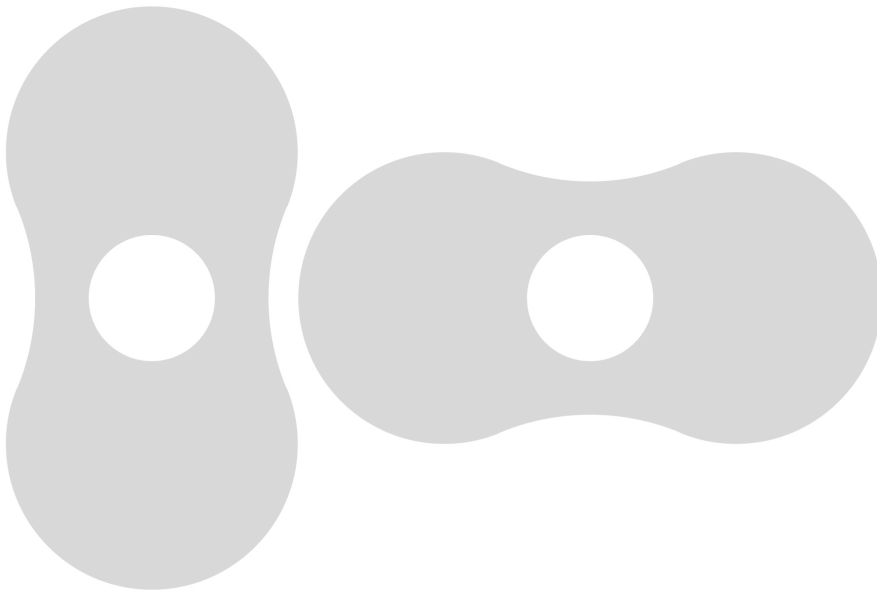




Installation and Operating Instructions



Vacuum pumps
WY 4500 C



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Introduction

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

These operating instructions contain information on

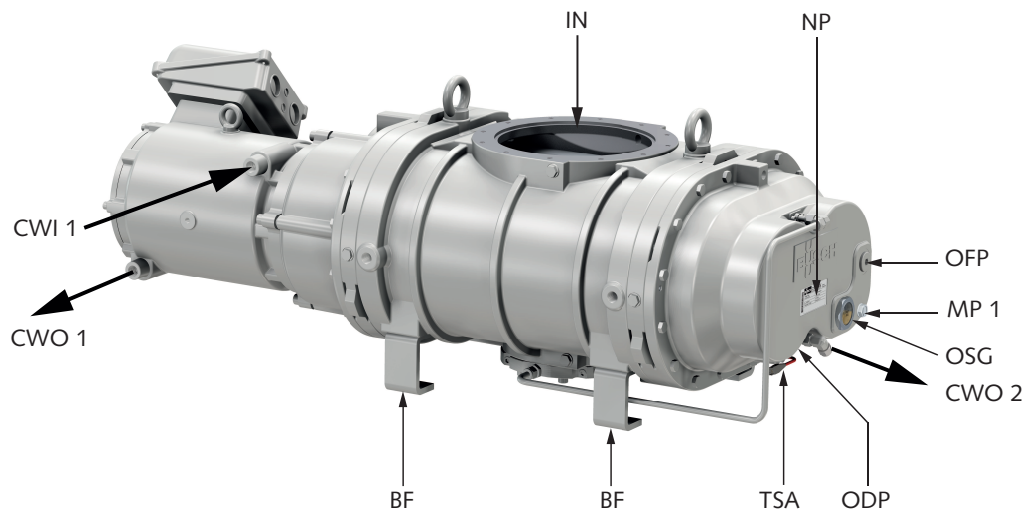
- product description,
- security,
- installation and commissioning
- maintenance,
- overhaul,
- troubleshooting

of the vacuum pump.

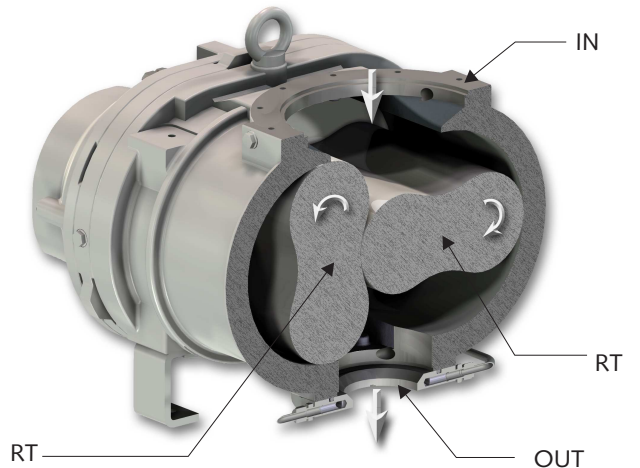
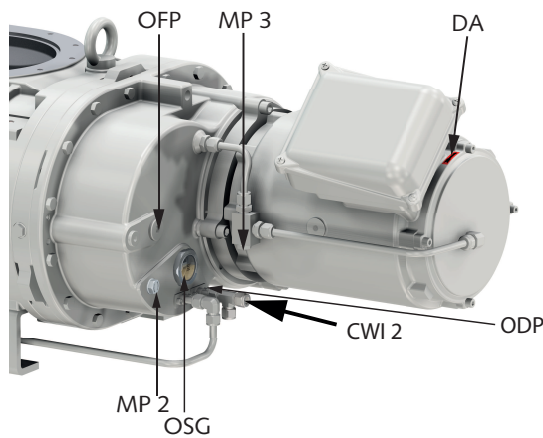
For the purpose of these instructions, "handling" the vacuum system means the transport, storage, installation, commissioning, influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum system.

Prior to handling the vacuum system, these operating instructions must be read and understood. If anything remains to be clarified please contact your Busch representative!

Keep these operating instructions and, if applicable, other relevant operating instructions available and accessible on site.



- DA Directional arrow
- OFF Oil filler plug
- IN Inlet
- NP Nameplate
- OSG Oil sight glass
- RT Rotor
- OUT Outlet
- ODP Oil drain plug
- BF Base frame
- MP 1 Magnetic plug
- MP 2 Magnetic plug
- MP 3 Magnetic plug
- TSA Resistance thermometer
- CWI 1 Cooling water inlet (motor)
- CWO 1 Colling water outlet (motor)
- CWI 2 Cooling water inlet (pump)
- CWO 2 Cooling water outlet (pump)



Product description

Use

The roots pumps are designed for applications in the semiconductor industry under Clean Room conditions. The WY 4500 C roots pumps can only be used as backing pumps in conjunction with other (primary) pumps in vacuum systems. They can be used to draw gases and mixtures of gases.

Make sure that the system complies with the appropriate national and international safety regulations and that all safety instructions are followed when drawing toxic, inflammable and/ or explosive gases.

