VACUUM SOLUTIONS

Part of the BUSCH GROUP

MINK

Claw Vacuum Pumps
MV 0360 A ECOTORQUE

Instruction Manual

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

CE UK CA

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Table of Contents

1 Safety

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

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

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

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

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

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

DANGER

Strong Magnetic Field: Hazard to individuals with active medical implants (e.g., pacemakers and insulin pumps), regardless of whether the machine is powered on or off.

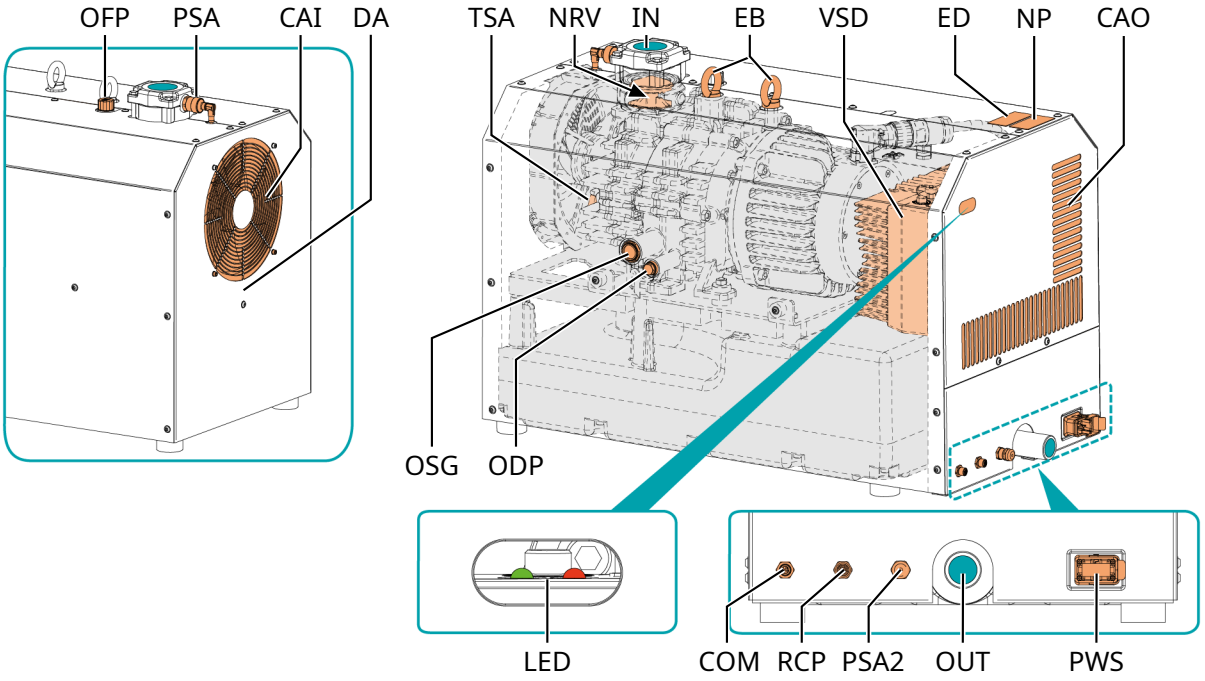
Risk of death for persons with pacemakers!

Risk of severe injuries!

Risk of damage to magnetically sensitive items / products!

- Make sure that personnel with pacemakers do not perform any work on the machine.
- Make sure that pregnant personnel do not perform any work on the machine.
- Secure the working area; if necessary, isolate the area:
  - Make sure that prohibited personnel keep a safe distance of at least 1m from the motor.
  - Make sure that no magnetizable parts can be attracted by the motor.
  - Make sure that the motor cannot be attracted by magnetizable metal parts.

2 Product Description



Description			
IN	Inlet connection	OUT	Exhaust connection
OFP	Oil fill plug / venting valve	ODP	Oil drain plug
CAI	Cooling air inlet (active cooling fan)	CAO	Cooling air outlet
OSG	Oil sight glass	NRV	Non-return valve (integrated)
EB	Eye bolt	DA	Directional arrow
VSD	Variable speed drive (below the cover)	LED	Function indicator
PWS	Power supply (Harting-Connector)	TSA	Temperature switch (pumping stage surface; below the cover)
PSA	Pressure transmitter (inlet)	PSA2	Pressure transmitter (optional customer process pressure regulation; not shown)
COM	Communication port (M12) 'A-coded'	RCP	Remote control I/O port (M12)
NP	Nameplate	ED	Electrical data

NOTE

Technical term.

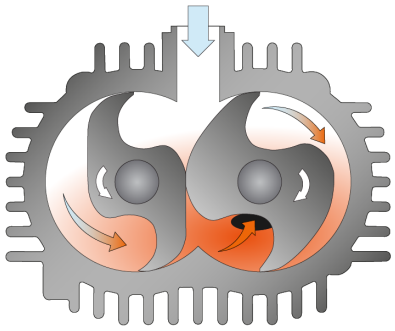
In this instruction manual, we consider that the term ‘machine’ refers to the ‘vacuum pump’.

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 claw principle.

The MINK is fully air-cooled thanks to an electrical fan.

In order to avoid solids from entering, the machine is equipped with an inlet screen (IS).

Inlet screen (IS):

- See *Cleaning from Dust and Dirt* [➔ 23]
- See *Troubleshooting* [➔ 28]

In order to avoid reverse rotation after switching off, the machine is equipped with a non-return valve (NRV).

2.2 Intended Use

WARNING

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

Risk of injuries!

Risk of damage to the machine!

Risk of damage to the environment!

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

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

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

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

The machine is designed for indoor installations. For outdoor installations, consult your Busch representative for special precautions.

The machine is capable of maintaining ultimate pressure, see *Technical Data* [➔ 34].

The machine is suitable for continuous operation.

Note: The non-return valve (NRV) shouldn't be used as a non-return or shut off valve for the System. The non-return valve is only to protect the machine.

If the machine needs to be maintained after shutdown:

- Provide an additional manual or automatic operated non-return valve in the suction line.

Permitted environmental conditions, see *Technical Data* [➔ 34].

2.3 Design Options

The design options described in the following chapters might be combined.

Please refer to the nameplate (NP) to identify the corresponding design option of your machine.

Design option	Codification	Example
Standard (no design option)	0	MV 0360 A 0**0**
Aqua version	A	MV 0360 A 0**A**

2.4 Standard Features

2.4.1 Temperature Sensor / Temperature Switch

Temperature switch (TSA) is used to detect high surface temperatures at the pumping stage and protects the machine in case of an electrical or mechanical failure of the cooling fan.

2.4.2 Pressure Monitoring

The pressure transmitter (PSA) is used to detect high inlet pressure and protects the machine by reducing the pumping speed if the inlet pressure drops below the permissible ultimate pressure.

The pressure transmitter (PSA) continuously monitors and controls the pumping speed to ensure that the target pressure is maintained.

2.4.3 ECOTORQUE Variable Speed Drive

The machine is equipped with an ECOTORQUE Variable Speed Drive (VSD). The ECOTORQUE Variable Speed Drive (VSD) regulates the pumping speed of the machine and saves energy. For more information contact your Busch representative.

