

Installation and Maintenance Instructions



Screw Vacuum Pumps

COBRA NC 0630 C

VR - Vapour recovery

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VACUUM APP

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Introduction

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

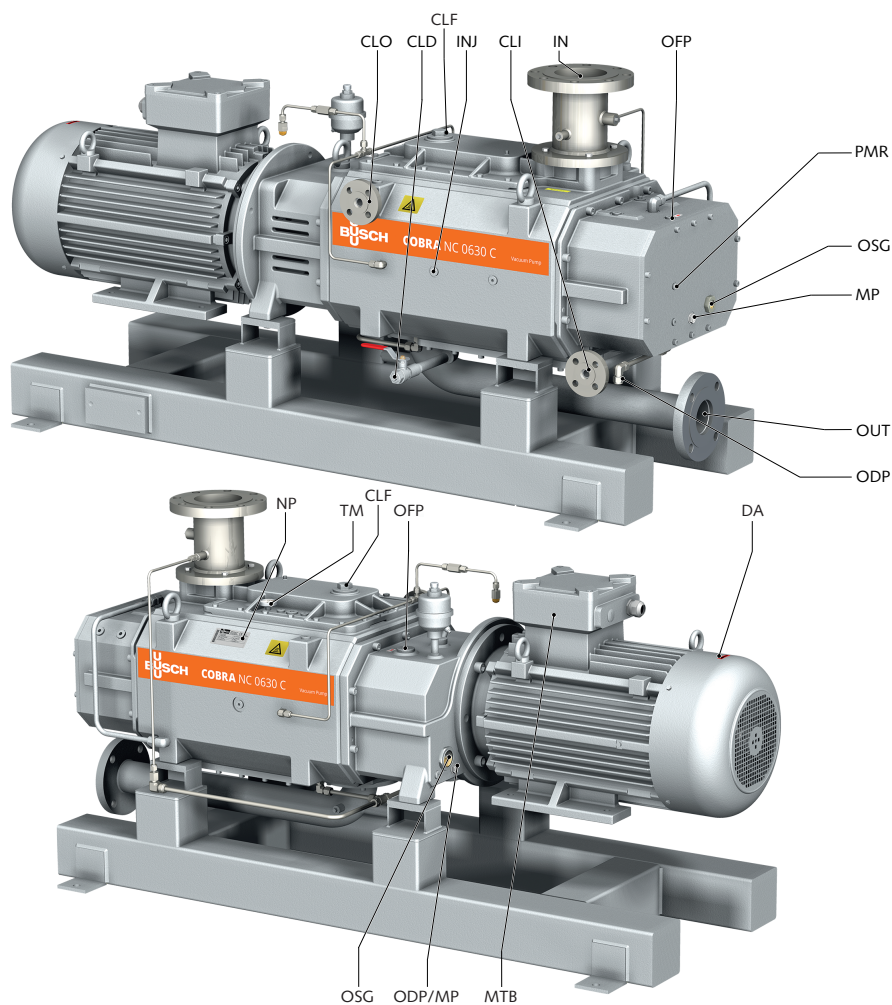
- product description,
- security,
- transport,
- storage,
- installation and commissioning,
- maintenance,
- overhaul,
- troubleshooting

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 system, 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.



CLD	Cooling liquid drain
CLI	Cooling liquid inlet
CLO	Cooling liquid outlet
CLF	Cooling liquid filler plug
DA	Directional arrow
IN	Inlet connection
INJ	Injection point for injected liquid
MTB	Motor terminal box
NP	Nameplate
ODP	Oil drain plug
OFP	Oil fill plug
OSG	Oil sight glass
OUT	Discharge connection
PMR	Plug for manual rotation of rotors
SV	Safety valve
TM	Thermometer

Product Description

Use

The COBRA NC vacuum pumps are designed for use in the field of industrial applications and similar industries.

They can be used to draw gases and gas mixtures and hydrocarbon gases.



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.

The maximum admissible temperature of drawn gas depends on the inlet pressure and the nature of the gases. The lower the inlet pressure (Pa), the higher can be the drawn gas temperature (TGas). We can consider as air the following indications:

- Pa < 50 mbar, TGas < 200°C
- Pa > 50 mbar, TGas < 70°C

Max. permissible number of starts per hour: 6

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

Principle of operation

The COBRA NC vacuum pumps are screw vacuum pumps with a cooling liquid circuit.

The COBRA NC vacuum pumps operate according to the principle of screw pumps. Two parallel screws rotate in opposite directions in the pump body. Entering gases are trapped between the pitches of the screws and the pump body. The gases are conveyed by the rotation of the screws to the exhaust side where they are discharged.

The COBRA NC vacuum pump is driven by an air-cooled motor.

Cooling

The vacuum pump is cooled by a cooling liquid inside the cooling liquid chambers of the cylinder and the inlet side end plate (B- side).

The screw rotors cooling must be made with cooling liquid injection (INJ) in the cylinder.



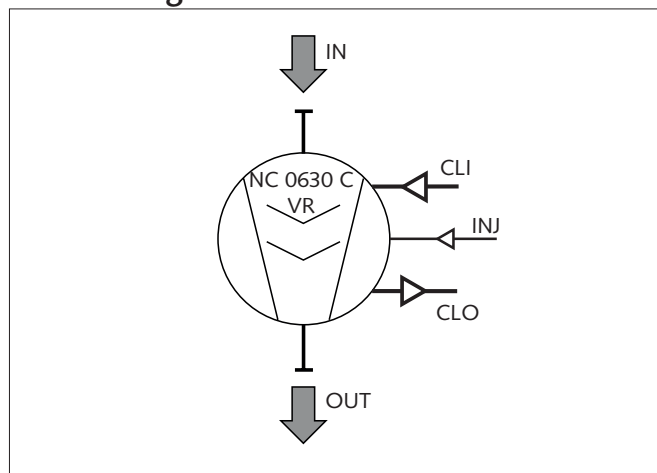
NOTE

Before first start-up of the vacuum pump, check the oil level, correct if needed.

