Installation and Operating Instructions

Vacuum Pumps
Mink MM 1324, 1202, 1252, 1322, 1200, 1250,1320 AV

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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.

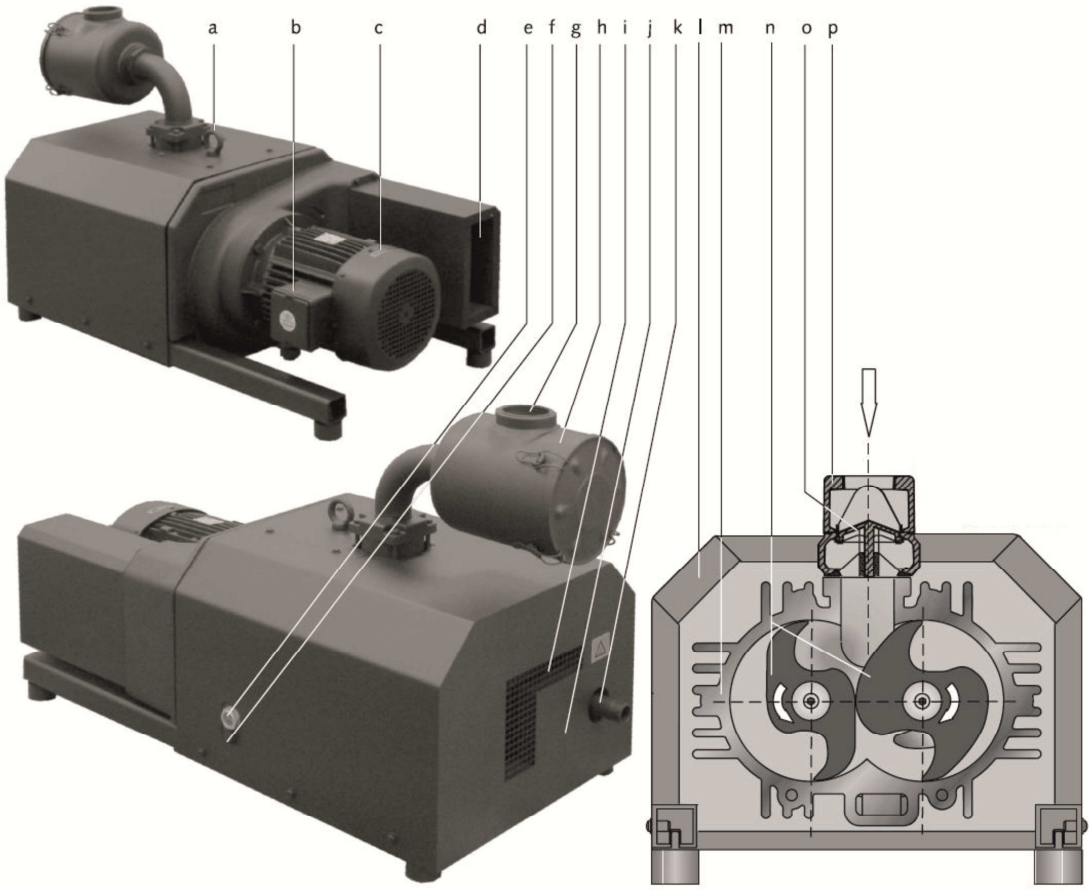
Version drive with integrated frequency inverter:

The drive with integrated frequency inverter is subject to a separate instruction manual.

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 Eye bolt
b Terminal box
c Directional arrow
d Cooling air outlet
e Oil sight glass
f Oil drain plug
g Suction connection (with inlet air filter)
h Inlet air filter (optional)
i Cooling air inlet
j Position of condensate drain cock (optional for version “Aqua”)
k Gas discharge
l Acoustic enclosure
m Cylinder
n Rotor
o Non return valve
p Suction connection (without inlet air filter)

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 9: 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.

Max. permissible number of startings per hour: 12

Vacuum pumps MM 1324 AV standard-version are thermally suitable for continuous operation down to ultimate pressure.