NOTICE

ECOTORQUE Variable Speed Drive (VSD) can only be controlled using Busch Vacuum Manager software, available at *www.buschvacuum.com* (free of charge).

Any changes to parameters outside of those done by Busch or certified representatives, particularly if made using methods other than the Busch Vacuum Manager software, which result in damage or malfunction of the ECOTORQUE Variable Speed Drive (VSD) or the machine, are not covered under the product warranty or liability.

The following parameters of ECOTORQUE VSD can be controlled:

1. Speed- / Pressure control
2. Auto / Manual START/STOP
3. Preset speed
4. Inlet pressure target setpoint
5. ECO-Mode

2.5 Optional Accessories

2.5.1 Communication Cable

In order to select between speed- or pressure control, using the **Busch Vacuum Manager** software, an M12 - USB communication cable is required for connection to a computer.

– Art. no. 0987 208 730 : M12 - USB Communicable cable

2.5.2 Inlet Filter

The inlet filter protects the machine against dust and other solids in the process gas. The inlet filter is available with a paper or polyester cartridge.

2.5.3 Process Pressure Monitoring

The pressure transmitter (PSA2) is used to monitor customer-side process pressure, including 5 meter cable.

- The optional pressure transmitter (PSA2) continuously monitors the customer-side process pressure and regulates the pumping speed to ensure that the target pressure is maintained.
- If the optional pressure transmitter PSA2 is in operation, the main pressure transmitter PSA functions as a safety sensor to protect the machine.

2.5.4 Remote Control Package

Remote control package (RCP) with an M12 female connector on the machine for customer-sided digital START/STOP-signal.

A 5 m customer cable with M12 male connector is within the delivery scope.

2.5.5 I/O and Communication Port

If the “Remote control package” option is selected:

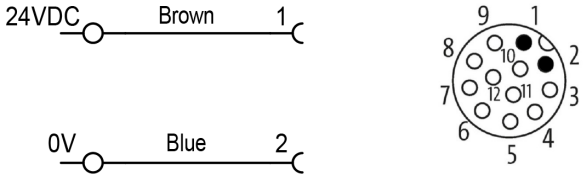
The machine is equipped with a M12 I/O port that can allow remote control and monitoring of the machine

Setup I/O port

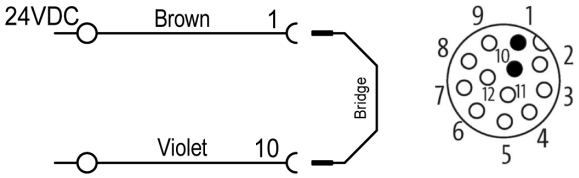
Connector type: M12 12p female A coded (connection cable included in the scope of supply).

Power Supply

- 24V DC power supply - Max 40 mA



Remote Pump START/STOP



It allows the machine to be started/stopped by an external signal.

NOTE

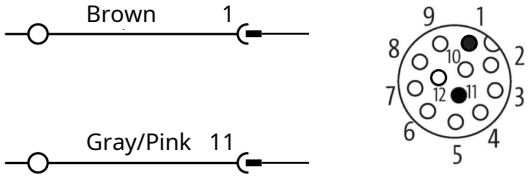
In case of a remote-control start, the machine must be integrated in the user's safety chain (signal warning the user to stop the machine in case of problem or emergency stop).

NOTE

According to the standard factory setting, there is a bridge inside the variable speed drive (VSD).

- Remove the bridge and connect to “Remote pump start” according to the wiring diagram delivered with the machine.

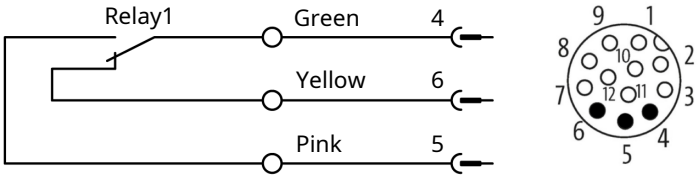
Reset Fault



It allows resetting remotely faults from the ECOTORQUE Variable Speed Drive (VSD) in case of alarm. Using a toggle switch is recommended to reset the ECOTORQUE Variable Speed Drive (VSD). Rising edge on the input will reset the fault..

Alarm Output

- M12 connector max. 30V DC 2 A

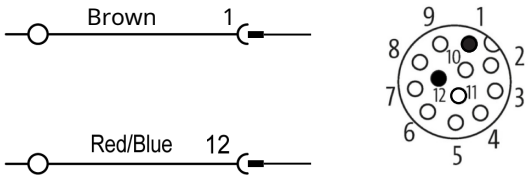


Operation Output

- M12 connector max. 30V DC 2 A

Customer Emergency OFF (EMO)

- A lockable disconnect switch or an emergency stop switch can be provided so the machine is completely secured in case of an emergency situation.



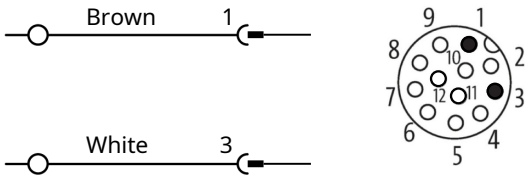
It allows to add an external safety element (dry contact).

Speed- / Pressure Control Selection

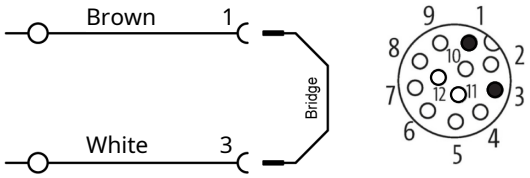
NOTE

The factory setting of the ECOTORQUE Variable Speed Drive (VSD) is Speed Control mode.

Speed Control (default factory setting)



Pressure Control



2.5.6 OTTO IoT Box

The machine can be equipped with the OTTO IoT Box.

It allows the vacuum pump to be connected to the Busch Cloud and collect live measured data during its operation.

For the activation and setup of this optional function, contact your Busch representative.

For any additional information, refer to the specific document “OTTO IoT Box User's Manual, art. no. 0870236702” or contact your Busch representative.

3 Transport and Handling

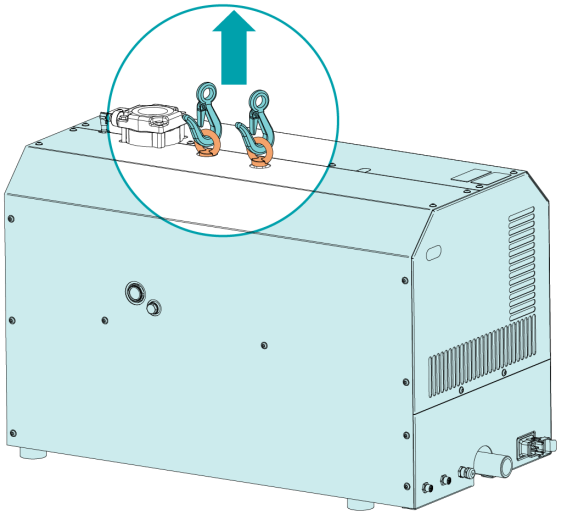
WARNING

Suspended load.

Risk of severe injury!

- Do not walk, stand, or work under suspended loads.

- To find out the weight of the machine, refer to the chapter *Technical Data* [➔ 34] or the name plate (NP).
- Make sure that the eye bolt(s) (EB) is/are in faultless condition, fully screwed in and tightened by hand.