Do not forget to connect the cooling liquid supply before the first start-up.

Operation without oil and cooling liquid can result in damage to the vacuum pump.

Process diagram



Sealing systems

The COBRA NC vacuum pumps are equipped with oil lubricated mechanical seals on the motor side (A-side) and inlet side (B-side) as standard.

Options/ Accessories

A resistance thermometer PT100 (TSA) can be provided to monitor the pump temperature or gas temperature.

A pressure switch (PS) can be provided to monitor the gas pressure.

On/ Off switch

The vacuum pump is delivered without on/ off switch. The control of the vacuum pump must be provided in the course of the installation.

Safety

Intended use

DEFINITION: For the purpose of correct understanding, the “handling” of the vacuum pump implies the transport, storage, installation, commissioning, the influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

The vacuum pump is intended for industrial use. It should only be handled by qualified staff.

The different applications for use and operational limits of the vacuum pump as laid out in the “Product Description” and the “Installation Prerequisites” of the vacuum pump must be observed both by the manufacturer of the machinery into which the vacuum pump is to be incorporated and by the end user.

The need for personal safety regulations depends mainly on the application the pump will be used in. The end user must provide the operators with all necessary means and tools and must inform his personnel about any dangers emanating from the processed products.

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 observed and respected.

It is vital that these installation and maintenance instructions are read and understood before the vacuum pump is used. If you have any doubts, please contact your local Busch representative.

Safety information

The vacuum pump has been designed and manufactured in accordance with the latest technical and safety standards. Nevertheless, residual risks may remain.

A lot of safety information is mentioned in these Installation and Operating Instructions as well as on the pump. The safety instructions must be observed. The safety information can quickly be detected through key words like DANGER, WARNING and CAUTION and is defined as follows:



DANGER

Disregard of this safety note will always lead to accidents with potentially fatal injuries and serious damages.



WARNING

Disregard of this safety note may lead to accidents with potentially fatal injuries and serious damages.



CAUTION

Disregard of this safety note will always lead to accidents with minor injuries and damages to property.

Noise emission

For the sound pressure level in free field according to EN ISO 2151, see “Technical Data”.



CAUTION

The vacuum pump emits noise of high intensity.

Risk of damage to the hearing.

Persons staying in the vicinity of a non noise insulated vacuum pump over extended periods shall wear ear protection.

Transport

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

Transportation of packaged pump

Packed on a pallet, the vacuum pump can be transported with a forklift.

Transport in unpacked state

The vacuum pump is bolted to a pallet or a base plate:

- ◆ Remove the bolts between the vacuum pump and the pallet or base plate



CAUTION

Do not walk, work 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 centre of gravity of the vacuum pump incl. drive motor. If any accessories that could upset the balance of the vacuum pump, are

- 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

Once filled with oil, the vacuum pump should not be lifted anymore.

Prior to every transport make sure that the oil has been drained from the vacuum pump

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

Storage

Short-term Storage

- Make sure that the inlet/ discharge connections are closed
- Store the vacuum pump
 - if possible in its original packaging,
 - indoors,
 - dry,
 - in a dust free room and
 - free from vibrations

Removal from storage

Before starting up 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.

Conservation

In case of adverse ambient conditions (e.g. aggressive atmosphere, frequent temperature changes) conserve the vacuum pump immediately.

In case of favourable ambient conditions conserve the vacuum pump if a storage of more than 3 months is anticipated.

- Make sure that all openings are hermetically sealed; use adhesive tape to fasten loose parts (such as o-rings, flat seals, etc.).
- Wrap the vacuum pump in VCI film
- Store the vacuum pump
 - if possible in its original packaging,
 - indoors,
 - dry,
 - in a dust free and
 - vibration free area

NOTE: VCI is the abbreviation for “volatile corrosion inhibitor”. The VCI molecule is an organic corrosion inhibitor in the vapour phase. Integrated in various carriers such as film, cardboard, paper, foam, liquid and powder, it protects parts against corrosion as a result of its action in vapour phase. However, VCI packaging can attack plastic 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 harshest conditions: overseas shipment, extended storage before use.

Starting-up of the vacuum pump after storage

- Please ensure that all protective agents such as gaskets, plugs or adhesive tapes that were used for the protection of the pump, are removed.
- Commission the vacuum pump as described in chapter “Installation and Commissioning”

Installation and Commissioning

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).

Local installation



WARNING

Local regulations regarding the motors and electric control elements must be observed when installing the pump in potentially explosive environments. Before start-up, make sure that all safety measures have been followed.

