



# Installation and Operating Instructions

Vacuum Pumps

Mink MM 1104, 1144, 1102, 1142 BVP

for V-belt Drive



Busch Produktions GmbH  
Schauinslandstr. 1  
79689 Maulburg  
Germany

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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.

These operating instructions contain information for

- product description,
- safety,
- transport,
- storage,
- installation and commissioning,
- maintenance,
- overhaul,
- troubleshooting and
- spare parts

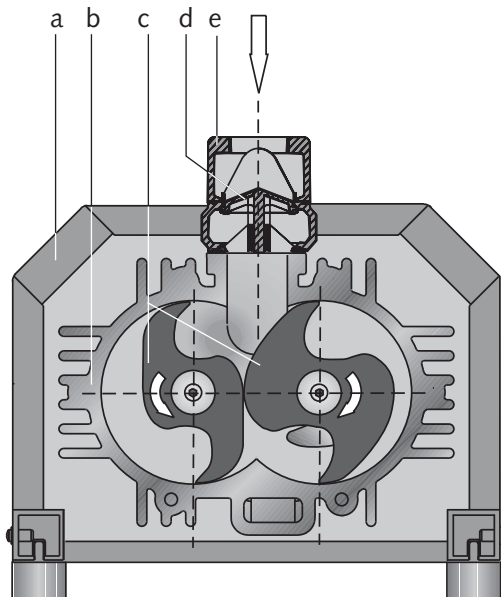
of the vacuum pump.

The drive motor does not form part of the Busch scope of delivery and is therefore not subject to these instructions.

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.

**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.**



- a Acoustic enclosure
- b Cylinder
- c Rotors
- d Non-return valve (optional)
- e Suction connection
- f Silencer
- g Gas discharge
- h Directional arrow
- i V-belt pulley
- j Nameplate, vacuum pump
- k Oil sight glass
- l Oil drain plug
- m Oil fill plug (=venting valve, underneath lid)
- n Eye bolt
- o Cooling air inlet



## Product Description

### Use

The vacuum pump is intended for

- the suction of
- air and other dry, non-aggressive, non-toxic and non-explosive gases

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

Max. allowed temperature of the inlet gas: 40 °C

Standard-version:

The gas shall be free from vapours that would condensate under the temperature and pressure conditions inside the vacuum pump.

Version "Aqua":

The vacuum pump features the corrosion protection coating CPC and is capable of conveying water vapour (→ page 7: Conveying Condensable Vapours). Conveyance of other vapours shall be agreed upon with Busch. Conveyance of water or other liquids in liquid phase increases the power consumption and shall therefore be avoided (risk of drive overload).

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

The vacuum pump is thermally suitable for continuous operation (100 percent duty).

The vacuum pump is not ultimate pressure proof. Operation with a closed ("blanked") suction line will damage the vacuum pump.

**The minimum allowed intake pressure of the vacuum pump is 200 hPa (=mbar) abs. By means of process control and/or vacuum relief valves it must be made sure that the minimum allowed intake pressure will not be underrun.**

### Principle of Operation

The vacuum pump works on the claw principle.

The components are dimensioned such, that on the one hand there is never contact between the two claws or between a claw and the cylinder, on the other hand the gaps are small enough to keep the clearance loss between the chambers low.

In order to avoid the suction of solids, the vacuum pump is equipped with a screen (715) in the suction connection.

The vacuum pump compresses the inlet gas absolutely oil-free. A lubrication of the pump chamber is neither necessary nor allowed.

### Cooling

The vacuum pump is cooled by

- radiation of heat from the surface of the vacuum pump
- the process gas
- the air flow from the fan wheel on the shaft of the vacuum pump

## Start Controls

The vacuum pump comes without start controls. The control of the vacuum pump is to be provided in the course of 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 shall be handled only by qualified personnel.

**The allowed media and operational limits (→ page 3: Product Description) and the installation prerequisites (→ page 5: Installation Prerequisites) of the vacuum pump shall be observed both by the manufacturer of the machinery into which the vacuum pump is to be incorporated and by the operator.**

The maintenance instructions shall be observed.

**Prior to handling the vacuum pump these installation and operating instructions shall 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 according to state-of-the-art methods. Nevertheless, residual risks may remain. These operating instructions highlight potential hazards where appropriate. Safety notes are tagged with one of the keywords DANGER, WARNING and CAUTION as follows:



#### DANGER

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



#### WARNING

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



#### CAUTION

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

### Noise Emission

For the sound pressure level in free field according to EN ISO 2151 → page 15: Technical Data.



#### CAUTION

The vacuum pump emits noise of high intensity in a narrow band.

Risk of damage to the hearing.

Persons staying in the vicinity of a non noise insulated vacuum pump over extended periods shall wear ear protection.

## Transport

### Transport in Packaging

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

### Transport without Packaging

In case the vacuum pump is packed in a cardboard box with inflated cushions:

- ◆ Remove the inflated cushions from the box

In case the vacuum pump is in a cardboard box cushioned with rolled corrugated cardboard:

- ◆ Remove the corrugated cardboard from the box

In case the vacuum pump is laid in foam:

- ◆ Remove the foam

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

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

In case the vacuum pump is fastened to the pallet by means of tightening straps:

- ◆ Remove the tightening straps



#### CAUTION

Do not walk, stand or work under suspended loads.