Vacuum pumps MM 1324 AV Version “Aqua” are thermally suitable for continuous operation at intake pressures down to 200 hPa abs (200 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.

Vacuum pumps MM 1202 AV, MM 1200 AV, MM 1252 AV and MM 1250 AV are thermally suitable for continuous operation at intake pressures down to 100 hPa abs (100 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.

Vacuum pumps MM 1322 AV and MM 1320 AV (version 600…3600 min^{-1}) are thermally suitable for continuous operation at intake pressures down to 150 hPa abs (150 mbar abs). MM 1320 AV (version 600…4200 min^{-1}) are thermally suitable for continuous operation at intake pressures down to 200 hPa abs (200 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.

Version “Aqua”:

The safety valve on the vacuum pump protects the vacuum pump against overheating only. It is not designed for frequent use and must therefore not be used as a system pressure regulating valve.

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.

In order to avoid reverse rotation after switching off, the vacuum pump is equipped with a non-return valve (o, 714).

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 air flow from the fan wheel of the drive motor
- 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.

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 18: 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 packed 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 (a, 615) is in faultless condition (replace a damaged, e.g. bent eyebolt with a new one)
- Make sure that the eye bolt (a, 615) is fully screwed in and tightened by hand
- Attach lifting gear securely to the eyebolt (a, 615) on the synchronising gear

When the vacuum pump is equipped with a very heavy drive motor and would hang very inclined (>10°) on the synchron ising gear eyebolt alone:

- ♦ Attach lifting gear securely to the eyebolts on the synchronising gear (a, 615) and the drive motor

In case the drive motor comes without an eyebolt or the eyebolt on the drive motor is located at an unfavourable position:

- ♦ Loop a belt/rope with suitable length and strength around the flange of the drive motor
- 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 packaging,

– 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 17: 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 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 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 (e, 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 (f, 80) and the filling port (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 (g/p) 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 (g/p) 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 pump 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)
- ♦ For non ultimate-pressure-proof vacuum pumps provide a vacuum relief valve (suitable for continuous operation) for the throttled aspiration of ambient air during warming up
- ♦ Make sure that the anti-pulsation chamber is equipped with a condensate drain cock (j) (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 (k) 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 2"

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

Electrical Connection / Controls

- Make sure that the stipulations acc. to the EMC-Directive 2004/108/EC and Low-Voltage-Directive 2006/95/EC as well as the EN-standards, electrical and occupational safety directives and the local or national regulations, respectively, are complied with (this is the responsibility of the designer of the machinery into which the vacuum pump is to be incorporated; ➔ page 17: note in the EC-Declaration of Conformity).
- Make sure that the power supply for the drive motor is compatible with the data on the nameplate of the drive motor
- Make sure that an overload protection according to EN 60204-1 is provided for the drive motor
- Make sure that the drive of the vacuum pump will not be affected by electric or electromagnetic disturbance from the mains; if necessary seek advice from the Busch service

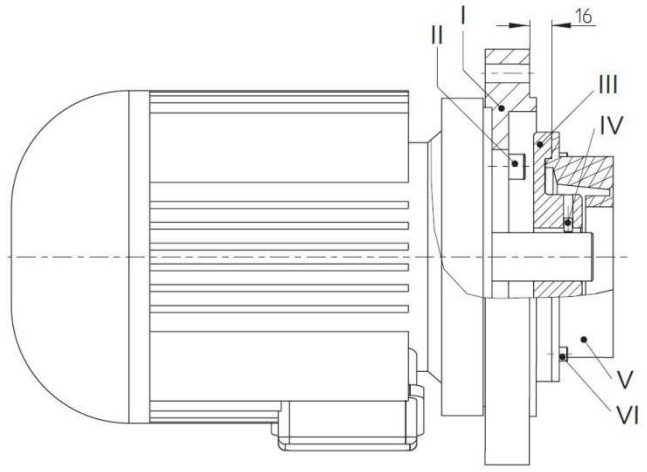
In case of mobile installation:

- ♦ Provide the electrical connection with grommets that serve as strain-relief

Installation

Mounting a NEMA-Motor with BoWex-Coupling

For certain markets the vacuum pump is available without motor, but with a NEMA-adaptor flange and a BoWex-coupling.



