VACUUM SOLUTIONS

Installation and Operating Instructions

Rotary Vane Vacuum Pumps HUCKEPACK

HO 0429-0441 F

Get technical data, instruction manuals, service kits

VACUUM APP

0870114286/ B0004 170222 / Original instructions

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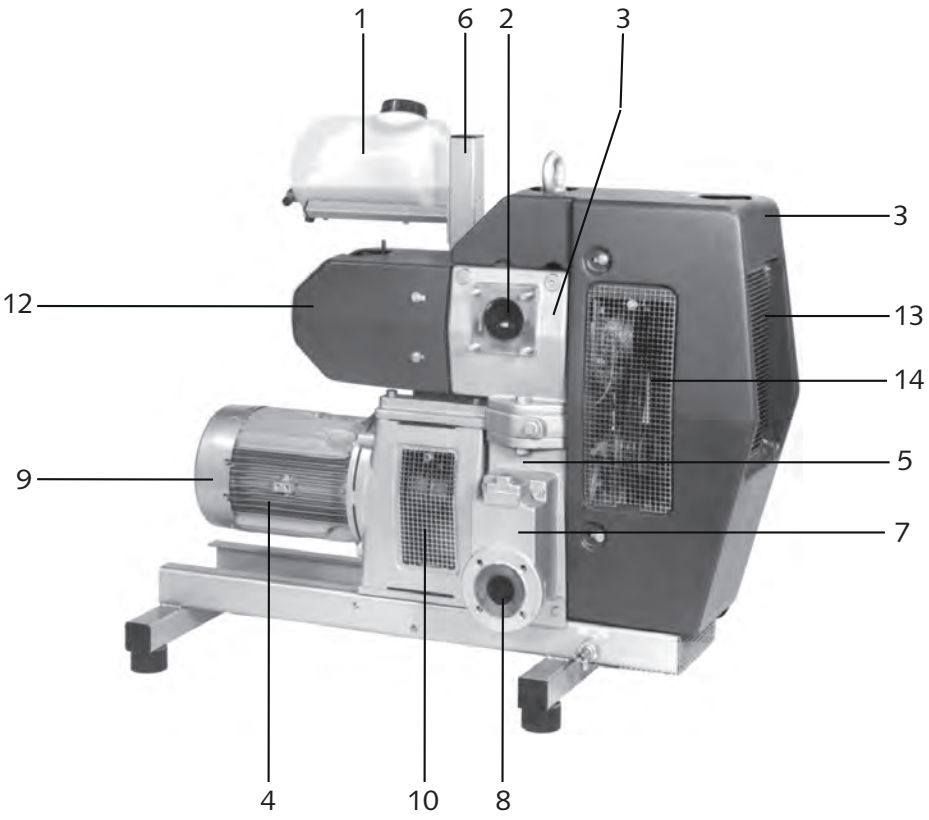
Preface

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

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 pump.

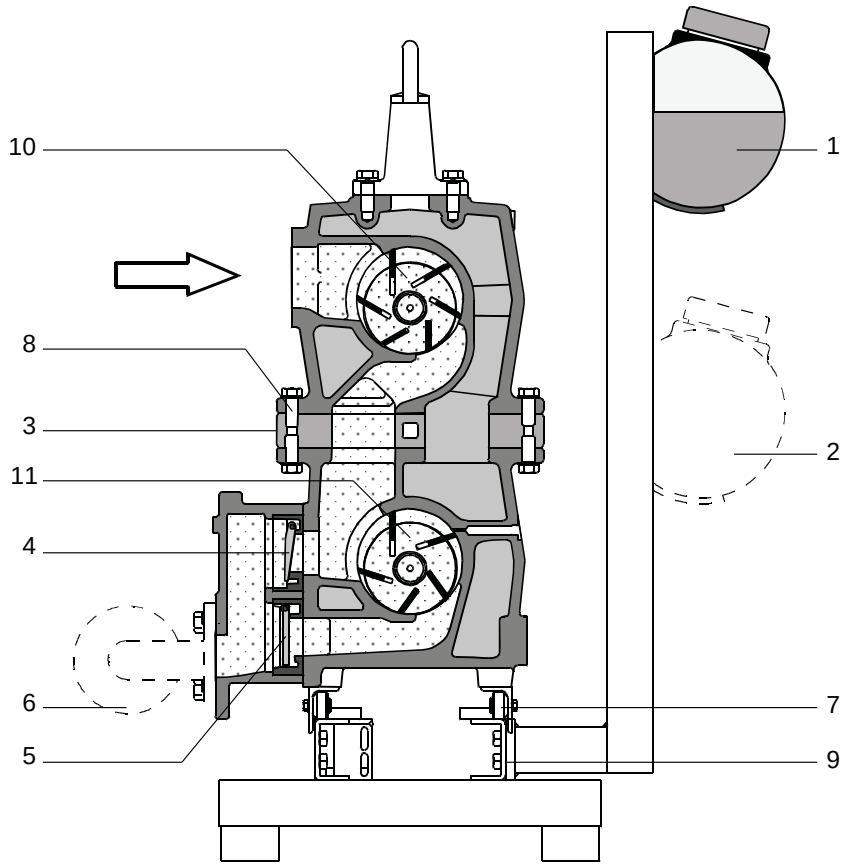
Prior to handling the vacuum pump these operating instructions shall be read and understood. If anything remains to be clarified please contact your Busch representative.

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



HO 0441 F

1 Seal fluid vessel
2 Inlet flange
3 LP stage
4 Motor
5 HP stage
6 Holding stage
7 Valve housing
8 Discharge flange
9 Hood of motor fan
10 Coupling safety grill
11 Hood of V-belt drive
12 Hood of seal fluid pump
13 Radiator safety grill
14 V-belt drive safety grill



1 Seal fluid vessel
2 Flushing fluid vessel (option)
3 Holding plate
4 Bypass valve
5 Flap valve
6 Exhaust silencer (accessory)
7 Tread rollers
8 Holding screws
9 Guide rail
10 LP rotor
11 HP rotor

Product description

Use

The Huckepack vacuum pumps are designed for use in the field of coarse and fine vacuum.

They can be used to suck off gases and gas mixtures.

WARNING

When using toxic, inflammable and/ or explosive gases, make sure that the system corresponds in design to applicable local and national safety regulations and that all applicable safety measures are followed. All product-specific safety regulations must be observed.

Solid particles must not get into the vacuum pump. There are different filters and separators to connect in series that can be found in our accessory program.
Procedural errors can result in the vacuum pump sucking in a certain quantity of liquid. If the vacuum pump has sucked in liquid, a short drying time is necessary at the end of the procedure.

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

Max. permissible number of startings per hour: 12.

As far as temperature is concerned, the vacuum pump is suitable for continuous duty at any pressure between atmosphere and ultimate pressure.

The vacuum pump is tight down to ultimate pressure.

Operating principle

The Huckepack vacuum pumps work according to the rotary vane principle. Thereby the pumping direction is vertical that means, that the circulation of the gas-flow is downwards. There are two modules which are placed one upon the other. The Huckepack vacuum pumps are water cooled. An eccentrically installed rotor rotates in the cylinder. The centrifugal force of the rotation pushes the vanes, which are gliding in slots in the rotor, towards the wall of the cylinder. The vanes separate the sickle-shaped space between the rotor and the cylinder in the chambers.
When connected with the inlet channel, the gas is sucked in, compressed by the rotation and compressed again in a further level (multistage versions) and discharged.
The seal fluid of the vacuum pump constantly causes the seal fluid to be pressed into the compression chambers, which is discharged with the medium as seal fluid fog.

There is a seal fluid separator or an exhaust muffler available. The use of these accessories makes it possible to reach an exhaust air which contains almost no seal fluid.

CAUTION

Liquid and solid particles must not enter the vacuum pump.
They can lead to ablution of the lubricating film in the compression chamber and to increased abrasion of the cylinder trads and therefore to overheating of the vacuum pump.
Additionally, it must be checked that there is no condensation during the compression (boiling point, partial vapour pressure). In the case of acids or alkaline vapours respectively solvents, consult your local Busch-Agency.

CAUTION

The Huckepack vacuum pumps are generally shipped without seal fluid. Operating the vacuum pump without seal fluid will damage the vacuum pump!

According to the medium processed by the vacuum pump, it must be run warm before beginning. In case of doubt, please contact your local Busch-agency.

After processing, it may be that the vacuum pump must be kept running for a time or that it must be flushed. In case of doubt, please contact your local Busch-Agency.

CAUTION

If there is danger of frost, it has to be made sure that all cooling water was drained. Therefore, open the water outlet. In the case of non circulating water cooling, the water inlet must be shut off at first.

Versions

Due to the numerous application cases, the Huckepack vacuum pumps are supplied in different versions.

Cooling systems variants

Sizes

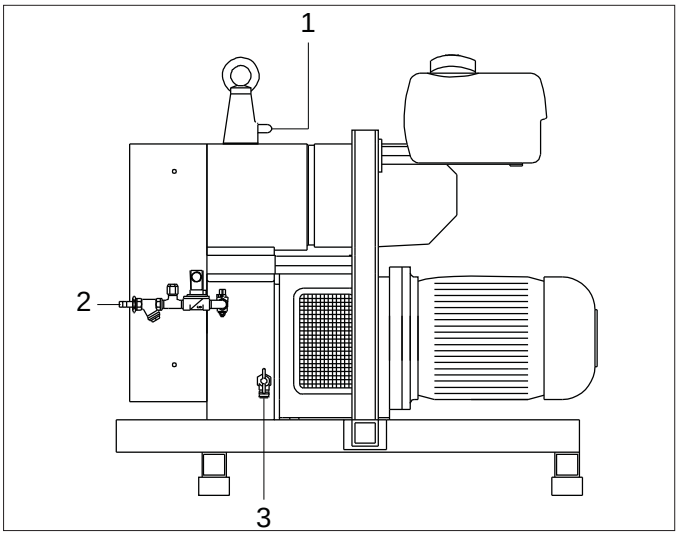
The Huckepack vacuum pumps are available in the following different sizes:

HO: Huckepack once-through oil lubricated

- HO 0429 = 160 m^3/h
- HO 0433 = 250 m^3/h
- HO 0437 = 400 m^3/h
- HO 0441 = 630 m^3/h

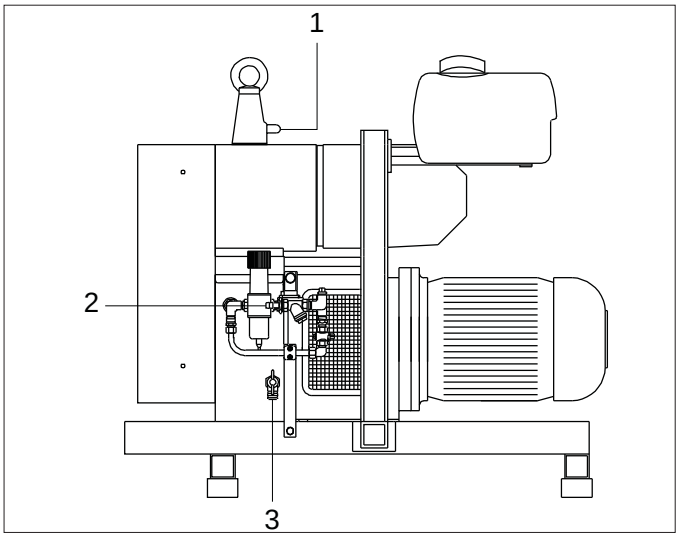
Non circulating cooling

The Huckepack vacuum pumps with direct cooling system have a water inlet unit with a magnetic valve that stops the water inflow at the shutdown of the pump and releases the water flow when the pump is running in order to ensure cooling. As an option, a water inlet unit with temperature regulating valve is possible. With this valve, the operating temperature of the vacuum pump can be regulated. A pressure control switch (accessory) controlling the static water pressure can be used to turn off the vacuum pump.