- Make sure the oil type corresponds to the ambient conditions, see "Oil type"
- Make sure that the following ambient conditions are adhered to:
 - Pressure: atmospheric
 - Humidity range: 20 to 95 %
 - Altitude: up to 1000 m
- Make sure that the cooling liquid fulfills the following requirements:
 - Temperature: +10 - +25 °C
 - Pressure: max 3,5 bar (relative)
 - Flow: 6 l/min
- Make sure that the cooling liquid is neutral and clean
- Make sure that the environmental conditions correspond to the protection class of the motor (according to motor nameplate)
- Make sure that the vacuum pump is placed on or fastened to a horizontal surface
- Make sure that the vacuum pump and chassis assembly are level to within 1° in all directions when measured from a suitable machined pump surface e.g. the pump inlet
- Prior to final fixation of the pump, ensure that the chassis and fixation positions are all in contact with the installation base/ base frame; use suitable shim material where necessary.
The maximum permissible space between the pump chassis/ fixation positions and installation base/ base frame = 0.05 mm

- Make sure that the vacuum pump cannot inadvertently or intentionally be used as a support for heavy objects
- Make sure that the vacuum pump cannot be hit by falling objects
- 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 part (such as plastic, wood, cardboard, paper, electronic parts) come into direct 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 assured



CAUTION

During operation the surface of the vacuum pump may reach a temperatures of 90° C.

Risk of burns!

- Make sure that the vacuum pump cannot be touched inadvertently during operation, provide a guard if necessary
- Make sure that the oil sight glasses (OSG) will remain easily accessible

If the oil change is meant to be performed on site:

- ◆ Make sure that the oil drain plugs as well as the oil filler plugs, are easily accessible.

Suction Connection

- Make sure that the protection that prevents the ingress of foreign matter during transport, has been removed before connecting up the vacuum pump to the piping.



CAUTION

Do not put hands into the inlet aperture.

Risk of body damage!



CAUTION

The ingress of foreign objects or liquids can destroy the vacuum pump.

In case the inlet gases can contain dust or other foreign solid particles:

- ◆ Make sure that a suitable filter or protection screen is installed at the inlet of the vacuum pump
- Make sure that the nominal diameter of the inlet line is at least equal to the diameter of the inlet flange 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 leak proof lines.



CAUTION

Once the inlet line has been connected up, make sure that the system does not leak. Leakage of dangerous substances must be prevented!

- Make sure that the inlet line is equipped with a shut-off device upstream of the inlet flange, so that the flow of drawn gases can be stopped
- Make sure that the inlet line does not exercise any load on the inlet flange. Use bellows if necessary.
- The inlet flange (IN) has the following dimension:

— DN100, PN16, EN 1092-1 or ASME B16.5 4" 150 lbs

Discharge connection



CAUTION

Do not put hands into the outlet aperture.

Risk of body damage !

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

- Make sure that the protection, that was fitted to prevent the ingress of particles during transport, has been removed before the vacuum pump is connected up to the vacuum pipe
- Make sure that the nominal diameter of the discharge line corresponds at least to the diameter of the exhaust flange of the vacuum pump in order to prevent an increased counter pressure at the discharge
- Make sure that the discharge line is fitted in such a way so that it prevents any liquids or condensates re-entering the vacuum pump (discharge line sloping away from the pump)
- Make sure that the discharge line does not exercise any load on the exhaust flange. Use bellows if necessary.
- The outlet flange (OUT) has the following dimension:
 - ◆ Pump outlet
 - DN80 PN16, EN 1092-1 or ASME B16.5 3" 150 lbs
- Maximal counter pressure at the discharge:
 - 0,2 bar

Cooling liquid connections (CL)

Connection dimension:

- cooling liquid inlet (CLI): DN15, PN16, EN 1092-1
- cooling water outlet (CLO): DN15, PN16, EN 1092-1

Injection point connection (INJ)

Connection dimension:

- G 3/8, ISO 228-1

Fitting the coupling

Description	Type
Coupling	ROTEX 48

- Fit the coupling hubs onto the respective shafts of the vacuum pump and the drive motor
- Axially move the unit motor/ coupling hub in such a way until axial distance between the coupling = 3.5 mm.

If the unit motor/ coupling hub is already fitted:

- ◆ Move the coupling hubs on the shafts in order to reach value of 3.5 mm
- Lock the coupling hubs by tightening the set screws
 - ◆ Tightening torque: 10 Nm

Axial displacement

When fitting/ replacing the motor or during maintenance work on the coupling, assembly tolerances have to be respected in order to prevent axial displacement.

Electrical connection/ Checks

- Make sure that the requirements according to EMC-Directive 2014/30/EU as well as the current EN-standards, electrical and occupational safety directives and the local or national regulations respectively, are complied with (this is the responsibility of the designer of the machinery into which the vacuum pump is to be

incorporated; see also the corresponding comments in the EC-Declaration of Conformity).

- Make sure that the power supply is compatible with the data on the nameplate of the drive motor
- Make sure that an overload protection according to EN 60204-1 is provided for the drive motor
- Make sure that the drive of the vacuum pump will not be affected by electric or electromagnetic interference; if unsure please seek advice from your Busch representative

Installation

- Make sure that the "Installation Prerequisites" are complied with
- Fit or install the vacuum pump at its final location

Electrical connection



WARNING

Risk of electrical shock, risk of damage to equipment.

Electrical installation work must only be executed by qualified personnel that knows and observes the following regulations:

- IEC 364 or CENELEC HD 384 or DIN VDE 0100, respectively,
- IEC-Report 664 or DIN VDE 0110,
- BGV A2 (VBG 4) or corresponding national accident prevention regulation.



CAUTION

The connection schemes given below are typical. Specific orders or deviating connection schemes for certain markets may apply.

Risk of damage to the drive motor!

Please check drive motor connections inside the terminal box and refer to the drive motor connection instructions.



