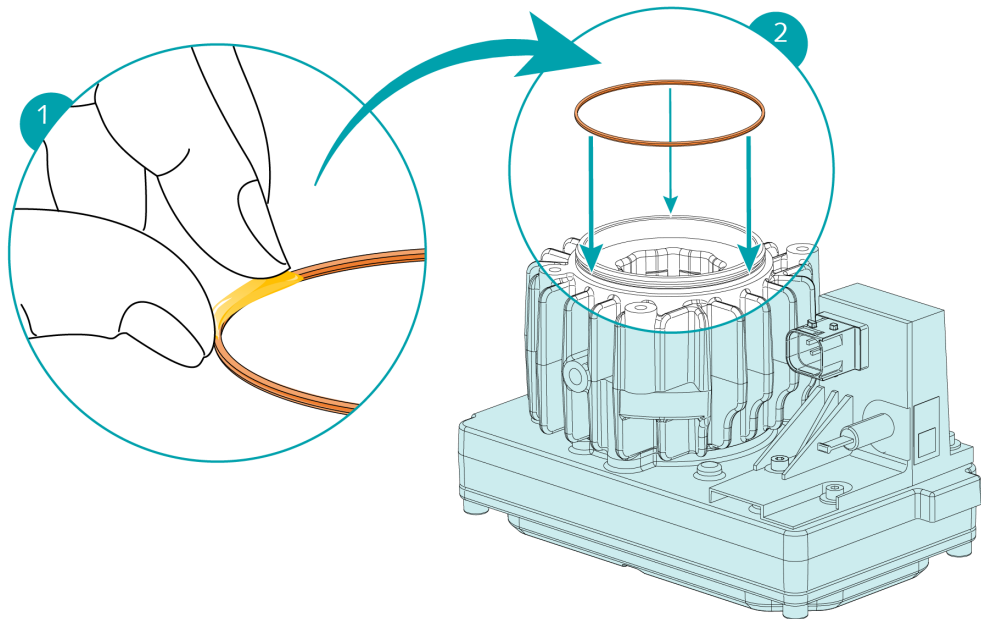
The new stage is delivered with a kit in a plastic bag including a label with Serial Number. **This label must follow the stage to maintain the traceability.**



Description			
1	New stage	2	M6 x 100 mm screws (x4)
3	New identification label with new serial number (x1)	4	Spare O-ring for motor nose (x1)

8.3.3 Stage Reassembly

- Place and stabilize the motor to be refurbished on an adapted positioning device.
- Replace the old motor nose O-ring by the new one delivered in the kit.
Put grease on it then place it correctly in its groove.



