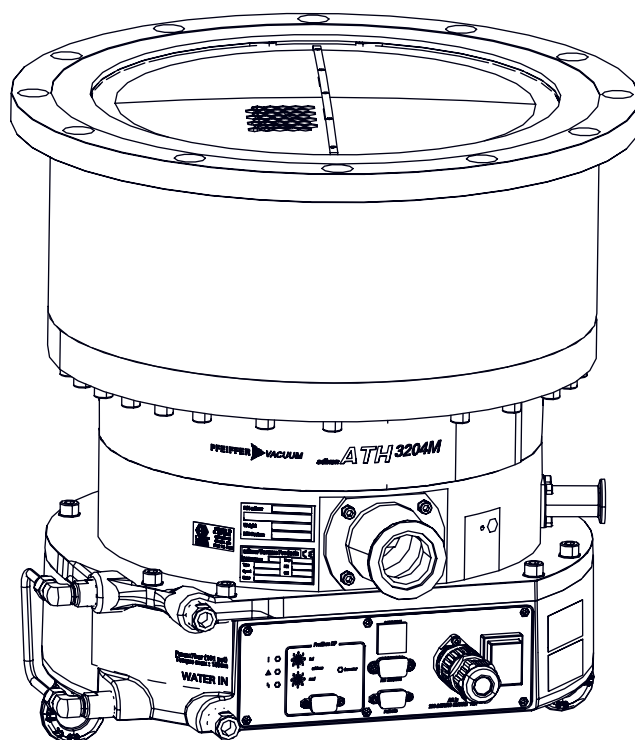




OPERATING INSTRUCTIONS

EN

Translation of the Original

ATH 2804 - ATH 3204 M/MT

Magnetically levitated turbomolecular pump

Disclaimer of liability

These operating instructions describe all models and variants of your product. Note that your product may not be equipped with all features described in this document. Pfeiffer Vacuum constantly adapts its products to the latest state of the art without prior notice. Please take into account that online operating instructions can deviate from the printed operating instructions supplied with your product.

Furthermore, Pfeiffer Vacuum assumes no responsibility or liability for damage resulting from the use of the product that contradicts its proper use or is explicitly defined as foreseeable misuse.

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We reserve the right to make changes to the technical data and information in this document.

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1 About this manual



IMPORTANT

Read carefully before use.

Keep the manual for future consultation.

1.1 Validity

This operating instructions is a customer document of Pfeiffer Vacuum. The operating instructions describe the functions of the named product and provide the most important information for the safe use of the device. The description is written in accordance with the valid directives. The information in this operating instructions refers to the product's current development status. The document shall remain valid provided that the customer does not make any changes to the product.

1.1.1 Products concerned

This document applies to products with the following part numbers:

Part Number	Description
TMAxxx4xx00 TMAxxx4xx5A	Pumps for light-duty applications
TMAxxx8xx01	Pumps for heavy-duty applications

The part numbers not ending in '00' or '01' concern products that feature the client's specifications: these are documented in another document. Nevertheless, these products are still used for a similar purpose, and it is the operator's responsibility to use this manual in conjunction with the additional document.

1.1.2 Applicable documents

Document	Part number
Operating instructions for Profibus fieldbus	004432
Operating instructions for EtherCAT [®] fieldbus	123800
Operating instructions for Devicenet fieldbus	123801 ¹⁾
Declaration of conformity	included with these operating instructions
1) also available at www.pfeiffer-vacuum.com	

1.2 Conventions

1.2.1 Pictographs

Pictographs used in the document indicate useful information.



Note



Tip

1.2.2 Target group

This user manual is intended for all persons in charge of transport, installation, commissioning/decommissioning, use, maintenance or storage of the product.

The work described in this document must only be carried out by persons with suitable technical training (specialized staff) or persons who have undergone Pfeiffer Vacuum training.

1.2.3 Instructions in the text

Usage instructions in the document follow a general structure that is complete in itself. The required action is indicated by an individual step or multi-part action steps.

Individual action step

A horizontal, solid triangle indicates the only step in an action.

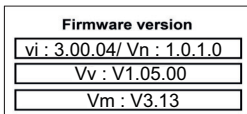
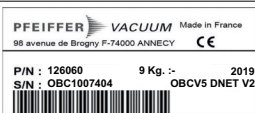
- This is an individual action step.

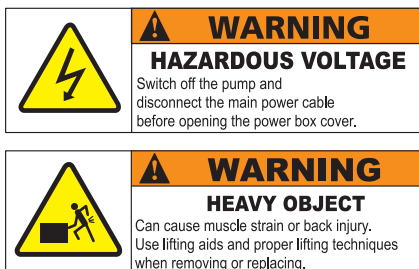
Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

1. Step 1
2. Step 2
3. ...

1.2.4 Labels

I/O	Switch on/Switch off
PURGE	Purge circuit connection
PUMP EXHAUST	Pump exhaust connection
WATER MAX Pr 7 bar/101 psi	Maximum water circuit pressure
WATER IN	Water circuit connection: inlet
WATER OUT	Water circuit connection: outlet
HEATING/BRAKING	Heating/Braking electrical cable
VENTING	Air inlet solenoid valve cable
WATER VALVE	Water solenoid valve cable
	Functional grounding connection
	CPC ground connection
	Direction of rotation of the pump rotor
	M10 holes for specific handling device connection (x 3)
	No lead presence in the product components (RoHS)
	Product rating plate (example)
	Software identification label (example)
	Electronic drive unit rating plate (example)



This label indicates that certain internal components carry an electric charge and can cause electric shock if touched: before working on the pump, always either disconnect it, or lock out/tag out the installation breaker in the appropriate manner.

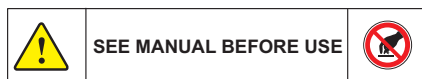
This label indicates that the product should not be handled manually due to its weight and that appropriate handling devices should always be used.



This label means that the user must lock the connector before using the pump. Do not disconnect before the pump has stopped.



This label warns users about the risk of crushing or cutting due to moving parts: keep a safe distance and/or keep your hands away from the moving parts.



Any person responsible for installation or operation of the product must first refer to the operating manual.

The product comes with a sheet of labels including other language versions. The installer must stick these labels to the most appropriate and visible place on the pump to warn the operator about potential hazards.



This label warns users that they risk being injured if their hands come into contact with a hot surface: protective gloves must be worn at all times when working on the pump.



This label warns users about pumped process gases that can be dangerous or toxic and lead to severe injury or death. It specifies that only trained personnel should perform preventive maintenance operations.

1.2.5 Abbreviations

AMB	Active magnetic bearings
Exh.	Exhaust
HHR	Hand Held Remote
IN	Inlet flange
LEL	Lower Explosive Limit
M	Pump version without temperature management system (no TMS)
MT	Pump version equipped with a temperature management system (TMS)
TMS	Temperature Management System
EtherCAT®	EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
[XXXX]	The HHR remote control unit menus and settings are shown in bold between square brackets. For example: [DEFINITION][LANGUAGE] to select the message display language.

2 Safety

2.1 General safety information

The following 4 risk levels and 1 information level are taken into account in this document.

DANGER

Immediately pending danger

Indicates an immediately pending danger that will result in death or serious injury if not observed.

- Instructions to avoid the danger situation

WARNING

Potential pending danger

Indicates a pending danger that could result in death or serious injury if not observed.

- Instructions to avoid the danger situation

CAUTION

Potential pending danger

Indicates a pending danger that could result in minor injuries if not observed.

- Instructions to avoid the danger situation

NOTICE

Danger of damage to property

Is used to highlight actions that are not associated with personal injury.

- Instructions to avoid damage to property



Notes, tips or examples indicate important information about the product or about this document.

2.2 Safety instructions

All safety instructions in this document are based on the results of the risk assessment carried out in accordance with Machinery Directive 2006/42/EC Annex I and EN ISO 12100 Section 5. Where applicable, all life cycle phases of the product were taken into account.

WARNING

Risk of crushing when the product is slung

Given the heaviness of the product, there is a risk of crushing during handling operations involving lifting devices. Under no circumstances shall the manufacturer be liable if the following instructions are not followed:

- Only qualified staff trained in handling heavy objects are authorized to handle the product.
- The lifting devices provided **must be used** and the procedures set out in this document must be followed.

⚠ WARNING**Risk of electric shock due to non-compliant electrical installations**

This product uses mains voltage for its power supply. Non-compliant electrical installations or installations not done to professional standards may endanger the user's life.

- ▶ Only qualified technicians trained in the relevant electrical safety and EMC regulations are authorized to work on the electrical installation.
- ▶ This product must not be modified or converted arbitrarily.
- ▶ Check that the product is properly connected to the equipment's or pumping installation's emergency stop circuit.

⚠ WARNING**Danger of electrocution by contact during maintenance or overhaul**

There is an electric shock hazard in case of contact with a product powered on and not electrically isolated.

- ▶ Before carrying out any work, set the main switch to **O**.
- ▶ Disconnect the power cable from the mains.
- ▶ Secure the installation correctly by tagging and locking (LO/TO) the system to prevent unintentional re-engagement.

⚠ WARNING**Risk of serious injury caused by the separation of the pump when the rotor is blocked**

If the pump is not secured properly and the rotor suddenly becomes blocked, the turbomolecular pump will detach from the equipment: the energy released could launch the entire pump or pieces of the pump across the room. This could cause severe, possibly fatal, injuries as well as serious property damage.

- ▶ Strictly comply with the installation instructions described in this manual. Pfeiffer Vacuum will be released from any warranty and liability for non-compliance with installation instructions.
- ▶ Only use approved original parts from Pfeiffer Vacuum for connection to the equipment (see accessories).

⚠ WARNING**Risk of poisoning when process gases are present in the atmosphere**

The manufacturer has no control over the types of gases used with the pump. Process gases are often toxic, flammable, corrosive, explosive and/or otherwise reactive. There is a risk of serious or fatal injury if these gases are allowed to escape freely into the atmosphere.

- ▶ Apply the relevant safety instructions in accordance with local regulation. This information is available from the operator's safety department.
- ▶ **Always connect the turbomolecular pump's exhaust to a backing pump compatible with process gases:** the backing pump's exhaust is connected to the installation's dangerous gas extraction system
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

⚠ WARNING**Risk of injury in case of contact with pressurized nitrogen**

The product uses pressurized nitrogen as a flushing gas. Non-compliant installations or installations not done to professional standards may endanger the user's life.

- ▶ Install a manual valve on the circuit at a distance of 3 m from the product, so that the nitrogen supply can be locked out.
- ▶ Observe the recommended supply pressure.
- ▶ Always lock out and disconnect the nitrogen circuit before working on the product.
- ▶ When carrying out maintenance, secure the installation properly by locating and locking out the pressurized nitrogen circuit to prevent it from being re-engaged by accident (LO/TO Lock Out/Tag Out procedure).
- ▶ Regularly check the condition of the pipework and supply circuit connections.

WARNING

Risk of injury in case of contact with pressurized water

The product uses pressurized water as a cooling fluid. Non-compliant installations or installations not done to professional standards may endanger the user's life.

- ▶ Install a manual valve on the circuit at a distance of 3 m from the product, so that the water supply can be locked out.
- ▶ Observe the recommended pressure and pressure differences.
- ▶ Always lock out and disconnect the water circuit before working on the product.
- ▶ When carrying out maintenance, secure the installation properly by locating and locking out the pressurized water circuit to prevent it from being re-engaged by accident (LO/TO Lock Out/Tag Out procedure).
- ▶ Regularly check the condition of the pipework and supply circuit connections.

WARNING

Risk of cuts on moving, sharp-edged parts when reaching into the open high vacuum flange

With the high vacuum flange open, access to sharp-edged parts is possible. A manual rotation of the rotor increases the danger situation. There is the risk of cuts, up to the separation of body parts (e.g. fingertips). There is a risk of hair and loose clothing being drawn in. Objects falling in destroy the turbopump during subsequent operation.

- ▶ Only remove the original protective covers immediately prior to connecting the high vacuum flange.
- ▶ Do not reach into the high vacuum connection.
- ▶ Wear protective gloves during installation.
- ▶ Do not start the turbopump with open vacuum connections.
- ▶ Always carry out the mechanical installation before electrical connection.
- ▶ Prevent access to the high vacuum connection of the turbopump from the operator side (e.g. open vacuum chamber).

WARNING

Risk of burns in case of contact with hot surfaces

For the operator's safety, the products are designed to avoid thermal risk. Depending on the application, the conditions of use generate high temperatures which require extra caution from users (surfaces > 65 °C).

- ▶ Pay attention to the marking of hot surfaces indicated by safety labels.
- ▶ Wait for the product to fully cool down before working on it.
- ▶ Protective gloves must be worn in accordance with standard EN ISO 21420.

2.3 Safety instructions relating to flammable/pyrophoric materials

It is the user and/or integrator who is/are solely responsible for the safety of the pump installation, the equipment and the gas exhaust extraction system. The user and/or the integrator is responsible for the application which uses the product.

Pumping pyrophoric or flammable gases may be hazardous. The user and/or integrator must comply with the safety instructions below and conduct a risk assessment.

DANGER

Danger of death by explosion or fire related to pyrophoric/flammable gases

Semiconductor, photovoltaic panel, flat panel display and industrial processes may use pyrophoric or flammable gases. When mixed with oxidizing agents, these gases can spontaneously combust (pyrophoric gases) or combust when ignited as a result of an unintended chemical reaction (flammable gases). In the worst case scenario, this could start a fire or set off an explosion causing metal parts to be ejected and serious injury to nearby persons.

- ▶ Conduct a risk assessment to assess the dangers before installing the pump.
- ▶ Install safety systems that comply with the requirements of the EN 50495 standard.

The risk assessment must take into account the pumped gases, by-products, and all components making up the installation. The following situations are hazardous and must be avoided at all cost:

- Flammable or pyrophoric gas concentrations in the flammable range.
- Flammable or pyrophoric gas concentrations above the flammable range (a leak could potentially cause the concentration to drop down into the flammable range).
- Insufficient dilution.
- An accumulation of reactive solids in the exhaust.
- Exposure of chemically-reduced species or reducing agents to oxidizing agents.

The following general safety recommendations must be applied:

- Ensure leak-tightness throughout system.
- Do not allow oxidizing agents (air, other gases, etc.) to mix with flammable/pyrophoric gases. ¹⁾
- Ensure that the oxidizing agent concentration does not exceed 60% of the maximum permissible concentration of the oxidizing agent gas (MOC) ²⁾, mainly when the dilution is not sufficiently high to reach 25% of the LEL.
- Perform a nitrogen gas purge prior to carrying out maintenance on the pumping line (inlet side, pump and exhaust lines).
- Regularly clean away reactive by-products such as silicon dust from the exhaust line to prevent clogging and/or explosion.

For further details on the safety instructions relating to flammable and pyrophoric gases, contact our service center.

Affix labels to the pump to identify the hazards inherent in all the above applications (flammability, explosion, toxicity, corrosion, etc.) and comply with the SEMI S1 requirements. This information must be added to the equipment operating instructions intended for end users.

2.4 Precautions



Duty to provide information on potential dangers

The product holder or user is obliged to make all operating personnel aware of dangers posed by this product.

Every person who is involved in the installation, operation or maintenance of the product must read, understand and adhere to the safety-related parts of this document.



Infringement of conformity due to modifications to the product

The Declaration of Conformity from the manufacturer is no longer valid if the operator changes the original product or installs additional equipment.

- Following the installation into a system, the operator is required to check and re-evaluate the conformity of the overall system in the context of the relevant European Directives, before commissioning that system.

Only qualified personnel trained in safety regulations (EMC, electrical safety, chemical pollution) are authorized to carry out the installation and maintenance described in this manual. Our service centers can provide the necessary training.

- ▶ **Secure the pump in strict compliance with the installation requirements.**
- ▶ Do not expose any part of the human body to the vacuum.
- ▶ Follow the safety and accident prevention requirements.
- ▶ Regularly check compliance with all precautionary measures.
- ▶ Do not remove the blanking plates sealing the inlet and exhaust ports if the product is not connected to the pumping line.
- ▶ Do not operate the product unless the inlet and exhaust are connected to a vacuum and exhaust pumping line.
- ▶ Before working on the inlet flange, wait until the rotor is immobilized.
- ▶ Keep pipes and cables well away from hot surfaces (> 70°C).

1) Reference NFPA 69-2019, § 8.3.1 chap.8 Deflagration prevention by combustible concentration reduction.

2) Reference NFPA 69-2019, § 7.7.2.5 chap.7 Deflagration prevention by oxydant concentration reduction.

2.5 Intended use

- The vacuum pump should only be used to generate a vacuum while pumping gases.
- The turbomolecular pump must be combined with an appropriate backing pump.
- The MT Version pump can be used to pump condensable fluids as long as condensation does not occur in the pump.
- The vacuum pump must be integrated into industrial equipment.

When the pump is integrated into industrial equipment, it becomes a pumping component: the integrator of this component must provide the operator with all safety measures, notably for hot surface risks.

2.6 Misuse

Misuse of the product will render the warranty and any claims void. Any use, whether intended or not, that diverges from the uses already mentioned will be treated as non-compliant; this includes but is not limited to:

- Pumping reactive fluids
- Pumping of corrosive or explosive media
- Pumping liquids
- Pumping of solids
- Pumping dust particles
- Pumping of media with risk of condensables (M version)
- Operation with improper high gas throughput
- Operation with improper high fore-vacuum pressure
- Operation with improper high levels of radiated heat input
- Venting with improper high venting rates
- Using accessories or spare parts not mentioned in these operating instructions
- Using the pump in potentially explosive areas
- Using the vacuum pump to generate pressure
- Operation in areas with ionizing radiation
- Operation in improper high magnetic fields
- Use of the devices in systems in which impact-like stress and vibrations or periodic forces affect the devices

3 Transportation and Storage

3.1 Receipt of the product



Condition of the delivery

- Check that the product has not been damaged during transport.
- If the product is damaged, take the necessary measures with the carrier **and** notify the manufacturer.