These pumps are not designed for the drawing of explosive mixtures. Before using the vacuum pump for drawing aggressive gases, you must imperatively contact your local Busch Agency.

Do not use the pump for other processes without a general overhaul. Gases or products could have remained inside the pump.

The Roots vacuum pumps are usually used as backing pumps in conjunction with other types of vacuum pumps in vacuum systems.

Conveying media with a higher density than air leads to an increased thermal and mechanical load on the vacuum pump and is permissible only after consultation with a Busch company.

Max. allowed temperature of the drawn gases:

See "Oil, Ambient temperature range"

Make sure that the oil level in both housings is in the target circle of the oil sight glasses after the vacuum pump has been switched off.

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

Max. permissible number of startings per hour: 6.

The vacuum pump is thermally suitable for continuous operation.

The vacuum pump is capable of holding end pressure.

Principle of operation

The Roots vacuum pumps operate according to the approved principle of the Roots type machine. Operation is both simple and effective.

Two rotors with identical profiles rotate in opposite directions within a casing. As they rotate, gas is drawn into the space between each rotor and the casing where it is trapped and pushed out at the discharge through the rotation of the lobes. This action is repeated twice for each revolution of each rotor and therefore four times for each revolution of the drive shaft. There is no mechanical contact between rotors and cylinder, therefore no oil lubrication in the process chamber is required.

The drive motor of the roots pump is a water-cooled motor.

Cooling



CAUTION

Operating the motor without water cooling will destroy the motor.

Water must be neutral and clean. It must fulfill the following conditions :

Temperature of water : 10-15°C at inlet

Quantity of cooling water : 4 l/min.

To ensure the flow rate regulation of the cooling water, we recommend to fit a regulating valve at the cooling water inlet.

The Roots WY 4500 C has cooling systems in both cylinder covers (cooling coils). These cooling systems are separated from each other.

A recirculating water-cooling system into the outlet flange enables a stable temperature of the oil and the bearings.

Cooling water connection:

The cooling water connection can be made with flexible hoses or water pipes (Connection: 1/4"). The water outlet must be without pressure.

Initial filling-up with cooling water:

- Remove the safety caps from the connections. Connect up the two hoses at the water inlet.

- Fill in water until water flows out at the outlet.

- Connect up the two hoses at the water outlet.

On/ Off switch

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

Safety

Intended use

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

The vacuum pump is intended for industrial use. It must be handled by qualified personnel only.

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

The maintenance instructions must be observed.

Prior to handling the vacuum pump these operating instructions must be read and understood. If anything remains to be clarified please contact your Busch representative!

Safety notes

The vacuum pump has been designed and manufactured in accordance with the latest technical and safety standards. Nevertheless, residual risks may remain. These operating instructions and the pump itself inform about potential hazards where appropriate. Safety instructions can be detected through the keywords, DANGER, WARNING and CAUTION as follows:



DANGER

Disregard of this safety instruction will always lead to accidents with fatal or serious injuries.



WARNING

Disregard of this safety instruction may lead to accidents with fatal or serious injuries.



CAUTION

Disregard of this safety instruction may lead to accidents with minor injuries or property damage.

Sound Emissions

Refer to the table "Technical Properties" for the permissible sound levels in free field conditions according to EN ISO 2151.



CAUTION

The vacuum pump emits sounds of high intensity.

Risk of hearing damage!

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

Transport

Roots vacuum pumps undergo a rigorous operating test in the factory and are packed carefully to avoid transport damage.

The inlet and outlet flange are sealed with plugs so that no dirt can enter the pump during transport. These covers must be removed before connecting up the pump.

Please check packaging for transport damage on delivery.

The pump can be lifted from the packaging with suitable lifting gear using the lifting brackets on the pump.

The packaging materials must be disposed of in accordance with applicable environmental protection regulations, or re-used.

These operating instructions are part of the delivery packaging consent.

Pumps are generally shipped without oil.

Operating the vacuum pump without oil will destroy the pump!

Transport in Packaging

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

Transport without packaging

In case the vacuum pump is bolted to a pallet or a base plate :

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



CAUTION

Do not walk, work or stand under suspended loads.



CAUTION

Please check out the weight of the vacuum pump before lifting it up (see "Technical Data").

Use adequate lifting gear for this.

- Attach lifting gear to a crane hook equipped with a safety latch
- Lift the vacuum pump with a crane hook

In case the vacuum pump was bolted to a pallet:

- Remove the stud bolts from the rubber feet



CAUTION

Tilting a vacuum pump that is already filled with oil can cause large quantities of oil to flow into the cylinder.

Starting the vacuum pump with excessive quantities of oil in the cylinder will immediately break the lobes and destroy the vacuum pump.

Once the vacuum pump is filled with oil it must not be lifted any more.

- Prior to every transport make sure that the oil has been drained (unless recommended otherwise)

Storage

Short-term Storage

- Make sure that the suction connection/ gas inlet and the discharge connection/ gas outlet are closed (fit the provided plugs)
- Store the vacuum pump
 - if possible in its original packaging,
 - indoors,
 - dry,
 - dust free
 - vibration free

Switching off and conservation of the pump

Removal of the pump

Before starting up a vacuum pump that has been stored outside the building for a while, the vacuum pump must be moved to a room with ambient temperature, where it should rest for a day.

Conservation

In case of adverse ambient conditions (e.g. aggressive atmosphere, frequent temperature changes) the vacuum pump must be preserved after one week using a conservation agent inside the cylinder. In case of favourable ambient conditions, the pump must be preserved using a conservation agent inside the cylinder if the pump is to be stored for more than 3 months.



CAUTION

Using the pump with the gas discharge connection closed will damage the vacuum pump.

Make sure that the gas discharge connection is open.



CAUTION

During operation the surface of the vacuum pump may exceed temperatures of 70°C.

Risk of burns!

Do not touch the hot housing.

- Electrically connect the vacuum pump (see "Installation and Commissioning, Installation, Connect Electrically")
- Let the vacuum pump run for at least half an hour
- Switch off the vacuum pump
- Drain the conservation oil (see "Maintenance, Oil Change, Draining Used Oil")
- Make sure that all openings are firmly closed; seal all openings that are not closed with PTFE-tape, gaskets or o-rings, with adhesive tape.
- Wrap the vacuum pump in VCI film

NOTE: VCI stands for "Volatile Corrosion Inhibitor". VCI-products (film, paper, cardboard, foam) evaporate a substance that condenses in molecular thickness on the packed good and by its electrochemical properties effectively suppresses corrosion on metallic surfaces. However, VCI-products may attack the surfaces of plastics and elastomers. Seek advice from your local packaging dealer! VCI packaging ensures good protection against corrosion for a few years, even in the most extreme of conditions such as see transport and prolonged storage.

- Store the vacuum pump
 - if possible in its original packaging,
 - indoors,
 - dry,
 - dust free and
 - vibration free

Repeat the conservation process after 12 months of standstill.