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

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

- Remove the machine from the transport support before installation.

4 Storage

- Seal hermetically all apertures with the caps provided with the machine, or with adhesive tape if the caps are no longer available.
- Store the machine indoors, in a dry place, away from dust and vibrations and if possible, in original packaging, preferably at temperatures between 0 ... 40 °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 0 ... 40 °C.

5 Installation

5.1 Installation Conditions

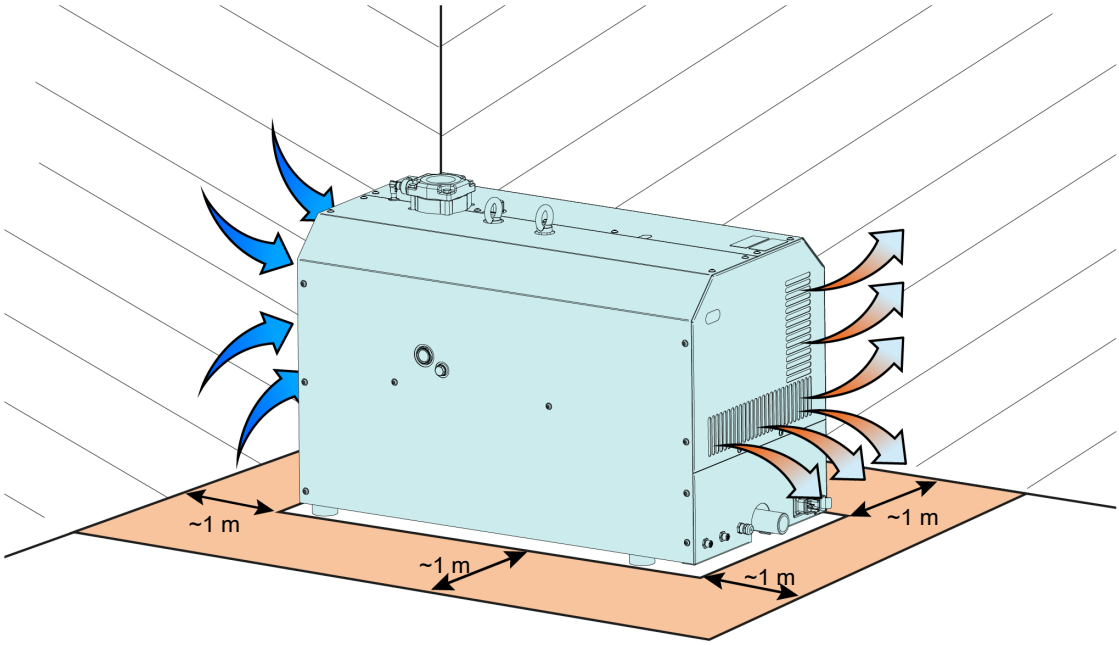
NOTICE

Use of the machine outside of the permitted installation conditions.

Risk of premature failure!

Loss of efficiency!

- Make sure that the installation conditions are fully respected.



- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the *Technical Data* [➔ 34].
- Make sure that the environmental conditions comply with the protection class of the motor and the electrical elements.
- Make sure that the installation space or location is protected from weather and lightning.
- Make sure that the installation space or location is vented such that sufficient cooling of the machine is provided.
- Make sure that cooling air inlets (CAI) and outlets (CAO) 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* [➔ 22].
- Make sure that all provided covers, guards, hoods, etc. are mounted.

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

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

5.2 Connecting Lines / Pipes

WARNING

Rotating Parts.

Risk of severe injury!

- Do not operate the machine without inlet and exhaust connections installed.

- 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 at the inlet and exhaust connections.
- Make sure that the diameter of the connecting lines over the entire length is at least as large as the connections of the machine.
- Make sure that there is no counter pressure (also called “back pressure”) at the exhaust connection (OUT).

In case of long connecting lines:

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

NOTICE

Flow of potential condensate from the piping to the machine.

Risk of damage to the machine!

- Make sure that the machine inlet and exhaust connection pipes are installed in a way to prevent potential condensate to flow from the piping to the machine .
- Busch recommends the use of the optional horizontal inlet filter and the exhaust drip leg to collect the condensate and prevent it from flowing into the machine

5.2.1 Inlet Connection

NOTICE

Ingress of foreign objects or liquids.

Risk of damage to the machine!

If the inlet gas contains dust or other foreign solid particles:

- Install a suitable filter (5 micron or less) at the inlet of the machine.

Connection size(s):

– G2” – without inlet filter (IF)

– G2 ½” - with inlet filter (IF)

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

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

5.2.2 Exhaust Connection

NOTICE

Exhaust gas flow obstructed.

Risk of damage to the machine !

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

Connection size(s):

– R1 ¼"

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

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

5.3 Filling Oil

NOTICE

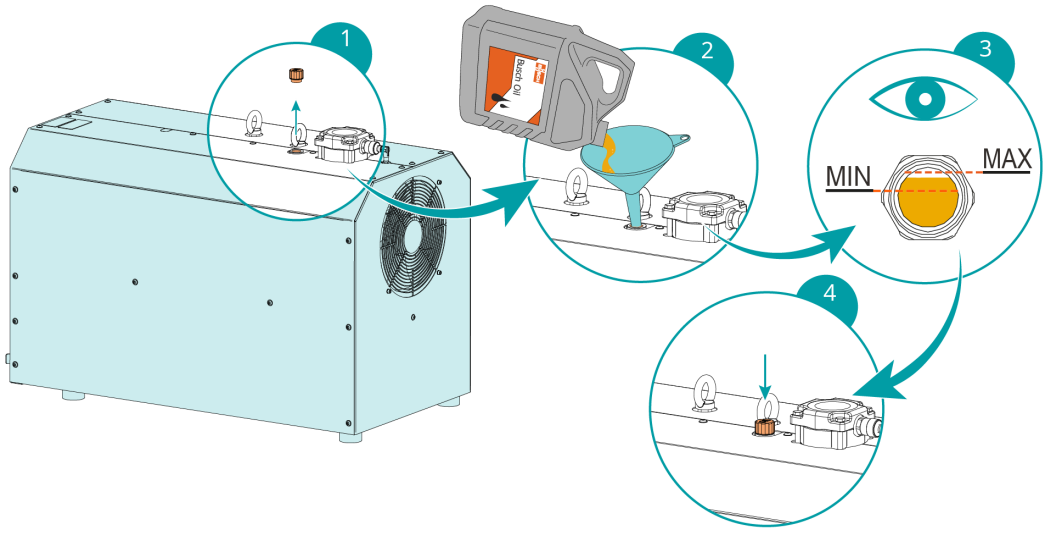
Use of inappropriate oil.

Risk of premature failure!

Loss of efficiency!

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

For oil type and oil capacity see *Technical Data* [➔ 34] and Oil chapters.



The oil level should stay constant over the lifetime of the oil. If the level does fall, this indicates a leak and the machine requires repair.

6 Electrical Connection

NOTICE

Electromagnetic compatibility.

