



# Installation and Maintenance Instructions



Screw Vacuum Pumps

**COBRA BC 0100 F**

Version with variator



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## Preface

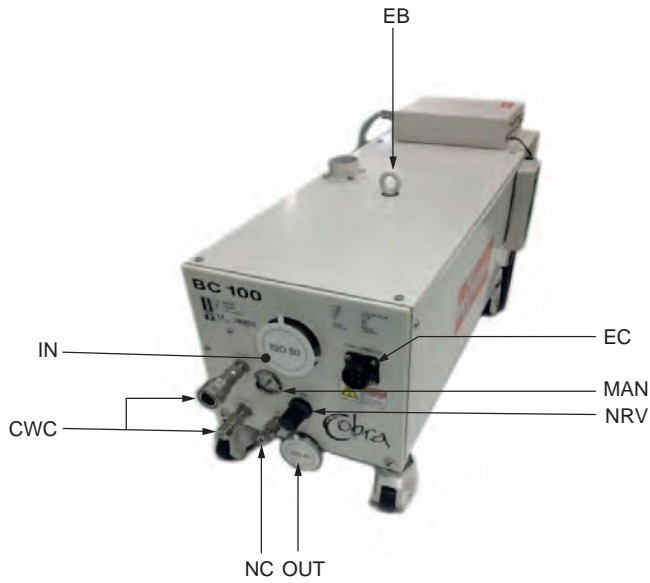
Congratulations on your purchase of the Busch vacuum pump. With watchful observation of the field's requirements, innovation and steady development Busch delivers modern vacuum and pressure solutions worldwide.

These operating instructions contain information for:

- product description,
- safety, transport,
- storage,
- installation and commissioning
- maintenance, overhaul and
- troubleshooting of the vacuum pump.

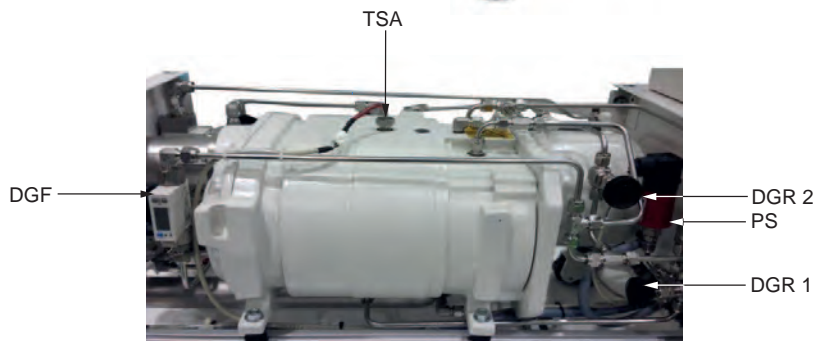
For the purpose of these instructions, "handling" the vacuum pump means the transport, storage, installation, commissioning, influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

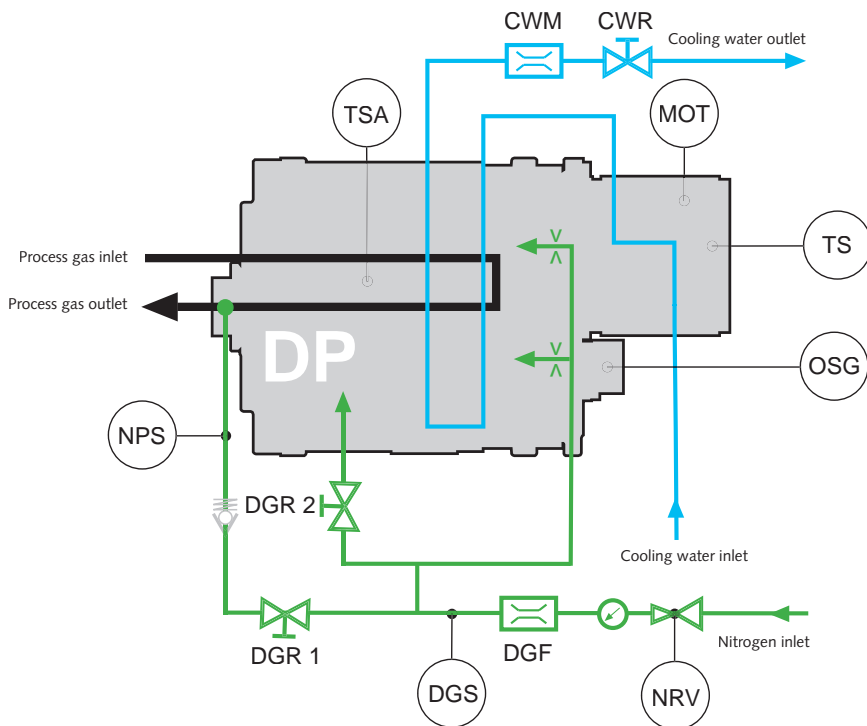
**Prior to handling the vacuum pump these operating instructions shall be read and understood. If anything remains to be clarified please contact your Busch representative. Keep these operating instructions and, if applicable, other pertinent operating instructions available on site.**