- Remove the NEMA-adaptor flange (I) from the vacuum pump
- Pull the elastomer part (V) together with the hub (III) off the shaft of the vacuum pump
- Mount the NEMA-adaptor flange (I) on the motor (the bolts (II) are not part of the Busch scope of delivery)
- Undo the cylinder screws (VI) and remove the elastomer part (V) from the hub (III)
- Make sure that the parallel key is inserted into the motor shaft

- Push the hub (III) onto the motor shaft such that the mounting face of the hub (III) will be located 16±1 mm before the mounting face of the NEMA-adaptor flange (I) (➔ sketch)
- Fasten the hub (III) on the motor shaft using the set screw (IV)
- Apply thread locking agent on the threads of the cylinder screws (VI)
- Mount the elastomer part (V) on the hub (III) with the cylinder screws (VI) and tighten the cylinder screws with 14 Nm
- Mount the motor on the vacuum pump

Mounting

- Make sure that the installation prerequisites (➔ page 5) are complied with
- Set down or mount the vacuum pump at its location

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 (e, 76).

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

Connecting Electrically

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 corresponding national accident prevention regulation.

CAUTION

The connection schemes given below are typical. Depending on the specific order or for certain markets deviating connection schemes may apply.

Risk of damage to the drive motor!

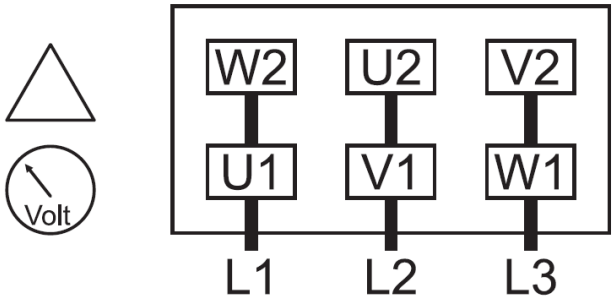
The inside of the terminal box shall be checked for drive motor connection instructions/schemes.

Note: For the connection of a drive with integrated frequency inverter see the separate operating instructions!

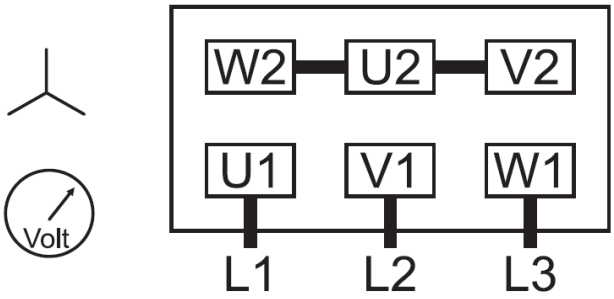
- Electrically connect the drive motor
- Connect the protective earth conductor

Connection Scheme Three-Phase Motor

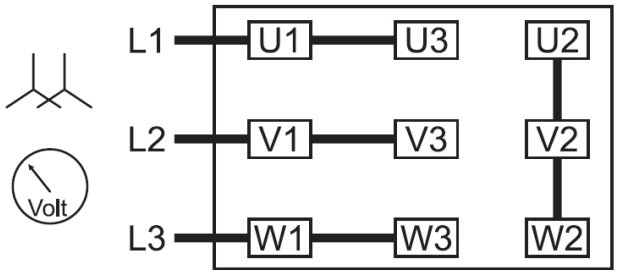
Delta connection (low voltage):



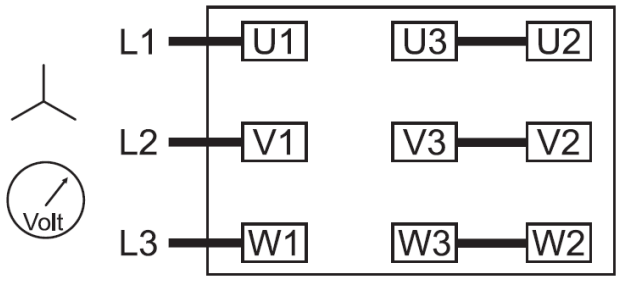
Star connection (high voltage):