Direct cooling

1 Cooling water outlet
2 Cooling water inlet
3 Drain cock

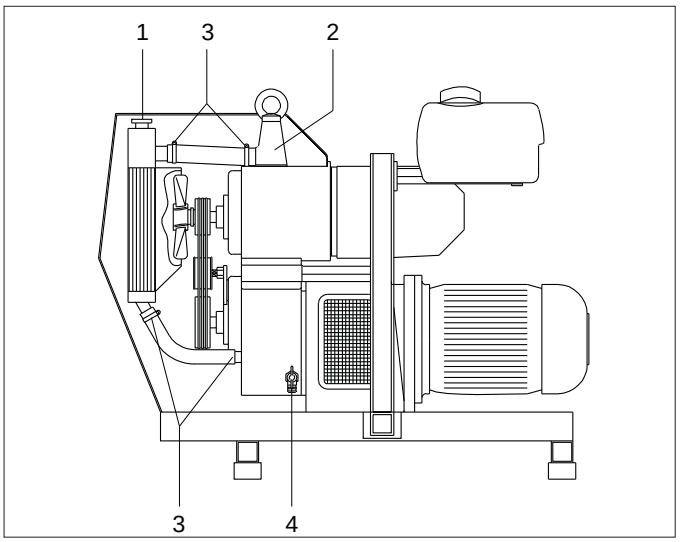


Direct cooling with temperature regulating valve

1 Cooling water outlet
2 Cooling water inlet
3 Drain cock

Radiator cooling

The Huckepack vacuum pumps with radiator cooling system are independent of the cooling water net. The water circulation is made by a gravity thermosiphon effect.
For higher demands (60 Hz operation, from 30°C ambient temperatures on) the pump can be equipped with a cooling circulation pump (contact your Busch representative). Water circulation pump can be retrofitted, if necessary.



Radiator cooling

1 Cooling water inlet
2 Thermostat for water circulation (option)
3 Hose clips
4 Cooling water outlet

Shock pressure resistant version

Shock pressure resistant vacuum pumps are verified by the manufacturer concerning the shock pressure resistance:

— Shock pressure resistance: 10 bar.

Limits of use

Operating pressure

The normal operating pressure range of the vacuum pump Huckepack is 0,5-100 hPa (mbar).
For continuous service with higher operating pressures a bypass valve is fitted in order to be able to operate at higher pressures. In case of higher intake pressures, the drive power of the motor must be checked. If necessary the motor must be replaced by a motor with a higher drive power.
The vacuum pump can operate with a closed valve on the suction side for continuous service (zero delivery).
When starting up an entire or a large volume system, throttle the suction valve so that the vacuum pump does not "see" more than approximately 200 hPa inlet pressure.
When the system pressure goes below 200 hPa, the inlet valve may be fully opened.

Counterpressure

The drive motors designed for vacuum operation below 100 hPa (mbar) that means that in this measurement range, the gas may be compressed to an overpressure of 0.2 bar relative.

Gas temperature

The admissible gas temperature on the operating side depends on the intake pressure. Above 100 mbar 70°C should not be exceeded. For 10 mbar, the max. temperature is 90°C.

Seal fluid circulation

The Huckepack vacuum pumps are lubricated by a lubrication pump. The seal fluid is transported through tubes directly to the lubrication spots. (See "Lubrication system")

Cooling

The Huckepack vacuum pumps are available with:

— Direct cooling

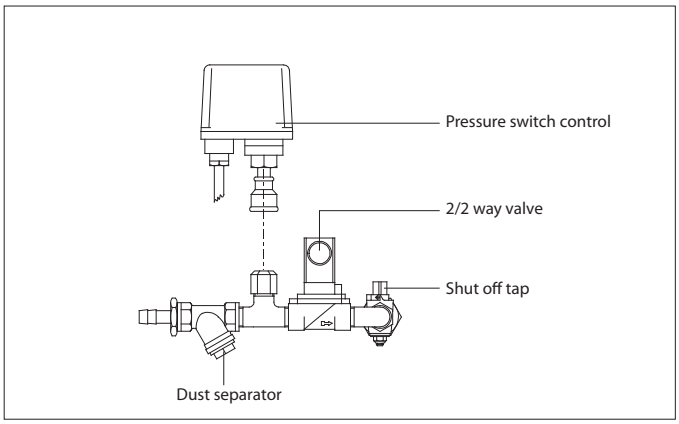
The cooling water connection can be made with flexible hoses or water pipes. The water outlet must be without pressure. The cooling water inlet is controlled by a magnetic valve. It stops the water inflow at the shutdown of the vacuum pump and releases the water flow when the vacuum pump is started.

For non circulating cooling, the cooling water must fulfill the following conditions:

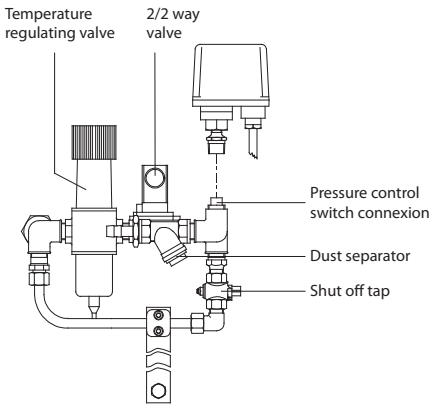
— Water pressure: 3...8 bar
— Water temperature: 15°C (max. 40°C)
— Water hardness: 12 dH

The water must be neutral and clean. The water outlet must be without pressure. Hose liner LW 13.

The pressure control switch (accessory) in front of the water inlet turns the vacuum pump off when the water pressure is too low.



The temperature regulating valve (option) is to be adjusted with the rotary button starting with 0 (max. quantity flow) to 5 (min. quantity flow) so that the temperature at the water thermometer is the same as of the vacuum pump.
The control value is 55-90°C, normal 80°C.



– Radiator cooling

With the help of the closed loop, cooling the Huckepack vacuum pump becomes independent of the cooling water circuit. The water circulation is made by the gravity thermosiphon effect. For higher demands (60 Hz operation, from 30°C ambient temperatures on) the pump can be equipped with a cooling circulation pump (contact your Busch representative). A retrofit cooling circulation pump is possible.

– Cooling water

In case of winter operation a mixture of water and anti freezing solution must be used as cooling liquid. The mixture must be mixed before it is charged.

Optional functions/ Use of available accessories

For simple applications, an exhaust silencer can be mounted on demand.

In order to separate the seal fluid and the seal fluid mist that leave the vacuum pump on the pressure side, a separator can be installed. The separator is available in the following finition: aluminium with filter elements, refined stainless steel with ceramic filter cartridges, steel with halar coating and ceramic filter cartridges.

For the suction-sided connection at the vacuum pump, a safety knock out separator Duosec can be mounted. Occurring condensate or splash waters are separated in the lower part of the Duosec. Dust particles or liquid drops which are dragged along are filtered in the filter element that is connected in series. The size of retention is 5µm stainless. Finish in stainless steel or glass with filter cartridge and safety high liquid level switch.

The gas ballast valve is recommended for installation in the HP stage. If there is danger of condensation in the vacuum pump, when pumping aggressive and high-boiling vapours.

The flushing device makes it possible to clean the slide and compression chambers from resinating, polymerizing, subliming or corrosive tailings. As options, manual and automatical flushing devices are available.

The suction filters in the standard version are delivered with steel/ aluminium housings and paper cartridge. The alloy steel version is equipped with a PTFE-filter cartridge.
The retention is 5µm. Install the suction filter vertically, if possible.

A safety thermostat in the LP stage is installed in the cylinder cover. This thermostat prevents overheating of the vacuum pump. The safety thermostat switches at 15 ± 3°C higher level than the thermostat for water circulation.
If no thermostat for water circulation is installed, a safety thermostat with a set point of 95°C must be installed.

A thermostat for water circulation can be installed to limit the operating temperature to a defined range. Three different thermostats for water circulation are available:

Thermostat for water circulation	Operating temperature range
70°C	68-73°C
80°C	78-83°C
90°C	89-93°C

The speed control (option) is an additional safety device. It is highly recommended in hazardous areas.

CAUTION

When using the vacuum pump in hazardous areas, the speed control is highly recommended.

On/ Off switch

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

Safety

Intended use

DEFINITION: To rule out any misunderstanding, the term "handling" of the vacuum pump covers transport, storage, installation of the vacuum pump as well as effects on operating states and troubleshooting on the vacuum pump.

The vacuum pump is intended for industrial use. It may only be operated by qualified personnel.

The different possibilities and limit values for operation described in "Product description" and "Installation requirements" must be observed by the manufacturer of the system into which the vacuum pump is to be integrated and by users.

The need for personal safety regulations depends in principle on the type of use. The operator must provide the users with the necessary means and must inform his personnel about the dangers emanating from the processed product.

The operator of the vacuum pump must observe the safety regulations and must train and instruct his personnel accordingly.

Local regulations regarding the motors and electric control elements must be observed when installing the vacuum pump in potentially explosive environments.

The maintenance instructions must be followed and observed.

These installation and maintenance instructions must be read and understood before the vacuum pump is used. If you have any doubts, contact your Busch representative.

Safety information

The vacuum pump is designed and manufactured in compliance with the latest technical standards and safety regulations. Nether less an element of residual risk remains.

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

DANGER

Disregard of this safety instruction will always result in death, serious injuries or severe damage.

WARNING

Disregard of this safety instruction may result in death, serious injuries or severe damage.

CAUTION

Disregard of this safety instruction may result in minor or moderate injuries or damage.

Noise emission

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

CAUTION

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

Risk of hearing damage.

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

Maintenance clearance

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

Transport

The Huckepack vacuum pumps are tested and checked in our factory before careful packing. Check the packaging for transport damage when the goods arrive. The vacuum pump can withstand temperatures between -25°C and +55°C during transport.

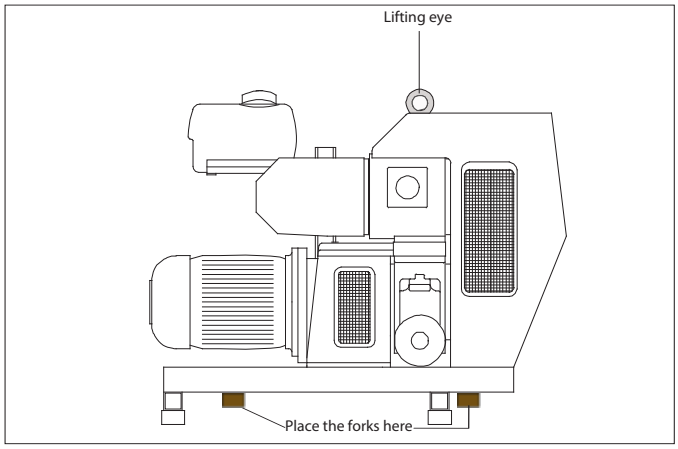
The inlet flange is sealed with a plug, so that no dirt can enter the vacuum pump during transport. Please check packing on delivery for transport damage. The pump can be lifted from the packing with a suitable lifting device using the lifting eye on the vacuum pump or the base frame under the vacuum pump.

CAUTION

When handling with the lifting eye, lift the pump by hooking it directly to the lifting eye, do not place a sling around the vacuum pump or under the base frame. Pay attention to the possibility tilting of the pump when lifting with the lifting eye. Depending on the accessories installed on the vacuum pump, the axis of the center of gravity may be offset from the axis of the lifting eye.

CAUTION

When transporting the pump with a fork truck, place the forks under the base frame as shown on the illustration below. Take care of the thrust point. This may vary according to the accessories installed on the vacuum pump.



Transport in packed state

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

Transport in unpacked state

The vacuum pump is fastened to the pallet with brackets (yellow):

- ◆ Remove the bolting between the vacuum pump and the pallet/ base plate.

