

COBRA

Dry Screw Vacuum Pumps
DS 2141 A

Instruction Manual



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1 Preface

1.1 Congratulations on your purchase

Congratulations on your purchase of the Busch vacuum pump. With watchful observation of the field's requirements, innovation and steady development Busch delivers modern vacuum and pressure solutions worldwide.

These operating instructions contain information for

- product description,
- safety,
- transport,
- storage,
- installation and commissioning
- maintenance,
- overhaul and
- troubleshooting

of the vacuum pump.

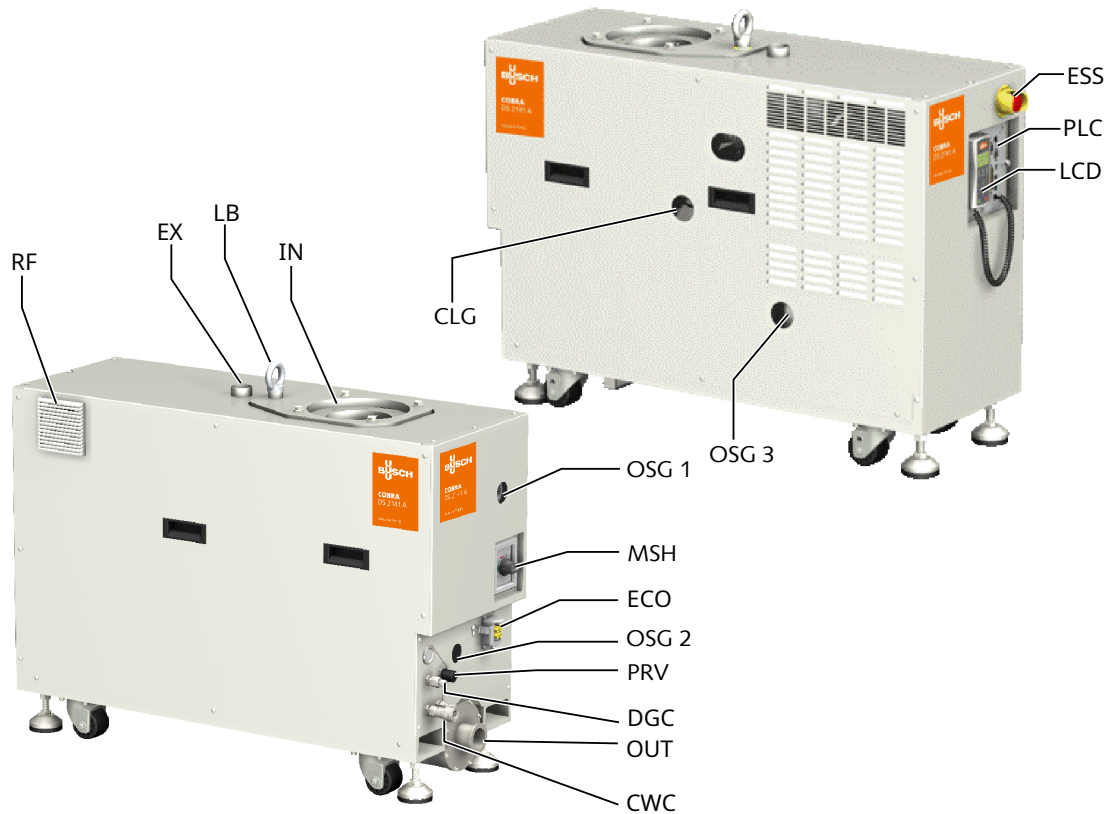
For the purpose of these instructions, "handling" the vacuum pump means the transport, storage, installation, commissioning, influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

Prior to handling the vacuum pump these operating instructions shall be read and understood. If anything remains to be clarified, please contact your Busch representative.

Keep these operating instructions and, if applicable, other pertinent operating instructions available on site.

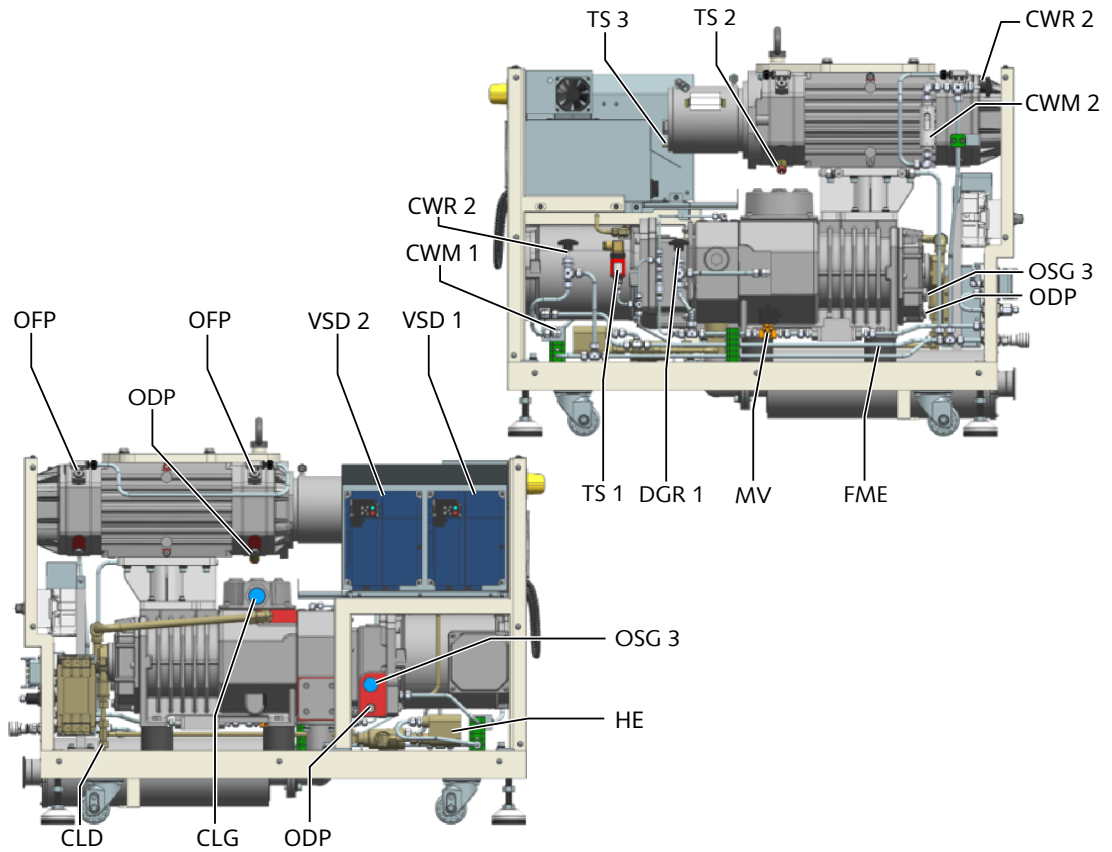
2 Product Description

2.1 COBRA DS 2141 A



Description

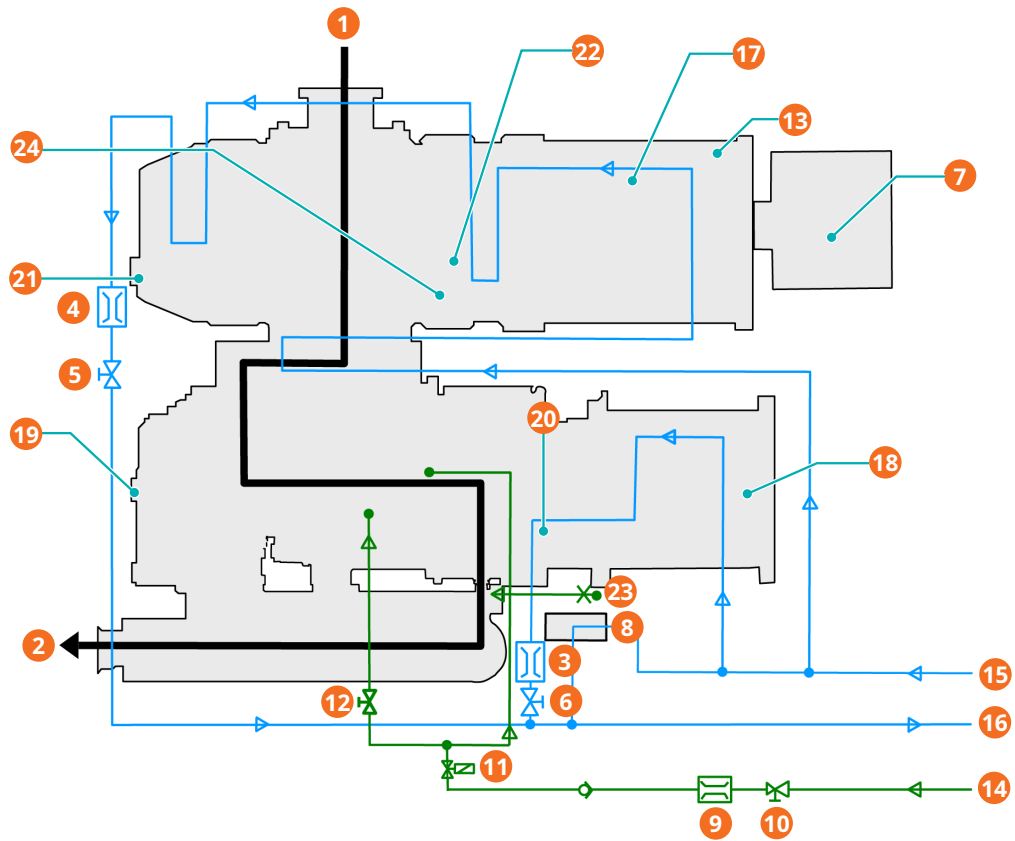
IN	Suction connection	OUT	Discharge connection
CLG	Cooling liquid glass	CWC	Cooling water connections
DGC	Nitrogen connections	ESS	Emergency stop button
ECO	Electrical connections	EX	Extracting ventilator
LB	Lifting eye bolt	LCD	Handpad
MSH	Main switch	OSG 1	Oil sight glass
OSG 2	Oil sight glass	OSG 3	Oil sight glass
PLC	Busch PLC	PRV	Regulating valve, Nitrogen
RF	Radial fan		



Description

CLD	Cooling liquid drain plug	CLG	Cooling liquid sight glass
CWC	Cooling water connections	CWM 1	Cooling water flow meter
CWM 2	Cooling water flow meter	CWR 1	Regulating valve, cooling water
CWR 2	Regulating valve, cooling water	FME	Nitrogen flowmeter
ODP	Oil drain plug	OFF	Oil filler plug
OSG 1	Oil sight glass	OSG 2	Oil sight glass
OSG 3	Oil sight glass	MV	Regulating with solenoid valve, dilution gas
PRV	Regulating valve, Nitrogen	TS 1	Pressure sensor
TS 2	Oil temperature sensor for MB	TS 3	Motor klixon for MB
VSD 1	Variable speed drive for MB	VSD 2	Variable speed drive for DP

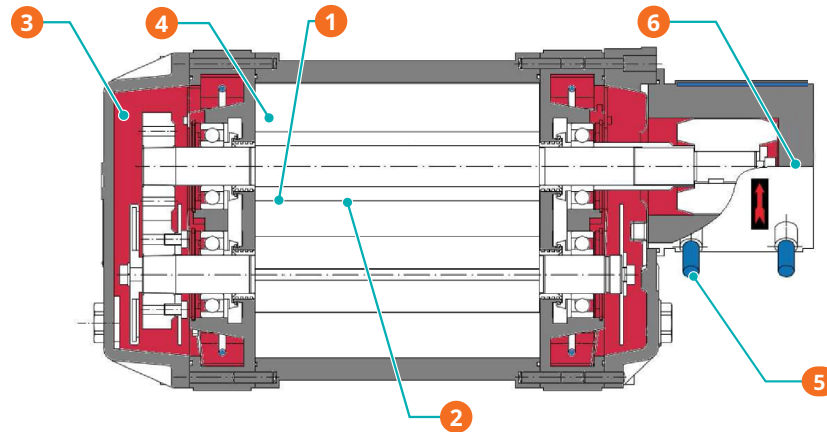
Process Gas Diagram



Description			
1	Process gas inlet	2	Process gas outlet
3	Cooling water flow meter (CWM1)	4	Cooling water switch (CWM 2)
5	Cooling water regulating valve (CWR 1)	6	Cooling water regulating valve (CWR 2)
7	Variable speed drive DP/ MB (VSD)	8	Heat exchanger (HE)
9	Nitrogen flow meter, dilution gas (FME)	10	Nitrogen pressure reducer (PRV)
11	Magnetic valve (MV), regulating valve with solenoid valve, dilution gas	12	Regulating valve, dilution gas DP (DGR 1)
13	Motor klixon (TS 3)	14	Nitrogen supply
15	Cooling water inlet	16	Cooling water outlet
17	Motor MB (MOT 2)	18	Motor DP (MOT 1)
19	Oil sight glass DP (OSG 1)	20	Oil sight glass DP (OSG 2)
21	Oil sight glass MB (OSG 3)	22	Oil sight glass MB (OSG 4)
23	Pressure sensor (TS 1)	24	Oil temperature sensor (TS 2)

COBRA NS 0350 A

PUMA WY 1251 B



Description			
1	Inlet	2	Outlet
3	Oil	4	Booster lobe
5	Cooling water	6	Motor klixon

2.2 Use

The COBRA DS vacuum pumps are designed for use in the field of microelectronics and similar industries.