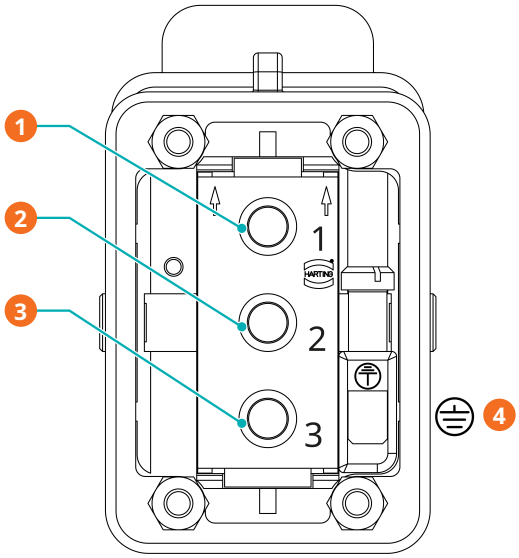
- Make sure that the motor of the machine will not be affected by electric or electromagnetic disturbance from the mains. If necessary:

➔ Provide additional interference suppression in accordance with the requirements of your supply network system.

➔ Contact your Busch representative for more information.

- Wire the mating connector (delivered loose) according to the wiring illustration below:

Mains connection (MC) - 4-pin connector



Description			
1	Phase 1 (L1)	2	Phase 2 (L2)
3	Phase 3 (L3)	4	Earth

- Electrically connect the machine directly to the mains connection (MC).

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.

- With a phase rotation tester, check if the wiring corresponds to the correct direction of rotation.
- Make sure that the machine is drawing air.

If the rotation of the active cooling fan must be changed:

- Switch any two phases of the mains supply (PWS) HARTING- connector.

Mains Connection – Precondition

To guarantee that the controls function properly, the following points must be ensured:

- The mains voltage must correspond to the voltage stated on the nameplate (NP).
- For three-phase power supply, a clockwise rotation field is required.

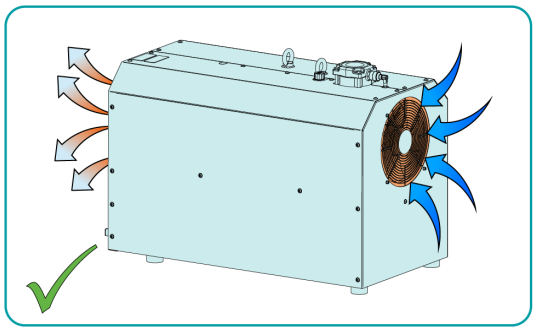
Connection of the Cooling Fan – correct direction

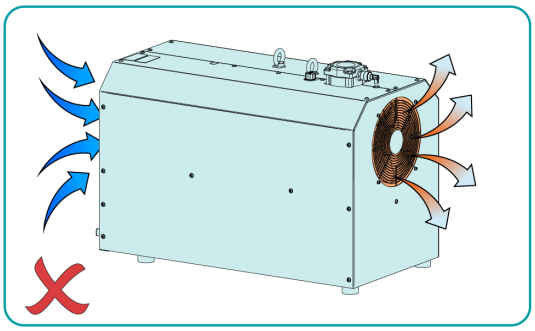
CAUTION

Insufficient cooling due to incorrect rotation of the cooling fan!

Damage to the machine!

- Make sure the cooling fan rotation is correct.





NOTICE

After the machine has been shut down by a digital signal but the mains supply to the machine is still ON, the active cooling fan will run for an extended time of 5 min.

6.1 Machine delivered with an ECOTORQUE VSD

DANGER

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

Risk of electrical shock!

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

- Make sure that the power supply is compatible with the data on the machine's nameplate (NP).
- 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 a lockable disconnect switch or an emergency stop switch on the power line so that the machine is completely secured in case of an emergency situation.
- Provide an overload protection according to EN 60204-1.
- Connect the protective earth conductor.

6.2 Start / Stop Connection

WARNING

Risk of induced voltage / regeneration.

Risk of severe injuries!

Risk of damage to the machine!

The machine uses a permanent magnet synchronous motor and an ECOTORQUE VSD without braking capability. If the machine is driven by reverse airflow or back-pressure (e.g. due to a missing or faulty non-return valve), the motor will act as a generator and may induce dangerous voltages into the ECOTORQUE VSD.

- Always make sure that the non-return valve (NRV) is functioning correctly to prevent reverse rotation of the pump.
- Do not allow the pump to spin freely after shutdown.
- Generated voltages can cause overvoltage faults, damage to the ECOTORQUE VSD, or pose an electrical hazard.
- Always verify zero voltage on ECOTORQUE VSD terminals before maintenance.

NOTICE

Risk of phase loss or voltage imbalance.

Risk of damage to the machine!

If a phase loss or significant voltage imbalance occurs, the ECOTORQUE VSD may experience:

- **Reduced Output Power:** The ECOTORQUE VSD may not be able to deliver the full rated power to the connected machine.
- **Increased Heat Generation:** Operating under unbalanced conditions can lead to higher thermal stress on the ECOTORQUE VSD components.
- **Potential Fault Triggers:** The ECOTORQUE VSD might enter a fault state to protect itself from damage.

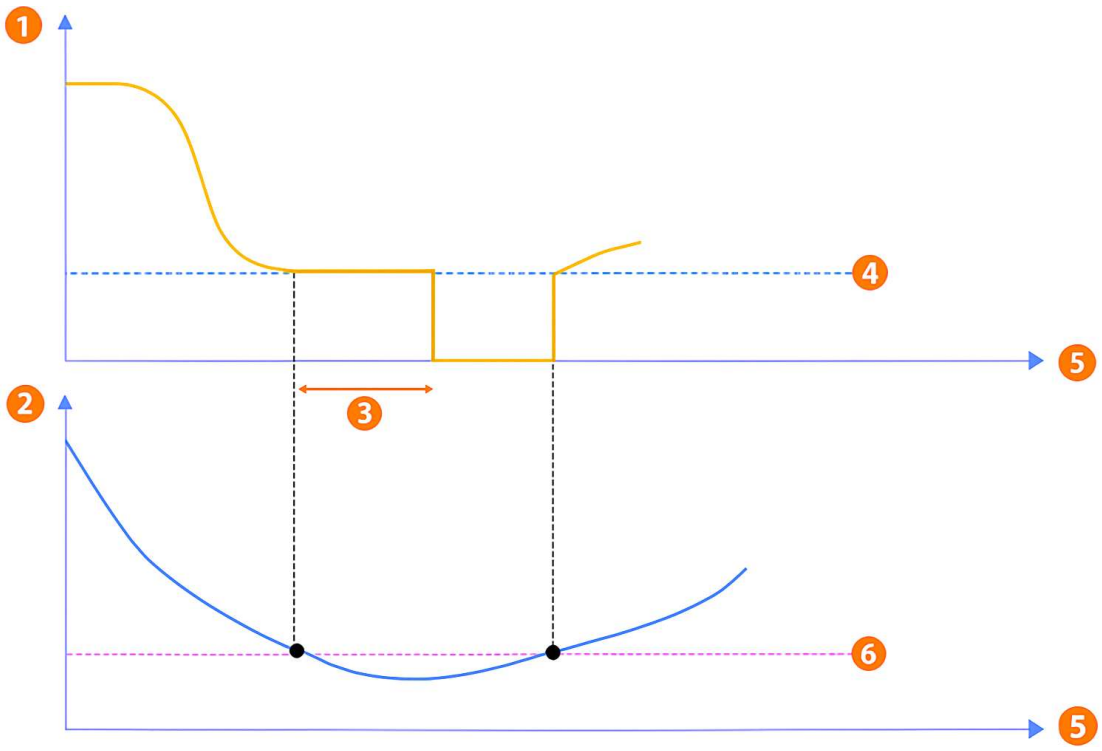
The following applies to machines equipped with an on-board variable speed drive (VSD).