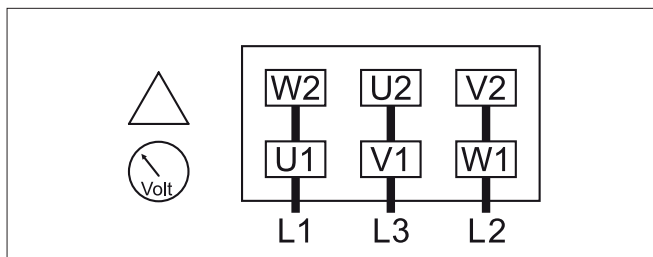
CAUTION

Providing the motor and the installation allow for it, the operating frequency of the motor must not go below 20 Hz, which corresponds to a nominal motor rotational speed of 1200 rpm.

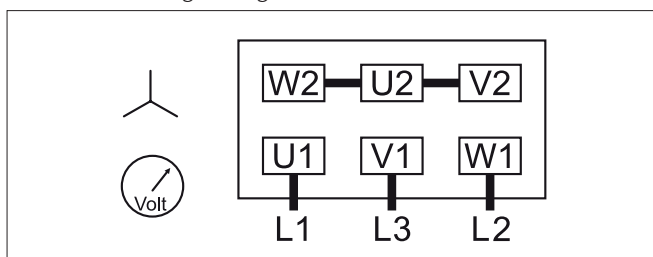
Risk of damage to the vacuum pump!

- Connect the drive motor electrically
- Connect the earth line

Delta connection (Low voltage):



Star connection (High voltage):



CAUTION

Operation of the pump in the wrong direction of rotation, even for a short period of time, can destroy the vacuum pump.

Risk of damage to the vacuum pump!

Prior to starting-up of the vacuum pump, please ensure that the vacuum pump is connected up correctly.

- Determine the direction of rotation with the arrow sign (DA) on the fan cover of the motor
- The motor fan should rotate in clockwise direction
- Press the start button and hold briefly
- Watch the fan of the drive motor and determine the direction of rotation just before the fan stops

If the fan is turning in the wrong direction:

- ◆ Switch around any two of the drive motor wires in the terminal box (MTB)

Connecting up of lines/ pipes

- Connect the suction line
- Connect the discharge line
- Make sure that all provided covers, guards, hoods etc. are fitted

Filling up with oil

The COBRA NC vacuum pumps are delivered without oil (see chapter "Oil Type" for information on recommended oils).

- Prepare the quantity of oil specified in the table "Oil quantity"

NOTE: The quantity of oil specified in the operating instructions is of informative nature only. Check the oil level with the help of the two oil sight glasses (OSG) on the vacuum pump.

- Unscrew the oil filler plugs (OFP)
- Fill in oil
- Make sure that the filling level is between the Min and Max of the oil sight glass (OSG)
- Make sure that the seals in the oil filler plugs are not damaged, replace plugs if necessary
- Fit the oil filler plugs and tighten up
- Switch on the vacuum pump

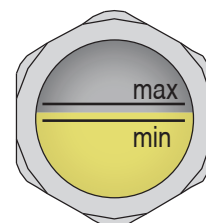
In case the suction line is equipped with a shut-off valve:

- ◆ Close the shut-off valve

In case the suction line is not equipped with a shut-off valve:

- ◆ Cover the inlet connection with a rubber mat

- Let the vacuum pump run for a few minutes
- Switch off the vacuum pump and wait for a few minutes
- Make sure that the filling level is between the Min and Max of the oil sight glass (OSG). Top-up with oil if necessary



In case the suction line is equipped with a shut-off valve:

- ◆ Open the shut-off valve

In case the suction line is not equipped with a shut-off valve:

- ◆ Remove the rubber mat from the suction flange and connect the suction line to the suction flange
- Before any transport, make sure that the oil has been drained out of the vacuum pump.



CAUTION

Once filled with oil, the vacuum pump should not be lifted or moved anymore.



CAUTION

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

Saving the operating parameters

As soon as the vacuum pump has been working for 30 minutes under normal conditions after having been switched on:

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

Installation and Commissioning Parameters	
Cooling jacket and Injected cooling liquid requirements (CLI + INJ) (pressure bar (g))	3.5 - 6 bar (g)
Cooling liquid flow rate (CLI)	6 l/min
Injected cooling liquid flow: Minimum (INJ)	1,5 l/min
Injected cooling liquid flow: Maximum* (INJ)	2...6 l/min
Ambient air temperature range (standard)	-20 ... +40C
Ambient air temperature range (high temperature version, refer to pump nameplate, (Specific motors)	-20 ... +60°C
Cooling liquid supply temperature	+10 ... +40°C
Max. allowable gas inlet temperature	70°C
Max. exhaust gas temperature (TSA+/0102)	80°C
Recommended exhaust gas temperature	60°C
Max. cooling liquid outlet temperature (TSA+/0101)	55°C
Maximum operational temperature difference between jacket and exhaust outlet	70°C
*The quantity of cooling liquid injected should be sufficient to ensure that at no time during the operation of the machine, the maximum exhaust gas outlet temperature is exceeded.	
Should the operating conditions of your pump fall outside of the recommended parameters as outlined, please contact your local Busch agency for advice.	

Recommendations on operation

Application



WARNING

The vacuum pump is designed for operation under the conditions described below.

In case of disrespect of the above, risk of damage or destruction of the vacuum pump!

The COBRA NC vacuum pumps have been designed for use in industrial applications and similar industries.

They can be used to draw gases and gas mixtures and hydrocarbon gases.



WARNING

When using toxic, inflammable and/ or explosive gases, make sure that the system corresponds 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 enter the vacuum pump.

Max. permissible number of starts per hour: 6

The vacuum pump is suitable for continuous use at any inlet pressure between atmospheric pressure and ultimate pressure.