They can be used to suck gases and gas mixtures.



WARNING

When using toxic, inflammable and/or explosive gases, make sure that the system corresponds in design to applicable local and national safety regulations and that all applicable safety measures are followed.

All product-specific safety regulations must be observed.

Solid particles must not get into the vacuum pump. Procedural errors can result in the vacuum pump sucking in a certain quantity of liquid. If the pump has sucked in liquid, a short drying time is necessary at the end of the procedure.

The allowed maximum inlet gas temperature depends on the inlet pressure and the type of gas: the lower the inlet pressure (Pa), the higher the drawn gas temperature (TGas) can be.

The following indicative values for air can be considered:

- Pa > 50 mbar, TGas < 80°C
- Pa < 50 mbar, TGas < 200°C

The vacuum pump is intended for use in a potentially non-explosive environment.

- Make sure that the maximum permissible number of starts does not exceed 6 starts per hour. Those starts should be spread within the hour.

The vacuum pump is thermally suitable for continuous operation at any pressure between atmospheric pressure and ultimate pressure.

The vacuum pump is tight down to ultimate pressure.

2.3 Operating Principle

2.3.1 COMBI

The COBRA DS 2141 A vacuum pumps are a combination of a screw vacuum pump NS 0350 A (DP) and a Booster vacuum pump WY 1251 B (MB). The COMBI vacuum pumps are streamlined.

The COBRA DS vacuum pumps are COBRA NS screw vacuum pumps with cooling water and nitrogen circuits.

The COBRA NS screw vacuum pumps are driven by water-cooled motors.

2.3.1.1 Principle of DP Vacuum Pumps

The COBRA NS screw vacuum pumps work by the principle of spiral pumps. Two parallel screws (8) rotate in opposite directions in the pump body. Entering gases are trapped between the flights of the screws and the pump body. The gases are conveyed by the rotation of the screws to the exhaust, where they are discharged.

2.3.1.2 Principle of MB Vacuum Pumps

The Booster vacuum pumps operate according to the approved principle of the Booster type machine. Operation is both simple and effective. Two lobes (9) with identical profiles rotate in opposite directions within a casing. As they rotate, gas is drawn into the space between each lobe and the casing where it is trapped and by the rotation pushed out into the discharge. This action is repeated twice for each revolution of each lobe and therefore four times for each revolution of the drive shaft. There is no mechanical contact between lobes and cylinder. So no oil lubrication is required.

The drive motor of Booster vacuum pump is a water-cooled canned motor.

2.3.2 Gas Flow Checks

A pressure sensor TS1 at the discharge monitors the discharge pressure. If the pressure reaches more than the limit value (alarm, preset at the factory: 0.2 bar), the purge cycle starts.

2.4 Oil Circuit

Since the complete operating principle works without contact, no oil circuit is needed in the work area.

2.5 Cooling

The vacuum pump is cooled by:

- a direct cooling water circuit in the motors, cylinder endplates and the DP transmission casing. The flow regulating valve CWR of cooling water are preset on 7 l/min at the factory. The water cools in the DP and MB pumps motors, the two variable speed drives (VSD) and the drive/pump transmission DP system.
- a direct cooling water circuit in the rear bearing (for exceptionally cool running in option).



NOTE

The COBRA DS vacuum pumps are principally dispatched with oil and cooling liquid already in the vacuum pump but, without cooling water. Before vacuum pump first startup, control the oil level and the cooling liquid level. In the event of absence of one or the other of these lubricants, please carry out the filling (please refer to the various chapters of filling). Do not forget to connect the cooling water supply before the first startup. Operation without these coolants can result in damage to the vacuum pump.

2.6 Nitrogen System

The nitrogen system can be used in a number of different ways:

- Nitrogen is used as dilution gas. It is injected inside the cylinder.
Nitrogen flow FME injected on cylinder endplate side is preset at 12 SLM and can be adjusted with valve DGR1, depending on the application. When flow is too low a warning then an alarm signal is generated by flowmeter FME to the PLC. Status of the pump depends on the alarm function set by user (factory setting: None, pump continues running with an alarm). Dilution improves the screws functioning, especially when sucking corrosive gases.
- Nitrogen is used as sealing gas. The nitrogen is injected between the transmission and the process gas to achieve good closeness. The nitrogen flow used for the sealing is set by two chips (ϕ). With a pressure of 1,5 bar, the flow is around 12 SLM.
- Nitrogen is used as purge gas. The purge eliminates traces of gases remaining in the vacuum pump. The vacuum pump purge cycle is programmed in the control and starts, either after a STOP operation or after an alarm function.
For a correct purge execution, the shut-off valve at the inlet flange must be closed. The purge cycle lasts about 30 min. (Programmable time in the basic parameters).

2.7 Optional Functions/ Use of Available Accessories

The relief valve (SV) prevents excessively high pressure in the expansion tank (EV), relief pressure: 6 bar.

A pressure switch (optional) with normally closed contact mounted in the expansion tank monitors the pressure of the cooling liquid. It must be connected in such a way that actuation causes the vacuum pump to be switched off when the pressure exceeds a value of 3 bar.

A pressure sensor (TS1) mounted at the exhaust, controls the overpressure at the exhaust. If overpressure is above 0,3 bar, pressure sensor gives a warning then an alarm signal. Status of the pump depends on the alarm function set by user (factory setting: None, vacuum pump continues running with an alarm).

A temperature sensor PT100 (TSA) mounted on the cylinder, measures the temperature inside the cylinder (DP).

A silencer or sound absorber (accessory) at the exhaust reduces the noise of the vacuum pump and collects any condensate.

A leak-protection non-return valve (optional) at the exhaust traps the condensate in the vacuum pump when the vacuum pump is switched off.

The LCD controller processes the data of the sensors as follows:

- TS1: exhaust pressure
- TSA: temperature inside the cylinder DP
- MOT1 and MOT2: DP and MB current and speed
- FME: nitrogen flow rate, dilution
- CWM: cooling water flow rate in motors/ transmission / variable speed drives

See "Installation and Maintenance Instructions, Busch PLC and Busch LCD (No. 0870758077)".

2.8 On/ Off Switch

The vacuum pump is delivered with a circuit breaker. The function start/ stop can be done in Local by using the LCD controller or in Remote by the production machine.

2.9 Versions

Further vacuum pump descriptions state the nominal displacement and the design level.

Example: DS 2141 A

DS = standard version

2141 = 1875 m³/h

A = Design

3 Safety

3.1 Intended Use

DEFINITION: To rule out any misunderstanding, the term “handling” of the vacuum pump covers transport, storage, installation, and operation of the pump as well as effects on operating states and troubleshooting on the vacuum pump.

The vacuum pump is intended for industrial use. It may only be operated by qualified personnel.

The different application possibilities and limit values for operation described in “Product description” and “Installation requirements” must be observed by the manufacturer of the system into which the vacuum pump is to be integrated and by users.

The need for personal safety regulations depends in principle on the type of use. The operator must provide the users with the necessary means and must inform his personnel about the dangers emanating from the processed product.

The operator of the vacuum pump must observe the safety regulations and must train and instruct his personnel accordingly.

Local regulations regarding the motors and electric control elements must be observed when installing the pump in potentially explosive environments.

The maintenance instructions must be followed and observed.

These installation and maintenance instructions must be read and understood before the vacuum pump is used. If you have any doubts, contact your Busch representative.

3.2 Safety Information

The vacuum pump is designed and manufactured in compliance with the latest technical standards and safety regulations. Nevertheless, an element of residual risk remains.

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.

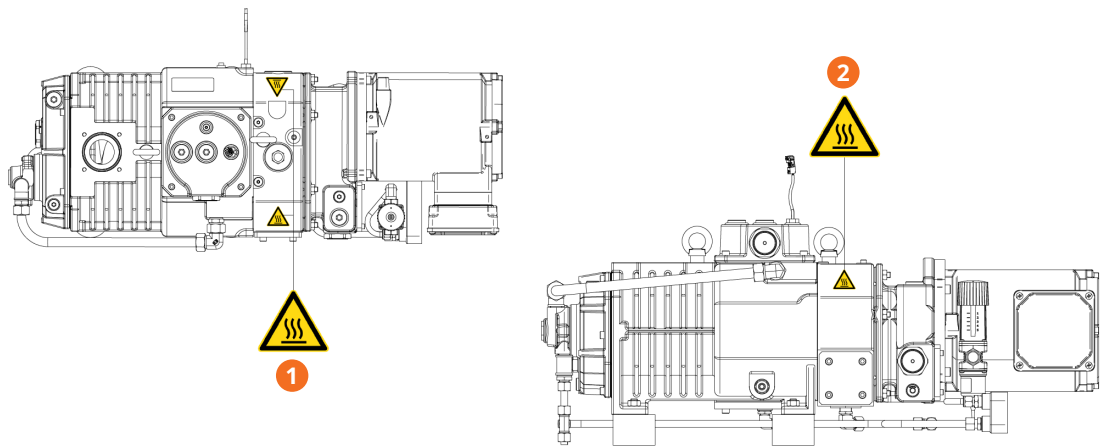


CAUTION

The COBRA DS system includes provision for the secondary containment of liquids leaks such as water and oil.

3.3 Safety Stickers

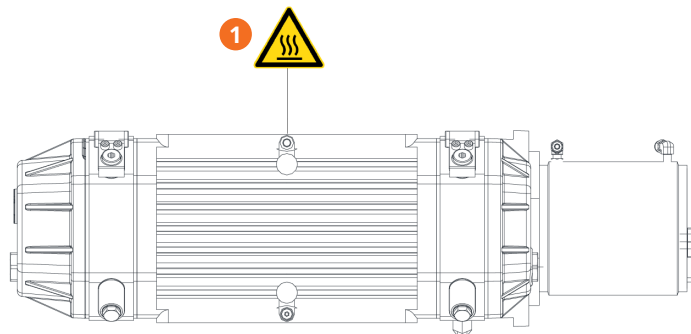
COBRA NS 0350 A



Description

1	Warning! Hot surface! Do not touch!	2	Warning! Hot surface! Do not touch!
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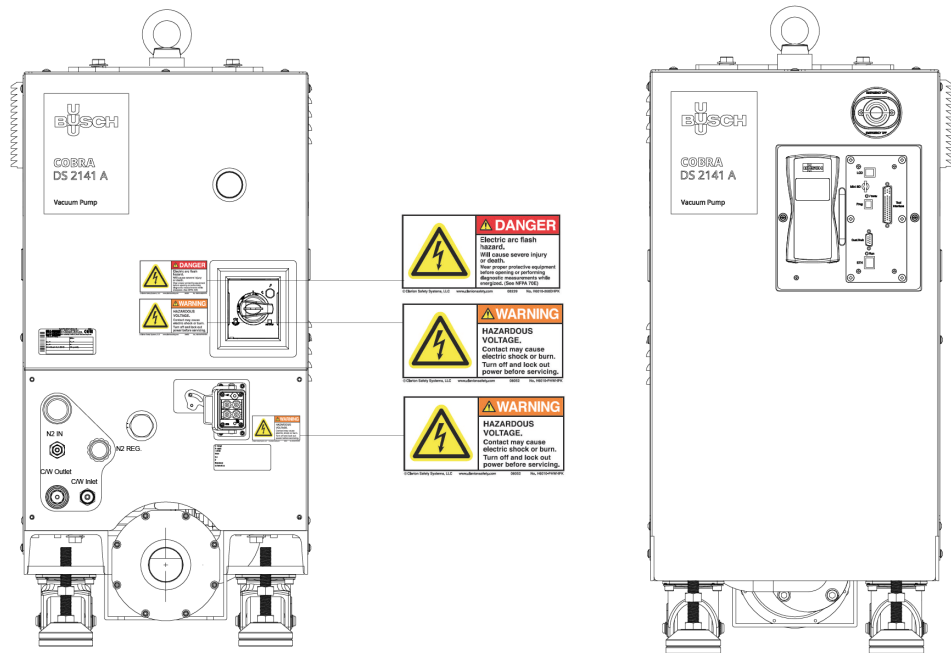
PUMA WY 1251 B



Description

1	Warning! Hot surface! Do not touch!		
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COBRA DS 2141 A



3.4 Noise Emission

Refer to the table “Technical data” for the permissible noise levelling free field conditions according to EN ISO 2151.

