VACUUM SOLUTIONS

Part of the BUSCH GROUP

PANDA

Vacuum Boosters
WV 2200 A

Instruction Manual

SERVICE
AND SPARE PARTS, INSTRUCTION MANUALS ...
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VACUUM APP

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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: • Standard motor • Housing and all parts forming the vacuum chamber made of GG (Cast iron with lamellar graphite) and GGG (Spheroidal graphite cast iron) • Exhaust/Inlet connections designed as ISO flanges • Bypass valve for protection against thermal overload
M version	Changes to the standard design: • Version with magnetic coupling

Type	Design
Special version	• Blocked bypass valve or changed differential pressure at the bypass valve • Special sealing materials resistant to aggressive media • Special coatings for corrosion protection or anti-stick properties • Version with PN flanges (PN: Pressure Nominal - Nominal pressure stage) • Special, process-specific oils

1.2 Target Group

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

- *Transport* [➔ 13]
- Setup (*Installation* [➔ 15])
- Usage and *Operation* [➔ 24]
- *Decommissioning* [➔ 40]
- *Maintenance* [➔ 29] and cleaning
- *Storage* [➔ 14] or *Disposing* [➔ 41]

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 reevaluate 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 thevacuum booster
- Before returning the vacuum booster, observe the notes in chapter *Service Solutions* [➔ 44].

2.3 Limits of Use of the Product

Parameter	Limit value
Installation location	Indoors, protected against: • Dust deposits • Falling objects • Fire-fighting water Outdoors, protected against: • Falling objects • Direct influence of weather, such as rain, splash water, strong drafts and sunlight • Fire-fighting water • Lightning strike
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
Orientation	Horizontal

2.4 Intended Use

- Use the vacuum booster only for generating vacuum.
- When pumping media with an oxygen concentration level of ≥ 21%, only use perfluorinated, synthetic oils (F4, F5, A113) 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* [➔ 49].

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:

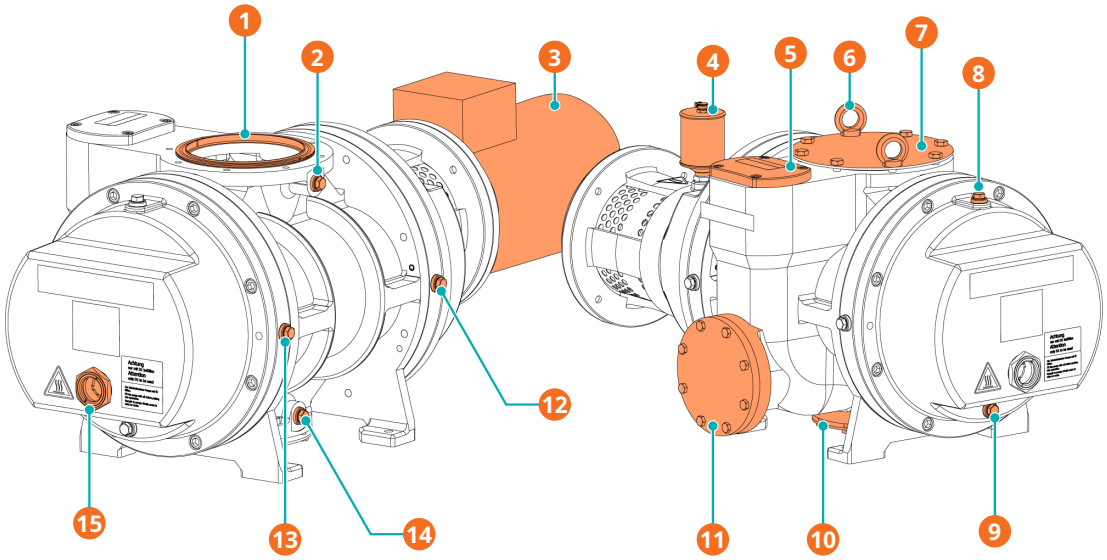
- Pumping explosive media
- Pumping of corrosive media
- Using for pressure generation
- Using in systems in which sporadic loads and vibrations or periodic forces act on the device
- Using of accessories or spare parts that are not listed in this instruction manual
- Pumping radioactive media
- Pumping 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: Panda WV 2200 M 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 Identifying the Product

- To ensure clear identification of the product when communicating with Busch, always keep all of the information on the nameplate 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)

3.2.1 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"
PANDA WV 2200 A pressure surge protected	DN 150 PN 16	DN 100 PN 16	4 × G 3/8"	2 × G 3/8"

3.3 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

4 Transport and Storage

4.1 Transport

WARNING

Risk of serious injury from swinging, toppling or falling.