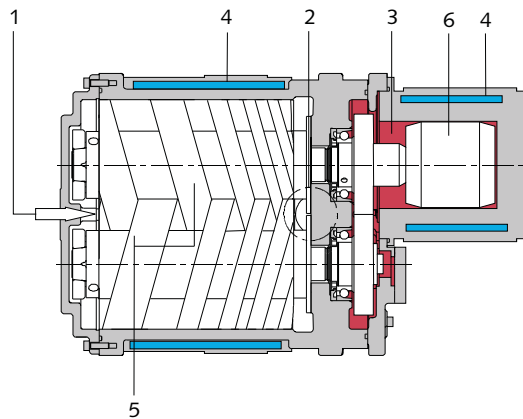
## BC 0100 F pump description

- IN Inlet connection
- OUT Discharge connection
- OFF Oil fill plug
- OSG Oil sight glass
- PS Pressure switch (Discharge)
- CWC Cooling water connection
- CWR Cooling water regulating valve
- CWM Cooling water flow meter
- NC Nitrogen connection
- NRV Nitrogen regulating valve
- DGR 1 Regulating valve, dilution gas (middle of cylinder)
- DGR 2 Regulating valve, dilution gas (end of cylinder)
- DGF Dilution gas nitrogen flow meter
- MAN Manometer
- ES Emergency stop
- EC Electrical connection
- TSA Resistance thermometer
- CP Control panel
- MB Main breaker
- EB Eye bolt





- CWR Cooling water regulating valve
- DGR 1 Regulating valve, dilution gas (middle of cylinder)
- DGR 2 Regulating valve, dilution gas (end of cylinder)
- DGF Dilution gas flow meter
- DGS Dilution gas system
- NRV Nitrogen regulating valve
- OSG Oil sight glass
- CWM Cooling water flow meter
- NPS Nitrogen pressure sensor
- TSA Resistance thermometer
- MOT Motor
- TS Temperature switch (motor)



- 1 Inlet
- 2 Discharge
- 3 Oil
- 4 Cooling water
- 5 Screw rotors
- 6 Temperature switch (motor)

## Product description

### Use

The COBRA BC 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 (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.

As far as temperature is concerned, the pump is suitable for evacuation of a 300 liters tank. The pump is not suitable for continuous duty at a pressure more or equal than 100 mbar. Caution, the operating cycle of 100 mbar must not exceed more than 5 min. For other applications, contact your Busch representative.

The vacuum pump is tight down to ultimate pressure.

### Operating principle

The COBRA BC 0100 F vacuum pumps are COBRA NW screw vacuum pumps with cooling water and nitrogen circuits.

The COBRA NW screw vacuum pumps operate according to the principle of screw pumps. Two parallel screws (5) 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.

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

## Oil circuit

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

## Cooling

The vacuum pump is cooled by

- a cooling water circuit (4) in the cylinder and motor. The cooling water flow is preset at 1 l/min at the factory and can be adjusted with valve CWR. This cooling water circuit is used to cool the motor of the pump, the frequency inverter and also the body of the NW pump.

**NOTE:** The COBRA BC vacuum pumps are always delivered without oil and without cooling water. Operation without these coolants can result in damage to the vacuum pump.

## Nitrogen system

The nitrogen system performs three main functions

- nitrogen is used as dilution gas. It is injected inside the cylinder on two different places. Nitrogen flow injected in the middle hole is preset at 2 l/min and can be adjusted with valve DGR 1, depending on the application. Nitrogen flow injected in the hole on cylinder endplate side is preset at 10 l/min and can be adjusted with valve DGR 2, depending on the application. When flow is too low a warning then an alarm signal is generated by flowmeter DGF 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 ( $\phi$ ). With a pressure of 1,5 bar, the flow is around 8-10 l/min.
- 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).

## Optional functions/ Use of available accessories

A pressure sensor mounted at the exhaust, controls the overpressure at the exhaust. If overpressure is above 0,1 bar, pressure switch gives a warning signal. If overpressure is above 0,2 bar an alarm is generated. Status of the pump depends on the alarm function set by user (factory setting : None, pump continues running with an alarm).

A temperature sensor mounted on the cylinder, measures the temperature inside the cylinder.

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

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

The LCD controller processes the data of the sensors (see chapter "Communication with the equipment") as follows:

- discharge pressure
- temperature in the cylinder
- current
- nitrogen flow rate (dilution, sealing)
- cooling water flow rate

The data process with the C.M.S. (Central Monitoring System) (accessory) has the same function as the LCD controller (see operating instructions of Central Monitoring System).

## On/ Off switch

The vacuum pump is delivered with on/ off switch.

## Versions

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

Example: BC 0100 F  
BC = standard version  
0100 = 100 m<sup>3</sup>/h  
F = Design

## Safety

### 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.

### 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.

Various safety instructions are to be found in this handbook and on the pump. These instructions must be followed. You can recognise these instructions by the signal words DANGER, WARNING and CAUTION, which are defined as follows:



**DANGER**

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



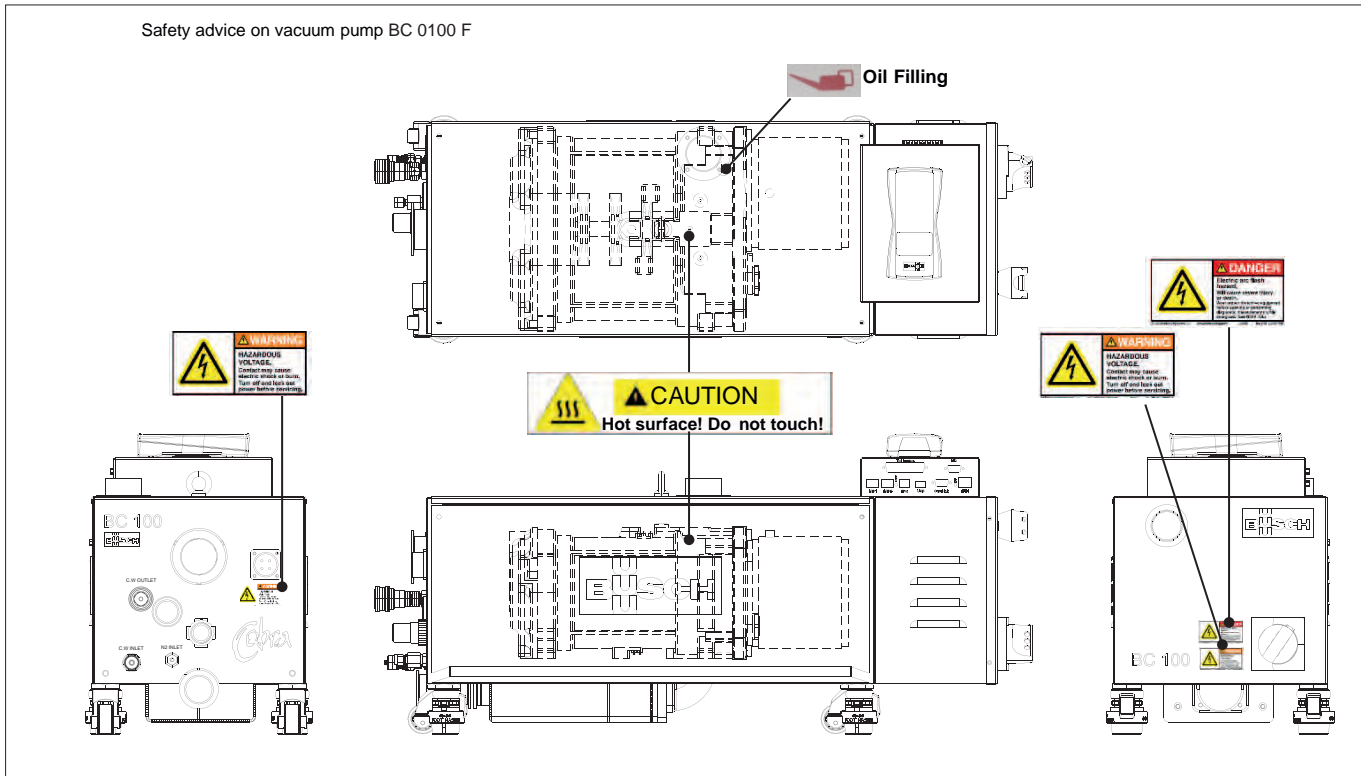
**WARNING**

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

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



**CAUTION**

The intensity of the noise of the vacuum pump is higher within a certain area of the pump.

Risk of hearing damage.

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

## Maintenance clearance

Before any maintenance action, ensure a maintenance clearance around the pump of min. 610 [mm].

## Electrical safety

### 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).

### Lock Out/ Tag Out procedure (Type 1 of electrical work)

- Stop the pump with the remote control or with the stop button (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 pump

### Safety Lockout procedure

- Take off the label or warning board “Maintenance processing”
- Check the cooling liquid and oil levels according to the chapters “Checking the oil level” and “Checking the cooling liquid level”
- Switch on the main circuit breaker
- Release the emergency stop button
- Switch on the water and nitrogen quick connections (outlet first, then inlet)
- Start the pump with the remote control (press on START button)

### Emergency off circuit description

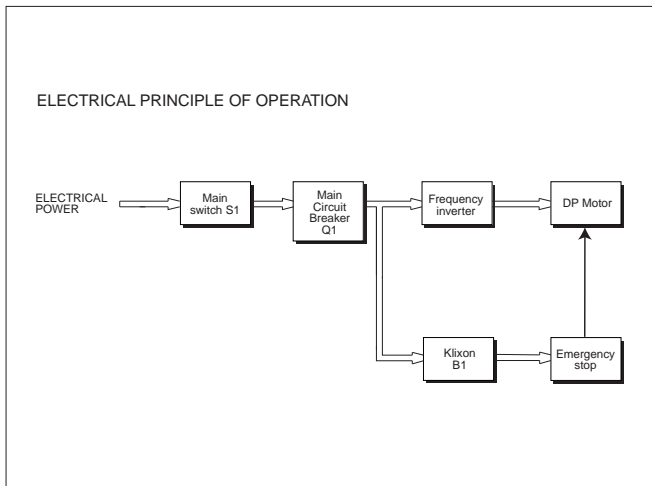
- The Emergency off circuit may be opened by pressing on emergency stop button, or the thermal protection B11. If one of the two elements show, then the pump will immediately stop. The PLC will remain energized to save the pump status.
- If the emergency stop button was pressed, check the start up of the pump then release this button to restart the pump. Press on Start button on the remote control, the pump will restart.
- If ok, check the wiring system from the terminal box motor to the KDP1 contactor. If ok, call the BUSCH Semicon service team in charge of the maintenance of the pumps.

- Switch on the main disconnect switch, then release the emergency stop button. Restart the pump by pressing on Start button on the remote control. If the pump does not start, press on emergency stop button, switch off and padlock the main disconnect switch, switch off the customer's power supply and put the label "maintenance processing". Call the BUSCH Semicon service team in charge of the maintenance of the pumps.
- If the external thermal protection B11 is engaged, check that the water flow shows 1l/min on the flowmeter. If not, set the water flow at 1 l/min according to the instruction (see chapter "Checking the cooling liquid flow"). Check the wiring system of the thermal protection by opening the side face (Type 3 of electrical work). Wait a few hours for the cooling of the protection, then press on Start button to restart the pump.