- ▶ Keep the product in its original packaging so it stays as clean as it was when dispatched by us. Only unpack the product once it has arrived at the location where it will be used.
- ▶ Keep the blanking plates in place on the inlet, exhaust and purge ports while the product is not connected to the pumping line.



Keep the packaging (recyclable materials) in case the product needs to be transported or stored.

3.2 Handling the pump

WARNING

Risk of crushing when the product is slung

Given the heaviness of the product, there is a risk of crushing during handling operations involving lifting devices. Under no circumstances shall the manufacturer be liable if the following instructions are not followed:

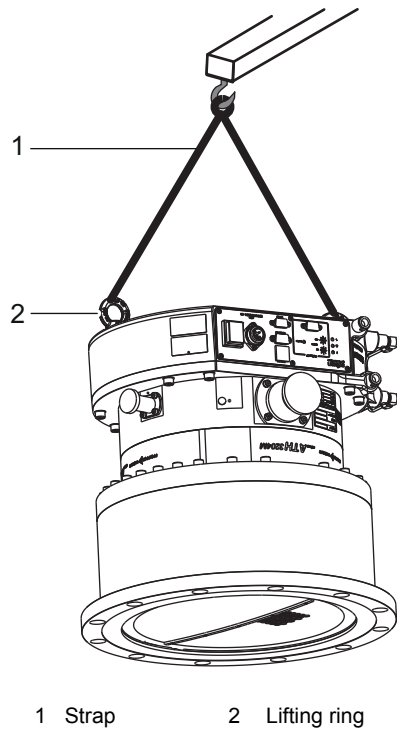
- ▶ Only qualified staff trained in handling heavy objects are authorized to handle the product.
- ▶ The lifting devices provided **must be used** and the procedures set out in this document must be followed.

WARNING

Risk of crushing due to product tilting

Even though compliance with EEC safety rules is guaranteed, all necessary precautions should be taken when handling and installing the product **until the pump has been integrated into the equipment**.

- ▶ Do not place the pump on an inclined plane.
- ▶ Do not push the pump sideways.
- ▶ Always secure the pump until it has been integrated into the equipment (mounting holes in the inlet flange).



Handling the pump using a hoist

When handling the pump, **a lifting device appropriate for the weight of the product must be used.** The weight and center of gravity vary depending on the model (see chapter "Dimensions").

1. Use the lifting rings installed on the electronic drive unit.
2. Use a multi-strand strap :
 - minimum length of 500 mm,
 - load per arm > 100 Kg.
3. Secure the pump using lifting rings and hoist it.
4. **Always transport** the turbomolecular pump in an upright position.

3.3 Storage

Storing a new pump

- ▶ Keep the pump wrapped in its protective envelope.
- ▶ **Always** leave the inlet, the exhaust and purge blanking plates in place.
- ▶ Store the pump in line with the permitted storage temperatures (see chapter "Environmental conditions").
- ▶ Store the pump in a clean, dry and non-contaminated area, **for a maximum period of 1 year.**

Storage after use

- ▶ To store a pump that has been used, (see chapter "Shutting down for longer periods").

4 Product description

4.1 Product identification

To correctly identify the product when communicating with our service center, always have the information from the product rating plate available (see chapter "Labels").

4.1.1 Scope of delivery

- 1 magnetically levitated turbomolecular pump with integrated electronic drive unit
- 1 splinter shield (in the pump inlet flange)
- 2 lifting rings installed on the product
- 1 label sheet
- 1 operating instructions

and, depending on the ordering guide, the following components are present:

- 1 copper gasket
- 1 flow reduction device
- 1 set of screws and bolts
- 1 purge solenoid valve
- 1 air inlet solenoid valve



The hand-held remote control (HHR) is not included in the order. To order, see chapter "Accessories".

4.1.2 Product applications

The pump manufacturer has developed a range of reliable, high performance magnetically levitated turbopumps with active magnetic bearings (AMB) and compression stages. They are specially adapted for coating and dry-etching plasma processes, for glass coating as well as for R&D applications. These pumps are equipped with an integrated electronic drive unit.

These pumps are characterized by their resistance to corrosion, robustness, high gas throughput at high operating pressure and lack of maintenance requirements.

For more detailed information on specific applications, please contact us.

Rotation speed

The magnetically levitated pump rotation speed can be selected and set between a minimum speed and the nominal speed. This makes it possible to optimize pumping characteristics according to each application (for example, high pressure pumping). A distinction is made between the following speeds:

- Selected rotation speed (= Stand-by speed) between minimum speed and the nominal rotation speed.
- Nominal rotation speed set in the factory.

M version pump

Standard version is suitable for most of the clean applications. This pump version has no temperature management system (no TMS).

MT version pump

This MT version is recommended for any application where high temperature for the pump and gases are demanded in order to minimize the condensation in the pump. This pump version is equipped with a temperature management system (TMS). The temperature management is controlled via the integrated electronic drive unit.

4.1.3 The options

To enhance product suitability for specific applications, the manufacturer has made several options available that can be configured when ordering. How these options operate and how to use them are described where necessary in the chapters of this manual. The options are:

- air inlet solenoid valve,
- purge solenoid valve,
- control interface type Remote, EtherCAT[®], Profibus, Devicenet, LonWorks.

4.2 Man/machine interface

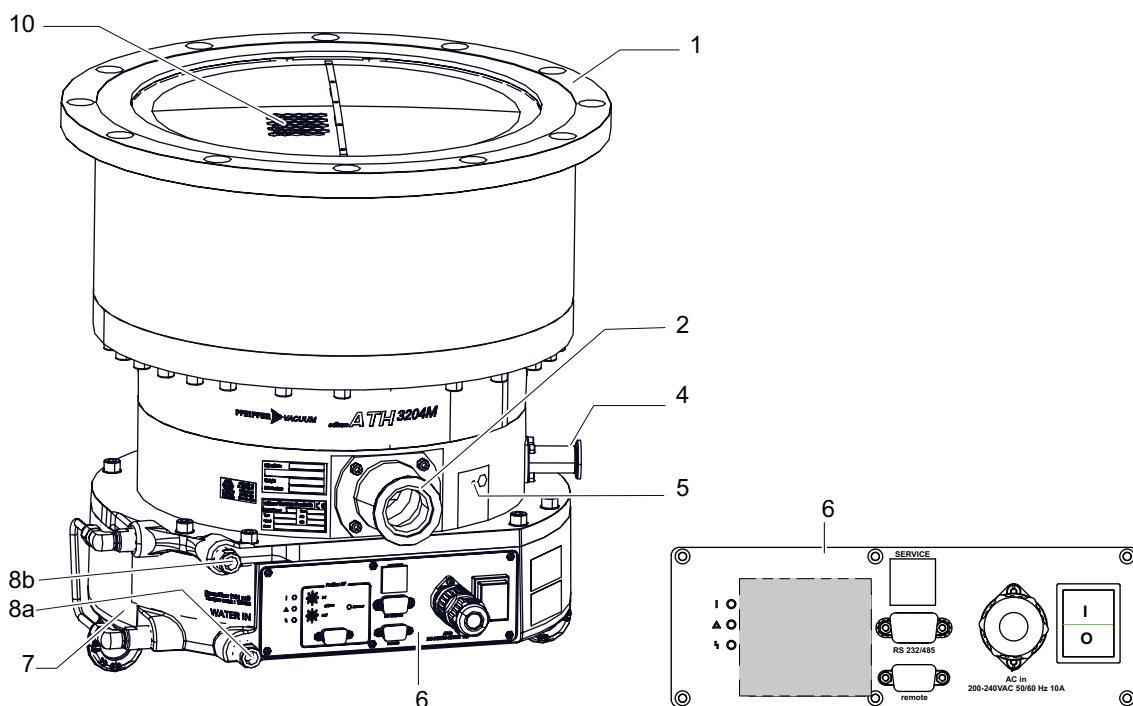


Fig. 1: Description of an ATH 3204 M pump

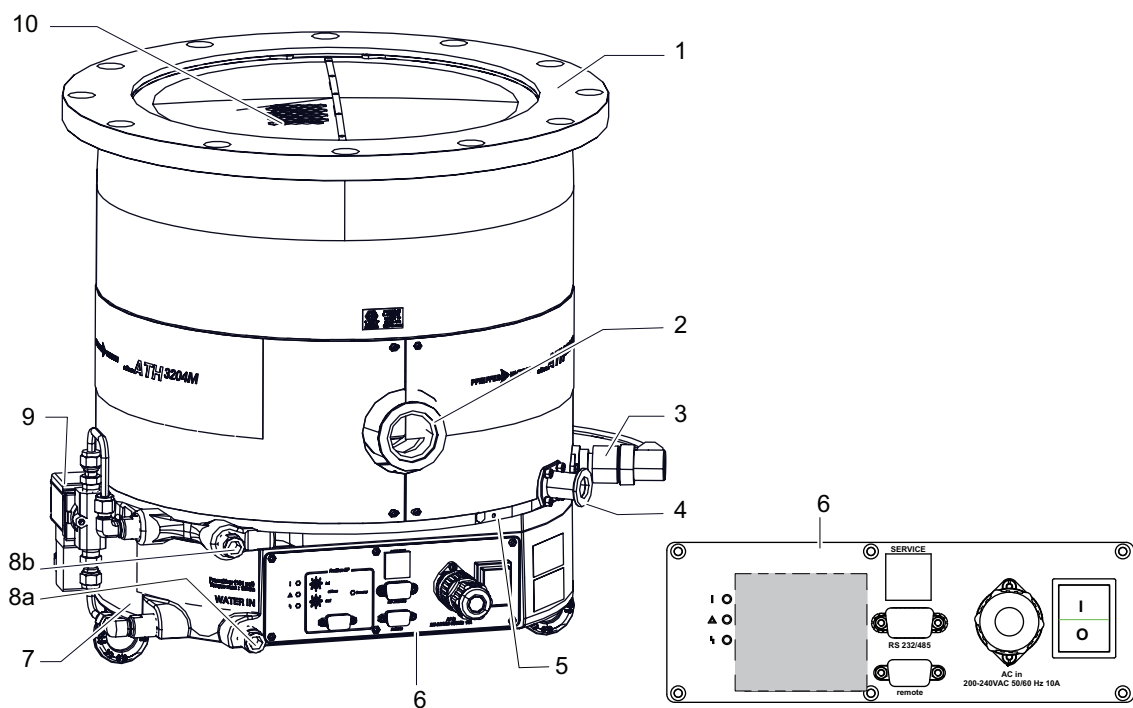


Fig. 2: Description of an ATH 3204 MT pump

Man/machine interface			
1	Inlet flange (high vacuum flange)	6	Control interface
2	Exhaust flange (Pump exhaust)	7	Integrated electronic drive unit
3	Heating band electrical connector (MT version pump)	8a	Water connection (WATER IN)
		8b	Water connection (WATER OUT)

Man/machine interface			
4	Neutral gas purge (PURGE)	9	Water solenoid valve (MT version pump)
5	Functional grounding	10	Splinter shield

4.3 Electronic drive unit

The magnetically levitated pump with integrated electronic drive unit is intended to be installed into and controlled by the equipment.

As standard, the electronic drive unit is equipped with an **RS-232/RS-485** serial link interface. It can also be controlled with the hand-held remote **HHR** available as an accessory (see chapter "Accessories").

Depending on the ordering guide, the integrated electronic drive unit is equipped with an interface that allows control through **REMOTE**, **EtherCAT**®, **Profibus**, **Devicenet** or **LonWorks** control networks.

In this document, only the operations with the **REMOTE**, **RS-232/RS-485** and **HHR** interfaces are described.

For the other interfaces, please refer to the operating manual of the control interface installed on the pump (see chapter "Applicable documents").

Regardless of the product's configuration, **the control interface** of the electronic drive unit enables a connection to the control network and display of the pump's operating status.

The integrated electronic drive unit makes it possible to:

- power the magnetically levitated turbomolecular pump,
- power and control the water solenoid valve and the heating (MT version pump),
- power the purge solenoid valve and air inlet valve (options). These can be controlled through the electronic interface if the wiring and configuration are made.

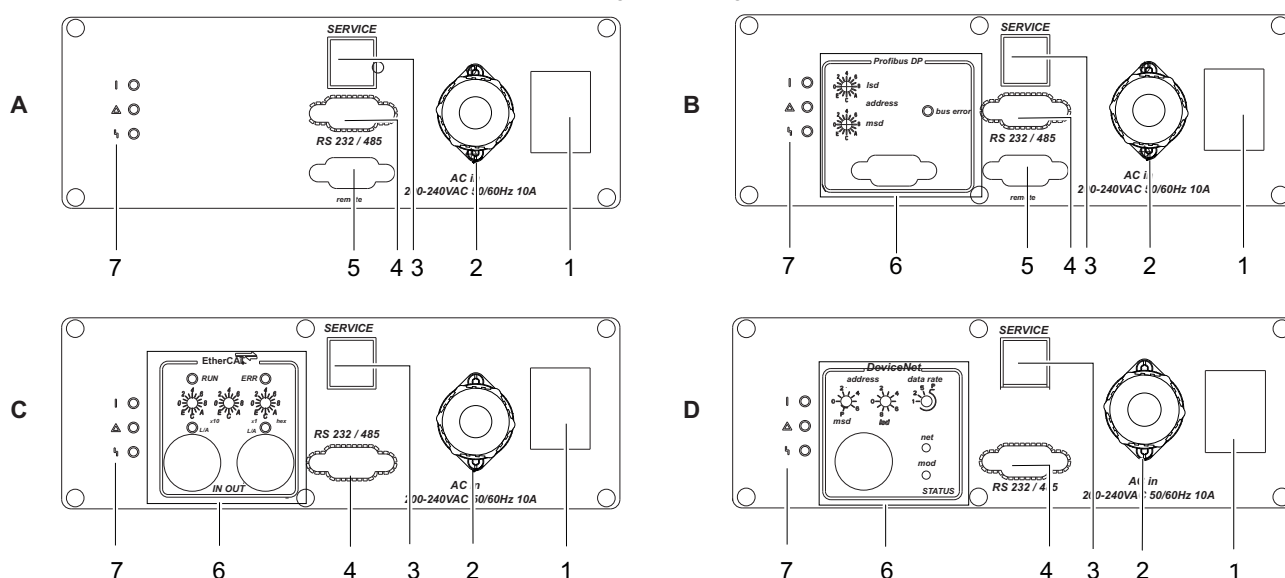


Fig. 3: Example of integrated electronic drive unit

Fig. A REMOTE - RS-232/RS-485 interface

Fig. B Profibus interface

Fig. C EtherCAT® interface

Fig. D DeviceNet interface

1	Mains switch I/O	Powering on the pump
2	Power supply connector	Used to connect a power supply cable
3	Service	Hand held remote control connector
4	RS-232/RS-485 serial link	The RS-232/RS-485 serial link is used to drive and control the pump from a computer. The RS-485 serial link enables the installation and control of several pumps simultaneously.
5	REMOTE connector	The REMOTE connector is used to drive the START/STOP/STANDBY , functions to enable the remote pump status via dry contacts.

6	Fieldbus connection area	<i>See chapter "Applicable documents"</i>
7	Pump status indicator lights	<i>Display of the pump operating status</i>

5 Installation

The installation of the turbopump and its fastening is of outstanding importance. The rotor of the turbopump revolves at very high speed. In practice it is not possible to exclude the risk of the rotor touching the stator (e.g. due to the penetration of foreign bodies into the high vacuum connection). The kinetic energy released acts on the housing and on the anchoring of the turbopump within fractions of a second.

Comprehensive tests and calculations conforming to ISO 27892 confirm the safety of the turbopump both against crashes (destruction of the rotor blades) and against bursting (breakage of the rotor shaft). The experimental and theoretical results are expressed in safety measures and recommendations for the correct and safe fastening of the turbopump.

5.1 Equipment installation conditions

WARNING

Risk of serious injury caused by the separation of the pump when the rotor is blocked

If the pump is not secured properly and the rotor suddenly becomes blocked, the turbomolecular pump will detach from the equipment: the energy released could launch the entire pump or pieces of the pump across the room. This could cause severe, possibly fatal, injuries as well as serious property damage.

- ▶ Strictly comply with the installation instructions described in this manual. Pfeiffer Vacuum will be released from any warranty and liability for non-compliance with installation instructions.
- ▶ Only use approved original parts from Pfeiffer Vacuum for connection to the equipment (see accessories).

The equipment frame on which the pump is installed must be sufficiently rigid to absorb the kinetic energy if the rotor blocks suddenly. For this, take into account:

- The maximum loads to calculate the attachment devices.
- The inlet flange dimensions.
- The quality and number of screws.
- The type of connection between the pump inlet and the chamber to be pumped.

When the pump is connected according to the manufacturer's recommendations, in case of overpressure resulting from an incident, the pump enclosure can withstand maximum static pressure of $11 \cdot 10^3$ hPa for 1 minute.