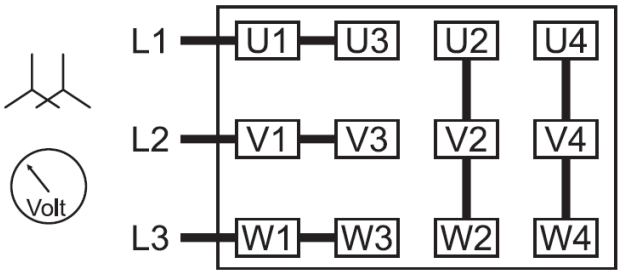
Double star connection, multi-voltage motor with 9 terminals (low voltage):



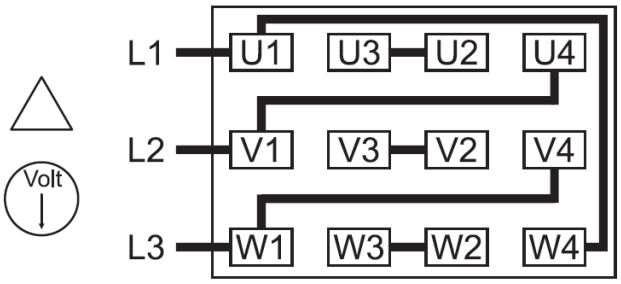
Star connection, multi-voltage motor with 9 terminals (high voltage):



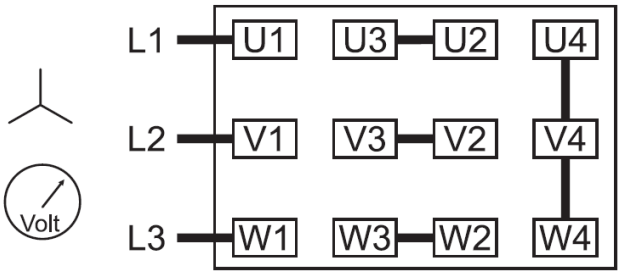
Double star connection, multi-voltage motor with 12 terminals (low voltage):



Delta connection, multi-voltage motor with 12 terminals (middle voltage):



Star connection, multi-voltage motor with 12 terminals (high voltage):



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 (clockwise rotating field).

Version with three-phase motor:

- Determine the intended direction of rotation with the arrow (c) (stuck on or cast)
- "Bump" the drive motor
- Watch the fan wheel of the drive motor and determine the direction of rotation just before the fan wheel stops

If the rotation must be changed:

- Switch any two of the drive motor wires (three-phase motor)

Connecting Lines/Pipes

- Connect the suction line
- Connect the discharge line

Installation without discharge line:

- Make sure that the gas discharge (k) is open
- Make sure that all provided covers, guards, hoods etc. are mounted
- Make sure that the cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way

Recording of Operational Parameters

As soon as the vacuum pump is operated under normal operating conditions:

- Measure the drive motor current and record it as reference for future maintenance and troubleshooting work

Operating 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 9: 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.

Max. permissible number of startings per hour: 12

Vacuum pumps MM 1324 AV standard-version are thermally suitable for continuous operation down to ultimate pressure.

Vacuum pumps MM 1324 AV Version "Aqua" are thermally suitable for continuous operation at intake pressures down to 200 hPa abs (200 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.

Vacuum pumps MM 1202 AV, MM 1200 AV, MM 1252 AV and MM 1250 AV are thermally suitable for continuous operation at intake pressures down to 100 hPa abs (100 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.

Vacuum pumps MM 1322 AV and MM 1320 AV (version 600…3600 min^{-1}) are thermally suitable for continuous operation at intake pressures down to 150 hPa abs (150 mbar abs). MM 1320 AV (version 600…4200 min^{-1}) are thermally suitable for continuous operation at intake pressures down to 200 hPa abs (200 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.