- Make sure that the eyebolt (n, 615) is in faultless condition (replace a damaged, e.g. bent eyebolt with a new one)
- Make sure that the eyebolt (n, 615) is fully screwed in and tightened by hand
- Attach lifting gear securely to the eyebolt (n, 615) on the synchronising gear
- Attach the lifting gear to a crane hook with safety latch
- Lift the vacuum pump with a crane

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

- ◆ Remove the stud bolts from the rubber feet

## Storage

### Short-term Storage

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

### Conservation

In case of adverse ambient conditions (e.g. aggressive atmosphere, frequent temperature changes) conserve the vacuum pump immediately. In case of favourable ambient conditions conserve the vacuum pump if a storage of more than 3 months is scheduled.

- Make sure that all ports are firmly closed; seal all ports that are not sealed with PTFE-tape, gaskets or o-rings with adhesive tape

**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 plastics and elastomers. Seek advice from your local packaging dealer! Busch uses CORTEC VCI 126 R film for the overseas packaging of large equipment.

- Wrap the vacuum pump in VCI film
- Store the vacuum pump
  - if possible in original packing,
  - indoors,
  - dry,
  - dust free and
  - vibration free.

For commissioning after conservation:

- Make sure that all remains of adhesive tape are removed from the ports
- Commission the vacuum pump as described in the chapter Installation and Commissioning (→ page 5)

## 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 plant components!

Risk of injury!

The installation prerequisites must be complied with.

- 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 complied with (in the responsibility of the designer of the machinery into which the vacuum pump is to be incorporated; → page 13: note in the EC-Declaration of Conformity)

### Mounting Position and Space

- Make sure that the environment of the vacuum pump is not potentially explosive
- Make sure that the following ambient conditions will be complied with:
  - ambient temperature: 0 ... 40 °C
  - ambient pressure: atmospheric
- 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 in order to warrant a sufficient cooling there will be a clearance of minimum 1 m between the vacuum pump and nearby walls
- Make sure that no heat sensitive parts (plastics, wood, cardboard, paper, electronics) will touch the surface of the vacuum pump
- Make sure that the installation space or location is vented such that a sufficient cooling of the vacuum pump is warranted



CAUTION

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

Risk of burns!

- Make sure that the vacuum pump will not be touched inadvertently during operation, provide a guard if appropriate
- Make sure that the sight glass (k, 76) of the synchronising gear will remain accessible

In case the synchronising gear oil change is planned to be carried out on location:

- ◆ Make sure that the drain port (l, 80) and the filling port (m, 72) of the synchronising gear will remain easily accessible

### Suction Connection



CAUTION

Intruding foreign objects or liquids can destroy the vacuum pump.

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

- ◆ Make sure that a suitable filter (5 micron or less) is installed upstream the vacuum pump
- Make sure that the suction line fits to the suction connection (e) of the vacuum pump
- Make sure that the gas will be sucked through a vacuum-tight flexible hose or a pipe

In case of using a pipe:

- ◆ Make sure that the pipe will cause no stress on the vacuum pump's connection, if necessary use an expansion joint
- Make sure that the line size of the suction line over the entire length is at least as large as the suction connection (e) of the vacuum pump

In case the length of the suction line exceeds 2 m it is prudent to use larger line sizes in order to avoid a loss of efficiency and an overload of the vacuum pump. Seek advice from your Busch representative!

In case the vacuum shall be maintained after shutdown of the vacuum pump:

- ◆ Provide a manual or automatic operated valve (= non-return valve) in the suction line

Version "Aqua", if very humid process gases and/or adverse operating cycles bear the risk, that condensates remain in the vacuum pump:

- ◆ Provide a shut-off valve, a drip-leg and a drain cock in the suction line, so that condensates can be drained from the suction line
- ◆ Provide a valve for the unthrottled suction of ambient air (ambient air valve) between the shut-off valve and the vacuum pump (in order to dry the vacuum pump after process end).
- ◆ Make sure that the anti-pulsation chamber is equipped with a condensate drain cock (optional; if the condensate drain cock is missing contact the Busch service)

- Make sure that the suction line does not contain foreign objects, e.g. welding scales

### Gas Discharge

**The discharged gas must flow without obstruction. It is not permitted to shut off or throttle the discharge line or to use it as a pressurised air source.**

The following guidelines for the discharge line do not apply, if the aspirated air is discharged to the environment right at the vacuum pump.

- Make sure that the discharge line fits to the gas discharge (g) of the vacuum pump

In case of using a pipe:

- ◆ Make sure that the pipe will cause no stress on the vacuum pump's connection, if necessary use an expansion joint
- Make sure that the line size of the discharge line over the entire length is at least as large as the gas discharge (g) of the vacuum pump

In case the length of the discharge line exceeds 2 m it is prudent to use larger line sizes in order to avoid a loss of efficiency and an overload of the vacuum pump. Seek advice from your Busch representative!