5.1.1 Installation specifications

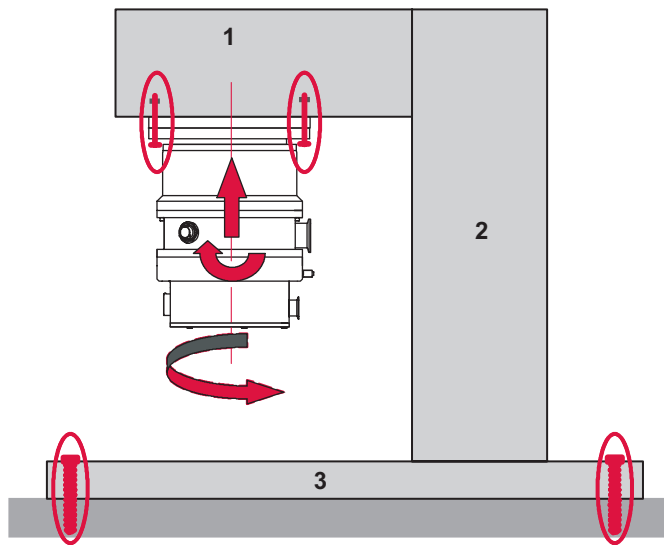


Fig. 4: Mechanical connection of the pump to the equipment

- | | |
|------------------|---------------------|
| 1 Vacuum chamber | 3 Frame |
| 2 Equipment | Secure anchor point |

Description of a sudden blocking scenario

The kinetic energy of the rotor has to be absorbed by the installation if the pump blocks suddenly. The maximum resulting loads have been measured on a test bench by simulating the worst-case turbo pump blockage with a rotor split in two with the pump rotating at nominal speed. The impact on the rotor parts creates the following transient loads.

Axial force (A)

The rotor parts can be ejected out of the pump inlet flange and can hit the valve plate or any other part of the system. If this is placed close to the turbo pump and if it has high stiffness, the impact can create a high axial force on the installation. Such axial force has not been observed on a standard pendulum valve, or when there is a free space greater than 100 mm.

Bending moment (B)

The impact of the rotor parts on the housing will create a radial force on the housing. This radial force will create a bending moment on the system as a function of the distance to the pump.

Torque (C)

The deceleration of the rotor parts creates a torque value on the pump housing, which is transmitted to the system. The maximum values of the axial force and the bending moment occur at approximately the same time. A delay of up to several ms has been observed for the maximum torque value.

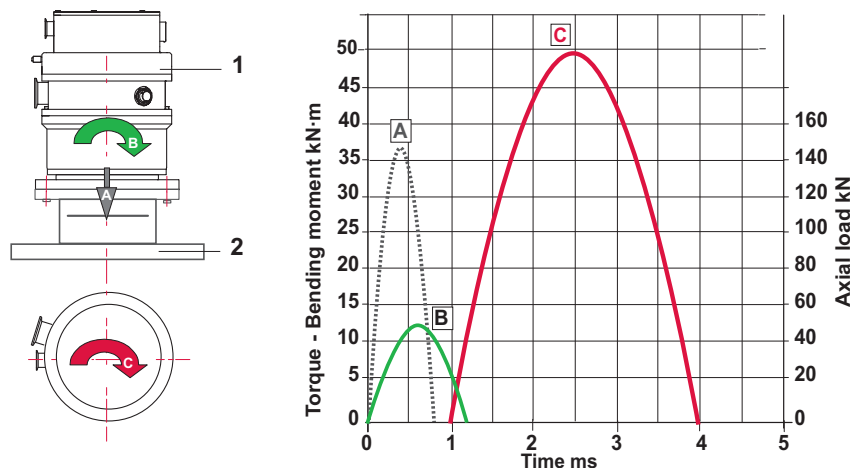


Fig. 5: Graph of the loads exerted on the equipment

- | | |
|-------------|------------------|
| 1 Turbopump | 2 Pendulum valve |
|-------------|------------------|

Characteristics	Unit	ATH 2804 - ATH 3204
Nominal speed	min ⁻¹	25000
Energy	kN·m	160
Torque (C)	Max. kN·m	< 50
	Duration ms	3
	Delay ms	1
Bending moment (B)	Max. kN·m	< 13
	Duration ms	1.3
	Delay ms	0
Axial force (A) ¹⁾	Max. kN	< 147
	Duration ms	< 1
	Delay ms	0

1) Maximum axial force occurs when pump inlet is blocked by the rigid parts. There is no load on the equipment in case of limited stiffness, e.g. with a valve.

Tbl. 1: Loads exerted on the equipment

5.1.2 Securing the equipment and the frame

Fastening the pump to the equipment

The maximum load caused by a sudden blockage must be absorbed by the pump's fastening elements.

- ▶ Design and secure the frame of the pump so that it can withstand the maximum load.
- ▶ The screws **must be** tightened with a torque wrench in accordance with the tightening torques in the following table:
 - if the torque is low: risk of screws loosening.
 - if the torque is high: risk of the screws deteriorating.

Type of inlet flange	DN250 CF-F	DN250 ISO-F	DN300 CF-F	DN320 ISO-F	VG 250	VG 350	VG 300
Type of screw ¹⁾	M 8	M 10	M 10	M 12	M 12	M 12	M 12
Number of screw ¹⁾	32	12	32	12	12	12	12
Screw metric grade ¹⁾	12-9	12-9	12-9	12-9	12-9	12-9	12-9
Tightening torque per screw (N·m)	20	30	30	50	50		
Total clamping force (N)	388000	197000	491000	283000	283000		
Length of screw (mm)	≥ 35	≥ 35	-	≥ 40	-	≥ 45	≥ 40

1) The type, number, grade and tightening torque of the screw are **imposed** and **mandatory**.

Tbl. 2: Securing the high vacuum flange (inlet flange)

The manufacturer recommends using set of screws designed for this purpose (accessories). Contact our service center.

Frame fastening

If the frame is not designed to withstand the maximum loads in case of sudden blockage, contact our service center who will help you design your installation.

5.2 Positioning the pump

NOTICE

Pump damage caused by external vibrations

External pump vibrations or shocks may cause magnet bearing overload and therefore landing bearing stress.

- ▶ Avoid lateral and tilting pump movements.
- ▶ Configure the equipment appropriately to compensate for external vibration.
- ▶ Secure the vacuum chamber on the equipment side against moving and tilting.

⚠ CAUTION

Risk of falling due to poorly-secured cables or pipework

The space around the pump must be kept clear of obstacles to prevent falls from potentially occurring.

- Route and secure electric cables and pipework in the appropriate pathways.

The manufacturer guarantees proper operation of the pump if it is used in a uniform magnetic field up to 0.5 mT. From 0.5 to 5 mT, proper operation depends on cooling and gas loads. A magnetic field exceeding 5 mT can cause excessive rotor heating. In this case, suitable shielding must be provided.

The standalone pump can withstand radiation levels of up to 10^3 Gy.

The turbomolecular pump cannot evacuate at atmospheric pressure; it must be connected to a backing pump. For a transient period, they can start to run at atmospheric pressure.

The turbomolecular pump can operate in any position.

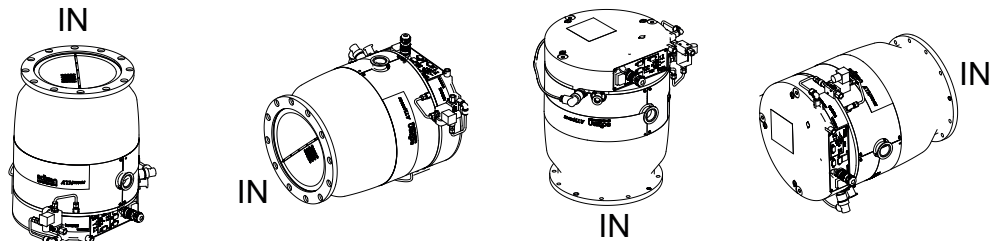


Fig. 6: Operating positions

Positioning the pump

1. Handling the pump, see chapter "Handling the pump".
2. Connect and secure the turbomolecular pump fastening to ensure operator safety and operational reliability (see chapter "Installation specifications").
3. Stick the safety labels in the operator's language to the most appropriate and visible place on the pump to warn the operator about potential hazards.

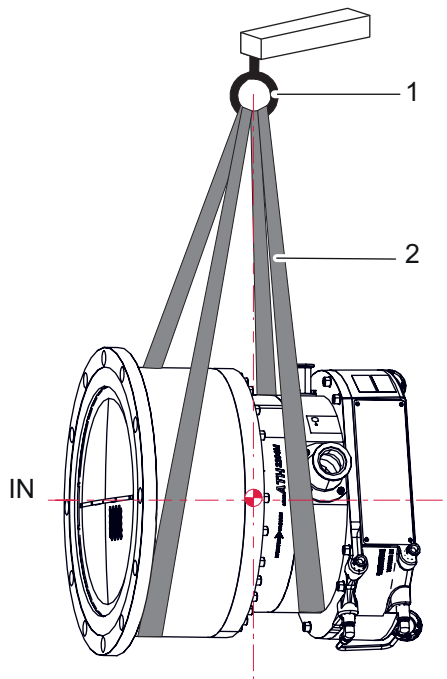


Fig. 7: Installing the pump horizontally

1 Strap (Qty2)

2 Safety hook

Installing the pump horizontally

When handling the pump, **a lifting device appropriate for the weight of the product must be used.** The weight and center of gravity vary depending on the model (see chapters “Technical data” and “Dimensions”).

1. Use 2 EN-1492-1 approved multi-strand straps that can support the weight of the pump.
2. Use approved accessories to attach the pump to the lifting device (e.g. hook with safety lock).
3. Position the straps securely around the pump.
4. **Position the lifting device hook vertically above the center of gravity.**
5. Hoist up the pump and move it to its location on the frame.
6. Keep the pump hanged all the installation time until the high vacuum flange is secured.

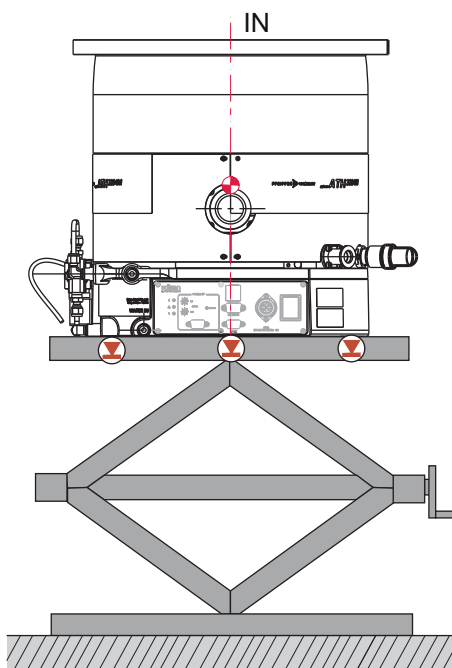


Fig. 8: Installing the pump inlet facing up

- 1 Lifting table (example)  Securing holes

Installing the pump inlet facing up

When handling the pump, **a lifting device appropriate for the weight of the product must be used.** The weight and center of gravity vary depending on the model (see chapters “Technical data” and “Dimensions”).

1. Affix the pump to the lifting device by using the holes designed and labelled for this purpose to avoid the tilting of the pump.
2. Keep the pump attached to the lifting device until the high vacuum flange is secured.

5.3 Connecting to the pumping line

The presence of pyrophoric, flammable or toxic materials in the pump can lead to additional risks, which the operator must assess and manage for the entire pumping installation.

The user and/or product OEM is ultimately responsible for the equipment and must apply the specific safety instructions, in accordance with local regulation.

DANGER

Danger of death by fire when pumping flammable gases

There is a fire risk caused by an unintended chemical reaction (ignition) between two pumped flammable materials.

- Provide an electromechanical LEL detection device in the extraction system (detection capability at 25% of the LEL) that will stop chemical supply to the pump when gas is detected over 25% of the LEL for that flammable material.

⚠ WARNING**Risk of crushing and/or cutting in case of contact with moving parts**

The pump inlet flange is large enough for body part (finger or hand) to be inserted into it, presenting a risk of crushing due to contact with moving parts. The inlet and exhaust ports should be sealed with blanking plates before connection.

- ▶ Wait for the pumping line to be connected before removing the blanking plates.
- ▶ **Wait for the pump to be connected before powering on.**

General instructions for installing the pump in the pumping line in accordance with industry best practice

The inlet and exhaust connections must not put undue strain on the pumping line that could cause leakage.

1. Wear gloves to connect and remove the pump from the equipment.
2. Always complete the mechanical installation before the electrical connection.
3. **Avoid connecting a reducing flange to the pump inlet.** Contact us if necessary.
4. **Check that the splinter shield is installed in the inlet flange.**
5. Only use accessories on the pumping line, for the inlet and exhaust lines, with materials and sealing properties that are compatible with the gases being pumped. Refer to the connection accessories catalog available at the [Pfeiffer-Vacuum](https://www.pfeiffer-vacuum.com) website.
6. When assembling the pumping line, include accessories for isolating the pump from the pumping line and making maintenance easier to carry out (pump inlet and exhaust isolation valves, purge valves, etc.).
7. The O-rings located under the blanking plates are not compatible with all applications. **Product users or integrators are responsible for installing O-rings compatible with the application.**
8. Remove the blanking plates used to seal the inlet and exhaust ports.
9. Keep the blanking plates, screws and washers for reuse when transporting the pump.
10. Ensure that no screws, washers or other objects are dropped into the pump inlet.
11. Perform a leak test on the entire pumping line after installation.

5.3.1 Pump inlet connection**⚠ WARNING****Risk of cutting injuries due to contact with sharp edges via the high vacuum flange**

With the high vacuum flange open, access to sharp-edged parts is possible. A manual rotation of the rotor increases the danger situation. There is the risk of cuts, up to the separation of body parts (e.g. fingertips).

- ▶ Wait for the pump to come to a complete standstill, before starting any work on the product.
- ▶ Keep the splinter shield in the inlet flange, as it limits the risk of injury.
- ▶ Wear protective gloves in accordance with standard EN ISO 21420.
- ▶ Never disconnect the high vacuum flange before the rotor is completely immobilized.

NOTICE**Failure to meet cleanliness requirements poses a risk of process contamination**

When parts in contact with high vacuum are dirty, pumping time increases and the process is contaminated.

- ▶ Use only dry parts and clean, grease-free, dust-free pipelines.
- ▶ Wear gloves when making connections, especially on the high vacuum side.



Make sure that the parts or chambers connected to the inlet of our products can withstand a negative pressure of $1 \cdot 10^{-3}$ hPa relative to atmospheric pressure.

5.3.2 Pump exhaust connection

WARNING

Risk of poisoning when process gases are present in the atmosphere

The manufacturer has no control over the types of gases used with the pump. Process gases are often toxic, flammable, corrosive, explosive and/or otherwise reactive. There is a risk of serious or fatal injury if these gases are allowed to escape freely into the atmosphere.

- ▶ Apply the relevant safety instructions in accordance with local regulation. This information is available from the operator's safety department.
- ▶ **Always connect the turbomolecular pump's exhaust to a backing pump compatible with process gases:** the backing pump's exhaust is connected to the installation's dangerous gas extraction system
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

- ▶ Connect the turbopump with an approved backing pump (see chapter "Technical data").
- ▶ Install an isolation valve (NC) between the turbomolecular pump and the backing pump.

5.4 Connecting the water circuit

To **limit corrosion** and **clogging of the water circuit**, we recommend using softened or non-aggressive water with the required characteristics (see chapter "Water characteristics"). If the solid pollution characteristics cannot be met, install a filter on the water inlet.

NOTICE

The water cooling circuit may be damaged if an unregulated mains supply is used

Using unregulated mains water can lead to water circuit clogging due to limescale deposition. This may necessitate complete cleaning and overhaul of the water cooling circuit.

Furthermore, **the presence of micro-organisms such as algae and biological substances such as bacteria** can lead to problems in the cooling circuit.

- ▶ Connect the water cooling circuit to a regulated water supply.
- ▶ Take appropriate measures to prevent the growth of such micro-organisms.



The effect of cooling continuity on the process

If an interruption to the water circuit represents a serious risk for the process, it is advisable to control the pump cooling with an external system capable of taking over if the water circuit fails.

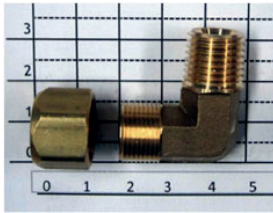
WARNING

Risk of injury in case of contact with pressurized water

The product uses pressurized water as a cooling fluid. Non-compliant installations or installations not done to professional standards may endanger the user's life.

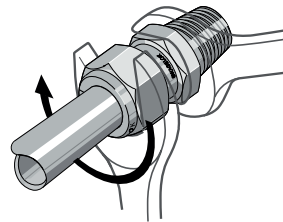
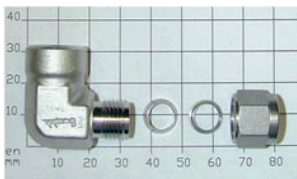
- ▶ Install a manual valve on the circuit at a distance of 3 m from the product, so that the water supply can be locked out.
- ▶ Observe the recommended pressure and pressure differences.
- ▶ Always lock out and disconnect the water circuit before working on the product.
- ▶ When carrying out maintenance, secure the installation properly by locating and locking out the pressurized water circuit to prevent it from being re-engaged by accident (LO/TO Lock Out/Tag Out procedure).
- ▶ Regularly check the condition of the pipework and supply circuit connections.

5.4.1 Procedure for assembly connectors



Threaded connections bonding and tightening procedure

1. Use 1/4 NPT male connectors (to be supplied by the customer).
2. Bond the connections using oleo-waterproof glue or put PTFE sealing tape on the threads.
3. Tighten the connection **while keeping the baseplate on the pump side**.



Procedure for the assembly of twin ferrule connectors

Connectors used to connect rigid pipe (stainless steel, nickel plated copper, etc.).