CAUTION

Before a new conservation process or re-installation of the vacuum pump, make sure that the gasket, plug or adhesive tape from the discharge connection are removed.

Commissioning after conservation

- Make sure that all gaskets, plugs or adhesive tape are removed from the openings
- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses
- Commission the vacuum pump as described in the chapter "Installation and Commissioning"

Installation and Commissioning

Installation Prerequisites



CAUTION

In case of non-compliance with the installation prerequisites, particularly in case of insufficient cooling:

Risk of damage or destruction of the vacuum pump and adjoining system components!

Risk of injury!

The installation prerequisites must be complied with.

- Make sure that the integration of the vacuum pump is carried out in such a way that the essential safety requirements of the Machine Directive 2006/42/EC are complied with (regarding the responsibility of the designer of the machinery into which the vacuum pump is to be incorporated; see also the note in the EU-Declaration of Conformity)

Local installation

- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again
- Make sure that the following ambient conditions are adhered to:
 - Ambient temperature : see "Oil"
 - Ambient pressure: atmospheric
- Make sure that the environmental conditions comply with the protection class of the drive motor (according to the nameplate)
- Make sure that the vacuum pump is placed on or fastened to a horizontal surface
- Make sure that the vacuum pump is level and even

- Make sure that the vacuum pump cannot inadvertently or intentionally be used as a support for heavy objects
- Make sure that the vacuum pump cannot be hit by falling objects
- Make sure that the vacuum pump is at least 0,5 m away from any wall to ensure sufficient cooling
- Make sure that no temperature-sensitive components (plastics, wood, cardboard, paper, electronics) come into direct contact with the hot surface of the vacuum pump
- Make sure that the installation site or assembly area is ventilated in such a way that adequate cooling of the vacuum pump is guaranteed



CAUTION

During operation the surface of the vacuum pump can exceed temperatures of 70°C.

Risk of burns!

- Make sure that the vacuum pump cannot be touched inadvertently during operation, provide a guard if necessary
- Make sure that the oil sight glasses (OSG, 220/ 222) remain easily accessible

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

- ◆ Make sure that the oil drain plugs (ODP, 252/ 262 or 610) and the oil filler plugs (OFP, 250/ 260) remain easily accessible

Configuration of the pump:

- ◆ Vertical gas flow

Vertical gas flow has the advantage of self-cleaning of the cylinder during operation.

Suction Connection



CAUTION

Do not put hands into the inlet aperture.

Risk of body damage!



CAUTION

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

In case the inlet gas contains dust or other foreign solid particles:

- ◆ Make sure that a suitable filter is installed upstream of the vacuum pump
- Make sure that the suction line fits the suction flange/ gas inlet of the vacuum pump
- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again

When using pipes :

- ◆ Make sure that the pipe does not exercise any pressure on the vacuum pump's connection, use bellows if necessary

If two or more vacuum pumps work on the same suction line, if the volume of the vacuum system is large enough to draw back oil after having been switched off, or if the vacuum must be maintained after switching off the vacuum pump :

- ◆ Provide a manual or automatic operated valve (non-return valve) in the suction line (the installed non-return valve inside the suction connection is not meant to be used for this purpose!)

If the vacuum pump is intended to be used for the drawing of gases that contain limited quantities of condensable vapour:

- ◆ Provide a shut-off valve, a drain line and a drain tap in the suction line, so that condensates can be drained from the suction line
- Make sure that the suction line does not contain foreign matter, e.g. welding slag

Discharge connection



CAUTION

Do not put hands into the outlet aperture.

Risk of body damage!

The following guidelines for the discharge line do not apply if the drawn air is discharged into the environment directly at the vacuum pump.

- Make sure that the discharge line fits the gas discharge of the vacuum pump

When using pipes:

- ◆ Make sure that the pipe does not exercise any pressure on the discharge connection, use bellows if necessary
- Make sure that the discharge line's diameter over its entire length is at least as large as the diameter of the gas discharge of the vacuum pump

In case of very long discharge lines, it is advisable to use a larger diameter piping in order to avoid a loss in efficiency and an overload on the vacuum pump. For advice please contact your local Busch representative!

- Make sure that the discharge line either slopes away downwards from the vacuum pump or provide a liquid separator or a drain line with a drain tap, so that no liquids can be drawn back into the vacuum pump



WARNING

Discharge lines made from non-conducting material can build up electrostatic charge.

Electrostatic discharge can lead to explosion of potentially present oil mist.

The discharge line must be made of conducting material or provisions must be made against electrostatic discharge.

Electrical connection/ Controls

- Make sure that the regulations acc. to the EMC-Directive 2004/108/EC as well as the EN-standards, electrical and occupational safety directives and the local or national regulations, respectively, are complied with (this is in the responsibility of the designer of the machinery into which the vacuum pump is to be incorporated; see also the note in the EU-Declaration of Conformity)
- Make sure that the power supply is compatible with the specification on the nameplate of the drive motor
- Make sure that an overload protection according to EN 60204-1 is provided for the drive motor
- Make sure that the drive of the vacuum pump will not be affected by electric or electromagnetic disturbance from the mains; if necessary contact the Busch service for advice

In case of mobile installation:

- ◆ Make sure that the vacuum pump is switched off and cannot accidentally be switched on again
- If the Roots blower is used in a vacuum system where a vacuum pump is connected upstream, the vacuum pump can only be started up after the primary pump has gone into operation.

Installation

Fitting

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

Electrical connection



WARNING

Risk of electrical shock, risk of damage to equipment.

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

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



CAUTION

The wiring diagrams given below are typical. Depending on specific purchase orders or certain markets different wiring diagrams may apply.

Risk of damage to the drive motor!

The inside of the terminal box must be checked for correct drive motor wiring diagrams/ instructions.

- Electrically connect the drive motor (120)
- Connect the earth

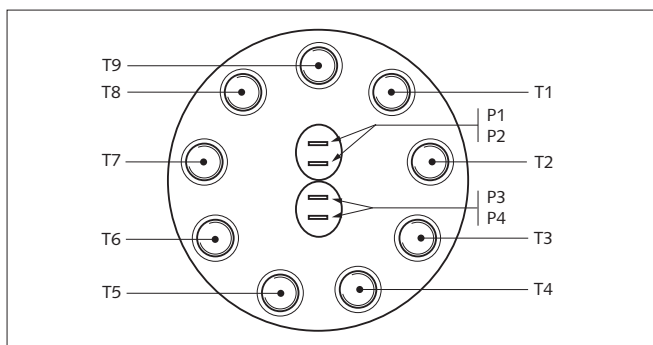
Electrical motor connection (15 kW)



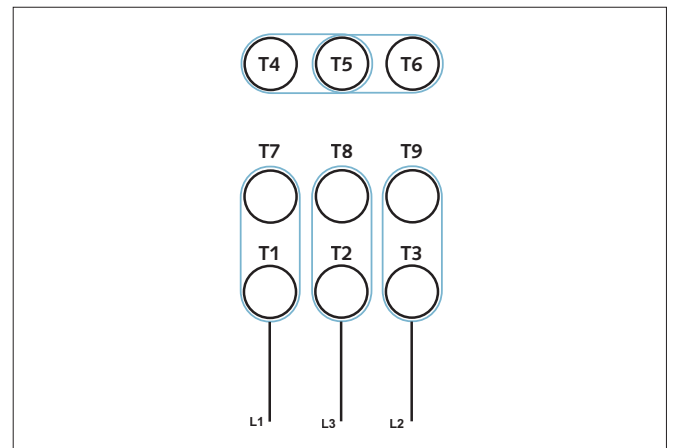
CAUTION

When connecting up the wires into the terminal box: please make sure the tightening torque of **3 Nm** is adhered to and check with a calibrated torque wrench (Nuts M6).