CAUTION

The sound level of the vacuum pump within a certain perimeter of the vacuum pump is high. Risk of hearing damage.

Users who are spending a longer period in the vicinity of a non-insulated vacuum pump must wear suitable ear protection.

3.5 Safety Area

Before any maintenance action, ensure a safety perimeter of a least 610 [mm] around the vacuum pump. Before any maintenance action, ensure a safety perimeter of a least 610 [mm] around the vacuum pump.

3.6 Electrical Safety

3.6.1 Types of Electrical Work

The following are the four types of electrical work defined by the SEMI S2, latest version, guideline:

Type 1

Equipment is fully deenergized.

Type 2

Equipment is energized. Energized circuits are covered or insulated.

NOTE: Type 2 work includes tasks where the energized circuits are or can be measured by placing probes through suitable openings in the covers or insulators.

Type 3

Equipment is energized. Energized circuits are exposed and inadvertent contact with uninsulated energized parts is possible. Potential exposures are no greater than 30 volts rms, 42.4 volts peak, 60 volts dc or 240 volt-amp in dry locations.

Type 4

Equipment is energized. Energized circuits are exposed and inadvertent contact with uninsulated energized parts is possible. Potential exposures are greater than 30 volts rms, 42.4 volts peak, 60 volts dc, or 240 volt-amp in dry locations. Potential exposures to radio-frequency currents, whether induced or via contact, exceed the limits in Table A5-1 of Appendix 5 (SEMI S2 guideline).

3.6.2 Lock Out/ Tag Out Procedure (Type 1 of Electrical Work)

- Stop the pump with the LCD controller (press on STOP button during 10s).
- Press on emergency stop button.
- Switch off the main circuit breaker.
- Switch off the customer's power supply.
- Switch off the water and nitrogen quick connections (inlet first, then outlet).
- Put the label or warning board "Maintenance processing" on or next to the vacuum pump.

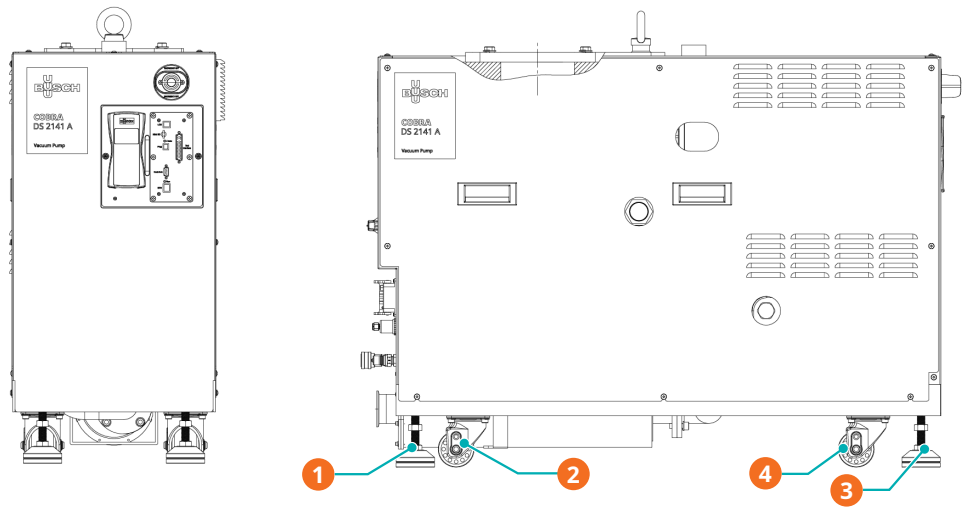
3.6.3 Emergency Off Circuit Description

- The Emergency off circuit may be opened by pressing on emergency stop button. If this element occurs, then the DP and MB vacuum pumps will immediately stop. The PLC will remain energized to save the pump status.
- If the emergency stop button was pressed, check the startup of the pump then release this button to restart the pump. Press on Start button on the LCD controller, the pump will restart.

3.7 Seismic Zone Installation

Upon receipt, the vacuum pump is fixed on the transport pallet with two brackets.

- Convey the vacuum pump to its final location with a pallet truck before removing it from its support.
- Unscrew the fixing screws of the vacuum pump on the transport pallet and remove the machine from its support with an appropriate lifting system by using the lifting brackets made for this purpose.



Description			
1	Adjusting nut	2	Wheel
3	Adjusting nut	4	Wheel

- The vacuum pump must not lay only on the brackets. Unscrew the four adjusting nuts until the machine legs touch the ground.
- Check that the wheels no longer touch the ground.

 **CAUTION**

The vacuum pump is fixed to the ground with four M10 screws, two screws per bracket. The fixing screw must stand a 1200 N tensible force (per bracket).

The final user must adapt the type of screws depending on the ground material.

3.8 Information over the Lubricants

3.8.1 Oil

Oil filling	NS 0350 A	WY 1251 B
Oil quantity (Liter)	1,6	1,4
Oil type	Busch YLC 250 B, Art. No. 0831 131 400 (0,5 l ≈ 1 kg)	

- Replacement: After 5000 h (see "Maintenance Schedule [→ 40]").

3.8.2 Cooling Liquid

Cooling liquid filling	NS 0350 A
Cooling liquid quantity (Liter)	5 liters
Cooling liquid type	Glycol (Ethylene), Art. No. 0831 563 469, Zitrec M-25 (already mixed ready-to-use)

- Replacement: After 5000 h (see "Maintenance [→ 38]").

3.9 Decommissioning Procedure

When the product arrives at the end of the lifetime, it is necessary to proceed to the decontamination of the vacuum pump.



CAUTION

Only authorized personnel may carry out any dismantling on the vacuum pump. Before work begins, the operator of the vacuum pump must fill in a form or a "Declaration Regarding Contamination of Vacuum Equipment and Components" that provides information on possible dangers and appropriate measures.

If this form has not been filled in completely and signed by a responsible person, the vacuum pump may not be dismantled.

- Proceed to disassembly of the vacuum pump. Please make sure to wear a personal protective equipment (PPE) prior to any intervention on the vacuum pump. Some residues may remain inside.
- Proceed to decommissioning of the different parts according to the current local and national laws.

4 Transport

The COBRA DS vacuum pumps are tested and checked in our factory before careful packing. Check the packaging for transport damage when the goods arrive. The vacuum pump can withstand temperatures between -25°C and +55°C during transport.

4.1 Transport in Packed State

Packed on a pallet, the vacuum pump can be moved with a hand forklift truck.

4.2 Transport in Unpacked State

The vacuum pump is fastened to the pallet with fixing pins:

- Unscrew the fastening nuts underneath the pallet.



CAUTION

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



CAUTION

Please check out the weight of the vacuum pump before lifting it up (see "Technical Data"). Use adequate lifting gear for this.



NOTE

The eyebolts are fitted more or less at equal distance from the center of gravity of the vacuum pump incl. drive motor. If any accessories that could upset the balance of the vacuum pump, are installed, or if the vacuum pump is delivered without drive motor, it is necessary to add a belt or rope at a suitable point when lifting the vacuum pump.

- Attach lifting gear securely to the eyebolt or eyebolts.
- Use lifting gear with a crane hook equipped with safety latch.
- Lift the vacuum pump.



In case the vacuum pump was bolted to a pallet with fixing bolts:

- Unscrew the fixing bolts in the base frame.



CAUTION

In case of a vacuum pump filled with oil, make sure that by lifting the inclination angle of the vacuum pump do not exceed 5° from the horizontal. In case of too high inclination (>5°), risk of oil leak within the work area.

- Make sure before every transport using the appropriate lifting mean that the inclination of the vacuum pump is less than 5°.

The packaging material must be disposed of in accordance with local and national regulations.

This handbook is contained in the delivery package.

5 Storage

5.1 Temporary Storage

- Make sure that the intake and exhaust flanges are closed (put on the protective caps included in the delivery package of the vacuum pump)
- Store the vacuum pump:
 - if possible, the vacuum pump should be stored in its original packaging,
 - indoors,
 - dry,
 - in a dust-free and vibration-free room.

5.2 Removal of the Vacuum Pump

Before starting a vacuum pump that has been stored outside the building for a while, the vacuum pump must be moved to a room with ambient temperature, where it should rest for a day.

5.3 Preservation

If the vacuum pump will be exposed to unfavorable ambient conditions (for example, aggressive environment, frequent temperature changes), begin immediately with preservation work on the vacuum pump.

In the case of favorable ambient conditions, perform preservation work on the vacuum pump if a storage period of more than three months is planned.

- Make sure that all openings are hermetically sealed; use adhesive tape to fasten loose parts (seal rings, flat seals, etc.).



NOTE

VCI is the abbreviation for “volatile corrosion inhibitor”. The VCI molecule is an organic corrosion inhibitor in the vapor phase. Integrated in various carriers such as film, cardboard, paper, foam, liquid and powder, it protects the parts against corrosion because of its action in the vapor phase. However, VCI packaging can attack synthetic surfaces and surfaces of other elastomers. If in doubt, please contact your nearest distributor. VCI packaging provides several years of protection against corrosion, even under the harshest of conditions: overseas shipment, extended storage before use.

- Wrap the vacuum pump in a VCI film.
- Store the vacuum pump:
 - if possible, the vacuum pump should be stored in its original packaging,
 - indoors,
 - dry,
 - in a dust-free and
 - vibration-free room.

5.3.1 Start-up of the Vacuum Pump after Storage

- Make sure that all protective elements, stoppers, or adhesive tapes attached before preservation have been removed.
- Switch on the vacuum pump in the sequence described in “*Installation and Commissioning* [→ 21]”.

6 Installation and Commissioning

6.1 Installation Prerequisites



CAUTION

In case of non-compliance with the installation prerequisites, particularly in case of insufficient cooling:

Risk of damage or destruction of the vacuum pump and its components!

Risk of personal injury!

The installation prerequisites must be complied with.

- Please ensure that the integration of the vacuum pump is compliant with the safety requirements of the Machine Directive 2006/42/EC (concerning the responsibility of the system's manufacturer into which the vacuum pump is to be incorporated, please also refer to the note in the EU-Declaration of Conformity).



WARNING

Local regulations regarding the motors and electric control elements must be observed when installing the vacuum pump in potentially explosive environments.

Make sure before start-up that all safety measures have been followed.

6.1.1 Local Installation

- Make sure that the environment of the vacuum pump is not potentially explosive.
- Make sure that the following ambient conditions are fulfilled:

Ambient conditions	Requirements
Ambient temperature	0 ... 40 °C (32 ... 104 °F).
Ambient pressure	Atmosphere
Humidity range	20 to 95%
Altitude	Up to 1000 m

- Make sure that the cooling water fulfills the following requirements:

Hardness	dGH	< 5 °
Temperature	°C	10 - 25
Overpressure	bar (relative)	2 - 5
Approximate flow rate for the standard version	l/ min	7 - 8
Approximate flow rate for other applications	l/ min	7 - 15
Properties	Clean & clear	
Particle size	µm	< 200
Chloride	mg/l	< 100
Electrical conductivity	µS/cm	≤ 100
Free chloride	mg/l	< 0.3

**NOTE**

1° (german degree = 1° dGH) = 1,78° (french degree) = 1,25 e (english degree) = 17,9 mg/kg Ca-CO3 (american hardness).

- Make sure that the cooling water is neutral and clean.
- Make sure that the cooling water outlet is unpressurised.
- Make sure that the nitrogen fulfills the following requirements:

Overpressure	bar	1,5
Approximate flow rate	l/ min	12 - 22

- Make sure that the ambient conditions correspond to the protection class of the motor (according to nameplate).
- Make sure that the vacuum pump is placed on or fastened to a horizontal surface.
- Make sure that the vacuum pump is level.
- Make sure that the vacuum pump is at least 1 m away from any wall to ensure good cooling.
- Make sure that the vacuum pump is easily accessible and that the selected installation site fulfills the requirements for assembly/dismantling.
- Make sure that no temperature-sensitive parts (for example, of plastic, wood, cardboard, paper, electronic parts) come into contact with the hot surfaces of the vacuum pump.
- Make sure that the installation site or assembly area is ventilated in such a way that adequate cooling of the vacuum pump is ensured.