CAUTION

Do not work, walk or stand under suspended loads.

CAUTION

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

Use adequate lifting gear for this.

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

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

CAUTION

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

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 ingress into the cylinder.

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

Once the vacuum pump is filled with oil, it shall not be lifted anymore.

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

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

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

This handbook is contained in the delivery package.

Storage

Temporary storage

- Make sure that the intake and exhaust flanges are closed (put on the protective caps included in the delivery package of the vacuum pump).
- Store the vacuum pump
  - if possible, the vacuum pump should be stored in its original packaging,
  - indoors,
  - dry,
  - in a dust-free and
  - vibration-free room

Removal of the vacuum pump

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

Preservation

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

In case of favourable ambient conditions, perform preservation work on the vacuum pump if a storage period of more than three months is planned.

- Make sure that all openings are hermetically sealed; use adhesive tape to fasten loose parts (seal rings, flat seals, etc...)

NOTE: VCI 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 electro-chemical properties effectively suppresses corrosion on metallic surfaces. However, VCI-products may attack the surfaces of plastic and elastomers.
If in doubt, please contact your nearest distributor. VCI packaging provides several years of protection against corrosion, even under the harshest of conditions: overseas shipment, extended storage before use.

- Wrap the vacuum pump in VCI film
- Store the vacuum pump

– if possible, the vacuum pump should be stored in its original packaging,
– indoors,
– dry,
– in a dust-free and
– vibration-free room

Start-up of the vacuum pump after storage

- Make sure that all protective elements, stoppers or adhesive tapes attached before preservation have been removed
- Switch in the vacuum pump in the sequence described in the chapter "Installation and start-up".

Installation and start-up

Necessary installation instructions

CAUTION

If the necessary installation instructions are not followed and particularly in the case of inadequate cooling.

Risk of damage to and total destruction of the vacuum pump and its components!

Risk of personal injury!

The necessary installation instructions must be followed.

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

WARNING

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

Mounting position and space

- Make sure that the environment of the vacuum pump is not potentially explosive.
- Make sure that the following ambient conditions are fulfilled:

– Ambient temperature: 12 to 40°C
– Ambient pressure: atmosphere
– Humidity ranges: 20 to 95 %
– Altitude: up to 1000 m

NOTE: In order to avoid overheating of the vacuum pump, an undisturbed fresh-air flow to the pump is necessary

- 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 will be placed or mounted horizontally
- Make sure that the base for placement/ mounting base is even
- Make sure that the vacuum pump is easily accessible and that the selected installation site fulfills the requirements for assembly/ dismantling.
- Make sure that the vacuum pump is at least 1 m away from any wall to ensure good cooling.
- Make sure that no temperature-sensitive parts (for example, of plastic, wood, cardboard, paper, electronic parts) come into contact with the hot surfaces of the vacuum pump.
- Make sure that the installation site or assembly area is ventilated in such a way that adequate cooling of the vacuum pump is ensured.

CAUTION

The surface temperature of the vacuum pump can exceed 90°C when the vacuum pump is in operation.

Danger of burns!

- Make sure that no-one can touch the vacuum pump accidentally. If necessary, attach safeguards.
- Make sure that the oil sight glasses are easily accessible

If oil changes are to be made on site:

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

Inlet connection

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

CAUTION

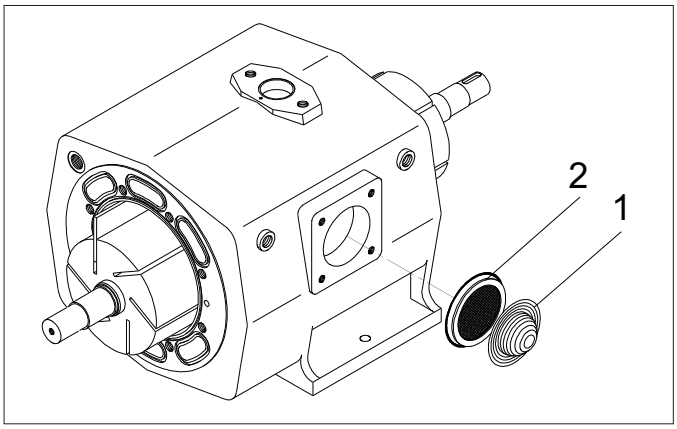
Do not put hands into the inlet aperture.

Risk of body damage!

CAUTION

The intake of liquids or solid particles can lead to the destruction of the vacuum pump.

The Huckepack vacuum pumps are supplied with loose-packed suction screens: a fine screen (1) and a standard screen (2).



These screens must be assembled before the suction inlet. They prevent dirt particles from entering into the vacuum pump.
The fine screen must be dismantled after about 20 working hours. The standard screen remains in place.
If the vacuum pump has been supplied with a suction flange, both screens are already assembled in the flange.

- Make sure that the nominal diameter of the intake line is at least equal to the diameter of the intake flange of the vacuum pump to prevent a drop in the performance of the vacuum pump in the case of a smaller cross-section.
- Make sure that the vacuum pump is connected with leakproof lines.

CAUTION

When the intake lines have been connected, make sure that the system does not leak. Leakages of dangerous substances must be prevented!

- Make sure that the intake lines do not exercise any force on the intake flange. Mount bellows if necessary.

In the case of long suction lines, the line cross-section should be larger than the intake flange to prevent a drop in the performance of the vacuum pump. If you have any doubts, contact your Busch representative.

Discharge connection

CAUTION

Do not put hands into the outlet aperture.

Risk of body damage!

The following instructions for connection to the discharge only apply if the sucked gas is discharged by the vacuum pump into a suitable environment.

- Make sure that the protection that was attached to prevent penetration of particles during transport has been removed before the vacuum pump is connected to the vacuum line.
- Make sure that the nominal diameter of the exhaust line is at least equal to the diameter of the exhaust flange of the vacuum pump to prevent a drop in the performance of the vacuum pump in the case of a smaller cross-section.
- Make sure that the vacuum pump is connected with leakproof lines.

CAUTION

When the discharge lines have been connected, make sure that the system does not leak. Leakages of dangerous substances must be prevented!

- Make sure that the discharge line is mounted in such a way that condensates cannot penetrate into the vacuum pump (siphon trap, gradient)
- Make sure that the discharge lines do not exercise any force on the discharge flange. Mount bellows if necessary.

In case of long discharge lines, the line cross-section should be larger than the discharge flange to prevent a drop in the performance of the vacuum pump. If you have any doubts, contact your Busch representative.

Electrical connection/ Checks

- Make sure that the regulations of the Electromagnetic Compatibility Directive 2014/30/EU as well as standard EN norms, safety directives and especially local and national regulations are observed (this is the responsibility of the manufacturer of the system into which the vacuum pump is integrated according to the Declaration of Conformity).
- Make sure that the mains power supply corresponds to the data on the nameplate of the motor.
- Make sure that an overload cut out according to EN 60204-1 is provided for the motor.
- Make sure that the drive of the vacuum pump is not disturbed by any electric or electromagnetic interferences. If you have any doubts, contact your Busch representative.

Connecting cooling water

The cooling water connection can be made with flexible hoses or tubes.

The cooling water outlet must be without pressure.

The cooling water should match with the following requirements:

– Cooling water pressure: 3...8 bar.
– Cooling water temperature: 15°C (max. 40°C).
– Water hardness: 12 dH

Water must be neutral and clean. The water outlet must be without pressure. Hose liner LW 13.

Installation

Mounting

- Make sure that the “Necessary installation instructions” are followed.
- Fasten or install the vacuum pump at its final installation site.

Connecting electrically

WARNING

Risk of electrocution, risk of damage.

Electrical installation must be performed by a suitably qualified electrician who knows and follows the following regulations:
- IEC 364 or CENELEC HD 384 or DIN VDE 0100,
- IEC Report 664 or DIN VDE 0110,
- VBG 4 or corresponding national regulations on accident prevention.

CAUTION

The circuit diagrams described below conform to the standard. Other circuit diagrams might be used. This depends on the particular order and the market.

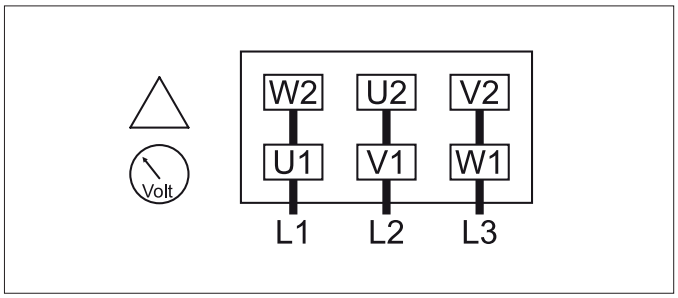
Risk of damage to the motor!

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

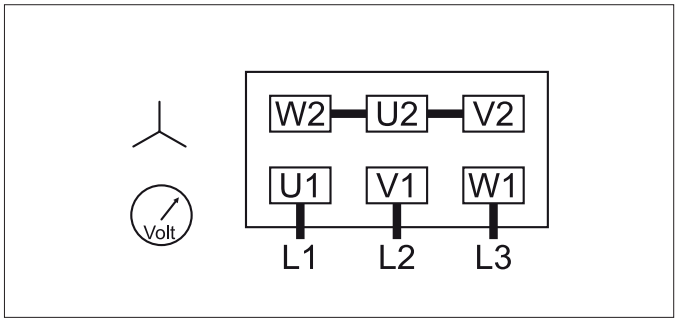
Voltage and frequency on the nameplate must agree with the supply voltage.

- Electrically connect the drive motor
- Connect the protective earth conductor

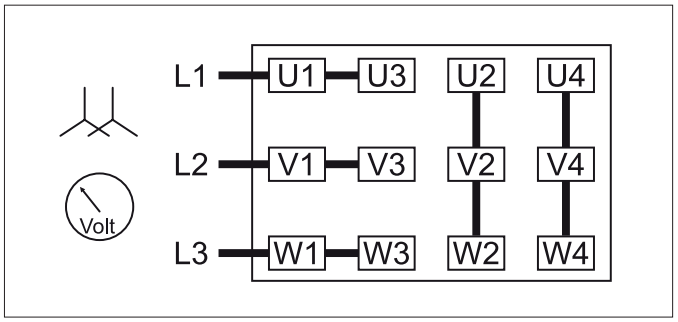
Delta connection (Low voltage)



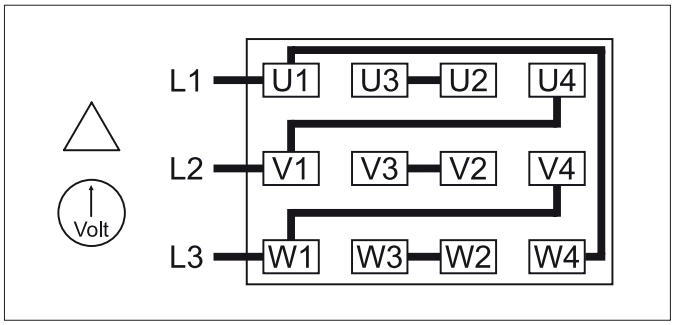
Star connection (High voltage)



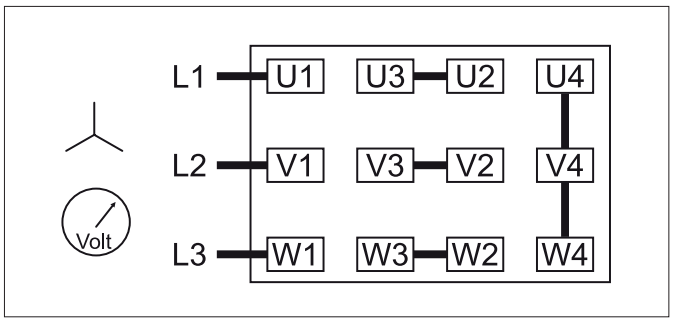
Star-star connection, multi-voltage motor (Low voltage)



Delta connection, multi-voltage motor (Middle voltage)



Star connection, multi-voltage motor (High voltage)



CAUTION

Operation in the wrong direction of rotation can destroy the vacuum pump in short time.

