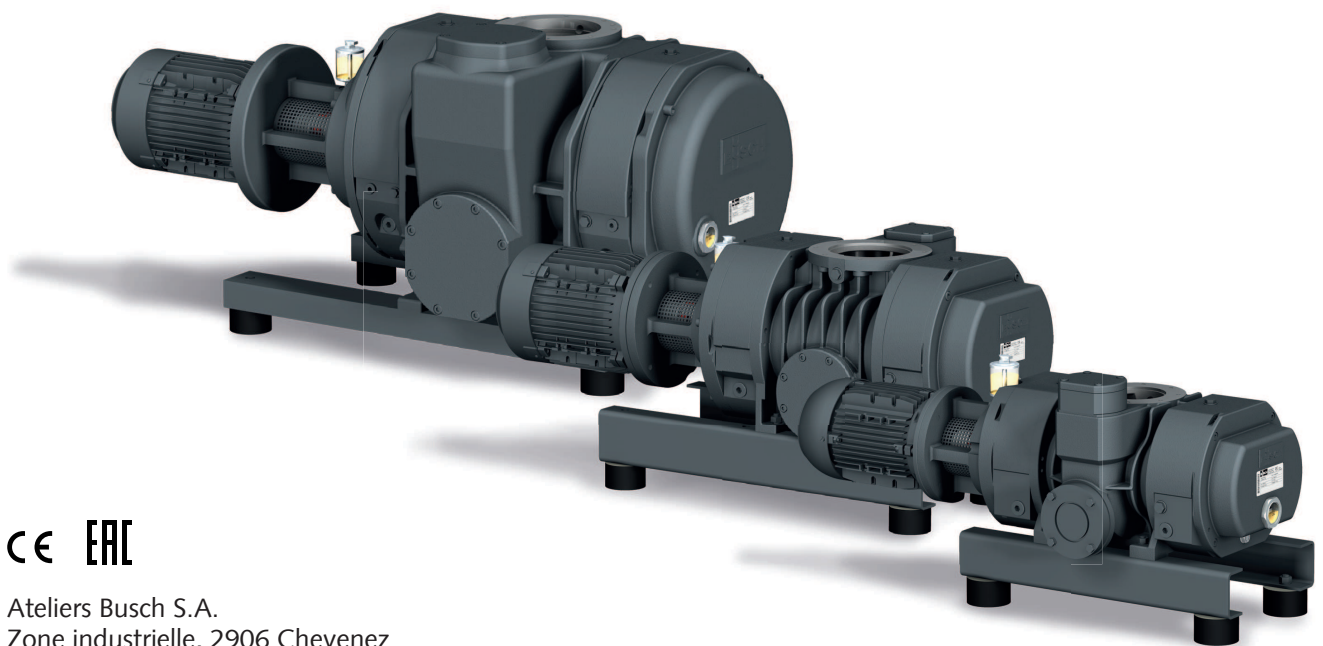
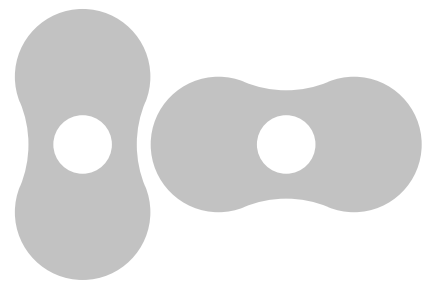


# Instruction Manual

## Panda

Vacuum Booster

WV 0250 C, WV 0500 C, WV 1000 C,  
WV 1500 C, WV 2000 C



CE EAC

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# 1 Safety

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

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

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

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

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

The machine has been designed and manufactured according to state-of-the-art methods. Nevertheless, residual risks may remain. This instruction manual highlights potential hazards where appropriate. Safety notes and warning messages are tagged with one of the keywords DANGER, WARNING, CAUTION, NOTICE and NOTE as follows:

## DANGER

... indicates an imminent dangerous situation that will result in death or serious injuries if not prevented.

## WARNING

... indicates a potentially dangerous situation that could result in death or serious injuries.