Inserting the stage into the motor



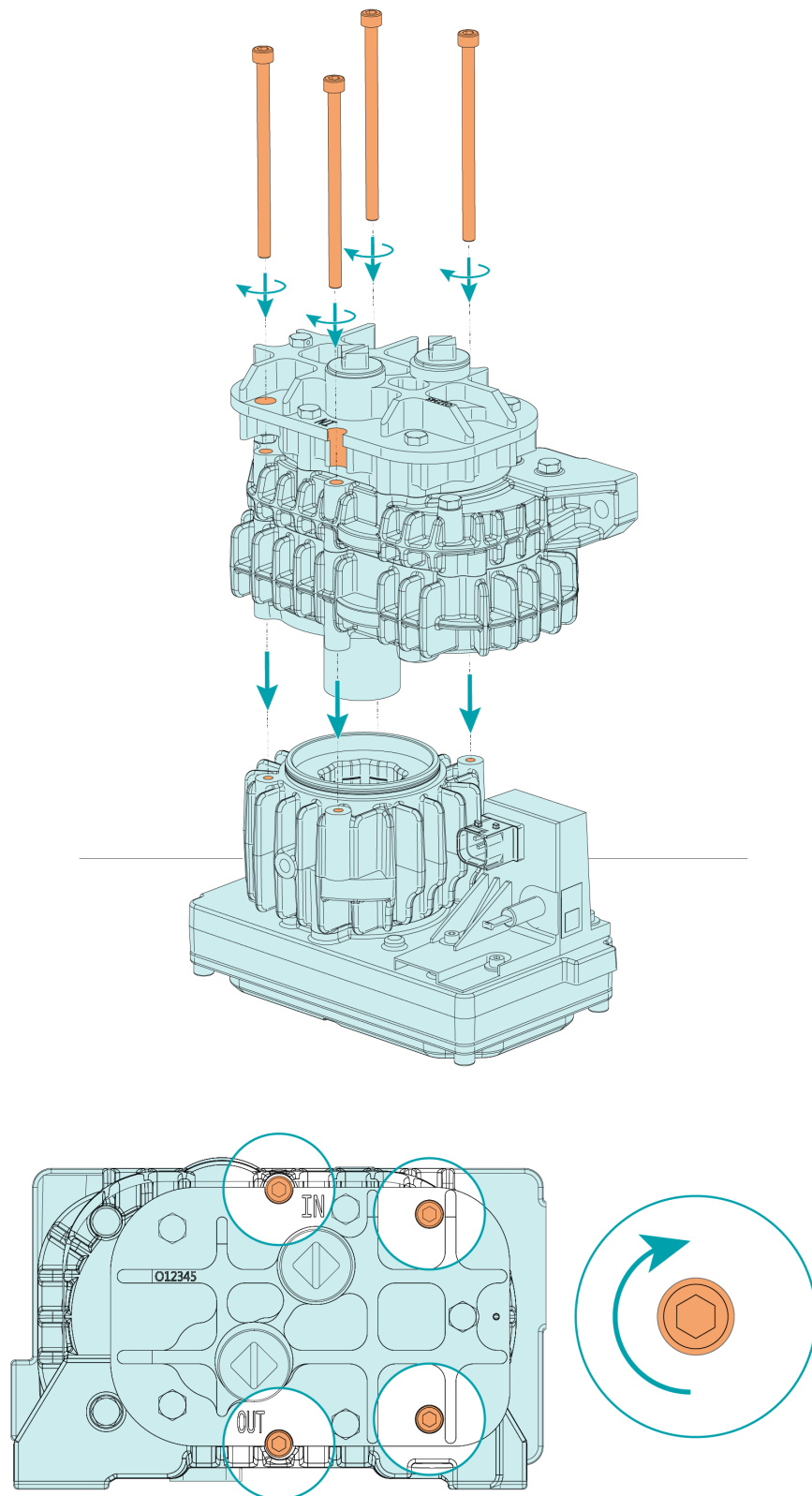
NOTICE

Inserting the stage into the motor.

Risk of damage to the machine!

- Take care and make sure not to shock or bump the stage while inserting it into the motor!

- Insert gently the stage into the motor. Then insert and tighten the four M6 screws with a **5 Nm (+/-10%) screwing torque**.



8.3.4 Stage Testing

Motor start test:

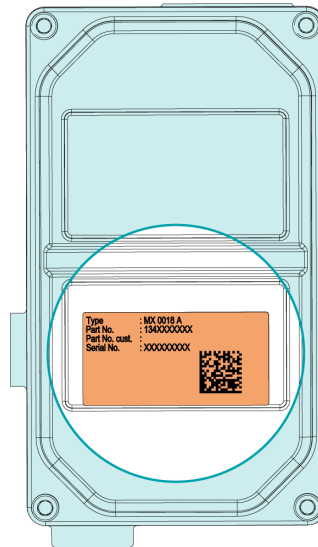
100% of stages are tested at the manufacturing company and performances are stored for traceability. This test intends to guarantee that the complete blower starts properly.

- Use a stabilized 500 Watts power supply.
- Plug the ground (black wire) on the motor housing. Plug the power (red wire) to the screw.
- Set the voltage to 24V and the current to maximum (the compressor will consume what it needs).
- Shut down the power after 10 seconds.

8.3.5 Machine Identification

Relabelling the pump with the new label contained in the kit package:

- Make sure that the serial number engraved on the gearbox cover of the machine is the same than the one on the new label (make sure the traceability was not lost).
- If the serial number is the same both on label and gearbox cover, stick the label on the motor side. If not, check pairing.



9

Overhaul

**WARNING**

Machines contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

**NOTICE**

Improper assembly.

Risk of premature failure!

Loss of efficiency!

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

In case of the machine having conveyed gas that was contaminated with foreign materials which are dangerous to health:

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

Busch will only accept machines that come with a completely filled in and legally binding signed 'Declaration of Contamination' (form downloadable from www.buschvacuum.com).

10 Decommissioning



DANGER

Live wires.

Risk of electrical shock.

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



CAUTION

Hot surface.

Risk of burns!

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

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

If the machine is going to be stored:

- See Storage.

10.1 Dismantling and Disposal

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

11 Spare Parts



NOTICE

Use of non-Busch genuine spare parts.

Risk of premature failure!

Loss of efficiency!

- The exclusive use of Busch genuine spare parts and consumables is recommended for the correct functioning of the machine and to validate the warranty.

Standard spare parts kits are available for this product.

- For oil draining, see *Service Kit and Oil Type* [→ 26].
- For stage replacement, see *Stage Replacement Package* [→ 29].
- Please contact your Busch representative for further information.