## Safety interlock description

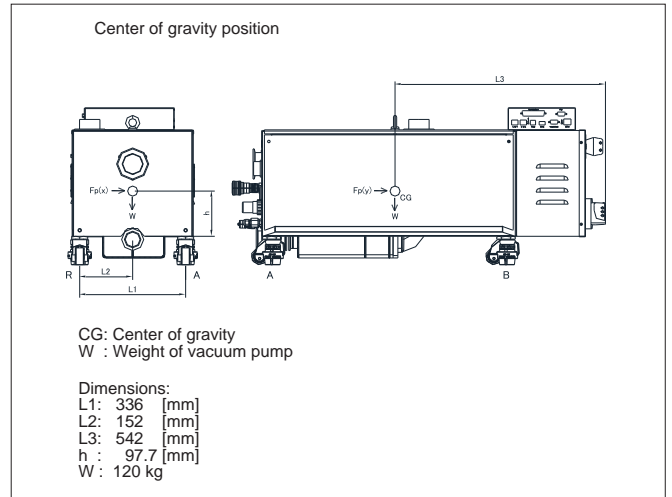
Interlock event	Sensor	Response	
Emergency Stop	EMO S/W	EMO Button Pushed during pump running	H
Motor overcurrent	Frequency inverter	Inverter default and remove power to motor	S
Motor overtemperature (t° > 150°C)	Thermo switch B1 (klixon)	Contactors open and remove power to motor	S
Discharge overpressure (option)	Pressure sensor B4	Depends on alarm function set in the PLC for overpressure Set at factory: None ie. the pump continues running with alarm	S
Cylinder overtemperature (option)	Temperature sensor B6	Depends on alarm function set in the PLC for cylinder temperature Set at factory: General Stop ie. the contactors open and remove power to motor	S
Cooling water flow low	Water flowmeter B2	Depends on alarm function set in the PLC for water flow Set at factory: General Stop ie. the contactors open and remove power to motor	S
Nitrogen flow to low	Nitrogen flowmeter B3	Depends on alarm function set in the PLC for nitrogen flow Set at factory: None ie. the pump continues running with alarm	S

H= Hardware, S= Software



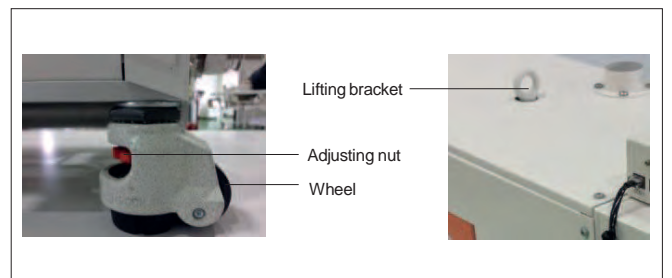
## Position of the pump gravity center

- The gravity center of the BC 0100 F pump is determined according to the drawing



## Installation of the vacuum pump in a seismic zone

- Convey the pump to its final location with a pallet truck before removing it from its support
- Unscrew the fixing screws of the 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



- Check that the wheels no longer touch the ground



### CAUTION

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

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

## Information over the lubricants

### Oil

Busch VF 250 n°.-art. 0831 000 054 (0.5l of Busch VF 250)

Quantity: BC 0100 F : 0,12 l

Replacement: After 5000 h (see Maintenance chapter, page 14)

## Decommissioning procedure

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



## WARNING

Any disassembly of the vacuum pump should only be carried out by staff trained for this purpose. Before disassembly, the user of the vacuum pump should complete a form or "Declaration about absence of danger" which indicates any dangers and corresponding actions.

Without this form duly completed and signed by a legally responsible person, the pump should not be disassembled.

- 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 residue may remain inside.
- Proceed to decommissioning of the different parts according to the current local and national laws

## Appliance after warehousing

Prior to reoperate a vacuum pump which remained outside the building for a certain period of time, make sure to let it stand at ambient temperature in a room for a whole day.

### Lock out/ Tag out for hydraulics and pneumatics

- ◆ Hydraulics: cooling water
- ◆ Pneumatics: nitrogen

### Lock Out/ Tag Out procedure (Type 1 of electrical work)

- Stop the pump with the remote control (press on STOP button during 10s)
- Press on emergency stop button
- Switch off the main 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 pump

The end user is responsible for providing energy isolation capabilities on the water and nitrogen