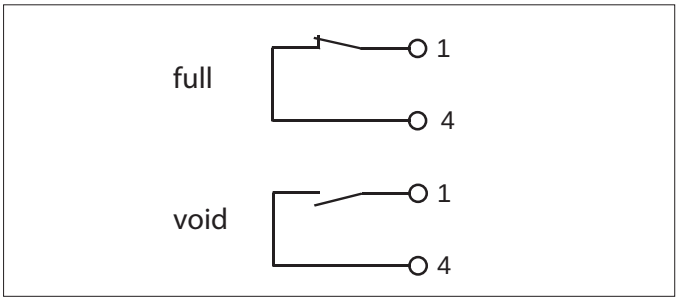
Risk of explosion!

Prior to starting-up it must be made sure that the vacuum pump is operated in the proper direction.

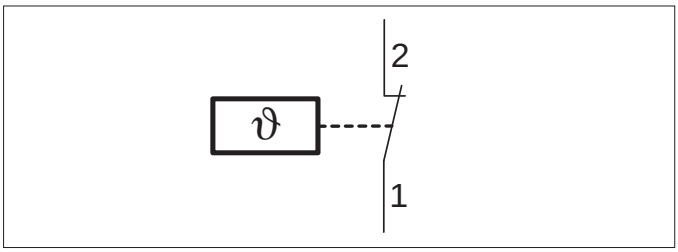
If the direction of rotation has to be changed:

- Exchange two of the three feeder leads.

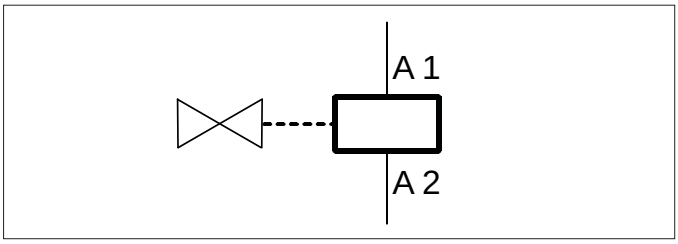
Level switch connection of seal fluid vessel



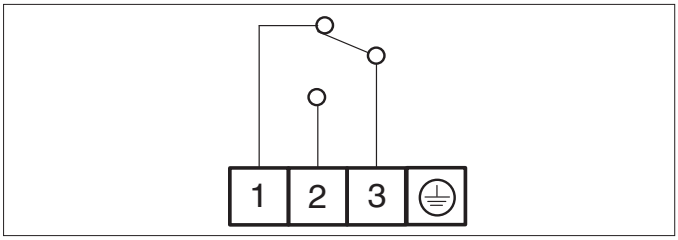
Temperature regulating valve connection



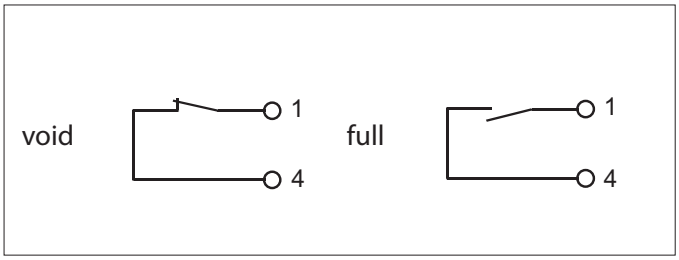
Magnetic valve connection



Pressure switch connection on the seal fluid separator



Level switch connection



First filling with cooling water

At first start-up or start-up after having drained the cooling water, the vacuum pump must be filled as follows:

Non circulating cooling

- Remove the hose at the water outlet
- Open the shut-off tap
- Open the magnetic valve
- Open the water supply and fill with water until water overflows
- Connect the hose at the water outlet

Circuit cooling with thermostat for water circulation

- Open the relief cock
- Fill with cooling water
- Switch the pump on for a short time so that the air bubbles come up in the feed pipe
- Close the relief cock

NOTE: Version without thermostat for water circulation are not delivered with relief cock.
Concerning cooling water quantity, see table "Technical data".

Connecting lines/ pipes

- Connect the intake lines
- Connect the discharge lines
- Make sure that all caps, safeguards and similar covers are mounted
- Make sure that the inlet and outlet for the cooling air are not covered or closed and that the flow of cooling air is not impaired in any way.

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

Seal fluid filling

The Huckepack vacuum pumps are generally delivered without seal fluid (see the chapter "Seal fluid types" for information on the recommended seal fluids).

- Prepare the quantity of seal fluid specified in the table "Seal fluid quantity".

NOTE: The quantity of seal fluid specified in the installation handbook is of informative nature only. Check the seal fluid level on the seal fluid vessel on the vacuum pump.

CAUTION

Operation without seal fluid will ruin the vacuum pump in short time.

Prior to commissioning, it must be made positively sure that seal fluid is filled in.

- Unscrew the filler cap on the top of the seal fluid vessel
- Fill in seal fluid through the seal fluid screen on the vessel inlet
- Make sure that the seal level lies upon the indicated limit of the seal fluid vessel
- Make sure that the seal ring is inserted into the seal fluid fill cap and undamaged, replace if necessary
- Screw on the filler cap on the top of the seal fluid vessel

CAUTION

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

- Make sure before every transport that the seal fluid has been drained out of the vacuum pump

CAUTION

The vacuum pump must remain in an horizontal position when it has been filled with seal fluid.

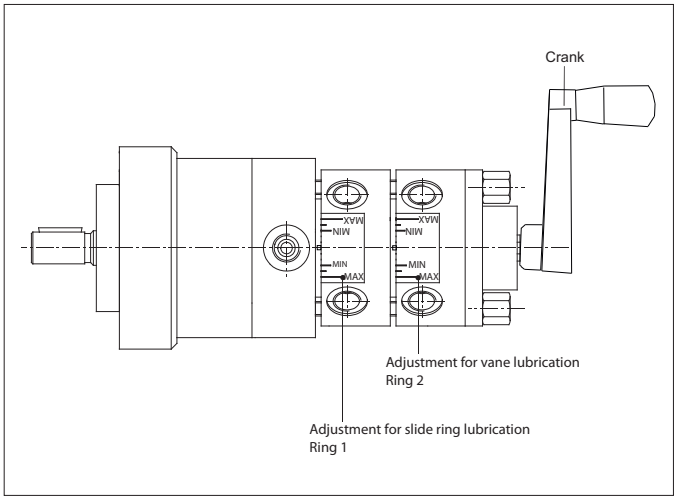
Lubrication system

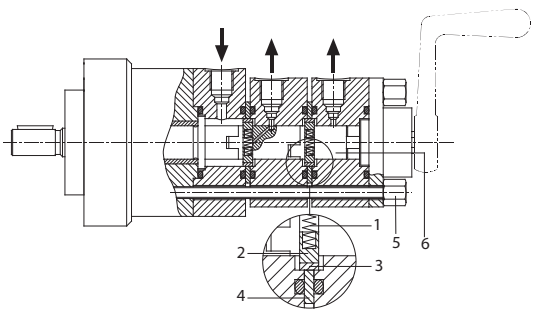
The Huckepack vacuum pumps are lubricated. Besides oil other seal fluids are possible. Please contact your local Busch representative or request our leaflet "Special Seal Fluids for Vacuum Pumps".
The exact measurable quantities of seal fluid are transported through tubes by the seal fluid pump directly to the lubrication spots.

The seal fluid pump

The seal fluid pump supplies the different lubrication spots with seal fluid. The measuring of the seal fluid can be varied directly by the seal fluid pump.

The seal fluid pump is connected directly to the LP-rotor. Therefore, the rotational speed is the same as of the LP-rotor.
The seal fluid pump functions with lifting cylinders. The lifting is adjustable in order to be able to dose the seal fluid quantity exactly. The seal fluid pump has eight connections for seal fluid tubes.





1 Spring
2 Lifting
3 Rolling ring
4 Adjustment ring
5 Tightening nut
6 Pump shaft

NOTE: The values below are standard values for chemical use. The quantity of seal fluid depends on the conditions of the process.

When pumping inert gas without corrosive components seal fluid rate can be reduced down to ½ (control value of scale).

Original calibration of the seal fluid pump	HO 0429 F	HO 0433 F	HO 0437 F	HO 0441 F
Lubrication fluid pump 8 connections, internal gear ratio	75 : 1	75 : 1	25 : 1	25 : 1
Slide ring lubrication Ring 1	½	½	½	½
Vane lubrication Ring 2	MAX	MAX	½	½
Total consumption of seal fluid 50 Hz cm³/h 60 Hz cm³/h	 285 351	 285 351	 536 597	 536 597

A variation of seal fluid consumption of about **+/- 8%** must be considered as acceptable, based on measured results.
Different adjustment of the oil pump can be done depending on customer process conditions after validation by Busch.

Adjustment of the seal fluid pump

- Turn off the vacuum pump
- Unscrew the tightening nuts
- Adjust the adjustment disc to the required seal fluid lift

Priming of the seal fluid pump

- Turn the crank of the seal fluid anticlockwise until the seal fluid reaches the several lubrication spots through the pipes
- Remove the crank

The seal pump is now ready for operation.

Adjustment depending on the direction of rotation

- Only adjust the seal fluid lift with the pump switched off. The adjustment of the seal fluid pump is from "0"(min) to "1" (max) in the direction of the arrow which has the same direction as the arrow label of the motor.

Recommendations on operation

Application

WARNING

The vacuum pump is designed for use under the conditions specified here.

If these conditions are not met, there is a risk of damage to or total destruction of the vacuum pump and its components!

The vacuum pump may only be switched on under the specified conditions.

The Huckepack vacuum pumps are designed for use in the field of coarse and fine vacuum.

They can be used to suck gases and gas mixtures.

WARNING

When using toxic, inflammable and/ or explosive gases, make sure that the system corresponds in design to applicable local and national safety regulations and that all applicable measures are followed.

All product-specific safety regulations must be observed.

Solid particles must not get into the vacuum pump. Procedural errors can result in the vacuum pump drawing-in a certain quantity of liquid. If the vacuum pump has sucked in liquid, a short drying time is necessary at the end of the procedure.
There are different filters and separators to fit in series that can be found in our accessory program.

To pump condensable vapours, a gas ballast valve should be installed. The vacuum pump should run for 30 minutes prior to operation with the inlet connection closed, in order to reach the operating temperature of 75°C. Only at this operating temperature can condensable vapours be pumped. After use the pump should be left running for an additional 30 minutes to clear the lubrication fluid of condensate.

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

Max. permissible number of startings per hour: 12.

CAUTION

The surface temperature of the vacuum pump can exceed 95°C when the vacuum pump is in operation.

Danger of burns!

The vacuum pump may not be touched when it is in operation. If touching the vacuum pump is unavoidable, wait until the surface temperature has cooled down or wear protective gloves.

CAUTION

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

Risk of hearing damage!

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

CAUTION

The Huckepack vacuum pumps are generally delivered without seal fluid.

Operation without seal fluid will result in damage to the vacuum pump!

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

CAUTION

If there is danger of frost, it has to be made sure all cooling water was drained. Therefore, open the water outlet. In the case of non circulating water cooling the water inlet must be shut off at first.

Maintenance

DANGER

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.

Always wear protective clothing when carrying out maintenance work.

Before any maintenance work, the inlet and outlet piping as well as the vacuum pump itself must be flushed with nitrogen.

CAUTION

Only authorised personnel may carry out dismantling work on the vacuum pump. Before work begins, the operator of the vacuum pump must fill in a form or a "Declaration Regarding Contamination of Equipment and Components" that provides information on possible dangers and appropriate measures.
If this form has not been filled in completely and signed, the vacuum pump may not be dismantled.