CAUTION

During operation the surface of the vacuum pump may reach a temperatures of 90° C.

Risk of burns!

The vacuum pump must be protected against contact during 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 pump within a certain perimeter of the pump is high.

Risk of hearing damage.

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



CAUTION

The COBRA NC vacuum pumps are always delivered without oil.

Operation without oil will destroy the vacuum pump within a short period of time.

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



CAUTION

The COBRA NC vacuum pumps are always delivered without cooling liquid.

Operation without cooling liquid will destroy the vacuum pump within a short period of time!

- Make sure that all provided covers, guards, hoods etc. remain fitted
- Make sure that protective devices will not be disconnected
- Make sure that there is no leakage in the system, the escape of dangerous substances must be avoided
- Make sure that the "Installation Prerequisites" are complied with and will remain so, and ensure that adequate cooling is guaranteed

If the pump is shut down for a longer period of time:

- Drain the cooling liquid
 - ◆ Put a drain tray underneath the cooling liquid drain valve (CLD)
 - ◆ Close the cooling liquid supply
 - ◆ Disconnect and isolate the cooling liquid system
 - ◆ Open the cooling liquid drain valve (CLD)
 - ◆ Drain the cooling liquid

- ◆ Close the cooling liquid drain valve (CLD)
- ◆ Collect the cooling liquid and re-use it or dispose of it according to local or national regulations

NOTE: When the pump has not been in operation for a few days or when a sticky substance has been drawn, it is possible that the two rotor screws of the COBRA NC vacuum pump stick to each other. Unscrew the access plug (PMR) to the rotor screws. Loosen the rotors from each other with an Allen key and an extension by turning them clockwise by hand.

Switching the vacuum pump on/ off

First start-up of the system

- Make sure that the "Installation Prerequisites" are followed
- Open the cooling liquid supply (CL)
 - ◆ Adjust the flow rate to 6 l/min
- Start the vacuum pump
- Open the injection of the cooling liquid (INJ) in the cylinder
 - ◆ Adjust the flow rate to 1.5 l/min

Switching off the system

- Close the injection of the cooling liquid (INJ) in the cylinder
 - ◆ Let the vacuum pump run for 1 minute
- Switch off the vacuum pump
- Close the cooling liquid supply (CL)

Maintenance



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.



Only authorised 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 of Decontamination" 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.



Before any maintenance work is started, a safety perimeter of at least 1m around the machine must be set up.



During operation the surface of the vacuum pump may reach a temperatures of 90° C.

Risk of burns !



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

Danger of burns!

- Leave the vacuum pump to cool down prior to any action that requires touching the vacuum pump
- Prior to disconnecting inlet and outlet pipes, make sure that all piping is vented to atmospheric pressure

Maintenance program

NOTE: The maintenance intervals depend on the individual operating conditions. The intervals given below should be considered as initial guidelines which should be shortened or extended as appropriate. In particularly heavy duty operation such as high dust loads in the environment or in the process gas, it can become necessary to shorten the maintenance intervals significantly.

Monthly:

- Check the oil level (see "Checking the Oil")
- Check the vacuum pump for oil leaks - in case of leaks, have the vacuum pump repaired (Busch service)
- Check the vacuum pump for cooling liquid leaks - in case of leaks, have the vacuum pump repaired (Busch service)

Yearly:

In case of operation in a dusty environment:

- ◆ Make sure that the operating room is clean and free of dust; clean the room if necessary
- Make sure that the vacuum pump has been switched off and that it cannot accidentally be switched on again
- Check the electrical connections
- Carry out a visual inspection of the vacuum pump

If the inlet is equipped with a mesh screen:

- ◆ Check the mesh screen at the inlet and clean it if necessary
- Check the correct operation of the measurement and safety equipment

Every 5'000 operating hours:

- Change the oil (see "Changing the Oil")

Every 10'000 operating hours:

- Check the seals and replace them if necessary
- Check the inlet and discharge lines and clean or replace them if necessary
- Check the external look of the oil lubricated mechanical seals. If they are worn or damaged, replace them.

Every 16'000 operating hours, at the latest after 4 Years:

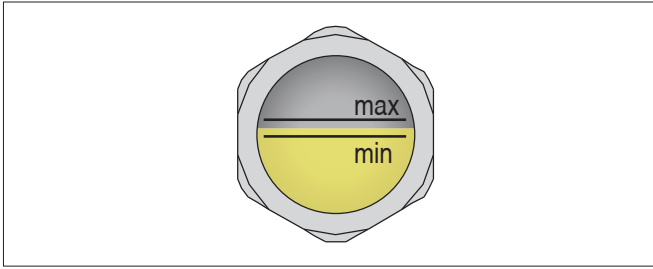
Have a major overhaul done on the vacuum pump (Busch service)

Checking the oil

Checking the oil level

- Check the oil level on the two oil sight glasses. This can be done during operation of the pump or during standstill

- Make sure that the filling level is between the Min and Max of the oil sight glass (OSG)



If the oil level is below the required level:

- ◆ Top up with oil (see “Topping up Oil”)

If the oil level is above the required level:

- ◆ Check the evacuation of the condensates at the pump exhaust
- ◆ Drain the oil (see “Draining oil”)

Topping up with oil

NOTE: Under normal conditions there should be no need to top up with oil in-between the recommended oil change intervals. A significant drop in the oil level indicates a malfunction (see “Troubleshooting”).