- Make sure that the discharge line either slopes away from the vacuum pump or provide a liquid separator or a drip leg with a drain cock, so that no liquids can back up into the vacuum pump

## Installation

### Mounting

- Make sure that the Installation Prerequisites (→ page 5) are complied with
- Set down or mount the vacuum pump at its location

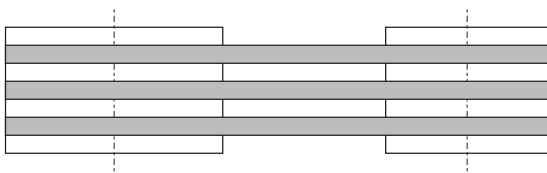
### Mounting the V-belt Drive

- Mount the v-belt drive

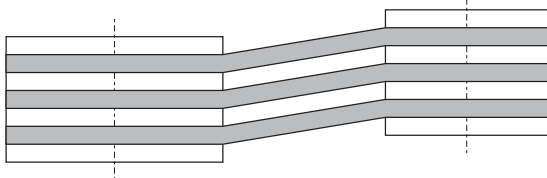
### Checking the Alignment of the Pulleys

- Make sure that the v-belt drive is properly aligned:

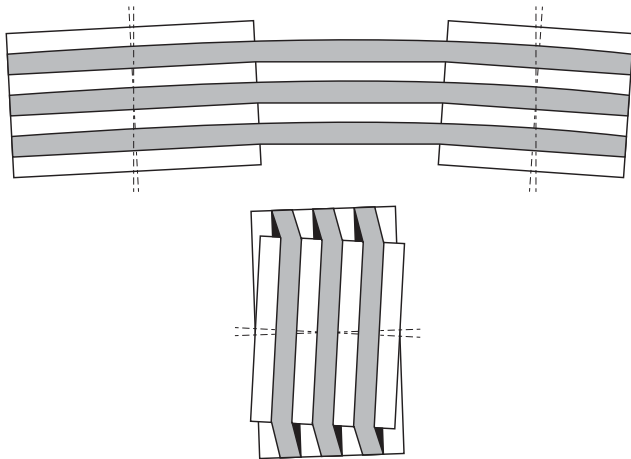
Proper alignment: both pulleys / pulley packages in one plane



Improper alignment: axial offset



Improper alignment: pulleys / pulley packages angled



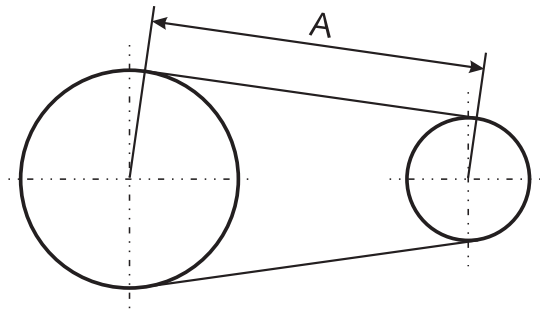
### Adjusting the V-belt Tension

**Note:** The v-belt drive is not part of the Busch scope of delivery. The deflection force values apply to v-belt type "Fenner Power Plus". Other types may require different values, which shall be inquired from the supplier.

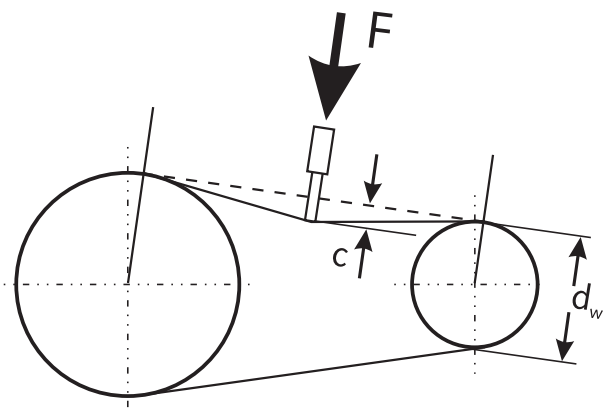
It is recommended to use a standard belt tension measurement device (e.g. Fenner part. no. 51-0035).

- Make sure that the pulleys are clean and grease-free
- Reduce the distance between the pulleys / pulley packages such that the v-belt(s) can be put on
- Put on the v-belt(s)
- Increase the distance between the pulleys / pulley packages such that the v-belt(s) get tensioned

- Measure the distance **A** (distance between the axles measured parallel to a belt section)



- Multiply the distance **A** (in metres) by 16; the result gives the test deflection **c** in millimetres
- Set the bottom marking ring on the measurement device to the test deflection **c**
- Set the marking ring for the deflection force to zero
- Apply the measurement device in the middle of the distance **A** right-angled to the belt



- Press on the measurement device until the test deflection **c** is reached
- Read the deflection force **F** on the measurement device
- Check the measured value **F** against the values in the table

Belt type	Effective Ø of the smaller pulley $d_w$ [mm]	Deflection force <b>F</b> [N]
SPZ	67 - 95	13 to 20
	100 - 140	20 to 25
SPA	100 - 132	25 to 35
	140 - 200	35 to 45
SPB	160 - 224	45 to 65
	236 - 315	65 to 85
SPC	224 - 355	85 to 115
	375 - 560	115 to 150

- If necessary adjust the distance between the axles, measure again, until the deflection force has reached the desired value - with new belts the value shall be close to the upper limit

### Checking Synchronising Gear Oil

The vacuum pump is delivered with oil filled synchronising gear.

The level shall be slightly above the middle of the sight glass (k, 76).