- The ECOTORQUE Variable Speed Drive (VSD) is delivered with preset factory parameters. Please refer to the specific wiring diagram supplied with the machine.
- For the connection of the control cables, install a cable to the female HARTING-Connector (delivered loosely with the machine).
- Contact your local Busch agency or your Busch representative to check if your machine is a custom or a standard one.

6.2.1 ECO-Mode in Pressure Control

This function can provide additional energy savings in pressure control mode, by stopping the machine when the target pressure is reached for a defined time (ECO-Mode stand-by time to be set in **Busch Vacuum Manager** software), instead of running at minimum speed (see *Technical Data* [➔ 34])

Once the pressure value (**2**) is higher than the target value (**6**), the machine will start again.



Description			
1	Frequency	2	Pressure
3	ECO-Mode stand-by time	4	Minimum speed (45 Hz / 900 min^{-1})
5	Time	6	Target pressure

In **Busch Vacuum Manager** software, the ECO-Mode can be activated by clicking on the toggle switch. Toggle turned orange means that the ECO-Mode is activated.

If the drive controller runs for this set time at its minimum speed, the machine is stopped (0 Hz) to save energy.

ECO-Mode stand-by time value	Description
0	ECO-Mode disabled (default)
> 0	Waiting time [sec.] until stand-by function is enabled. (maximum 10000 sec), to be adapted at customer process.

6.3 Electrical Connection of the Monitoring Devices

6.3.1 Wiring Diagram Temperature Switch

NOTE

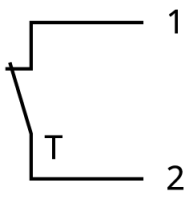
Already connected to the ECOTORQUE Variable Speed Drive.

- No wiring required on ECOTORQUE machines.

Article number: 2000278986

Contact: Normally closed

Switch point: T_{trip} = 180 °C



1 = White ; 2 = Red

6.3.2 Wiring Diagram Inlet Pressure Transmitter

NOTE

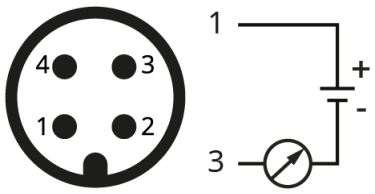
Already connected to the ECOTORQUE Variable Speed Drive.

- No wiring required on ECOTORQUE machines.

Article number: 0653 233 987

Connector: M12x1, 4-pin

Electrical data: 4 ... 20 mA ▶ 0 ... 1 bar (abs.)



1 = Brown; 3 = Blue

7 Maintenance

DANGER

Strong Magnetic Field: Hazard to individuals with active medical implants (e.g., pacemakers and insulin pumps), regardless of whether the machine is powered on or off.

Risk of death for persons with pacemakers!

Risk of severe injuries!

Risk of damage to magnetically sensitive items / products!

- Make sure that personnel with pacemakers do not perform any work on the machine.
- Make sure that pregnant personnel do not perform any work on the machine.
- Secure the working area; if necessary, isolate the area:
  - Make sure that prohibited personnel keep a safe distance of at least 1m from the motor.
  - Make sure that no magnetizable parts can be attracted by the motor.
  - Make sure that the motor cannot be attracted by magnetizable metal parts.

DANGER

Maintenance work without switching off the power supply to the control unit.

Risk of electrical shock!

- Switch off the power supply to the control unit with a lockable disconnect switch 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 disconnecting the electrical supply.
- Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals before starting any work.

DANGER

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

Risk of electrical shock!

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

WARNING

The machine is contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

CAUTION

Hot surface.

Risk of burns!

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

CAUTION

Hot liquids.

Risk of burns!

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

CAUTION

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.

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.
- Vent the connected lines to atmospheric pressure.

If necessary:

- Disconnect all connections.

7.1 Maintenance Schedule

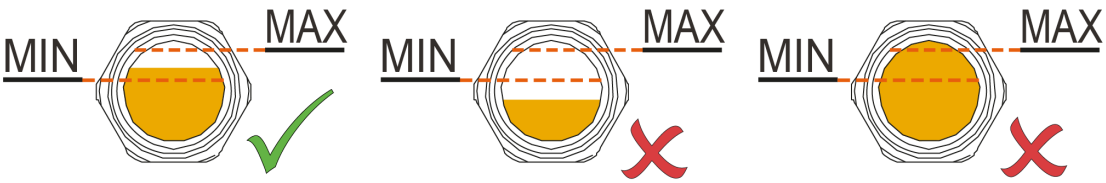
The maintenance intervals depend very much on the individual operating conditions. The intervals given below are considered as starting values which should be individually shortened or extended as appropriate.

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

Interval	Maintenance work
Monthly	• Check the inlet screen (IS), clean if necessary. In case of an inlet filter (IF) being installed: • Check the inlet filter cartridge, replace if necessary.
Every 3 months	• Check the oil level, see *Oil Level Inspection* [➔ 22].
Every 6 months	• Clean the machine from dust and dirt, see *Cleaning from Dust and Dirt* [➔ 23].
Every 20000 hours	• Change the oil. The change interval of 20000 operating hours is valid for Busch approved oils only. The change interval depends very much on the operating conditions. Borderline operation may reduce the change interval down to approximately 5000 operating hours. Other oils may reduce the change interval.
Every 40000 hours or after 6 years	• Have a major overhaul on the machine (contact Busch).

7.2 Oil Level Inspection

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



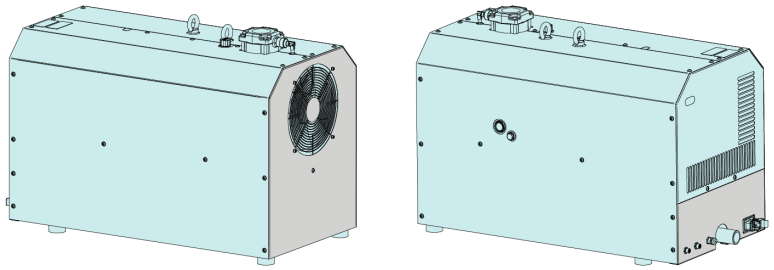
The oil level should stay constant over the lifetime of the oil. If the level does fall, this indicates a leak and the machine requires repair.