12 CAN Protocol

12.1 Standard CAN Interface 250 kBit/s

Transmit Control Unit	No. Control Unit	Message Name	Signal Name	Identifier	DLC	Repetition Rate	Start Byte	Start Bit	Bit Length	Signal Resolution	Signed/Unsigned Value	Offset	Signal Unit	Comments	Default Value
EnCU		Control Message		Hex	Byte	msec	Dez	Dez	Dez	Dez		Dez			
			Mass Flow Setpoint	0x0C FF A6 3D	8	50	0	0	16	0.001	Unsigned	0	kg/h	0 - 64.255 kg/h	
			Speed Setpoint				2	0	16	1.000	Unsigned	0	U/min	0 - 64255 U/min	
			Enable Pump				4	0	2		Unsigned	0		00 - Disable Pump 01 - Enable Pump 11 - Not Available	
			Enable Mass Flow Governor				4	2	2		Unsigned	0		00 - Disable Mass Flow Governor 01 - Enable Mass Flow Governor 11 - Not Available	
PCU		Actual Values		0x0C FF A7 B4	8	50	0	0	16	0.002	Unsigned	-60	kg/h	-60-68.51 kg/h	
			Actual Mass Flow				2	0	8	40.000	Unsigned	0	U/min	0 - 10200 U/min	
			Actual Speed				3	0	8	0.500	Unsigned	0	A	0 - 125 A	
			Actual Current				4	0	8	0.200	Unsigned	0	V	0 - 50 V	
			Actual Voltage				5	0	8	1.000	Unsigned	-40	°C	40 - 210 °C	
			Actual Electronic Temperature				6	0	8	1.000	Unsigned	-40	°C	40 - 210 °C	
			Actual Air Temperature				7	0	8		Unsigned	0		see below	
EnCU		Parameter Values	Status and Diagnose Word (see below)	0x0C FF A8 3D	8		0	0	8	10.00	Unsigned	0	ms	0 - 2500 ms	100 ms
			Bm_iP1MassFlow_C				1	0	8	0.05	Unsigned	0	1/g	0 - 12.7	1.25 1/g
			Bm_KpAirGvnr_C				2	0	8	0.05	Unsigned	0	1/g	0 - 12.7	2.6 1/g
			Bm_KdAirGvnr_C				3	0	8	20.00	Unsigned	0	U/min	0 - 5000 U/min	3120 U/min
PCU		Acknowledgment (according to SAE-J1939-21)	Acknowledge	0x18 FF AB B4	8		0	0	1		Unsigned	0		0 for Positive Acknowledge 1 for Negative Acknowledge	
			Parameter Group Number of the Message, which needs an Acknowledge				5	0	24		Unsigned	0		In this Case 'FF A8'	

Bit-Timing	Status and Diagnose Word	Bit
Baudrate	Status and Diagnose Word	bit0
Time Quanta TQ:	Pump enabled	bit1
Bit time	Mass Flow Governor enabled	bit2
Sync. jump width	MAF error detected, pump switched to rpm control	bit3
Sample Point	Power On bit is set for 1 second after power on/reset	bit4
Number of samples	Wrong Voltage	bit5
	Voltage not in operating range, pump shut down	bit6
	Plausibility error	bit7
	Speed derating	
	Over current	

12.2 CAN Interface 500 kBit/s

- Baudrate 500 kb/s
- Bit length 11 bit
- Behavior at CAN loss: "0" RPM
- Enable signal for electronics activation "Yes"
- Motor behavior when flow request "0" → "Motor waits for signal"
- CAN ID
 - Control message: 0x101
 - Parameter values: 0x103
 - Actual values: 0x102
 - Acknowledgement: 0x104

12.3 CAN Interface 250 kBit/s, DOT Yellow

- Baudrate 250 kb/s
- Bit length 29 bit
- Behavior at CAN loss: "0" RPM
- Enable signal for electronics activation "No"
- Motor behavior when flow request "0" → "Motor waits for signal"
- CAN ID
 - Control message: 0x0C FF A6 3D
 - Parameter values: 0x0C FF A8 3D
 - Actual values: 0x0C FF A7 B4
 - Acknowledgement: 0x18 FF AB B4

12.4 CAN Interface 250 kBit/s, DOT Red

- Baudrate 250 kb/s
- Bit length 29 bit
- Behavior at CAN loss: "0" RPM
- Enable signal for electronics activation "No"
- Motor behavior when flow request "0" → "Motor waits for signal"
- CAN ID
 - Control message: 0x0C FF A6 3F
 - Parameter values: 0x0C FF A8 3F
 - Actual values: 0x0C FF A7 B6
 - Acknowledgement: 0x18 FF AB B6

12.5 CAN Interface 250 kBit/s, DOT Purple

- Baudrate 250 kb/s
- Bit length 29 bit
- Behavior at CAN loss: "0" RPM
- Enable signal for electronics activation "No"
- Motor behavior when flow request "0" → "Motor waits for signal"
- CAN ID

- Control message: 0x0C FF A6 4D
- Parameter values: 0x0C FF A8 4D
- Actual values: 0x0C FF A7 C4
- Acknowledgement: 0x18 FF AB C4

