



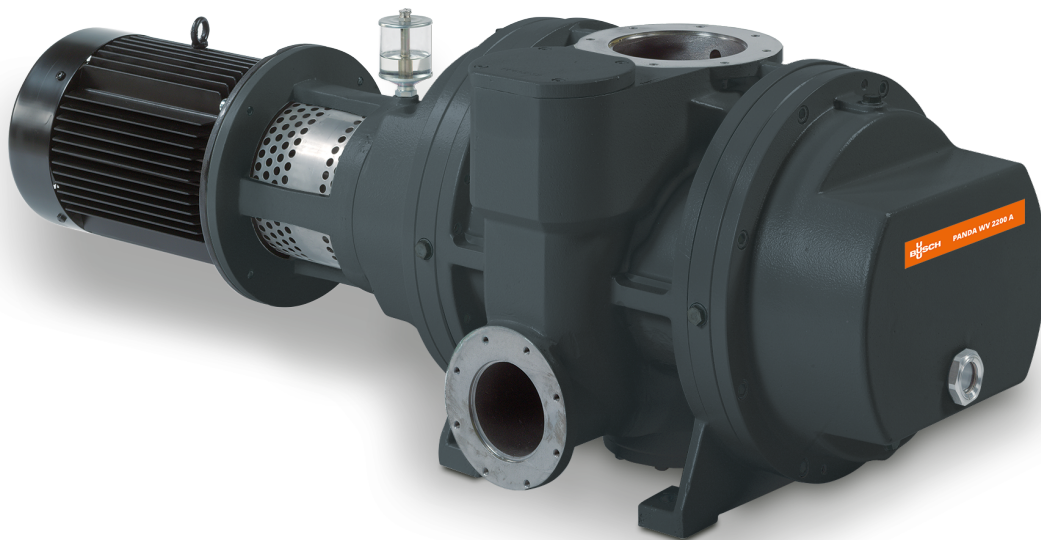
**VACUUM SOLUTIONS**

Part of the **BUSCH** GROUP

# PANDA

Vacuum Boosters  
WV 2200 A

## Instruction Manual



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# 1 About this Manual



## NOTE

### Important

**Read carefully before use.**

- Keep the manual for future consultation.

## 1.1 Validity

This instruction manual is a customer document of Busch. The instruction manual describes the functions of the named product and provide the most important information for the safe use of the device. The description is written in accordance with the valid directives. The information in this instruction manual refers to the product's current development status. The document shall remain valid provided that the customer does not make any changes to the product.

### 1.1.1 Applicable Documents

| Document                                                                 | Number                                 |
|--------------------------------------------------------------------------|----------------------------------------|
| Supplementary Information for vacuum boosters with special bypass valves | PW 0022                                |
| Spray Lance Instruction Manual                                           | PW 0332                                |
| Declaration of conformity                                                | A component of this instruction manual |

### 1.1.2 Variants

These instructions apply to vacuum booster of the following versions:

| Type             | Design                                                                                                                                                                                                                                                                                                                                                              |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard version | Standard version: <ul style="list-style-type: none"> <li>• Standard motor</li> <li>• Housing and all parts forming the vacuum chamber made of GG (Cast iron with lamellar graphite) and GGG (Spheroidal graphite cast iron)</li> <li>• Exhaust/Inlet connections designed as ISO flanges</li> <li>• Bypass valve for protection against thermal overload</li> </ul> |
| M version        | Changes to the standard design: <ul style="list-style-type: none"> <li>• Version with magnetic coupling</li> </ul>                                                                                                                                                                                                                                                  |

## 1.2 Target Group

This instruction manual is aimed at all persons performing the following activities on the product:

- *Transport* [→ 14]
- *Setup (Installation* [→ 17])
- *Usage and Operation* [→ 26]
- *Decommissioning* [→ 43]
- *Maintenance* [→ 31] and *Cleaning*
- *Storage* [→ 15] or *Disposing* [→ 45]

The work described in this document is only permitted to be performed by persons with the appropriate technical qualifications (expert personnel) or who have received the relevant training from Busch.

## 2 Safety

### 2.1 General Safety Information

The following 4 risk levels and 1 information level are taken into account in this document.



#### **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.

## 2.2 Safety Precautions



### NOTE

**Duty to provide information on potential dangers.**

**The product holder or user is obliged to make all operating personnel aware of dangers posed by this product.**

**Every person who is involved in the installation, operation or maintenance of the product must read, understand and adhere to the safety related parts of this document.**



### NOTE

**Infringement of conformity due to modifications to the product.**

**The Declaration of Conformity from the manufacturer is no longer valid if the operator changes the original product or installs additional equipment.**

- Following the installation into a system, the operator is required to check and re-evaluate the conformity of the overall system in the context of the relevant European Directives, before commissioning that system.

### General safety precautions when handling the product

- Do not expose body parts to the vacuum.
- Check all safety measures at regular intervals.
- Observe the safety and accident prevention regulations, if necessary, wear personal protective equipment.
- Always ensure a secure connection to the earthed conductor (PE), protection class I.
- Never operate the vacuum booster with open vacuum flange.
- Provide suitable touch protection, if the surface temperature exceeds 70°C.
- Provide suitable noise protection measures as necessary.
- During operation, make sure that plug-and-socket connections are securely fitted.
- Before working on the vacuum connection, wait until the rotor is at a complete standstill (rotation speed  $f = 0$  Hz).
- Never make your own conversions or modifications to the vacuum booster.
- Before returning the vacuum booster, observe the notes in chapter *Service Solutions* [→ 48].

## 2.3 Limits of Use of the Product

| Parameter                     | Limit value                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Installation location         | Indoors, protected against: <ul style="list-style-type: none"> <li>• Dust deposits</li> <li>• Falling objects</li> <li>• Fire-fighting water</li> </ul> Outdoors, protected against: <ul style="list-style-type: none"> <li>• Falling objects</li> <li>• Direct influence of weather, such as rain, splash water, strong drafts and sunlight</li> <li>• Fire-fighting water</li> <li>• Lightning strike</li> </ul> |
| Installation altitude         | Max. 2000 m above sea level (When installing at altitudes > 1000 m above sea level and an ambient temperature of 40°C the rated power of the motor reduces by around 10%)                                                                                                                                                                                                                                          |
| Ambient temperature           | +5°C to +40°C                                                                                                                                                                                                                                                                                                                                                                                                      |
| Relative air humidity         | Max. 85% (depending on the motor version)                                                                                                                                                                                                                                                                                                                                                                          |
| Gas temperature, exhaust side | Max. +200°C                                                                                                                                                                                                                                                                                                                                                                                                        |
| Inlet pressure                | Max. 1300 hPa absolute                                                                                                                                                                                                                                                                                                                                                                                             |

## 2.4 Intended Use

- When pumping media with an oxygen concentration level of  $\geq 21\%$ , only use perfluorinated, synthetic oils as oil.
- Adhere to the installation, commissioning, operating, and maintenance instructions.
- Do not use any accessory parts other than those recommended by Busch.
- Use barrier gas as appropriate for the process.
- Operate the vacuum booster within the application limits and in compliance with the *Technical Data* [→ 53].

## 2.5 Foreseeable Misuse

Improper use of the product invalidates all warranty and liability claims. Any use that is counter to the purpose of the product, whether intentional or unintentional, is regarded as improper use; in particular:

- Pumping explosive media
- Pumping of corrosive media
- Using for pressure generation
- Using in systems in which sporadic loads and vibrations or periodic forces act on the device
- Using of accessories or spare parts that are not listed in this instruction manual
- Pumping radioactive media
- Pumping of gases that introduce an ignition source to the vacuum chamber
- Using in strong electrical, magnetic or electromagnetic fields
- Pumping media prone to exothermic reactions
- Transporting, installing, or operating the vacuum pump in an impermissible spatial position

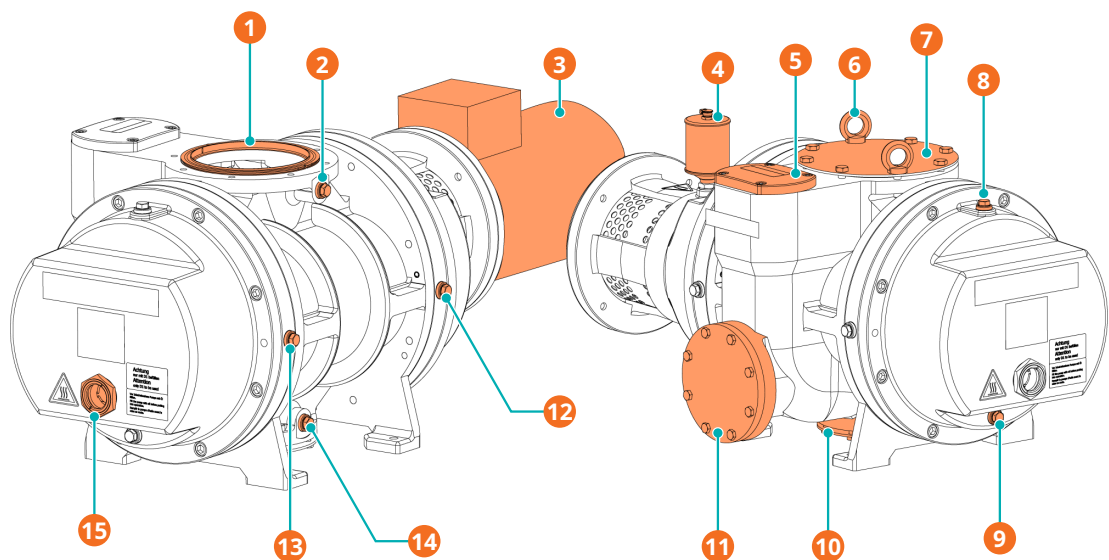
- Pumping media that form adhesive deposits inside the vacuum chamber and cause the pistons to touch or jam
- Pumping of fluids (except flushing media for cleaning)
- Using in potentially explosive atmospheres
- Lifting the vacuum pump without the prescribed eye bolts, for example on piping
- Use of the vacuum booster with open vacuum and/or forevacuum flange open to the atmosphere
- Using oils not specified by Busch
- Using the vacuum pump as a climbing aid

## 3 Product Description

### 3.1 Function

The operating principle of the vacuum booster is based on 2 synchronous pistons that rotate in a housing without touching. The pumping effects arise as a result of the opposing rotation of the 2 figure-of-eight shaped rolling pistons. While vacuum chambers are formed between the rolling pistons and the housing, the rolling pistons continuously form a mutual seal without touching each other or the housing. This opposing yet synchronised movement of the rolling pistons is achieved by means of a pair of gears mounted on the extended shaft ends. Lubrication is limited to the two bearing and gear housing which are arranged separately from the vacuum chambers. As the vacuum booster is not capable of compressing against atmospheric pressure, the vacuum booster must be operated in conjunction with a backing pump connected upstream.

Vacuum boosters of the M series are equipped with a magnetic coupling.