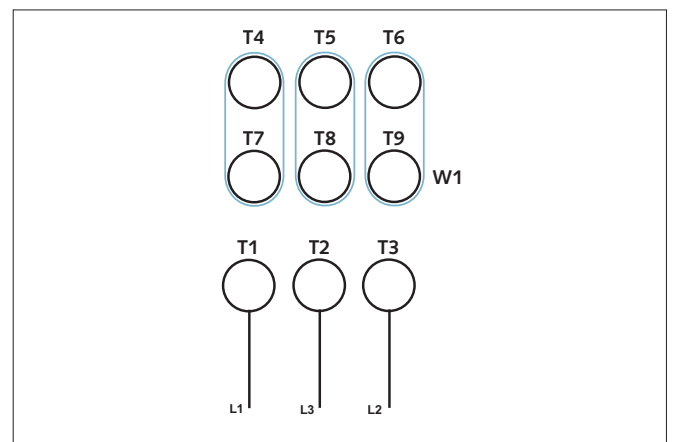
Three phase motor connection:



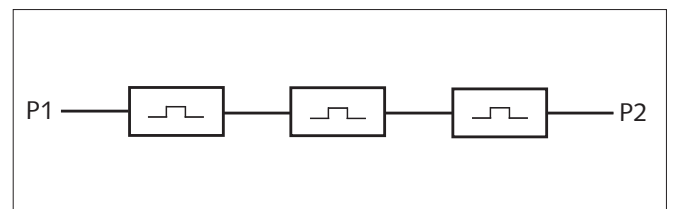
Star-star connection (Low voltage):



Star connection (High voltage):



Thermoswitch connection:



CAUTION

Operation in the wrong direction of rotation can destroy the vacuum pump within a very short period of time.

Risk of explosion of the drive motor!

Prior to starting-up make sure that the vacuum pump is to be operated in the right direction.

- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again
- Determine rotation sense of the motor by using a measure tool or by placing a rubber plate on the inlet.
- Press the on/ off switch briefly
- Make sure that the vacuum pump draws in

If the direction of rotation has to be changed :

- ◆ Exchange two of the three feeder leads

Adjustment values for the temperature sensor

The temperature of the oil is monitored by a temperature sensor TSA which is fitted to the cover on the B-side.

Depending on the temperature of the oil, first a warning is emitted, then the pump will eventually be switched off when the temperature of the oil has reached the corresponding temperature values.

Oil	TSA	
	T _{Warning}	T _{Switch off}
YLC 250 B	80°C	90°C

Connecting Lines/ Pipes

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

- ◆ Connect the suction line
- Connect the discharge line
- Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way

Filling up with Oil

The gears and the bearings are oil-lubricated.

In case the pump has been preserved with conservation oil:

- ◆ Drain any remaining conservation liquids



CAUTION

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

Prior to commissioning the vacuum pump, make sure that oil is filled in.

The vacuum pump can be delivered with or without oil.

In case the pump is delivered filled with oil, the oil used is PFPE oil.

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

NOTE: The quantity of oil given in these operating instructions serves as a guideline only. Check the oil level with the help of the oil sight glasses (OSG, 220/ 222) on the vacuum pump.



CAUTION

In case the vacuum pump has been treated with conservation oil:

Synthetic oils (except for oils based on poly-olefin) are incompatible with mineral oils and conservation oils.

Risk of foam building leading to the destruction of the vacuum pump.



CAUTION

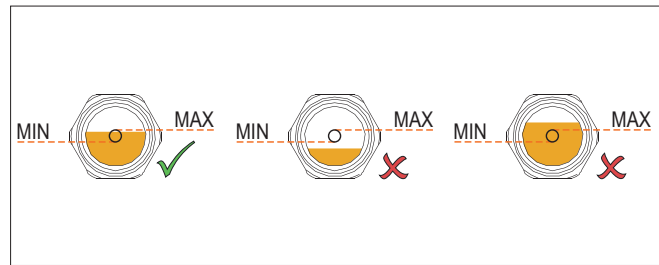
Oil may only be filled in through oil filler holes (OFP, 250/ 260)

Remove oil filler plugs (OFP, 250/ 260) only if the vacuum pump and the primary pump are at a complete standstill.

The vacuum pump must only be operated with the oil filler plugs (OFP, 250/ 260) firmly tightened up.

- Remove oil filler plugs (OFP, 250/ 260)
- Fill in the relevant quantity of oil as detailed in the table "Oil Quantity"

- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses



- Make sure that the seals of the filler plugs (OFP, 250/ 260) are not damaged and positioned correctly. Replace seals if damaged.
- Refit the oil filler plugs (OFP, 250/ 260)
- Switch on the vacuum pump

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

- ◆ Close the shut-off valve

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

- Cover the suction flange (IN) with a rubber mat
- Let the vacuum pump run for a few minutes
- Switch off the vacuum pump and wait for a few minutes
- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses
- Make sure that the vacuum pump is switched off and cannot accidentally be switched on again.

- ◆ Top-up with oil

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

- ◆ Open the shut-off valve

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

- ◆ Remove the rubber mat from suction flange and connect the suction line

Saving the operating parameters

As soon as the vacuum pump is working under normal conditions after being switched on:

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

Recommendations on operation

Application



CAUTION

In case of disrespect of the above, risk of damage or destruction of the vacuum pump and adjacent system components!

Risk of Injury!

The vacuum pump has been designed for use in the semiconductor industry under clean room conditions. The roots pumps can only be used in conjunction with primary pumps in vacuum systems. They can be used to draw gases and mixtures of gases.

The end user must make sure that the system complies with national and international safety regulations and that all safety measures are followed, when drawing toxic, inflammable and/ or explosive gases.

Max. permissible number of startings per hour: 6.

These pumps are not suitable for the drawing of explosive mixture. Before using the vacuum pump with aggressive gases, imperatively contact your local Busch Agency.

Do not use the pump for another process without general overhaul, as gases or products can remain inside the pump.

Make sure that the system is leak-tight and that there is no leakage of dangerous substances.