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

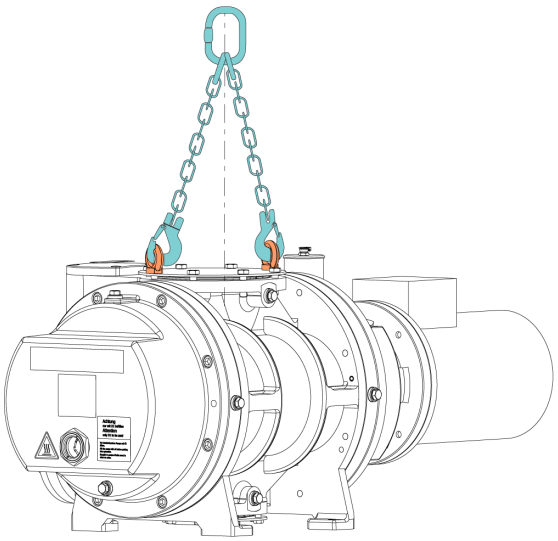
Busch recommends keeping the transport packaging and original protective cover.

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 pallet truck 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.

4.2 Storage

NOTE

Busch recommends keeping the transport packaging and original protective cover.

Neither the vacuum chamber nor the pistons 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

Risk of injury from loss of stability.

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 adjustment elements from the range of *Accessories* [➔ 46] 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 Up the Oil

WARNING

Danger of poisoning from toxic vapors.

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

- P3 for standard applications
- F5 for corrosive gas versions
- D2 for special applications (such as higher operating temperatures)
- H1 for version with magnetic coupling

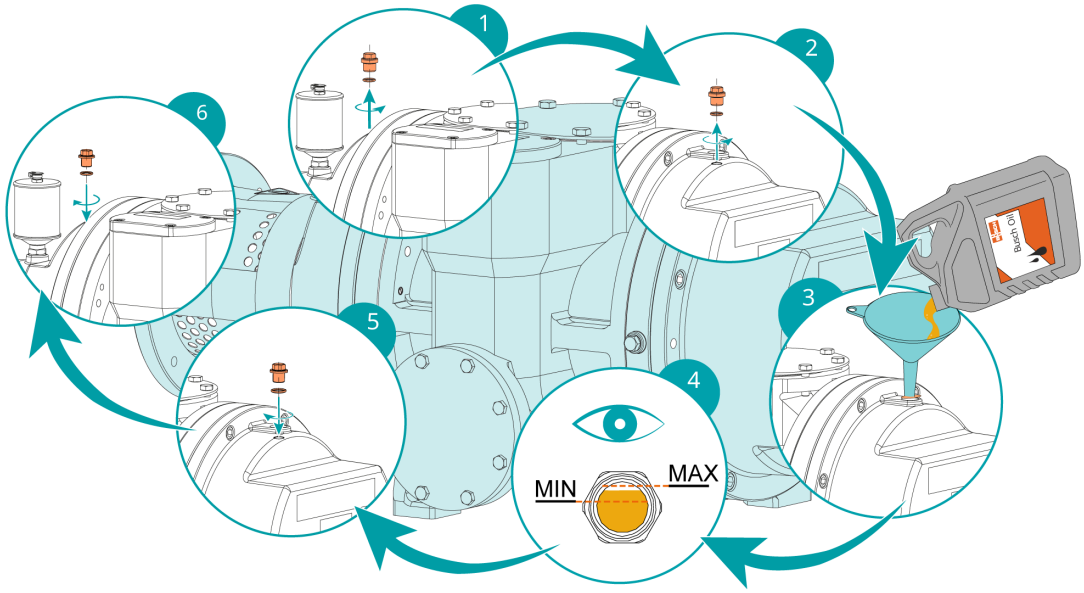
Other oils on request

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.
  - D2 is permitted as a replacement for D1.
- Contact Busch in case of using another type of oil.

Required tools

- Hex key, **WAF 17**
- Calibrated torque wrench (tightening factor ≤ 2.5)



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.

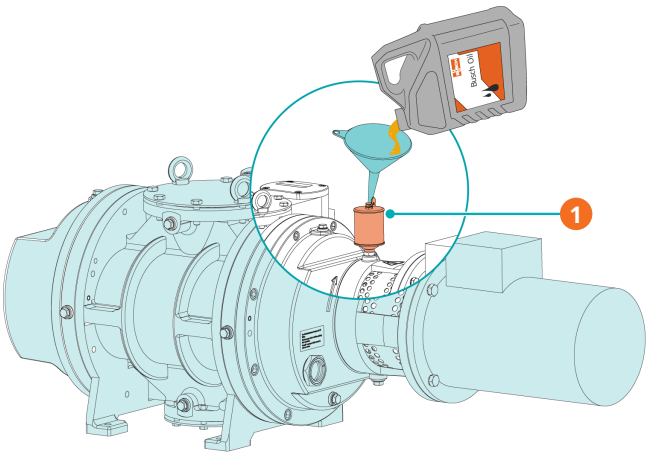
- Use only the oiler's filler flap to fill up.
- While the vacuum booster is cold, fill the oiler no more than halfway.

NOTE

Versions with RSSR (radial shaft seal ring).