## CAUTION

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

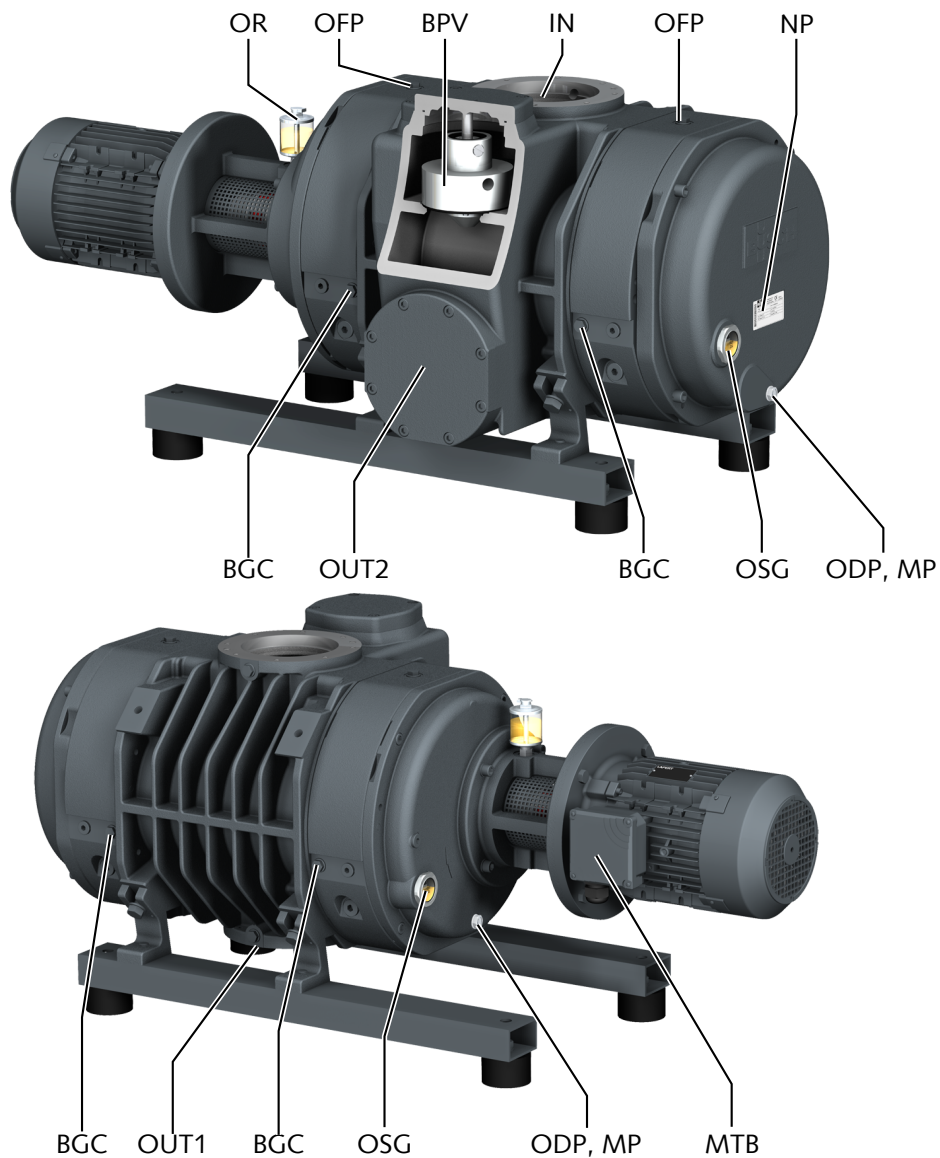
## NOTICE

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

## NOTE

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

## 2 Product Description



IN	Suction connection	MTB	Motor terminal box
OUT	Discharge connection	OUT2	Lateral discharge connection (Optional)
MP	Magnetic plug	OFP	Oil fill plug
NP	Nameplate	OSG	Oil sight glass
BPV	Bypass valve	ODP	Oil drain plug
OR	Oiler ( <i>with lip seals only</i> )	BGC	Barrier gas connection

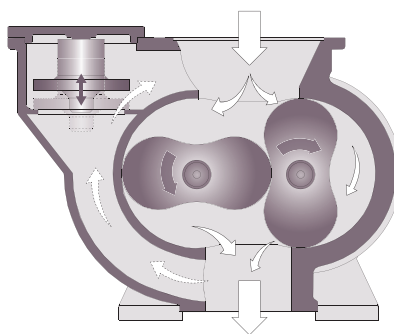
### **i** NOTE

#### **Technical term.**

In this instruction manual, we consider that the term 'machine' refers to the 'vacuum booster'.



## 2.1 Operating Principle



The machine works on the Roots blower principle.

The two oil housings (on each side) allow the lubrication of the gears, bearings and in certain versions the oil lubricated mechanical seals.

A bypass valve (BPV) limits automatically the differential pressure between inlet and outlet.

## 2.2 Application

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

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

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

The vacuum booster is used in combination with a backing pump in vacuum system.

Permitted environmental conditions see Technical Data [▶ 20].

### ! NOTICE

Chemical compatibility of the process gases with the machine component materials.

**Risk of corrosion inside the compression chamber which can reduce performance and its lifetime!**

- Check if the process gases are compatible with those following materials:
  - Cast iron
  - Steel
  - Aluminium
  - Fluoroelastomer (FKM/FPM)
- In doubt, please contact your Busch representative.

## 3 Transport

### ⚠ WARNING

Suspended load.

**Risk of severe injury!**

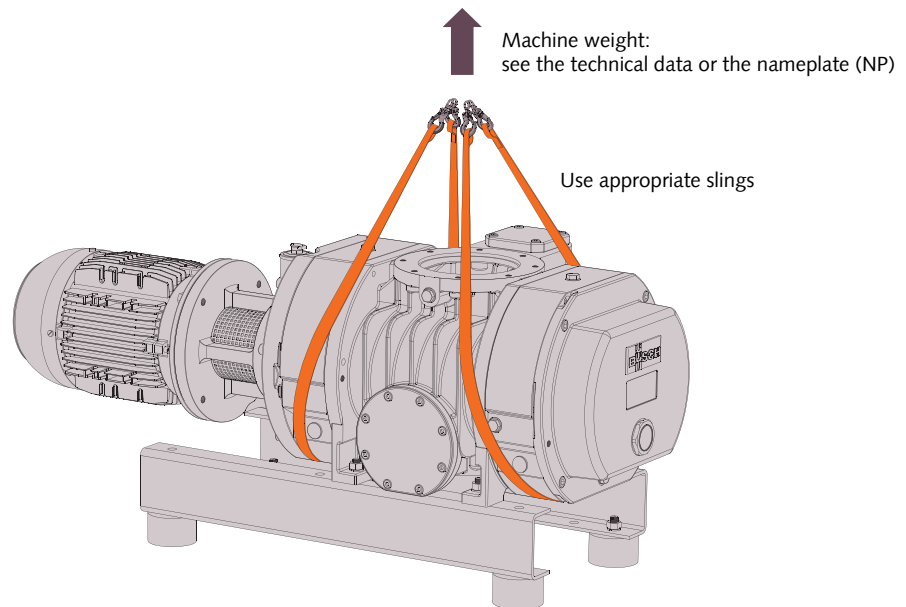
- Do not walk, stand or work under suspended loads.

## ! NOTICE

In case the machine is already filled with oil.

**Tilting a machine that is already filled with oil can cause large quantities of oil to ingress into the cylinder.**

- Drain the oil prior to every transport or always horizontally transport the machine.



- Check the machine for transport damage.
- If the machine is secured to a base plate:
- Remove the machine from the base plate.

## ! WARNING

Lifting the machine using the motor eye bolt.

**Risk of severe injury!**

- Do not lift the machine using the eye bolt fitted to the motor. Only lift the machine as previously shown.

## 4 Storage

- Seal all apertures with adhesive tape or reuse provided caps.

If the machine is to be stored for more than 3 months:

- Wrap the machine in a corrosion inhibiting film.
- Store the machine indoors, dry, dust free and if possible in original packaging preferably at temperatures between -20 ... 55 °C.

## 5 Installation

### 5.1 Installation Conditions

- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the Technical Data [► 20].
- Make sure to use a suitable backing pump, if necessary seek advice from your Busch representative
- Make sure that the environmental conditions comply with the protection class of the motor.
- Make sure that the installation space or location is vented such that sufficient cooling of the machine is provided.
- Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way.
- Make sure that the oil sight glass (OSG) remains easily visible.
- Make sure that enough space remains for maintenance work.
- Make sure that the machine is placed or mounted horizontally, a maximum of 1° in any direction.
- Make sure that the machine is secured either from the four feet or from the discharge flange.
- Check the oil level, see Oil Level Inspection [► 14].
- Make sure that all provided covers, guards, hoods, etc. are mounted.