If in doubt on drawn process-related liquids, we recommend the installation of a separator.

Drawing substances with a higher density than air leads to an increased thermal and mechanical load on the vacuum pump and is permissible only after consultation with Busch.

Max. allowed temperature of the drawn gas:

See "Oil, Ambient temperature range"

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

The vacuum pump is thermally suitable for continuous operation.

The vacuum pump is ultimate pressure-proof.

The pumping of other vapours must be previously approved by the Busch Company.



CAUTION

During operation the surface of the vacuum pump may exceed temperatures of 70°C.

Risk of burns!

The vacuum pump must be protected against contact during operation, provide a guard if necessary



CAUTION

The vacuum pump emits sound of high intensity.

Risk of hearing damage.

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

- Make sure that the vacuum pump and the primary pump are switched off and cannot accidentally be switched on again.
- Make sure that protective devices will not be disconnected
- Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow can circulate without obstruction
- Make sure that the "Installation Prerequisites" (see "Installation Prerequisites and Commissioning") are followed, particularly follow those instructions that ensure sufficient cooling

Cooling water

To drain the cooling water, the hoses have to be removed and the cooling water system blown through with compressed air, until all the water has been completely removed.

Advice: When there is danger of frost, the cooling water must be fully drained at a standstill of the pump, as described above.

Limitations of use

ΔP = differential pressure between the outlet and the inlet of the vacuum pump. See table "Technical Characteristics". Do not exceed the values given in the table.

Maintenance

For all maintenance work, the vacuum pump or the vacuum system must be switched off and it must be ensured that it cannot accidentally be switched on again.

Any dismantling of the pump must be executed by qualified personnel only. Before dismantling, the end user of the vacuum pump must fill in a "Certificate about Absence of Danger" which will inform about possible risks and dangers and corresponding measures. Without this document duly filled in and signed by an authorised person, the pump cannot be dismantled.



CAUTION

During operation, the surface of the vacuum pump may exceed temperatures of 70°C.

Risk of burns!

- Prior to any work that requires touching the vacuum pump, let the vacuum pump cool down

When draining the oil:

- ◆ Let the vacuum pump cool down for no more than 20 minutes
- Prior to disconnecting the inlet or discharge lines, make sure that these pipes/ lines have been vented to atmospheric pressure

Maintenance Schedule

NOTE: The maintenance intervals depend very much on the individual operating conditions. The intervals given below must be considered as starting values which should be shortened or extended as appropriate. Particularly heavy duty operation, e.g. high dust loads in the environment or in the process gases, other contaminations or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

Weekly

- Check the oil level (see "Checking the oil")

Monthly:

- Make sure that the vacuum pump and the primary pump are switched off and cannot be accidentally be switched on again
- Check the vacuum pump for oil leaks - in case of leaks have the vacuum pump repaired (Busch service)

In case of operation in a dusty environment:

- ◆ Make sure that the working area is free from dust and dirt, clean if necessary (see "Every 6 Months")
- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses

Yearly:

- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses

Every 16000 Operating hours, at the latest after 4 years

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

Checking the oil

Checking the oil level at the gears and bearing housings

- Make sure that the vacuum pump and the primary pump are switched off and cannot accidentally be switched on again
- Read the level on the oil sight glasses (OSG, 220/ 222)

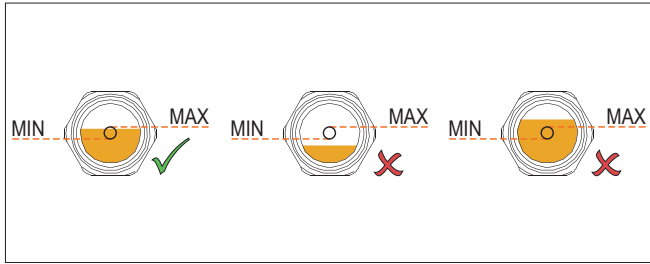
In case the level has dropped below the target circle:

- ◆ Top up with oil (see "Topping up Oil")

In case the level is above the target circle:

- ◆ Change the oil (see "Change the oil")

- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses



Dispose of the used oil in compliance with applicable environmental protection regulations.

NOTE: Under normal conditions, there should be no need to top up with oil during the recommended oil change intervals. A significant level drop indicates a malfunction (see "Troubleshooting").



CAUTION

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

Please fill in the oil after removing the oil filler plugs on the cylinder covers.

- Remove oil filler plugs (OFP, 250/ 260)
- Top up with oil until the oil level is in the target circle of the oil sight glasses
- Make sure that the oil level at the gears and bearings is in the target circle of the oil sight glasses
- Refit the oil filler plugs (OFP, 250/ 260)
- Make sure that the oil filler plugs have been correctly fitted after filling in the oil, so that no air can enter the pump. Too high an oil level must be avoided as well as this could lead to overheating of the gears

Checking the colour of the oil

NOTE: The oil should have a light colour and can be transparent, a little foamy or a little clouded. A milky discolouration that does not vanish after the oil has been left to rest indicates contamination with foreign material. Darkly coloured oil has either been contaminated with foreign material or burnt and must be changed (see "Oil Change").



WARNING

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



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

Life span of the oil at the gears and the bearings

The oil life depends very much on the operating conditions. A clean and dry air stream and operating temperatures below 100°C are ideal. Under these conditions the oil and the oil filter must be changed every 5000 operating hours, latest after 6 months.

Under very unfavourable operating conditions the oil life can be less than 500 operating hours. Extremely short life times indicate

malfunctions (see "Troubleshooting") or unsuitable operating conditions.

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

Oil Change



WARNING

Draining used oil from the gears and the bearings

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

- Make sure that the vacuum pump and the primary pump are switched off and cannot accidentally be switched on again
- Make sure that the vacuum pump is vented to atmospheric pressure
- Put a drain tray underneath the oil drain plugs (ODP, 252/ 262 or 610)
- Remove the oil drain plugs (ODP, 252/ 262 or 610)
- Drain the oil

When the oil flow has stopped:

Make sure that all the used oil is drained

- Carefully unscrew and take off the magnetic plugs (MP 1, 590, MP 2, 592)
- Check that no metal swarf sticks to the magnet of the drain plug, clean or change it if necessary
- Make sure that the seals of the oil drain plugs are not damaged and fits correctly. Replace seal if damaged
- Refit the oil drain plugs (ODP, 252/ 262 or 610)
- Make sure that the seals of the oil drain plugs are not damaged and fits correctly. Replace seal if damaged
- Refit the magnetic plugs
- Dispose of the used oil in compliance with applicable regulations



CAUTION

Because the ends of the drain plugs are magnetic, metal swarf can stick to them. Always clean away this swarf when removing the drain plugs.