- Check on the sight glass (k, 76) that the proper amount of oil is filled





#### CAUTION

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

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

- Switch on the drive motor for an instant and check that there is underpressure at the suction connection/gas inlet and overpressure at the gas discharge/pressure connection

### Connecting Lines/Pipes

- Connect the suction line
- Connect the discharge line

Installation without discharge line:

- ◆ Make sure that the gas discharge (g) is open
- Make sure that all provided covers, guards, hoods etc. are mounted
- 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

After the vacuum pump has run under load for approx. 30 minutes:

- Check the tension of the v-belt(s) (→ page 6: Adjusting the V-belt Tension)

### Operation Notes

#### Use



#### CAUTION

The vacuum pump is designed for operation under the conditions described below.

In case of disregard risk of damage or destruction of the vacuum pump and adjoining plant components!

Risk of injury!

The vacuum pump must only be operated under the conditions described below.

The vacuum pump is intended for

– the suction

of

– air and other dry, non-aggressive, non-toxic and non-explosive gases

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

Max. allowed temperature of the inlet gas: 40 °C

Standard-version:

The gas shall be free from vapours that would condensate under the temperature and pressure conditions inside the vacuum pump.

Version "Aqua":

The vacuum pump features the corrosion protection coating CPC and is capable of conveying water vapour (→ page 7: Conveying Condensable Vapours). Conveyance of other vapours shall be agreed upon with Busch. Conveyance of water or other liquids in liquid phase increases the power consumption and shall therefore be avoided (risk of drive overload).

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

The vacuum pump is thermally suitable for continuous operation (100 percent duty).

The vacuum pump is not ultimate pressure proof. Operation with a closed ("blanked") suction line will damage the vacuum pump.

**The minimum allowed intake pressure of the vacuum pump is 200 hPa (=mbar) abs. By means of process control and/or vacuum relief valves it must be made sure that the minimum allowed intake pressure will not be underrun.**



#### CAUTION

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

Risk of burns!

The vacuum pump shall be protected against contact during operation, it shall cool down prior to a required contact or heat protection gloves shall be worn.



#### CAUTION

The vacuum pump emits noise of high intensity in a narrow band.

Risk of damage to the hearing.

Persons staying in the vicinity of a non noise insulated vacuum pump over extended periods shall wear ear protection.

- Make sure that all provided covers, guards, hoods etc. remain mounted
- Make sure that protective devices will not be disabled
- Make sure that cooling air inlets and outlets will not be covered or obstructed and that the cooling air flow will not be affected adversely in any other way
- Make sure that the installation prerequisites (→ page 5: Installation Prerequisites) are complied with and will remain complied with, particularly that a sufficient cooling will be ensured

### Conveying Condensable Vapours

Version "Aqua":



#### CAUTION

Due to the corrosion protection coating CPC the vacuum pump is capable of conveying water vapour.

Very humid process gases and/or adverse operating cycles can lead to residual condensates, though, which cause corrosion.

If this is the case, it is necessary to counteract residual condensates by warming up the vacuum pump, conveyance of ambient air after process end and regular draining of the anti-pulsation chamber.

- ◆ Close the shut-off valve in the suction line
  - ◆ Warm up the vacuum pump for approx. 10 minutes
- At process start:
- ◆ Open the shut-off valve in the suction line
- At the process end:
- ◆ Close the shut-off valve in the suction line
  - ◆ Open the ambient air valve
  - ◆ Operate the vacuum pump for another approx. 10 minutes
  - ◆ Close the ambient air valve
  - ◆ Regularly drain condensate from the anti-pulsation chamber

# Maintenance



**DANGER**

In case the vacuum pump conveyed gas that was contaminated with foreign materials which are dangerous to health, harmful material can reside in filters.

Danger to health during inspection, cleaning or replacement of filters.

Danger to the environment.

Personal protective equipment must be worn during the handling of contaminated filters.

Contaminated filters are special waste and must be disposed of separately in compliance with applicable regulations.



**CAUTION**

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

Risk of burns!

- Prior to disconnecting connections make sure that the connected pipes/lines are vented to atmospheric pressure

## Maintenance Schedule

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

### Monthly:

- Make sure that the vacuum pump is shut down and locked against inadvertent start up

In case an inlet air filter is installed:

- ◆ Check the inlet air filter, if necessary replace

In case of operation in a dusty environment:

- ◆ Clean as described under page 8: Every 6 Months:

### Every 3 Months:

- Make sure that the vacuum pump is shut down
- Check the level of the synchronising gear oil

The level shall be slightly above the middle of the sight glass (k, 76).

The level of the synchronising gear should stay constant over the lifetime of the oil. If the level does fall, the gear is leaky and the vacuum pump requires repair (Busch service).

### Every 6 Months:

- Make sure that the housing is free from dust and dirt, clean if necessary
- Make sure that the vacuum pump is shut down and locked against inadvertent start up
- Remove the acoustic enclosure
- Clean the fan cowling, the fan wheel, the ventilation grille and the cooling fins
- Mount the acoustic enclosure
- Check the tension of the v-belt(s) ( page 6: Adjusting the V-belt Tension)

### Every Year:

- Make sure that the vacuum pump is shut down and locked against inadvertent start up

In case an inlet air filter is installed:

- ◆ Replace the inlet air filter
- Check the inlet screen (715), clean if necessary