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

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

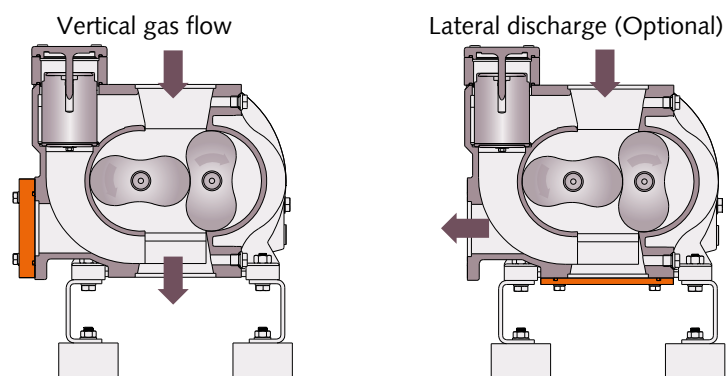
### 5.2 Connecting Lines / Pipes

- Make sure that the connection lines cause no stress on the machine's connection; if necessary use flexible joints.
- Make sure that the line size of the connection lines over the entire length is at least as large as the connections of the machine.

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

#### 5.2.1 Gas Flow Variants

The machine can be installed in different ways:



(In some specific cases, other gas flow variantes may apply)

## 5.2.2 Suction Connection

### **WARNING**

Unprotected suction connection.

#### **Risk of severe injury!**

- Do not put hand or fingers in the suction connection.

### **NOTICE**

Intruding foreign objects or liquids.

#### **Risk of damage to the machine!**

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

- Install a suitable filter (5 micron or less) upstream from the machine.

Connection size:

- DN100, DIN 28404 for WV 0250-0500 C
- DN160, DIN 28404 for WV 1000-2000 C

Depending on the specific order, other connection dimensions may apply.

## 5.2.3 Discharge Connection

Connection size:

- DN100, DIN 28404 for WV 0250-1500 C
- DN160, DIN 28404 for WV 2000 C

Connection size for lateral discharge (OUT2):

- DN63, DIN 28404 for WV 0250-0500 C
- DN100, DIN 28404 for WV 1000-1500 C
- DN160, DIN 28404 for WV 2000 C

Depending on the specific order, other connection dimensions may apply.

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

## 5.3 Filling Oil

### **NOTICE**

Use of an inappropriate oil.