1. Insert the pipe with the ferrules until it is affixed tightly to the connector.
2. Lock the fitting in position
3. Manually place the nut into contact.
4. Tighten the nut **3/4 turn using an open-ended spanner while holding the body of the connector still**.

5.4.2 Connecting the pump to the water circuit

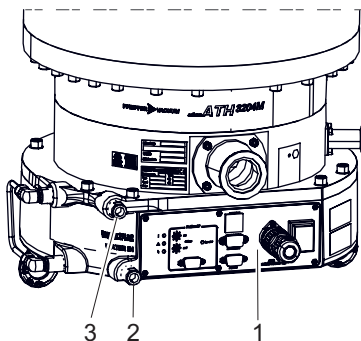


Tightening the connectors and direction of water circulation

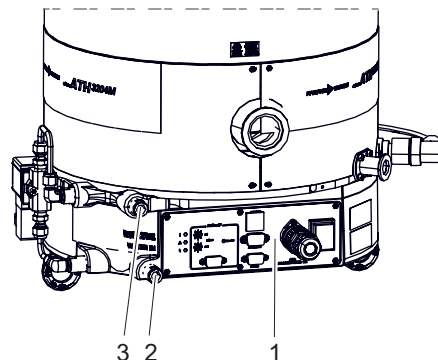
Observe the connection/tightening procedure of the connectors to avoid any risk of leaks.

MT version pump: observe the direction of water circulation so as not to disrupt the operation of the solenoid valve.

M version pump



MT version pump



- 1 Electronic drive unit
- 2 Water inlet connector (WATER IN)
- 3 Water outlet connector (WATER OUT)

Water-cooling circuit connection

Provide a water-cooling circuit and a tap to adjust the flow.

1. Connect the water inlet circuit to the **WATER IN** connector and the water outlet to the **WATER OUT** connector of the pump drainage circuit.
2. Check that there are no leaks in the water circuit or on the water circuit connections.

5.5 Nitrogen circuit connection

Depending on the application, the inert gas purge can consist of:

- Injecting ambient air, or
- Injecting an inert gas into the pump.

In this manual, the inert gas will be called 'nitrogen', as it is the most commonly used gas. For more information on the type of purge gas, contact our service center.

⚠ DANGER**Danger of death by explosion when pumping gases containing pyrophoric/flammable materials**

There is a risk of explosion if pyrophoric materials above the LEL are sent to the pump.

- ▶ Ensure there is a sufficient flow of nitrogen to lower the concentration below the LEL.
- ▶ Provide an interlock to ensure that gas flow towards the pump is stopped if the nitrogen flow is interrupted.

⚠ WARNING**Risk of injury in case of contact with pressurized nitrogen**

The product uses pressurized nitrogen as a flushing gas. Non-compliant installations or installations not done to professional standards may endanger the user's life.

- ▶ Install a manual valve on the circuit at a distance of 3 m from the product, so that the nitrogen supply can be locked out.
- ▶ Observe the recommended supply pressure.
- ▶ Always lock out and disconnect the nitrogen circuit before working on the product.
- ▶ When carrying out maintenance, secure the installation properly by locating and locking out the pressurized nitrogen circuit to prevent it from being re-engaged by accident (LO/TO Lock Out/Tag Out procedure).
- ▶ Regularly check the condition of the pipework and supply circuit connections.

A filtered dry nitrogen supply with the given characteristics is required for optimum performance (see chapter "Nitrogen characteristics").

Inert gas purge**NOTICE****Inert gas purge function**

When the inert gas purge is stopped, the pumped gases can pass from the fore vacuum side to the high vacuum side and damage the bearing housings.

- ▶ Maintain the inert gas purge flow as long as the rotor is running to prolong the flushing.
- ▶ The purge maximum pressure must not exceed $1 \cdot 10^3$ to $1.5 \cdot 10^3$ hPa (absolute).

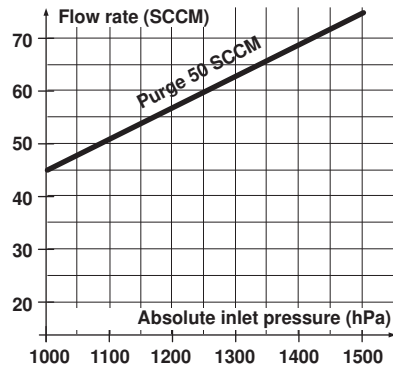
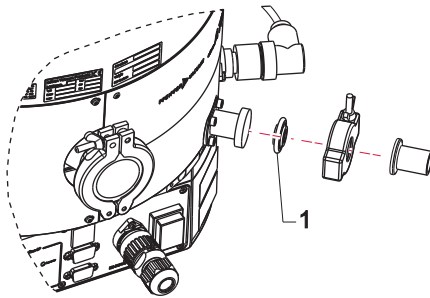


Fig. 9: Purge flow diagram



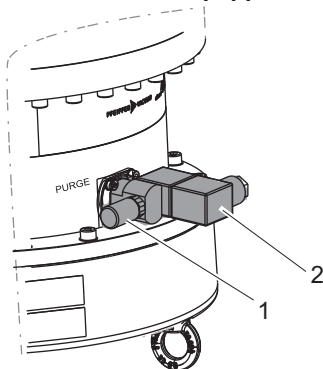
1 Flow reduction - 50 sccm

Purge device 50 sccm

The operation of this purge is continuous. The flow reducer guarantees a 50 sccm flow for a pressure of $1.1 \cdot 10^3$ hPa. When the inert gas line is equipped with a mass flowmeter, do not install the flow reduction device.

1. Directly connect the inert gas supply to the **PURGE** port equipped with the flow reduction device (see chapter "Accessories").
2. Adjust the inert gas pressure to obtain the desired flow (see Purge flow diagram).

Solenoid valve equipped with 50 sccm purge



1 Dust filter 2 Purge solenoid valve

Solenoid valve equipped with 50 sccm purge

This option is available depending on the pump configuration.

The solenoid valve installed on the pump is supplied and controlled by the electronic drive unit connected to the pump.

1. Connect the solenoid valve to the **PURGE** port (affixed using 4 supplied screws).
2. Control the solenoid valve via the **REMOTE** connector or via the serial link from the electronic drive unit.

Connection of the purge solenoid valve to an inert gas line

This solenoid valve can be connected to an inert gas line. The inert purge flow must be present when the pump is running.

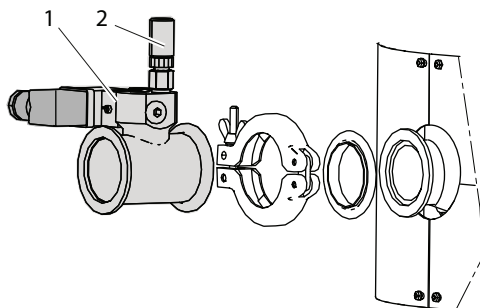
When the pump is stopped, the solenoid valve can be closed to perform a tightness test on the equipment.

1. Remove the dust filter from the solenoid valve.
2. Connect the inert gas line instead.
3. Bond the connection using oleo-waterproof glue, or put PTFE sealing tape on the threads.
4. Tighten the connection, applying a maximum tightening torque of 10 N·m.
5. Adjust the inert gas pressure to obtain the desired flow (see Purge flow diagram).

5.6 Connection of the air inlet solenoid valve

This option is available depending on the pump configuration.

The air inlet solenoid valve (flow $11 \cdot 10^3$ sccm), is calibrated to restore the atmospheric pressure in the pump internal volume. When isolation valves are installed on the pump inlet and exhaust, the rotor slow-down efficiency is improved. This solenoid valve is supplied and controlled by the electronic drive unit.



1 Air inlet solenoid valve 2 Dust filter

1. Connect the solenoid valve to the **PUMP EXHAUST** port of the pump (use connecting accessories of product catalog).
2. Connect the solenoid valve to the **VENTING** connector of the electronic drive unit.
3. Send a control order via the control panel (remote control, the serial link or the fieldbus connection).

Connection of the air inlet solenoid valve to an inert gas line

To connect the solenoid valve to an inert gas line, the nitrogen supply must be clean and filtered and must have the characteristics required (see chapter "Nitrogen characteristics").

1. Remove the dust filter from the solenoid valve.
2. Connect the inert gas line instead.
3. Bond the connection using oleo-waterproof glue, or put PTFE sealing tape on the threads.
4. Tighten the connection, applying a maximum tightening torque of 10 N·m.

5.7 Check that the installation is leaktight

When the product leaves the factory, product leaktightness under normal operating conditions is guaranteed. The operator must maintain this level of leaktightness, especially when pumping dangerous gases. For more information concerning leak tests, please contact our service center.

1. Perform a leak test on the entire pumping line after installation.
2. Carry out regular checks to ensure that there are no traces of the pumped gases in the surrounding environment and that no air is entering the pumping line during operation.

5.8 Electrical connection

WARNING

Risk of electric shock due to non-compliant electrical installations

This product uses mains voltage for its power supply. Non-compliant electrical installations or installations not done to professional standards may endanger the user's life.

- ▶ Only qualified technicians trained in the relevant electrical safety and EMC regulations are authorized to work on the electrical installation.
- ▶ This product must not be modified or converted arbitrarily.
- ▶ Check that the product is properly connected to the equipment's or pumping installation's emergency stop circuit.

WARNING

Danger of electrocution by contact during maintenance or overhaul

There is an electric shock hazard in case of contact with a product powered on and not electrically isolated.

- ▶ Before carrying out any work, set the main switch to **O**.
- ▶ Disconnect the power cable from the mains.
- ▶ Secure the installation correctly by tagging and locking (LO/TO) the system to prevent unintentional re-engagement.

WARNING

Risk of electric shock in case of contact with the mains connector at power-off

Certain components use capacitors that are charged up to over 60 VDC and that hold their electrical charge **at power-off**: residual voltages due to filter capacitance can cause electric shock, up to and including mains voltage levels.

- ▶ Wait 5 minutes after power-off before commencing work on the product.

NOTICE

Risk of electromagnetic disturbance

Voltages and currents can induce a multitude of electromagnetic fields and interference signals. Installations that do not comply with the EMC regulations can interfere with other equipment and the environment in general.

- ▶ Use shielded cables and connections for the interfaces in interference-prone environments.



The pump is a class A product. In a domestic environment, this product can cause radio interference. In this case, users must take appropriate measures.

Electrical safety

The pump motor is protected against overload by the current limitation of the variable speed drive in electronic drive unit (in case of overload, the speed decreases automatically).

When there is a hazard due to accidental contact with liquids, gases or solids, you must install a hard-wired emergency stop circuit to cut the power supply.

- ▶ **Never override these interlocks during installation, use or maintenance.**

During the pump stop following a fault, the variable speed drive is switched off and the pump is put in a safe condition. To restart the pump, you must:

- ▶ **Wait until all moving parts have stopped** before switching the power off.
 - Mains switch of the electronic drive unit to **O**.
- ▶ Wait approximately 15 seconds.
- ▶ Correct the cause of the fault.
- ▶ Restore power supply.
 - Mains switch of the electronic drive unit to **I**.

5.8.1 Customer electrical installation protection

Circuit breaker protection

The power circuit used to supply the pump must be fitted with a breaker complying with the IEC 60947-2 curve D standard whose short circuit cut-off capacity is at least 10 kA. This protection device should be in close proximity to the pump (no further than 7 m away) and in line of sight of the product.

The customer must provide a correctly-rated main circuit breaker: see chapter "Electrical characteristics".

Differential circuit breaker

In the event of an insulation defect, you must install a differential circuit breaker to protect personnel (see chapter "Electrical characteristics").

The pump is Class 1 equipment and therefore must be grounded. The user must make sure the installation has an earth wire properly connected to the ground.

Grounding

When necessary, the installer must provide dual protection in addition to the existing one. It consists of an uninsulated braid or a separate green/yellow conductor with a minimum section 3 mm² (9AWG). The impedance between the pump body and the ground connection point must be < 0.1 Ohm at 25 A.

- Use an M4 x 8 screw and a locking washer fitted to the hole on the pump (mark $\perp$) to secure the conductor to the pump and to the installation's ground connection point.



Absence of emergency stop

The vacuum pump is not equipped with an emergency stop device (EMS) or a lock-out device. The vacuum pump is designed to be integrated into equipment fitted with an emergency stop device.

- When activated, the EMS of the equipment must switch off the vacuum pump.



Operation in local mode

There is no device to warn that the pump is operating in local mode.

- Provide a means to warn about local mode operation when the pump is not integrated neither controlled by the equipment.

5.8.2 Mains connection

⚠ WARNING

Danger to life from electric shock in the event of a fault

In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.

- Always keep the mains connection freely accessible so you can disconnect it at any time.

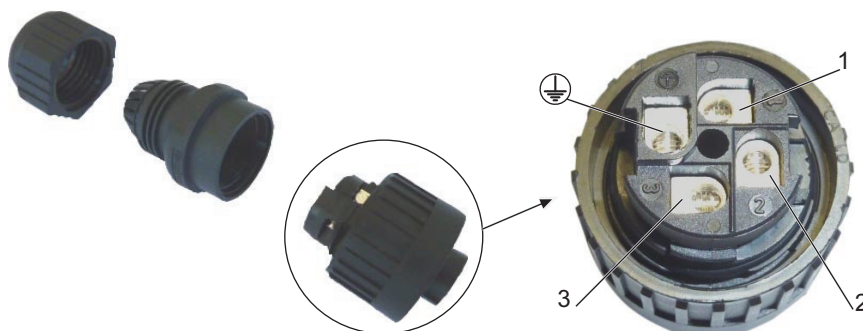


Fig. 10: Electrical connection using an electrical connector

1 Phase
2 Neutral

3 Not used
4  CPC Earth

Procedure for electrical connection to the mains via a connector

The electronic drive unit comes with a mains plug whose wiring is the customer's responsibility.

1. Use an EEC cable in compliance with IEC 60227 and IEC 60245 standards with the following characteristics:
 - cable diameter: 6 to 12 mm
 - heatproof (because it can come into contact with hot surfaces)
 - conducting wire section suitable for cable length (1.5 to 2.5 mm²)
 - current carrying capability: 10 A under 250 V
2. Connect the protective earth (ground) wire to the delivered mains plug.
3. Ensure that the quality of the ground is reliable. If it's not the case:
 - use the dual protection (see chapter "Customer electrical installation protection").
4. Connect the mains plug to the mains socket **AC In**.

The IEC 60417 #5019 symbol  is located in the electronic module on the CPC earth terminal block.

Typical wiring diagram

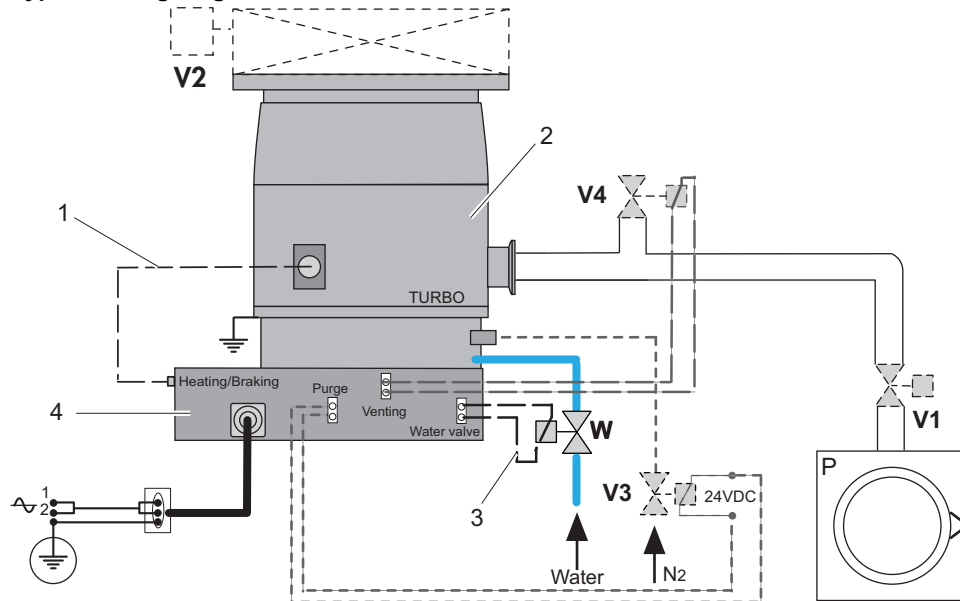


Fig. 11: Typical wiring diagram

1	Heater jacket power supply (MT version)
2	Magnetically levitated turbomolecular pump
3	Water valve power supply (MT version)
4	Electrical drive unit
P	Backing pump
N2	Inert gas input
V1	Fore-vacuum isolation valve ²⁾
V2	High vacuum isolation valve ²⁾
V3	Purge solenoid valve (option) ²⁾
V4	Air inlet solenoid valve (option) ²⁾
W	Cooling circuit solenoid valve (MT version)
	Functional grounding connection ¹⁾
	CPC ground connection

1) Recommended for connecting the pump to the ground electrode in an environment affected by electromagnetic waves.

2) Solenoid valve controlled via the electronic drive unit.

6 Operation

6.1 Preliminary precautions for use

WARNING

Risk of poisoning when process gases are present in the atmosphere

The manufacturer has no control over the types of gases used with the pump. Process gases are often toxic, flammable, corrosive, explosive and/or otherwise reactive. There is a risk of serious or fatal injury if these gases are allowed to escape freely into the atmosphere.