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

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



Graphic 4: Filling sealing oil for radial shaft seal rings

Description			
1	Oiler		

Procedure

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

5.4 Inlet Connection

WARNING

Risk of crushing from rotating parts.

Fingers and hands may be caught by rotating pistons within the connection flange. This results in severe injuries.

- Keep limbs out of the reach of the vacuum booster.

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, at a minimum, the nominal diameter of the vacuum booster 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.

5.5 Exhaust Connection

WARNING

Risk of crushing from rotating parts.

Fingers and hands may be caught by rotating pistons within the connection flange. This results in 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

Danger of injury from bursting as a result of high pressure in the exhaust line.

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g. increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- 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.

Procedure

- Degrease the connection flanges.
- Choose a minimum pipe cross section equal to the nominal diameter of the pressure flange.
- Clear welded lines of any tinder, loose parts or similar before installation.
- 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

Danger to life from electric shock.

Touching exposed and voltage-bearing elements causes an electric shock. Improper connection of the mains supply leads to the risk of touchable live housing parts. There is a risk to life.

- 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.

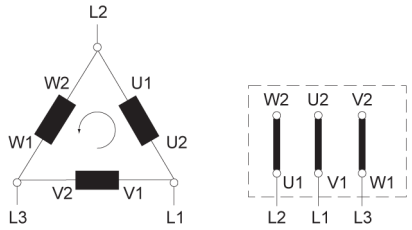
The specific load behavior of the vacuum booster requires direct on-line starting at full motor power. Engine damage occurs if a different starting circuit is used.

- Always start the motor directly.
- Never use a star-delta start-up circuit.

Prerequisites

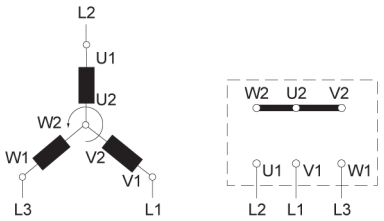
- Vacuum booster switched off

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

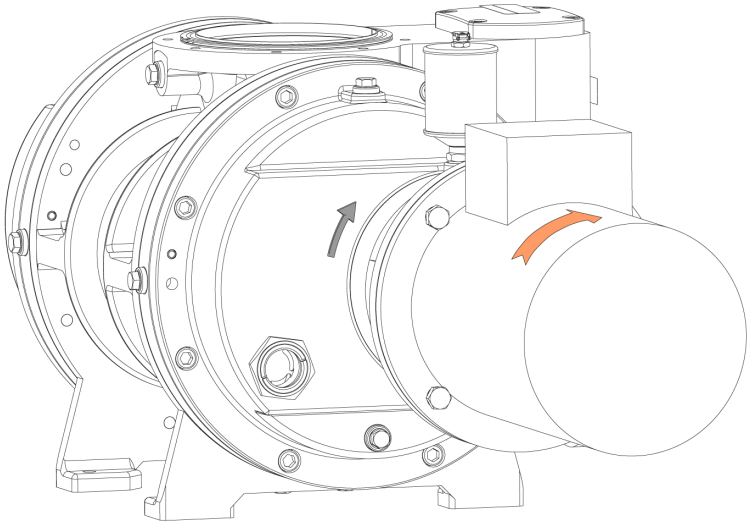
The 3 phases are connected in series, and their connection points connected to the mains. The voltage per phase is equal to the mains voltage, while the mains current is √3 times the phase current. The delta connection is marked with the Δ symbol. The voltage between the incoming mains supply lines is 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 √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

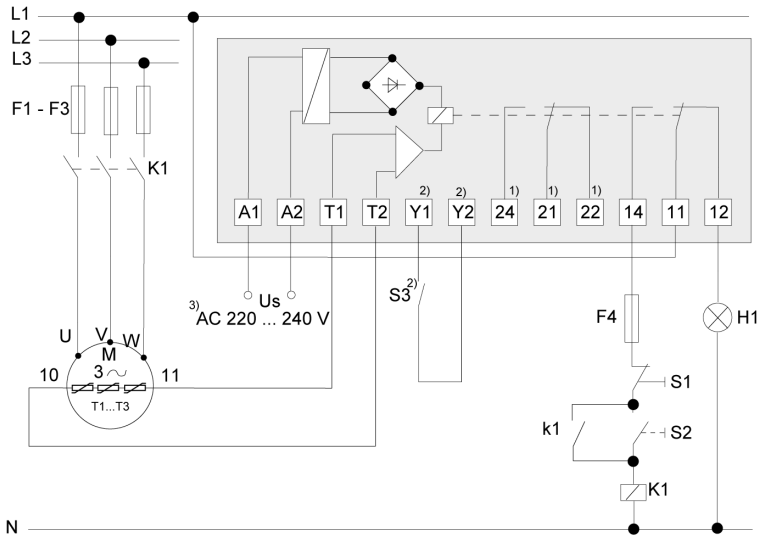
- Switch on the vacuum booster briefly (2 to 3 seconds).
  - The motor and motor fan must rotate clockwise (see the arrow on the fan cover).
- If the direction of rotation is incorrect, exchange the 2 phases on the connection cable.
- Refill the oil.