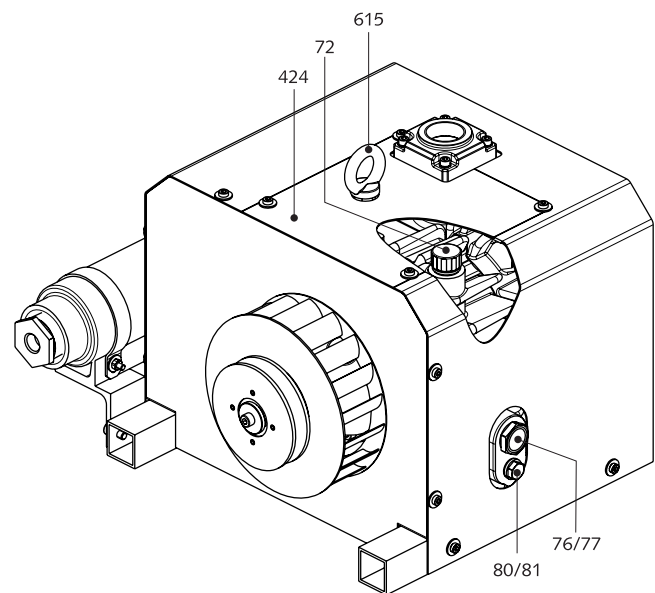
### Every 20000 Operating Hours, At the Latest after 6 Years:

**Note:** The change interval of 20000 operating hours is valid for the gear oil Busch VS 150 only. Other gear oils reduce the change interval.

- Change the synchronising gear oil

## Changing Synchronising Gear Oil

- Make sure that the vacuum pump is shut down and locked against inadvertent start up



- Remove the lid (424)
- Undo the venting valve (m, 72) for venting
- Place a drain tray underneath the drain plug (l, 80)
- Open the drain plug (l, 80) and drain the oil
- Make sure that the seal ring (l, 81) on the drain plug (l, 80) is serviceable, replace if necessary
- Firmly reinsert the drain plug (l, 80) together with the seal ring (l, 81)
- Remove the venting valve (m, 72) completely
- Fill in new gear oil until the level is slightly above the middle of the sight glass (k, 76)
- Make sure that the seal ring on the venting valve (m, 72) is undamaged, if necessary replace the venting valve (m, 72)
- Firmly reinsert the venting valve (m, 72) together with the seal ring
- Mount the lid (424)
- Reinsert the eyebolt (n, 615)
- Dispose of the used oil in compliance with applicable regulations



# Overhaul



## CAUTION

In order to achieve best efficiency and a long life the vacuum pump was assembled and adjusted with precisely defined tolerances.

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

It is therefore strictly recommended that any dismantling of the vacuum pump that is beyond of what is described in this manual shall be done by Busch service.



## DANGER

In case the vacuum pump conveyed gas that was contaminated with foreign materials which are dangerous to health, harmful material can reside in pores, gaps and internal spaces of the vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

Prior to shipping the vacuum pump shall be decontaminated as good as possible and the contamination status shall be stated in a "Declaration of Contamination" (form downloadable from [www.busch-vacuum.com](http://www.busch-vacuum.com)).

Busch service will only accept vacuum pumps that come with a completely filled in and legally binding signed "Declaration of Contamination" (form downloadable from [www.busch-vacuum.com](http://www.busch-vacuum.com)).

## Removal from Service

### Temporary Removal from Service

- Prior to disconnecting pipes/lines make sure that all pipes/lines are vented to atmospheric pressure

### Recommissioning

- Observe the chapter Installation and Commissioning (→ page 5)

### Dismantling and Disposal



## DANGER

In case the vacuum pump conveyed gas that was contaminated with foreign materials which are dangerous to health, harmful material can reside in pores, gaps and 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 personal protective equipment must be worn.

**The vacuum pump must be decontaminated prior to disposal.**

- Drain the oil
- Make sure that materials and components to be treated as special waste have been separated from the vacuum pump
- Make sure that the vacuum pump is not contaminated with harmful foreign material

According to the best knowledge at the time of printing of this manual the materials used for the manufacture of the vacuum pump involve no risk.

- Dispose of the used oil in compliance with applicable regulations

- Dispose of the vacuum pump as scrap metal

# 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 CENELEC 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 70 °C.

Risk of burns!

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

Problem	Possible Cause	Remedy
The vacuum pump does not reach the usual pressure 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
	In case a vacuum relief valve/regulating system is installed: The vacuum relief valve/regulating system is misadjusted or defective	Adjust, repair or replace, respectively
	The screen (715) in the suction connection (e) is partially clogged	Clean the screen (715) If cleaning is required too frequently install a filter upstream
	In case a filter is installed on the suction connection (e): The filter on the suction connection (e) is partially clogged	Clean or replace the inlet air filter, respectively
	Partial clogging in the suction, discharge or pressure line	Remove the clogging
	Long suction, discharge or pressure line with too small diameter	Use larger diameter
	Internal parts are worn or damaged	Repair the vacuum pump (Busch service)
The gas conveyed by the vacuum pump smells displeasing	Process components evaporating under vacuum	Check the process, if applicable
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 screen If necessary additionally provide a filter
	Corrosion in the vacuum pump from remaining condensate	Repair the vacuum pump (Busch service) Check the process Observe the chapter Conveying Condensable Vapours (→ page 7)
	Version with three-phase motor: Version with DC motor: The vacuum pump was run in the wrong direction	Repair the vacuum pump (Busch service) When connecting the vacuum pump make sure the vacuum pump will run in the correct direction (→ page 6: Installation)
The drive motor is running, but the vacuum pump stands still	The belt(s) is/are torn	Replace the v-belt(s)