**CAUTION**

The surface temperature of the vacuum pump can exceed 50°C when the vacuum pump is in operation.

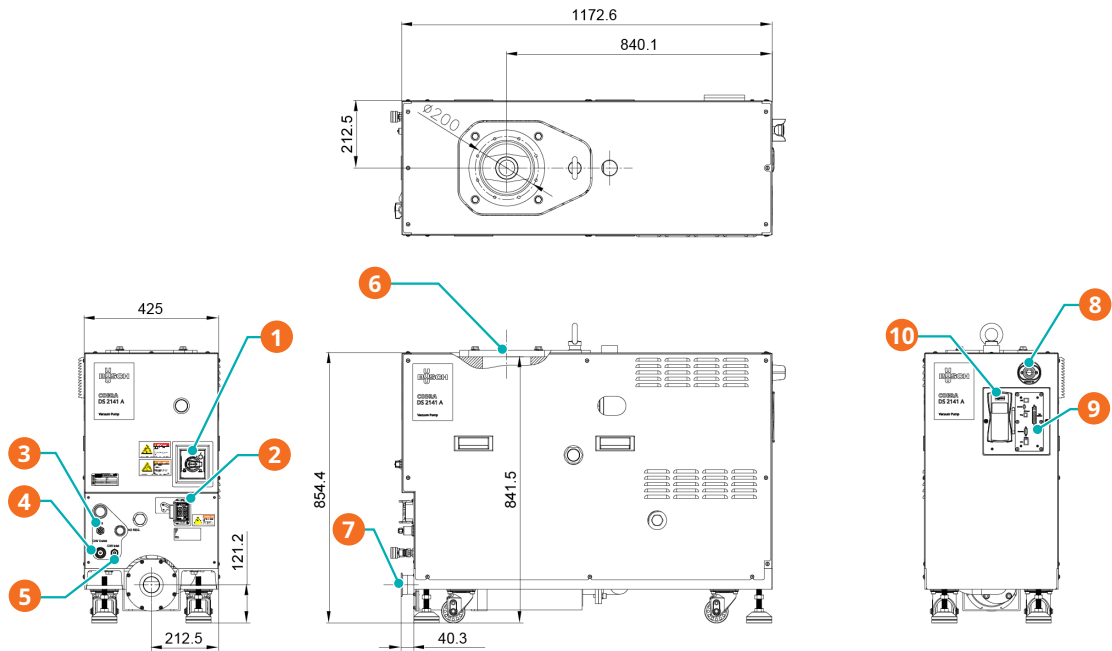
Danger of burns!

- Make sure that no-one can touch the vacuum pump accidentally. If necessary, attach safeguard.
- Make sure that the oil sight glasses (OSG1,2,3,4) are easily accessible.

If oil changes are to be made on site:

- Make sure that the oil drain and oil filler are easily accessible.

6.1.2 Dimensional Drawing



Description			
1	Interrupter main	2	Power connector
3	Nitrogen inlet 1/4"	4	Cooling water outlet 3/8"
5	Cooling water inlet 3/8"	6	Inlet DN 160 ISO-K
7	Outlet DN 50 ISO-KF	8	Emergency stop
9	Remote Control (moveable)	10	Busch PLC

- Make sure that the vacuum pump is at least 1 meter away from any wall to ensure good cooling.
- Before any maintenance action, ensure a safety perimeter of at least 610 [mm] around the vacuum pump.

6.1.3 Inlet Connection

- Make sure that the protection that was attached to prevent penetration of particles during transport has been removed before the vacuum pump is connected to the vacuum line



Do not put hands into the inlet aperture!
Risk of body damage!



The intake of liquids or solid particles can lead to the destruction of the vacuum pump.

If the sucked gas contains dusts or solid foreign bodies:

- Make sure that a filter or protective grating is installed at the extraction point.
- Make sure that the nominal diameter of the intake line is at least equal to the diameter of the intake flange of the vacuum pump to prevent a drop in the performance of the vacuum pump in the case of a smaller cross-section
- Make sure that the vacuum pump is connected with leakproof lines.



CAUTION

When the intake lines have been connected, make sure that the system does not leak.

Leakages of dangerous substances must be prevented!

- Make sure that the intake lines are equipped with a shut-off device upstream of the intake flange so that the flow of sucked gas can be stopped.
- Make sure that the intake lines do not exercise any force on the intake flange. Mount bellows if necessary.
- The inlet flange has the following dimension:
 - DN 160 ISO-K

In the case of long intake lines, the line cross-section should be larger than the intake flange to prevent a drop in the performance of the vacuum pump. If you have any doubts, contact your Busch representative.

6.1.4 Discharge Connection

- Make sure that the protection that was attached to prevent penetration of particles during transport has been removed before the vacuum pump is connected to the vacuum line



CAUTION

Do not put hands into the outlet aperture!

Risk of body damage!

The following instructions for connection to the discharge only apply if the sucked gas is discharged by the vacuum pump into a suitable environment.

- Make sure that the nominal diameter of the exhaust line is at least equal to the diameter of the exhaust flange of the vacuum pump to prevent a drop in the performance of the vacuum pump in the case of a smaller cross-section
- Make sure that the vacuum pump is connected with leakproof lines.



CAUTION

When the discharge lines have been connected, make sure that the system does not leak.

Leakages of dangerous substances must be prevented!

- Make sure that the discharge line is mounted in such a way that condensate cannot penetrate into the vacuum pump (siphon trap, gradient).
- Make sure that no shut-off devices are mounted in the discharge line.

- Make sure that the discharge lines do not exercise any force on the discharge flange. Mount bellows if necessary.
- The discharge flange has the following dimension:
 - DN 50 ISO KF

In the case of long discharge lines, the line cross-section should be larger than the discharge flange to prevent a drop in the performance of the vacuum pump. If you have any doubts, contact your Busch representative.

6.1.5 Cooling Water Connection

The cooling water is generally connected with a hose.
The cooling water outlet must be unpressurised.

Connection diameter	3/8 NPT
---------------------	----------------

6.1.6 Nitrogen Connection

The nitrogen is connected with a pipe (leakproof against oxygen).

Connection diameter	1/4 NPT
---------------------	----------------

6.1.7 Electrical Connection/ Checks

- Make sure that the regulations of the Electromagnetic Compatibility Directive 2014/30/EU as well as standard EN norms, safety directives and especially local and national regulations are observed, (this is the responsibility of the manufacturer of the system into which the vacuum pump is integrated according to the EU-Declaration of Conformity).
- Make sure that the main power supply corresponds to the data on the nameplate of the motor.
- Make sure that an overload cut-out according to EN 60204-1 is provided for the motor.
- Make sure that the drive of the vacuum pump is not disturbed by any electric or electromagnetic interferences. If you have any doubts, contact your Busch representative.

6.2 Installation

6.2.1 Mounting

- Make sure that the "Necessary installation instructions" are followed.
- Fasten or install the pump at its final installation site.

6.2.2 Electrical Connection



WARNING

Risk of electrocution, risk of damage.

Electrical installation must be performed by a suitably qualified electrician who knows and follows the following regulations:

- IEC 364 or CENELEC HD 384 or DIN VDE 0100,
- IEC Report 664 or DIN VDE 0110,
- VBG 4 or corresponding national regulations on accident prevention.



CAUTION

The circuit diagrams described below conform to the standard. Other circuit diagrams might be used. This depends on the particular order and the market.

Risk of damage to the motors!

Check the connection of the motors inside the terminal box according to the circuit diagram.

Motor of screw pump DS is connected at factory.

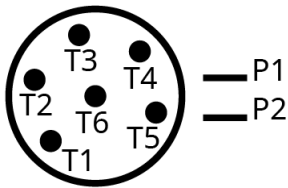


CAUTION

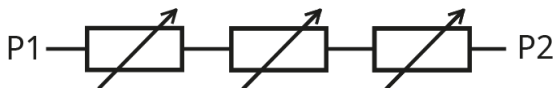
When connecting up the wires into the terminal box: please make sure the tightening torque of 2 Nm is adhered to and check with a calibrated torque wrench (Nuts M6).

DP Motor Connection

Motor connectors:



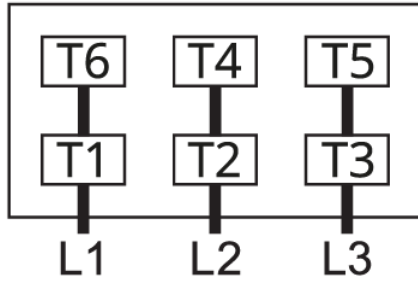
Connection of motor temperature switch (recommended):



Only apply voltages $\leq 2.5\text{ V}$

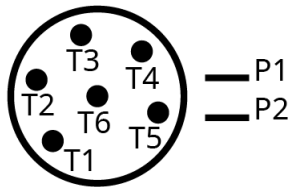
MTS = Motor temperature switch (in motor coil)

Delta connection (low voltage):

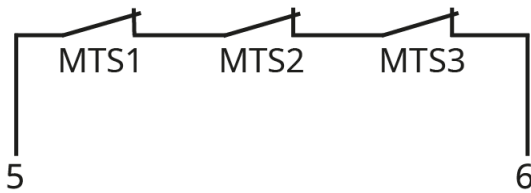


MB Motor Connection

Motor connectors:



Connection of motor temperature switch (recommended):

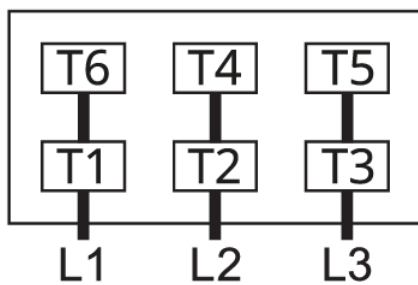


Control voltage: ≤ 250 V

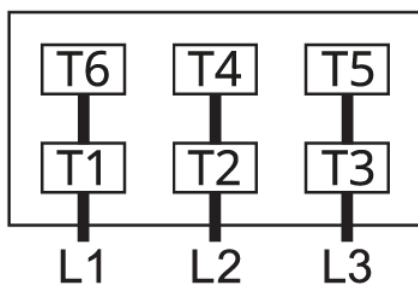
Max current: 1.6 A

MTS = Motor temperature switch (in motor coil)

Delta connection (low voltage):



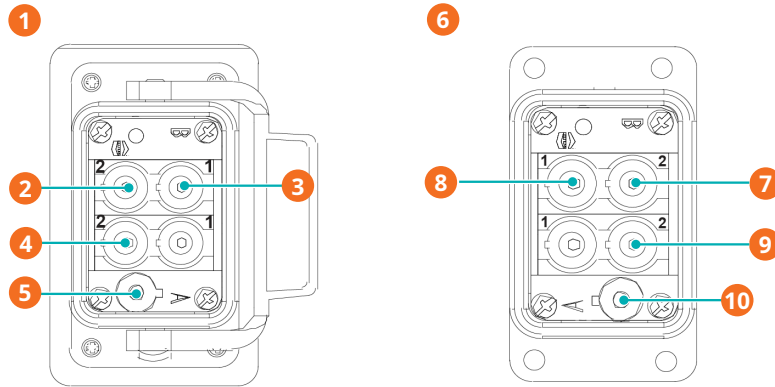
Star connection (high voltage):



6.2.2.1 Power Wiring Connection

Power wiring 4 poles	
1	Phase L1
2	Phase L2
3	Phase L3
4	Ground

6.2.2.2 Power Connector on Rear Side



Description			
1	Pump side	2	Phase L1 (Pump side)
3	Phase L2 (Pump side)	4	Phase L3 (Pump side)
5	Ground (Pump side)	6	Mating connectors
7	Phase 1 (Mating connectors)	8	Phase 2 (Mating connectors)
9	Phase 3 (Mating connectors)	10	Ground (Mating connectors)

- Protect the vacuum pump with the electrical device according to the rated current of the vacuum pump.