Graphic 1: PUMA WV 2200 A design

| Description |                                            |    |                                                      |
|-------------|--------------------------------------------|----|------------------------------------------------------|
| 1           | Inlet connection (IN)                      | 2  | Measurement connection inlet side                    |
| 3           | Motor (MOT)                                | 4  | Oiler for version with RSSR (radial shaft seal ring) |
| 5           | Bypass valve                               | 6  | Eye bolt (EB)                                        |
| 7           | Cardboard cover disk                       | 8  | Oil fill plug (OFP)                                  |
| 9           | Oil drain plug (ODP)                       | 10 | Exhaust connection (OUT)                             |
| 11          | Optional forevacuum connection             | 12 | Barrier gas connection motor side (BG-CM)            |
| 13          | Barrier gas connection bearing side (BGCP) | 14 | Measurement connection forevacuum side               |
| 15          | Oil sight glass (OSG), gearbox side        |    |                                                      |

## 3.2 Scope of Delivery

- Vacuum booster
- Seals for the exhaust/inlet connections; for ISO flanges, centering rings are included
- Screw kit for the exhaust/inlet connections
- 2 eye bolts
- Oil P3 (for standard version of the vacuum booster)
- Motor-side coupling half for vacuum booster without motor
- Instruction manual

## 3.3 Identifying the Product

To ensure clear identification of the product when communicating with Busch, always keep all of the information on the name plate to hand.

The following information is shown on the nameplates:

- Vacuum booster model
- Article number
- Type and quantity of the oil
- Max. allowable pumping speed
- Date of manufacture
- Input voltage range (motor nameplate)

### 3.3.1 Product Features

| Flange types    | Inlet connection | Forevacuum connection | Barrier gas | Measurement |
|-----------------|------------------|-----------------------|-------------|-------------|
| PANDA WV 2200 A | DN 160 ISO-F     | DN 100 ISO-F          | 4 × G 3/8"  | 2 × G 3/8"  |

## 4 Transport and Storage

### 4.1 Transport



#### WARNING

**Suspended load.**

**Risk of severe injury!**

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



#### WARNING



**Risk of crushing and impact on swinging or falling objects.**

**Risk of severe injuries!**

**During transport, there is a risk of crushing and impact on swinging, toppling or falling objects. There is a risk of injuries to limbs, up to and including bone fractures and head injuries.**

- Secure the danger zone if necessary.
- Pay attention to the center of gravity of the load during transport.
- Ensure even movements and moderate speeds.
- Observe safe handling of the transport devices.
- Avoid sloping attachment aids.
- Never stack products.
- Wear safety shoes.



#### NOTE

**Instructions for safe transport.**

- Only remove the protective cover for the connection flange once the pipes have been mounted.
- Fill the gear and bearing chambers with oil only once the final installation position is reached.



#### NOTE

**We recommend keeping the transport packaging and original protective cover.**

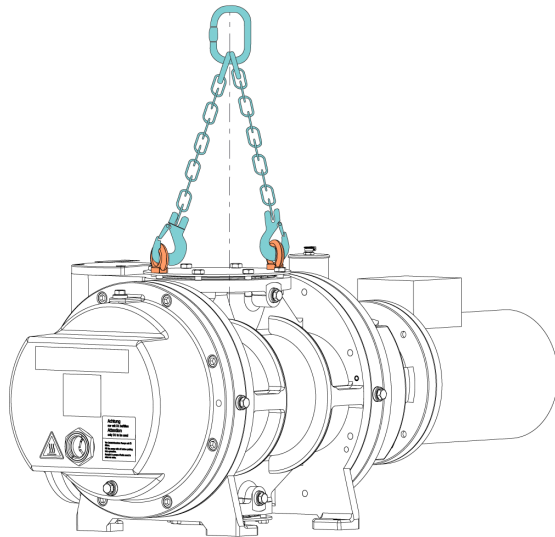
#### Safe transport of the product

- Transport the vacuum booster only within the permissible temperature limits.
- Observe weight specified on the nameplate.
- Where possible, always transport or ship the vacuum booster in its original packaging.
- Remove the protective cover only immediately prior to installation.

#### Transport the vacuum booster in its packaging

- Use a forklift to transport the vacuum booster in its packaging.
- Note the center of gravity of the load.

- Observe safe handling of manually operated transport devices.
- Ensure harmonious movements and moderate speeds.
- Ensure a flat substrate.
- Wear protective equipment, e.g. safety shoes.



Graphic 2: Transporting vacuum booster

### Transport the vacuum booster without its packaging

2 eye bolts (EB) are included in the shipment, which are firmly bolted to the vacuum booster ex-factory.

- Unpack the vacuum booster.
- Attach suitable lifting tools to both EB.
- Pay attention to the correct use and fastening of the lifting equipment.
- Lift the vacuum booster out of the transport packaging.
- If necessary, remove the EB after transport and installation.
  - Keep the EB for future use.
  - Close the threaded holes in the pump housing with appropriate screws to prevent the entry of dust or contamination.

## 4.2 Storage



### NOTE

**We recommend keeping the transport packaging and original protective cover.**

Neither the vacuum chamber nor the lobes in the vacuum booster interior are provided with **corrosion protection**.

### Storing the vacuum booster

- Vacuum-seal exhaust/inlet connections with protective covers.
- Seal all other connections (e.g. venting connection) with the corresponding original parts.
- Store the vacuum booster only in dry, dust-free rooms, within the specified ambient conditions.

- Evacuate and then fill the vacuum chamber with nitrogen to achieve the best corrosion protection for the vacuum booster.
- In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum booster together with a drying agent in a plastic bag.
- Change the oil if the storage period is longer than 2 years.
- If you intend to store the vacuum booster for longer periods, we recommend that you use a special corrosion protection agreed with Busch.

## 5 Installation

### 5.1 Setting Up the Vacuum Pump



#### CAUTION



**Tipping and falling hazard, if machine is not anchored on standing surface.**

**Risk of severe injury!**

**Risk of damage to the machine!**

**During setup, there is a risk of injury from tipping, if the vacuum booster is not anchored on the standing surface.**

- Secure the vacuum booster using suitable lifting gear.
- Wear personal protective equipment.

#### General notes for the installation of vacuum components

- Choose an installation location that permits access to the product and to supply lines at all times.
- Observe the ambient conditions given for the limits of use.
- Provide the highest possible level of cleanliness during assembly.
- Ensure that flange components during installation are grease-free, dust-free and dry.

#### Procedure

- Check the carrying capacity of the floor at the installation location.
- Place the vacuum booster on a flat, horizontal and fixed surface, to safeguard the oil supply.
  - Reference surface is the inlet connection.
- Evenly screw the 4 feet of the vacuum booster onto the base without distorting the pump housing.
- Use shims from the range of *Accessories* [→ 50] for vacuum booster to mount the feet horizontally.
- When installing the vacuum booster in a closed housing, ensure adequate air circulation.
- Keep both oil sight glasses freely accessible for checks and maintenance.
- Keep the filling/drain holes freely accessible.
- Ensure that the motor nameplate always remains accessible for a clear view of the voltage and frequency specifications.
- Maintain the minimum distances to bordering surfaces to guarantee sufficient air circulation.
- Fill with oil prior to first commissioning.

## 5.2 Filling Oil



### WARNING



**Igniting and heating synthetic oil generates toxic vapors. Poisoning when inhaling toxic vapors.**

**Risk of poisoning!**

**Risk to the health!**

**Igniting and heating synthetic oil generates toxic vapors. Danger of poisoning if inhaled.**

- Observe the application instructions and precautions.
- Do not allow tobacco products to come into contact with the oil.



### NOTICE

**Risk of damage due to the use of non-approved oil.**

**Product-specific performance data are not achieved. All liability and warranty claims against Busch are also excluded.**

- Only use approved oils.
- Only use other application-specific oils after consultation with Busch.

#### Permitted oil for standard applications

- P3

#### Permitted oil for pump with magnetic coupling

- YLC250 for corrosive gas versions
- VSC100/D2 for special applications (such as higher operating temperatures)
- H1

Other oils on request

#### The oil type is listed on the nameplate

- Refer to the nameplate for type and quantity of intended oil.
- Only the oil used during initial installation is permissible.
- Contact BUSCH Group in case of using another type of oil.

#### Required tools

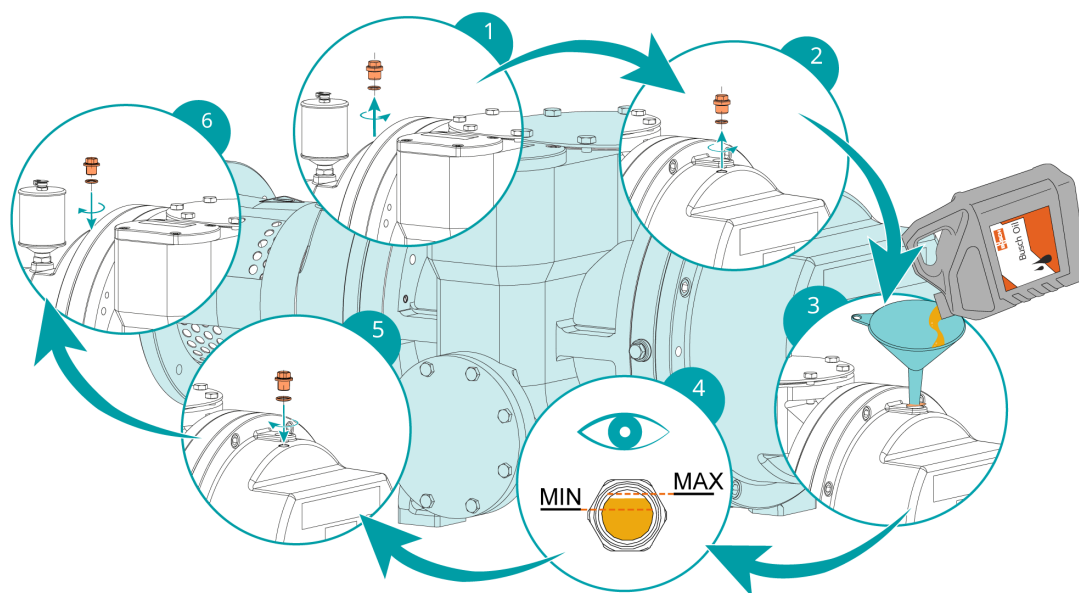
- Hex key, **WAF 17**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )



### NOTE

**Fill oil on both sides.**

**Fill oil on both sides according to the oil sight glass. The fill level for the initial filling is approx. 5 mm above the center of the oil sight glass.**



Graphic 3: Filling with oil

### Procedure

- Screw in the fill plugs.
  - Tightening torque: **max. 32 Nm**
- Check the fill level during operation in the final vacuum.
- If necessary, top up the oil only when the vacuum booster is switched off and vented.

## 5.3 Filling Up the Sealing Oil

### ! NOTICE

**Damage to the vacuum booster due to incorrect procedure when filling sealing oil.**

**Disassembly of the oiler causes leakage in the system. The oil expands when the vacuum booster heats up, which could cause oil to leak if overfilled.**

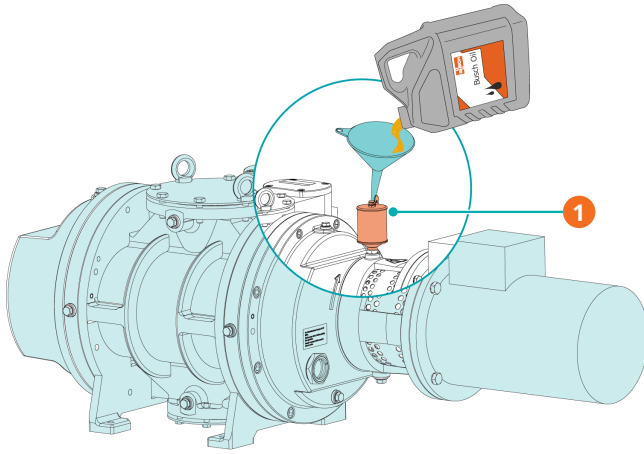
- Use only the oiler's filler flap to fill up.
- While the vacuum booster is cold, fill the oiler no more than halfway.