Version "Aqua":

The safety valve on the vacuum pump protects the vacuum pump against overheating only. It is not designed for frequent use and must therefore not be used as a system pressure regulating valve.

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 Condensables 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 (j)

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 (h) is installed:

- ♦ Check the inlet air filter (h), if necessary replace

In case of operation in a dusty environment:

- ♦ Clean as described under ➔ page 9: Every 6 Months

Every 3 Months:

- Make sure that the vacuum pump is shut down and locked against inadvertent start up
- Check the level and the colour of the synchronising gear oil

The level shall be slightly above the middle of the sight glass (e, 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

Note: Make sure that the foam mats do **n o t** get soaked with water

- Clean the fan cowlings, fan wheels, the ventilation grilles and cooling fins
- Mount the acoustic enclosure

Every Year:

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

In case an inlet air filter (h) is installed:

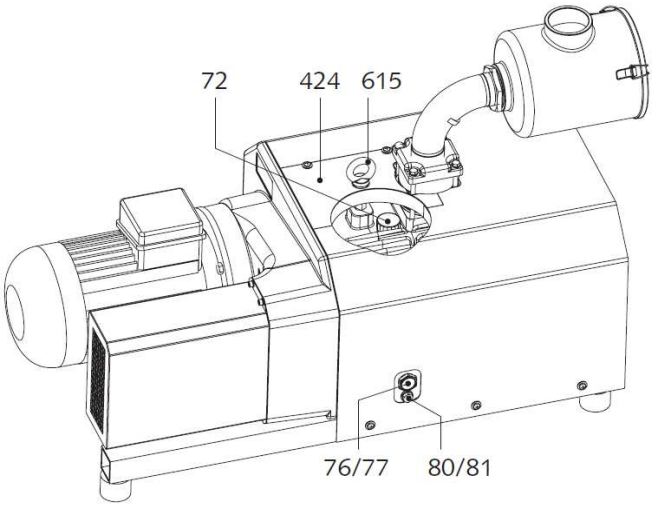
- ♦ Replace the inlet air filter (h)
- Check the inlet screen (715), clean if necessary

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

Note: The change interval of 20000 operating hours is valid for the approved gear oil Busch R 550 only. The change interval depends very much on the operating conditions. Borderline operation may reduce the change interval down to approximately 5000 operating hours or 6 months. Other gear oils may reduce the change interval.

Changing Synchronising Gear Oil

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



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

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).

Removal from Service

Temporary Removal from Service

- Prior 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 corresponding national accident prevention regulation.

CAUTION

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

Risk of burns!

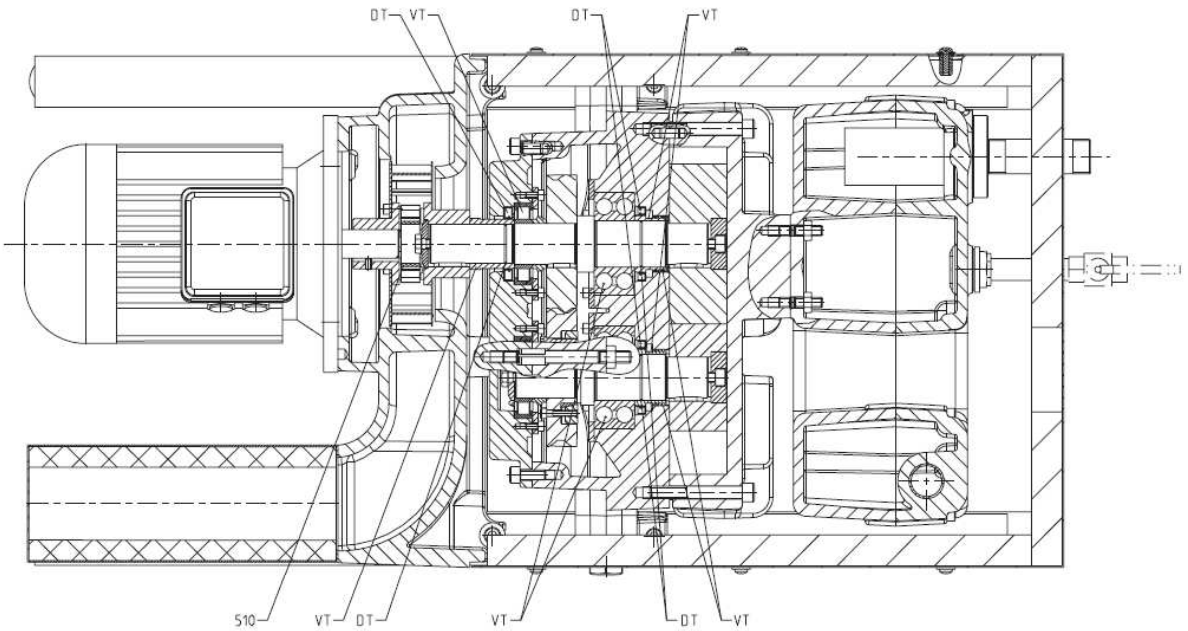
Let the vacuum pump cool down prior to a required contact or wear heat protection gloves.