Pump side

Supplier	Part description	Part number
HARTING	Housing 6B, 1 Lever	0680700058
HARTING	Frame 6B, Marking a...f	0680700064
HARTING	Insert 70A, 6~16SQ, Male	0676700050

Mating connectors

Supplier	Part description	Part number
HARTING	Housing 6B, Top Entry, M25, 1 Lever	0680800044
HARTING	Frame 6B, Marking a...f	0680700063
HARTING	Insert 70A, 6~16SQ, Female	0676700049

CAUTION

If the vacuum pump is operated with a motor that turns in the wrong direction, it can be destroyed, even if this is the case for only a short moment.

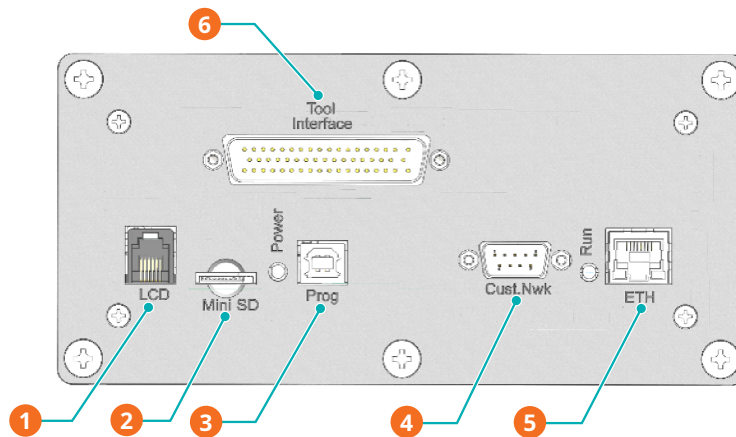
- Make sure that the vacuum pump is connected correctly before switching it on.

- Determine rotation sense of the motor by using a phase rotation tester.
- Press on the start button.
- Make sure that the vacuum pump draws in.
- If not, push the Emergency stop button.

If the direction of rotation must be changed:

- Exchange two of the three feeder leads.

6.2.3 Equipment Connections (with Options)



Description			
1	LCD serial wiring (RJ12), LCD	2	Micro SD slot
3	PC serial wiring (only for Busch engineers)	4	Customer Network, Communication modbus RTU RS 232/ RS 485
5	Ethernet network connection (Busch Monitoring System - Option)	6	Interface connection (50 poles) / PID Interface

The information concerning the use of the Busch PLC and the Busch LCD can be found in the Operation and Maintenance manual (Art. No. 0870758077).

6.2.4 Connection of Lines/ Pipes

- Connect the intake lines.
- Connect the discharge lines.
- Make sure that all caps, safeguards, and similar covers are mounted.
- Make sure that the inlet and outlet for the cooling air are not covered or closed and that the flow of cooling air is not impaired in any way.

6.2.5 Oil Filling

NOTE

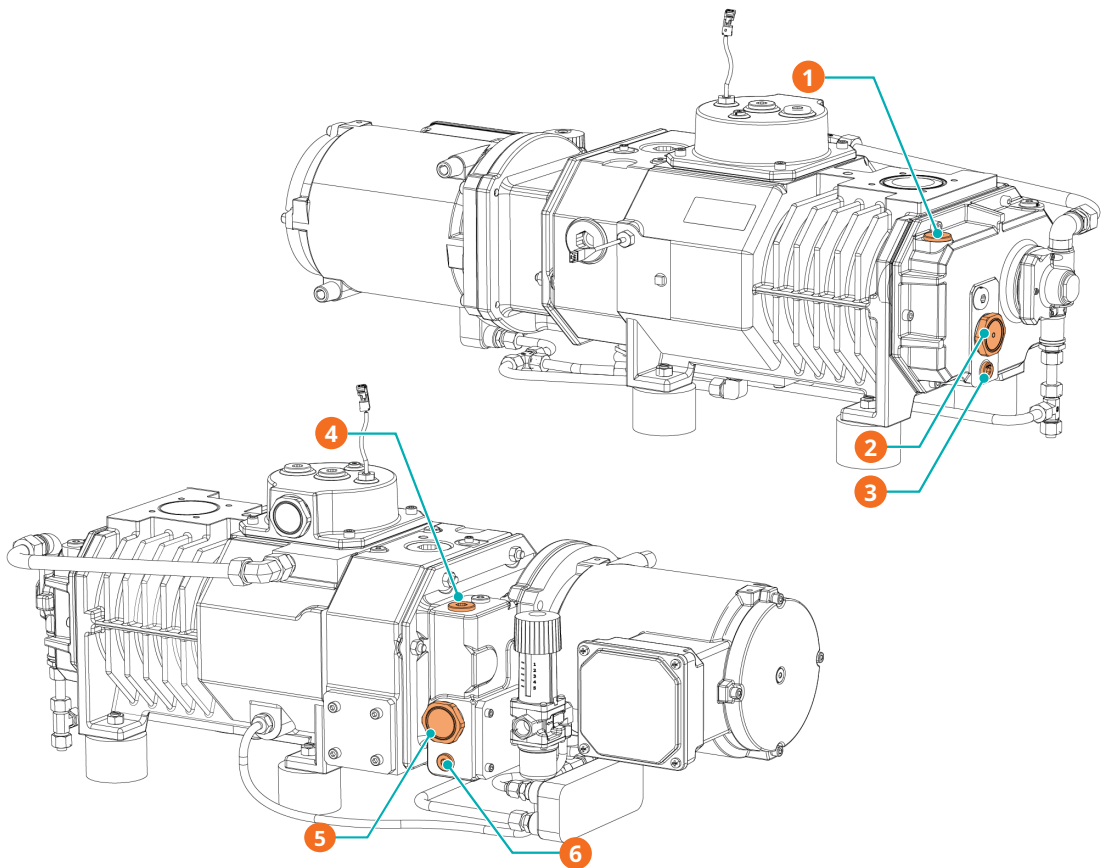
The COBRA DS vacuum pumps are generally dispatched with oil already in the vacuum pump. Before vacuum pump first startup, control the oil level.

In the event of absence of one or the other of these lubricants, please carry out the filling (see "Oil Type/ Quantity [→ 55]" for information on the recommended oils).

- Prepare the quantity of oil specified in the table "Oil Quantity [→ 55]".

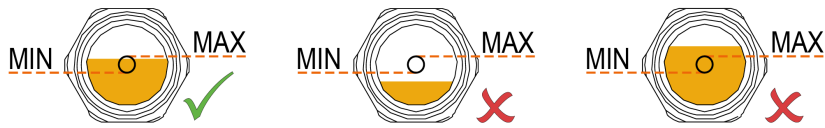
Oil filling	NS 0350 A	WY 1251 B
Oil quantity (Liter)	1,6	1,4
Oil type	Busch YLC 250 B, Art. No. 0831 131 400 (0,5 l ≈ 1 kg)	

6.2.5.1 COBRA NS 0350 A Oil Filling



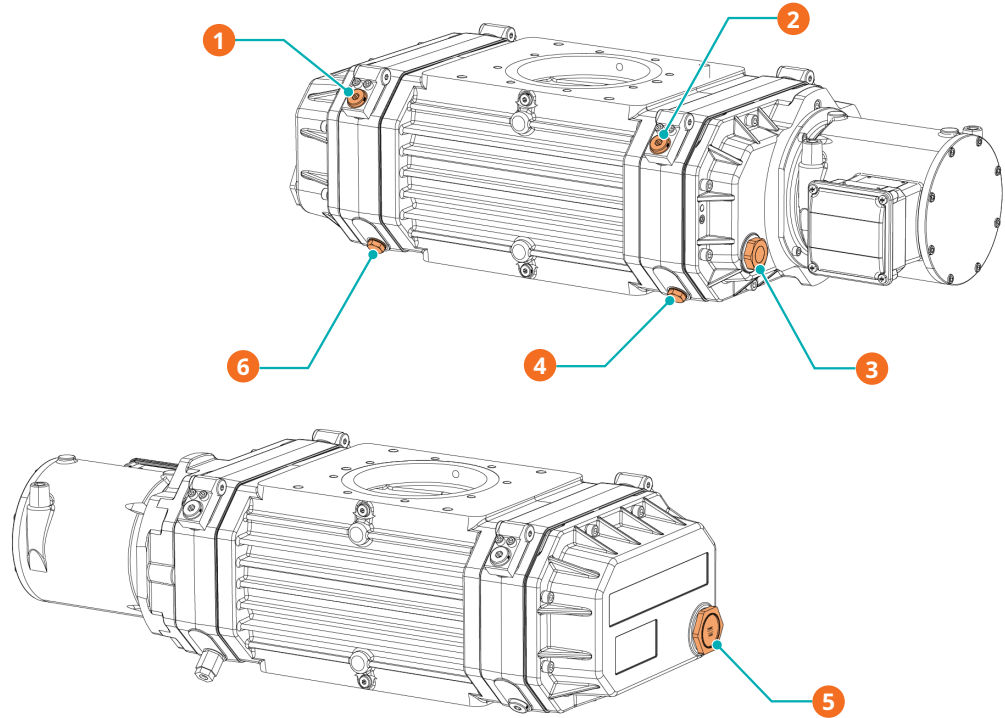
Description	
1	Oil fill plug B-side (OFP)
2	Oil sight glass (OSG)
3	Oil drain plug (ODP)
4	Oil fill plug A-side (OFP)
5	Oil sight glass (OSG)
6	Oil drain plug (ODP)

- Unscrew the oil filler plugs (OFP).
- Fill up to the upper level of the target circle of the oil sight glasses (OSG). Make sure that the filling level is in the target circle of the oil sight glasses (OSG).



- Make sure that the seal ring in the oil filler plugs is not damaged, replace plugs if necessary. Fit the oil filler plugs and tighten up.

6.2.5.2 PUMA WY 1251 B A Oil Filling



Description			
1	Oil fill plug (OFP)	2	Oil fill plug (OFP)
3	Oil sight glass (OSG)	4	Oil drain plug (ODP)
5	Oil sight glass (OSG)	6	Oil drain plug (ODP)



NOTE

The quantity of oil specified in the installation handbook is of informative nature only. Check the oil level with the help of the various oil sight glasses (OSG1,2,3,4) on the vacuum pump.



CAUTION

Before you change the type of oil, make sure that the new type is compatible with the old type. If necessary, flush the vacuum pump.

- Unscrew the oil filler cap (OFP).
- Fill in oil.
- Make sure that the oil level lies between the MIN and MAX markings on the oil sight glasses.
- Make sure that the seals of the oil filler cap are not damaged. Replace them if necessary
- Screw on the oil filler cap hermetically tight.



NOTE

It is easier to switch on the vacuum pump with cold oil when the intake line is not closed or when the intake flange is not covered by a rubber plate.

- Start the vacuum pump.

If the intake line is equipped with a shut-off device:

- Close the shut-off device.

If the intake line is not equipped with a shut-off device:

- Place a rubber plate on the intake flange.
- Let the vacuum pump run for a few minutes.
- Stop the vacuum pump and wait a few minutes.
- Make sure that the oil level still lies between the MIN and MAX markings on the oil sight glasses.

If the oil level is below the MIN marking (Booster):

- Fill in more oil.

If the intake line is equipped with a shut-off device:

- Open the shut-off device.

If the intake line is not equipped with a shut-off device:

- Remove the rubber plate from the intake flange and connect the intake line to the intake flange.



CAUTION

In case of a vacuum pump filled with oil, make sure that by lifting the inclination angle of the vacuum pump do not exceed 5° from the horizontal.

In case of too high inclination (>5°), risk of oil leak within the work area.

- Make sure before every transport using the appropriate lifting mean that the inclination of the vacuum pump is less than 5°.



CAUTION

The vacuum pump must remain in a horizontal position when it has been filled with oil.

6.2.6 Cooling Liquid Filling

i NOTE

The COBRA DS vacuum pumps are generally dispatched with cooling liquid already in the vacuum pump. Before vacuum pump first startup, control the cooling liquid level. In the event of absence of one or the other of these lubricants, please carry out the filling (see “Cooling Liquid Type/ Quantity [→ 56]” for information on the recommended cooling liquids).