CAUTION

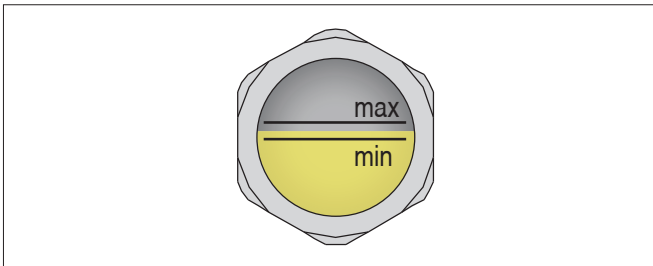
Risk of injury (burns) with open oil filler orifice.

Risk of injury in case of badly screwed-in plugs.

Remove the oil filler plugs only when the vacuum pump is stopped.

The vacuum pump must only be operated when the oil filler plugs are firmly tightened up and do not leak.

- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again
- Remove the oil filler plugs (OFP)
- Top up with oil
- Make sure that the filling level is between the Min and Max of the two oil sight glasses (OSG)



- Make sure that the seals of the oil filler plugs are not damaged and replace plugs if necessary
- Refit the oil filler plugs and tighten up

Life-span of the Oil

The oil life depends very much on the operating conditions. Under normal conditions the oil must be changed every 5000 operating hours or after 12 months, whichever comes first.

Under very unfavourable operating conditions the oil life can be less than 500 operating hours. A very short oil life time indicates either a malfunction (see “Troubleshooting”) or unsuitable operating conditions.

If there is no experience available regarding the oil life under the prevailing operation conditions, it is recommended to have the oil analysed every 500 operating hours and thus to establish the oil change interval accordingly.

Changing the oil



WARNING

In case the vacuum pump has conveyed gases that have been contaminated with harmful foreign materials, the oil will also be contaminated.

Danger to health during the change of contaminated oil.

Danger to the environment.

Wear protective equipment during the change of contaminated oil.

Contaminated oil is hazardous waste and must be disposed of separately in compliance with applicable regulations.

Draining oil

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

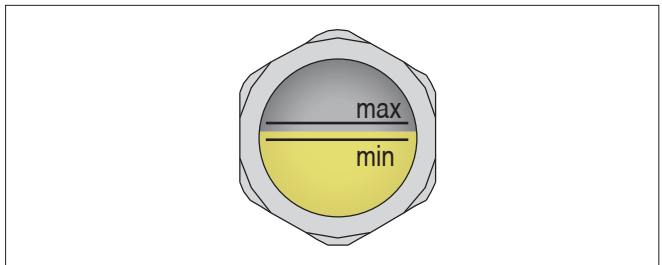
- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again
- Make sure that the vacuum pump is vented to atmospheric pressure
- Put a drain tray underneath the oil drain plugs (ODP)
- Remove the oil drain plugs (ODP)
- Drain the oil
- Because of wear and tear on the seals replace the current drain plugs with new ones
- Remove the two magnetic plugs (MP), clean or change it if necessary
- Refit the two magnetic plugs (MP)
- Refit the oil drain plugs (ODP) and tighten up
- Dispose of the used oil in compliance with applicable regulations

Filling in new oil

- Prepare the quantity of oil needed (see “Oil type/ quantity”)

NOTE: The quantity of oil specified in the operating instructions 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 oil drain plugs have been fitted properly and that they do not leak
- Remove the oil filler plugs (OFP)
- Fill in oil
- Make sure that the filling level is between the Min and Max of the two oil sight glasses (OSG)



- Make sure that the seals of the oil filler plugs are not damaged and replace plugs if necessary
- Refit the oil filler plugs (OFP) and tighten up

Checking the cooling liquid

Checking the cooling liquid flow rate

- Check regularly the flow rate of the cooling liquid. If the flow rate is below the values indicated in the "Technical Data", detect the leakages

Checking the cooling liquid temperature

- Check regularly the cooling liquid temperature.
 - ◆ Make sure that the specifications of the cooling liquid are followed

Draining the cooling liquid

- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again



CAUTION

Wait until pump has cooled down to ambient temperature

- Make sure that the vacuum pump is vented to atmospheric pressure
- Put a drain tray underneath the cooling liquid drain valve (CLD)
- Close the cooling liquid supply
- Disconnect and isolate the cooling liquid system
- Remove the cooling liquid filler plug (CLF) on cylinder upper plate
- Open the cooling liquid drain valve (CLD)
- Drain the cooling liquid
- Close the cooling liquid drain valve (CLD)
- Collect the cooling liquid and re-use it or dispose of it according to local or national regulations
- Refit the cooling liquid filler plug (CLF) on cylinder upper plate

Checking the current consumption

- Check the current of the motor

An increased current indicates a fault (see "Troubleshooting")

Overhaul



CAUTION

In order to achieve best efficiency and a long life the vacuum pump was assembled and adjusted with precisely defined tolerances.

This adjustment will be lost during dismantling of the vacuum pump.

It is therefore strictly recommended that any dismantling of the vacuum pump that is beyond of what is described in this manual shall be done by Busch service.



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.

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.

Busch service will only accept vacuum pumps that come with a completely filled in and legally binding signed form.

Removal from service

Temporary removal from service

Prior to disconnecting inlet and outlet pipes as well as cooling water pipes, make sure that all piping is vented to atmospheric pressure

Recommissioning



CAUTION

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

Turn the rotor screws manually.

- Make sure that all gaskets, plugs or adhesive tapes have been removed.
- Start the vacuum pump as described in the chapter "Installation and Commissioning"

Dismantling and Disposal of the vacuum pump



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.