- ▶ Apply the relevant safety instructions in accordance with local regulation. This information is available from the operator's safety department.
- ▶ **Always connect the turbomolecular pump's exhaust to a backing pump compatible with process gases:** the backing pump's exhaust is connected to the installation's dangerous gas extraction system
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

WARNING

Risk of electric shock in the event of electrical disconnection while the pump is running

The turbomolecular pump and its electronic drive unit cannot be disconnected from the electrical network before the rotor completely stops rotating: the pump/electronic drive unit must be isolated from the electrical network to prevent electric shock!

1. Stop the pump from rotating by sending a '**Stop**' order on the control interface.
2. Wait for the rotor to completely stop rotating (several minutes).
3. Switch off customer power supply from the equipment.
4. Unplug the mains cable.

WARNING

Risk of cutting injuries due to contact with sharp edges via the high vacuum flange

With the high vacuum flange open, access to sharp-edged parts is possible. A manual rotation of the rotor increases the danger situation. There is the risk of cuts, up to the separation of body parts (e.g. fingertips).

- ▶ Wait for the pump to come to a complete standstill, before starting any work on the product.
- ▶ Keep the splinter shield in the inlet flange, as it limits the risk of injury.
- ▶ Wear protective gloves in accordance with standard EN ISO 21420.
- ▶ Never disconnect the high vacuum flange before the rotor is completely immobilized.

Pumping pyrophoric or flammable gases may be hazardous. The user and/or integrator must comply with the safety instructions (see chapter "Safety instructions relating to flammable/pyrophoric materials"). Every time the pump is commissioned:

1. Check that the pump has been correctly secured in accordance with safety instructions (see chapter "Equipment installation conditions").
2. Check that the pump inlet is properly connected to the pumping line.
3. Start the water and nitrogen circuits.
4. Check that the exhaust pipework is not clogged and that all the extraction system valves are open.
5. Check that the valves are connected and supplied, including the purge valve (where applicable).
6. Switch on the electrical supplies.

6.2 Starting the pump

6.2.1 Powering on

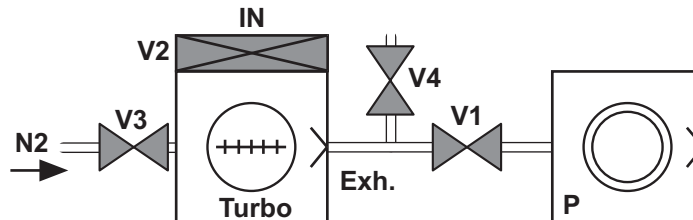
- ▶ Position the main switch to I: the electronic drive unit boots up.
 - At the end of initialization, the yellow LED turns off and the green LED flashes at 10%.

6.2.2 Pumping start-up

The following steps describe the use of the pump regardless of the control interface. Refer to chapter “Interfaces for control” for instructions on how to wire and set the parameters of the different interfaces.

- Use via **HHR** (see chapter “Control via the HHR”).
- Use via **Remote** control (see chapter “Control via the Remote connector”).
- Use via **RS-232/RS-485** serial link (see chapter “Command via the RS-232/RS-485 serial link”).
- Use via **Fieldbus** (see chapter “Operation via fieldbus”).

Pumping installation diagram



V1 ¹⁾	Fore vacuum isolation valve	N2	Inert gas purge inlet
V2 ¹⁾	High vacuum isolation valve	Turbo	Magnetically levitated turbomolecular pump
V3 ²⁾	Purge solenoid valve (option)	P ¹⁾	Backing pump
V4 ²⁾	Air inlet solenoid valve (option)		

1) The supply, power supply and control of these components are the customer's responsibility.

2) These solenoid valves are controlled via the electronic drive unit.

Pumping start-up procedure

Initial conditions:

Valves V3 and V4 are connected and controlled via the electronic drive unit.

Valves V1 and V2 are connected and controlled by the equipment.

The vacuum chamber and the pumping lines are at atmospheric pressure, the backing pump is stopped and the valves are closed.

1. Start up the water-cooling circuit.
2. Send a pump '**Start**' order via the HHR, Remote, serial link or fieldbus control panel:
 - The backing pump starts up and valves V1 and V2 open.
 - The turbomolecular pump starts to **reach the selected speed**: the green LED turns on at 90 %.
 - When the speed is reached, the LED is lit continuously.
3. Depending on the application, open the V3 purge solenoid valve:
 - send a '**Purge**' order via the HHR, Remote, serial link or fieldbus control panel.

The pumping operation is performed until the operating pressure for the customer's application is reached.

Stand-by speed

The Stand-by speed is selected when the pump is stopped or rotating:

- Send a '**Stand-by**' order via Remote, serial link or fieldbus control panel or press the **STD-BY** key of the HHR interface.

Temperature set point (MT version)

- Select the temperature set point via the HHR, serial link or fieldbus control panel.

For more information about temperature management, see chapter “Pump Temperature management system”).

6.2.3 Restarting the pump after an emergency equipment stop

The equipment emergency stop manages the pump stop. To restart the pump after an emergency stop, it is necessary to:

1. Make sure the pump has stopped (all LED are off).
2. Wait until pump rotor has stopped.
3. Correct the problem.

4. Unlock the emergency stop button on the equipment,
5. Start the pump by sending a '**Start**' pump order via the control panel: the pump starts at the selected speed.

6.3 Shutting down the pump

6.3.1 Pumping shutdown

NOTICE

Risk of damaging the pump by generating an electric arc

The pump and its electronic drive unit must not be disconnected from the electrical network before the rotor completely stops rotating and the unit is isolated from the electrical network: an electric arc is created when the circuit is interrupted, which damages internal components.

1. Stop the pump from rotating by sending a '**Stop**' order on the control interface.
2. Wait for the rotor to completely stop rotating (several minutes).
3. Switch off customer power supply from the equipment.
4. Unplug the mains cable.

Pumping interruption procedure

Initial conditions:

Valves V3 and V4 are connected and controlled via the electronic drive unit.

Valves V1 and V2 are connected and controlled by the equipment.

The vacuum chamber and the pumping lines are under vacuum, the backing pump is on, and the V3 purge valve is open.

1. Close the V2 valve to isolate the pump from the vacuum chamber.
2. Send a pump '**Stop**' order via the HHR, Remote, serial link, or fieldbus control panel:
 - Pump speed slow down: the green LED flashes at 50% as long as the rotation speed is $> 60 \text{ min}^{-1}$, then at 10% when the rotation speed is $< 60 \text{ min}^{-1}$.
3. Activate the V4 air inlet solenoid valve by sending a '**Venting**' order via Remote, serial link or fieldbus control panel.
 - The air inlet solenoid opens when the speed is less than 10000 min^{-1} .
4. Close the V1 valve and the backing pump stops.
5. Stop the water-cooling circuit **when the pump is stopped** (the rotor has stopped rotating).
6. Stop the inert gas purge flow.

NOTICE

Inert gas purge function

When the inert gas purge is stopped, the pumped gases can pass from the fore vacuum side to the high vacuum side and damage the bearing housings.

- ▶ Maintain the inert gas purge flow as long as the rotor is running to prolong the flushing.
- ▶ The purge maximum pressure must not exceed $1 \cdot 10^3$ to $1.5 \cdot 10^3 \text{ hPa}$ (absolute).

NOTICE

Air inlet solenoid valve function

The air inlet solenoid valve reduces the braking time required for the pump to get up to the atmospheric pressure. When isolation valves are installed on the pump inlet and exhaust, the rotor slow-down efficiency is improved.

- ▶ If the pump has been stopped by a sudden air inlet, **limit the number of restarts to 2 per hour**.
- ▶ if the pump has been stopped without air inlet, the number of restarts is not limited.
- ▶ Please contact us for advice on the air inlet solenoid valve.

Pump stop due to power failure

Stopping the pump by disconnecting the mains power supply is not a normal way to stop the pump:

- Always send a '**Stop**' order via the control panel and wait for the pump to stop rotating before starting work on the product.

When a power failure occurs, the rotor remains suspended by the energy emitted by the motor's counter-electromotive force, until the rotor rotation speed is low enough that it can rest on the landing bearings without being damaged.

If the power is restored before the minimum speed is reached, the pump recovers its initial speed without any disturbance. The landing bearing counter does not decrease.

Otherwise, if the minimum speed is reached before the power supply has been restored:

- The pump lands on its landing bearings.
- The electronic drive unit is powered off; no indicator light is on.
- The landing bearings' counter decreases.

Start up the pump according to the standard start-up procedure when the mains supply has been restored.

6.3.2 Powering off

1. Power off the pump by setting the main switch to **O**:
 - the green LED turns off;
 - wait for the rotor to completely stop rotating.
2. Turn on the customer's electrical installation breaker.

6.3.3 Prolonged stoppage

If the pump has to be stopped for a prolonged period, follow the shutting down procedure (see chapter "Shutting down for longer periods").

6.4 Operation monitoring

LED	Symbol	LED status	Display	Meaning
		off		Switched off.
		on, flashing 10 %		Power supplied. Pump stopped or rotation speed < 60 min ⁻¹ .
		on, flashing 90 %		The pump has not reached the selected speed.
		on, constant light		The pump has reached the selected speed.
		on, flashing 50 %		The pump speed decreases, speed > 60 min ⁻¹ .
		off		No warning
		on, constant light		Electronic drive unit initialized or warning signaled.
		off		No fault.
		on, constant light		Pump is faulty.

Tbl. 3: Meaning of LED on the control panel

When a problem occurs, the user is warned by:

- Activation of the fault/warning LED
- Audible warning of the HHR (if enabled)
- Activation of the fault contacts on the **Remote** connector
- Pumping interruption when the '**Stop**' order has not been activated
- Fault/warning message displayed on the HHR
- A message via the RS-232 or RS-485 serial link
- A message via the fieldbus

Fault messages are listed in the instructions; see chapter "Malfunctions".

7 Advanced settings



This chapter describes the available functions and how they work. This chapter helps the user and/or the integrator to configure the pump parameters according to the requirements during the process.

7.1 Pump temperature management system

The temperature management system (TMS) fitted on the **MT version** pump consists on a heater band and a water solenoid valve.

The integrated heater band heats the pump to an adjustable temperature (referred to as temperature setpoint) to prevent the effects of condensation. The temperature setpoint depends on the application the pump is to be used for. Contact Pfeiffer Vacuum's applications department for advice in choosing the correct temperature setpoint.

The heater band and the water solenoid valve allow to manage the pump temperature up to the temperature setpoint. The electronic drive unit controls this temperature setpoint. The temperature setpoint is selected via the HHR control panel or via the serial link or fieldbus (see chapter "Control modes").

Depending on the temperature setpoint chosen to heat the pump and the temperature of the cooling water circuit, the pump can take a certain amount of time to reach the specified temperature.

To reduce this time, when the pump is rotating and isolated at the inlet (V2 closed):

- Inject the purge flow and close the exhaust isolation valve (V1 closed) so as to have a maximum motor current of 5.5 A.

7.2 Pump braking

Braking reduces the time it takes to stop the pump. We distinguish between:

- electric braking,
- braking with the air inlet solenoid valve.

Electric braking

Electric braking makes it possible to slow the pump by sending a pump '**Stop**' order, or in the event of a default stop, after a delay of 15 minutes during which time the pump can be kept under vacuum.

It is possible to perform electric braking by sending a command via the RS-232/RS-485 serial link: this will not result in optimal braking of the pump.

Braking with air inlet solenoid valve

Braking with the air inlet solenoid valve makes it possible to reset the pump to atmospheric pressure on sending a pump '**Stop**' order, or in the event of a default stop. Stopping time until complete shutdown of the rotor can be very long, as it depends on the pump isolation conditions.

It is possible to manage the opening/closing of the valve through the wiring of the '**Venting**' contact on the **Remote** connector or by sending a command via the RS-232/RS-485 serial link or via the fieldbus.

The pump is reset to atmospheric pressure when the pump stops or in the event of a default stop (see chapter "Malfunctions").

The air inlet valve is supplied only if the pump's rotation speed is $< 10000 \text{ min}^{-1}$ and on receipt of a valve opening order via the control interface.



It is a NC (normally closed) valve

- The air inlet valve must be closed to restart the pump.
- The air inlet valve does not close automatically when the pump stops!

8 Interfaces for control

8.1 Control modes

This chapter describes the connections and protocols associated with each control mode. There are 4 control modes:

- **HHR**
The pump is controlled **locally** from a Hand-Held Remote control (HHR), connected on the **SERVICE** connector.
- **REMOTE**
The pump is controlled **remotely** by opening and closing different dry contacts or applying voltage to the **REMOTE** connector.
- **SERIAL LINK**
The pump is controlled remotely by the commands transmitted via serial link **RS-232/RS-485**.
- **FIELDBUS CONNECTION**
The pump is controlled with a remote-control system (automation, control, supervision) that communicates with the pump according to the fieldbus communication protocol.
Different control interfaces for communication with fieldbuses (Profibus, EtherCAT, ...) are available in the ordering guide.

Choice of control mode

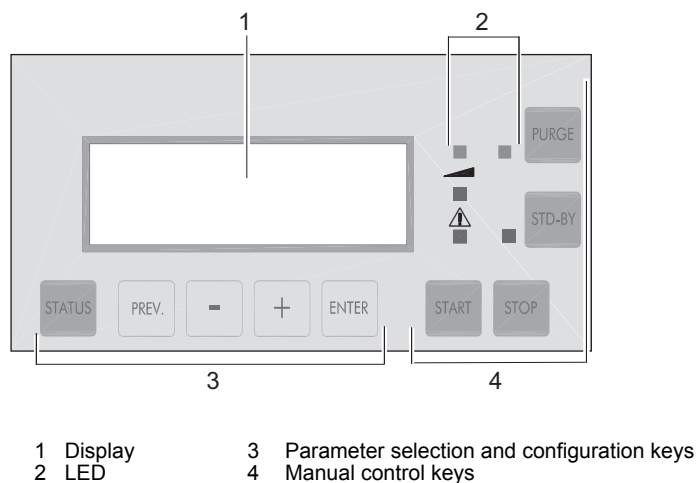
The selected mode controls the pump. The control mode can be selected:

- via the HHR **unit**
- via serial link **RS-232/RS-485**

8.2 Control via the HHR

Description of the HHR

Connected to the electronic drive unit, the HHR allows to display and configure the pump parameters.



Key	Functions	Key	Functions
STATUS	- To access the parameter display mode. - To exit the menus and return to parameter display.	ENTER	- To validate the selection of a menu, parameter, or value. - To confirm the answer to a question.
PREV.	- To access the configuration mode. - To exit the various menus without validating the functions.	STD-BY	To allow pump operation at reduced speed via HHR when the [SET UP][REMOTE CONTROL] menu is set to [KEYBOARD] (see chapter 'Menu SETUP'). LED is lit when the pump rotates at Stand-by speed.

Key	Functions	Key	Functions
	To move to the next or previous menu, next or previous parameter in the displayed menu.		To start the pump in local mode via HHR when the [SET UP][REMOTE CONTROL] menu is [KEYBOARD] (see chapter 'Menu SETUP').
	To select or adjust the parameter value.		
	To allow purge operation via HHR when the [SET UP][REMOTE CONTROL] menu is set to [KEYBOARD] (see chapter 'Menu SETUP'). LED is lit when the purge is activated.		To stop the pump in local mode via HHR when the [SET UP][REMOTE CONTROL] menu is [KEYBOARD] (see chapter 'Menu SETUP').

Tbl. 4: Description of the HHR's keys

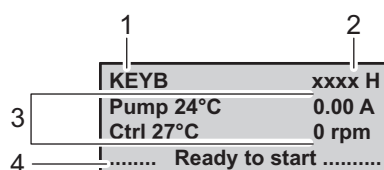
NOTICE**Risk of damage to the keypad**

The keys are protected by a membrane. Using hard, pointed objects like pens and screwdrivers can damage the keys.

- Always use your hands to operate the keypad.

Description of the display

The display shows the status of the pump and the monitored parameters. Use the +/- keys to scroll through the monitored parameters.



1 Control mode
2 Running time

3 Operating parameters/fault messages
4 Pump operating status messages

8.2.1 Powering on

- Check that the electrical connections have been made before using the HHR.
- Connect the hand held remote to the **SERVICE** connector.
- Set the main switch to I: the HHR unit boots up.

The HHR unit can be connected when the pump is switched on and/or when the rotor is rotating.

**The factory settings**

When the pump is run for the first time, it uses the default settings set at the factory to reflect the settings in the ordering guide. The factory settings are protected by an access code (initially 0) that can be changed.

- The user or the integrator is responsible for changing the pump parameters according to the requirements of the application.

HHR mode is active when the 'Keyboard' control mode is configured by the HHR or the RS-232/RS-485 serial link.

Display initialization		
1.	The electronic drive unit performs a self-test and identifies the connected pump. Boot-up time is approximately 15 seconds.	
2.	The equipment is identified, the software release is displayed, and communication with the pump is tested.	HHR V0X.0Y.00 Checking procedure
3.	In the meantime, the indicator lights are tested, they light up sequentially.	HHR V0Z.0X.00 Collecting data
4.	At the end of the test, the type of connected pump and the message 'Ready to start....' are displayed.	KEYB 0 H CTRL VXX.0Y.0V ATHxxxx Ready to start
Access to menus		
1.	Access to the settings mode by pressing PREV. key. Access to the menu [DISPLAY] by pressing ENTER key.	KEYB xxxx H DISPLAY SETUP SER NUM Ready to start
2.	Set the display parameters. Access from one menu to another by pressing +/- keys. Return to the previous menu using PREV. key.	KEYB xxxx H STATUS VER FAULT WARNING BEARING Ready to start
3.	Access to the menu [SETUP] using +/- keys. Access the menu using ENTER key.	KEYB xxxx H DISPLAY SETUP SER NUM Ready to start
3.	Enter the access code to modify the setting and valid the new code by pressing ENTER . Return to the previous menu using PREV. key.	KEYB xxxx H ACCESS CODE 0 Ready to start

8.2.2 DISPLAY menu

Selection	Description
STATUS	Display of the electronic drive unit and pump status: - Pump temperature - Pump motor current - Electronic drive unit temperature - Pump rotation speed
VERSION	Display of the electronic drive unit version (depends on the connected pump model): - HHR version - HHR front panel version - Frequency converter version - Turbomolecular pump magnetic spindle version
FAULT	Successive display of the last 10 defaults with their titles.
WARNING	Successive display of the last 10 warnings with their titles.
BEARING	Display of the landing bearing lifetime (in %) and the warning setpoint (in %).