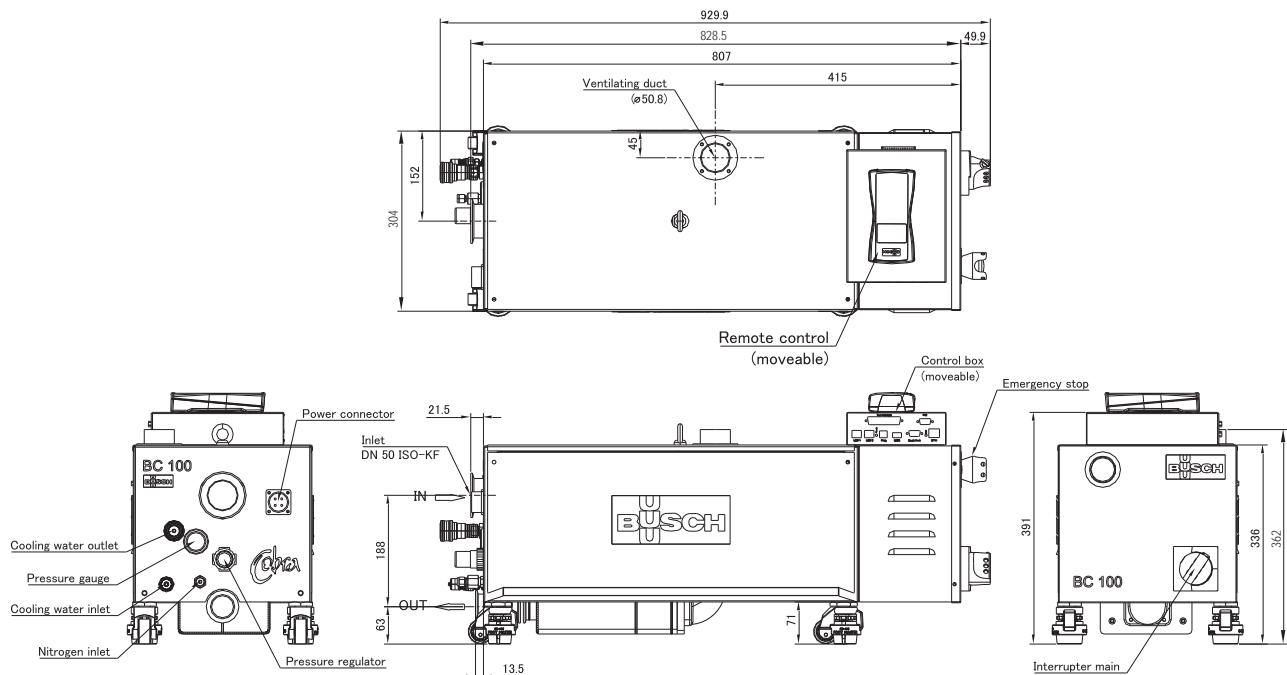
## Lock Out/ Tag Out procedure

- Stop the pump with the remote control (press on STOP button during 10s)
- Press on emergency stop button
- Switch off the main 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 pump

## Safety Lockout procedure

- Take off the label or warning board "Maintenance processing"
- Check the oil level according to the chapters "Checking the oil level"
- Switch on the main breaker
- Release the emergency stop button
- Switch on the water and nitrogen quick connections (outlet first, then inlet)
- Start the pump with the remote control (press on START button)

## Dimensions drawing







# Transport



The COBRA BC 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.

## Transport in packed state

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


## Transport in unpacked state

 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 suspension eyes are located at about the centre-of-gravity of the vacuum pump. If the vacuum pump is equipped with accessories that could influence the centre-of-gravity, this must be taken into account when lifting and a belt must additionally be attached to a specific point.

- Fasten the hoist to the suspension eye on the cylinder
- Use a hoist that is equipped with a hook and safety lock
- Lift the vacuum pump

 CAUTION  
The vacuum pump may not be lifted anymore when it has been filled with oil.

Moving of the vacuum pump is simple using the four wheels placed under the vacuum pump frame.

The design of the baseframe is such that transport of the pump can be made with a Europe pallet truck.

Make sure before every transport that the oil has been drained out of the vacuum pump.

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

This handbook is contained in the delivery package.

# Storage

## 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

# Removal of the 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.

## Preservation

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

In the case of favourable 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 vapour phase. Integrated in various carriers such as film, cardboard, paper, foam, liquid and powder, it protects the parts against corrosion as a result of its action in the vapour 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

## 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 the chapter "Installation and start-up"

# Installation and start-up

## Necessary installation instructions

 CAUTION  
If the necessary installation instructions are not followed and particularly in the case of inadequate cooling:  
  
Risk of damage to and total destruction of the vacuum pump and its components!  
  
Risk of personal injury!  
  
The necessary installation instructions must be followed.

- Make sure that the integration of the vacuum pump in its new environment complies with the safety regulations according to the Machinery Directive 2006/ 42/ EC (regarding the responsibility of the manufacturer of the system in which the vacuum pump is to be integrated, see information in the Declaration of Conformity).

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

## Installation site and installation

- Make sure that the environment of the vacuum pump is not potentially explosive
- Make sure that the following ambient conditions are fulfilled:
  - Ambient temperature: 0 ... 40 °C (32 ... 104 °F)
  - Ambient pressure: atmosphere
  - Humidity range: 20 to 95%
  - Altitude: up to 1000 m



### CAUTION

In case of high ambient temperature, extract the air between the machine panel and pumps casings by connecting on ventilating extractor (u) to the casing vent of min. 30 m<sup>3</sup>/h.

Do not connect the ventilating extractor with any process gas discharge.

- Make sure that the cooling water fulfills the following requirements:
  - Temperature: 10 - 20 °C
  - Overpressure: 4 bar (relative)
  - Approximate flow rate: 1 l/ min for the standard version
  - Water hardness: < 5° dGH

**NOTE:** 1° (german degree = 1° dGH) = 1,78° (french degree) = 1,25 e (english degree) = 17,9 mg/kg CaCO<sub>3</sub> (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: 1,5 bar
  - Approximate flow rate: 0 - 50 l/ min
- 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

**NOTE:** The levelling of the pump is facilitated by the adjustment stroke (~15 mm) of the four machine feet.

- Make sure that the four rollers do not touch the ground

**NOTE:** In order to ensure the fixation of the pump to the ground, it is possible to use again the four yellow brackets that were removed at the reception of the machine.

- 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 (OSG) are easily accessible

If oil changes are to be made on site:

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

## 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



### CAUTION

Do not put hands into the inlet aperture.

Risk of body damage !



### CAUTION

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 50 ISO KF

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.

## Discharge connection



### 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 protection that was attached to prevent penetration of particles during transport has been removed before the vacuum pump is connected to the vacuum line
- 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 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 40 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.

### Cooling water connection

The cooling water is generally connected with a hose.