The vacuum pump must be decontaminated prior to disposal.

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 vacuum pump comes to the end of its life:

- it must be decontaminated



CAUTION

Only authorised 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 used oil in compliance with applicable environmental regulations
- dismantle 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 different components of the pump in compliance with applicable regulations

Troubleshooting



WARNING

Risk of electrical shock, risk of damage to equipment.

Electrical installation work must only be executed by qualified personnel that knows and observes the following regulations:

- IEC 364 or CENELEC HD 384 or DIN VDE 0100, respectively,
- IEC-Report 664 or DIN VDE 0110,
- BGV A2 (VBG 4) or equivalent national accident prevention regulation.



CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 90 °C.

Risk of burns!

Let the vacuum pump cool down prior to a required contact or wear heat protection gloves.

Problem	Possible Cause	Remedy
The vacuum pump does not reach the usual pressure	The vacuum system or suction line is not leak-tight	Check the hose or pipe connections for possible leak
The drive motor draws a too high current (compare with initial value after commissioning)	Process deposits on the pumping components (the most common cause)	Flush the pump carefully
Evacuation of the system takes too long	In case a mesh screen is installed on the suction connection: The mesh screen on the suction connection is partly clogged	Clean the mesh screen If cleaning is required too frequently install a filter upstream
	In case an inlet filter is installed on the suction connection: The filter on the suction connection is partly clogged	Clean or replace the inlet filter, respectively
	Partial clogging in the suction, discharge or pressure line	Remove the clogging
	Long suction, discharge or pressure line with too small diameter	Use larger diameter
	Internal parts worn or damaged	Repair the vacuum pump (Busch service)
The vacuum pump does not start	The drive motor is not supplied with the correct voltage or is overloaded	Supply the drive motor with the correct voltage
	The drive motor starter overload protection is too small or trip level is too low	Compare the trip level of the drive motor starter overload protection with the data on the name-plate Correct if necessary In case of high ambient temperature: Set the trip level of the drive motor starter overload protection 5 percent above the nominal drive motor current
	One of the fuses has blown	Check the fuses
	The connection cable is too long causing a voltage drop at the vacuum pump	Use sufficiently dimensioned cable
	The vacuum pump or the drive motor is blocked	Turn the screws rotors manually (PMR) or repair the vacuum pump (Busch service)
	The drive motor is defective	Replace the drive motor (Busch service)
The vacuum pump is blocked	Solid foreign matter has entered the vacuum pump	Repair the vacuum pump (Busch service) Make sure the suction line is equipped with a mesh screen If necessary additionally provide a filter

	Corrosion in the vacuum pump from remaining condensate	Repair the vacuum pump (Busch service) Check the process Observe the chapter "Installation and Commissioning, Operating Notes"
	The vacuum pump was run in the wrong direction	Repair the vacuum pump (Busch service) When connecting the vacuum pump make sure the vacuum pump will run in the correct direction (see "Installation")
	Condensate ran into the vacuum pump	Repair the vacuum pump (Busch service) Make sure no condensate will enter the vacuum pump, if necessary provide a drip leg and a drain cock Drain condensate continuously
The vacuum pump starts, but labours or runs noisily or rattles The drive motor draws a too high current (compare with initial value after commissioning)	Connections in the drive motor terminal box are defective	Check the proper connection of the wires against the connection diagram
	Not all drive motor coils are properly connected	Tighten or replace loose connections
	The drive motor operates on two phases only	
	The vacuum pump runs in the wrong direction	Verification and rectification see "Installation and Commissioning", correct if necessary
	Standstill over several weeks or months	Let the vacuum pump run warm with inlet closed
	Improper oil quantity, unsuitable oil type	Use the proper quantity of the recommended oils (see "Oil", oil change see "Maintenance")
	No oil change over extended period of time	Perform oil change incl. flushing (see "Maintenance")
	Foreign objects in the vacuum pump Stuck bearings	Repair the vacuum pump (Busch service)
The vacuum pump runs very noisily	Defective bearings	Repair the vacuum pump (Busch service)
	Worn coupling element	Replace the coupling element (Busch service)
The vacuum pump runs very hot (The surface of the vacuum pump shall not exceed a temperature of 100°C)	Cooling liquid flow too low	Check the cooling liquid circuit and adjust the flow if necessary
	Ambient temperature too high	Observe the permitted ambient temperatures
	Temperature of the inlet gas too high	Observe the permitted temperatures for the inlet gas
	Oil level too low	Top up oil Check the oil filler plugs Check the mechanical seals (option)
	Oil burning by an overheating of the vacuum pump	Drain oil Fill in new oil (see "Maintenance")
	Mains frequency or voltage outside tolerance range	Provide a more stable power supply
	In case a mesh screen is installed on the suction connection: The mesh screen on the suction connection is partially clogged	Clean the mesh screen If cleaning is required too frequently install a filter upstream
	In case an inlet air filter is installed on the suction connection: The filter on the suction connection is partially clogged	Clean or replace the filter
	Partial clogging in the discharge line	Remove the clogging

	Long discharge or pressure line with too small diameter	Use larger diameter
The oil is black	Oil change intervals are too long The oil was overheated	Drain oil Fill in new oil (see "Maintenance")

Spare parts

NOTE: For COBRA pumps, please contact your local Busch representative for any ordering of spare parts or concerning the servicing of the vacuum pump.

When ordering spare parts or accessories, please always quote the type ("Type") and the serial no. ("S/N") of the vacuum pump. This will allow Busch service to check if the vacuum pump is compatible with a modified or improved part.