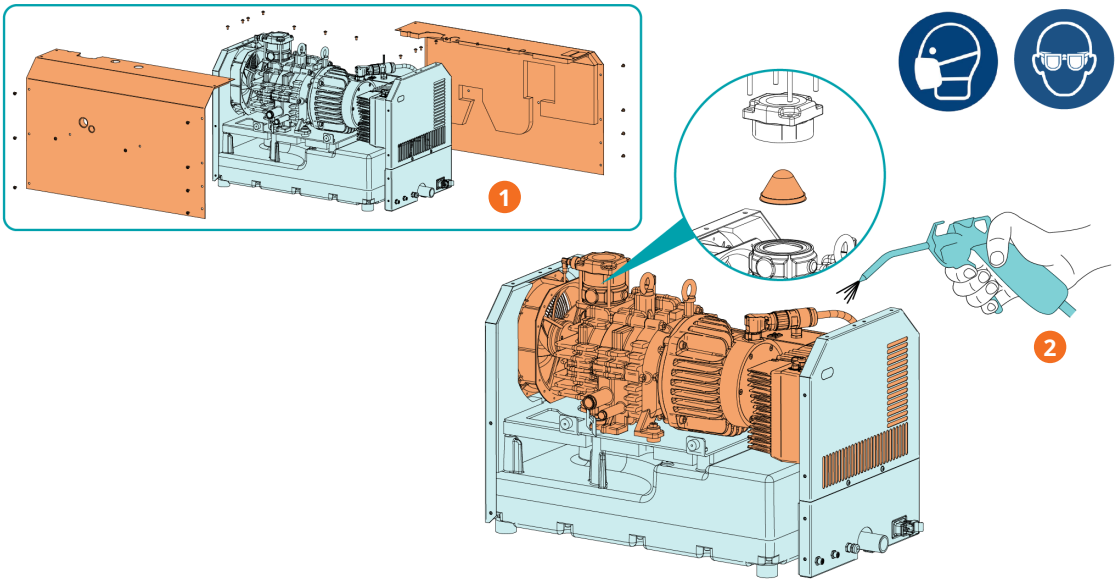
- Fill up if necessary, see *Filling Oil* [➔ 14].

7.3 Cleaning from Dust and Dirt

NOTICE

These cover elements must not be removed.





Description			
1	Remove the covers	2	Clean the ventilation grilles, fans, inlet screen and cooling fins

7.4 Oil Change

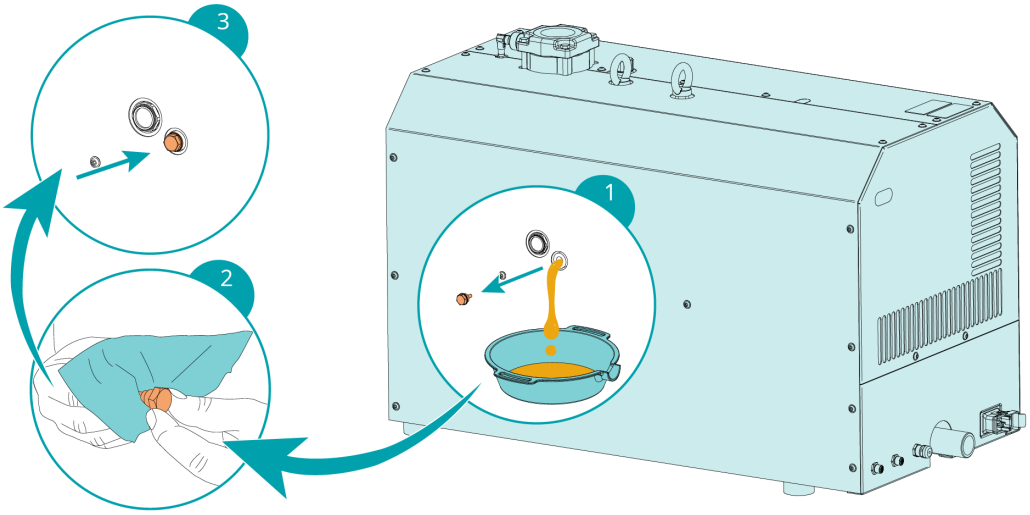
NOTICE

Use of inappropriate oil.

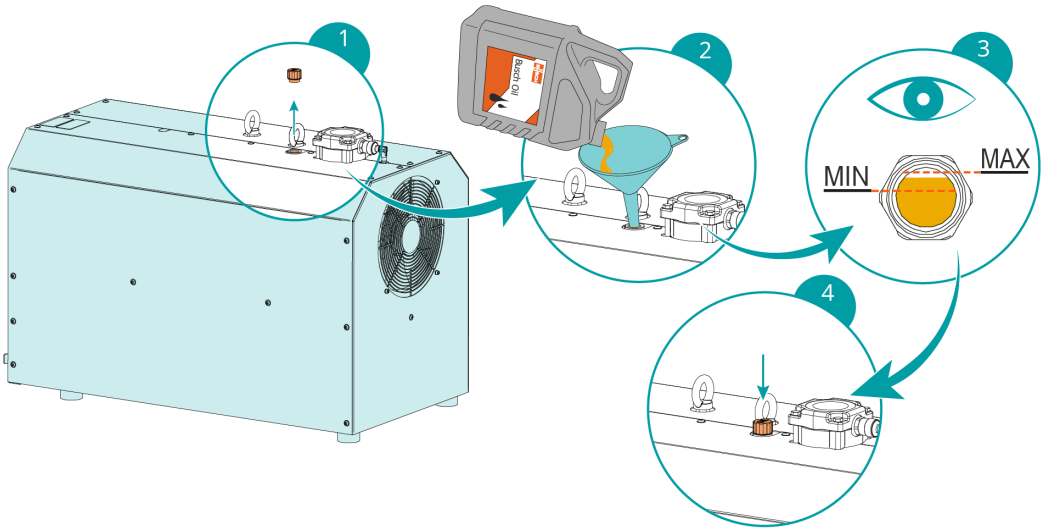
Risk of premature failure!

Loss of efficiency!

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



For oil type and oil capacity see *Technical Data* [➔ 34] and Oil chapters.



The oil level should stay constant over the lifetime of the oil. If the level does fall, this indicates a leak and the machine requires repair.

8 Overhaul

DANGER

Strong Magnetic Field: Hazard to individuals with active medical implants (e.g., pacemakers and insulin pumps), regardless of whether the machine is powered on or off.

Risk of death for persons with pacemakers!

Risk of severe injuries!

Risk of damage to magnetically sensitive items / products!

- Make sure that personnel with pacemakers do not perform any work on the machine.
- Make sure that pregnant personnel do not perform any work on the machine.
- Secure the working area; if necessary, isolate the area:
  - Make sure that prohibited personnel keep a safe distance of at least 1m from the motor.
  - Make sure that no magnetizable parts can be attracted by the motor.
  - Make sure that the motor cannot be attracted by magnetizable metal parts.

WARNING

The machine is contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

NOTICE

Incorrect assembly.

Risk of premature failure!

Loss of efficiency!

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

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

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

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

9 Decommissioning

DANGER

Strong Magnetic Field: Hazard to individuals with active medical implants (e.g., pacemakers and insulin pumps), regardless of whether the machine is powered on or off.

Risk of death for persons with pacemakers!

Risk of severe injuries!

Risk of damage to magnetically sensitive items / products!

- Make sure that personnel with pacemakers do not perform any work on the machine.
- Make sure that pregnant personnel do not perform any work on the machine.
- Secure the working area; if necessary, isolate the area:
  - Make sure that prohibited personnel keep a safe distance of at least 1m from the motor.
  - Make sure that no magnetizable parts can be attracted by the motor.
  - Make sure that the motor cannot be attracted by magnetizable metal parts.

CAUTION

Hot surface.

Risk of burns!