CAUTION

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

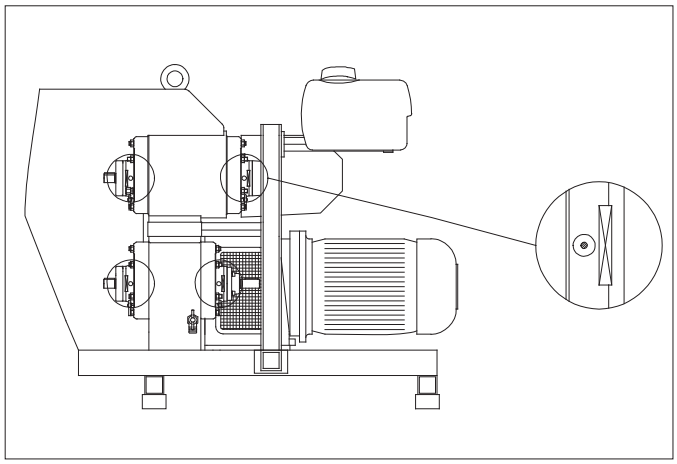
CAUTION

The surface temperature of the vacuum pump can exceed 95°C when the vacuum pump is in operation.

Danger of burns!

- The seal fluid level in the reservoir has to be checked at least once a day. If the quantity of seal fluid in the reservoir has reached a certain minimum, the vacuum pump is automatically turned off by the level switch in order to avoid the destruction of the vacuum pump. Seal fluid must be added at the latest when the level of seal fluid is about 20 mm above the level switch.
- The type of seal fluid depends on the working area. Seal fluids adequate to DIN 51506, lubricant group VC 150 must be used. We recommend original seal fluids of VM series, which comply with this DIN. If you need further information, request our leaflet "Special Seal Fluids for Vacuum pumps".

  Used seal fluid should be disposed of according to environmental laws.
- The suction screen in the inlet flange must be cleaned regularly.
- The fan hood should be inspected regularly. Soiling of the motor hood prevents cool air intake and may lead to overheating of the driving motor.
- The bearings at the two stages must be lubricated yearly. Remove the yellow plastic plug and charge with grease until grease comes out of the opening.
  The grease to use must be a high melting-point grease up to 150°C and the consistence: SKF LGHP-2/1 lithium grease.



Lubrication spots

Assembly

CAUTION

Maintenance jobs on the vacuum pump may only be carried out by duly authorised staff.
The vacuum pump must be switched off and guarded against accidental switch-on for all maintenance.

Rapid exchange of stage

NOTE: Huckepack vacuum pumps are constructed in a way that the exchange of the HP stage can be done easily.
The different steps (circuit cooling) are as follows:

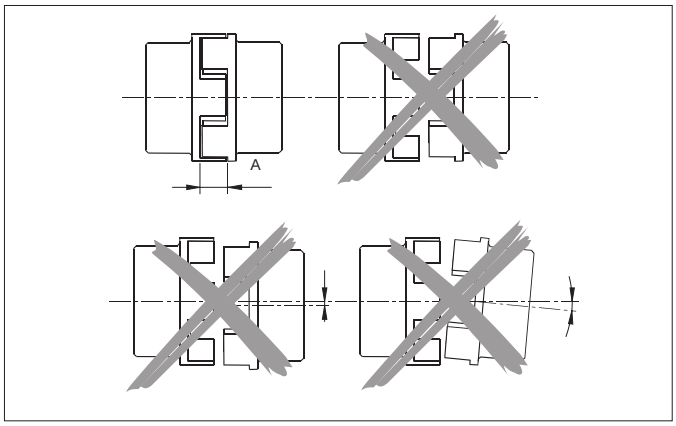
- Switch off the pump
- Drain off the cooling water
- Take off the V-belt hood
- Release the hose clips of the water inlet and outlet pipes
- Take off the V-belt using an appropriate tool
- Dismantle the hose at the water inlet (direct cooling)
- Dismantle the vacuum pump
- Dismantle the valve housing
- Release the holding screws

Now the HD stage will come down on the tread rollers. It may be taken out over the rails.

- Assemble the new stage in the reversed order of operations. Use new seals for valve housing.

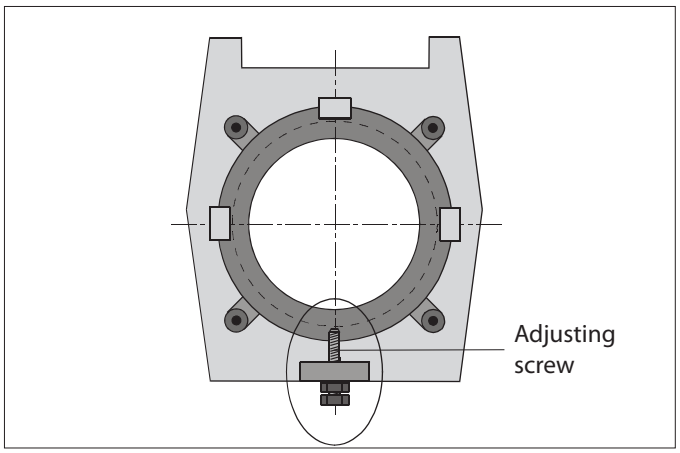
Motor installation

When installing a new flange motor, mind the correct position of the motor and pump shaft.



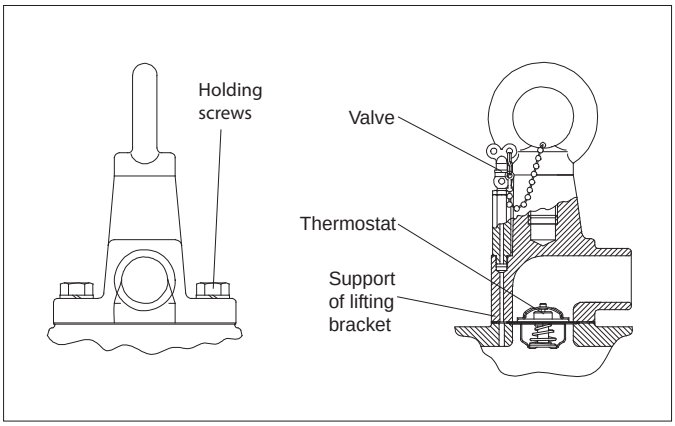
Pump type	∅ Shaft	Dimension "A"
HO 0429 F	38 mm	26 mm
HO 0433 F	38 mm	26 mm
HO 0437 F	42 mm	30 mm
HO 0441 F	48 mm	30 mm

The flange motor can be held at the side by an intermediate flange. The elevation of the motor can be adjusted by a regulating screw.



Dismantling and installation of thermostat for water circulation

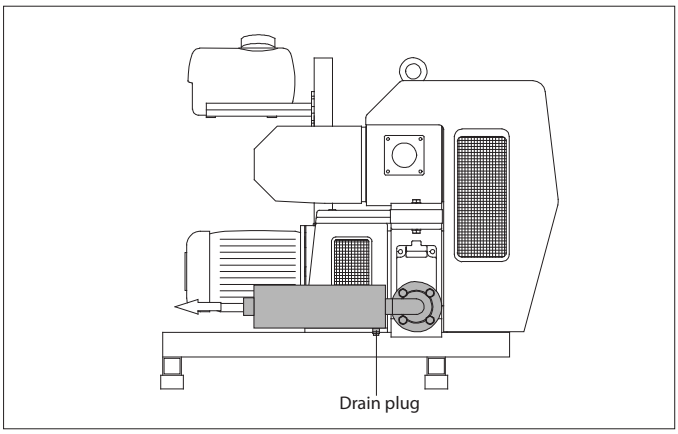
- Switch off the vacuum pump
- Drain a part of the cooling water
- Release the clamps and remove the hoses
- Unscrew the screws of the cover and remove the cover
- Unscrew the holding screws and the lifting bracket
- Screw the thermostat
- Remount the lifting bracket and the holding screws
- Remount the dismantled accessories and switch on the vacuum pump



Maintenance of add-on pieces

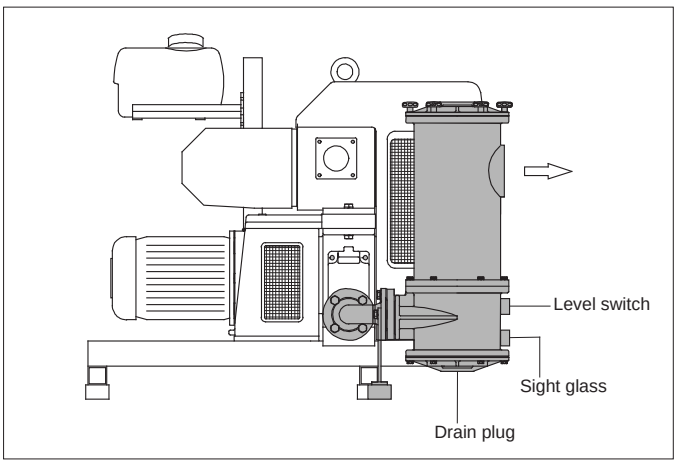
Exhaust muffler

The seal fluid resulting at the exhaust side must be drained off continuously through the seal fluid plug or collected in a vessel that is big enough.
It must be disposed according to environmental laws. At the exhaust side, there must not be any stagnation of seal fluid or condensate. When transporting poisonous agents, the environmental regulations for dissolving must be observed.



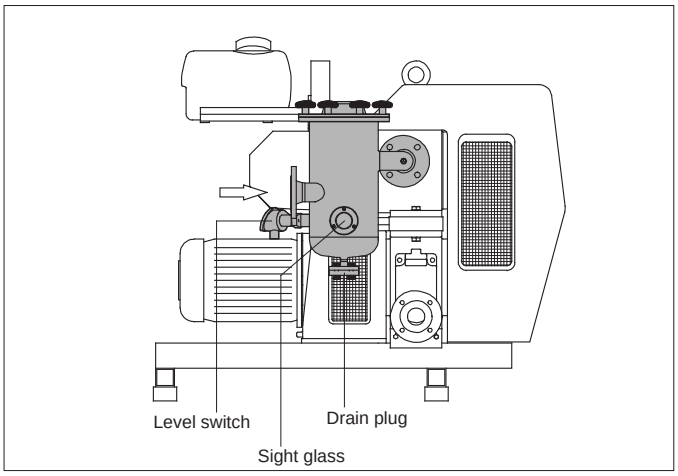
Seal fluid separator

The seal fluid level on the sight glass of the collecting vessel must be checked daily. If the seal fluid level has reached the sight glass, draw off the used seal fluid through the drain plug.
The change intervals of the filter elements in the separator depend on the dirt sediment, respectively on the medium.
The filter element must be replaced at least once a year. The pressure switch (option) turns the vacuum pump off automatically when the filter resistance is getting too high.



Safety knock-out separator Duosec

The liquid level on the sight glass must be checked daily. When the liquid has reached the sight glass, it must be drawn off through the drain plug with the vacuum pump turned off. The filter cartridge has to be changed, according to the dirt sediment, at least once a year.



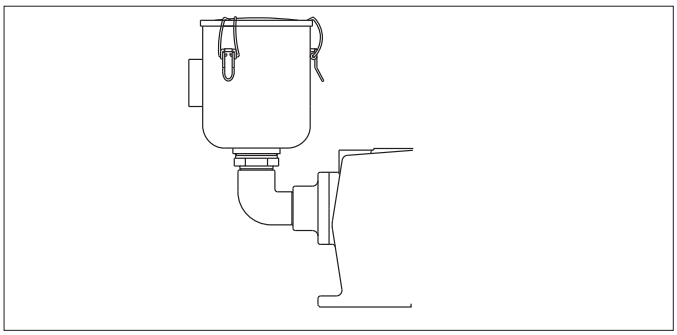
CAUTION

Only open the drain plug with Duosec ventilated (pressure side) and the vacuum pump turned off.