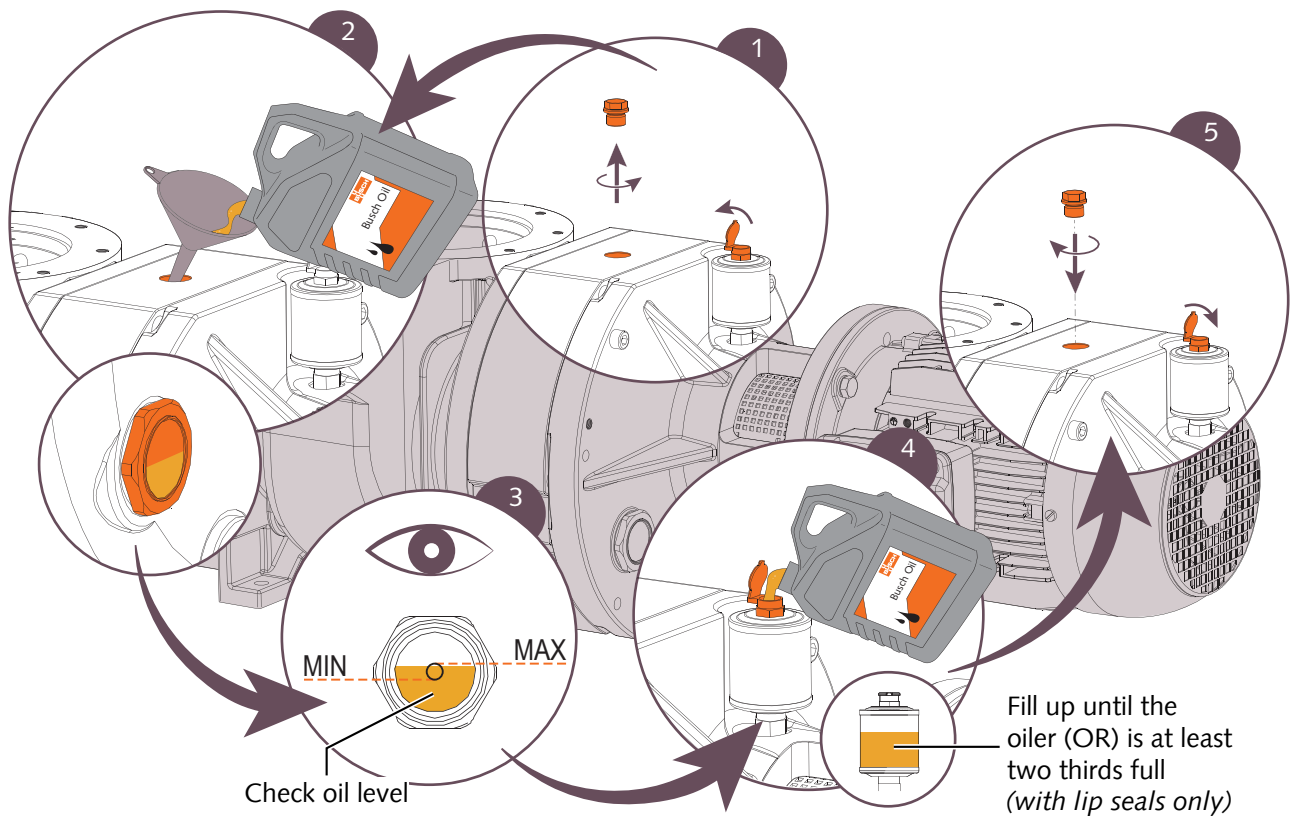
#### **Risk of premature failure!**

#### **Loss of efficiency!**

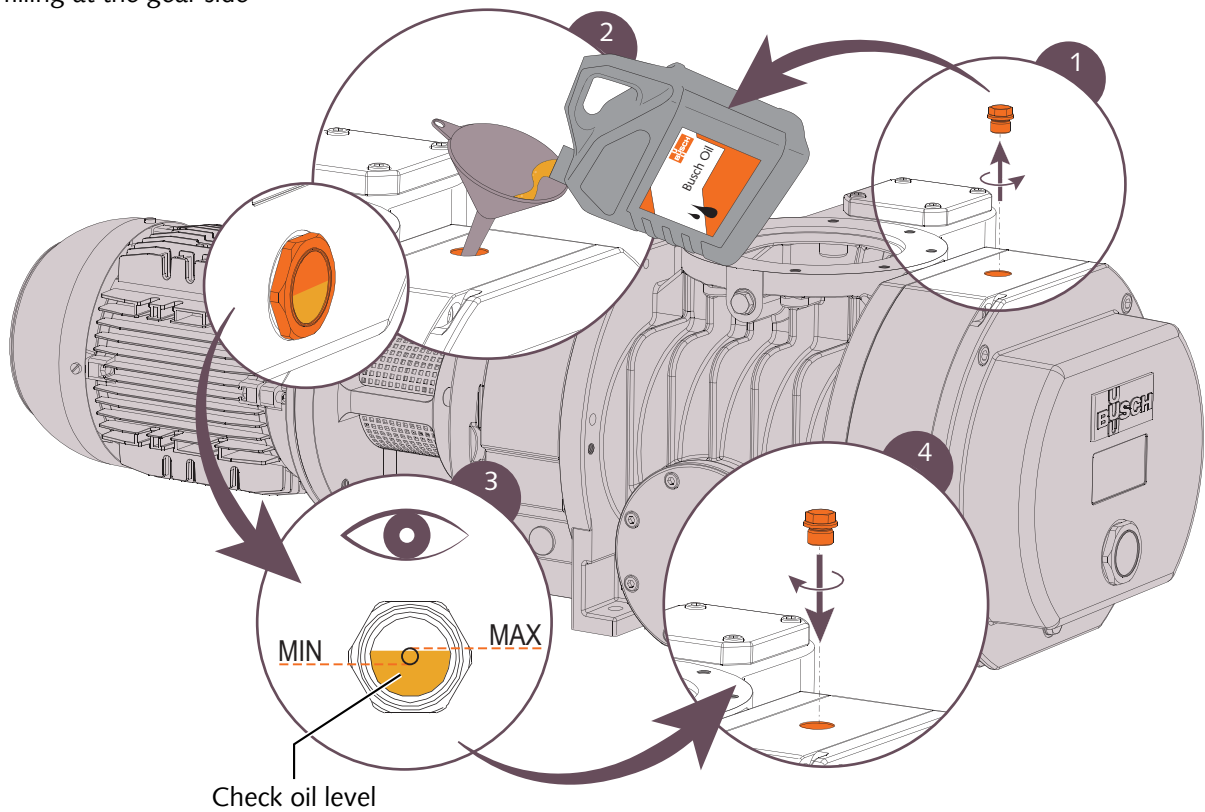
- Only use an oil type which has previously been approved and recommended by Busch.

For oil type and oil capacity see Technical Data [ ▶ 20] and Oil [ ▶ 20].

Oil filling at the motor side



Oil filling at the gear side



## 5.4 Electrical Connection

 **DANGER**

Live wires.

**Risk of electrical shock.**

- Electrical installation work must only be executed by qualified personnel.
- Make sure that the power supply for the motor is compatible with the data on the nameplate of the motor.
- Provide overload protection according to EN 60204-1 for the motor.
- Make sure that the motor of the machine will not be affected by electric or electro-magnetic disturbance from the mains; if necessary seek advice from Busch.
- Connect the protective earth conductor.
- Electrically connect the motor.

 **NOTICE**

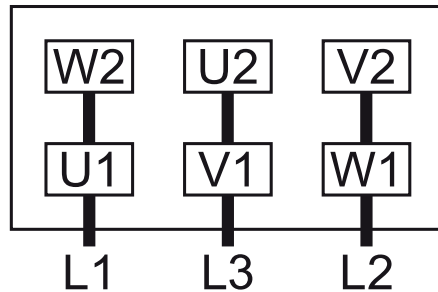
Incorrect connection.

**Risk of damage to the motor!**

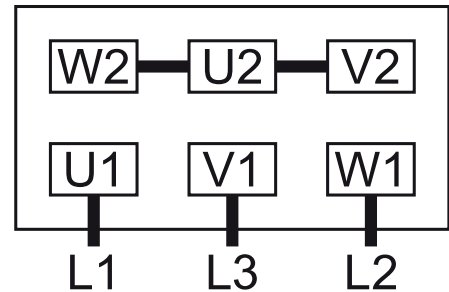
- The wiring diagrams given below are typical. Check the inside of the terminal box for motor connection instructions/diagrams.

### 5.4.1 Wiring Diagram Three-Phase Motor

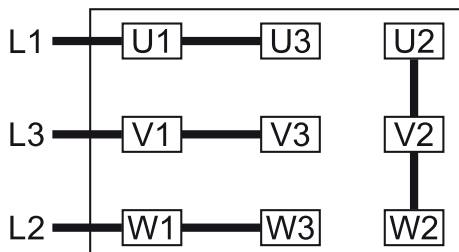
Delta connection (low voltage):



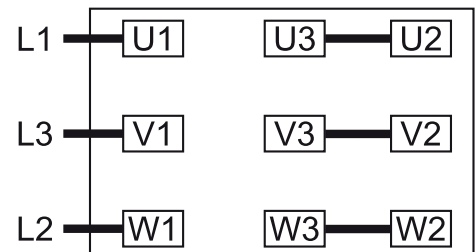
Star connection (high voltage):



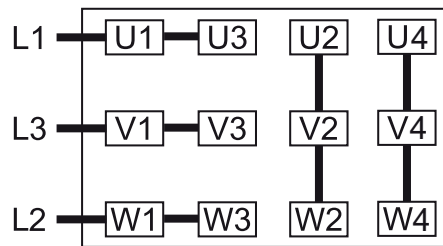
Double star connection, multi-voltage motor with 9 pins (low voltage):



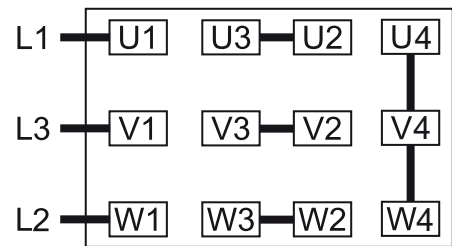
Star connection, multi-voltage motor with 9 pins (high voltage):



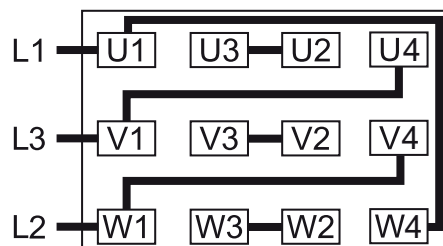
Double star connection, multi-voltage motor with 12 pins (low voltage):



Star connection, multi-voltage motor with 12 pins (high voltage):



Delta connection, multi-voltage motor with 12 pins (middle voltage):



### ! NOTICE

Incorrect direction of rotation.