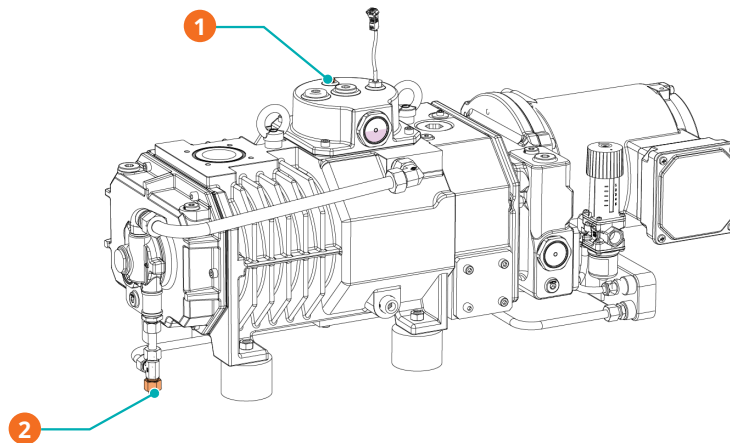
- Prepare the quantity of cooling liquid specified in the table “Cooling Liquid Quantity [→ 56]”.

Cooling liquid filling	NS 0350 A
Cooling liquid quantity (Liter)	5 liters
Cooling liquid type	Glycol (Ethylene), Art. No. 0831 563 469, Zitrec M-25 (already mixed ready-to-use)

6.2.6.1 COBRA NS 0350 A Cooling Liquid Filling

i NOTE

The quantity of cooling liquid specified in the installation handbook is of informative nature only. Respect the procedure of filling the cooling liquid.



Description

1	Cooling liquid fill plug (CLF)	2	Cooling liquid drain (CLD)
---	--------------------------------	---	----------------------------

- Unscrew filler cap (CLF) of cooling liquid on cylinder upper plate.
- Fill in by filler hole until cooling liquid reaches the top of the cylinder upper plate and below the MAX marking of the cooling liquid sight glass (CLG).
- Stop filling in cooling liquid.
- Screw on the filler cap for the cooling liquid again.
- If liquid has run on to the outside surfaces of the vacuum pump, wipe it off.
- Start the vacuum pump.

If the intake line is equipped with a shut-off device:

- Close the shut-off device.

If the intake line is not equipped with a shut-off device:

- Place a rubber plate on the intake flange.
- Let the vacuum pump run for a few minutes.
- Stop the vacuum pump and wait a few minutes.

In case cooling liquid level is below required level:

- Fill in more cooling liquid.

If the intake line is equipped with a shut-off device:

- Open the shut-off device

If the intake line is not equipped with a shut-off device:

- Remove the rubber plate from the intake flange and connect the intake line to the intake flange.

6.2.7 Direct Cooling Checking

The flow of the cooling water is checked by the flow meter CWM1. The flowmeter must be connected in such a way that switching-on leads to a warning at 7 l/min, when the flow drops below 6,5 l/min, the vacuum pump must be stopped.

6.2.8 Nitrogen Supply Checking

The flow of the nitrogen is checked by the flowmeter FME. The flowmeter must be connected in such a way that switching-on leads to an alarm. The alarm limit can be adjusted depending the type of process.

6.2.9 Operating Parameters Saving

As soon as the vacuum pump is working under normal conditions after being switched on:

- Measure the working current of the motor and save it as reference value for all future maintenance and repair work.

6.3 Recommendations on Operation

6.3.1 Application



WARNING

The vacuum pump is designed for use under the conditions specified here.

If these conditions are not met, there is a risk of damage to or total destruction of the vacuum pump and its components!

The vacuum pump may only be switched on under the specified conditions.

The COBRA DS vacuum pumps are designed for use in the field of microelectronics and similar industries.

They can be used to suck gases and gas mixtures.



WARNING

When using toxic, inflammable and/or explosive gases, make sure that the system corresponds in design to applicable local and national safety regulations and that all applicable safety measures are followed.

All product-specific safety regulations must be observed.

Solid particles must not get into the vacuum pump. Procedural errors can result in the pump sucking in a certain quantity of liquid. If the pump has sucked in liquid, a short drying time is necessary at the end of the procedure.

The allowed maximum inlet gas temperature depends on the inlet pressure and the type of gas: the lower the inlet pressure (Pa), the higher the drawn gas temperature (T_{Gas}) can be.

The following indicative values for air can be considered:

Pa > 50 mbar	T _{Gas} < 80°C
Pa < 50 mbar	T _{Gas} < 200°C

The vacuum pump is intended for use in a potentially non-explosive environment.

- Make sure that the maximum permissible number of starts does not exceed 6 starts per hour. Those starts should be spread within the hour.

As far as temperature is concerned, the pump is suitable for continuous duty at any pressure between atmosphere and ultimate pressure.

The vacuum pump is tight down to ultimate pressure.



CAUTION

The surface temperature of the vacuum pump can exceed 50 °C when the vacuum pump is in operation.

Danger of burns!

The vacuum pump may not be touched when it is in operation. If touching the pump is unavoidable, wait until the surface temperature has cooled down or wear protective gloves.



CAUTION



The sound level of the vacuum pump within a certain perimeter of the vacuum pump is high. Risk of hearing damage.

Users who are spending a longer period in the vicinity of a non-insulated vacuum pump must wear suitable ear protection.



CAUTION

The COBRA DS vacuum pumps could be delivered without oil, without cooling water and without cooling liquid.

Operation without oil will result in damage to the vacuum pump!

The vacuum pump must remain in a horizontal position when it has been filled with oil.



CAUTION

The COBRA DS vacuum pumps are always delivered without oil, without cooling water and without cooling liquid.

Operation without coolants will result in damage to the vacuum pump!



CAUTION

The cooling water flow, which is checked by the flow meter CWM1, must be at least 7 l/min.

- Make sure that all caps, safeguards, and similar covers are mounted.
- Make sure that the safeguards are switched on.
- Make sure that the inlet and outlet for the cooling air are not covered or closed and that the flow of cooling air is not impaired in any way.
- Make sure that the system does not leak. Leakages of dangerous substances must be prevented.
- Make sure that the "Necessary installation instructions" are followed and especially that adequate cooling is ensured.

The following must be noted when the vacuum pump is shut down for a longer period of time:



CAUTION

If there is a risk of frost, all the cooling water must be drained out of the vacuum pump if the pump is shut down for a longer period of time!

- Drain the cooling liquid.
 - Unscrew the filler cap for the cooling liquid.
 - Drain the cooling liquid completely.
 - Screw on the filler cap for the cooling liquid again.
 - Collect the cooling liquid and recycle it or dispose of it according to local or national regulations.
- Drain the cooling water
 - Pull off the connections for the inlet and outlet of the cooling water.
 - Drain the cooling water completely.
 - If necessary, drain the cooling water with the help of compressed air to prevent any risk of frost or corrosion.



NOTE

When the vacuum pump has not been in operation for a few days or when a sticky substance has been sucked, it is possible that the two scroll rotors of the NS (DP) vacuum pump will stick to each other. Screw opens the access cover to the scroll rotors. Loosen the rotors from each other with the help of an Allan key by turning them in clockwise direction by hand.

6.3.2 Switching the Vacuum Pump On/ Off

6.3.2.1 First Start-up of the System

- Make sure that the “Necessary installation instructions” are followed.

If the system is equipped with a solenoid gate valve in the cooling water circuit:

- Open the solenoid gate valve.
- Make sure that the cooling water flow is set correctly:
 - The cooling water flow is factory set on 7 l/min and can be adjusted at the regulating valve CWR. This water circuit is used to cool the motor of the NS pump. It cools also the cylinder and cylinder endplate B-side when temperature of cooling liquid is above 50°C.
- Make sure that the nitrogen flow is set correctly_
- Nitrogen is used as dilution gas. It is injected inside the cylinder. Nitrogen flow FME injected on cylinder endplate side is preset at 12 SLM and can be adjusted with valve DGR1, depending on the application. When flow is too low a warning then an alarm signal is generated by flowmeter FME to the PLC. Status of the pump depends on the alarm function set by user (factory setting: None, pump continues running with an alarm). Dilution improves the screws functioning, especially when sucking corrosive gases.
- Switch on the vacuum pump.
 - Make sure that the system does not leak.

If the system is equipped with a solenoid gate valve at the intake:

- Open the solenoid gate valve.

6.3.2.2 Switching the System Off

If the system is equipped with a solenoid gate valve at the intake:

- Close the solenoid gate valve.
- Switch off the vacuum pump.
- Shut off the nitrogen supply.
- Shut off the cooling water supply.

If the system is equipped with a solenoid gate valve in the cooling water circuit:

- Close the solenoid gate valve.
- Make sure that the system is current less.

7 Maintenance



DANGER

Live wires.

Risk of electrical shock.

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



DANGER



In case the vacuum pump has conveyed gases that have been contaminated with foreign materials that are dangerous to health, the oil and condensates will also be contaminated.

These foreign materials can infiltrate the pores, recesses, and other internal spaces of the vacuum pump.

Danger to health when the vacuum pump is dismantled.

Danger to the environment.

Always wear protective clothing when carrying out maintenance work.

Before any maintenance work, the inlet and outlet piping as well as the vacuum pump itself must be flushed with nitrogen.



CAUTION

Only authorized personnel may carry out dismantling work on the vacuum pump. Before work begins, the operator of the vacuum pump must fill in a form or a "Declaration of Contamination of Vacuum Equipment and Components" that provides information on possible dangers and appropriate measures.

If this form has not been filled in completely and signed, the vacuum pump may not be dismantled.



CAUTION

Before maintenance work is started, a safety area of at least 610 [mm] around the machine must be set up.



CAUTION

The surface temperature of the vacuum pump can exceed 50 °C when the vacuum pump is in operation.

Danger of burns!

The vacuum pump may not be touched when it is in operation. If touching the pump is unavoidable, wait until the surface temperature has cooled down or wear protective gloves.

Before starting maintenance work, make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally. Follow the shutdown procedure in the section "Lock Out/ Tag Out Procedure [→ 41]":

- Stop the pump with the LCD control (press on STOP button during 10s).
- Press on emergency stop button.
- Switch off the main circuit breaker.
- Switch off the customer's power supply.
- Switch off the water and nitrogen quick connections (inlet first, then outlet).
- Put the label or warning board "Maintenance processing" on or next to the vacuum pump.



CAUTION

The oil temperature can reach a value of 100°C!

The cooling liquid temperature can reach a value of 100°C!

Danger of burns!

- Make sure that the oil circuit and the coolant circuit have been emptied before moving the vacuum pump.
- Make sure that there are no cleaning tools in the pump anymore according to local and national regulations.

Before pulling off the different connections, make sure that the intake and exhaust lines of the vacuum pump correspond to atmospheric pressure

When the maintenance work has been finished, follow the procedure "*Safety Lockout Procedure* [→ 41]":

- Take off the label or warning board "Maintenance Processing".
- Check the cooling liquid and oil levels according to the chapters "*Oil Level Checking* [→ 42]" and "*Cooling liquid Level Checking* [→ 46]".
- Switch on the main circuit breaker.
- Release the emergency stop button.
- Switch on the water and nitrogen quick connections (outlet first, then inlet).
- Make sure that the "Necessary Installation Instructions" are followed.
- Start the pump with the LCD control (press on START button).

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 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
Weekly	<ul style="list-style-type: none"> • Check the oil level, see “<i>Oil Level Checking</i> [→ 42]”. • Check the cooling liquid, see “<i>Cooling Liquid Level Checking</i> [→ 46]”. • Check the cooling water flow, see “<i>Cooling Water</i>” in “<i>Additional Checking</i> [→ 48]”. • Check the nitrogen flow, see “<i>Nitrogen in “Additional Checking</i> [→ 48]”. • Check the vacuum pump for oil leaks - in case of leaks have the vacuum pump repaired (contact Busch). • Check the vacuum pump for cooling liquid leaks - in case of leaks have the vacuum pump repaired (contact Busch). • Check the vacuum pump for cooling water leaks - in case of leaks have the vacuum pump repaired (contact Busch).
Monthly	<ul style="list-style-type: none"> • In the case of operation in a dusty environment: <ul style="list-style-type: none"> • Make sure that the operating room is clean and free of dust; clean if necessary. • Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally. • Check the electrical connections. • Carry out a visual inspection of the vacuum pump.
Yearly	<ul style="list-style-type: none"> • Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally. • Carry out a visual inspection and clean the machine from dust and dirt • Check the electrical connections and the monitoring devices. • Check the seals and replace if necessary. • Check the intake and discharge lines and clean or replace if necessary.