Suction filter

The cleaning intervals depend on the application. To change the filter cartridge:

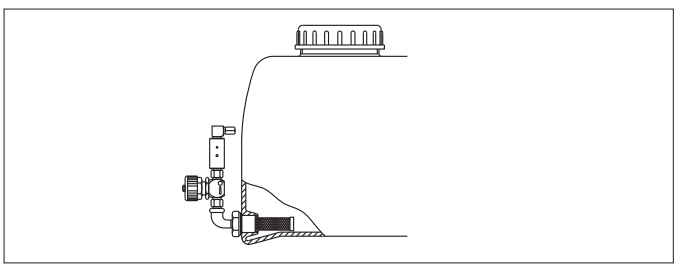
- Turn off the vacuum pump and ventilate
- Remove the cover clamps
- Remove the cover and replace the filter cartridge
- Clean the PTFE-filter cartridges with solvent



Flushing device

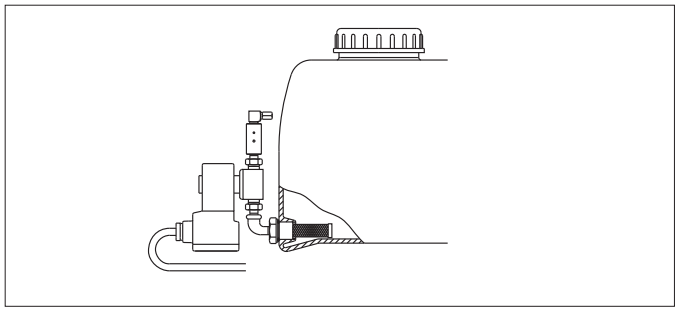
Manual flushing device

- Open the shut-off valve during the vacuum pump running. The duration of the flushing depends on the process sediment but should last at least 10 minutes.
- After finishing the flushing, close the shut-off valve again and keep the vacuum pump running for another 5 minutes.



Automatical flushing device

If an automatical flushing device is installed, the flushing can be started by pressing the button "Flushing" at the control cabinet. A special timing relay stops the flushing automatically. In case of automatic shut down flushing is made automatically.

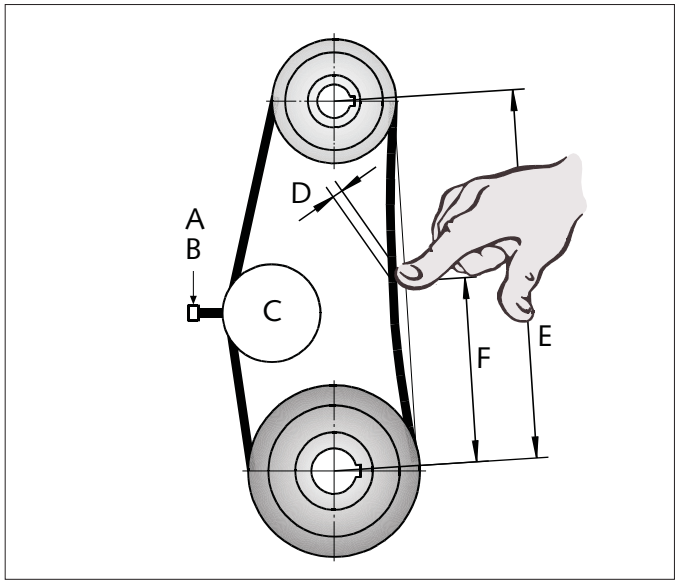


Flushing liquids

The flushing liquids depend on the process. Oils, synthetic oils, oil/ diesel or oil/ petroleum mixtures can be used. In case of doubt, please contact your local Busch-Agency.

Inspection and adjustment of the belts

- Press with moderate pressure onto the middle (F) of the two of the three belts
- The belts are tightened correctly when the belts can be pushed in (D) to the thickness of the belt itself
- In case the belts are too slack, they ought to be tightened up to the required tension
- In order to do this, loosen the two bolts of the belt tensioning guide
- Loosen the nut (A)
- Turn the screw (B) in order to tighten up the belts with the belt tensioner (C)
- Check the tension of the belts again the correct adjustment
- Tighten up the nut (A)
- Tighten up the two bolts of the belt tensioning guide again



Maintenance program

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

Daily

- Dismantle the fine screen and check for particles
  - ◆ Clean and remount the fine screen
- Check the seal fluid level and the colour of the seal fluid in the seal fluid vessel
- Clean the fan hood and the inlet flange

If the discharge is equipped with an exhaust muffler:

- Check the seal fluid level

If the discharge is equipped with a seal fluid separator:

- Check the seal fluid level

Weekly

If the vacuum pump is equipped with a safety knock-out vessel Duosec:

- Check the level of the cooling liquid

If the vacuum pump is equipped with a suction filter:

- Clean the suction filter
- Control the adjustment and the functioning of the seal fluid pump

If the vacuum pump is equipped with a seal fluid separator:

- Exchange the filter elements
- Control the water quantity and the pressure of the non circulating cooling
- Clean the screen of the seal fluid vessel
- Check the functioning of the safety devices
- Control the water quantity of the circulating cooling

Yearly

If the vacuum pump is equipped with a safety knock-out vessel Duosec:

- Exchange the filter elements
- Control and grease the bearings

Every 5000 hours of operation

- Drain the seal fluid (see “Draining the seal fluid”)

If the cooling water line is equipped with a filter:

- ◆ Check the filter and clean or replace if necessary

Every 10 000 hours of operation

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

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

- A main inspection of the vacuum pump (Busch)

Every operation of dismantling

- Control the V-belt tension
- Exchange the wearing parts: the slide rings and the vanes

Checking the seal fluid

Checking the seal fluid level

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally
- Indication of the seal fluid level on the seal fluid vessel

If the seal fluid level does not reach the MIN marking:

- ◆ Top up with seal fluid (see “Refilling seal fluid”)

If the seal fluid level exceeds the MAX marking:

- ◆ Check the condensate drain
- Drain the seal fluid (see “Draining the oil”)

Refilling the seal fluid

NOTE: Seal fluid does not normally have to be refilled outside the recommended seal fluid change intervals. A drop in the seal fluid level indicates a fault (see “Troubleshooting”).

CAUTION

Only fill in seal fluid through the seal fluid vessel filler opening.

CAUTION

Danger of burns when the seal fluid filler cap is open.

Danger of injuries when the seal fluid cap is not screwed on properly.

Only unscrew the seal fluid filler cap when the vacuum pump has been switched off.

The vacuum pump may only be switched on when the seal fluid filler cap is properly closed and tight.

- Make sure that the vacuum pump has been switched off and that it cannot be switched on again accidentally
- Unscrew the seal fluid filler cap
- Fill in the seal fluid up to the indicated limit
- Make sure that the seal of the filler cap and the screen are not damaged and that they sit properly. Replace if necessary.
- Screw on the filler cap again

Checking the colour of the seal fluid

NOTE: The seal fluid must be clear and transparent or foamy or slightly cloudy. A permanent milky colour is an indication for contamination by foreign bodies. A dark colour is an indication for seal fluid that has to be replaced because it has been burnt or contaminated by foreign bodies.

Lifetime of the seal fluid

The lifetime of the seal fluid depends mainly on the operating conditions. Under ideal conditions, the seal fluid must be replaced every 5000 hours of operation or at the latest after six months.

Under slightly worse operating conditions, the seal fluid can expire after less than 500 hours of operation. A short lifetime is an indication that there is either a fault (see “Troubleshooting”) or the operating conditions are not appropriate.

If you do not yet have any experience on the lifetime of the seal fluid, we recommend that you analyse the seal fluid every 500 hours of operation and fix the maintenance intervals accordingly.

Seal fluid change

DANGER

If the vacuum pump has pumped gases that were contaminated with foreign bodies that are hazardous to health, the seal fluid is also contaminated with these foreign bodies.

There is a health hazard when changing contaminated seal fluid.

There is also a danger to the environment.

Wear protective clothing when replacing contaminated seal fluid.

Contaminated seal fluid must be treated specially and must be disposed of according to applicable regulations.

Replacing used seal fluid

NOTE: Drain the seal fluid at the latest 20 minutes after switching off the vacuum pump.

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

- Make sure that the vacuum pump has adjusted to atmospheric pressure
- Place a container under the seal fluid drain plug
- Unscrew the seal fluid drain plug
- Drain the seal fluid

When the seal fluid stops running out:

  - ◆ Screw on the seal drain plug again

- Make sure that the seal of the drain plug is not damaged and that it sit properly. Replace if necessary.
- Dispose of the used seal fluid according to applicable environmental protection regulations

Filling in new seal fluid

- Prepare the quantity of seal fluid needed (see "Seal fluid type/ quantity")

NOTE: The quantity of seal fluid in the installation handbook is of informative nature only. Check the seal fluid level on the seal fluid vessel.

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

CAUTION

Only fill in seal fluid through the seal fluid filler opening.

- Unscrew the seal fluid filler cap
- Fill in up to the limit of the seal fluid vessel
- Make sure that the seal of the filler cap is not damaged and that it sits properly. Replace if necessary.
- Screw on the filler cap again

Checking the current consumption

- Check the current intensity of the motor

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

CAUTION

Wear protective clothing when carrying out maintenance work on the exhaust muffler.

There could still be residues of contamination.

Overhaul

CAUTION

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

Danger of explosion!

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

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

DANGER

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

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

There is a health hazard when dismantling the vacuum pump.

There is also a danger to the environment.

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

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 inlet and outlet pipes as well as cooling water pipes, make sure that all piping is vented to atmospheric pressure

Recommissioning

- Make sure that the various protective elements, stoppers or adhesive tapes have been removed
- Switch on the vacuum pump by following the procedure described in the chapter "Installation and start-up"

Dismantling and disposal

DANGER

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

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

There is a health hazard when dismantling the vacuum pump.

There is also a danger to the environment.

Protective clothing must be worn when dismantling the vacuum pump.

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

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

When the product has reached the end of its lifetime:

– decontaminate the vacuum pump

CAUTION

Only authorised personnel may carry out dismantling work on the vacuum pump. Before work begins, the operator of the vacuum pump must fill in a form or a "Declaration of Decontamination" that provides information on possible dangers and appropriate measures.

If this form has not been filled in completely and signed, the vacuum pump may not be dismantled.