#### Risk of damage to the machine!

- Operation in the wrong direction of rotation can destroy the machine in a short time! Prior to start-up, ensure that the machine is operated in the right direction.

The intended rotation direction of the motor is defined by the specific instruction label stuck on the machine.

- Jog the motor briefly.
- Watch the fan wheel of the motor and determine the direction of rotation just before the fan wheel stops.

If the rotation of the motor must be changed:

- Switch any two of the motor phase wires.

## 6 Commissioning

### ! NOTICE

The machine is shipped without oil.

#### Operation without oil will ruin the machine in short time!

- Prior to commissioning, the machine must be filled with oil, see Filling Oil [► 8].

### ! NOTICE

Lubricating a dry running machine (process chamber).

#### Risk of damage to the machine!

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

**CAUTION**

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

**Risk of burns!**

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



**CAUTION**

Noise of running machine.

**Risk of damage to hearing!**

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

- Make sure that ear protection is being used.
- Make sure that the installation conditions (see Installation Conditions [▶ 7]) are complied with.
- Switch on the machine.
- Make sure that the maximum permissible number of starts does not exceed 6 starts per hour.
- After few minutes of operation, perform an Oil Level Inspection [▶ 14].

As soon as the machine is operated under normal operating conditions:

- Measure the motor current and record it as reference for future maintenance and troubleshooting work.

## 6.1 Process Chamber Flushing

Depending on the process type (very demanding application), flushing through the process chamber (cylinder + lobes) might need to be performed. Seek advice from your Busch representative.

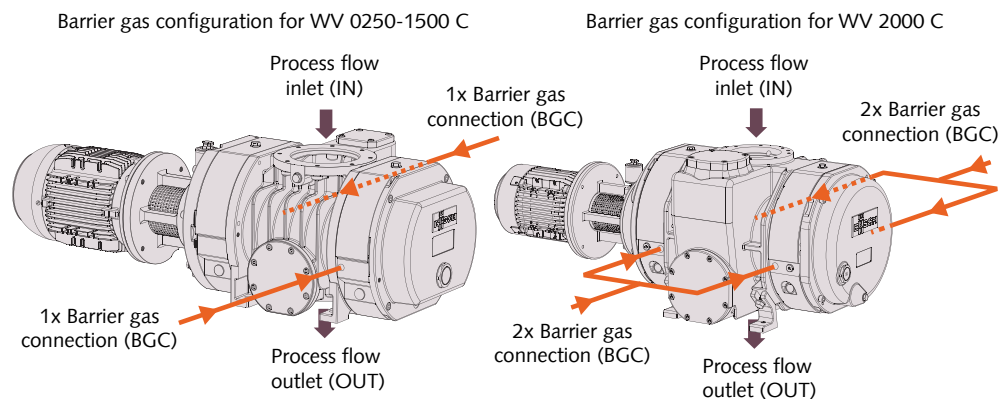
**NOTICE**

Flushing without barrier gas.

**Risk of damage to the machine!**

- The flushing process can pass over into the bearings and the oil chambers!  
Do not perform flushing without using the barrier gas.

Beforehand, a barrier gas must be connected according to the following illustration and recommendations:





Connection size:

- 2 x G3/8 (BGC) for WV 0250-1500 C
- 4 x G3/8 (BGC) for WV 2000 C

Barrier gas requirements:

Gas type	Dry nitrogen, air or other suitable gas	
Gas temperature	°C	0 ... 60
Filtration	µm	≤ 5
Gas pressure	bar	≥ Pressure of flushing fluid + 1 bar
Recommended flow rate	SLM*	30

\* *standard litre per minute*

- Stop the machine.
- Open the gas supply.
- Flush the machine.

When the flushing is finished:

- Close the gas supply.
- Dry the machine of flushing fluid.

Do not operate the machine in normal operating conditions with the barrier gas opened. It might affect the ultimate pressure and the suction capacity.

## 7 Maintenance



### **WARNING**

Machines contaminated with hazardous material.

**Risk of poisoning!**

**Risk of infection!**

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

### **CAUTION**

Hot surface.

**Risk of burns!**

- Prior to any action requiring touching the machine, let the machine cool down first.
- Shut down the machine and lock against inadvertent start up.
- Vent the connected lines to atmospheric pressure.

If necessary:

- Disconnect all connections.

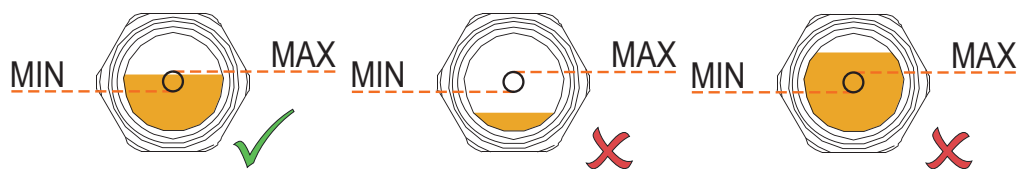
### 7.1 Maintenance Schedule

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

Interval	Maintenance work
Monthly	<ul style="list-style-type: none"> <li>Check the oil level, see Oil Level Inspection [▶ 14].</li> <li>Check the machine for oil leaks - in case of leaks have the machine repaired (contact Busch).</li> </ul>
After the first 500 hours	<ul style="list-style-type: none"> <li>Change the oil of the gear and bearing housings (both sides), see Oil Change [▶ 14].</li> </ul>
Every 6 months	<ul style="list-style-type: none"> <li>Perform an oil inspection; change it if the oil has changed its initial colour, see Oil Colour Inspection [▶ 14].</li> </ul>
Every 5000 hours, at the latest after 1 year	<ul style="list-style-type: none"> <li>Change the oil of the gear and bearing housings (both sides)</li> <li>Clean the magnetic plugs (MP)</li> </ul>
Every 8 years	<ul style="list-style-type: none"> <li>Have a major overhaul on the machine (contact Busch).</li> </ul>

## 7.2 Oil Level Inspection

- Shut down the machine.
- When the machine is stopped, wait 1 minute before checking the oil level.