The exclusive use of genuine spare parts and consumables is a prerequisite for the proper function of the vacuum pump and for the granting of warranty, guarantee or goodwill.

Find the list of companies all over the world (by the time of the publication of these installation and operating instructions) on the rear cover page.

Find the up-to-date list of Busch companies and agencies all over the world on the internet at www.buschvacuum.com.

Oil type/ quantity

Oil type

- Make sure that the oil type corresponds to specifications:

Ambient temperature	Oil type
- 20 ... + 60 °C	Shell Tellus S2 M 68, High Performance hydraulic oil, viscosity class ISO HM 68
- 20 ... + 60 °C	Shell Tellus S2 V 68, High Performance hydraulic oil, viscosity class ISO HV 68
- 20 ... + 60 °C	TOTAL AZOLLA ZS 68, viscosity class ISO VG 68

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	Motor side (A)	Suction side (B)
NC 0630 C	1,7 L	0,6 L

Technical data

Technical data			NC 0630 C
Nominal suction capacity	50 Hz	m ³ /h	580
	60 Hz	m ³ /h	680
Ultimate pressure	50 Hz	mbar	≤ 30
	60 Hz	mbar	≤ 20
Nominal motor rating (depending on application)	50 Hz	kW	22 with VFD
	60 Hz	kW	
Nominal motor speed	50 Hz	min ⁻¹	3000
	60 Hz	min ⁻¹	3600
Noise level (EN ISO 2151)	50 Hz	dB(A)	< 73
	60 Hz	dB(A)	< 78
Ambient temperature		°C	-20 ... +60
Maximal counter pressure at the discharge side		bar	0,2
Cooling liquid requirement		l/ min	6
Cooling liquid injection rate*		l/ min	1,5
Cooling liquid temperature		°C	+10 ... +25
Weight	approx.	kg	880
*The quantity of cooling liquid injected should be sufficient to ensure that at no time during the operation of the pump, the maximum exhaust gas outlet temperature is exceeded.			

EU Declaration of Conformity

This Declaration of Conformity and the CE-mark 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-mark.

The manufacturer

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

declares that the machine(s) **COBRA NC 0630 B VR**

fulfil(s) all the relevant provisions from European directives:

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

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

Standard	Title of the Standard
EN ISO 12100 : 2010	Safety of machinery - Basic concepts, general principles of design
EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN 1012-1 : 2010 EN 1012-2 : 1996 + A1 : 2009	Compressors and vacuum pumps - Safety requirements - Part 1 and 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
EN ISO 13849-1 : 2015 ⁽¹⁾	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design

⁽¹⁾ In case control systems are integrated.

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

Busch Dienste GmbH
Schauinslandstr. 1
DE-79689 Maulburg

Chevenez, 14.05.2021



Christian Hoffmann, General Director

UK Declaration of Conformity

This Declaration of Conformity and the UKCA-mark 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-mark.

The manufacturer

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

declares that the machine(s) **COBRA NC 0630 B VR**

fulfil(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 fulfil those provisions:

Standard	Title of the Standard
BS EN ISO 12100 : 2010	Safety of machinery. Basic concepts, general principles of design. Risk assessment and risk reduction.
BS EN ISO 13857 : 2019	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs.
BS EN 1012-1 : 2010 BS EN 1012-2 : 1996 + A1 : 2009	Compressors and vacuum pumps. Safety requirements. Air compressors and vacuum pumps.
BS EN ISO 2151 : 2008	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
BS EN 60204-1 : 2018	Safety of machinery. Electrical equipment of machines. General requirements.
BS EN IEC 61000-6-2 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments.
BS EN IEC 61000-6-4 : 2019	Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.
BS EN ISO 13849-1 : 2015 ⁽¹⁾	Safety of machinery. Safety-related parts of control systems. General principles for design.

⁽¹⁾ In case control systems are integrated.

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

Busch (UK) Ltd
30 Hortonwood
Telford - UK

Chevenez, 14.05.2021



Christian Hoffmann, General Director

Busch

Vacuum Solutions

We shape vacuum for you.

Argentina

info@busch.com.ar

Australia

sales@busch.com.au

Austria

busch@busch.at

Bangladesh

sales@busch.com.bd

Belgium

info@busch.be

Brazil

vendas@buschdobrasil.com.br

Canada

info@busch.ca

Chile

info@busch.cl

China

info@busch-china.com

Colombia

info@buschvacuum.co

Czech Republic

info@buschvacuum.cz

Denmark

info@busch.dk

Finland

info@busch.fi

France

busch@busch.fr

Germany

info@busch.de

Hungary

busch@buschvacuum.hu

India

sales@buschindia.com

Ireland

sales@busch.ie

Israel

service_sales@busch.co.il

Italy

info@busch.it

Japan

info@busch.co.jp

Korea

busch@busch.co.kr

Malaysia

busch@busch.com.my

Mexico

info@busch.com.mx

Netherlands

info@busch.nl

New Zealand

sales@busch.co.nz

Norway

post@busch.no

Peru

info@busch.com.pe

Poland

busch@busch.com.pl

Portugal

busch@busch.pt

Romania

office@buschromania.ro

Russia

info@busch.ru

Singapore

sales@busch.com.sg

South Africa

info@busch.co.za

Spain

contacto@buschiberica.es

Sweden

info@busch.se

Switzerland

info@buschag.ch

Taiwan

service@busch.com.tw

Thailand

info@busch.co.th

Turkey

vakutek@ttmail.com

United Arab Emirates

sales@busch.ae

United Kingdom

sales@busch.co.uk

USA

info@buschusa.com