13 Technical Data

MA 0018 A		
Nominal max. pumping speed	m ³ /h	18
Overpressure	bar(g)	0.4 max.
Nominal motor rating	kW	0.5
Nominal motor voltage	V DC	24 (20-32)
Permitted motor speed range	min ⁻¹	480 ... 6000 (peak 6600)
Noise level (EN ISO 2151) at 3000 / 6000 min ⁻¹	dB(A)	68 / 73 (inlet and outlet connected to a system)
Ambient temperature range	°C	-40 ... +100
Ambient pressure		Atmospheric pressure
Oil capacity	mL	100 0/+5
Oil leak rate	mL/1000hours	5
Dimensions	mm	249.5 x 120 x 199
Weight approx.	kg	6.5

High frequency transient phases (with up and down pressure levels) need to be discussed and validated between customers and Busch on applications themselves.

14 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: MINK MA 0018 A

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

- 'Machinery' 2006/42/EC
- 'Electromagnetic Compatibility' (EMS) 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 designated standards that have been used to fulfill those provisions:

Standards	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN 1012-1 : 2010 EN 1012-3 : 2013	Compressors - Safety requirements - Part 1 and Part 3
EN ISO 2151 : 2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN IEC 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments

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

Busch Dienste GmbH
Schauinslandstr. 1
DE-79689 Maulburg

Chevenez, 25.01.2022



Christian Hoffmann, General Director

15 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: MINK MA 0018 A

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

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

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

Standards	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
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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, 25.01.2022



Christian Hoffmann, General Director

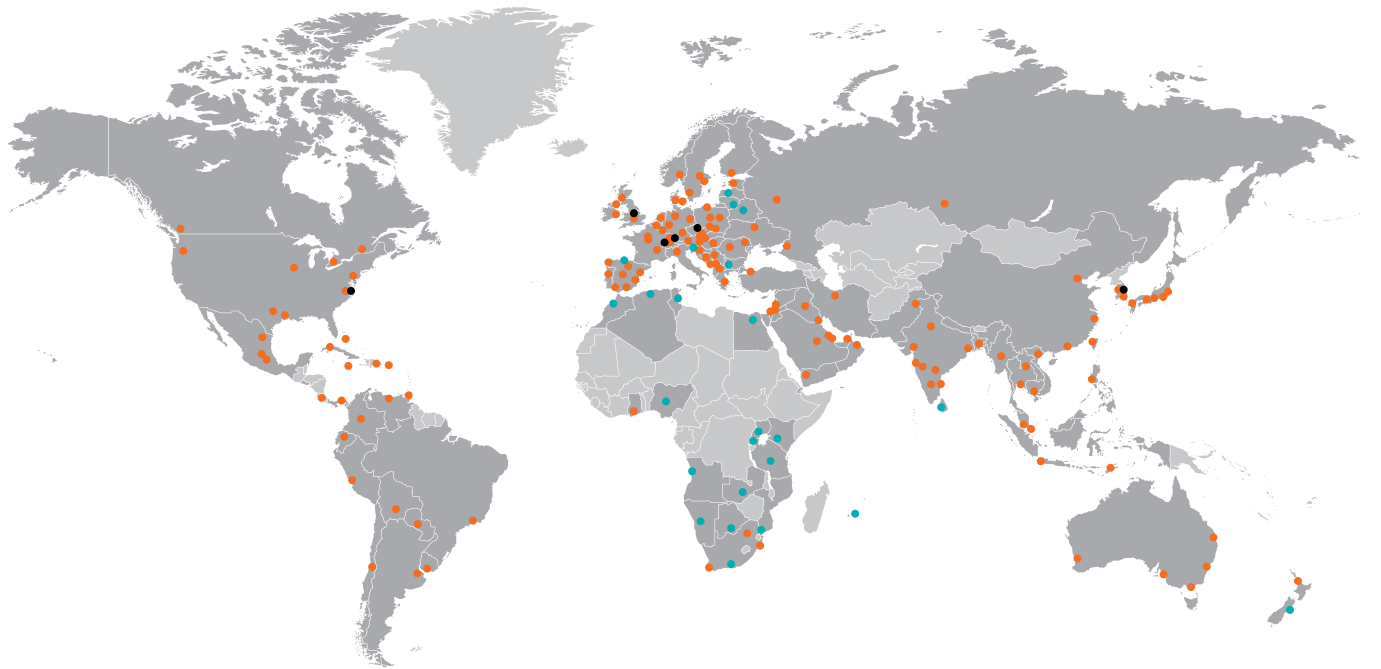
Notes

A large grid of dots for taking notes, consisting of 20 columns and 30 rows of small, light gray dots.



Busch Vacuum Solutions

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



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

www.buschvacuum.com