The cooling water outlet must be unpressurised.

Connection diameter: 3/8 NPT

### Nitrogen connection

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

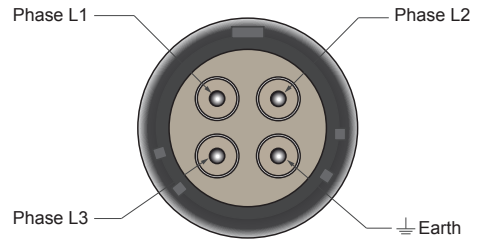
Connection diameter: 1/4 NPT

### Electrical connection/ Checks

- Make sure that the regulations of the Electromagnetic Compatibility Directive 2004/ 108/ EC 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 Declaration of Conformity)
- Make sure that the mains 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

### Power wiring connections

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



## Installation

### Mounting

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

### 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 motor!

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

Motor of screw pump COBRA BC 0100 F is connected at factory.

- Connect supply cable on the female connection (EC) of the vacuum pump



### CAUTION

The transformer voltage (in the electrical box) must be in accordance with the supply voltage of the machine.



### 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.

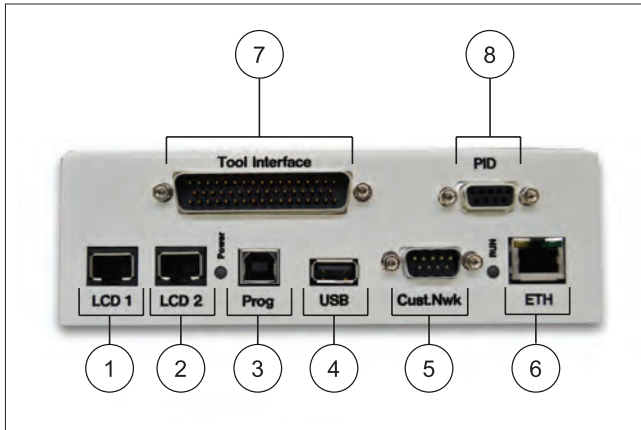
Make sure that the vacuum pump is connected correctly before switching it on.

- Determine rotation sense of the motor by placing a rubber plate on the inlet.
- Press the on/ off switch briefly
- Make sure that the vacuum pump sucks

If the direction of rotation has to be changed:

- ◆ Exchange two of the three feeder leads

## Equipment connections (with options)



- 1 LCD serial wiring (RJ45), LCD 1
- 2 LCD serial wiring (RJ45), LCD 2
- 3 PC serial wiring (9 poles) (option)
- 4 USB connection
- 5 Customer Network, Communication modbus RTU RS 232
- 6 Ethernet Network connection (Busch Monitoring System) (option)
- 7 Interface connection (50 poles) (option)
- 8 PID Interface (9 poles) (option)

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

### Connection of the 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

### Oil filling

The **COBRA BC 0100 F vacuum pumps** are always delivered without oil (see the chapter "Oil types" for information on the recommended oils).

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

Oil filling	BC 0100 F	Oil type
Oil capacity [Liter]	0,12	Busch VF 250, Art. No. 0831 000 054

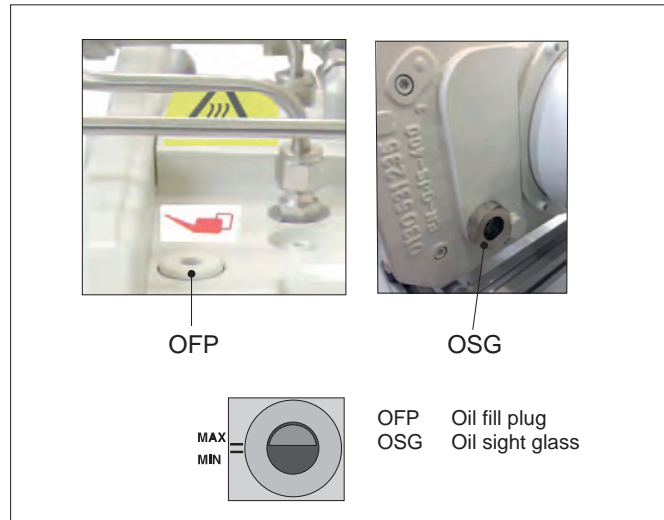
**NOTE:** The quantity of oil specified in the installation handbook is of informative nature only. Check the oil level with the help of the oil sight glass (OSG) on the vacuum pump.



#### 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 fill plug (OFF)
- Fill in oil



- Make sure that the oil level lies between the MIN and MAX markings on the oil sight glass
- Make sure that the seal of the oil filler cap is not damaged. Replace it 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 glass

If the oil level is below the MIN marking:

- ◆ 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

The vacuum pump may not be lifted anymore when it has been filled with oil.

- Make sure before every transport that the oil has been drained out of the vacuum pump.



#### CAUTION

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

## Checking the direct cooling

The flow of the cooling water is checked by the flowmeter CWM. The flowmeter must be connected in such a way that switching-on leads to an alarm and stopping of the vacuum pump when the flow drops below 0,3 l/min.

## Checking the nitrogen supply (dilution gas)

The flow of the nitrogen is checked by the flowmeter DGF. 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.

## Checking the nitrogen supply (sealing gas)

The flow of the nitrogen is checked by the flowmeter DGF2. 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.

## Saving the operating parameters

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

## Recommendations on operation

### 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 BC 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<sub>Gas</sub>) can be.