	Version with three-phase motor: Version with DC-motor: The vacuum pump runs in the wrong direction	Verification and rectification → page 5: Installation and Commissioning
	Foreign objects in the vacuum pump Stuck bearings	Repair the vacuum pump (Busch service)
The vacuum pump runs very noisily	Defective bearings	Repair the vacuum pump (Busch service)
	Low oil level in the synchronising gear	The synchronising gear is leaky Repair the vacuum pump (Busch service)
	Synchronising gear damaged due to operation with low oil level	Repair the vacuum pump (Busch service)
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, the fan wheels, the ventilation grilles and the cooling fins 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
	Insufficient gas transfer	Provide a vacuum relief valve
	In case a vacuum relief valve/regulating system is installed: The vacuum relief valve/regulating system is misadjusted or defective	Adjust, repair or replace, respectively
	Partial clogging of filters or screens Partial clogging in the suction, discharge or pressure line	Remove the clogging
	Long suction, discharge or pressure line with too small diameter	Use larger diameter

## Spare Parts

**Note:** When ordering spare parts or accessories acc. to the table below please always quote the type ("Type") and the serial no. ("No") of the vacuum pump. This will allow Busch service 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.**

Your point of contact for service and spare parts in the United Kingdom:

Busch (UK) Ltd.  
Hortonwood 30-35  
Telford  
Shropshire  
TF1 7YB

Tel: 01952 677 432  
Fax: 01952 677 423

Your point of contact for service and spare parts in Ireland:

Busch Ireland Ltd.  
A10-11 Howth Junction Business Centre  
Kilbarrack, Dublin 5  
Tel: +353 (0)1 8321466  
Fax: +353 (0)1 8321470

Your point of contact for service and spare parts in the USA:

Busch Inc.  
516-B Viking Drive  
Virginia Beach, VA 23452  
Tel: 1-800-USA-PUMP (872-7867)

Your point of contact for service and spare parts in Canada:

Busch Vacuum Technics Inc.  
1740, Boulevard Lionel Bertrand  
Boisbriand (Montréal)  
Québec J7H 1N7  
Tel: 450 435 6899  
Fax: 450 430 5132

Your point of contact for service and spare parts in Australia:

Busch Australia Pty. Ltd.  
30 Lakeside Drive  
Broadmeadows, Vic. 3047  
Tel: (03) 93 55 06 00  
Fax: (03) 93 55 06 99

Your point of contact for service and spare parts in New Zealand:

Busch New Zealand Ltd.  
Unit D, Arrenway Drive  
Albany, Auckland 1311  
P O Box 302696  
North Harbour, Auckland 1330  
Tel: 0-9-414 7782  
Fax: 0-9-414 7783

Find the list of Busch companies all over the world (by the time of the publication of these installation and operating instructions) on page 16 (rear cover page).

Find the up-to-date list of Busch companies and agencies all over the world on the internet at [www.busch-vacuum.com](http://www.busch-vacuum.com).

Pos.	Part	Qty	Part no.
72	Venting valve (=oil fill plug) with seal ring	1	0543 138 026
76	Sight glass	1	0583 000 001
77	Seal ring for sight glass	1	0480 000 271
80	Plug with magnet and seal ring	1	0415 134 870
81	Seal ring for plug with magnet	1	0482 137 352
714	Inlet flange, lower part, with non-return valve	1	0916 102 518

715	Screen	1	0534 000 018
—	Filter cartridge, paper, for inlet filter (optional)	1	0532 000 003
—	Filter cartridge, PP, for inlet filter (optional)	1	0532 119 435
—	Filter cartridge, polyester, for inlet filter (optional)	1	0532 121 863

## Spare Parts Kits

Spare parts kit	Part no.
Overhaul kit (incl. set of seals, marking "VT" and "DT")	0993 138 031
Set of seals (marking "DT")	0990 138 032

## Accessories

Accessories	Description	Part no.
Inlet air filter	inlet-side, horizontal, with paper cartridge, to separate solids	0945 118 998
Inlet air filter	inlet-side, horizontal, with PP-cartridge, to separate solids	0945 124 344
Inlet air filter	inlet-side, horizontal, with polyester cartridge, food proof, to separate solids	0945 124 531
Non-return valve	inlet-side	0541 124 287

## Oil

Denomination	Busch VS 150
ISO-VG	150
Base	PAO
Density [g/cm <sup>3</sup> ]	0.846
Kinematic viscosity at 40 °C [mm <sup>2</sup> /s]	150
Kinematic viscosity at 100 °C [mm <sup>2</sup> /s]	19.8
Flashpoint [°C]	236
Pourpoint [°C]	-54
Part no. 1 l packaging	0831 164 883
Part no. 5 l packaging	0831 164 884
Filling quantity, approx. [l]	0.85

# EC-Declaration of Conformity

**Note:** This Declaration of Conformity and the **CE**-mark affixed to the nameplate are valid for the vacuum pump within the Busch-scope of delivery. When this vacuum pump 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 acc. to the Directive Machinery 2006/42/EC for the superordinate machine, issue the Declaration of Conformity for it and affix the **CE**-mark.

For maintenance of this Declaration of Conformity of vacuum pumps without a drive may only be used a drive with a written consent of Busch.