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_S	Supply voltage	T1-T3	PTC resistor sensor
S_1	OFF button	H1	Tripping indicator
S_2	ON button	M	Motor, 3-phase
S_3	RESET button	1)	For devices with two relay outputs only
K1	Contactor	2)	For MSR type (model) only
F1-F4	Fuses	3)	Only for article number: P 4768 052 FQ and P 4768 052 FE

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.
- 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.

During operation with no exhaust line, the vacuum booster allows exhaust gases and vapors to escape freely into the air. There is a risk of injury and fatality due to poisoning in processes with toxic process media.

- 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

Danger of burns on hot surfaces.

Depending on the operating and ambient conditions, the surface temperature of the vacuum booster can increase to above 70°C. If access to the vacuum booster is unrestricted, there is a danger of burns due to contact with hot surfaces.

- Install suitable touch protection if the vacuum booster is unrestrictedly accessible.
- Allow the vacuum booster to cool down before carrying out any work.
- Contact Busch for suitable touch protection in system solutions.

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

Risk of injury from reactive, potentially explosive or other hazardous gas/air mixtures.

Uncontrolled gas inlet of air or gases containing oxygen provides ideal conditions for the formation of unexpected explosive gas/air mixtures in the vacuum system. This results in severe injuries.

- Use only inert gases for supplying the sealing 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_2), 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^3/h]
- S_{th} = Rated volume flow rate of the vacuum booster [m^3/h]
- p = Inlet pressure [hPa]
- Δp = 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:

- $Q_S = (2065 \times 20 \times 0.08)/1013$
- $Q_S = 3.26\ Nm^3/h$

6.5 Flushing the Vacuum Chamber

NOTICE

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

Exceeding the specified flushing quantities damages the vacuum booster.

- Observe the maximum permissible flushing quantities at max. 3000 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

Risk of crushing from rotating parts.

Fingers and hands may be caught by rotating pistons within the connection flange. This results in 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 on 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

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

Risk of crushing from rotating parts.

Fingers and hands may be caught by rotating pistons within the connection flange. This results in 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.

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 extend 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	Inspection	Maintenance level 1	Maintenance level 2	Maintenance level 3	Required material
Described in	Instruction Manual	Instruction/ Maintenance Manual	Maintenance Manual	Service Instructions	
Interval	Daily	≤ 1 year	≤ 1.5 years	≤ 3 years	
Inspection					
Visual and acoustic check • Checking oil level and color of the oil • Checking oil level of the sealing oil	■				
• Checking vacuum booster for leaks • Checking vacuum booster for running noises • Check the bypass valve for unusual noises	■				
Maintenance level 1					
Clean the vacuum booster Pump housing from outside Flushing vacuum chamber with a suitable cleaning agent adapted to the process Check and clean bypass valve		■ as required			Oil Suitable cleaning agent, compatible with the process
Changing oil and sealing oil		■			

Maintenance level 2					
• Checking coupling for damage, replacing toothed ring if necessary • Changing radial shaft seal rings and protective sleeves • Clean the gear housings and replace the seals			■		Maintenance kit with wearing parts of the coupling and the radial shaft seal rings
Maintenance level 3					
Dismantling and cleaning vacuum booster • Replace the seals and all wearing parts • Replace 4 piston bearings (ball bearings/roller bearings) • Replace bypass valve wear parts				■	Overhaul kit Oil **Option** • Magnetic coupling set • Set of gear wheels
Checking critical components and replacing if necessary • Checking magnetic coupling for damage • Calibrate the temperature sensor with the reference temperature • Checking gear wheels for breaks				■	

7.3 Changing the Oil

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

Scalding from hot oil.

Danger of burns when draining oil if it comes into contact with the skin.

- Wear protective equipment.
- Use a suitable collection receptacle.

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.