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

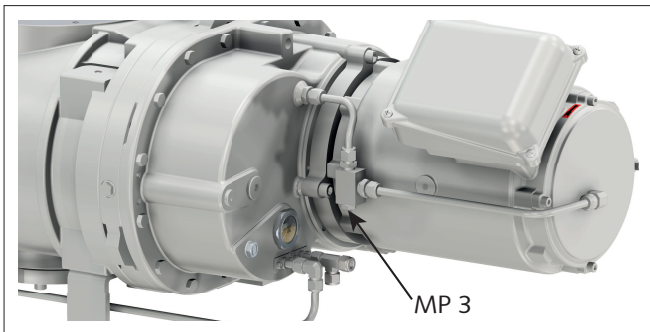
Checking the magnetic plug from the rear lubrication circuit of the motor bearing



CAUTION

Never unscrew and remove the magnetic plug (MP 3, 536) when the vacuum pump is operating.

- Make sure that the vacuum pump and the primary pump are switched off and cannot accidentally be switched on again
- Make sure that the vacuum pump has been vented to atmospheric pressure
- Make sure that all the oil has been drained



- Carefully unscrew and take off the magnetic plug (MP 3, 536), which is situated on the rear lubrication circuit of the motor bearing
- Make sure there is no metallic swarf on the magnetic part of the magnetic plug, clean off as necessary
- Refit the magnetic plug (MP 3, 536)



CAUTION

It is recommended that the magnetic plug (MP 3, 536) is replaced at every oil change due to wear and tear of the seal.

Filling in fresh oil for the gears and the bearings

- Prepare the necessary oil quantity (see table "Oil quantity")

NOTE: The quantity given in these operating instructions serves as a guideline only. Check the oil level with the help of the oil sight glasses (OSG, 220/ 222) on the vacuum pump.

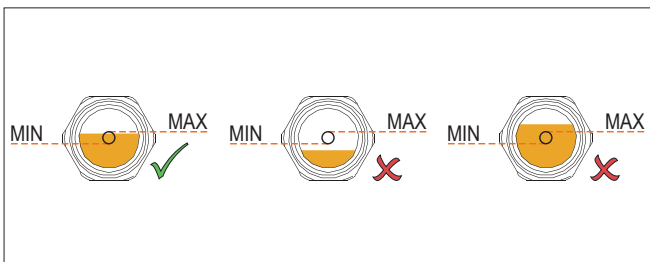
- Make sure that oil drain plugs (ODP, 252/ 262 or 610) have been correctly fitted and are tight
- Make sure that the magnetic plugs (MP 1, 590, MP 2, 592) have been fitted and tightened up correctly



CAUTION

Oil may be filled through oil filler holes (OFP, 250/ 260) only.

- Remove oil filler plugs (OFP, 250/ 260)
- Top up with oil until the oil level is in the target circle of the oil sight glasses



- Make sure that the seals of the filler plugs (OFP, 250/ 260) are not damaged and positioned correctly. Replace seals if damaged.
- Refit the oil filler plugs (OFP, 250/ 260)

Overhaul



CAUTION

In order to achieve the highest degree of efficiency and a long life span, the vacuum pump has been assembled and adjusted in accordance with precisely defined tolerances.

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

It is therefore highly recommended that any dismantling of the vacuum pump going beyond the scope of description in this manual should be carried out by specially trained Busch service personnel only.



CAUTION

Risk for the operating safety after improper work on the vacuum pump.

Risk of explosion!

Approval for operation of the pump will be void!

Any dismantling of the vacuum pump going beyond the scope of what is described in this manual must be carried out by specially trained Busch service personnel only.



WARNING

In case the vacuum pump has conveyed gases that have been contaminated with foreign materials that are dangerous to health, the oil and condensates will also be contaminated.

These foreign materials can infiltrate the pores, recesses and other internal spaces of the vacuum pump.

Danger to health when the vacuum pump is dismantled.

Danger to the environment.

Prior to shipping, the vacuum pump must imperatively be decontaminated and the degree of contamination must be documented in a declaration of decontamination ("Declaration of Decontamination"), which can be downloaded from www.buschvacuum.com.

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

Removal from Service

Temporary Removal from Service

- Prior to disconnecting the inlet and discharge lines, as well as the water piping to and from the motor, make sure that all pipes have been vented to atmospheric pressure

Recommissioning

After longer periods of standstill:

- ◆ Make sure that the vacuum pump and the primary pump are switched off and cannot accidentally be switched on again
- Follow the instructions in chapter "Installation and Commissioning"

Dismantling and Disposal



In case the vacuum pump has conveyed gases that have been contaminated with harmful foreign material which are harmful to health, the oil and the condensates will also be contaminated with harmful foreign material.

These foreign materials can infiltrate the pores, recesses and other internal spaces of the vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

During dismantling of the vacuum pump protective equipment and clothing must be worn.

The vacuum pump must be decontaminated prior to disposal.

Prior to shipping, the vacuum pump must imperatively be decontaminated and the degree of contamination must be documented in a declaration of decontamination ("Declaration of Decontamination"), which can be downloaded from www.buschvacuum.com.