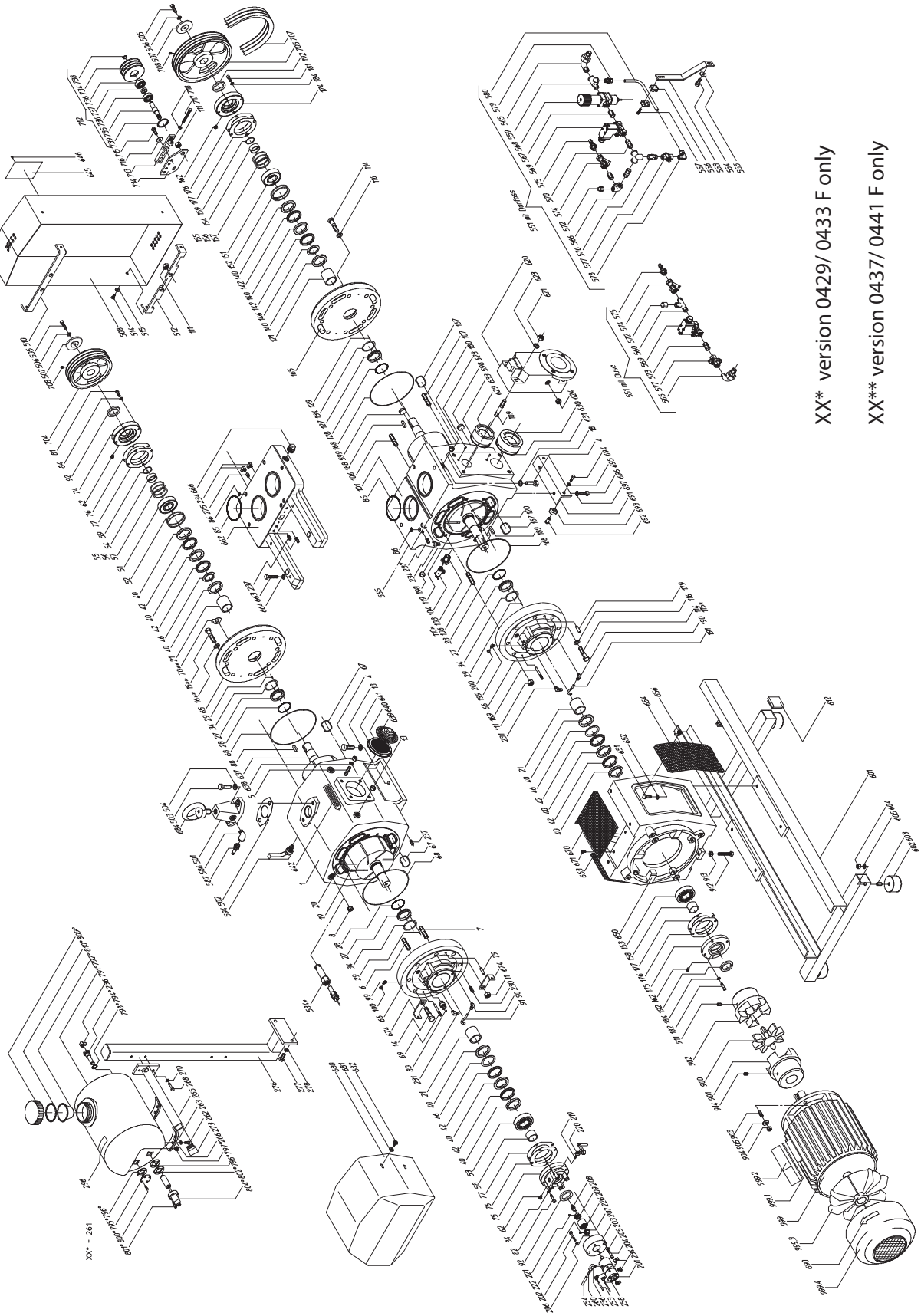
– drain the seal fluid
  - ◆ dispose of the seal fluid according to local environmental protection regulations
– begin dismantling the vacuum pump

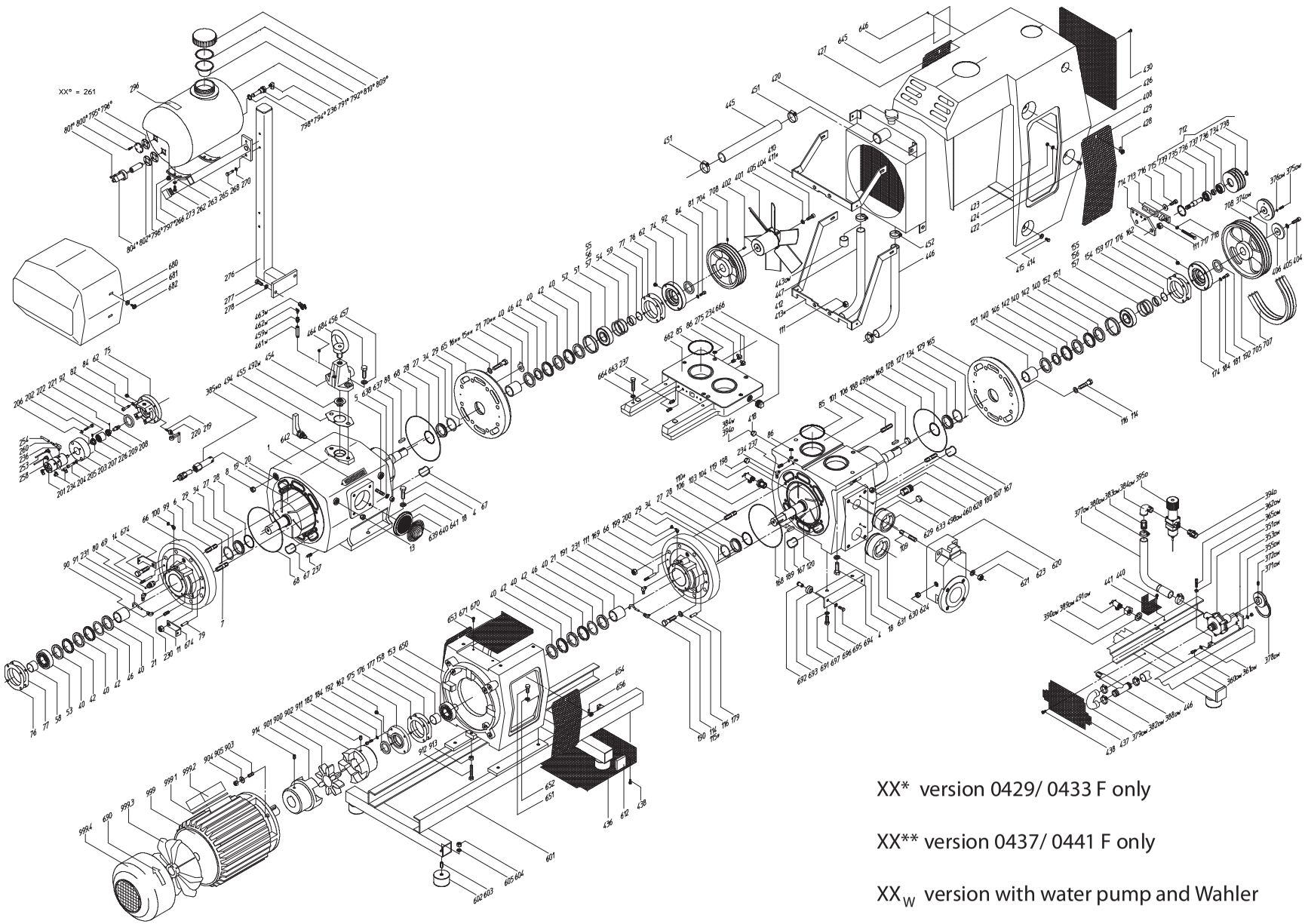
CAUTION

Wear protective clothing when carrying out dismantling work.

– dispose of the vacuum pump as scrap metal
– dispose of the individual parts of the machine according to local regulations.

Exploded drawing





shown HO 0429-0441 F Radiator cooling

XX* version 0429/ 0433 F only

XX** version 0437/ 0441 F only

XX_W version with water pump and Wahler

XX_D version with water pump and Danfoss

Wearing parts

Overhaul kit HO 0429 F N° 0993 513 252			
Part N°.	Part	Qty.	Pos.
0437 000 080	Taper pin	4	69
0438 000 001	Transfer cone	32	258
0438 000 006	Transfer cone	2	260
0442 500 445	Cutting ring	24	-
0442 500 446	Cutting ring	1	-
0442 000 020	Cutting ring	8	-
0442 000 021	Cutting ring	1	-
0460 508 925	Sleeve	4	21
0473 508 910	Angular ball bearing	2	51
0473 508 911	Cylindrical roller bearing	2	53
0473 000 231	Deep groove ball bearing	2	736
0488 508 521	Sliding ring	4	27
0512 000 114	Gear rim	1	900
0512 000 001	Coupler sleeve	1	207
0513 508 527	V-belt	3	707
0541 000 028	Non-return valve	8	231
0722 510 545	Vane	11	119
0433 000 006	Lubricator nipple	4	99
0754 000 055	Tube-Teflon	7	253
0754 000 056	Tube-PTFE	1.1 m	254
0513 508 528	V-belt	1	378
0472 508 918	Sleeve	2	154
0472 508 919	Sleeve	2	158
0433 000 059	Tolerance washer	3	56
0433 000 060	Tolerance washer	3	57
0433 511 324	Tolerance washer	3	55
Gasket kit HO 0429 F N° 0990 513 250			
Part N°.	Part	Qty.	Pos.
0481 000 164	Bearing cover seal	4	76
0481 000 165	Bearing cover seal	4	77
0481 000 257	Flat gasket	1	455
0481 000 272	Float switch seal	1	-
0482 000 079	Level switch seal	2	796
0482 000 096	Bearing cover seal	1	810
0486 000 518	O-ring	4	28/ 128
0486 000 534	O-ring	2	633
0486 000 538	O-ring	1	631
0486 000 616	O-ring	1	798
0486 000 638	O-ring	1	-
0486 508 909	O-ring	2	59/ 159
0486 000 707	O-ring	4	85
0486 000 711	O-ring	8	86
0486 000 758	O-ring	2	168
0486 000 759	O-ring	2	68
0486 508 906	O-ring	16	67/ 167
0487 000 144	Shaft seal	4	92
0487 000 055	Shaft seal	12	40/ 140

Overhaul kit HO 0433 F N° 0993 513 253			
Part N°.	Part	Qty.	Pos.
0437 000 080	Taper pin	4	69
0438 000 001	Transfer cone	32	258
0438 000 006	Transfer cone	2	260
0442 500 445	Cutting ring	24	-
0442 500 446	Cutting ring	1	-
0442 000 020	Cutting ring	8	-
0442 000 021	Cutting ring	1	-
0460 508 925	Sleeve	4	21
0473 508 910	Angular ball bearing	2	51
0473 508 911	Cylindrical roller bearing	2	53
0473 000 231	Deep groove ball bearing	2	736
0488 508 521	Sliding ring	4	27
0512 000 114	Gear rim	1	900
0512 000 001	Coupler sleeve	1	207
0513 508 527	V-belt	3	707
0541 000 028	Non-return valve	8	231
0722 510 545	Vane	5	119
0722 510 546	Vane	6	19
0433 000 006	Lubricator nipple	4	99
0754 000 055	Tube-Teflon	7	253
0754 000 056	Tube-PTFE	1.1 m	254
0513 508 528	V-belt	1	378
0472 508 918	Sleeve	2	154
0472 508 919	Sleeve	2	158
0433 000 059	Tolerance washer	3	56
0433 000 060	Tolerance washer	3	57
0433 511 324	Tolerance washer	3	55
Gasket kit HO 0433 F N° 0990 513 250			
Part N°.	Part	Qty.	Pos.
0481 000 164	Bearing cover seal	4	76
0481 000 165	Bearing cover seal	4	77
0481 000 257	Flat gasket	1	455
0481 000 272	Float switch seal	1	-
0482 000 079	Level switch seal	2	796
0482 000 096	Bearing cover seal	1	810
0486 000 518	O-ring	4	28/ 128
0486 000 534	O-ring	2	633
0486 000 538	O-ring	1	631
0486 000 616	O-ring	1	798
0486 000 638	O-ring	1	-
0486 508 909	O-ring	2	59/ 159
0486 000 707	O-ring	4	85
0486 000 711	O-ring	8	86
0486 000 758	O-ring	2	168
0486 000 759	O-ring	2	68
0486 508 906	O-ring	16	67/ 167
0487 000 144	Shaft seal	4	92
0487 000 055	Shaft seal	12	40/ 140