- Fill up if necessary, see Oil Filling [▶ 8].

## 7.3 Oil Colour Inspection

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

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

- Change the oil immediately, see Oil Change [▶ 14].



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

## 7.4 Oil Change

### ! NOTICE

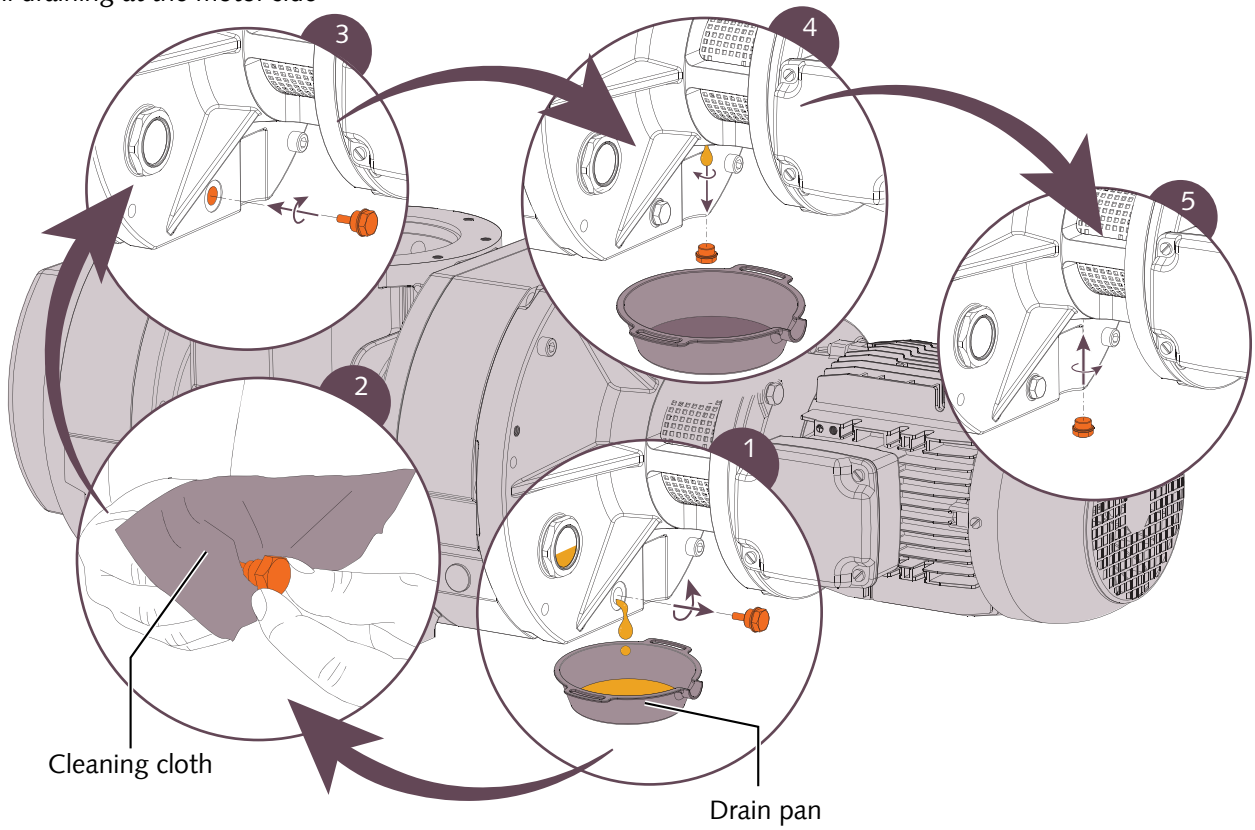
Use of an inappropriate oil.

**Risk of premature failure!**

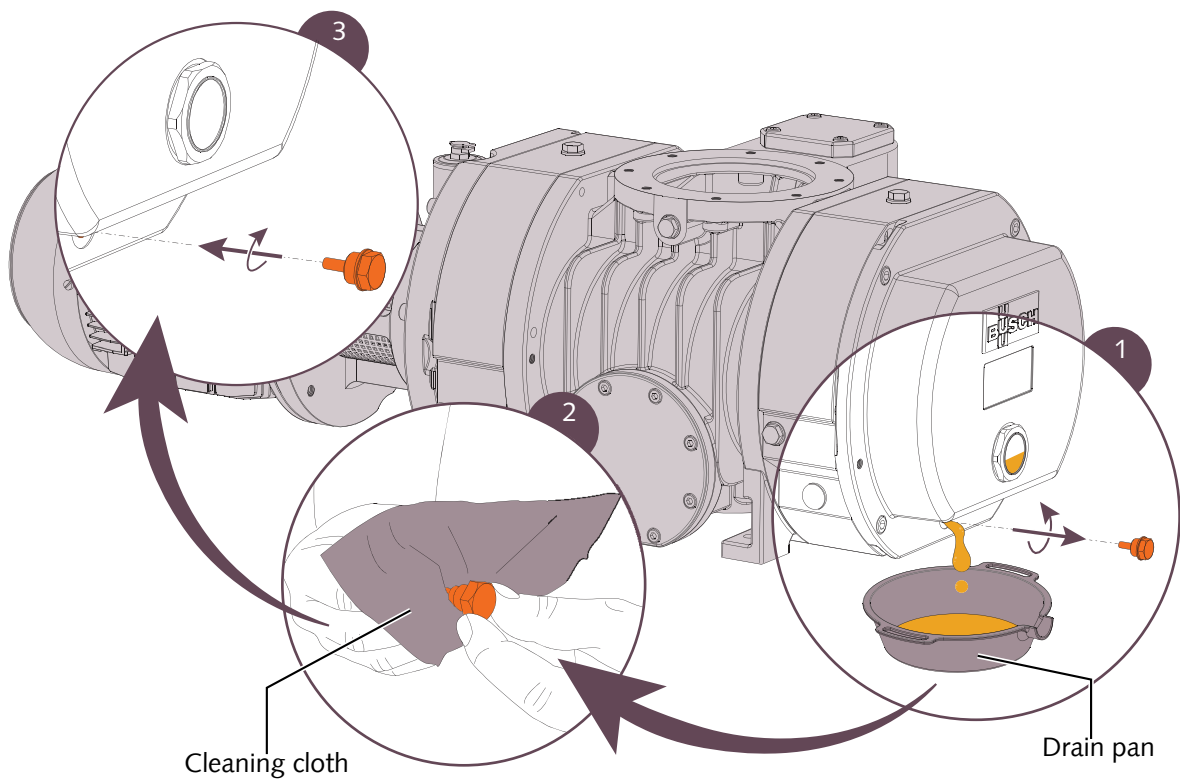
**Loss of efficiency!**

- Only use an oil type which has previously been approved and recommended by Busch.