### i NOTE

**Versions with shaft seal.**

**This section is only valid for vacuum booster with shaft seal. The version with magnetic coupling "M" does not have a lubricator.**

The shaft feedthrough of the drive shaft is sealed with sealing oil-covered shaft seals. The corresponding oiler on the seal casing cools and lubricates the shaft seals. The sealing oil type is the same as the lubricating oil.



Graphic 4: Filling sealing oil for radial shaft seal rings

#### Description

|   |       |  |  |
|---|-------|--|--|
| 1 | Oiler |  |  |
|---|-------|--|--|

#### Procedure

- Always make sure that the oiler is screwed tightly to the vacuum booster.
- Open the filler flap on the oiler.
- Fill the oiler with sealing oil to max. halfway.
- Close the filler flap.

## 5.4 Inlet Connection



### WARNING

**Limbs, hair and clothing might be caught by rotating parts.**

**Risk of severe injuries!**

- Wait until the vacuum booster comes to a complete standstill.
- Keep limbs out of the reach of the vacuum booster.
- Secure the vacuum booster against restart.



### NOTICE

**Property damage from intake of solid particles.**

**During commissioning, there is a risk of damage to the vacuum chamber from dirt from the system or the pipes.**

- Use a suitable protection strainer ("start-up strainer") in the intake flange.
- Ensure that this strainer is only removed when the risk of solid particles entering the vacuum booster can be excluded.
- Observe any pumping speed decrease.

#### Required tools

- Ring spanner, **WAF 13** with flange DN 100 ISO-F
- Ring spanner, **WAF 24** with flange DN 100 PN16

## Procedure

- Degrease the connection flanges.
- Clear welded lines of any tinder, loose parts or similar before installation.
- Route the piping between the vacuum booster and vacuum chamber so that it remains as short as possible.
- Choose a minimum pipe cross section equal to the nominal diameter of the pressure flange.
  - Select a larger nominal diameter for pipe lengths > 5 m.
- Support or suspend the piping to the vacuum booster so that no piping system forces act on the vacuum booster.
  - Install a bellows in the piping if necessary.
- Always use all prescribed screws to fasten the flange.
  - Use a torque of 200 Nm for all screws of connection flanges.

## 5.5 Exhaust Connection



### WARNING

**Limbs, hair and clothing might be caught by rotating parts.**

**Risk of severe injuries!**

- Wait until the vacuum booster comes to a complete standstill.
- Keep limbs out of the reach of the vacuum booster.
- Secure the vacuum booster against restart.



### CAUTION



**Faulty or inadequate exhaust pipes and hoses lead to dangerous situations, e.g. increasing exhaust pressure. Danger of bursting parts and flying fragments from the high pressure.**

**Risk of severe injuries!**

- Route the exhaust line without shut-off units.
- Observe the permissible pressures and pressure differentials for the product.
- Check the function of the exhaust line on a regular basis.

## Required tools

- Ring spanner, **WAF 13** with flange DN 100 ISO-F
- Ring spanner, **WAF 24** with flange DN 100 PN16

## Procedure

- Degrease the connection flanges.
- Clear welded lines of any tinder, loose parts or similar before installation.
- Choose a minimum pipe cross section equal to the nominal diameter of the pressure flange.
- Route the pipes so that no mechanical tension can act on the vacuum booster or the backing pump.
- Install a bellows in the piping if necessary.
- Ensure that mating flanges are in a parallel position.
- Install the pipes downward from the vacuum booster, so that condensate does not flow back into the vacuum booster.

- Install a condensate separator if necessary.
- If a syphon is created in the system, then install a condensate drain facility at the lowest point.

## 5.6 Connecting to the Mains



### DANGER

**Contact with exposed live parts can cause electric shock.**

**Improper connection of the mains supply can result in accessible live components.**

**Risk of death!**

**Risk of electric shock!**

- Before the installation, check that the connection leads are voltage-free.
- Make sure that electrical installations are only carried out by qualified electricians.
- Provide adequate grounding for the device.
- After connection work, carry out an earthed conductor check.



### WARNING

**Risk of injury due to incorrect installation.**

**Dangerous situations may arise from unsafe or incorrect installation.**

- Do not carry out your own conversions or modifications on the unit.
- Ensure the integration into an Emergency Off safety circuit.



### CAUTION

**Risk of injury from entrapment of body parts.**

**After a power failure or a standstill as a result of overheating, the motor restarts automatically. A risk exists of minor injury to fingers and hands (e.g., hematoma), from direct contact with the vacuum flange.**

- Maintain sufficient distance to the vacuum flange during all work.
- Safely disconnect motor from the mains.
- Secure the motor against restart.



### NOTICE

**Risk of property damage from excess voltage.**

**Incorrect or excessive mains voltage will destroy the motor.**

- Always observe the motor nameplate specifications.
- Route the mains connection in accordance with locally applicable provisions.
- Always provide a suitable mains fuse to protect the motor and supply cable in the event of a fault. Busch recommends type "K" circuit breakers with slow tripping characteristics.



### NOTICE

**Motor damage from overheating.**

**Limited motor fan cooling capacity, caused by low speeds, causes the motor to overheat.**

- During operation with a frequency converter, observe the rotational speed range specified in the technical data.

The vacuum boosters are equipped with three-phase motors for different voltages and frequencies. The applicable motor type is shown on the motor nameplate.

### Standard versions

- Three phase motor with PTC, without switch and mains cable

## 5.6.1 Connecting a Three-Phase Motor with a 6-pin Terminal Board



### NOTICE

**Property damage from high starting torque.**

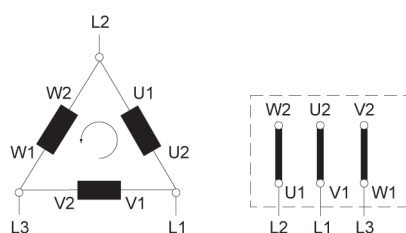
**The specific load behavior of the vacuum booster requires direct on-line starting at full motor power. Engine damage occurs if a different starting circuit is used.**

- Always start the motor directly or with optional VSD (variable speed drive).
- Never use a star-delta start-up circuit.

### Prerequisites

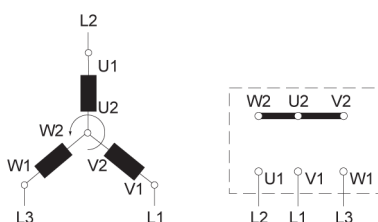
- Vacuum booster switched off

Connectors U1 – L2, V1 – L1 and W1 – L3 rotate the motor shaft clockwise when looking at the motor fan.



*Graphic 5: Delta connection for Low Voltage*

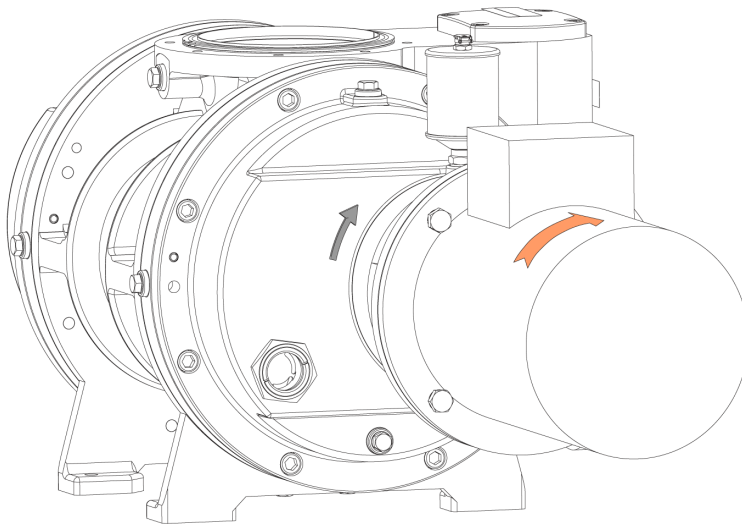
The 3 phases are connected in series, and their connection points connected to the mains. The voltage per phase is equal to the mains voltage, while the mains current is  $\sqrt{3}$  times the phase current. The delta connection is marked with the  $\Delta$  symbol. The voltage between the incoming mains supply lines is called mains voltage. The mains current is the current flowing in the incoming supply lines.



*Graphic 6: Star connection for High Voltage*

The ends of the 3 phases are connected in the star point. The terminal voltage is  $\sqrt{3}$  times the phase voltage, the mains current is equal to the phase current. The star connection is marked with the Y symbol.

## 5.6.2 Checking the Direction of Rotation



Graphic 7: Check of direction of rotation

### Procedure

- Switch on the vacuum booster briefly (2 to 3 seconds).
  - The motor and motor fan must rotate clockwise (see the arrow symbol).
- If the direction of rotation is incorrect, exchange the 2 phases on the connection cable.

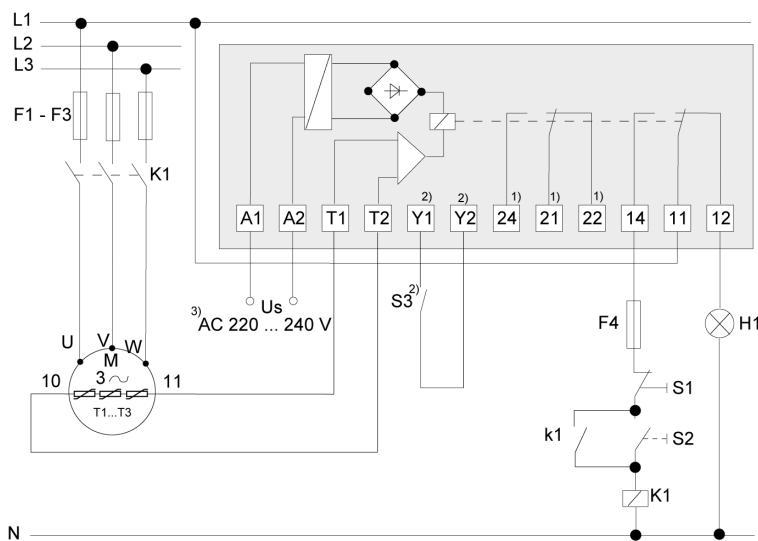
## 5.6.3 Connecting a PTC Thermistor Tripping Unit



### NOTE

Tripping units store the shut-down.

Busch recommends connecting motors with PTC (positive temperature coefficient) in the stator winding to a PTC thermistor tripping unit for protection against overload.



Graphic 8: Connection example with PTC thermistor tripping unit

| Position       | Description    | Position | Description                                        |
|----------------|----------------|----------|----------------------------------------------------|
| U <sub>s</sub> | Supply voltage | T1-T3    | PTC resistor sensor                                |
| S <sub>1</sub> | OFF button     | H1       | Tripping indicator                                 |
| S <sub>2</sub> | ON button      | M        | Motor, 3-phase                                     |
| S <sub>3</sub> | RESET button   | 1)       | For devices with two relay outputs only            |
| K1             | Contactors     | 2)       | For MSR type (model) only                          |
| F1-F4          | Fuses          | 3)       | Only for article number: 2000028243 and 2000028242 |

### Procedure

- After shut-down, switch the tripping unit back on manually via the installed RESET button or via the external RESET S3.
  - Switching on the mains is detected as automatic RESET.