The following indicative values for air can be considered:

- Pa > 50 mbar, T<sub>Gas</sub> < 80°C
- Pa < 50 mbar, T<sub>Gas</sub> < 200°C

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

As far as temperature is concerned, the pump is suitable for evacuation of a 300 liters tank. The pump is not suitable for continuous duty at a pressure more or equal than 100 mbar. Caution, the operating cycle of 100 mbar must not exceed more than 5 min. For other applications, contact your Busch representative.

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 intensity of the noise of the vacuum pump is higher within a certain area of the pump.

Risk of hearing damage.

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



#### CAUTION

The COBRA BC 0100 F vacuum pumps are always delivered without oil and without cooling water.

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 cooling water flow, which is checked by the flowmeter CWM, must be at least 1 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 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 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

## Switching the vacuum pump on/off

### 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 1 l/min and can be adjusted at the regulating cock CWR. This water circuit is used to cool the motor of the NW pump and also the body of the pump.
- Make sure that the nitrogen flow is set correctly
  - dilution gas, injected in the cylinder is preset at 2 NI/min and can be adjusted with valves DGR.
  - sealing gas, injected into the intermediate chamber in the cylinder of the pump, between the drive and the process gas.
- 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

### Switching the system off

- Flush the vacuum pump with nitrogen at the end of the process (the duration of flushing can be programmed)

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 currentless

## 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 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.**



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 Regarding Contamination of 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.



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



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

Danger of burns!

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":

- stop the pump with the remote control (press on STOP button during 10s)
- press on emergency stop button
- switch off the main 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 pump



The oil temperature can reach a value of 90°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":

- take off the label or warning board "Maintenance processing"
- check the oil level according to the chapter "Checking the oil level"
- switch on the main 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 remote control (press on START button)

## Maintenance program

**NOTE:** The maintenance intervals depend on the operating conditions. The following intervals are basic values, which can be shortened or lengthened depending on operating conditions. In especially difficult operating conditions such as, for example, a very dusty environment the maintenance intervals must be shortened considerably.

### Weekly:

- Check the oil level and the colour of the oil (see "Checking the oil")
- Check the cooling water flow (see "Checking the cooling water")
- Check the nitrogen flow (see "Checking the nitrogen")
- Inspect the vacuum pump for oil leaks - if there are leaks, repair the vacuum pump (Busch)

- Inspect the vacuum pump for leaks of cooling water - if there are leaks, repair the vacuum pump (Busch)

## Monthly:

In the case of operation in a dusty environment:

- ◆ 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:

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

If the intake is equipped with a sieve:

- ◆ Check the sieve at the intake and clean if necessary
- Check the measuring and safety equipment for working order

## Every 1000 hours of operation:

If the discharge is equipped with a sound absorber:

- ◆ Clean the sound absorber

If the discharge is equipped with a leak-protection non-return valve:

- ◆ Clean the leak-protection non-return valve

## Every 5000 hours of operation:

- Drain the oil (see "Draining the oil")

If the cooling water line is equipped with a filter:

- ◆ Check the filter and clean or replace if necessary

## Every 10 000 hours of operation:

- Check the seals and replace if necessary
- Check the intake and discharge lines and clean or replace if necessary

## Every 16 000 hours of operation, at the latest after 4 years:

A main inspection of the vacuum pump (Busch)

## Lock Out/ Tag Out procedure

- Stop the pump with the remote control (press on STOP button during 10s)
- Press on emergency stop button
- Switch off the main 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 pump

## Safety Lockout procedure

- Take off the label or warning board "Maintenance processing"
- Check the oil level according to the chapter "Checking the oil level"
- Switch on the main 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 remote control (press on START button)

## Checking the oil

### Checking the oil level

- 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 oil sight glass

If the oil level does not reach the MIN marking:

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

If the oil level exceeds the MAX marking:

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

### Refilling oil

**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 "Troubleshooting").



CAUTION

Only fill in oil through the oil filler opening.



CAUTION

Danger of burns when the oil fill plug is open.

Danger of injuries when the oil fill plug is not screwed on properly.

Only unscrew the oil fill plug when the vacuum pump has been switched off.

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

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally
- Unscrew the oil fill plug (OFP)
- Fill in oil up to the middle of the oil sight glass
- Make sure that the oil level lies between the MIN and MAX markings on the oil sight glass
- Make sure that the seal of the filler cap is not damaged and that they sit properly. Replace it if necessary
- Screw on the fill plug again

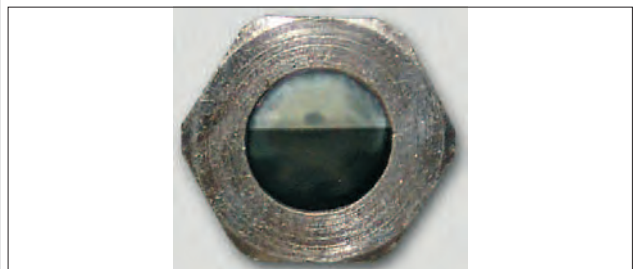
### Checking the colour of the oil

**NOTE:** The oil must be clear and transparent. A permanent milky colour is an indication for contamination by foreign bodies. A dark colour is an indication for oil that has been chemically altered or contaminated by foreign bodies.



WARNING

Dark colored oil may indicate a hazardous pump condition which could cause personal injury.



If dark oil similar to the example shown is observed, you have to contact the Busch Customer Service without delay.

## Oil change



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.