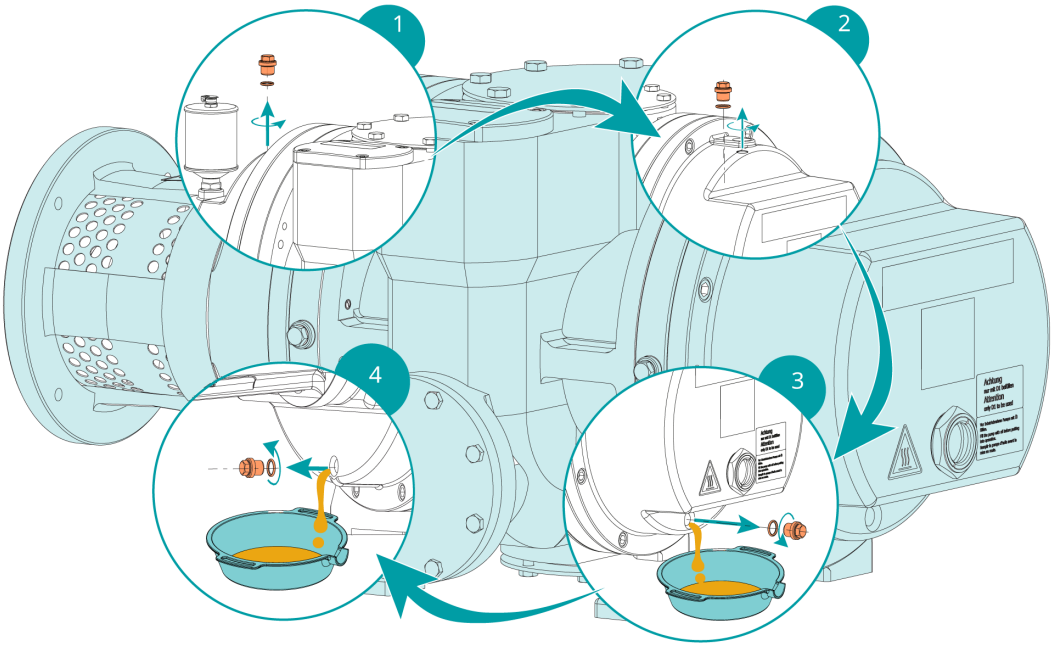
Safety data sheets for operating fluids can be obtained from Busch on request, or from the Busch Download Center.

Consumable

- Oil

Required tools

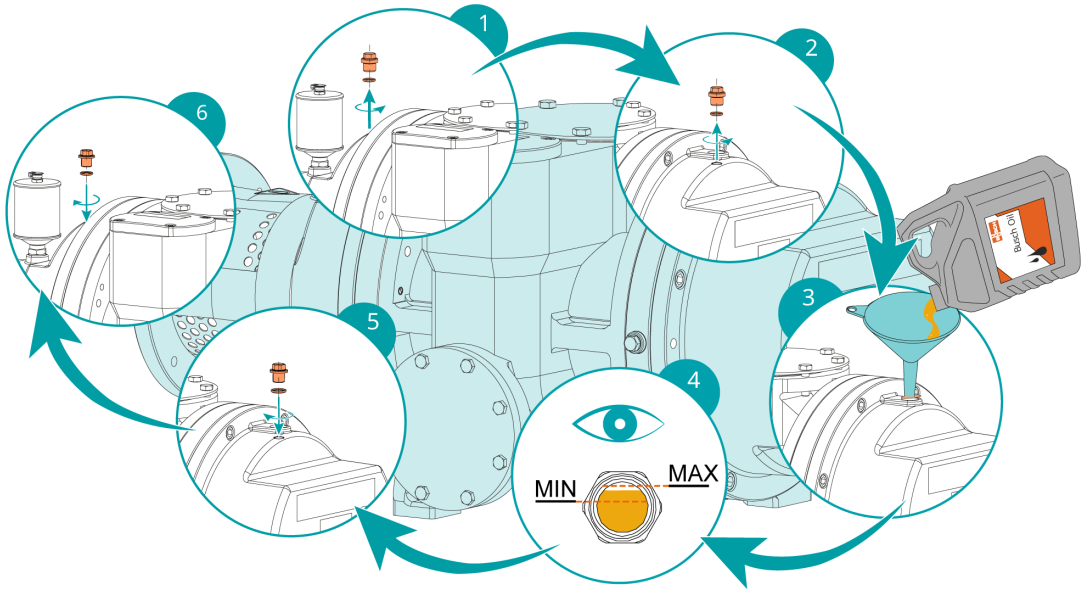
- Ring spanner, **WAF 17 mm**
- Calibrated torque wrench, tightening factor ≤ 2.5



Graphic 9: Draining the oil

Draining the oil

- 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**



Graphic 10: Filling with oil

Filling with oil

- Fill the oil on both sides until the max. fill level is reached *Filling Up the Oil* [➔ 16].
- Screw in the oil fill plugs again.
  - Tightening torque: **max. 32 Nm**