## 6 Operation

### 6.1 Commissioning

#### Before starting the vacuum booster

- Check the oil levels on both oil sight glasses (OSG).
- Compare the specifications on the motor nameplate with the available mains voltage and frequency.
- Make sure that the vacuum chamber is free from all foreign matters.
- Check the vacuum booster for visible damage and put it into operation only in a correct state.
- Protect the vacuum booster from sucking in contamination using suitable measures (e.g. dust filter).
- Make sure that shut-off devices on the pressure are side open before starting the vacuum booster.

### 6.2 Starting the Vacuum Booster



#### WARNING

**Danger of poisoning due to toxic process media escaping from the exhaust pipe.**

**If operated without an exhaust line, the vacuum booster will discharge gases and vapors directly into the ambient air. In processes involving toxic media, this can result in severe injury or death due to poisoning.**

**Risk of poisoning!**

**Risk of infection!**

- Observe the pertinent regulations for handling toxic process media.
- Safely purge toxic process media via an exhaust line.
- Use appropriate filter equipment to separate toxic process media.



#### CAUTION

**Hot surface.**

**Risk of burns!**

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

#### Procedure in case of open bypass valve

- The customer must provide an appropriate start-up circuit (e.g., contactor circuit) for switching on the vacuum booster simultaneously with, or after, the backing pump.
- Allow the vacuum booster to warm up with the vacuum flange closed, for approx. 30 minutes prior to the process start.

The bypass valve is open at the beginning of evacuation in high pressures ranges. This protects the vacuum booster from overload. The bypass valve closes as soon as the differential pressure between the suction side and pressure side reaches or exceeds 35 hPa.

### Procedure in case of a blocked bypass valve

- Switch on the vacuum booster only at a pressure at which the backing pump can take over the delivered gas quantity.
- Limit the torque in the event of overload with a frequency converter, if you wish to switch on the vacuum booster simultaneously with the backing pump.
- Allow the vacuum booster to warm up with the vacuum flange closed, for approx. 30 minutes prior to the process start.

## 6.3 Checking the Oil Level

### Checking the oil level

- Regularly check oil level while vacuum booster is running and at operating temperature.
- Make sure that the fill level is within the markings on the oil sight glass frame.
- Check oil fill level daily during continuous operation, and every time vacuum booster is switched on.

## 6.4 Adjusting the Barrier Gas Amount



### WARNING

**Uncontrolled ingress of air or oxygen-containing gases can create reactive, potentially explosive, or otherwise hazardous gas/air mixtures within the vacuum system.**

**Risk of severe injuries!**

**Risk of explosion!**

- Use only inert gases for supplying the barrier gas supply in order to avoid a potential ignition.



### NOTICE

**Property damage from impermissibly high barrier gas pressure.**

**Excessive barrier gas pressure leads to damage to the seals after switching on the vacuum booster.**

- Make sure that the barrier gas pressure inside the vacuum booster does not exceed 1200 hPa.
- Stop the barrier gas supply immediately after switching off the vacuum booster.

### Procedure

The set quantity of barrier gas influences effective pumping speed and achievable ultimate pressure. Depending on the operating pressure, the empirical value for the supplied barrier gas amount is between 1% (for a high operating pressure) and 8% (for a lower operating pressure) of the effective suction capacity.

Inert gases, mostly nitrogen (N<sub>2</sub>), are used as barrier gas.

- Open the barrier gas supply on the gas cylinder.
- Set a max. pressure of 2500 hPa on the pressure reducer.
- Set the desired quantity of barrier gas on the dosing valve of the flow meter.

**Formula for calculating barrier gas flow:**

$$Q_s = (S_{th} \times p \times A_s) / p_0$$

**At discharge pressures > 100 hPa:**

$$Q_s = (S_{th} \times (p_v - \Delta p) \times A_s) / p_0$$

- $Q_s$  = Barrier gas flow under standard conditions [Nm<sup>3</sup>/h]
- $S_{th}$  = Rated volume flow rate of the vacuum booster [m<sup>3</sup>/h]
- $p$  = Inlet pressure [hPa]
- $\Delta p$  = Differential pressure max. [hPa]
- $p_v$  = Forevacuum pressure [hPa]
- $A_s$  = Barrier gas content at the operating gas flow ( $0.01 \leq A_s \leq 0.08$ )
- $p_0$  = Ambient pressure under standard conditions [hPa]

**Example for PANDA WV 2200 A with 20 hPa inlet pressure and 8% barrier gas content:**

- $Q_s = (2065 \times 20 \times 0.08) / 1013$
- $Q_s = 3.26 \text{ Nm}^3/\text{h}$

## 6.5 Flushing the Vacuum Chamber

**NOTICE**

**Property damage from impermissibly high pressure build-up in the vacuum chamber.**

**Exceeding the specified flushing quantities damages the vacuum booster.**

- Observe the maximum permissible flushing quantities at max. 2500 hPa.
- Fully purge all supplied fluid.
- Observe the vapor compatibility of the downstream vacuum pumps.

**NOTICE**

**Property damage from incorrect cleaning procedure.**

**Flushing fluid and process media that enters the bearing and oil chambers will stick.**

- During the cleaning processes, always protect all bearings with barrier gas in order to prevent a contamination of the oil and bearing chambers.

If the extracted medium polymerizes or is deposited in the vacuum chamber, continuous or discontinuous flushing of the vacuum chamber is possible during operation.

**Procedure**

- Choose a suitable spray lance from the Busch accessories range and follow the recommended cleaning procedure, as specified in the lance's instruction manual.

## 6.6 Stopping and Venting



### WARNING

**Limbs, hair and clothing might be caught by rotating parts.**

**Risk of severe injuries!**

- Wait until the vacuum booster comes to a complete standstill.
- Keep limbs out of the reach of the vacuum booster.
- Secure the vacuum booster against restart.



### NOTICE

**Property damage from impermissibly high barrier gas pressure.**

**Excessive barrier gas pressure leads to damage to the seals after switching on the vacuum booster.**

- Make sure that the barrier gas pressure inside the vacuum booster does not exceed 1200 hPa.
- Stop the barrier gas supply immediately after switching off the vacuum booster.

### Procedure with clean processes

It is possible to switch off the vacuum booster in every pressure range, between atmospheric pressure and ultimate pressure directly after the process end.

- Close the shut-off valve in the vacuum line and disconnect the vacuum booster from the process.
- Switch off the vacuum booster.
- Vent the vacuum booster via the inlet side.
- Make sure that you do not vent the vacuum chambers through the vacuum booster.
- Switch off the process- and pump-specific media supply (e.g. the barrier gas supply).

### Procedure with contaminated medium

With media that heavily contaminate the vacuum chamber, flush the vacuum chamber with air, nitrogen or any other suitable flushing medium at the end of the process.

- Close shut-off devices in the vacuum line and disconnect the vacuum booster from the process.
- At the end of the process, continue to operate the vacuum booster with flushing gas supply at the vacuum flange for another approx. 20-40 minutes.
- Then stop the flushing gas supply.
- Switch off the vacuum booster.
- Vent the vacuum booster via the inlet side.
- Make sure that you do not vent the vacuum chambers through the vacuum booster.
- Switch off the process- and pump-specific media supply (e.g. the barrier gas supply).

## 6.7 Restart



### NOTICE

**Damage to the vacuum booster from significant temperature fluctuation.**

**If the housing cools down too quickly due to external influences, there is a risk of contact being made between the rotor at warm operating temperature, and the colder pump housing. This will result in irreversible pump damage.**

- Avoid uneven cooling, if you are going to restart the vacuum booster after a short period.
  - Vent the vacuum booster in order to achieve a temperature compensation between the housing and rotor as quickly as possible.
-

## 7 Maintenance

### 7.1 General Maintenance Information



#### **DANGER**

**Live wires.**

**Risk of electrical shock!**

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



#### **WARNING**

**The thickness of the paint can generate an electrostatic charge.**

**Risk of severe injury!**

**Risk of explosion!**

- Wipe the machine surface with a damp cloth only!



#### **WARNING**

**Create a potentially explosive atmosphere by opening and/or venting the machine.**

**Risk of severe injury!**

**Risk of explosion!**

- Make sure that processed media and/or gas mixtures inside the machine and its connections do not generate an explosive atmosphere when combined with the ambient atmosphere.



#### **WARNING**



**Health hazard through poisoning from toxic contaminated machines or parts.**

**Toxic process media result in contamination of machines or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.**

- Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- Decontaminate affected parts before carrying out maintenance work.
- Wear protective equipment.



#### **CAUTION**

**Hot surface.**

**Risk of burns!**

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



## CAUTION

**Hot liquids.**

**Risk of burns!**

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



## CAUTION

**Failing to properly maintain the machine.**

**Risk of injuries!**

**Risk of premature failure and loss of efficiency!**

- Maintenance work must only be executed by qualified personnel.
- Respect the maintenance intervals or ask your Busch representative for service.



## NOTICE

**Using inappropriate cleaners.**

**Risk of removing safety stickers and protective paint!**

- Do not use incompatible solvents to clean the machine.

### Maintenance instructions

- Switch off the vacuum booster and allow it to cool if necessary.
- Vent the vacuum booster to atmospheric pressure via the vacuum side.
- Safely disconnect the motor from the mains.
- Secure the motor against unintentional reactivation.
- Remove the vacuum booster from the system if necessary.
- Dispose of used oil according to applicable regulations in each case.
- For maintenance work, only dismantle the vacuum booster to the extent needed.
- Only clean the vacuum booster parts using industrial alcohol, isopropanol or similar media.
- Avoid residues of cleaning agent inside the vacuum booster.

## 7.2 Checklist for Inspection and Maintenance



## NOTE

**Maintenance frequency and service lives.**

**Maintenance frequency and service lives are process-dependent. Chemical and thermic loads or contamination reduce the recommended reference values.**

- Determine the specific service lives during the first operating interval.
- Consult with Busch Service if you wish to reduce the maintenance frequency.

Maintenance work at **maintenance level 1** can be carried out by the user.

We recommend Busch Service for carrying out maintenance work at **maintenance level 2 and maintenance level 3** (revision). If the required intervals listed below are exceeded, or if maintenance work is carried out improperly, no warranty or liability claims are accepted on the part of Busch. This also applies if original spare parts are not used.