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

CAUTION

Hot liquids.

Risk of burns!

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

- Stop the machine and lock it to prevent accidental start-up.
- Disconnect the power supply.
- Vent the connected lines to atmospheric pressure.
- Disconnect all connections.

If the machine is to be stored:

- See *Storage* [➔ 11].

9.1 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.

10 Spare Parts

NOTICE

Use of non-Busch genuine spare parts.

Risk of premature failure!

Loss of efficiency!

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

Spare part	Description	Article number
Service kit	Includes all parts to perform maintenance work	0992 204 509
Inlet screen (IS)		0534 000 041
Inlet filter cartridge	Paper	0532 000 004
Inlet filter cartridge	Polyester	0532 121 864

If other parts are required:

- Contact your Busch representative.

11 Troubleshooting

DANGER

Strong Magnetic Field: Hazard to individuals with active medical implants (e.g., pacemakers and insulin pumps), regardless of whether the machine is powered on or off.

Risk of death for persons with pacemakers!

Risk of severe injuries!

Risk of damage to magnetically sensitive items / products!

- Make sure that personnel with pacemakers do not perform any work on the machine.
- Make sure that pregnant personnel do not perform any work on the machine.
- Secure the working area; if necessary, isolate the area:
  - Make sure that prohibited personnel keep a safe distance of at least 1m from the motor.
  - Make sure that no magnetizable parts can be attracted by the motor.
  - Make sure that the motor cannot be attracted by magnetizable metal parts.

DANGER

Maintenance work without switching off the power supply to the control unit.

Risk of electrical shock!

- Switch off the power supply to the control unit with a lockable disconnect switch 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 disconnecting the electrical supply.
- Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals before starting any work.

CAUTION

Hot surface.

Risk of burns!

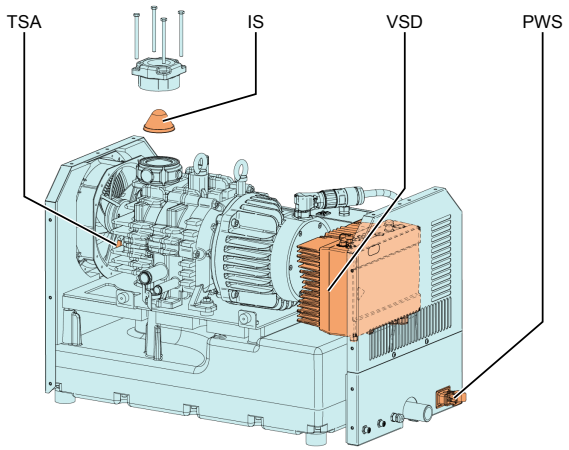
- Before doing anything that requires touching the machine, let it cool down first.

CAUTION

Hot liquids.

Risk of burns!

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



Description			
IS	Inlet screen	VSD	Variable speed drive ECOTORQUE
TSA	Temperature switch	PWS	Power supply (HARTING connector)

Problem	Possible Cause	Remedy
The machine does not start.	The ECOTORQUE variable speed drive (VSD) is not supplied with the correct voltage.	• Check the power supply.
	The ECOTORQUE variable speed drive (VSD) is in alarm.	• Solve the alarm source, see *Troubleshooting ECOTORQUE Variable Speed Drive (VSD)* [➔ 30].
The machine does not reach the usual pressure at the inlet connection.	The inlet screen (IS) is partially clogged.	• Clean the inlet screen (IS).
	The inlet filter cartridge (optional) is partially clogged.	• Replace the inlet filter cartridge.
	Internal parts are worn or damaged.	• Repair the machine (contact Busch).
The machine runs very noisily.	Oil level too low.	• Top up oil.
	Defective bearings.	• Repair the machine (contact Busch).
The machine runs too hot.	Insufficient cooling.	• Remove dust and dirt from the machine .
	The cooling fan's rotation direction is incorrect.	• Check the rotation direction of the cooling fan, see Machine delivered with an ECOTORQUE Variable Speed Drive.
	The cooling fan is not running (due to a tripped circuit breaker).	• Open the electrical cabinet and check the circuit breaker, turn it ON if it has tripped.
	Ambient temperature is too high.	• Observe the permitted ambient temperature, see *Technical Data* [➔ 34].
	Temperature of the process gases at the inlet too high.	• Observe the permitted gas inlet temperature, see *Technical Data* [➔ 34].
	Oil level is too low.	• Check the machine for leakage. • Top up oil.

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

11.1 Troubleshooting ECOTORQUE Variable Speed Drive (VSD)

DANGER

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

Risk of electrical shock!

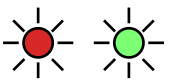
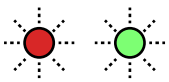
- Electrical installation work must only be executed by qualified personnel.

11.1.1 LED Flash Codes

When an error occurs, the LEDs on the variable speed drive display a flashing code that allows the errors to be diagnosed.

The following table contains an overview:

Red LED	Green LED	State
		Boot loader active (flashing in turn)
		Ready for operation (activate En_HW for operation)
		Operation / ready
		Warning
		Error
		Identification of motor data
		Initialisation
		Firmware update
		Bus error operation
		Bus error ready for operation

Key			
	LED off		LED on
	LED flashing		LED flashing quickly

11.1.2 List of Errors

The variable speed drive shuts down if an error occurs. Consult the flash code table / PC tool for the corresponding error numbers.

NOTE

Error messages can only be acknowledged once the error has been remedied.

Error messages can be acknowledged as follows:

- Digital input 2, see wiring diagram delivered with the machine
- switch device off and on again
- Busch Vacuum Manager Software

The following section contains a list of possible error messages.

Please contact your Busch representative if you encounter errors that are not listed here.

No.	Error name	Description of error	Possible causes / remedy
1	Undervoltage 24 V application	Supply voltage for the application is less than 15 V.	24 V supply overload.
2	Overvoltage 24 V application	Supply voltage for the application is greater than 31 V.	Internal 24 V supply is not OK, or external supply is not OK.
4	Warning: Customer PLC runtime environment	Customer PLC is not running.	The customer PLC is being downloaded / The customer PLC has a programming error, e.g. division by 0.
6	Customer PLC version error	The version of the customer PLC doesn't match the device firmware.	Check the version numbers of the customer PLC and device firmware.
8	Communication application<>power	Internal communication between the application plate and the power-conducting plate is not OK.	EMC interference.
9	Warning: Warning: multi-pump error	A fault has occurred in the multi-pump system: One participant has a fault. The CAN open connection is disturbed/interrupted.	Check that all participants are available, and the status LED is green. Check CAN open connection.
10	Parameter distributor.	The internal distribution of parameters during initialization failed.	Parameter set is incomplete.
11	Time-out power	The power part does not respond.	Operation with 24 V without mains feed-in.
13	Cable break at analog in 1 (4–20 mA / 2–10 V)	Current or voltage is less than the lower limit of analog input 1.	Cable break, faulty external sensor.
14	Cable break at analog in 2 (4–40 mA / 2–10 V)	Current or voltage is less than the lower limit of analog input 2.	Cable break, faulty external sensor.
15	Blocking detection	The drive shaft of the motor is stalled.	Remove the blockage.
16	PID dry run	No PID actual value despite maximum speed.	PID actual value sensor defective Extend dry run time parameter.
17	Start-up error	Motor not starting up or starting up incorrectly.	Check motor connections / check motor and controller parameters.