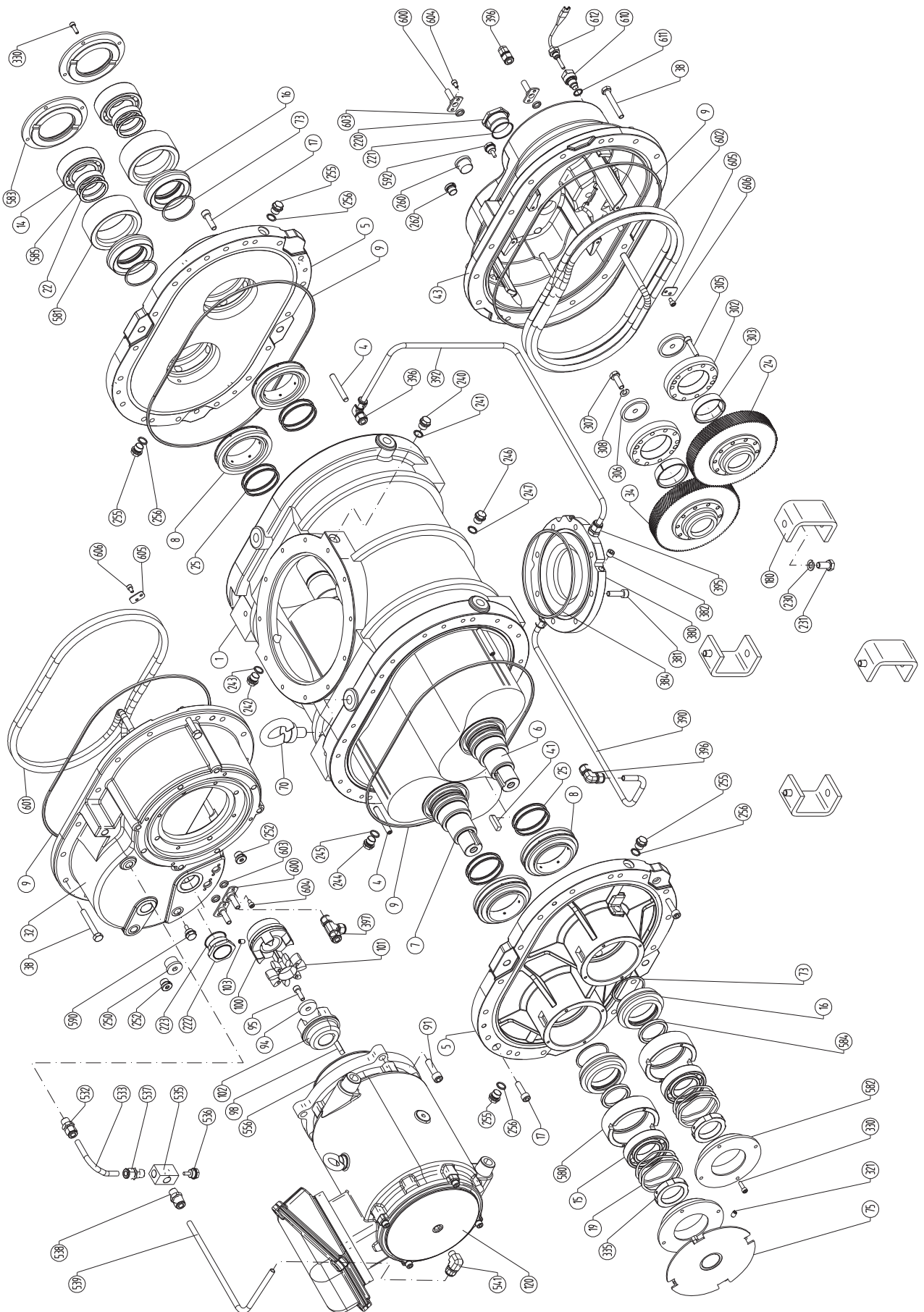
Used oil and condensates must be disposed of separately in compliance with applicable environmental regulations.

- Drain the oil
 - ◆ Dispose of the used oil in compliance with applicable regulations
- Make sure that all materials and components that must be treated as special waste have been removed from the vacuum pump
- Make sure that the vacuum pump is not contaminated with any harmful foreign material

Based on what is known at the time of print of this manual, the materials used for the manufacturing of the vacuum pump involve no risk.

- Please dispose of used parts and fluids in accordance with local applicable environmental laws and regulations
- Dispose of the vacuum pump as scrap metal

Exploded drawing



Spare parts

NOTE: When ordering spare parts or accessories acc. to the table below please always quote the type and the serial no. of the vacuum pump (on the nameplate of the pump). This will allow Busch service technicians to check if the vacuum pump is compatible with a modified or improved part.

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

This parts list applies to a standard configuration of the vacuum pump. Specific pump configuration parts lists can be supplied upon request.

Gasket kit

The gasket kits contain all the seals to be changed during service work on a vacuum pump.

Partnumber: 0990 565 406			
Pos.	Part	Qty	WY 4500 C
9	O-ring	4	0486 000 695
73	O-ring	4	0486 508 907
221	O-ring	1	0486 000 633
223	O-ring	1	0486 000 633
241	O-ring	1	0486 000 647
243	O-ring	1	0486 000 647
245	O-ring	1	0486 000 647
247	O-ring	1	0486 000 647
256	O-ring	4	0486 000 647
384	O-ring	1	0486 000 686
523	O-ring	2	0486 565 397
556	O-ring	1	0486 000 761
603	O-ring	4	0486 000 711
611	Sealing ring	1	0482 545 177

Full service kit

These full service kits contain all relevant gasket kits as well as the wear and tear parts that need to be changed.

Partnumber: 0994 565 407			
Pos.	Part	Qty	WY 4500 C
4	Parallel pin	4	0437 558 180
14	Angular ball bearing double row	2	0473 556 351
15	Grooved ball bearing single row	2	0473 556 375
19	Compensation washer	6	0433 509 261
22	Tolerance washer	4	0433 543 715
25	Piston ring	8	0488 544 216
101	Gear rim	1	0512 530 018
250	Screw plug	1	0415 503 596
252	Screw plug	2	0415 000 074
260	Screw plug	1	0415 503 596
262	Screw plug	1	0415 000 074
-	Screw plug with magnet	2	0415 134 870
520	Deep groove ball bearing	2	0473 558 800
522	Compensation washer	1	0433 509 261
-	Gasket kit	1	0990 565 406

Oil

Oil type



CAUTION

It is possible that the vacuum pump was tested with a different type of oil to the type you will be using for your application. Vacuum pumps that have been tested with a special oil, are labelled with specific stickers ("Special oil") affixed on the B-side cover (inlet side) as well as on the A-side cover (motor-side). If the oil type is not compatible, all parts that have come into contact with the oil must be cleaned. Make sure that the bearings are lubricated prior to reassembly.

- Make sure that the oil type corresponds to specifications:
 - Busch YLC 250 B, n° art. 0831 000 054 (0,5 l \cong 1 kg)



WARNING

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

Oil quantity

The quantity of oil specified in the following table is of informative nature only. Check the oil level with the help of the various oil sight glasses on the vacuum pump.

Quantity of oil [l]	Motor side	Gear side
WY 4500 C	2,2	1,8

Technical Data

Technical Properties			WY 4500 C
Nominal displacement	50 Hz 60 Hz	m ³ /h	4500 5400
Max. differential pressure (according to DIN 28426)	50 Hz 60 Hz	hPa (mbar)	30 30
Nominal motor rating	50 Hz 60 Hz	kW	15 15
Nominal motor speed	50 Hz 60 Hz	min ⁻¹	3000 3600
Weight approx.		kg	600

Troubleshooting



WARNING

Risk of electrical shock, risk of damage to equipment.

Electrical installation work must only be carried out by qualified personnel that know and observe the following regulations:

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



CAUTION

During operation, the surface of the vacuum pump may exceed temperatures of 70°C.

Risk of burns!

Do not touch the hot surfaces of the vacuum pump or wear heat protection gloves.