7.4 Changing 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.

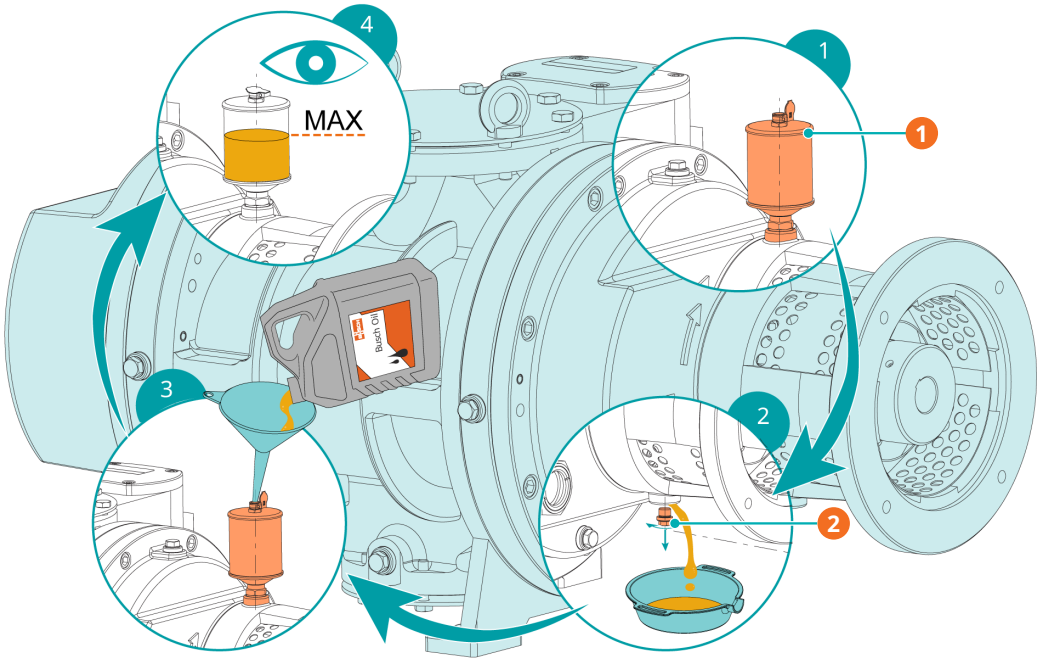
- Use only the oiler's filler flap to fill up.
- While the vacuum booster is cold, fill the oiler no more than halfway.

Consumable

- Oil

Required tools

- Ring spanner, **WAF 17 mm**
- Calibrated torque wrench, tightening factor ≤ 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** radial shaft seal ring.

- 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** radial shaft seal ring.

- Should this occur, arrange for maintenance to be carried out by Busch Service, during which all 3 radial shaft seal rings 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

Risk of crushing from rotating parts.

Fingers and hands may be caught by rotating pistons within the connection flange. This results in 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 pistons 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 pistons 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 vacuum and forevacuum 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.

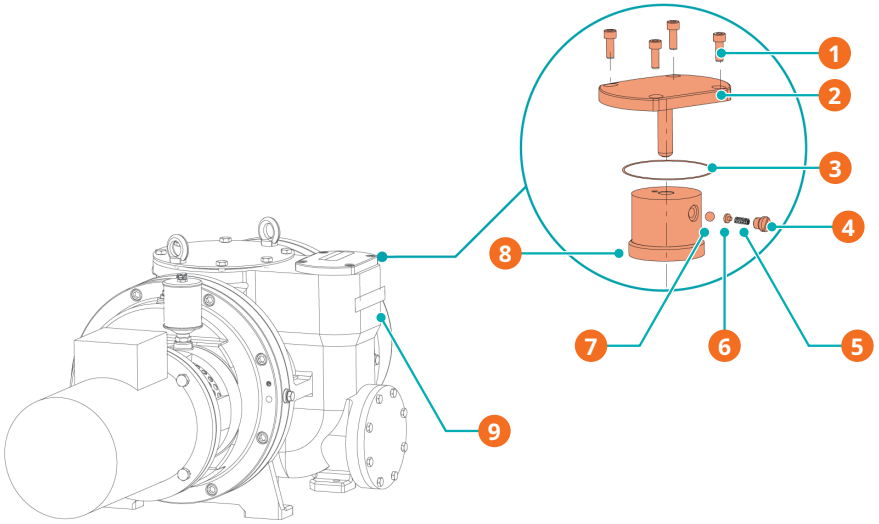
- Never oil the guide pin of the bypass valve, as this will have an adverse effect on the damping of the bypass valve.
- Replace the guide pin completely if there are pronounced signs of wear

Required tools

- Allen key, **WAF 10 mm**
- Calibrated torque wrench (tightening factor ≤ 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 overflow channel.
- 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 bypassoverflow 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

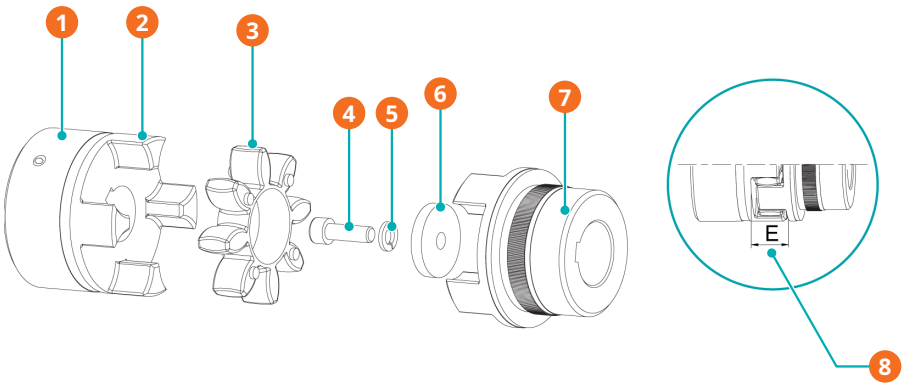
In the operating range of the motor coupling, there is a danger of clothing being caught and wound up.