We

**Busch Produktions GmbH**  
**Schauinslandstr. 1**  
**79689 Maulburg**  
**Germany**

declare that vacuum pumps **MM 1104, 1144, 1102, 1142 BVP for V-belt Drive**

in accordance with the European Directive:

– “Machinery” 2006/42/EC,

have been designed and manufactured to the following specifications:

Standard	Title of the Standard
Harmonised Standards	
EN ISO 12100-1 EN ISO 12100-2	Safety of machinery - Basic concepts, general principles of design - Part 1 and 2
EN ISO 13857	Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs
EN 1012-1 EN 1012-2	Compressors and vacuum pumps - Safety requirements - Part 1 and 2
EN ISO 2151	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)

<p>Manufacturer</p>  <p><b>Dr.-Ing. Karl Busch</b> General director</p>	<p>Person authorised to compile the technical file</p>  <p><b>Andrej Riwe</b> Technical writer</p>
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# Technical Data

Type	Minimum allowed intake pressure [hPa abs = mbar abs]	Max. nominal rating [kW]	Max. nominal speed [min <sup>-1</sup> ]	Max. nominal suction capacity [m <sup>3</sup> /h]	Ambient temperature capacity [°C]	Ambient temperature range	Ambient pressure	Synchronisation gear oil qty filled ex-works	Sound pressure level (EN ISO 2:151) at 400 hPa (=mbar) abs. suction pressure [db(A)]	Weight [kg]
MM 1104 BVP	200	1.5	1800	75	0 ... 40	atmospheric	0.85	see nameplate	-	~80
MM 1144 BVP		2.2	1800	96					-	~85
MM 1102 BVP		3.0	3300	115					-	~80
MM 1142 BVP		4.0	3300	155					87	~85

## Australia

Busch Australia Pty. Ltd.  
30 Lakeside Drive  
Broadmeadows, Vic. 3047  
Tel: (03) 93 55 06 00  
Fax: (03) 93 55 06 99

## Austria

Busch Austria GmbH  
Industriepark Nord  
2100 Korneuburg  
Tel: 02262 / 756 65-0  
Fax: 02262 / 756 65-20

## Belgium

Busch N.V./Busch SA  
Kruinstraat 7  
9160 Lokeren  
Tel: (0)9 / 348 47 22  
Fax: (0)9 / 348 65 35

## Brazil

Busch do Brasil Ltda.  
Rod. Edgard Máximo Zambotto, Km 64  
13240-000 Jarinu-SP  
Tel: (55) 11-4016 1400/5277  
Fax: (55) 11-4016 5399

## Canada

Busch Vacuum Technics Inc.  
1740, Boulevard Lionel Bertrand  
Boisbriand (Montréal)  
Québec J7H 1N7  
Tel: 450 435 6899  
Fax: 450 430 5132

## Chile

Busch Chile S. A.  
Calle El Roble N° 375-G  
Lampa - Santiago  
Tel: (56-2) 7387092  
Fax: (56-2) 7387092

## China

Busch Vacuum (Shanghai) Co., Ltd  
No.5, Lane 195 Xipu Road  
Songjiang Industrial Estate East New Zone  
Shanghai 201611 PRC  
Tel: +86 (0)21 67600800  
Fax: +86 (0)21 67600700

## Czech Republic

Busch Vakuum s.r.o.  
Pražákova 10  
619 00 Horní Heršpice  
Brno  
Tel: +420 543 42 48 55  
Fax: +420 543 42 48 56

## Denmark

Busch Vakuumtechnik A/S  
Parallelvej 11  
8680 Ry  
Tel: +45 87 88 07 77  
Fax: +45 87 88 07 88

## Finland

Busch Vakuumtechnik Oy  
Sinikellontie 4  
01300 VANTAA  
Tel: 09 774 60 60  
Fax: 09 774 60 666

## France

Busch France S.A.  
Parc Technologique  
de Bois Chaland CE 2922  
91029 Evry Cedex  
Tel: 01 69 89 89 89  
Fax: 01 60 86 16 74

## Germany

Dr.-Ing. K. Busch GmbH  
Schauinslandstr. 1  
79689 Maulburg  
Tel: (0 76 22) 6 81-0  
Fax: (0 76 22) 6 81-194  
e-mail: info@busch.de

Dr.-Ing. K. Busch GmbH  
Niederlassung Nord  
Ernst-Abbe-Str. 1-3  
25451 Quickborn  
Tel: (0 41 06) 7 99 67-0  
Fax: (0 41 06) 7 99 67-77

Dr.-Ing. K. Busch GmbH  
Niederlassung West  
Nordring 35  
64807 Dieburg  
Tel: (0 60 71) 92 82-0  
Fax: (0 60 71) 14 71

Dr.-Ing. K. Busch GmbH  
Außenstelle Neuenrade  
Breslauer Str. 36  
58809 Neuenrade  
Tel: (0 23 92) 50 29 92  
Fax: (0 23 92) 50 72 11

Dr.-Ing. K. Busch GmbH  
Niederlassung Süd-Ost  
Gewerbestraße 3  
90579 Langenzenn  
Tel: (09 01) 90 25-0  
Fax: (09 01) 90 25-25

Dr.-Ing. K. Busch GmbH  
Außenstelle Zella-Mehlis  
Am Rain 11  
98544 Zella-Mehlis  
Tel: (0 36 82) 46 92 71  
Fax: (0 36 82) 46 92 73