8.2.3 SETUP menu

Selection	Choice	Description	Initial setting ¹⁾
ACCESS CODE	0 to 65535		0
REMOTE CONTROL	Keyboard Remote hard Serial link Profibus Devicenet EtherCAT® LON	Choose the interface control mode.	According to ordering guide.
STAND-BY SPEED	from 15000 min ⁻¹ to pump nominal speed	Activate pump Stand-by speed (selected speed) between minimum speed and nominal speed (= speed set at factory).	15000
BUZZER	ON OFF	Activate the acoustic signal in case of default. To stop the signal, press OFF .	OFF
THERMOSTAT	ON = 55 to 85 °C OFF	Activate the pump temperature set point .	OFF (M version) ON = 65 °C (MT version)
RELAY AT SPEED	-3 to 50 % of the nominal speed	Modify the speed contact set point.	- 3 %
FIELD BUS PRO-FILE ²⁾	0 1	0 = compatible with OBCV4, OBCV5. 1 = compatible with OBCV3.	0
FIELD BUS ADDRESS ²⁾			
RS-232 SPEED	9K6 19K2 38K4 57K6	Choose the RS-232 serial link transmission speed.	9K6
RS-232 ECHO	ON OFF	Activate all received characters to be echoed over the RS-232 serial link.	OFF
RS SEPARATOR	0 to 255	Enter the separator character in ASCII: e.g. "044" for ";".	44
RS ADDRESS	0 to 255	Number given to the pump in the serial link.	0
BEARING LIVE Warning limit	0 to 99 %	Modify the landing bearing warning set point.	20
NEW CODING	0 to 65535	Modify the access code.	0

1) For client's specification product, initial settings could be different (see chapter "Product concerned").

2) Refer to the operating manual of the fieldbus interface that controls the pump.

8.2.4 SER NUM menu

Selection	Display	Initial settings
HHR	Display the HHR serial number.	XXXXXXXXXX
CONTROLLER	Display the control interface serial number of the electronic drive unit.	YYYYYYYYYY

8.3 Control via the REMOTE connector

NOTICE

Safety of Extra-Low Voltage circuits

Remote control circuits are equipped with dry contact outputs (24 V - 1 A max). Overvoltages and overcurrents can result in internal electrical damage. Users must observe the following wiring conditions:

- ▶ Connect these outputs in accordance with the rules and protection of Safety Extra-Low Voltage (SELV) circuits.
- ▶ The voltage applied to these contacts should be less than 24 VDC and the current less than 1 A.

Description

Connection via the **REMOTE** connector (HD, 15-pin D-Sub female) can be used for:

- remote control of following functions: start, stop, purge, and air inlet
- remote pump status through auxiliary dry contacts

The remote control mode is active when the 'Remote hardware' control mode is set on the RS-232/RS-485 serial link or via the HHR unit.

When the 'Remote hardware' control mode is set, the Stand-by speed and temperature setpoint can be set via the RS-232/RS-485 serial link or the HHR unit.

- ▶ Use shielded cable and connect both sides to the ground.

8.3.1 Logic input wiring

Control by direct voltage

The inputs are active when a DC voltage between 10 and 24 VDC is applied between their pins (wiring customer supplied).

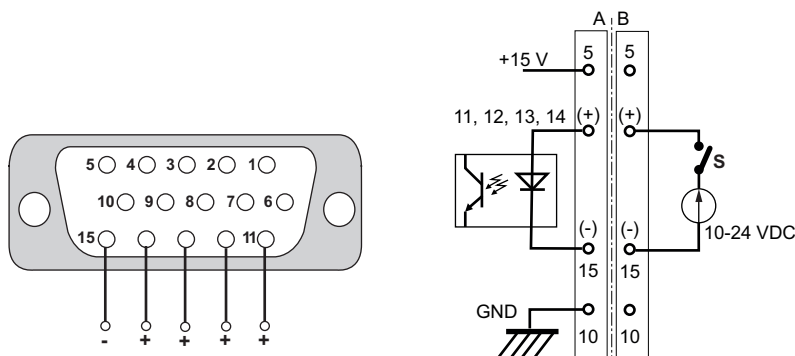


Fig. 12: Remote connector: control by direct voltage

A Internal wiring

B Wiring from customer's side

Voltage 10-24 VDC	Function	
S1 (11-15)	Purge ¹⁾	Contact closed: the purge solenoid valve is activated. Contact open: the purge solenoid valve is not activated.
S2 (12-15)	Venting ¹⁾	Contact closed: the air inlet solenoid valve is activated. Contact open: the air inlet solenoid valve is not activated.
S3 (13-15)	Stand-by ¹⁾	Contact closed: Stand-by speed is selected. Contact open: pump rotation speed is the pump nominal speed.
S4 (14-15)	Start/Stop pump ¹⁾	Contact closed: the pump starts. Contact open: the pump stops.

¹⁾ This function runs when the control mode is set to 'Remote hard' via the RS-232/RS-485 serial link (see chapter "List of commands") or via HHR (see chapter "SETUP menu").

Control by dry contacts

To control these inputs by external contacts of the host equipment, connect pins 10 with 15 and wire the used contacts (wiring customer supplied). Pins 11, 12, 13, 14 are connected to + 15 V (pin 5) to be active.

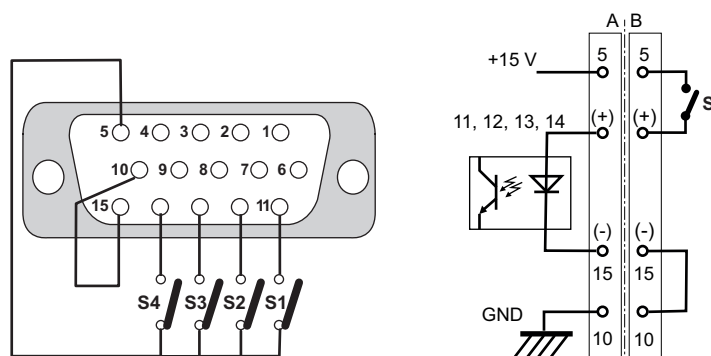


Fig. 13: Remote connector: control by dry contacts

A Internal wiring

B Wiring from customer's side

Contact	Function	
S1 (11-5)	Purge ¹⁾	Contact closed: the purge solenoid valve is activated. Contact open: the purge solenoid valve is not activated.
S2 (12-5)	Venting ¹⁾	Contact closed: the air inlet solenoid valve is activated. Contact open: the air inlet solenoid valve is not activated.
S3 (13-5)	Stand-by ¹⁾	Contact closed: Stand-by speed is selected. Contact open: pump rotation speed is the pump nominal speed.
S4 (14-5)	Start/Stop pump ¹⁾	Contact closed: the pump starts. Contact open: the pump stops.

1) This function runs when the control mode is set to 'Remote hard' via the RS-232/RS-485 serial link (see chapter "List of commands") or via HHR (see chapter "SETUP menu").

8.3.2 Logic output wiring

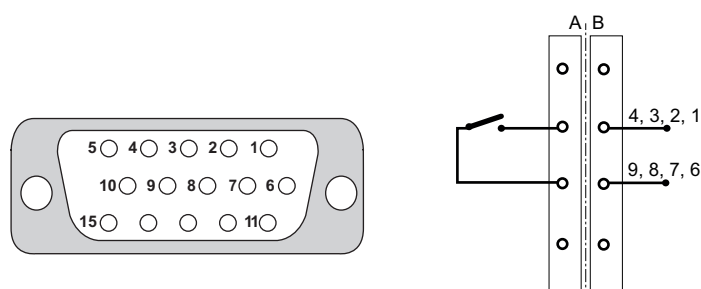


Fig. 14: Remote connector: logic outputs

A Internal wiring

B Wiring from customer's side

Contact	Function	
1-6	OK for process	Contact closed: OK for Process ¹⁾ – M version : speed $\geq$ nominal speed (set by 'Relay At Speed' parameter), (see chapter "SETUP menu"), (see chapter "List of commands"). – MT version : speed $\geq$ nominal speed (set by 'Relay At Speed' parameter), (see chapter "SETUP menu"), (see chapter "List of commands"); and if the temperature is $\geq$ the setpoint temperature - 3 °C. When 'OK for Process' = 'At speed' is set (OPT37), this signal behaves as in the case of an M version.
2-7	Rotation	Contact closed: pump speed > 100 min ⁻¹
3-8	Warning	Contact open: presence of a warning
4-9	Fault	Contact open: presence of a fault

1) If the parameter 'OK for process up to Stand-by speed' is set to 1 (see chapter 'Command list'), the contact opens if the Stand-by speed is selected and while the speed of the pump is greater than the Stand-by speed.

8.4 Command via the RS-232/RS-485 serial link

NOTICE

Risk of electromagnetic disturbance

Voltages and currents can induce a multitude of electromagnetic fields and interference signals. Installations that do not comply with the EMC regulations can interfere with other equipment and the environment in general.

- Use shielded cables and connections for the interfaces in interference-prone environments.

WARNING

Risk of electric shock in case of contact with a non-electrically insulated product

When powering off _mains switch to **O**_, certain components located between the mains connection and the circuit breaker will still contain an electric charge (live). There is a risk of electric shock in case of contact.

- Make sure that the mains connection is always visible and accessible so that it can be unplugged at any time.
- Disconnect the power cable from the mains supply before working on the product.

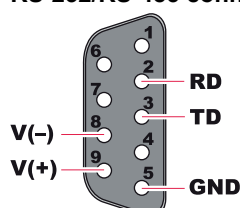
8.4.1 Connections

The 9-pin D-Sub male connector marked **RS-232/RS-485** is used to control and monitor the pump connected to an external computer. It allows also the installation of several pumps in a network. The connected computer allows the modification of the default serial link setting, according to the command list (see chapter "Command list").

Initial serial link configuration

Description	Value
Serial link	RS-232
Transmission speed	9600 bauds
Data word length	8 bits
Parity	none (no parity)
Stop bit	1
Echo	no

RS-232/RS-485 connector

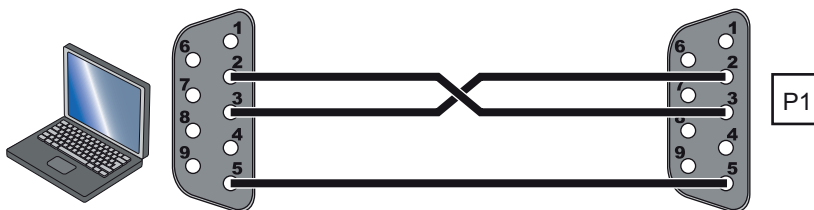


Pin	Assignment
2	Data reception (RS-232)
3	Data transmission (RS-232)
5	GND
8	RS-485: V-
9	RS-485: V+

The user must use shielded links and connections in compliance with EMC and electrical safety standards.

RS-232 connection

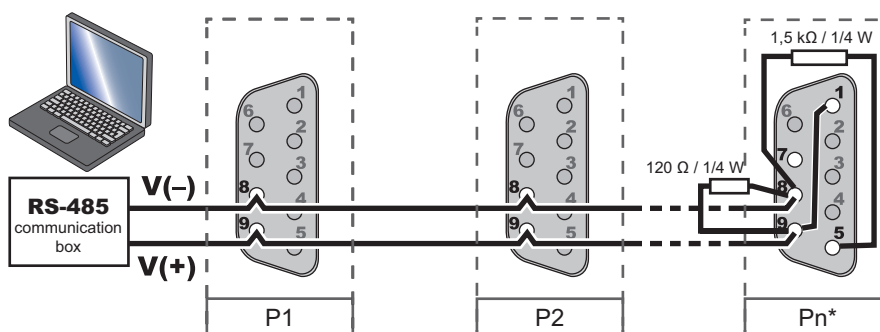
A computer manages a single pump (P1) using the RS-232 link via the **RS-232/RS-485** connector.



RS-485 connection

A computer manages several pumps (P1, P2, Pn, etc.) using a RS-485 serial link via the **RS-232/RS-485** connector. This parallel wiring allows communication between the pumps even if a pump is disconnected.

The wiring of the product at the end of line Pn* and the wiring of a single product on the network is specific.



Setting

The serial link control mode is active when the wiring is done and when the 'Serial link' control mode is configured by the HHR (see chapter "SETUP" menu) or on the RS-232/RS-485 serial link (see chapter "Command list").

- Position the mains switch to I.
- Send an order via the serial link.

8.4.2 Communication protocol

Control commands	
Header character	The default setting is the decimal code 035 of the character #
Address	Number given to the pump, 3 characters
Order	Command sent on serial link, 3 characters
Order	The number of characters depends on the command
End parameter	This is the message end character. The setting is ASCII 13 code <CR> The <LF> character is not taken into account.

Example:

Header character	Pump address	Order	Parameter	End character
#	ADR	ODR	XXXX	<CR>

Responses			
Header character	Pump address	Respons	End character
#	ADR	yyyxxxabc	<CR>
OK	If everything is OK, or specific respons to the order sent		
ERR0	Setting fault		
ERR1	Order fault		
ERR2	Parameter fault		
ERR3	Context fault		
ERR4	Checksum fault		
Example of dialog			
Order	#005ECHON<CR>		
Response	#005OK<CR>		

8.4.3 Command list

Order	Parameter	Description	Functions	Min	Max	Initial setting
ADR	xxx	Number given to the pump in the serial link	adr = pump address before change aaa = new pump address (RS-232 only)	000	255	0
ACK	-	Default acknowledgment				
DEF	-	Display of warnings/defaults	List of the last 40 warnings/faults stamped on the electronic drive unit operating time, followed by the name of the fault. The arrow->indicates the ongoing warning/fault. <i>Example:</i> * 00000:02:20 / Default list ->00000:01:37 / Default in current Yh ->00000:01:37 / PM Default * 00000:02:20 / Warning list ->00000:02:37 / Holweck Temp. sensor 00000:01:30 / Speed controller Hall sensor 00000:00:50 / Holweck Temp. sensor			
DLI	xxx	Data logger read interval	Defines the automatic read interval of pump status (STA) in seconds.	0	255s	1s
DLR	-	Automatic read activated	Authorizes automatic reading of pump status (STA) according to the DLI interval (RS-232 only).			OFF
ECH	ON or OFF	Return all characters received on the serial link	Activated if ECHON (RS-232 only) Deactivated if ECHOFF (RS-232 only)			OFF

Order	Parameter	Description	Functions	Min	Max	Initial setting
EVT	-	Display of last actions	List of the last 40 actions stamped on the electronics drive unit operating time, followed by the description of the action (RS-232 only) * 00000:02:28/Actions list 00000:01:37/Serial link:pump stop 00000:01:34/Serial link:pump start * 00000:01:10/Serial link:pump stop 00000:00:59/Serial link:pump start			
IDN	-	Identification of the product connected with the computer	Returns the electronic drive type, the software version (x, yy), release (zz), and the type of pump connected to the computer (1234) <i>Example: #adr,OBC V5 Vx.y.zz,ATH1234M<CR></i>			
LEV10	-	Returns the status of the operating parameters defined by SET	<i>Example:</i> <i>#adr,nnnnn,sssss,00000,0,cccc,eeee,00000,0000,0000,jj,kk,ll,mmm<CR></i> nnnnn = nominal speed (min ⁻¹) sssss = standby speed (min ⁻¹) 00000 = not used 0 = not used cccc = operating time of the pump (hours) eeee = operating time of the electronic drive unit 00000 = not used 0000 = not used jj = 'At speed' relay set point (3 to 50%) kk = temperature setpoint (30 to 65°C) ll = landing bearing warning set point (0 to 99%) mmm = landing bearing counter (0 to 100%)			
NSP	-	Switches from Stand-by speed to nominal speed	The speed is set to the nominal speed (default setting)			

Order	Parameter	Description	Functions	Min	Max	Initial setting
OPT	XX	Setting options/orders	<i>Example: #adrOPTxx,n<CR></i>			
			XX = 14 control mode n = 0 HHR control mode (keyboard) n = 1 Remote control mode (hardware)* n = 2 RS-232/RS-485 control mode n = 3 LON fieldbus control mode n = 4 Devicenet fieldbus control mode n = 5 Profibus fieldbus control mode n = 8 EtherCAT [®] fieldbus control mode * not possible with LON and EtherCAT [®]			
			XX = 20 Air inlet solenoid valve control n = 0 valve not supplied n = 1 valve supplied	0	1	0
			XX = 21 Purge solenoid valve control n = 0 valve not supplied n = 1 valve supplied	0	1	0
			XX = 25 Braking control n = 0 motor braking up to 10000 min ⁻¹ n = 1 no motor braking n = 2 braking up to rotation stop	0	1	0
			XX = 26 'OK for Process' up to Standby speed n = 0 the pump slows down and stays in 'OK for Process' mode n = 1 the pump slows down, the 'OK for Process' status disappears and it switches to 'START' mode. Pump will indicate 'OK for Process' when the speed set point is reached.	0	1	0
			XX = 29 TMS ON/OFF (MT version) n = 0 temperature management disabled n = 1 temperature management enabled	0	1	1
			XX = 37 'OK for Process' management (MT version) n = 0 'OK for Process' when pump speed ≥ nominal speed and adjustable temperature ≥ temperature set point -3°C. n = 1 'OK for Process' when speed ≥ nominal speed Note: for pumping condensable vapor, selecting n = 0 is recommended for preventing condensation of gases during the process.	0	1	1
RDI	-	Serial number of the electronic drive unit	Serial number, coded with 10 digits and stored in EEPROM, of the pump, pin and electronic drive unit interface serial numbers.			
RPM	-	Stand-by speed setting	<i>Example: #adr,nnnnn<CR></i> nnnnn = Stand-by speed	15000	25000	15000
SBY	-	Switches from the selected rotation speed to the Stand-by speed	The pump runs at the last Stand-by speed stored value. This can be modified with the RPM order.			