Oil draining at the motor side

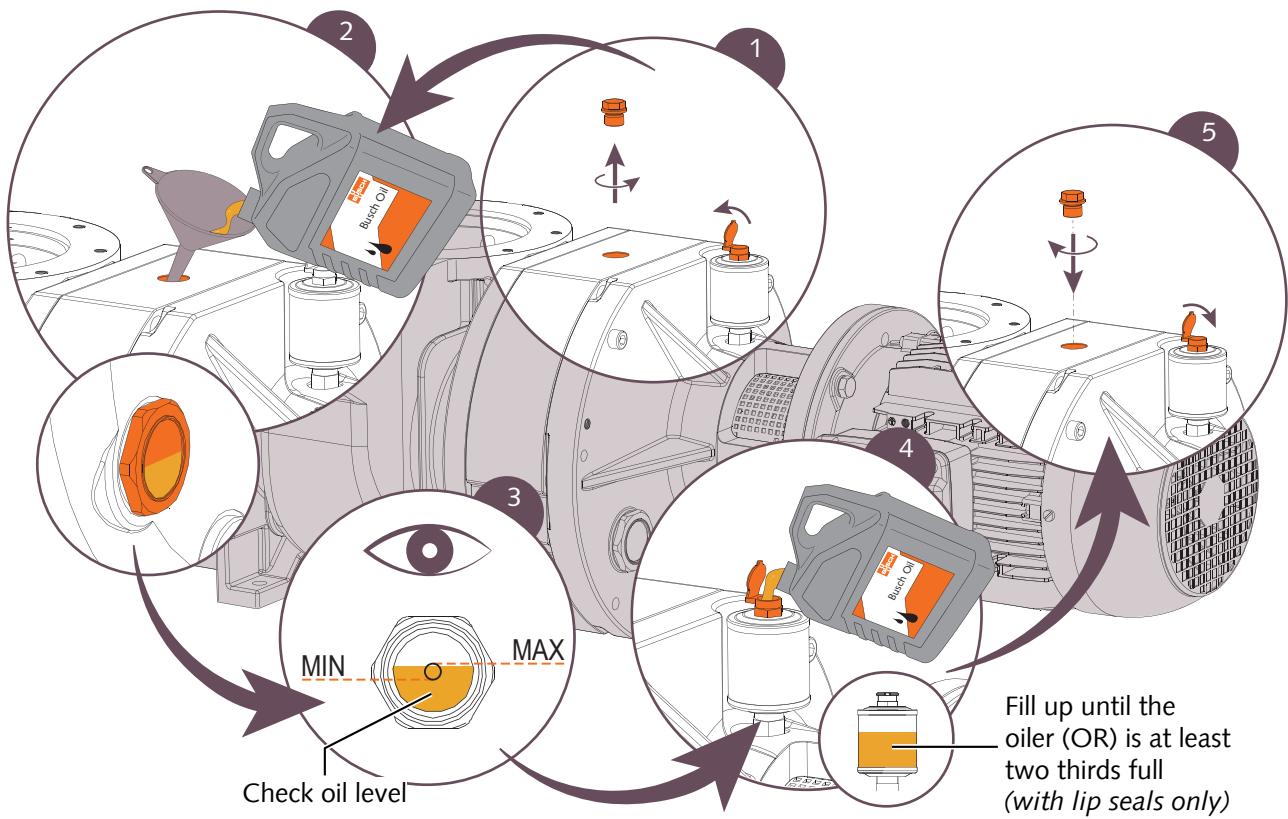


Oil draining at the gear side

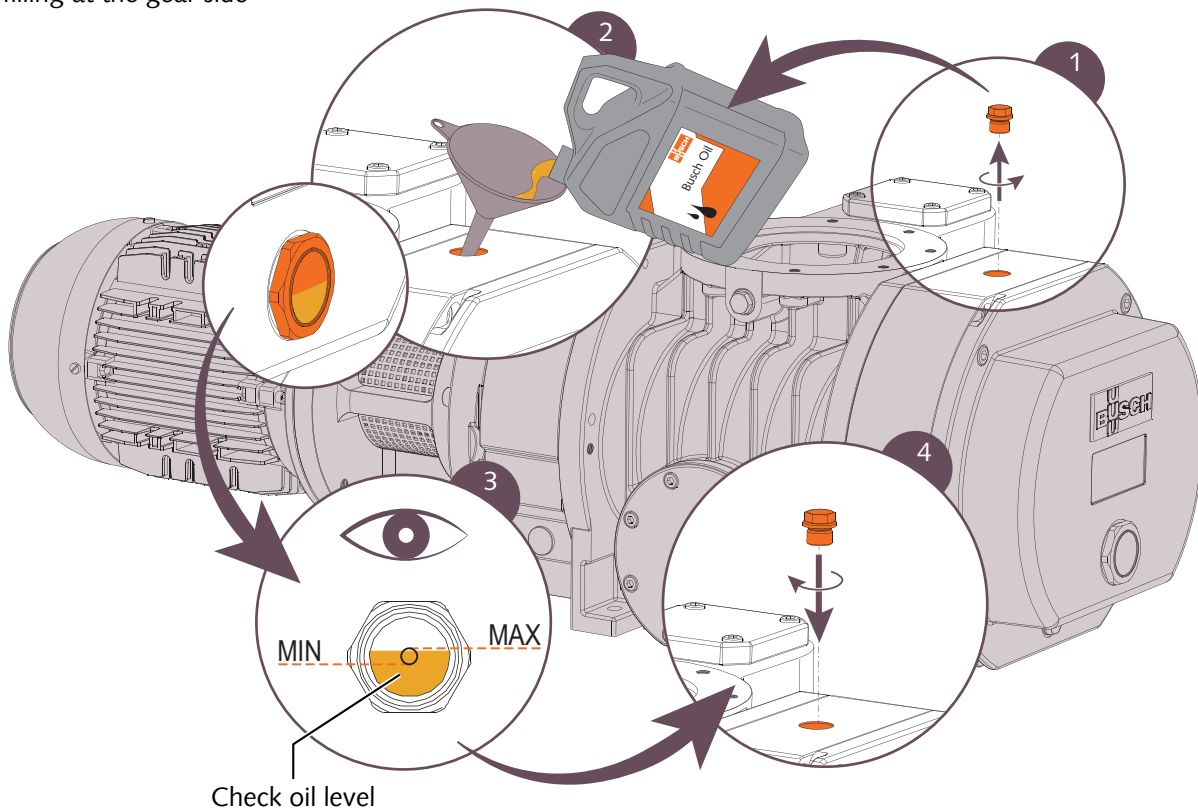


For oil type and oil capacity see Technical Data [▶ 20] and Oil [▶ 20].