Please contact your local Busch representative if you have any doubts or questions

Problem	Possible Cause	Remedy	
The vacuum pump does not reach the usual working pressure	The vacuum system or suction line are not leak-tight	Check piping, hoses or pipe connections for possible leaks	
The current consumption of the motor is too high (compared with the initial value after commissioning)	Jammed lobes	Inspection of the lobes	
	Defective bearings	Have the vacuum pump repaired (Busch service)	
	Reaching operational pressure takes too long	In case an inlet filter is installed on the suction side : The filter on the suction flange is partially clogged	Clean or change the filter
		Partial clogging or blockage in suction or discharge lines	Remove foreign particles
		Suction or discharge lines too long, or too small (diameter)	Use larger diameter lines
	Internal parts worn or damaged	Have the vacuum pump repaired (Busch service)	
	The vacuum pump runs in the wrong direction	Check rotation of the driving motor. See "Installation and Commissioning", change if necessary	
The vacuum pump does not start	The drive motor is not supplied with the correct voltage or is overloaded	Supply the drive motor with the correct voltage	
	The drive motor trip switch protection is too weak or trip level is too low	Compare the technical data of drive motor trip switch with the data on the nameplate of the motor. Correct if necessary In case of high ambient temperature: Set the trip level of the drive motor trip switch 5% above the nominal drive motor current	
	One of the fuses has blown	Check the fuses	
	The connection cable is too long or too small causing a voltage drop at the vacuum pump	Use adequately dimensioned cable	

	The vacuum pump or the drive motor is jammed or seized	<p>Make sure that the drive motor is disconnected from the power supply</p> <p>Remove the fan cover</p> <p>Try to turn the fan by hand</p> <p>If the unit vacuum pump/ drive motor is still jammed:</p> <p>Remove the drive motor and check the drive motor and the vacuum pump separately</p> <p>If the vacuum pump is jammed:</p> <p>Have the vacuum pump repaired (Busch service)</p>
	The drive motor is defective	Change the drive motor (Busch service)
The vacuum pump is jammed or seized	Solid foreign matter has entered the vacuum pump	<p>Have the vacuum pump repaired (Busch service)</p> <p>Make sure the suction line is equipped with a mesh screen</p> <p>If necessary fit a mesh screen at the inlet</p>
	Corrosion in the vacuum pump from remaining condensates	<p>Have the vacuum pump repaired (Busch service)</p> <p>Check the process</p> <p>Follow the instructions in chapter "Installation and Commissioning, Operating Notes"</p>
<p>The vacuum pump starts, but labours or runs noisily or rattles</p> <p>The drive motor draws too high a current (compare with initial value after commissioning)</p>	<p>Connection(s) in the drive motor terminal box are defective</p> <p>The motor winding is defective</p> <p>The drive motor operates on two phases only</p>	<p>Check the proper connection of the wires against the wiring diagram</p> <p>Tighten or change the connections</p>
	Wrong oil quantity, unsuitable oil type	<p>Use one of the recommended oils in the correct quantity</p> <p>(see "Oil", Oil change see "Maintenance")</p>
	Foreign particles in the vacuum pump Seized bearings	Have the vacuum pump repaired (Busch service)
The vacuum pump is very noisy	Defective bearings	Have the vacuum pump repaired (Busch service)
	Worn coupling element	Replace the coupling elements
	Defective gears	Have the vacuum pump repaired (Busch service)
Noise at the sealings	Insufficient lubrication	Check oil levels and top up with oil
	Worn sealing (wear parts)	Change sealing
The vacuum pump is very hot (the temperature of the drained oil must not exceed 90°C)	Cooling water flow is too low	Check the cooling water circuit and adjust the flow if necessary
	Ambient temperature too high	Keep within the permitted ambient temperature range
	Temperature of the gases at inlet too high	Keep within the permitted temperature range for the gases at inlet
	Mains frequency or voltage outside tolerance range	Provide a more stable power supply
The oil is black	<p>Oil change intervals are too long</p> <p>The oil has overheated</p>	<p>Drain the oil</p> <p>Fill in new oil</p> <p>(see "Maintenance")</p> <p>In case the oil life is too short : use oil with better heat resistance (see "Oil") or fit additional cooling</p>

The rotors do not turn, and cannot be turned either way by hand:	Failure of the motor	Repair or change motor
The rotors do not turn, and cannot be turned by hand either way:	Rotors are jammed, stuck or seized	Free the rotors Check for signs of overheating (discolouration) and contact Busch Service for a service/ dismantling for repair
	Foreign substances in the pump	Dismantle pump to clean and repair
Abnormal sounds or vibrations: STOP BLOWER IMMEDIATELY !!	Excessive wear of bearings	Change bearings
	Too little gear oil in the pump, or oil in the pump is worn	Top up with oil/ Change gear oil
	Resonance of piping	Provide support for the piping or use flexible connections
	**Abnormal increase of discharge pressure	Refer to cause marked with **
	Leakage	Find and stop leaks
	Synchronising the rotors	Have the vacuum pump repaired (Busch service)
	Foreign particles in the gear housing	Have the vacuum pump repaired (Busch service)
	Failure of non-return valve	Change non-return valve
Abnormal heat	Abnormal increase of discharge pressure	Refer to causes marked with **
	Rotational speed of blower and/ or motor too low (when using a frequency converter)	Check the minimal admissible rotational speed and correct
	Too much gear oil in the housing	Fill in oil only to the target circle of the oil sight glass, while the blower is switched off
	Ambient temperature too high	Increase ventilation of the machine room/ increase rotational speed (ventilation) of motor
	Blockage of the suction inlet or filter	Clean suction inlet, and clean or change filter
	Excessive wear of rotors and consequently increase of rotor tolerances	Install filter and dismantle blower for repair Have the vacuum pump repaired (Busch service)
**Abnormal increase of discharge pressure	Blockage of discharge pipe	Clean discharge pipe
	Blockage of system piping	Clean system piping
	Primary pump failure	Have the vacuum pump repaired (Busch service)
Oil leaks	Too much oil in the pump	Fill up oil only to the target circle of the oil sight glass, while the blower is switched off
	Worn or broken mechanical seals (oil-lubricated single mechanical seals) do not apply to WY pumps	Change mechanical seals
	Ambient conditions and vacuum combined with pressure operation and high dP	Fit an oil separator, ensure adequate ventilation
	Pump has been tilted or is not level	Install the pump on a horizontal surface
Oil level in the seal housing fluctuates abnormally (Applies to pumps equipped with a drop oiler)	Worn or broken mechanical seals	Change mechanical seals

EU Declaration of Conformity

This Declaration of Conformity and the CE-mark affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer. When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the CE-mark.

The manufacturer

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

declares that the machine(s) **PUMA WY 4500 C**

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

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

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

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

⁽¹⁾ In case control systems are integrated.

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

Busch Dienste GmbH
Schauinslandstr. 1
DE-79689 Maulburg

Chevenez, 14.05.2021



Christian Hoffmann, General Director

UK Declaration of Conformity

This Declaration of Conformity and the UKCA-mark affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer. When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the UKCA-mark.

The manufacturer

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

declares that the machine(s) **PUMA WY 4500 C**

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

- Supply of Machinery (Safety) Regulations 2008
- Electromagnetic Compatibility Regulations 2016
- Restriction of the use of certain hazardous substances in electrical and electronic equipment Regulations 2012

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

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

⁽¹⁾ In case control systems are integrated.

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

Busch (UK) Ltd
30 Hortonwood
Telford - UK

Chevenez, 14.05.2021



Christian Hoffmann, General Director

Note

Note

Busch

Vacuum Solutions

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