## Maintenance intervals

| Action                                                                                                                                                                                                                                               | Interval                | Required material                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inspection: Instruction Manual</b>                                                                                                                                                                                                                |                         |                                                                                                                                        |
| Visual check: <ul style="list-style-type: none"> <li>• Check level and color of the oil.</li> <li>• Check the level of the sealing oil.</li> <li>• Check the vacuum booster for leaks.</li> </ul>                                                    | Daily                   |                                                                                                                                        |
| Acoustic check: <ul style="list-style-type: none"> <li>• Check the vacuum booster for running noises.</li> <li>• Check the bypass valve for unusual noises.</li> </ul>                                                                               | Daily                   |                                                                                                                                        |
| <b>Maintenance Level 1: Instruction- / Maintenance Manual</b>                                                                                                                                                                                        |                         |                                                                                                                                        |
| Cleaning and flushing: <ul style="list-style-type: none"> <li>• Clean the vacuum booster housing from outside.</li> <li>• Flush the vacuum chamber.</li> <li>• Check and clean the bypass valve.</li> </ul>                                          | ≤ 1 year<br>as required | <ul style="list-style-type: none"> <li>• Oil</li> <li>• Suitable cleaning agent, compatible with the process</li> </ul>                |
| Changing oil: <ul style="list-style-type: none"> <li>• Change oil and sealing oil.</li> </ul>                                                                                                                                                        | ≤ 1 year                | <ul style="list-style-type: none"> <li>• Oil</li> </ul>                                                                                |
| <b>Maintenance Level 2: Maintenance Manual</b>                                                                                                                                                                                                       |                         |                                                                                                                                        |
| <ul style="list-style-type: none"> <li>• Checking coupling for damage, replacing toothed ring if necessary.</li> <li>• Changing radial shaft seal rings and protective sleeves.</li> <li>• Clean the gear housings and replace the seals.</li> </ul> | ≤ 1.5 years             | <ul style="list-style-type: none"> <li>• Maintenance kit with wearing parts of the coupling and the radial shaft seal rings</li> </ul> |
| <b>Maintenance Level 3: Service Instructions</b>                                                                                                                                                                                                     |                         |                                                                                                                                        |

| Action                                                                                                                                                                                                                                                                                                                                                                       | Interval  | Required material                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dismantling and cleaning the vacuum booster: <ul style="list-style-type: none"> <li>• Replace the seals and all wearing parts.</li> <li>• Replace 4 piston bearings (ball bearings/roller bearings).</li> <li>• Replace bypass valve wear parts.</li> </ul>                                                                                                                  | ≤ 2 years | <ul style="list-style-type: none"> <li>• Overhaul kit</li> <li>• Oil</li> </ul> <b>Option</b> <ul style="list-style-type: none"> <li>• Magnetic coupling set</li> <li>• Set of gear wheels</li> </ul> |
| Checking/replacing critical parts if necessary: <ul style="list-style-type: none"> <li>• Magnetic coupling (check magnets for damage).</li> <li>• Thermocouple (calibrate the sensor with the reference temperature).</li> <li>• Gear wheels (check the teeth for breaks).</li> <li>• Check the runout of the motor shaft (in accordance with DIN EN 50347:2001).</li> </ul> | ≤ 2 years |                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li>• Changing oil.</li> </ul>                                                                                                                                                                                                                                                                                                            | ≤ 2 years |                                                                                                                                                                                                       |

Depending on the process, the required maintenance intervals can be shorter than the reference values specified in the table. Please consult Busch if necessary.

## 7.3 Changing the Oil



### WARNING



The machine is contaminated with hazardous material.

**Risk of poisoning!**

**Risk of infection!**

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.



## WARNING



**Health hazard through poisoning from toxic contaminated machines or parts.**

**Toxic process media result in contamination of machines or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.**

- Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- Decontaminate affected parts before carrying out maintenance work.
- Wear protective equipment.



## CAUTION

**Hot surface.**

**Risk of burns!**

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



## CAUTION

**Hot liquids.**

**Risk of burns!**

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



## NOTE

**Busch recommends determining the precise service life of the oil within the first maintenance frequency.**

**The usable life may deviate from the reference value specified depending on thermic and chemical loads, and the accumulation of suspended particles and condensate in the oil.**



## NOTE

**Safety data sheets.**

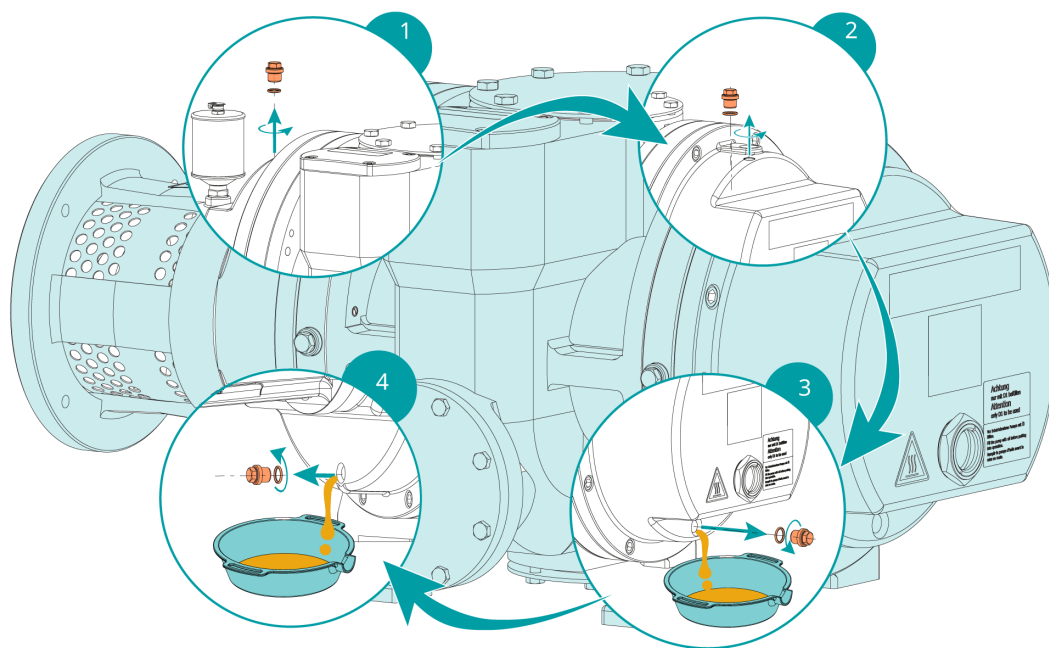
**Safety data sheets for operating fluids can be obtained from Busch on request, or from the Busch Download Center.**

### Consumable

- Oil

### Required tools

- Ring spanner, **WAF 17 mm**
- Calibrated torque wrench, tightening factor  $\leq 2.5$



Graphic 9: Draining the oil

### Procedure

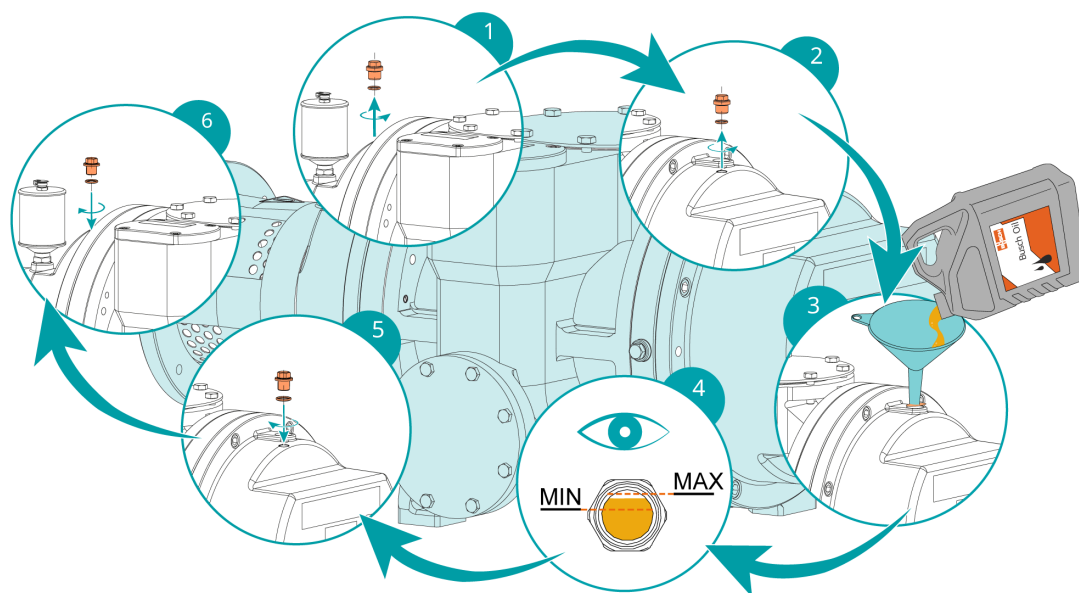
- Shut down the vacuum booster and allow it to cool if necessary.
- Vent the vacuum booster to atmospheric pressure via the inlet side.
- Screw the drain plugs back in.
  - Tightening torque: **max. 32 Nm**



### NOTE

**Fill oil on both sides.**

**Fill oil on both sides according to the oil sight glass. The fill level for the initial filling is approx. 5 mm above the center of the oil sight glass.**



Graphic 10: Filling with oil

### Procedure

- Fill the oil on both sides until the max. fill level is reached *Filling Oil* [→ 18].
- Screw in the oil fill plugs again.
  - Tightening torque: **max. 32 Nm**

## 7.4 Changing the Sealing Oil



### NOTICE

**Damage to the vacuum booster due to incorrect procedure when filling sealing oil.**

**Disassembly of the oiler causes leakage in the system. The oil expands when the vacuum booster heats up, which could cause oil to leak if overfilled.**

- Use only the oiler's filler flap to fill up.
- While the vacuum booster is cold, fill the oiler no more than halfway.

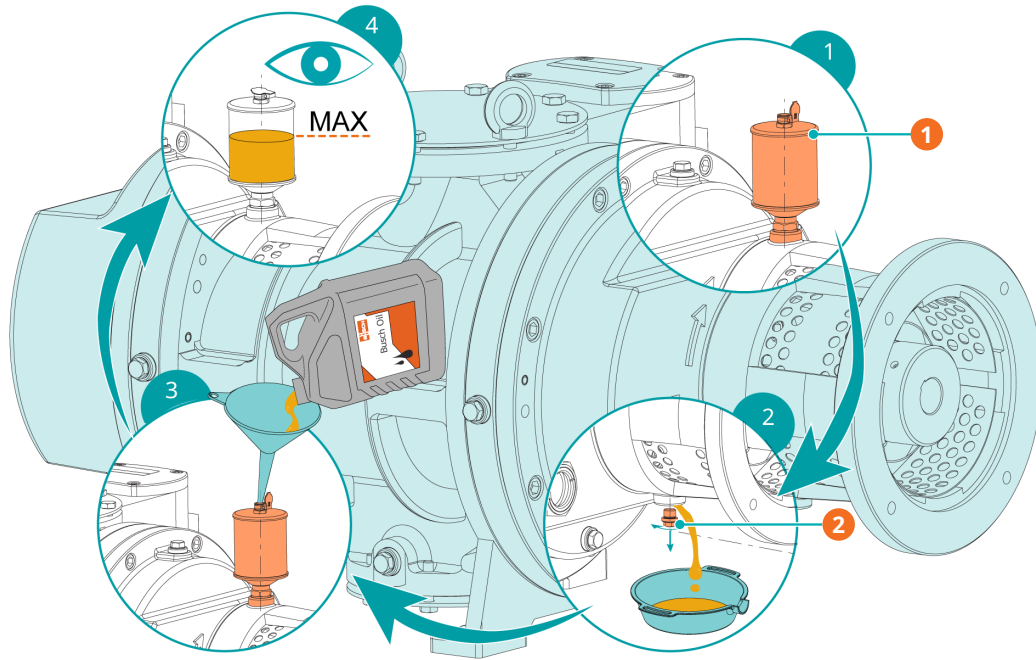
### Consumable

- Oil

### Required tools

- Ring spanner, **WAF 17 mm**

- Calibrated torque wrench, tightening factor  $\leq 2.5$



Graphic 11: Replacing sealing oil for radial shaft seal rings

| Description |       |   |                        |
|-------------|-------|---|------------------------|
| 1           | Oiler | 2 | Sealing oil drain plug |

### Procedure in the event of minor oil loss

A decreasing oil level in the oiler and an oil leak below the lantern indicate a defective **external** shaft seal.

- Check the level at shorter intervals and top up regularly as required.
  - With this type of damage, the vacuum booster can continue to be operated for a time.