No.	Error name	Description of error	Possible causes / remedy
18	Excess temperature for frequency converter application	Inner temperature too high.	Insufficient cooling, low motor speed and high torque, switching frequency too high.
19	Firmware update error	A firmware update could not be completed.	Connection aborted during a FW update. Repeat the FW update. The variable speed drive is supplied externally with 24 V. **Note:** During a firmware update, 24 V must not be connected externally.
21	Bus time-out	No response from bus sharing unit or remote control/PC.	Check bus wiring.
22	Acknowledgement error	The number of maximum automatic acknowledgements was exceeded.	Check error history and remedy error.
23	External fault 1	The parameterized fault input is active.	Correct the external error.
24	External fault 2	The parameterized fault input is active.	Correct the external error.
25	Motor detection	Motor identification error.	Check variable speed drive/ motor and PC / remote control / variable speed drive connections / restart motor identification.
26	STO inputs plausibility	The statuses of the two STO inputs have not been identical for more than 2 sec.	Incorrect activation of the STO inputs. Check corresponding external wiring / Indoor temperature too high.
27	Bus address invalid	CAN open fieldbus address invalid.	The ID must be > 0 and < 127.
28	Limit frequency exceeded / not met	The parameterized minimum / maximum frequency has not been met / has been exceeded.	Motor blocked / Brake not opened / Motor overloaded.
32	Trip IGBT	Protection of the IGBT module against overcurrent has been triggered.	Short circuit in the motor or motor feed line / controller settings.
33	Overvoltage of intermediate circuit	The maximum intermediate circuit voltage has been exceeded.	Feedback by motor in generator mode / supply voltage too high / incorrect setting of speed controller / brake resistor not connected or defective / ramp times too short / operation on transformer / operation with mains choke.
34	Undervoltage of intermediate circuit	The minimum intermediate circuit voltage has not been reached.	Mains voltage too low, mains connection defective / check wiring.
35	Excess motor temperature	Motor PTC has been triggered.	Overload of the motor (e.g. high torque at low motor speed) / ambient temperature too high.
36	Power failure	The grid voltage has dropped briefly.	Grid fluctuation / grid voltage interrupted.

No.	Error name	Description of error	Possible causes / remedy
38	Excess IGBT module temperature	Excess IGBT module temperature.	Insufficient cooling, low motor speed and high torque, switching frequency too high.
39	Overcurrent	Maximum output current of variable speed drive exceeded.	Motor stalled / check motor connection / incorrect speed controller setting / check motor parameters / ramp times too short / brake not open.
40	Excess frequency converter temperature	Inner temperature too high.	Insufficient cooling / low motor speed and high torque / switching frequency too high permanent overload / reduce ambient temperature / check fan.
42	I2t motor protection shutoff	The internal I2t motor protection (can be parameterized) has been triggered.	Permanent overload.
43	Ground leak	Ground leak during a motor phase.	Insulation fault.
45	Motor connection disrupted	No motor current despite control through frequency converter.	No motor connected or not completely connected. Check phases or motor connections and connect correctly when necessary.
46	Motor parameters	Plausibility check for motor parameters failed.	Parameter set not OK.
47	Variable speed drive parameters	Plausibility check for variable speed drive parameters failed.	Parameter sets are not OK, motor type and control method are not plausible.
48	Type plate data	No motor data entered.	Please enter the motor data according to the motor nameplate.
49	Power class restriction	Max. overload of the variable speed drive exceeded more than 60 sec.	Check application / reduce load / use larger variable speed drive.
53	Motor tipped	Only for synchronous motors, field orientation lost.	Load too high Optimize controller parameters.
56	Grid overvoltage	The mains input voltage is above 528 V AC.	Check the mains supply.
57	**Warning:** Switching frequency reduction active	The switching frequency was reduced due to the ambient temperature.	Insufficient cooling / low speed and high torque / permanent overload/reduce ambient temperature/check fan.
58	IGBT module overheating	The IGBT module overheating at high starting current and high clocking frequency.	Reduce clocking frequency. Reduce load in the lower speed range.
-	Pressure / Speed target not reached	Speed limitation to avoid overloading the motor.	Control possible overload due to excessive exhaust back pressure: pressure drops in the discharge line downstream of the machine, clogged exhaust filters. In cold ambient conditions, preheat the machine for 5 minutes at start-up.

12 Technical Data

		MV 0360 A ECOTORQUE
Nominal pumping speed	m^3/h	360
	ACFM	212
Ultimate pressure	hPa (mbar) abs.	100
	Torr abs.	75
Nominal motor rating	kW	7.5
	hp	10
Nominal motor speed (45 – 200 Hz)	min^{-1}	900 – 4000
	rpm	900 – 4000
Sound pressure level (ISO 3744), 1 m distance, at medium load (4000 min^{-1})	dB(A)	70 +/-3
Ambient temperature	°C	0 ... 40 *
	°F	32 ... 104 *
Inlet gas temperature	°C	0 ... 40 *
	°F	32 ... 104 *
Ambient pressure		Atmospheric pressure
Installation altitude		Up to 1000 m: no derating 100% load capacity At 1000 ... 3000 m: derating 1% per 100 m
Permitted stationary vibration: sinusoidal		3 Hz < f < 8.72 Hz: 10 mm 8.72 Hz < f < 200 Hz: 3g 3M7 acc. IEC 60721-3-3
Oil capacity	l	1.1
	qts.	1.1
Weight approx.	kg	300 **
	Lbs.	660 **
Supply network		TN- and TT-network (can't be used with corner grounded networks)
Immunity		EN 61800-3, 1st and 2nd environment
Emissions		EN 61800-3, category C2 as standard

* *In case of higher or lower temperatures, please consult your Busch representative.*

** *The weight can vary depending on the order.*

13 Oil

Name	ISO-VG	Oil type	0.1 L packing	0.5 L packing	1 L packing	5 L packing
VS 150	150	Synthetic	-	0831 168 695	0831 164 883	0831 164 884

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

Oil suitability

- **Oil VS 150**: Suitable for standard applications.

14 EU Declaration of Conformity

This Declaration of Conformity and the CE-markings affixed to the name plate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer.

When this machine is integrated into a superordinate machinery, the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the CE-marking.

The manufacturer

Busch Produktions GmbH
Schauinslandstr. 1
DE-79689 Maulburg

declares that the machine: MINK MV 0360 A ECOTORQUE

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 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 3744 : 2010	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
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

Maulburg, 2025.01.02

Dr. Martin Gutmann, General Manager

Busch Produktions GmbH

15 UK Declaration of Conformity

This Declaration of Conformity and the UKCA-markings affixed to the name plate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer.

When this machine is integrated into a superordinate machinery, the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the UKCA-marking.

The manufacturer

Busch Produktions GmbH
Schauinslandstr. 1
DE-79689 Maulburg

declares that the machine: MINK MV 0360 A ECOTORQUE

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 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 3744 : 2010	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
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

Maulburg, 2025.01.02

Dr. Martin Gutmann, General Manager

Busch Produktions GmbH

Notes

BUSCH GROUP

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

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

www.buschvacuum.com

www.pfeiffer-vacuum.com

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