- 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 ≤ 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

WARNING

Danger of injury from strong magnetic field.

There is a risk of injury for people with pacemakers and medical implants.

- Make sure that such individuals do not enter the sphere of influence (≤ 2 m) of the magnetic field.
- Identify rooms in which magnetic couplings are openly accessible with the symbol: "**No access for people with pacemakers**".
- Always keep disassembled couplings away from computers, data carriers, and other electronic components.

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 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 radial shaft seal rings 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 pearls from the suction chamber.
- Do not operate the vacuum booster if there is evidence of rust on the parts which form the housing.
- Contact Busch Service.
- Perform a leak test prior to recommissioning the vacuum booster as required.

8.2 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 $p < 1$ 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.

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.

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
- 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.

- We recommend taking advantage of our service training offering.
- When ordering spare parts, specify the information on the nameplate.

Problem	Possible causes	Remedy
Vacuum booster will not start up.	• Mains voltage is missing or the incorrect operating voltage is present	• Check the mains voltage and mains fuse. • Check the motor switch.
	• The circuit breaker trips; the circuit breaker may be of the wrong type	• Check the terminal connection in the motor terminal box. • Check the circuit breaker type; use type “K” with slower tripping characteristic.
	• Suction chamber contaminated	• Clean suction chamber. • If necessary, contact Busch Service.
	• Gear (gear wheels) damaged	• Switch off the vacuum booster immediately. • If necessary, contact Busch Service.
	• Bearing damaged present	• Have the bearing changed. • Contact the Busch Service.
	• Motor faulty	• Replace the motor.
Vacuum booster switches off after a while after being started	• Thermal protection switch of the motor has triggered. • Forevacuum pressure possibly too high	• Determine and eliminate the cause of overheating. • Allow the motor to cool down. • Check the forevacuum pressure.

Problem	Possible causes	Remedy
Vacuum booster does not reach the specified usual pressure	• Vacuum chamber dirty	• Clean vacuum chamber.
	• Lubricant soiled	• Change the lubricant.
	• Backing pump operates incorrectly	• Check the backing pump.
	• Leak in the system	• Locate and eliminate the leak.
	• Loss of lubricant at the lubricator or the radial shaft seal rings	• Check the radial shaft seal rings. • Have the radial shaft seal rings replaced. • If necessary, contact Busch Service.
	• Bypass valve does not close completely	• Check the bypass valve; replace if necessary.
Unusual noises during operation	• Vacuum chamber dirty	• Switch off the vacuum booster immediately. • Clean vacuum chamber.
	• Damage to the bearing or gear wheels	• Switch off the vacuum booster immediately. • Contact Busch Service.
	• Bypass valve soiled	• Switch off the vacuum booster immediately. • Contact Busch Service.
	• Damage to motor bearing	• Switch off the vacuum booster immediately. • Change the motor. • Contact Busch Service.
	Only applies to vacuum boosters with magnetic coupling • Motor is running – vacuum booster is not working, i.e., the magnetic coupling is defective or the magnetic field has broken down • If the vacuum booster continues to run with a "broken down" magnetic field, the magnetic coupling is destroyed by demagnetization	• Switch off the vacuum booster immediately and wait for it to come to a complete standstill. • While the vacuum booster is at a standstill, the magnets can re-align with each other. • Slowly restart the vacuum booster and check the power transmission and vacuum pressure.
Vacuum booster losing oil	• A decreasing oil level in the oiler and an oil leak below the lantern indicate a defective **external** radial shaft seal ring	• Check the level at shorter intervals and top up regularly as required. • Continue to operate the vacuum booster for a while.
	• A decreasing oil level, with no leaked oil visible below the vacuum booster, is due to a worn **inner** radial shaft seal ring	This damage leads to an inadmissibly high oil level in the bearing chamber. • Contact Busch Service to arrange for replacement of the protective sleeve and all three radial shaft seal rings.

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 RSSR

The set of seals contains:

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

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

12.3 Maintenance Kit for Version with RSSR

The maintenance kit contains:

- All sealing parts in the area of the radial shaft seal ring including the protective sleeve
- All sealing rings of the filling and drain screws and both O-rings for the device cover and cap
- The coupling buffer (toothed ring)

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 device

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.

Gear evacuation

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

Protective strainer

The protective strainer on the vacuum 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
Frequency converter	PP 078 304 AT
Barrier gas kit	PP 027 401 -T

Description	Article number
Oil level monitoring 20–250 V AC	PK 004 930 -U
Oil level monitoring 24 V DC	PK 005 639 -U
Oil compensating line with oil level monitoring	PP 031 448 -T
Sprayer DN ISO-F	PP 031 252 -T
Gear box evacuation (Plastic hose)	PP 144 120 -T
Gear housing evacuation (Stainless Steel - corrugated hose)	PP 144 121 -T
EVB 160 PA, Angle valve, electro-pneumatic, with PI, with PV, 24 V DC	310VEP160-02

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-pump performance - General description”
- Integral leakage rate with 100% helium concentration, 10 s measurement duration
- Sound pressure level at distance to vacuum pump = 1 m
- Technical data measured without splinter shield at pump inlet.