### Procedure in the event of significant oil loss

A decreasing oil level, with no leaked oil visible below the vacuum booster, is due to a worn **inner** shaft seal.

- Should this occur, arrange for maintenance to be carried out by Busch Service, during which all 3 shaft seals and the protective sleeve are replaced.
  - This damage leads to an inadmissibly high oil level in the bearing chamber.

### Changing sealing oil

- In general, carry out a sealing oil change once a year.
- Open the filler flap on the oiler.
- Place the collection receptacle underneath.
- Unscrew the sealing oil drain screw.
- Fully drain the oil.
- Screw the drain screw back in.
  - Tightening torque: **max. 32 Nm**
- Fill the oiler with oil to max. halfway.
- Close the filler flap.

## 7.5 Cleaning the Vacuum Chamber



### WARNING

**Limbs, hair and clothing might be caught by rotating parts.**

**Risk of severe injuries!**

- Wait until the vacuum booster comes to a complete standstill.
- Keep limbs out of the reach of the vacuum booster.
- Secure the vacuum booster against restart.



### NOTICE

**Property damage from incorrect cleaning procedure.**

**Flushing fluid and process media that enters the bearing and oil chambers will stick.**

- During the cleaning processes, always protect all bearings with barrier gas in order to prevent a contamination of the oil and bearing chambers.

The clearance between lobes and housing are within a tenth of a millimeter range. Sustained, accumulating contamination has the following effect:

- the friction heat inside the vacuum booster increases
- the power consumption of the vacuum booster increases
- the lobes jam

### Required aids

- Brushes and cleaning agents
- Suitable vessel for collecting the cleaning fluid
- Absorbent materials for absorbing the cleaning fluid

### Procedure

- Dismantle the pipes from the inlet and exhaust connections.
- Clean the vacuum chamber and the overflow channel with suitable brushes and cleaning agents.
- After cleaning, completely remove remaining fluids using absorbent materials, and dry the vacuum chamber.
- After cleaning, mount all pipes.
- Screw in the drain plugs.

## 7.6 Cleaning Bypass Valve

### NOTE

#### Notes on bypass valve maintenance.

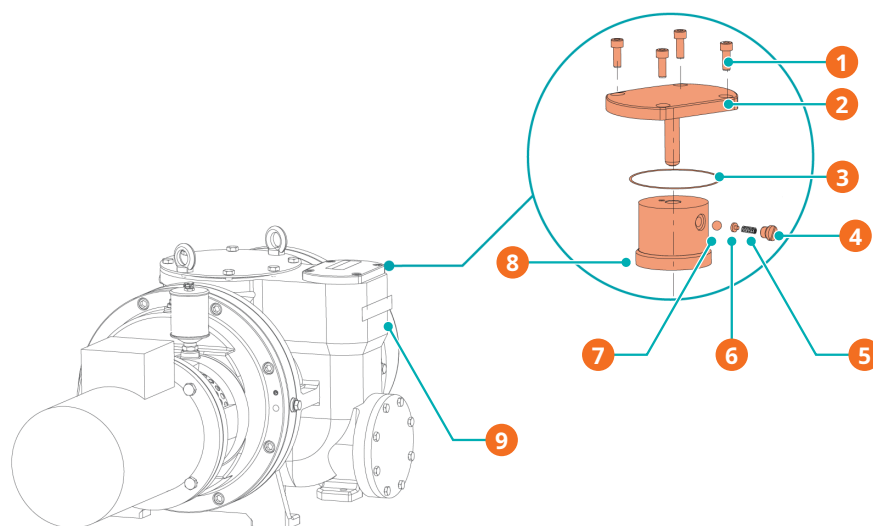
- Never oil the guide pin of the bypass valve, as this will have an adverse effect on the damping of the bypass valve.
- Replace the guide pin completely if there are pronounced signs of wear

#### Required tools

- Allen key, **WAF 10 mm**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

#### Required aids

- Emery cloth, grain size 180



Graphic 12: Bypass valve

| Description |                    |   |                   |
|-------------|--------------------|---|-------------------|
| 1           | Allen head screws  | 2 | Valve cover       |
| 3           | O-ring             | 4 | Pressure screw    |
| 5           | Compression spring | 6 | Compression piece |
| 7           | Ball               | 8 | Valve plate       |
| 9           | Pump housing       |   |                   |

#### Removing the bypass valve

- Unscrew the screws and remove the valve cover.
- Be careful with the O-ring.
- Remove the valve plate from the housing.
- Unscrew and remove the pressure screw and at the same time remove the compression spring, compression piece, and ball.
- Clean and dry the guide pin from the valve cover.
- Lightly rub the surface with an emery cloth.
- Never oil the guide pins, this has an adverse effect on damping.

- If necessary, replace completely if there are pronounced traces of wear.
- Clean the other parts.
- Inspect all parts for wear and replace if necessary.

### Install the bypass valve

- Mount the ball, compression piece, and spring.
- Lock the thread on the pressure screw with **Loctite 243**.
- Screw in the pressure screw.
- Locate the valve plate in the bypass overflow channel.
- Install the O-ring in the appropriate groove.
- Place the valve cover on the housing.
- Tighten the screws crosswise.
  - Tightening torque: **85 Nm**

## 7.7 Fitting the Coupling



### WARNING

**Danger of injury due to exposed rotating parts.**

**In the operating range of the motor coupling, there is a danger of clothing being caught and wound up.**

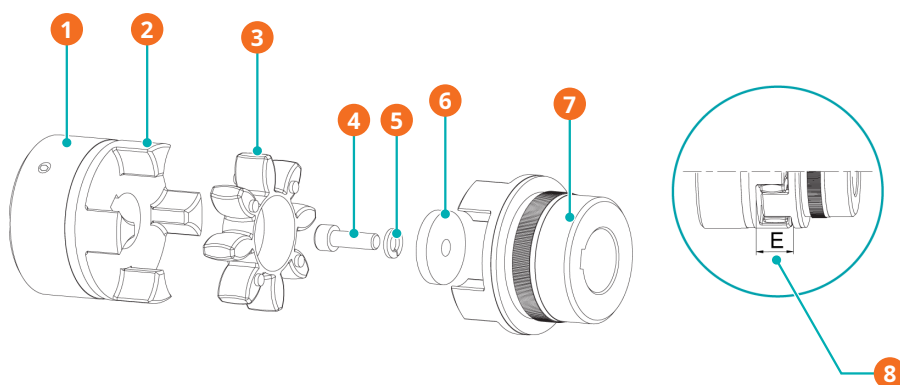
- When assembling the motor and coupling, make sure that the coupling protection is seated correctly.
- Wear correct clothing.



### NOTE

**Coupling assembly.**

**Observe the installation instructions of the coupling manufacturer.**



Graphic 13: Installation instructions gear rim coupling

| Description |                           |   |                     |
|-------------|---------------------------|---|---------------------|
| 1           | Stud screw (Ta)           | 2 | Coupling half motor |
| 3           | Toothed ring coupling hub | 4 | Cylinder screw (Tp) |
| 5           | Lock washer               | 6 | Washer              |
| 7           | Coupling half pump side   | 8 | Clearance E         |

**Required tools**

- Allen key, **WAF 4 mm**
- Allen key, **WAF 8 mm**
- Calibrated torque wrench, tightening factor  $\leq 2.5$

**Procedure**

- Precisely adhere to the prescribed installation dimensions.
  - Angular and radial displacement of the shafts.
  - Clearance E: 24 mm.
- Lock the thread on the stud screw with **Loctite 243**.
- Tighten the stud screw in the motor side coupling half.
  - Tightening torque  $T_A$ : **10 Nm**
- Install the pump side coupling half.
- Lock the thread on the cylinder screw with **Loctite 243**.
- Install the cylinder screw with washer and spring washer.
  - Tightening torque  $T_P$ : **40 Nm**

## 7.8 Fitting the Coupling for Versions with Magnetic Coupling

**NOTICE**

**Damage to the magnetic coupling due to incorrect installation and removal.**

**The isolating shroud on the magnetic coupling is made of impact-sensitive material (synthetic or ceramic). If the motor is installed or removed incorrectly, there is a risk of damage.**

- Attach the motor to the lifting gear with the eye bolt and pull the motor horizontally away from the vacuum booster.
- Use jacking bolts and guide pins.

**NOTE**

**Supplementary information for work on the magnetic couplings of vacuum boosters.**

**Contact your Busch Representative to obtain supplementary information PW0142 upon request.**

## 8 Decommissioning

### 8.1 Long-term Shutdown

Before shutting down the vacuum booster, observe the following instructions to adequately protect the interior of the vacuum booster (vacuum chamber) from corrosion:

#### Shutting down the vacuum booster

- Stop the vacuum booster.
- Vent the vacuum booster.
- Allow the vacuum booster to cool down.
- Clean the vacuum chamber.
- Change the oil.
- Seal the vacuum and forevacuum flanges as well as any other openings with blind flanges from the Busch accessories range.
- Evacuate the vacuum booster interior via the measurement connection on the vacuum side to  $p < 1 \text{ hPa}$ .
- Fill the vacuum chamber with nitrogen.
- Store the vacuum booster in dry, dust-free rooms, within the specified ambient conditions.
- In rooms with damp or aggressive atmospheres, you should pack the vacuum booster in a plastic bag together with a drying agent, and seal it so that it is airtight.
- For storage durations longer than 2 years, we recommend to carry out maintenance and a oil change prior to recommissioning.
- The vacuum booster may not be stored in the vicinity of machines, traffic routes, etc., as strong vibrations may damage the bearing.

### 8.2 Recommissioning



#### NOTICE

**Risk of damage to vacuum booster as a result of oil aging.**

**The oil usability is limited (max. 2 years). Prior to recommissioning, following a shutdown of 2 years or more, carry out the following work.**

- Change the oil.
- Change the shaft seals and other elastomer parts, if required.
- Observe the maintenance instructions – consult Busch if necessary.

#### Procedure when recommissioning the vacuum booster

- Check the vacuum booster for visible damage and operate the vacuum booster only in an appropriate operating status.
- Check the interior of the vacuum booster for contaminants.
- Remove any drying agent from the vacuum chamber.
- Do not operate the vacuum booster if there is evidence of rust on the parts which form the housing.
- Contact Busch Service, if required.
- If possible perform a leak test prior to recommissioning the vacuum booster.

## 9 Recycling and Disposal



### WARNING



**Health hazard through poisoning from toxic contaminated machines or parts.**

**Toxic process media result in contamination of machines or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.**

- Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- Decontaminate affected parts before carrying out maintenance work.
- Wear protective equipment.



### WARNING



**The machine is contaminated with hazardous material.**

**Risk of poisoning!**

**Risk of infection!**

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.



### NOTE

**Environmental protection.**

**Disposal of the product and its components must be carried out in accordance with all applicable regulations for the protection of people, the environment and nature.**

- Help to reduce the wastage of natural resources.
- Prevent contamination.

### 9.1 General Disposal Information

Busch products contain materials that must be recycled.

Dispose of our products according to the following:

- Iron/Steel
- Aluminium
- Copper
- Synthetic
- Electronic components
- Oil and fat, solvent-free

Observe the special precautionary measures when disposing of:

- Fluoroelastomers (FKM)
- Potentially contaminated components that come into contact with media

## 9.2      **Disposing**

Busch vacuum boosters of the PANDA WV 2200 A series contain materials that must be recycled.