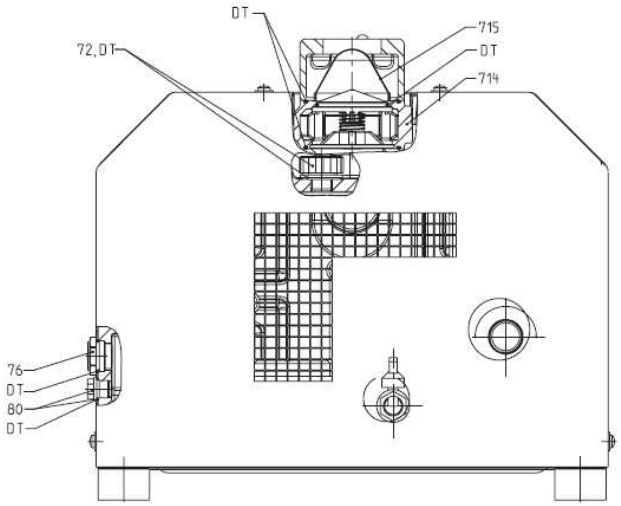
Problem	Possible Cause	Remedy
The vacuum pump does not reach the usual pressure The drive motor draws a too high current (compare with initial value after commissioning) Evacuation of the system takes too long	The vacuum system or suction line is not leak-tight	Check the hose or pipe connections for possible leak
	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 (g/p) is partially clogged	Clean the screen (715) If cleaning is required too frequently install a filter upstream
	In case a filter (h) is installed on the suction connection (g/p): The filter (h) on the suction connection (g/p) is partially clogged	Clean or replace the inlet air filter (h), 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
	The valve disk of the inlet non-return valve is stuck in closed or partially open position	Disassemble the inlet, clean the screen (715) and the valve (o, 714) as required and reassemble
	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 does not start	The drive motor is not supplied with the correct voltage or is overloaded	Supply the drive motor with the correct voltage
	The drive motor starter overload protection is too small or trip level is too low	Compare the trip level of the drive motor starter overload protection with the data on the nameplate, correct if necessary In case of high ambient temperature: set the trip level of the drive motor starter overload protection 5 percent above the nominal drive motor current
	One of the fuses has blown	Check the fuses
	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 connected from the power supply Remove the fan cover Try to turn the drive motor with the vacuum pump by hand If the unit 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 proper function of the fan wheel requires the precise adjustment of the coupling on the motor shaft and the pump shaft; therefore the motor can be mounted by the Busch service only)
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 9)
	Version with three-phase 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 coupling between the drive motor and the vacuum pump is defective	Replace the coupling element (the proper function of the fan wheel requires the precise adjustment of the coupling on the motor shaft and the pump shaft; therefore the motor can be mounted by the Busch service only)
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)	Loose connection(s) in the drive motor terminal box Version with three-phase motor: Not all drive motors coils are properly connected The drive motor operates on two phases only	Check the proper connection of the wires against the connection diagram (particularly on motors with six coils) Tighten or replace loose connections
	Version with three-phase 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)
	Worn coupling element	Replace the coupling element
	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 is very hot	Insufficient air ventilation	Make sure that the cooling of the vacuum pump is not impended 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
	Mains frequency or voltage outside tolerance range	Provide a more stable power supply
	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