Interval	Maintenance work
Yearly If one or more of these accessories are installed.	<ul style="list-style-type: none"> ● If the intake is equipped with a sieve: <ul style="list-style-type: none"> ● Check the sieve at the intake and clean if necessary. ● Check the measuring and safety equipment for working order. ● If the discharge is equipped with a silencer (SI): <ul style="list-style-type: none"> ● Bleed the condensation of the silencer (SI) through the purge system ● If the discharge is equipped with a leak-protection non-return valve: <ul style="list-style-type: none"> ● Clean the leak-protection non-return valve. ● Drain the cooling liquid (see <i>"Cooling Liquid Draining [→ 47]"</i>). ● Check the ventilator filter (RF), clean if necessary. ● If the cooling water line is equipped with a filter: <ul style="list-style-type: none"> ● Check the filter and clean or replace if necessary.
Every 5000 hours or after 1 year	<ul style="list-style-type: none"> ● Change the cooling liquid, see <i>"Cooling Liquid Draining [→ 47]"</i>. ● Clean the magnetic plugs (MP).
Every 16000 hours or after 4 years	<ul style="list-style-type: none"> ● Change the oil of the gear and bearing housings (both sides), see <i>"Oil Change [→ 43]"</i>. ● Have a major overhaul on the vacuum pump (contact Busch).

7.1.1 Lock Out/ Tag Out Procedure

- Stop the pump with the LCD control (press on STOP button during 10s).
- Press on emergency stop button.
- Switch off the main circuit breaker.
- Switch off the customer's power supply.
- Switch off the water and nitrogen quick connections (inlet first, then outlet).
- Put the label or warning board "Maintenance Processing" on or next to the vacuum pump.

7.1.2 Safety Lockout Procedure

- Take off the label or warning board "Maintenance Processing".
- Check the cooling liquid and oil levels according to the chapters *"Oil Level Checking [→ 42]"* and *"Cooling Liquid Level Checking [→ 46]"*.
- Switch on the main circuit breaker.
- Release the emergency stop button.
- Switch on the water and nitrogen quick connections (outlet first, then inlet).
- Make sure that the "Necessary Installation Instructions" are followed.
- Start the pump with the LCD control (press on START button).

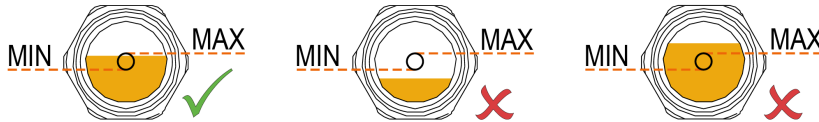
7.2 Oil Checking

7.2.1 Oil Level Checking

Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.

Indication of the oil level on the various oil sight glasses (OSG 1,2,3,4).

Oil level, pump not operating



COBRA NS (DP) vacuum pump:

If the oil level lies below the target circle:

- Top up with oil (see "Refilling oil")

If the oil level exceeds the target circle:

- Check the condensate drain
- Drain the oil (see "Draining the oil")

Booster (MB):

If the oil level lies below the target circle:

- Top up with oil (see "Refilling oil")

If the oil level exceeds the target circle:

- Check the condensate drain
- Drain the oil (see "Draining the oil")

7.2.2 Oil Refilling



NOTE

Oil does not normally have to be refilled outside the recommended oil change intervals. A drop in the oil level indicates a fault (see "Alarms and warnings -> Busch PLC and Busch LCD").



CAUTION

Only fill in oil through the oil filler opening.



CAUTION

Danger of burns when the oil filler cap is open.

Danger of injuries when the oil filler cap is not screwed on properly.

Only unscrew the oil filler cap when the vacuum pump has been switched off.

The vacuum pump may only be switched on when the oil filler cap is properly closed and tight.

We recommend submitting the pump to a leakage rate test in order to ensure the pump is leak tight.

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Unscrew the oil filler cap (OFF).
- Fill up to the upper level of the target circle of the oil sight glasses (OSG) or middle of the oil sight glass (Booster).
- Make sure that the oil level still lies in the target circle or between the MIN and MAX markings (Booster) on the oil sight glasses.
- Make sure that the seals of the filler cap are not damaged and that they sit properly. Replace them if necessary. Screw on the filler cap again.

7.2.3 Oil Color Inspection



WARNING

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

Risk of explosion!

If the oil becomes dark:

- Contact your Busch representative without delay.

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

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

- Change the oil immediately, see Oil Change.



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

7.2.4 Oil Change



DANGER



If the vacuum pump has pumped gases that were contaminated with foreign bodies that are hazardous to health, the oil is also contaminated with these foreign bodies.

There is a health hazard when changing contaminated oil. There is also a danger to the environment.

Wear protective clothing when replacing contaminated oil.

Contaminated oil must be treated specially and must be disposed of according to applicable regulations.

7.2.4.1 Used Oil Draining



NOTE

After switching off the vacuum pump at normal operating temperature wait no more than 20 minutes before the oil is drained.

- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again.
- Make sure that the vacuum pump is vented to atmospheric pressure.

COBRA NS (DP) vacuum pump:

- Put a drain tray underneath the oil drain plugs (ODP).
- Remove the oil drain plugs (ODP).
- Carefully remove the drain plugs.
- Drain the oil.
- Because of wear and tear on the seals replace the current drain plugs with new ones.

When the oil flow has stopped:

- Close the oil drain plugs (ODP).
- Switch on the vacuum pump for a few seconds.
- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again.
- Remove the oil drain plugs again and drain any remaining oil.
- Check that no metal swarf sticks to the magnet of the drain plug, clean if necessary.
- Refit the oil drain plugs and tighten up.
- Dispose of the used oil in compliance with applicable regulations.



CAUTION

Because the ends of the drain plugs are magnetic, metal swarf can stick to them. Always clean away this swarf when removing the drain plugs.

Because of wear and tear of the seals, it is recommended to replace the drain plugs whenever the oil is changed.

Booster (MB):

- Put a drain tray underneath the oil drain plugs (ODP).
- Unscrew the oil drain plugs (ODP).
- Drain the oil.

When the oil flow has stopped:

- Refit the oil drain plugs (ODP) again.
- Switch on the vacuum pump for a brief moment and let it run for a few seconds.
- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again.
- Carefully remove the oil drain plugs again and drain any remaining oil.
- Make sure that the seals of the drain plugs are not damaged and that they sit properly. Replace them if necessary.
- Refit the oil drain plugs and tighten them up.
- Dispose of the used oil in compliance with applicable regulations.

7.2.4.2 New Oil Filling

COBRA NS (DP) vacuum pump:

- Prepare the quantity of oil needed (see "Oil Type/ Quantity [→ 55]").



CAUTION

The use of chemically contaminated or polluted oil can lead to hazardous pump conditions which could cause personal injury.



NOTE

The quantity of oil specified in the Instruction Manual is of informative nature only. Check the oil level with the help of the various oil sight glasses on the vacuum pump.

- Make sure that the drain plugs have been fitted properly and that they do not leak.

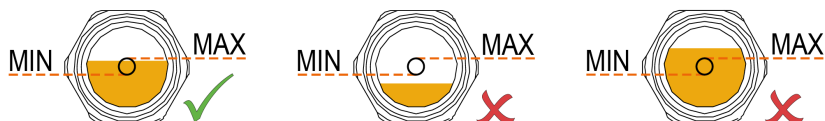


CAUTION

Only fill in oil through the oil filler opening.

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Unscrew the oil filler cap (OFP)

Oil level, pump not operating



- Fill up to the upper level of the target circle of the oil sight glasses (OSG).
- Make sure that the oil level still lies in the target circle of the oil sight glasses.
- Make sure that the seals of the filler cap are not damaged and that they sit properly. Replace them if necessary.
- Screw on the filler cap again.

Booster (MB):

- Prepare the quantity of oil needed (see "Oil Type/ Quantity [→ 55]").



CAUTION

The use of chemically contaminated or polluted oil can lead to hazardous pump conditions which could cause personal injury.



NOTE

The quantity of oil specified in the Instruction Manual is of informative nature only. Check the oil level with the help of the various oil sight glasses on the vacuum pump.

- Make sure that the drain plugs have been fitted properly and that they do not leak.

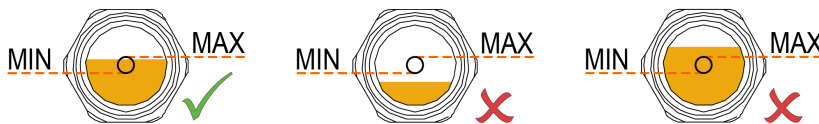


CAUTION

Only fill in oil through the oil filler opening.

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Unscrew the oil filler cap (OFP)

Oil level, pump not operating



- Fill up to the upper level of the target circle of the oil sight glasses (OSG).
- Make sure that the oil level still lies in the target circle of the oil sight glasses.
- Make sure that the seals of the filler cap are not damaged and that they sit properly. Replace them if necessary.
- Screw on the filler cap again.
- Fill up to the upper level of the target circle of the oil sight glasses (OSG) or middle of the oil sight glass (Booster).
- Make sure that the oil level still lies in the target circle or between the MIN and MAX markings (Booster) on the oil sight glasses.
- Make sure that the seals of the filler cap are not damaged and that they sit properly. Replace them if necessary. Screw on the filler cap again.

7.3 Cooling Liquid Checking

7.3.1 Cooling Liquid Level Checking

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Let the vacuum pump cool down.
- Check the level of the cooling liquid.
- Unscrew purge cap (CLV) on cylinder upper plate.
- Cooling liquid level should be just under the plate.

If the level is below:

- Top up with cooling liquid (see "Cooling Liquid Refilling").

7.3.2 Cooling Liquid Refilling



NOTE

Cooling liquid does not normally have to be refilled outside the recommended change intervals. A drop in the level of the liquid indicates a fault (see "Troubleshooting [→ 53]").

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Unscrew the filler cap (CLF) for the cooling liquid.
- Fill in by filler hole until cooling liquid reaches the top of cylinder upper plate and below the MAX marking of the (CLG).
- Stop fill in.
- Screw on the cooling liquid filler cap again.
- If liquid has run on to the outside surfaces of the vacuum pump, wipe it off.

7.3.3 Cooling Liquid Draining

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Make sure that the vacuum pump has adjusted to atmospheric pressure.
- Place a container under the drain plug (CLD) for the cooling liquid.
- Unscrew drain plug of cooling liquid.
- Drain the cooling liquid.

When cooling liquid stops running out:

- Close the drain plug for the cooling liquid.
- Screw the drain plug.
- Switch on the vacuum pump and let it run for a few seconds.
- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally.
- Unscrew the drain plug for the cooling liquid again and drain the remaining liquid.
- Make sure that the seal of the drain plug is not damaged and that it sits properly. Replace it if necessary.
- Screw on the drain plug again.
- Dispose of the used cooling liquid according to applicable environmental protection regulations.

7.3.4 New Cooling Liquid Filling

- Prepare the quantity of cooling liquid needed (see "Cooling Liquid Type/ Quantity [→ 56]").



NOTE

The quantity of cooling liquid specified is of informative nature only. Respect the procedure of filling the cooling liquid.

- Make sure that the drain plug sits properly and does not leak.
- Unscrew the filler cap for the cooling liquid.
- Fill in by filler hole until cooling liquid flows reaches the top of cylinder upper plate and below the MAX marking of the cooling liquid sight glass (CLG).

- Stop fill in.
- Close the drain plug.
- Make sure that the seal of the filler cap is not damaged and that they sit properly. Replace them if necessary.
- Screw on the filler cap again.
- Wipe cooling liquid that may have run on outside surfaces of vacuum pump.
- Start the vacuum pump.

7.4 Additional Checking

Subject	Checking
Cooling Water	<ul style="list-style-type: none"> • Check the cooling water flow. <p>If the flow drops, check for leaks:</p> <ul style="list-style-type: none"> • Make sure that the cooling water specifications are followed.
Nitrogen	<ul style="list-style-type: none"> • Check the nitrogen flow. <p>If the flow drops, check for leaks:</p> <ul style="list-style-type: none"> • Make sure that the nitrogen specifications are followed.
Current Consumption	<ul style="list-style-type: none"> • Check the current intensity of the motor. <p>An increased intensity is an indication for a fault (see "<i>Troubleshooting</i> [→ 53]").</p>
Silencer (Accessory)	<ul style="list-style-type: none"> • Make sure that the condensate does not collect at the exhaust of the vacuum pump. • Drain the condensate at the drain opening and collect it in a container. • Dispose of the condensate according to applicable environmental protection regulations. • Check the silencer regularly and clean it if necessary.
Leak-protection Non-return Valve (Accessory)	<ul style="list-style-type: none"> • Check the leak-protection non-return valve regularly and clean it if necessary.



CAUTION



Wear protective clothing when carrying out maintenance work on the silencer and leak-protection non-return valve.

There could still be residues of contamination.

8 Overhaul



WARNING



The machine is contaminated with hazardous material.