- Fully drain the oil.
- Dismantle the motor.
- Decontaminate the components that come into contact with process gases.
- Separate the components into recyclable materials.
- Recycle the non-contaminated components.
- Dispose of the product or components in a safe manner according to locally applicable regulations.

# 10 Troubleshooting



## CAUTION

**Danger of burns on hot surfaces.**

**In the event of a fault, the surface temperature of the vacuum booster can increase to above 105°C.**

- Allow the vacuum booster to cool down before carrying out any work.
- Wear personal protective equipment if necessary.



## NOTICE

**Danger of property damage from improper maintenance.**

**Unprofessional work on the vacuum booster will lead to damage for which Busch accepts no liability.**

- Contact Busch for service support.
- When ordering spare parts, specify the information on the nameplate.

| Problem                                                       | Possible causes                                                                                                             | Remedy                                                                                                                                                                                                    |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vacuum booster will not start up.                             | <ul style="list-style-type: none"> <li>• Mains voltage is missing or the incorrect operating voltage is present</li> </ul>  | <ul style="list-style-type: none"> <li>• Check the mains voltage and mains fuse.</li> <li>• Check the motor switch.</li> </ul>                                                                            |
|                                                               | <ul style="list-style-type: none"> <li>• The circuit breaker trips; the circuit breaker may be of the wrong type</li> </ul> | <ul style="list-style-type: none"> <li>• Check the terminal connection in the motor terminal box.</li> <li>• Check the circuit breaker type; use type "K" with slower tripping characteristic.</li> </ul> |
|                                                               | <ul style="list-style-type: none"> <li>• Suction chamber contaminated</li> </ul>                                            | <ul style="list-style-type: none"> <li>• Clean suction chamber.</li> <li>• If necessary, contact Busch Service.</li> </ul>                                                                                |
|                                                               | <ul style="list-style-type: none"> <li>• Gear (gear wheels) damaged</li> </ul>                                              | <ul style="list-style-type: none"> <li>• Switch off the vacuum booster immediately.</li> <li>• If necessary, contact Busch Service.</li> </ul>                                                            |
|                                                               | <ul style="list-style-type: none"> <li>• Bearing damaged present</li> </ul>                                                 | <ul style="list-style-type: none"> <li>• Have the bearing changed.</li> <li>• Contact the Busch Service.</li> </ul>                                                                                       |
|                                                               | <ul style="list-style-type: none"> <li>• Motor faulty</li> </ul>                                                            | <ul style="list-style-type: none"> <li>• Replace the motor.</li> </ul>                                                                                                                                    |
| Vacuum booster switches off after a while after being started | <ul style="list-style-type: none"> <li>• Thermal protection switch of the motor has triggered.</li> </ul>                   | <ul style="list-style-type: none"> <li>• Determine and eliminate the cause of overheating.</li> </ul>                                                                                                     |
|                                                               | <ul style="list-style-type: none"> <li>• Forevacuum pressure possibly too high</li> </ul>                                   | <ul style="list-style-type: none"> <li>• Allow the motor to cool down.</li> <li>• Check the forevacuum pressure.</li> </ul>                                                                               |

| Problem                                                    | Possible causes                                                                                                                                                                                                                                                                                                                   | Remedy                                                                                                                                                                                                                                           |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vacuum booster does not reach the specified usual pressure | <ul style="list-style-type: none"> <li>• Vacuum chamber dirty</li> </ul>                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Clean vacuum chamber.</li> </ul>                                                                                                                                                                        |
|                                                            | <ul style="list-style-type: none"> <li>• Lubricant soiled</li> </ul>                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• Change the lubricant.</li> </ul>                                                                                                                                                                        |
|                                                            | <ul style="list-style-type: none"> <li>• Backing pump operates incorrectly</li> </ul>                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Check the backing pump.</li> </ul>                                                                                                                                                                      |
|                                                            | <ul style="list-style-type: none"> <li>• Leak in the system</li> </ul>                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• Locate and eliminate the leak.</li> </ul>                                                                                                                                                               |
|                                                            | <ul style="list-style-type: none"> <li>• Loss of lubricant at the lubricator or the radial shaft seal rings</li> </ul>                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• Check the radial shaft seal rings.</li> <li>• Have the radial shaft seal rings replaced.</li> <li>• If necessary, contact Busch Service.</li> </ul>                                                     |
|                                                            | <ul style="list-style-type: none"> <li>• Bypass valve does not close completely</li> </ul>                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Check the bypass valve; replace if necessary.</li> </ul>                                                                                                                                                |
| Unusual noises during operation                            | <ul style="list-style-type: none"> <li>• Vacuum chamber dirty</li> </ul>                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Switch off the vacuum booster immediately.</li> <li>• Clean vacuum chamber.</li> </ul>                                                                                                                  |
|                                                            | <ul style="list-style-type: none"> <li>• Damage to the bearing or gear wheels</li> </ul>                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Switch off the vacuum booster immediately.</li> <li>• Contact Busch Service.</li> </ul>                                                                                                                 |
|                                                            | <ul style="list-style-type: none"> <li>• Bypass valve soiled</li> </ul>                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• Switch off the vacuum booster immediately.</li> <li>• Contact Busch Service.</li> </ul>                                                                                                                 |
|                                                            | <ul style="list-style-type: none"> <li>• Damage to motor bearing</li> </ul>                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Switch off the vacuum booster immediately.</li> <li>• Change the motor.</li> <li>• Contact Busch Service.</li> </ul>                                                                                    |
|                                                            | Only applies to vacuum boosters with magnetic coupling                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• Switch off the vacuum booster immediately and wait for it to come to a complete standstill.</li> </ul>                                                                                                  |
|                                                            | <ul style="list-style-type: none"> <li>• Motor is running – vacuum booster is not working, i.e., the magnetic coupling is defective or the magnetic field has broken down</li> <li>• If the vacuum booster continues to run with a "broken down" magnetic field, the magnetic coupling is destroyed by demagnetization</li> </ul> | <ul style="list-style-type: none"> <li>• While the vacuum booster is at a standstill, the magnets can re-align with each other.</li> <li>• Slowly restart the vacuum booster and check the power transmission and vacuum pressure.</li> </ul>    |
| Vacuum booster losing oil                                  | <ul style="list-style-type: none"> <li>• A decreasing oil level in the oiler and an oil leak below the lantern indicate a defective <b>external</b> radial shaft seal ring</li> </ul>                                                                                                                                             | <ul style="list-style-type: none"> <li>• Check the level at shorter intervals and top up regularly as required.</li> <li>• Continue to operate the vacuum booster for a while.</li> </ul>                                                        |
|                                                            | <ul style="list-style-type: none"> <li>• A decreasing oil level, with no leaked oil visible below the vacuum booster, is due to a worn <b>inner</b> radial shaft seal ring</li> </ul>                                                                                                                                             | This damage leads to an inadmissibly high oil level in the bearing chamber. <ul style="list-style-type: none"> <li>• Contact Busch Service to arrange for replacement of the protective sleeve and all three radial shaft seal rings.</li> </ul> |

# 11 Service Solutions

## We offer first-class service

High vacuum component service life, in combination with low downtime, are clear expectations that you place on us. We meet your needs with efficient products and outstanding service.

We are always focused on perfecting our core competence – servicing of vacuum components. Once you have purchased a product from Busch, our service is far from over. This is often exactly where service begins. Obviously, in proven Busch quality.

## For a quick and smooth service process, we recommend the following steps:

- Fill out the *online service request*.
- Your request will be sent to the competent Service Center in your country/region.

A copy of your request and a ticket number will be emailed to you.

Remember to print out the declaration of contamination, sign it and return it to Busch.

You will receive the pre-filled declaration by E-mail after submitting the online service request.

## In addition, follow the steps below:

- Prepare the product for safe transport according to the specifications from the declaration on contamination.
- Attach the Declaration of Contamination on the outside of the shipping box.
- Next, send your product to your local *Service Center* (you will receive the shipping address by E-Mail).
- You will receive response from Busch.

## 12 Spare Parts



### NOTE

**Ordering and using spare parts.**

**Spare parts for service work are grouped into packs. These vary according to vacuum booster version.**

- Ask Busch Service for spare parts pack article numbers.
- Have the full vacuum booster article number (with index where applicable) to hand. It is available on the nameplate of the machine.
- Replace all parts contained in the pack.

### 12.1 Set of Seals for Version with shaft Seal

The set of seals contains:

- All sealing parts such as O-rings, shaft seals and supporting rings
- Flat seals, square washers and annular profile seals

The protective sleeve and centering rings for connecting the vacuum booster to the inlet and exhaust sides are not included.

### 12.2 Set of Seals for Version with magnetic Coupling

The set of seals contains:

- All sealing parts such as O-rings
- Flat seals, square washers and annular profile seals

Centering rings for connecting the inlet and exhaust sides are not included.

### 12.3 Maintenance Kit for Version with shaft Seal

The maintenance kit contains:

- All sealing parts in the area of the shaft seal including the protective sleeve and the tolerance ring
- All sealing rings of the filling and drain screws and both O-rings for the device cover and cap
- Coupling buffer

### 12.4 Maintenance Kit for Version with magnetic Coupling

The maintenance kit contains:

- All sealing rings of the filling and drain screws and both O-rings for the device cover and cap
- The O-ring for the isolation shroud

## 13 Accessories



### NOTE

View the range of accessories for Busch vacuum boosters on our website.

### 13.1 Accessory Information

#### Barrier gas system

The use of barrier gas at the bearing points protects the oil from contamination by the ingress of process media and flushing fluid into the bearing and oil chambers.

#### Flushing device

The flushing device is used to clean the materials in contact with the medium if the extracted medium polymerizes or deposits in the vacuum chamber.

#### Oil chamber evacuation

The gear housing extractor serves to evacuate the gear and bearing chambers to shorten pump-down time.

#### Inlet mesh screen

The inlet mesh screen on the inlet connection prevents solids from penetrating into the vacuum chamber of the vacuum booster.

### 13.2 Ordering Accessories

| Description                                                     | Article number |
|-----------------------------------------------------------------|----------------|
| Centering ring with outer ring DN 100 ISO-F                     | PF 303 110 -T  |
| Centering ring with outer ring DN 160 ISO-F                     | PF 303 116 -T  |
| Splinter shield DN 160 ISO-K/F                                  | PP 031 114 -X  |
| Splinter shield DN PN 16/PN 10                                  | PP 031 115 -X  |
| OmniControl 200 with TPR 270                                    | PT 440 950 -T  |
| Temperature sensor                                              | PP 041 457 -T  |
| Spray lance G3/8"                                               | PP 041 469 -U  |
| Screw set, zinc-plated steel DN PN 16                           | PP 144 117 -T  |
| Adjusting elements for fastening the feet                       | PP 144 118 -T  |
| Screw set, zinc-plated steel                                    | PP 043 873 -T  |
| Screw set, stainless steel                                      | PP 043 878 -T  |
| Claw set (Stainless steel)                                      | PP 043 879 -T  |
| Galvanized steel bracket set                                    | PP 043 880 -T  |
| Clamping bracket set for PANDA WV 2200 A, steel, galvanized     | PP 043 881 -T  |
| Blank flange set for PANDA WV 2200 A, Stainless steel           | PP 043 883 -T  |
| Blank flange set for PANDA WV 2200 A, DN ISO-K, stainless steel | PP 043 884 -T  |
| Blank flange set for PANDA WV 2200 A, DN PN16, stainless steel  | PP 043 885 -T  |
| Set of seals (FKM) for PANDA WV 2200 A, DN PN16                 | PP 043 886 -T  |
| Barrier gas kit                                                 | PP 027 401 -T  |
| Sprayer DN ISO-F                                                | PP 031 252 -T  |

| Description                                                 | Article number |
|-------------------------------------------------------------|----------------|
| Gear box evacuation (Plastic hose)                          | PP 144 120 -T  |
| Gear housing evacuation (Stainless Steel - corrugated hose) | PP 144 121 -T  |

# 14 Technical Data and Dimensions

## 14.1 General

This section describes the basis for the technical data of Busch vacuum booster.