Sectional Drawing





Spare Parts

Note: When ordering spare parts or accessories acc. to the table below please always quote the type and the serial no. of the vacuum pump. 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.
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Telford
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Fax: 01952 677 423

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

Busch Ireland Ltd.
A10-11 Howth Junction Business Centre
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Your point of contact for service and spare parts in the USA:

Busch LLC
516-B Viking Drive
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Tel: 1-800-USA-PUMP (872-7867)

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

Busch Vacuum Technics Inc.
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Tel: 450 435 6899
Fax: 450 430 5132

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

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

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Find the list of Busch companies all over the world (by the time of the publication of these installation and operating instructions) on
➔ page 20 (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**.

Pos.	Part	Qty	Part no.
72	Venting valve (=oil fill plug) with seal ring	1	0543 107 407
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 000 670
715	Screen	1	0534 000 041
—	Filter cartridge, paper, for inlet filter (optional)	1	0532 000 004
—	Filter cartridge, polyester, for inlet filter (optional)	1	0532 121 864

Spare Parts Kits

Spare parts kit	Part no.
Overhaul kit (incl. set of seals, marking “VT” and “DT”; insert for flexible coupling for Rotex only)	0993 134 022
Set of seals (marking “DT”)	0990 134 021

Accessories

Accessories	Description	Part no.
Inlet air filter	inlet-side, horizontal, with paper cartridge, to separate solids	0945 000 071

Oil

Denomination	Busch R 550

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 be 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 awritten consent of Busch.

We

Busch Produktions GmbH
Schauinslandstr. 1
79689 Maulburg
Germany

Declare that the vacuum pumps **MM 1324, 1202, 1252, 1322, 1200, 1250, 1320 AV**

In accordance with the European Directives:

- "Machinery" 2006/42/EC,
- "Electromagnetic Compatibility" 2004/108/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 ba 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)
EN 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61000-6-1 EN 61000-6-2	Electromagnetic compatibility (EMC) - Generic immunity standards
EN 61000-6-3 EN 61000-6-4	Electromagnetic compatibility (EMC) - Generic immunity standards

Manufacturer	Person authorized to compile the technical file
Dr.-Ing. Karl Busch General Director	**Andrej Riwe** Technical writer

Maulburg, 29.11.2012

Technical Data

For motor connection parameters see nameplate

Type	Frequency [Hz]	Ultimate pressure standard version [hPa abs = mbar abs]	Ultimate pressure version "Aqua" [hPa abs = mbar abs]	Nominal motor rating [kW]	Nominal speed [min^{-1}]	Nominal suction capacity [m^3/h]	Sound pressure level (EN ISO 2151) at 400 hPa (=mbar) abs. suction pressure [db(A)]	Weight [kg]	Ambient temperature range [°C]	Ambient pressure	Synchronising gear oil qty [l]	Synchronising gear oil filled ex-works
MM 1324 AV	50	60	200*	3.0	1500	160	70	~250 … 280	0 … 40	atmospheric	1	R 550
				4.0								
	60			4.2	1800	192	74					
MM 1202 AV	50	100*		4.2	3000	200	75	~235				
				4.3								
	60			5.2	3600	240	79					
				5.5								
MM 1252 AV	50			5.0	3000	250	75	~240 … 285				
				5.1								
	60			6.8	3600	300	79					
MM 1322 AV	50	150*		6.0	3000	300	77	~275 … 310				
				6.0								
	60			6.5	3600	360	82					
MM 1200 AV	50/60	100*		5.5	600-3600**	max. 240	79	~240				
MM 1250 AV						max. 300		~250				
MM 1320 AV		150*		8.1		max. 360	82	~310				
MM 1320 AV		200*		8.1	600-4200**	max. 420	86					

*to be limited by means of process control and/or vacuum relief valves

**see nameplate of the vacuum pump

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