Overhaul kit HO 0437 F N° 0993 513 254			
Part N°.	Part	Qty.	Pos.
0437 000 082	Taper pin	4	69
0438 000 001	Transfer cone	32	258
0438 000 006	Transfer cone	2	260
0442 500 445	Cutting ring	24	-
0442 500 446	Cutting ring	1	-
0442 000 020	Cutting ring	8	-
0442 000 021	Cutting ring	1	-
0460 510 818	Sleeve	4	21
0473 510 542	Angular ball bearing	2	51
0473 510 541	Cylindrical roller bearing	2	53
0473 000 231	Deep groove ball bearing	2	736
0488 508 520	Sliding ring	4	27
0512 000 116	Gear rim	1	900
0512 000 001	Coupler sleeve	1	207
0513 510 517	V-belt	3	707
0541 000 028	Non-return valve	8	231
0722 510 547	Vane	11	119
0433 513 262	Lubricator nipple	4	99
0754 000 055	Tube-Teflon	8	253
0754 000 056	Tube-PTFE	1.2 m	254
0513 511 367	V-belt	1	378
0472 508 948	Sleeve	2	158
0472 510 848	Sleeve	2	154
0433 511 321	Tolerance washer	3	56
0433 511 322	Tolerance washer	3	57
0433 511 323	Tolerance washer	3	55
Gasket kit HO 0437 F N° 0990 513 251			
Part N°.	Part	Qty.	Pos.
0481 000 162	Bearing cover seal	4	76
0481 000 163	Bearing cover seal	4	77
0481 000 257	Flat gasket	1	455
0481 000 272	Float switch seal	1	-
0482 000 079	Level switch seal	2	796
0482 000 096	Bearing cover seal	1	810
0486 000 523	O-ring	4	28/ 128
0486 000 534	O-ring	1	633
0486 000 537	O-ring	1	631
0486 000 538	O-ring	1	641
0486 000 612	O-ring	4	85
0486 000 616	O-ring	1	798
0486 000 638	O-ring	1	-
0486 508 947	O-ring	2	59/ 159
0486 000 711	O-ring	8	86
0486 000 755	O-ring	2	168
0486 000 756	O-ring	2	68
0486 508 907	O-ring	24	67/ 167
0487 000 115	Shaft seal	4	92
0487 000 063	Shaft seal	12	40/ 140

Overhaul kit HO 0441 F N° 0993 513 255			
Part N°.	Part	Qty.	Pos.
0437 000 082	Taper pin	4	69
0438 000 001	Transfer cone	32	258
0438 000 006	Transfer cone	2	260
0442 500 445	Cutting ring	24	-
0442 500 446	Cutting ring	1	-
0442 000 020	Cutting ring	8	-
0442 000 021	Cutting ring	1	-
0460 510 818	Sleeve	4	21
0473 510 542	Angular ball bearing	2	51
0473 510 541	Cylindrical roller bearing	2	53
0473 000 231	Deep groove ball bearing	2	736
0488 508 520	Sliding ring	4	27
0512 000 116	Gear rim	1	900
0512 000 001	Coupler sleeve	1	207
0513 510 517	V-belt	3	707
0541 000 029	Non-return valve	1	230
0541 000 028	Non-return valve	7	231
0722 510 547	Vane	5	119
0722 510 548	Vane	6	19
0433 513 262	Lubricator nipple	4	99
0754 000 055	Tube-Teflon	8	253
0754 000 056	Tube-PTFE	1.2 m	254
0513 511 367	V-belt	1	378
0472 510 848	Sleeve	2	154
0472 508 948	Sleeve	2	158
0433 511 321	Tolerance washer	3	56
0433 511 322	Tolerance washer	3	57
0433 511 323	Tolerance washer	3	55
Gasket kit HO 0441 F N° 0990 513 251			
Part N°.	Part	Qty.	Pos.
0481 000 162	Bearing cover seal	4	76
0481 000 163	Bearing cover seal	4	77
0481 000 257	Flat gasket	1	455
0481 000 272	Float switch seal	1	-
0482 000 079	Level switch seal	2	796
0482 000 096	Bearing cover seal	1	810
0486 000 523	O-ring	4	28/ 128
0486 000 534	O-ring	1	633
0486 000 537	O-ring	1	631
0486 000 538	O-ring	1	641
0486 000 612	O-ring	4	85
0486 000 616	O-ring	1	798
0486 000 638	O-ring	1	-
0486 508 947	O-ring	2	59/ 159
0486 000 711	O-ring	8	86
0486 000 755	O-ring	2	168
0486 000 756	O-ring	2	68
0486 508 907	O-ring	24	67/ 167
0487 000 115	Shaft seal	4	92
0487 000 063	Shaft seal	12	40/ 140

Troubleshooting

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

CAUTION

During operation, the surface of the vacuum pump may reach temperatures of more than 95°C.

Risk of burns!

Let the vacuum pump cool down prior to a required contact or wear heat protection gloves.

Problem	Possible cause/ Check items	Remedy
The vacuum pump does not reach the usual pressure The drive motor draws a too high current (compare with initial value after commissioning) Evacuation of the system takes too long	The vacuum system or suction line is not leak-tight.	Check the hose or pipe connections for possible leak.
	Contaminated oil (the most common cause).	Drain the oil (see "Maintenance").
	No or not enough oil in the reservoir.	Top up with oil (see "Maintenance").
	The standard and/ or the fine screen on the suction connection is partly clogged.	Clean or replace the standard and/ or the fine screen, respectively.
	Partial clogging in the suction, discharge or pressure line.	Remove the clogging.
	Long suction, discharge or pressure line with too small diameter.	Use large diameter.
	No oil gets to the lubrication points.	Follow instructions of the “Control of the suction stroke” chapter.
	The lubrication pump does not work.	Change the lubrication pump.
	The oil tubing is defective or leaking. The oil return line is broken.	Tighten the connections. Replace the connections and/ or the tubing (replace with identically dimensioned parts only).
	A shaft seal is leaking.	Replace the shaft seal ring (Busch service).
	The exhaust valve is not properly seated or stuck in partially open position.	Disassemble or reassemble the exhaust valve (Busch service).
	A vane is blocked in the rotor or otherwise damaged.	Free the vanes or replace with new ones (Busch service).
	The radial clearance between the rotor and the cylinder is no longer adequate.	Readjust the vacuum pump (Busch service).
	Internal parts worn or damaged.	Repair the vacuum pump (Busch service).
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 connection cable is too small or too long causing a voltage drop at the vacuum pump.	Use sufficiently dimensioned cable.

	The vacuum pump or the drive motor is blocked.	Make sure the drive motor is disconnected from the power supply. Remove the fan cover. Try to turn the fan by hand. If the unit vacuum pump/ drive motor is still frozen: Remove the drive motor and check the drive motor and the vacuum pump separately. If the vacuum pump is blocked: Repair the vacuum pump (Busch service).
	The drive motor is defective.	Replace the drive motor (Busch service).
The vacuum pump is blocked	Solid foreign matter has entered the vacuum pump.	Repair the vacuum pump (Busch service). Make sure the suction line is equipped with a standard and a fine screen.
	Corrosion in the vacuum pump from remaining condensate.	Repair the vacuum pump (Busch service). Check the process. Observe the chapter “Installation and Commissioning, Operating Notes ”.
	The vacuum pump was run in the wrong direction.	Repair the vacuum pump (Busch service). When connecting the vacuum, make sure the vacuum pump will run in the correct direction (see “Installation”).
	After shutting down the vacuum pump, the vacuum system exerted under pressure onto the pump chamber which sucked back excessive oil from the oil separator into the pump chamber. When the vacuum pump was restarted too much oil was enclosed between the vanes. Oil could not be compressed and thus broke a vane	Repair the vacuum pump (Busch service). Make sure the vacuum system will not exert under pressure onto the shut-down vacuum pump, if necessary provide an additional shut-off valve or non-return valve.
	Condensate ran into the pump chamber. When the vacuum pump was restarted too much condensate was enclosed between the vanes. Condensate could not be compressed and thus broke a vane.	Repair the vacuum pump (Busch service). Make sure no condensate will enter the vacuum pump, if necessary provide a drip leg and a drain cock. Drain condensate regularly.
The drive motor is running, but the vacuum stands still	The coupling between the drive motor and the vacuum pump is defective.	Replace the coupling.
The vacuum pump starts, but labours or runs noisily or rattles. The drive motor draws a too high current (compare with initial value after commissioning).	Connections in the drive motor terminal box are defective. Not all drive motor coils are properly connected. The drive motor operates on two phases only.	Check the proper connection of the wires against the connection diagram. Tighten or replace loose connections.
	The vacuum pump runs in the wrong direction.	Verification and rectification see “Installation and Commissioning”, correct if necessary.
	Standstill over several weeks or month.	Let the vacuum pump run warm with inlet closed.
	Improper oil quantity, unsuitable oil type.	Use the proper quantity of one of the recommended oils (see “Oil”). Oil change (see “Maintenance”).
	No oil change over extended period of time.	Perform oil change including flushing (see “Maintenance”).
	The lubrication pump does not work.	Replace the lubrication pump.

The vacuum pumps runs very noisily	Defective bearings. Worn coupling element. Stucked vanes.	Repair the vacuum pump (Busch service). Replace the coupling element. Use only approved oils (see “Oil”) and change more frequently.
The vacuum pump runs very hot	Insufficient air ventilation.	Make sure that the cooling of the vacuum pump is not impeded by dust/ dirt. Clean the fan cowlings, fan wheels, ventilation screens and cooling fans. Install the vacuum pump in a narrow space only if sufficient ventilation is ensured.
	Ambient temperature too high.	Observe the permitted ambient temperatures.
	Temperature of the inlet gas too high.	Observe the permitted temperatures for the inlet gas.
	Oil burnt from overheating.	Flush the vacuum pump. Replace the filters. Fill in new oil (see “Maintenance”).
	The filter is partially clogged.	Replace the filter.
	Mains frequency or voltage outside tolerance range.	Provide a more stable power supply.
	The standard and/ or fine screen on the suction connection is partially clogged.	Clean the standard and/ or fine screen.
	Partial clogging in the suction or discharge line.	Remove the clogging.
The oil is black. The oil is watery and coloured white. The oil is resinous and/ or sticky.	Oil change intervals are too long. The oil was overheated. The vacuum pump aspirated water or significant amounts of humidity. Improper oil type, perhaps in confusion.	Flush the vacuum pump. Replace the filters. Fill in new oil (see “Maintenance”). Make sure the proper oil is used for the application.

Seal fluid type/ quantity

Seal fluid type

- Make sure that the oil type corresponds to specification:

– The type of seal fluid depends on the working area. Seal fluids adequate to DIN 51506, lubricant group VC 150 must be used.
We recommend original seal fluids of VM Series, which comply with this DIN. If you need further information, request our leaflet “Special seal Fluids for Vacuum Pumps”.

Seal fluid 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 system.

Vacuum pump	Quantity [l]
HO 0429/ 0433 F	12
HO 0437/ 0441 F	25

Technical data

Technical data				HO 0429 F	HO 0433 F	HO 0437 F	HO 0441 F
Nominal suction capacity		50 Hz 60 Hz	m^3/h (cfm) m^3/h (cfm)	160 190	250 300	400 480	630 760
Ultimate pressure			Torr mbar	0,5	0,5	0,5	0,5
Nominal motor rating		50 Hz 60 Hz	kW	5,5 7,5	7,5 11	11 15	15 18,5
Nominal motor speed		50 Hz 60 Hz	min^{-1}	1500 1800	1500 1800	1000 1200	1000 1200
Noise level (EN ISO 2151)		50 Hz 60 Hz	dB(A) dB(A)	72	73	73	74
Operating temperature			°C	65-95	65-95	65-95	65-95
Cooling liquid requirement	Direct cooling		50 Hz l/h 60 Hz l/h	150 180	180 215	230 275	330 400
Seal fluid requirement		50 Hz 60 Hz	cm^3/h $cm^3/$ h	285 351	285 351	536 597	536 597
Seal fluid vessel capacity			l	12	12	25	25
Weight	ap. ap.	50 Hz 60 Hz	kg kg	380 385	400 440	920 930	950 1000

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) **HUCKEPACK HO 0429-0441 F**

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) **HUCKEPACK HO 0429-0441 F**

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

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Vacuum Solutions

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