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^2						

Conversion table: units for gas throughput

	mbar l/s	Pa m^3/s	sccm	Torr l/s	atm cm^3/s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m^3/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^3/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.

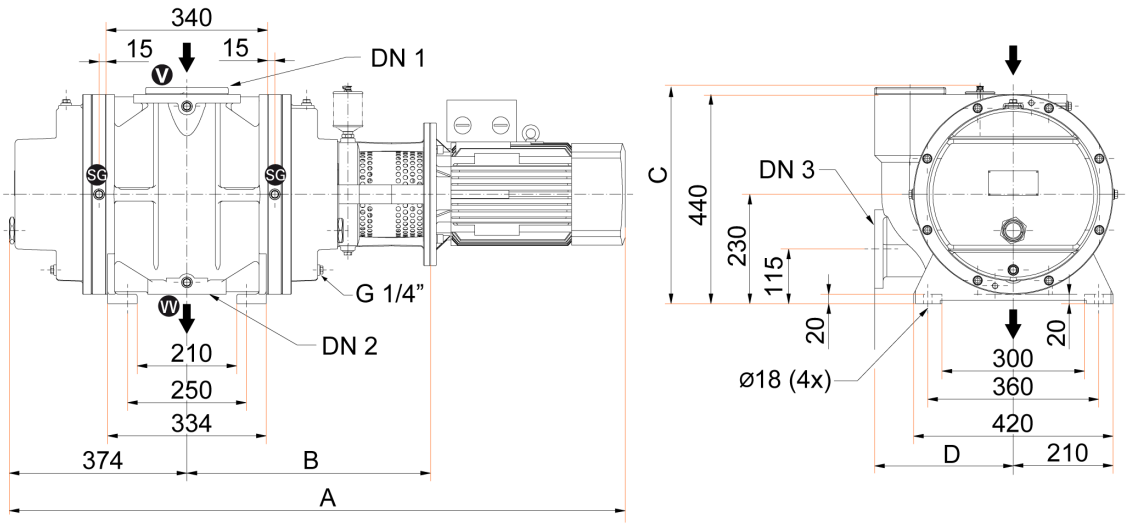
- For deviations in special versions, please refer to the nameplates or the enclosed information.

14.2 Technical Data

Type designation	PANDA 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
Nominal pumping speed	1075 – 3230 m^3/h
Nominal pumping speed at 50 Hz	2155 m^3/h
Nominal pumping speed at 60 Hz	2585 m^3/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
Rotation speed	1500 – 4500 rpm
Integral leak rate	$1 \cdot 10^{-3}$ Pa m^3/s
Emission sound pressure level (EN ISO 2151) at inlet pressure 10 hPa	75 dB(A)
Emission sound pressure level (EN ISO 2151) at inlet pressure 1 hPa	72 dB(A)
Protection degree	IP55
Cooling method	Natural convection
Motor protection	3TF
Pumping speed category	2000 m^3/h
Oil amount	5 l
DN 1	DN 160 ISO-F
DN 2	DN 100 ISO-F
DN 3	DN 100 ISO-F
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

Type designation	Panda WV 2200 A
A	1297
B	513
C	458
D	292

15 Oil

Consumables

Description	Article number
P3, mineral oil, 1 l	PK 001 106 -T
P3, mineral oil, 5 l	PK 001 107 -T
P3, mineral oil, 20 l	PK 001 108 -T
H1, 1 l	PK 001 210 -T
H1, 5 l	PK 001 211 -T
H1, 20 l	PK 001 212 -T
H1, 208 l	PK 001 213 -T
VSC100/D2, synthetic diester based oil, 1 l	PK 005 875 AT
VSC100/D2, synthetic diester based oil, 5 l	PK 005 876 AT
VSC100/D2, synthetic diester based oil, 20 l	PK 005 877 AT
F5, Perfluoropolyether, 0.5 l	PK 001 851 -T
F5, Perfluoropolyether, 1 l	PK 001 852 -T
F5, Perfluoropolyether, 5 l	PK 001 853 -T

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 nameplate 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. 6, Hongli Xingye Industrial Park,
87 Huayuanwan 2nd Street,
Caidian District, Wuhan 430113 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
- '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 : 2011	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 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 nameplate 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. 6, Hongli Xingye Industrial Park,
87 Huayuanwan 2nd Street,
Caidian District, Wuhan 430113 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 : 2011	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 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 importer in the UK (if the manufacturer is not located in the UK):

Busch (UK) Ltd
30 Hortonwood
Telford – UK

Wuhan, 2025.02.01

Philip Wu, General Manager

Busch Manufacturing China Co., Ltd.

Notes

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.

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- Busch Group production sites
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www.buschvacuum.com

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