Order	Parameter	Description	Functions	Min	Max	Initial setting
SEL10	-	Status of the options/orders set with OPT order	<i>Example: #adr,0,0,1,0,r<CR></i>			
			0 = not used			
			1 = not used			
			r = returns the remote control choice r = 0 Hand Held Remote (key-board) r = 1 Remote control r = 2 Serial link r = 3 LON r = 4 Devicenet r = 5 Profibus r = 8 EtherCAT ® by default, the value depends on the pump configuration			
SEL20	none	Status of the parameters set with OPTXX	Returns the status of parameters set with OPTXX: S ₂₀ , S ₂₁ , S _{xx} <i>Example : #000,S₂₀, S₂₁, S₂₂, S_{xx}<CR></i>			
SEP	-	Separator character	Valid for parameters returned on DLR, STA and LEV. ASCII input value of the character code 044 corresponds with comma “,”	000	255	044
SET	XX	Setting pump operating parameters	<i>Example: # adrSETXX,cccc<CR></i>			
			XX = 11 electronic drive unit operating time (in hours)			
			XX = 30 ‘at speed’ relay set point (%)	- 3	- 50	- 3
			XX = 31 temperature control (°C) (MT version)	55	85	65
			XX = 32 landing bearing warning set point (%)	0	99	20
			cccc = value			
TMP	ON or OFF	Start/Stop the pump	The pump rotation starts with TMPON The pump stops with TMPOFF			
TIM	-	Display of the operating time	<i>Example: #adr,rrrrrrrrrr,tttttttt,eeeeeeeeee,hhhhh,mmm,ss<CR></i> rrrrrrrrrr = pump operating time (in seconds) tttttttt = pump maintenance time (in seconds) eeeeeeeeee = electronic drive unit operating time (in seconds) hhhhh = pump operating time (in hours) mmm = pump operating time (in minutes) ss = pump operating time (in seconds)			
VER	-	Display of software versions	<i>Example: #adr,INTERFACE Vx.yy.zz,CARTRIDGE Vx.yy,TYPE zzzz,FIRMWARE Vx.yy.zz<CR></i> INTERFACE vx.yy.zz = control panel software version speed controller vx.y.zz = frequency converter software version TYPE zzzz = type of connected pump magnetic Vx.yy.zz = software version 1234 = checksum variator software			

Order	Description	Functions								
STA	Pump status	Example: #adr,s ₁ s ₂ s ₃ , rrrrr,vvv, www, xxx, yyy, zzz, aa, bbbbb, ccc, ddd, gggggggggggggggggggggg<CR>								
		rrrrr = pump rotation speed (min ⁻¹) aa = motor current voltage (V) bbbbb = motor current (mA) ccc = pump temperature (°C) ddd = electronic drive unit temperature (°C) s ₁ s ₂ s ₃ = requires conversion of ASCII to binary				vvv = Radial Xh www = Radial Yh xxx = Radial Xb yyy = Radial Yb zzz = Axial Z g ₀ to g ₂₄ = warning and default bytes				
STA	s ₁ : order status	Bit	7	6	5	4	3	2	1	0
				INH	Local	Fault	Serial Fieldbus	REM	STBY	START
		0	-	0	OFF	OK	OFF	OFF	OFF	OFF
		1	1	-	ON if HHR has control	Fault if status Fault status activated	ON if fieldbus mode is activated	ON if hard Remote is activated	ON if Stand-by mode is activated	ON when starting, at speed, or over-speed
STA	s ₂ : pump status	Bit	7	6	5	4	3	2	1	0
				Fault	Warning Temp.	Braking	Nominal speed&temp	Accelerating	Rotating	Power (init).
		0	-	OFF	OFF	OFF	OFF	OFF	OFF	-
		1	1	- if Fault status is activated	ON if pump temp. is too high	ON	ON OK for process	ON if start-ing mode is activated	ON rotor rotating > 100 min ⁻¹	ON
STA	s ₃ : solenoid valve status	Bit	7	6	5	4	3	2	1	0
				Speed	(Free)	Purge	Water valve	TMS	Air inlet valve	Isolat. valve
		0	-	OFF	-	OFF	OFF	OFF	OFF	0
		1	1	ON if At speed activated	-	ON if purge valve is powered	ON if water valve is powered (MT)	ON if TMS activated (MT)	ON if air inlet valve is open	-

Order	Description	Functions			
STA	g ₀ to g ₂₄ : warning and default bytes	g	0 = ok	1 = warning	2 = default
		0		Power overheat	Seized pump, not accelerating
		1			
		2			
		3			
		4		Hall sensor	
		5			
		6			
		7			Mag. suspens.
		8		Power fail	
		9			
		10			Upper radial bearing Yh
		11			Upper radial bearing Xh
		12			Lower radial bearing Yb
		13			Lower radial bearing Xb
		14			Axial bearing Z
		15		Maintenance	
		16		Electronic temperature	Electronic temperature
		17		Pump temperature	Pump temperature
		18		Pump sensor	
		19			
		20			
		21			
		22			
		23		Fieldbus communication	Pump not connected
		24		Internal communication	Mag. comm. fail. parameter init.

8.5 Operation via fieldbus

Connecting and using Pfeiffer Vacuum turbomolecular pumps with a fieldbus system is possible when the corresponding control interface is installed on the pump (depends on the ordering guide).

- Refer to the operating instructions of the corresponding control interface (see chapter "Applicable documents").

9 Maintenance

9.1 Maintenance safety instructions

DANGER

Risk to health posed by residual traces of process gases inside the pump

Process gases are toxic and hazardous to health. They can cause poisoning and be fatal. Before disconnecting the pump, any remaining traces of process gases must be eliminated.

- ▶ **The equipment (pumping installation) must be purged with a stream of nitrogen for 30 minutes** at the same pressure and flow as that used for the process itself.

DANGER

Risk of poisoning in case of contact with toxic substances and by-products generated by the process

The vacuum pump, pumping line components and operating fluids **will potentially be contaminated** with toxic, corrosive, reactive and/or radioactive materials related to the process. Any contact with the contaminated parts or by-products generated by the process may be injurious to health and could cause poisoning.

- ▶ Appropriate protective equipments must be worn when disconnecting the pump for maintenance, filling it with operating fluid, or draining it.
- ▶ Ventilate the area thoroughly or carry out the maintenance under an extraction hood.
- ▶ Do not eliminate the by-products/residue via as common waste; have them destroyed by a qualified company where necessary.
- ▶ **Close off all the ports with airtight blanking plates** (the product comes with blanking plates that are also available for sale as accessories).

WARNING

Risk of cutting injuries due to contact with sharp edges via the high vacuum flange

With the high vacuum flange open, access to sharp-edged parts is possible. A manual rotation of the rotor increases the danger situation. There is the risk of cuts, up to the separation of body parts (e.g. fingertips).

- ▶ Wait for the pump to come to a complete standstill, before starting any work on the product.
- ▶ Keep the splinter shield in the inlet flange, as it limits the risk of injury.
- ▶ Wear protective gloves in accordance with standard EN ISO 21420.
- ▶ Never disconnect the high vacuum flange before the rotor is completely immobilized.

WARNING

Danger of electrocution by contact during maintenance or overhaul

There is an electric shock hazard in case of contact with a product powered on and not electrically isolated.

- ▶ Before carrying out any work, set the main switch to **O**.
- ▶ Disconnect the power cable from the mains.
- ▶ Secure the installation correctly by tagging and locking (LO/TO) the system to prevent unintentional re-engagement.

WARNING

Risk of burns in case of contact with hot surfaces

Component temperature remains high, even after the pump has stopped. There is a risk of burns through contact with hot surfaces, especially at the pump exhaust.

- ▶ Wait for the product to fully cool down before working on it.
- ▶ Protective gloves must be worn in accordance with standard EN ISO 21420.

WARNING

Poisoning risk in case of process gas leakage

When connecting/disconnecting components to/from the pumping line (pump, pipework, valves, etc.) for maintenance, the leaktightness of the installation is broken, potentially causing hazardous process gas leakage.

- ▶ Always protect the inlet and exhaust surfaces during dismantling.
- ▶ Perform a leak test on the pumping line after reassembly.

NOTICE

Risk of damaging the pump by generating an electric arc

The pump and its electronic drive unit must not be disconnected from the electrical network before the rotor completely stops rotating and the unit is isolated from the electrical network: an electric arc is created when the circuit is interrupted, which damages internal components.

1. Stop the pump from rotating by sending a '**Stop**' order on the control interface.
2. Wait for the rotor to completely stop rotating (several minutes).
3. Switch off customer power supply from the equipment.
4. Unplug the mains cable.

General maintenance recommendations

- Ensure that the maintenance technician is trained in the safety regulations that cover the pumped gases.
- Disconnect the mains cable from all sources of power before working on the product.
- Wait 5 minutes after powering off before working on the electrical components.
- Wait for the product to cool down completely before working on it.
- Pressurized circuits – nitrogen and water – pose potential energy risks: always lock out these circuits using the LO/TO (Lock Out/Tag Out) procedure before working on the product.
- Route and secure cables, hoses and pipework to guard against falls.
- Collect the residues from the processes and call in a competent organization to dispose of them.
- Always protect the inlet and exhaust flange surfaces.

9.2 Maintenance frequency

By design, the pump does not include parts liable to wear and does not need preventive maintenance. However, **the landing bearings** used to protect the pump against accidental air in-rushes, accidental shocks or power failure have to be changed when indicated by the electronic drive unit: the percentage of landing time to be deducted depends on the number and type of incidents.

The warning threshold informing the operator of the need for landing bearing maintenance is configured via the control mode which controls the pump (HHR, serial link or fieldbus). A counter displays the bearing wear level when landing bearing maintenance should be performed.

Landing bearings

Landing bearings are designed to withstand many accidental landings of the rotor at full speed. The wear of landing bearings is monitored by the electronic drive unit, based on the rotation speed and landing duration. The initial percentage is set at 100%. When this value reaches the warning threshold, a warning is triggered: the landing bearings must be replaced. If other landings occur, the counter continues to decrease to 0%. **These landing bearings must be replaced by a Pfeiffer Vacuum service center.**

Rotor of the pump

The life of the pump rotor changes with the operating conditions and applications. To ensure the best performance, **after 5 years of operation, check the condition of the rotor.** Consult us.



How to contact us

Product overhauls must be carried out by personnel with manufacturer training. Contact our nearest service center at the following e-mail address: Pfeiffer Vacuum Service Support.

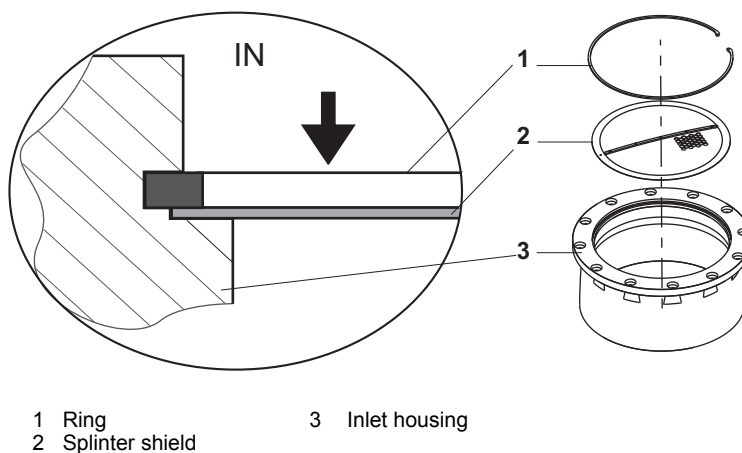
9.3 On-site maintenance

The pump does not require any maintenance on the customer's premises other than the day-to-day servicing described in this manual. All other maintenance operations must be carried out by our service center.

- ▶ Clean the outer surfaces of the product using a clean, lint-free cloth and a product that will not damage the screen-printed surfaces or adhesive labels.
- ▶ Check the exhaust line for clogging.
- ▶ Check that the splinter shield is not clogged; clean it or replace it.
- ▶ Replace the dust filter on the purge solenoid valve if it is obstructed (if valve present).
- ▶ Replace the solenoid valve coils if they are defective.
- ▶ Replace the water solenoid valve if it is defective (if valve present).

Splinter shield replacement

Pump is delivered with splinter shield installed in the pump inlet housing. This splinter shield protects the pump against solid particles coming from vacuum chamber. When it is polluted or damaged, it must be replaced.



For reassembly, respect the following instructions:

1. Install the splinter shield in the inlet housing groove, **bent side facing the vacuum chamber**.
2. Position the ring and **manually press it down on the groove bottom all around its circumference**.

9.4 Exchange procedure by a replacement product

To proceed with a standard exchange, key steps must be followed in sequential order:

1. Disconnecting the pump from the installation.
2. Draining the water circuit.
3. Preparing the pump for shipping.
4. Completing the declaration of contamination.
5. Handling the new pump (see chapter "Handling the pump").
6. Installing a new pump (see chapter "Installation").

Familiarize yourself with the service request procedure and fill in the declaration of contamination when returning products to our service centers ([see chapter "Service solutions by Pfeiffer Vacuum", page 67](#)).

9.4.1 Disconnecting the pump from the installation



Reminder of the risks and safety measures

- Follow the maintenance safety instructions.
- Apply the specific safety instructions in accordance with local laws; this information is available from the customer's health and safety department.

Disconnection procedure

1. Stop the pump by sending a **Stop** order (see chapter "Pumping shutdown").
2. Switch off the pump by setting the mains switch of the electronic drive unit to **O**.
3. Switch off the circuit breaker of the customer's installation.
4. Disconnect the power cable at the electrical connector.
5. Disconnect all the connectors on the control interface.
6. Disconnect the nitrogen supply.
7. Disconnect the **WATER IN** connector followed by the **WATER OUT** connector.
8. Disconnect the pump from the high vacuum flange and blank off the inlet port with the airtight connection accessories (available as accessories).
9. Disconnect the pump from the exhaust and blank off the exhaust port with the airtight connection accessories (available as accessories).
10. Install the handling devices (see chapter "Handling the pump").
11. Disconnect the pump from the installation.

9.4.2 Draining the water circuit

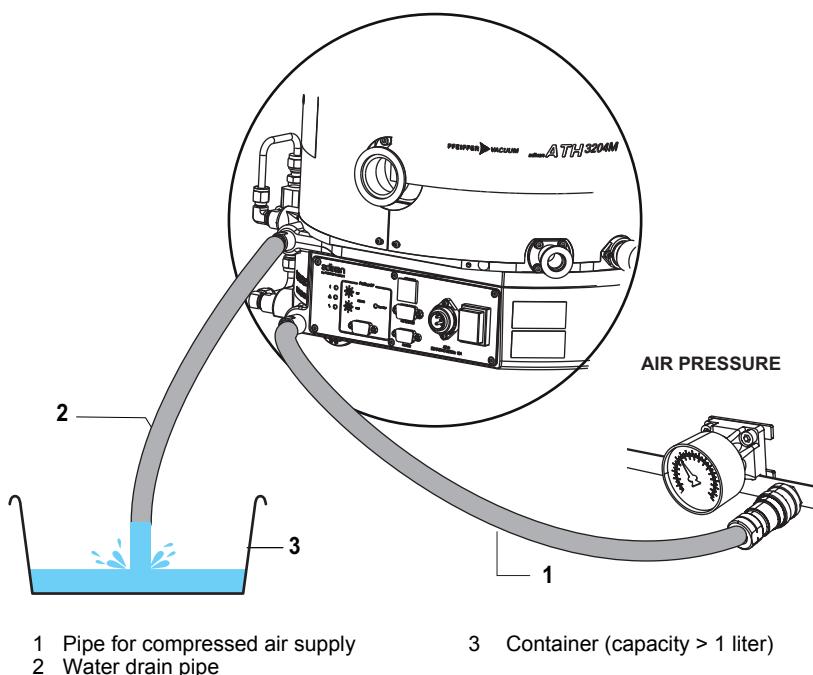
The water must be drained from the pump. To do this, users will need to provide flexible tubes and connectors as well as a compressed air circuit (pressure of 2 to 5·10³ hPa).

NOTICE

Damage to the cooling water circuit

Presence of water in the cooling circuit during transport may cause freezing and therefore damage the valve.