Dr.-Ing. K. Busch GmbH  
Außenstelle Meitingen-Ostendorf  
Grüntenbergweg 8  
86405 Meitingen-Ostendorf  
Tel: (0 82 71) 426-341  
Fax: (0 82 71) 426-342

## India

Busch Vacuum India Pvt Ltd.  
Plot No. 110, Sector 7  
PCNTDA, Bhosari  
Pune 411026, Maharashtra  
Tel: (0)206410 2886  
Fax: (0)202711 2838

## Ireland

Busch Ireland Ltd.  
A10-11 Howth Junction Business Centre  
Kilbarrack, Dublin 5  
Tel: 00353 1 832 1466  
Fax: 00353 1 832 1470

## Israel

Busch Israel Ltd.  
1 Mevo Sivan Street  
Qiryat Gat 82022, Israel  
Tel: +972 (0)8 6810485  
Fax: +972 (0)8 6810486

## Italy

Busch Italia S.r.l.  
Via Ettore Majorana, 16  
20054 Nova Milanese  
Tel: 0362 370 91  
Fax: 0362 370 999

## Japan

Nippon Busch K.K.  
1-23-33, Megumigaoka  
Hiratsuka City, Kanagawa  
Japan 259-1220  
Tel: 0463-50-4000  
Fax: 0463-50-4004

## Korea

Busch Korea Ltd.  
392-1 Yangji-Ri, Yangji-Myun,  
Yongin-si, Kyunggi-Do  
Tel: (031) 321-8114  
Fax: (031) 321 4330

## Malaysia

Busch (Malaysia) Sdn Bhd.  
6 Jalan Taboh 33/22  
Shah Alam Technology Park  
Section 33  
40400 Shah Alam  
Selangor D. E.  
Tel: 03 5122 2128  
Fax: 03 5122 2108

## Mexico

Busch Vacuum Mexico S de RL de CV  
Tlaquepaque 4865, Los Altos  
Monterrey, Nuevo Leon  
Mexico 64370  
Tel: (81) 8311-1385  
Fax: (81) 8311-1386

## Netherlands

Busch B.V.  
Pompomolenlaan 2  
3447 GK Woerden  
Postbus 2091  
3440 DB Woerden  
Tel: (0)348 - 462300  
Fax: (0)348 - 422939

## New Zealand

Busch New Zealand Ltd.  
Unit D, 41 Arrenway Drive  
Albany 0632  
Auckland  
Tel: 09 414 7782  
Fax: 09 414 7783

## Norway

Busch Vakuumteknikk AS  
Hestehagen 2  
1440 Drøbak  
Tel: 64 98 98 50  
Fax: 64 93 66 21

## Poland

Busch Polska Sp. z o.o.  
Ul. Chopina 27  
87800 Włocławek  
Tel: (054) 2315400  
Fax: (054) 2327076

## Portugal

Busch Ibérica S.A., Sucursal em Portugal  
Zona Industrial Raso de Travassô, Fracção B, Armazém 2  
3750-753 Agueda  
Aveiro, Portugal  
Tel: +351 234 648 070  
Fax: +351 234 648 068

## Singapore

Busch Vacuum Singapore Pte Ltd  
20 Shaw Road  
#01-03 Ching Shine Building  
Singapore 36 79 56  
Tel: (65) 6488 0866  
Fax: (65) 6288 0877

## Spain

Busch Ibérica S.A.  
C/ Jaume Ferran, 6-8  
Pol. Ind. Coll de la Manyà  
08403 Granollers  
Tel: +34 93 861 61 60  
Fax: +34 93 840 91 56

## Sweden

Busch Vakuumtechnik AB  
Bråta Industriområde  
435 33 Mölnlycke  
Tel: 031 - 338 00 80  
Fax: 031 - 338 00 89

## Switzerland

Busch AG  
Waldweg 22  
4312 Magden  
Tel: 061 / 845 90 90  
Fax: 061 / 845 90 99

## Taiwan

Busch Taiwan Corporation  
1F. No. 69, Sec. 3, Beishen Rd.  
Shenkeng Township,  
Taipei Country,  
Taiwan (222), R.O.C  
Tel: (02) 2662 0775  
Fax: (02) 2662 0796

## Thailand

Busch Vacuum (Thailand) Co., Ltd.  
888/30 Moo19, Soi Yingcharoen, Bangplee-Tamru Rd.,  
Bangpleeyai, Bangplee, Samutprakarn 10540 Thailand  
Tel: (66) 2-382-5428  
Fax: (66) 2-382-5429

## Turkey

VAKUTEK  
Emlak Kredi Ishani No: 179  
81130 Üsküdar-Istanbul  
Tel: (216) 310 0573  
Fax: (216) 343 5126

## United Kingdom

Busch (UK) Ltd  
Hortonwood 30-35  
Telford Shropshire TF1 7YB  
Tel: 01952 677 432  
Fax: 01952 677 423

## USA

Busch, Inc.  
516-B Viking Drive  
Virginia Beach, VA 23452  
Tel: (757) 463-7800  
Fax: (757) 463 7407

Semiconductor Vacuum Group Inc.  
Morgan Hill, CA 95037  
Tel: (408) 955 1900  
Fax: (408) 955 0229