- Specifications according to PNEUROP committee PN5
- ISO 21360-1: 2016 "Vacuum technology - Standard methods for measuring vacuum booster performance - General description"
- Integral leakage rate with 100% helium concentration, 10 s measurement duration
- Sound pressure level at distance to vacuum booster = 1 m

### Conversion table: Pressure units

|              | mbar | bar                  | Pa             | hPa  | kPa               | Torr   mm Hg        |
|--------------|------|----------------------|----------------|------|-------------------|---------------------|
| mbar         | 1    | $1 \cdot 10^{-3}$    | 100            | 1    | 0.1               | 0.75                |
| bar          | 1000 | 1                    | $1 \cdot 10^5$ | 1000 | 100               | 750                 |
| Pa           | 0.01 | $1 \cdot 10^{-5}$    | 1              | 0.01 | $1 \cdot 10^{-3}$ | $7.5 \cdot 10^{-3}$ |
| hPa          | 1    | $1 \cdot 10^{-3}$    | 100            | 1    | 0.1               | 0.75                |
| kPa          | 10   | 0.01                 | 1000           | 10   | 1                 | 7.5                 |
| Torr   mm Hg | 1.33 | $1.33 \cdot 10^{-3}$ | 133.32         | 1.33 | 0.133             | 1                   |

1 Pa = 1 N/m<sup>2</sup>

### Conversion table: units for gas throughput

|                        | mbar l/s             | Pa m <sup>3</sup> /s | sccm | Torr l/s             | atm cm <sup>3</sup> /s |
|------------------------|----------------------|----------------------|------|----------------------|------------------------|
| mbar l/s               | 1                    | 0.1                  | 59.2 | 0.75                 | 0.987                  |
| Pa m <sup>3</sup> /s   | 10                   | 1                    | 592  | 7.5                  | 9.87                   |
| sccm                   | $1.69 \cdot 10^{-2}$ | $1.69 \cdot 10^{-3}$ | 1    | $1.27 \cdot 10^{-2}$ | $1.67 \cdot 10^{-2}$   |
| Torr l/s               | 1.33                 | 0.133                | 78.9 | 1                    | 1.32                   |
| atm cm <sup>3</sup> /s | 1.01                 | 0.101                | 59.8 | 0.76                 | 1                      |



### NOTE

#### Special versions.

The technical data and dimensions for the vacuum booster refer to the specified standard version.

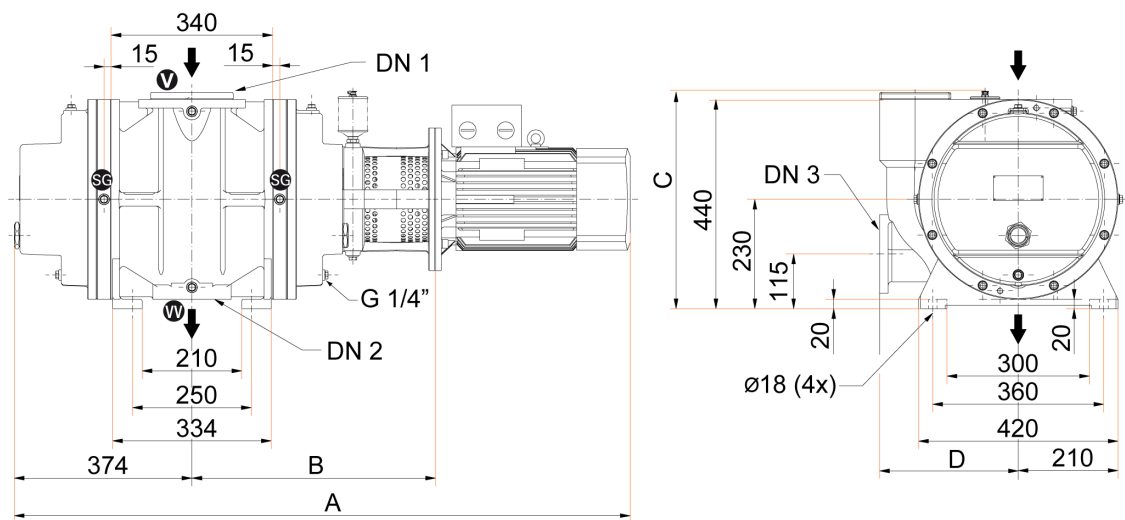
- For deviations in special versions, please refer to the nameplates or the enclosed information.

## 14.2 Technical Data

| Type designation                                                     | WV 2200 A                                 |
|----------------------------------------------------------------------|-------------------------------------------|
| Version                                                              | Standard with motor                       |
| Differential pressure max.                                           | 35 hPa                                    |
| Inlet connection (IN)                                                | DN 160 ISO-F                              |
| Exhaust connection (OUT)                                             | DN 100 ISO-F                              |
| Exhaust connection (LATERAL)                                         | DN 100 ISO-F                              |
| Nominal pumping speed                                                | 1078 – 3230 m <sup>3</sup> /h             |
| Nominal pumping speed at 50 Hz                                       | 2155 m <sup>3</sup> /h                    |
| Nominal pumping speed at 60 Hz                                       | 2585 m <sup>3</sup> /h                    |
| Input voltage 50 Hz                                                  | 230 / 400 V                               |
| Input voltage 60 Hz                                                  | 265 / 460 V                               |
| Input voltage: tolerance                                             | ±5%                                       |
| Rated power 50 Hz                                                    | 5.5 kW                                    |
| Rated power 60 Hz                                                    | 6.3 kW                                    |
| Nominal rotation speed at 50 Hz                                      | 3000 rpm                                  |
| Nominal rotation speed at 60 Hz                                      | 3600 rpm                                  |
| Rotational speed                                                     | 1500 – 4500 rpm                           |
| Integral leak rate                                                   | 1 · 10 <sup>-3</sup> Pa m <sup>3</sup> /s |
| Emission sound pressure level (EN ISO 2151) at inlet pressure 1 hPa  | 72 dB(A)                                  |
| Emission sound pressure level (EN ISO 2151) at inlet pressure 10 hPa | 75 dB(A)                                  |
| Protection degree                                                    | IP55                                      |
| Cooling method                                                       | Natural convection                        |
| Motor protection                                                     | 3TF                                       |
| Oil amount                                                           | 5 l                                       |
| Ambient temperature                                                  | 5 – 40°C                                  |
| Temperature: Shipping                                                | -10 – 40°C                                |
| Weight: with motor                                                   | 340 kg                                    |

## 14.3 Dimensions

Dimensions in mm



Graphic 14: Dimensions Panda WV 2200 A

| Dimension | Value [mm] |
|-----------|------------|
| A         | 1297       |
| B         | 513        |
| C         | 458        |
| D         | 292        |

## 15 Oil

### Consumables

| Description                                  | Article number |
|----------------------------------------------|----------------|
| P3, mineral oil, 1 l                         | 2000025858     |
| P3, mineral oil, 5 l                         | 2000025859     |
| P3, mineral oil, 20 l                        | 2000025860     |
| H1, 1 l                                      | 2000025889     |
| H1, 5 l                                      | 2000025890     |
| H1, 20 l                                     | 2000025891     |
| H1, 208 l                                    | 2000025892     |
| VSC100/D2, synthetic diester based oil, 1 l  | 0831168356     |
| VSC100/D2, synthetic diester based oil, 5 l  | 0831168357     |
| VSC100/D2, synthetic diester based oil, 10 l | 0831210162     |
| YLC250/F5, perfluoropolyether, 0.5 l         | 2000025930     |
| YLC250/F5, perfluoropolyether, 1 l           | 2000025931     |
| YLC250/F5, perfluoropolyether, 5 l           | 2000025932     |

To know which oil has been filled in the machine, refer to the nameplate.

# 16 EU Declaration of Conformity

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

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

The manufacturer

**Busch Manufacturing China Co., Ltd.**  
**No. 73, Zhulin 4th Road, Daji Street,**  
**Caidian District, Wuhan City,**  
**P.R.China**

declares that the machine(s): PANDA WV 2200 A

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

- 'Machinery' 2006/42/EC
- 'Machinery Directive' 2006/42/EC, if the serial number is less than or equal to 126999999
- 'Machinery Regulation' (EU) 2023/1230, if the serial number is greater than or equal to 127000000
- 'Electromagnetic Compatibility' (EMC) 2014/30/EU
- 'RoHS' 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (incl. all related applicable amendments)

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

| Standard                | Title of the Standard                                                                                                                    |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| EN ISO 12100 : 2010     | Safety of machinery - Basic concepts, general principles of design                                                                       |
| EN 1012-2 : 2011        | Vacuum pumps - Safety requirements - Part 2                                                                                              |
| EN ISO 13857 : 2020     | Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs                                |
| EN ISO 2151 : 2009      | Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)                                              |
| EN IEC 63000 : 2019     | Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances |
| EN IEC 61000-6-2 : 2019 | Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments                                            |
| EN IEC 61000-6-4 : 2020 | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments                                   |
| ISO 21360-1 : 2020      | Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 1: General description                                 |
| ISO 21360-2 : 2020      | Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 2: Positive displacement vacuum pumps                  |

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**

Wuhan, 2025.02.01



**Philip Wu, General Manager**

**Busch Manufacturing China Co., Ltd.**

# 17 UK Declaration of Conformity

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

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

The manufacturer

**Busch Manufacturing China Co., Ltd.**  
**No. 73, Zhulin 4th Road, Daji Street,**  
**Caidian District, Wuhan City,**  
**P.R.China**

declares that the machine(s): PANDA WV 2200 A

fulfill(s) all the relevant provisions from UK legislations:

- Supply of Machinery (Safety) Regulations 2008
- Electromagnetic Compatibility Regulations 2016
- Restriction of the use of certain hazardous substances in Electrical and Electronic Equipment Regulations 2012

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

| Standard                | Title of the Standard                                                                                                                    |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| EN ISO 12100 : 2010     | Safety of machinery - Basic concepts, general principles of design                                                                       |
| EN 1012-2 : 2011        | Vacuum pumps - Safety requirements - Part 2                                                                                              |
| EN ISO 13857 : 2020     | Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs                                |
| EN ISO 2151 : 2009      | Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)                                              |
| EN IEC 63000 : 2019     | Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances |
| EN IEC 61000-6-2 : 2019 | Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments                                            |
| EN IEC 61000-6-4 : 2020 | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments                                   |
| ISO 21360-1 : 2020      | Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 1: General description                                 |
| ISO 21360-2 : 2020      | Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 2: Positive displacement vacuum pumps                  |

Wuhan, 2025.02.01



**Philip Wu, General Manager**

**Busch Manufacturing China Co., Ltd.**

# Notes

Grid of dots for notes.

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# BUSCH GROUP

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



● Busch Group companies

▲ Busch Group production sites

● Busch Group service centers

■ Busch Group local representatives

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

[www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)