Risk of poisoning!

Risk of infection!

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.



NOTICE

Improper assembly.

Risk of premature failure!

Loss of efficiency!

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

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

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

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

9 Removal from Service



DANGER

Live wires.

Risk of electrical shock.

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



CAUTION

Hot surface.

Risk of burns!

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

9.1 Temporary Removal from Service

Before disconnecting the intake and exhaust lines and switching off the cooling water and nitrogen lines, make sure that the lines have adjusted to atmospheric pressure.

9.2 Recommissioning



CAUTION

After a long period of inactivity, it is possible that the rotor screws of the COBRA NS vacuum pump are stuck.

Turn the rotor screws manually.

- Make sure that the various protective elements, stoppers, or adhesive tapes have been removed.
- Switch on the vacuum pump by following the procedure described in "*Installation and Commissioning* [→ 56]".

9.3 Dismantling and Disposal



DANGER



In case the vacuum pump has conveyed gases that have been contaminated with harmful foreign material which are harmful to health, the oil and the condensates will also be contaminated with harmful foreign material.

These foreign materials can infiltrate the pores, recesses, and other internal spaces of the vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

During dismantling of the vacuum pump protective equipment and clothing must be worn.

Prior to shipping, the vacuum pump must imperatively be decontaminated, and the degree of contamination must be documented in a declaration of decontamination ("Declaration of Decontamination"), which can be downloaded from www.buschvacuum.com.

Used oil and condensates must be disposed of separately in compliance with applicable environmental regulations.

When the product has reached the end of its lifetime:

- decontaminate the vacuum pump.



CAUTION

Only authorized personnel may carry out dismantling work on the vacuum pump. Before work begins, the operator of the vacuum pump must fill in a form or a "Declaration of Decontamination" that provides information on possible dangers and appropriate measures.

If this form has not been filled in completely and signed, the vacuum pump may not be dismantled.

- drain the oil.
- dispose of the oil according to local environmental protection regulations.
- drain the cooling liquid.
- dispose of the cooling liquid according to local environmental protection regulations.
- begin dismantling the vacuum pump.



CAUTION



During dismantling of the vacuum pump protective equipment and clothing must be worn.

- dispose of the vacuum pump as scrap metal.
- dispose of the individual parts of the machine according to local regulations.

A lithium battery is present inside the PLC:

- eliminate the lithium battery according to local and national regulations in place, relating to environment.

10 Spare Parts



NOTICE

Use of non-Busch genuine spare parts.

Risk of premature failure!

Loss of efficiency!

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

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

If you require Busch genuine parts:

- Contact your Busch representative.

11 Troubleshooting



DANGER

Live wires.

Risk of electrical shock.

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



CAUTION

Hot surface.

Risk of burns!

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

Problem	Possible Cause	Remedy
The machine does not start.	The motor is not supplied with the correct voltage.	<ul style="list-style-type: none"> • Check the power supply.
	The rotors are jammed or seized.	<ul style="list-style-type: none"> • Turn the screw rotors manually from the rotor access plug (PMR). • Repair the machine (contact Busch).
	Solid foreign matter has entered the machine.	<ul style="list-style-type: none"> • Remove the solid foreign matter or repair the machine (contact Busch). • Install an inlet filter if necessary.
	A temperature sensor has reached the switch point.	<ul style="list-style-type: none"> • Let the machine cool down. • See problem "The machine runs too hot".
	Corrosion in the machine from remaining condensate.	<ul style="list-style-type: none"> • Repair the machine. • Check the process and follow the recommendation in case of Conveying Condensable Vapours.
	The motor is defective.	<ul style="list-style-type: none"> • Replace the motor.

Problem	Possible Cause	Remedy
The machine does not reach the usual pressure on the suction connection.	Suction or discharge lines too long or section diameter too small.	<ul style="list-style-type: none"> • Use larger diameter or shorter lines. • Seek advice from your local Busch representative.
	Process deposits on the pumping components	<ul style="list-style-type: none"> • Flush the machine.
	If an inlet screen or an inlet filter is installed, it can be partially clogged.	<ul style="list-style-type: none"> • Clean the inlet screen or replace the inlet filter cartridge.
	The machine runs in the wrong direction.	<ul style="list-style-type: none"> • Check the direction of rotation, see Wiring Diagram Three-Phase Motor (Pump Drive).
	Internal parts are worn or damaged.	<ul style="list-style-type: none"> • Repair the machine (contact Busch).
The machine runs very noisily.	Wrong oil quantity or unsuitable oil type.	<ul style="list-style-type: none"> • Use one of the recommended oils in the correct quantity, see Oil.
	Defective gears, bearings or coupling element.	<ul style="list-style-type: none"> • Repair machine (contact Busch).
The machine runs too hot.	Insufficient cooling.	<ul style="list-style-type: none"> • Make sure to comply with the cooling water requirements, see Cooling Water Connection.
	Ambient temperature too high.	<ul style="list-style-type: none"> • Observe the permitted ambient temperature, see Technical Data.
	Temperature of the process gases at the inlet too high.	<ul style="list-style-type: none"> • Observe the permitted gas inlet temperature, see Technical Data.
	The cooling water pump is defective.	<ul style="list-style-type: none"> • Repair the machine.
	Oil level too low.	<ul style="list-style-type: none"> • Top up oil.
The oil is black.	Oil change intervals are too long.	<ul style="list-style-type: none"> • Drain the oil and fill in new oil, see Oil Change.
	The machine runs too hot.	<ul style="list-style-type: none"> • See problem "The machine runs too hot".

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

12 Oil Type/ Quantity

12.1 Oil Type

Make sure that the oil type corresponds to specifications:

YLC 250 B	
Part number 0.5 L packaging (~1 kg)	0831 131 400
Part number 1.0 L packaging (~2 kg)	0831 108 878
Part number 5.0 L packaging (~10 kg)	0831 108 879



CAUTION

The use of chemically contaminated or polluted oil can lead to hazardous pump conditions which could cause personal injury.

12.2 Oil Quantity

The quantity of oil specified in the following table is of informative nature only. Check the oil level with the help of the various oil sight glasses on the vacuum pump.

Quantity (l)	Motor side (A)	Inlet side (B)
NS 0350 A	1,15	0,45
Quantity (l)	Motor side (A)	Gear side (B)
WY 1251 B	0,6	0,8

13 Cooling Liquid Type/ Quantity

13.1 Cooling Liquid Type

Make sure that the Cooling Liquid type corresponds to specifications:

Zitrec M-25 (ready-to-use)	
Part number 25 L packaging	0831 563 468
Part number 5 L packaging	0831 563 469

The cooling liquid Zitrec M-25 is ready-to-use and does not require additional water.

For further information, consult the website www.arteco-coolants.com.

13.2 Cooling Liquid Quantity

The quantity of cooling liquid specified in this Instruction Manual is of informative nature only. Respect the procedure of filling the cooling liquid.

Cooling liquid filling	NS 0350 A
Cooling liquid quantity (Liter)	5 liters
Cooling liquid type	Glycol (Ethylene), Art. No. 0831 563 469, Zitrec M-25 (already mixed ready-to-use)



CAUTION

The proportion of pure glycol and water for the cooling liquid corresponds to a percentage of 40% pure glycol and 60% water. It is therefore not necessary to prepare the mix before use. But when using pure glycol, it is imperative to prepare the mix prior to filling the vacuum pump and to respect this proportion.

14 Technical Data

DS 2141 A		
Nominal pumping speed	m ³ /h	1875
Ultimate pressure	TORR	0.00225
	hPa (mbar)	0.003
Nominal motor rating backing pump	kW (72 Hz)	7.9
Nominal motor rating vacuum booster	kW (90 Hz)	4.0
Power consumption at ultimate pressure	kW (MB: 90 Hz; DP: 60 / 85 Hz)	5.0
Maximal intensity Δ	A	35
Nominal motor speed backing pump	min ⁻¹ (72 Hz)	4320
Nominal motor speed vacuum booster	min ⁻¹ (90 Hz)	5400
Noise level (ISO 2151) *	dB(A)	< 75
Ambient temperature range	°C	0 - 40
	°F	32 - 104
Maximum allowable counter pressure at discharge	hPa (mbar)	200
Water consumption	l/min	min. 7.0 - 8.0
Cooling water temperature	°C	10 - 25
Cooling water pressure	bar / ΔP	2 - 5
Nitrogen consumption	l/min	0 - 75
Nitrogen overpressure	bar	1.5
Weight approx.	kg	600

* with silencer at exhaust

15 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

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

declares that the machine: COBRA DS 2141 A

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

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

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

Standards	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN 1012-2 : 1996 + A1 : 2009	Vacuum pumps - Safety requirements - Part 2
EN ISO 2151 : 2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN IEC 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments

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

Busch Dienste GmbH
Schauinslandstr. 1
DE-79689 Maulburg

Icheon-si, 29.06.2023



Seung-hwa Yoo

General Manager

Busch Manufacturing Korea, Ltd

16 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

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

declares that the machine: COBRA DS 2141 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
EN 1012-2 : 1996 + A1 : 2009	Vacuum pumps - Safety requirements - Part 2
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EN 60204-1 : 2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN IEC 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments
EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments

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

Busch (UK) Ltd
30 Hortonwood
Telford - UK

Icheon-si, 29.06.2023



Seung-hwa Yoo

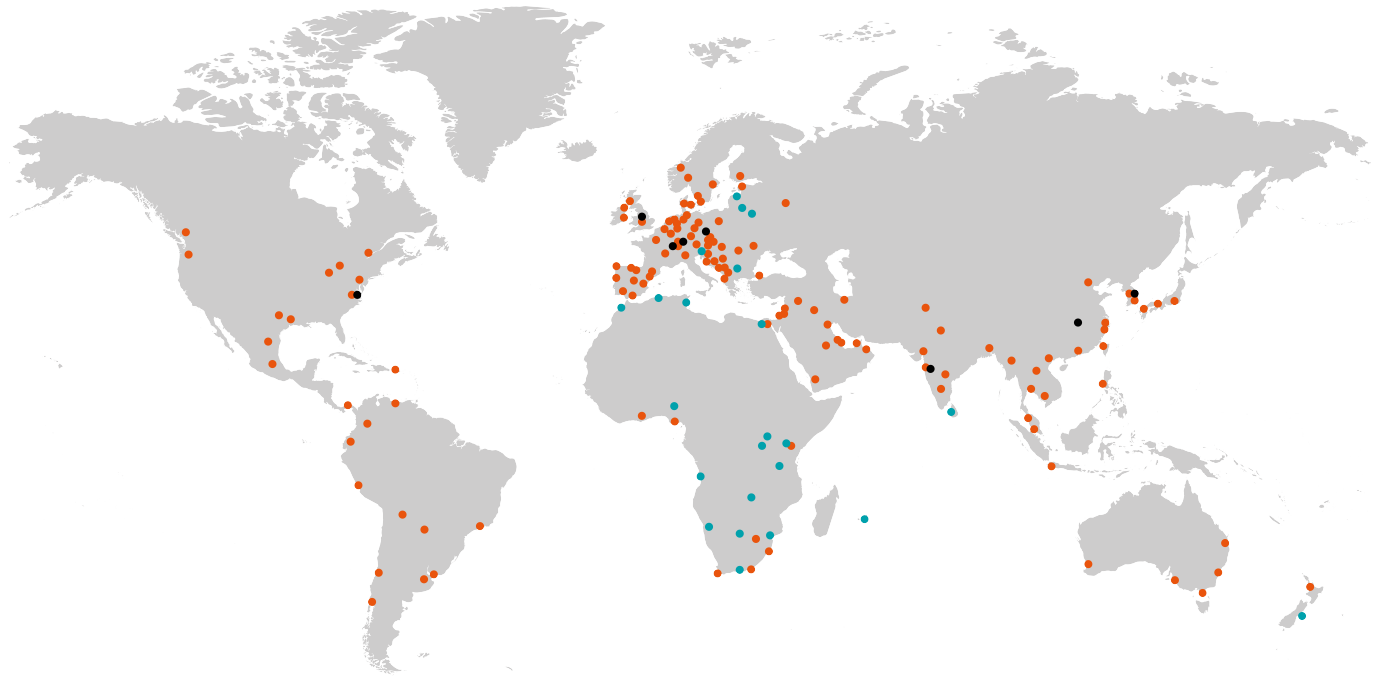
General Manager

Busch Manufacturing Korea, Ltd

Busch

Vacuum Solutions

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



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

www.buschvacuum.com