### Oil filling at the motor side



### Oil filling at the gear side



## 8 Overhaul

### NOTICE

Improper assembly.

**Risk of premature failure!**

**Loss of efficiency!**

- It is highly recommended that any dismantling of the machine that goes beyond anything that is described in this manual should be done through Busch.



### WARNING

Machines contaminated with hazardous material.

**Risk of poisoning!**

**Risk of infection!**

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

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

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

Busch will only accept machines that come with a completely filled in and legally binding signed 'Declaration of Contamination'.

(Form downloadable from [www.buschvacuum.com](http://www.buschvacuum.com))

## 9 Decommissioning

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

If the machine is going to be stored:

- See Storage [▶ 6].

### 9.1 Dismantling and Disposal

- Drain the oil.
- Separate special waste from the machine.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the machine as scrap metal.

# 10 Spare Parts

 **NOTICE**

Use of non-Busch genuine spare parts.

**Risk of premature failure!**

**Loss of efficiency!**

- The exclusive use of Busch genuine spare parts and consumables is recommended for the proper function of the machine and for granting of warranty.

There is no standard spare parts kits available for this product, if you require Busch genuine parts:

- Contact your Busch representative for the detailed spare parts list.

# 11 Troubleshooting

 **DANGER**

Live wires.

**Risk of electrical shock.**

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

 **CAUTION**

Hot surface.

**Risk of burns!**

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

Problem	Possible Cause	Remedy
The machine does not start.	The motor is not supplied with the correct voltage.	<ul style="list-style-type: none"> <li>• Check the power supply.</li> </ul>
	The lobes are jammed or seized.	<ul style="list-style-type: none"> <li>• Lobes inspection or repair the machine (contact Busch).</li> </ul>
	Solid foreign matter has entered the machine.	<ul style="list-style-type: none"> <li>• Remove the solid foreign matter or repair the machine (contact Busch).</li> <li>• Equip the machine with a mesh screen at the suction connection.</li> </ul>
	The motor is defective.	<ul style="list-style-type: none"> <li>• Replace the motor.</li> </ul>

The machine does not reach the usual pressure.	Suction or discharge lines too long or section diameter too small.	<ul style="list-style-type: none"> <li>• Use larger diameter or shorter lines.</li> <li>• Seek advice from your local Busch representative.</li> </ul>
	The backing pump is not correctly defined.	<ul style="list-style-type: none"> <li>• Contact Busch.</li> </ul>
	The machine runs in the wrong direction.	<ul style="list-style-type: none"> <li>• Check the direction of rotation, see Wiring Diagram Three-Phase Motor [▶ 10].</li> </ul>
	Internal parts are worn or damaged.	<ul style="list-style-type: none"> <li>• Repair the machine (contact Busch).</li> </ul>
The machine runs very noisily.	Wrong oil quantity or unsuitable oil type.	<ul style="list-style-type: none"> <li>• Use one of the recommended oils in the correct quantity, see Oil [▶ 20].</li> </ul>
	Defective gears, bearings or coupling element.	<ul style="list-style-type: none"> <li>• Repair machine (contact Busch).</li> </ul>
The machine runs too hot.	Ambient temperature too high.	<ul style="list-style-type: none"> <li>• Observe the permitted ambient temperature, see Technical Data [▶ 20].</li> </ul>
	Temperature of the process gases at the inlet too high.	<ul style="list-style-type: none"> <li>• Observe the permitted gas inlet temperature, see Technical Data [▶ 20].</li> </ul>
	Oil level too low.	<ul style="list-style-type: none"> <li>• Top up oil.</li> </ul>
	The backing pump is not correctly defined.	<ul style="list-style-type: none"> <li>• Contact Busch.</li> </ul>
The oil is black.	Oil change intervals are too long.	<ul style="list-style-type: none"> <li>• Drain the oil and fill in new oil, see Oil Change [▶ 14].</li> </ul>
	The machine runs too hot.	<ul style="list-style-type: none"> <li>• See problem "The machine runs too hot".</li> </ul>

For the solution of problems not mentioned in the troubleshooting chart contact your Busch representative.

## 12 Technical Data

		WV 0250 C	WV 0500 C	WV 1000 C	WV 1500 C	WV 2000 C
Nominal pumping speed (50Hz / 60Hz)	m <sup>3</sup> /h	250 / 300	500 / 600	1000 / 1200	1500 / 1800	2000 / 2400
Nominal motor rating (50Hz / 60Hz)	kW	1.1 / 1.2	2.2 / 3.0	3.5 / 4.8	4.2 / 5.5	6.0 / 7.6
Nominal motor speed (50Hz / 60Hz)	min <sup>-1</sup>	1500 / 1800	3000 / 3600	3000 / 3600	3000 / 3600	3000 / 3600
Ambient temperature range	°C	5 ... 40				
Max. gas inlet temperature	°C	200 (P <10 hPa, staging ratio of 4)				
Relative humidity	at 30°C	90%				
Oil capacity (Motor side)	l	0.4	0.4	0.7	0.7	1.65
Oil capacity (Gear side)	l	0.5	0.5	1.2	1.2	3
Oil capacity (Oiler)	l	0.35	0.35	0.5	0.5	0.25
Weight approx.	kg	146	146	256	270	546

## 13 Oil

	VE 101	VSL 100
ISO-VG	100	100
Part number 1 L packaging	0831 000 099	0831 122 573
Part number 5 L packaging	0831 000 100	0831 122 572

To know which oil has been filled in the machine, please refer to the nameplate (NP).