### Draining used oil

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

- 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 is vented to atmospheric pressure
- Put a drain tray underneath the oil drain plug
- Unscrew the oil drain plug
- Drain the oil

When the oil flow has stopped:

- ◆ Refit the oil drain plug
- 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 plug again and drain any remaining oil
- Carefully unscrew and remove the magnetic plug
- Check that no metal swarf sticks to the magnet of the magnetic plug, clean if necessary
- Make sure that the sealing washer of the magnetic plug is not damaged, replace it if necessary
- Refit the magnetic plug and tighten up
- Make sure that the sealing washer on the drain plug is undamaged and correctly positioned, replace it if necessary
- Refit the oil drain plug and tighten up

Dispose of the used oil in compliance with applicable regulations



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

### Filling in new oil

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



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 installation handbook is of informative nature only. Check the oil level with the help of the oil sight glass on the vacuum pump.

- Make sure that the drain plug has been fitted properly and that they do not leak



Only fill in oil through the oil filler opening.

- Unscrew the oil fill plug (OFF)
- Fill in oil up to the middle of the oil sight glass
- Make sure that the oil level lies between the MIN and MAX markings on the oil sight glass
- Make sure that the seal of the fill plug is not damaged and that it sits properly. Replace it if necessary
- Screw on the fill plug again

## Checking the cooling water

### Checking the cooling water flow

- Check the cooling water flow regularly

If the flow drops, check for leaks

- ◆ Make sure that the specifications of the cooling water are followed

## Checking the nitrogen

### Checking the nitrogen flow

- Check the nitrogen flow regularly

If the flow drops, check for leaks

- ◆ Make sure that the specifications of the nitrogen are followed

## Checking the current consumption

- Check the current intensity of the motor

An increased intensity is an indication for a fault (see "Troubleshooting")

## Checking the sound absorber (accessory)

- 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 sound absorber regularly and clean it if necessary

## Checking the leak-protection non-return valve (accessory)

- Check the leak-protection non-return valve regularly and clean it if necessary



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

There could still be residues of contamination.



# Overhaul



CAUTION

Inappropriate maintenance work on the vacuum pump can damage the pump.

Danger of explosion!

If requirements are not met, the vacuum pump may not be switched on!

Should work exceed the dismantling work described in this handbook, it may only be carried out by authorised persons.



DANGER

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

These foreign bodies can penetrate into pores, openings and other internal parts of the vacuum pump.

There is a health hazard when dismantling the vacuum pump.

There is also a 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](http://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

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

### Recommissioning

- 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 the chapter "Installation and start-up"

## Dismantling and disposal



DANGER

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

These foreign bodies can penetrate into pores, openings and other internal parts of the vacuum pump.

There is a health hazard when dismantling the vacuum pump.

There is also a danger to the environment.

Protective clothing must be worn when dismantling the vacuum pump.

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](http://www.buschvacuum.com).

Dispose of the used oil and condensate according to applicable environmental protection regulations.

When the product has reached the end of its lifetime:

- decontaminate the vacuum pump



CAUTION

Dismantling work must be carried out by authorised personnel. 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
- begin dismantling the vacuum pump



CAUTION

Wear protective clothing when carrying out dismantling work.

- ◆ 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

# Oil type/ quantity

## Oil type

- Make sure that the oil type corresponds to specification:
  - Busch VF 0250, Art. No. 0831 000 054 (0,5 l  $\cong$  1 kg)



**WARNING**

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

## 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 oil sight glass on the vacuum pump.

Quantity [Liter]	Quantity [Liter]
BC 0100 F	0,12

# Technical data

Technical data			BC 0100 F
Nominal suction capacity		m <sup>3</sup> /h (cfm)	100 (59)
Ultimate pressure		hPa(mbar)/ mTorr	0,01/ 7,5
Nominal motor rating		kW	1,5
Power consumption at ultimate pressure		kW	1,3
Nominal motor speed		min <sup>-1</sup>	3000
Noise level (EN ISO 2151)		dB(A)	<58
Ambient temperature		°C (°F)	0-40 (32-104)
Maximal counter pressure	Discharge	bar	0,2
Cooling water requirement		l/ min	1.0
Cooling water pressure		bar	2 - 5
Cooling water temperature		°C	10 - 25
Nitrogen requirement	approx.	l/ min	0 - 50
Nitrogen overpressure		bar	1,5
Weight	approx.	kg	120





# EC DECLARATION OF CONFORMITY

In accordance with:-

EC Machinery Directive 2006/42/EC (Annex II 1 A)

& Low Voltage Directive 2006/95/EC

We, Busch Manufacturing Korea, Ltd., herewith declare that the:-



**Product description:** VACUUM PUMP SYSTEM  
**Model Number:** BC 0100, BC 0101, BC 0200, BC 0600  
**Serial Number:** N/A  
**Manufacturer:** Busch Manufacturing Korea, Ltd.  
**Address:** 189-51, Soicheon-ro, Majang-myun, Icheon-si, Kyunggi-do, Republic of Korea

when used in accordance with the manufacture's instructions, conforms with the essential health and safety requirements of the Machinery Directive by virtue of its design, construction and assessment.

In support of this declaration the subject machine has been evaluated as complying with the following:-

- a) The Machinery Directive (Annex I), by compliance with the applicable clauses of the following harmonized standards:-  
**ISO 12100:2010, EN 60204-1:2006+A1:2009 and EN 1012-2:1996+A1:2009**
- b) Technical file No: MD-140302<sup>ND</sup>
- c) ISO 9001 Certified by KOREA INT'L STANDARDS CERTIFICATION  
 ISO 9001 Certificate No.QSC 1880

If the equipment is modified without the agreement of the undersigned, this declaration becomes invalid.

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(Technical Writer)

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**Jei-hong Kim**

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