- Cut power supply to the electronic drive unit to ensure that the water valve is open (NO: normally open) during the circuit draining. (see chapter "Powering off")



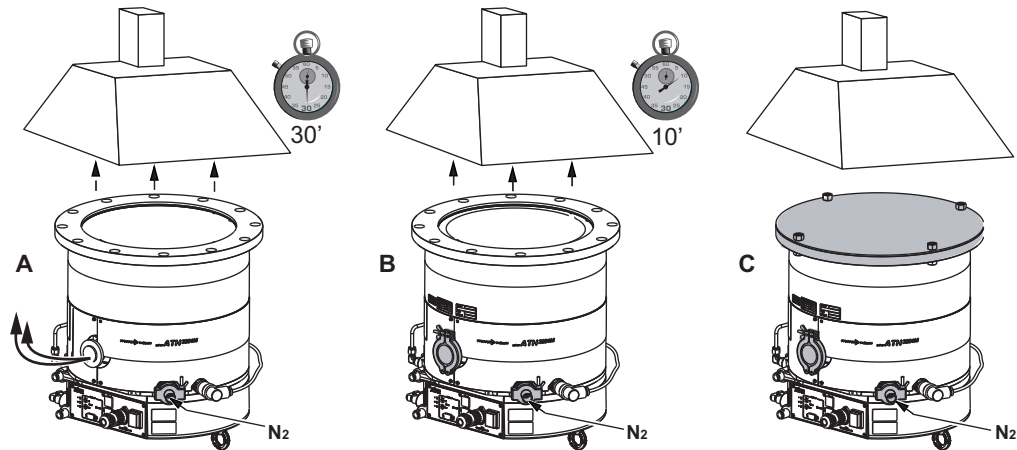
Water circuit draining procedure

1. Disconnect the water circuit from the **WATER IN** and **WATER OUT** connectors.
2. Connect a drain pipe to one of the pump water connectors.
3. Place a container below the connectors.
4. Connect the other connector to a compressed air circuit.
5. Inject compressed air until the water has been completely evacuated.

9.4.3 Preparing the pump for shipping

Pumps due to be shipped must first be roughly decontaminated then pressurized with nitrogen.

To decontaminate and pressurize the pump, you must have a nitrogen supply with the required characteristics (see chapter "Nitrogen characteristics"). Similarly, you should have connection accessories so that the pump can be tightly sealed (see accessories).



A Complete flushing
B Purge/inlet flushing

C Pressurizing the pump

Complete flushing

1. Install the blanking plate equipped with the injector on the connector **PURGE**.
2. Connect the nitrogen to the gas connector provided for this purpose.
3. Flush with nitrogen by injecting a relative pressure of 120 to 150 hPa for 30 minutes.
4. Stop the nitrogen flow.

Purge/inlet flushing

1. Install the blanking plate on the exhaust port **PUMP EXHAUST** and seal.
2. Flush with nitrogen by injecting a relative pressure of 120 to 150 hPa for 10 minutes.
3. Stop the nitrogen flow.

Pressurizing the pump

1. Seal the pump inlet with airtight connection accessories.
2. Pressurize the pump with nitrogen to a relative pressure of 120 hPa.
3. Stop the nitrogen flow.

Labeling the pump

1. Affix this label to the product to warn users that the pump has been in contact with unsafe products.
2. Fill in the declaration of contamination and attach it to the product (see chapter "Service solutions").



10 Decommissioning

10.1 Shutting down for longer periods

NOTICE

Process gas accumulation in stopped equipment

All process pumps are designed for continuous operation in process gas pumping applications and should not be stopped. Pfeiffer Vacuum declines any liability for process pumps that have been stopped for a prolonged period of time leading to by-product condensation, powder build-up or corrosion inside the pump, nor does its warranty cover such items.

► **Carry out a product overhaul before putting it back into service. Contact Pfeiffer Vacuum.**

After use in clean applications

1. Continue nitrogen flow from the process tool for **30 minutes**. Nitrogen pressure and flow rate should be identical to the programmed values during process.
2. Drain the water circuit.
3. Disconnect the pump from the installation.
4. Seal the pump inlet, exhaust and purge ports with included accessories.
5. Store the pump in a clean and dry area, for a maximum period of **6 months** in accordance with storage temperatures.

After use in aggressive applications

► **Never store a pump which has been used in aggressive applications!!**

Proceed with a standard exchange (see chapter "Exchange procedure for replacement products") and return the product to the service center ([see chapter "Service solutions by Pfeiffer Vacuum", page 67](#)).

10.2 Recommissioning

To restart the pump after prolonged storage, refer to the installation instructions ([see chapter "Installation", page 21](#)).

10.3 Disposal

In accordance with directives on the treatment of waste electrical and electronic equipment (WEEE), and concerning the restriction of hazardous substances (RoHS), end-of-life products can be returned to the manufacturer for decontamination and recycling.

The manufacturer shall only be required to take back equipment that is complete and unmodified, using Pfeiffer Vacuum SAS original spare parts, sold by Pfeiffer Vacuum and including all assemblies and sub-assemblies.

This obligation does not cover the shipping cost to a reclamation facility or services provided, for which the customer will be invoiced.

Familiarize yourself with the service request procedure and fill in the declaration of contamination when returning products to our service centers ([see chapter "Service solutions by Pfeiffer Vacuum", page 67](#)).



Environmental protection

The product and its components **must be disposed of in accordance with the applicable regulations relating to environmental protection and human health**, with a view to reducing natural resource wastage and preventing pollution.

Our products contain various materials which can be recycled: steel, stainless steel, brass, aluminum, nickel, copper, fluoroelastomers, PTFE, FEP and electronic boards. Take special precautions for:

- fluoroelastomers which may break down if they are exposed to high temperatures,
- components in contact with products resulting from processes which may have been contaminated.

11 Malfunctions

11.1 Malfunction and fault indication

Read the safety instructions for maintenance (see chapter "Maintenance safety instructions").

When a problem occurs, the user is warned by:

- Activation of the fault/warning LED
- Audible warning of the HHR (if enabled)
- Activation of the fault contacts on the **Remote** connector
- Pumping interruption when the '**Stop**' order has not been activated
- Fault/warning message displayed on the HHR
- A message via the RS-232 or RS-485 serial link
- A message via the fieldbus

Meaning of the LED

- Lit yellow LED = presence of a warning
- Lit red LED = presence of a fault, pump stops

For operation monitoring: (see chapter "Operation monitoring", page 38).

Recommissioning after a stop due to a fault

During the pump stop following a fault, the variable speed drive is switched off and the pump is put in a safe condition. To restart the pump, you must:

- ▶ Switch the power off and **wait until the rotor has stopped**.
 - Mains switch on **O**.
- ▶ Wait approximately 15 seconds.
- ▶ Correct the cause of the fault.
- ▶ Restore power supply.
 - Mains switch on **I**.

11.2 Malfunction

The pump does not start: No indicator light is on

Symptom	Cause	Remedy
The mains switch is on I and no LEDs are lit on the electronic control panel.	No power supply.	1. Check for the presence of voltage on the power line.
	The pump supply voltage is not compatible with the equipment's power configuration.	1. Check that the power line voltage corresponds to required power voltage.

Pump starts only in Stand-by mode

Symptom	Cause	Remedy
Green LED is flashing, nominal speed is not reached while Stand-by mode is not activated.	Electronic drive unit problem.	1. Stop the pump rotation. 2. Reset mains power: mains switch O/I .

Pump runs but vibrates

Symptom	Cause	Remedy
Pump noisy: vibrations appear over 7000 min ⁻¹ .	Mechanical attachment problem.	1. Check that the pump is correctly fastened to the equipment frame. 2. Check that the vibrations do not come from the equipment. 3. Check that the equipment is correctly fastened to the floor (problem due to an anti-vibration flagstone, for example).
	Other problem.	Contact our service center.

Pump is running and a defect occurs: the yellow LED is lit

Message	Symptom	Cause	Remedy
PUMP HOLWECK TEMPERATURE	Electronic drive unit does not stop the pump.	The pump temperature reaches the authorized limits.	1. Check the water-cooling circuit. 2. Check the temperature range.
PUMP SPINDLE TEMPERATURE			
SPEED CONTROLLER TEMPERATURE	Electronic drive unit does not stop the pump.	The electronic drive unit temperature reaches the authorized limits.	1. Check the water-cooling circuit. 2. Check the temperature range.
ELECTRONIC HOUSING TEMPERATURE			
POWER SUPPLY OVER-TEMPERATURE			
MAINTENANCE	The landing bearings need to be replaced.	Landing bearing counter reaches the warning set point.	1. <i>Contact our service center.</i>
INTERNAL COMMUNICATION	The pump cannot start.	Internal communication fault.	1. Turn off the mains power, then turn the pump back on. if the disappears, restart the pump. If the fault occurs again: <i>contact our service center.</i>
HOLWECK TEMPERATURE SENSOR	Electronic drive unit does not stop the pump	MT version: temperature measurement error.	1. Check the heating belt electrical connection.
POWER LIMITATION	Electronic drive unit does not stop the pump, but the maximum flow is limited.	The electronic drive unit's temperature is high.	1. Check the water-cooling circuit.
WATER TEMPERATURE	Electronic drive unit does not stop the pump.	Water inlet temperature on cooling circuit is too high.	1. Check the temperature range.

Pump is running and a defect occurs: the red LED is lit

Message	Symptom	Cause	Remedy
Parameter INIT	The pump cannot start.	Pump is not recognized by the electronic drive unit.	1. Turn off the mains power, then turn it back on. If the message disappears, restart the pump. If the fault happens again <i>contact our service center.</i>
Upper radial bearing Lower radial bearing Axial position Upper radial current Lower radial current Axial current	Electronic drive unit stops the motor. The air inlet solenoid valve is activated. The pump cannot restart.	Electronic drive unit cannot position the rotor.	1. Check that the pump is correctly fastened to the frame (see chapter "Positioning the pump in the installation"). 2. Turn off the mains power, then turn the pump back on. If the message disappears, restart the pump. If the fault occurs again: <i>contact our service center.</i>
PUMP HOLWECK TEMPERATURE PUMP SPINDLE TEMPERATURE	Electronic drive unit stops the motor. The air inlet solenoid valve is activated.	The pump temperature exceeds the authorized limits.	1. Check the water-cooling circuit.

Pump is running and a defect occurs: the red LED is lit			
Message	Symptom	Cause	Remedy
SPEED CONTROLLER TEMPERATURE	Electronic drive unit stops the motor. The air inlet solenoid valve is activated.	The pump temperature exceeds the authorized limits.	1. Check the water-cooling circuit.
ELECTRONIC HOUSING TEMPERATURE			
POWER SUPPLY TEMPERATURE			
SPEED CONTROLLER HALL SENSORS	Electronic drive unit stops the motor. The air inlet solenoid valve is activated.	Hall sensors failure.	1. Turn off the mains power, then turn the pump back on. If the message disappears, restart the pump.
MAGNETIC BEARING	Electronic drive unit stops the motor. The air inlet solenoid valve is activated.	Rotor suspension fault.	If the fault occurs again: <i>contact our service center.</i>
SEIZED PUMP	Electronic drive unit stops the motor.	Rotor is blocked.	1. Turn off the mains power, then turn the pump back on. If the message disappears, restart the pump. If the fault occurs again: <i>contact our service center.</i>
MAG. COMM. FAILURE	The pump cannot start.	Internal communication fault.	1. Turn off the mains power, then turn the pump back on. If the message disappears, restart the pump. If the fault occurs again: <i>contact our service center.</i>
NOT ACCELERATING	Electronic drive unit stops the motor.	The pump cannot accelerate.	1. Check if the backing pump is running (level of fore vacuum).
PUMP NOT CONNECTED	The pump cannot start.	The electronic drive unit does not receive the pump control signals.	1. <i>Contact our service center.</i>
NO MAG SUSPENSION	The pump cannot start.	The electronic drive unit cannot manage the levitation of the rotor.	1. Turn off the mains power, then turn the pump back on. If the message disappears, restart the pump. If the fault occurs again: <i>contact our service center.</i>
WATER TEMPERATURE	Electronic drive unit stops the motor.	Water inlet temperature on cooling circuit is too high.	1. Check the water-cooling circuit . 2. Check the temperature range.

The pump runs but performance is inadequate

Symptom	Cause	Remedy
The pump does not reach the selected speed.	Leaks on the pumping line.	1. Close the isolation valve on the vacuum chamber. 2. Restart the pump. If the selected speed is reached, the leak is in the vacuum chamber.
	Isolation valve at pump exhaust remains closed.	This is the case when the V1 isolation valve control is the customer's responsibility = valve is controlled with 'Start' contact. 1. Check that the valve opens by sending a 'Start' order. If the valve does not open, check the valve electrical wiring and the coil status. 2. With an ohmmeter, check that the 'Start' contact on the electronic drive unit closes when the valve is disconnected. Otherwise, <i>contact our service center</i>.
	Defective fore vacuum.	1. Connect a gauge at the pump inlet and measure the ultimate pressure: it must be $\leq 1 \cdot 10^{-1}$ hPa.
	Air inlet solenoid valve problem.	1. Check on the S2 (12-5) contactor 'Venting' that the output voltage (0 V) when the electronic drive unit is on. 2. Check the correct operation of the air inlet valve (NC). If the output contact is defective, <i>contact our service center</i>.
	Leaks on the air inlet solenoid valve.	1. Replace the solenoid valve with a blanking plate: caution, the pump is no longer secure in this configuration! 2. Start the pump by sending a 'Start' order. If the pump reaches a speed $< 10000 \text{ min}^{-1}$: stop the pump immediately and change the valve otherwise, <i>contact our service center</i>.

12 Accessoires

Accessory	Function	Description	Dimension	P/N
Isolation valve	This isolation valve is used to maintain vacuum in the pump by isolating it in the pumping line.	Manual valve	see manufacturer's catalog	
Hand-held remote control	This accessory allows remote man/machine interface for controlling the pump in local mode.	Control box with cable		114461
Copper seal for CF-F inlet flange	This seal makes the connection between the CF-F housing of the pump and the flange of the installation airtight.		DN 250 CF-F	303294
Purge flow reduction device	This accessory is used to reduce the purge gas flow rate to 50 sccm in some applications.	Installed on purge port	DN 16 ISO-KF	066752S
Splinter shield	This splinter shield protects the pump from solid particles. It is installed in the pump inlet housing.	Stainless steel bent screen + bored clip (mesh size 8 mm)	DN 250 ISO-F	121607
		Aluminum bent screen + bored clip (mesh size 8 mm)	DN 250 ISO-F	123537
		Stainless steel bent screen + bored clip (mesh size 8 mm)	DN 320 ISO-F	112132
		Stainless steel bent screen + bored clip (mesh size 8 mm)	VG 250	121607
		Stainless steel bent screen + bored clip (mesh size 8 mm)	VG 350	114683
Closing accessories	For pump exhaust port	Centering ring with O-ring	DN 40 ISO-KF DN 50 ISO-KF	122ZRG040 122ZRG050
		Quick-connect clamp	DN 40 ISO-KF DN 50 ISO-KF	120BSR040 120BSR050
		Blank-off flange	DN 40 ISO-KF DN 50 ISO-KF	120FBL040 120FBL050
	For purge port	Centering ring with O-ring	DN 16 ISO-KF	122ZRG016
		Quick-connect clamp	DN 16 ISO-KF	120BSR016
		Connection	1/4 VCR-1/8 NPT	108500
Set of screws for pump installation	This set includes connecting accessories to fasten the pump to the equipment via the inlet pump housing.	Set of 12 M 10 x 35 CHc screws	DN 250 ISO-F	110676S
		Lot 32 goujons CHc M 8 x 35	DN 250 CF-F	118690
		Set of 32 M 10 x 70 CHc screws	DN 300 CF-F	121678S
		Set of 12 M 12x 40 CHc screws	DN 320 ISO-F	122531S
Closing set for inlet port	This set includes: the blank-off flange, the O-ring, screws to fix the blanking plate on inlet and 2 lifting rings.		DN 250 ISO-F	108497
			DN 320 ISO-F	114503
			VG 250	108497
			VG 350	115698
			DN 200 ISO-F/VG200	108496
			DN 250 ISO-F/VG250	108497

For blanking plates, claw clamps and quick connect clamps, please refer to the connecting accessories catalog on the pfeiffer-vacuum.com site. Select material properties compatible with the application.

Accessory	Function	Description	Dimension	P/N
Set purge pressurization	For purge port, blanking plate equipped with 1/8" BSPT gas connection		DN 16-ISO-KF	A458805
	For purge port equipped with 1/4 VCR	O-ring		076705
		Female connection		108500

For blanking plates, claw clamps and quick connect clamps, please refer to the connecting accessories catalog on the pfeiffer-vacuum.com site. Select material properties compatible with the application.

13 Spare parts

Description	Function	P/N
24 VDC coil (For pump version M/MT)		038066
Dust filter (For pump version M)		106229
Mains voltage (For pump version M)		119610
Purge solenoid valve 24 VDC (NC) 50 sccm	Purge solenoid valve is used to protect the spindle from back-scattering of application.	111921S
Air inlet solenoid valve 24 VDC (NC) 50 sccm	Air inlet solenoid valve is used to slow down the pump. It only opens for a rotation speed < 10000 min ⁻¹ .	114280
Water solenoid valve 24 VDC (NO)		121681S

14 Service solutions by Pfeiffer Vacuum

We offer first-class service

High vacuum component service life, in combination with low downtime, are clear expectations that you place on us. We meet your needs with efficient products and outstanding service.

We are always focused on perfecting our core competence – servicing of vacuum components. Once you have purchased a product from Pfeiffer Vacuum, our service is far from over. This is often exactly where service begins. Obviously, in proven Pfeiffer Vacuum quality.

Our professional sales and service employees are available to provide you with reliable assistance, worldwide. Pfeiffer Vacuum offers an entire range of services, from original replacement parts to service contracts.

Make use of Pfeiffer Vacuum service

Whether preventive, on-site service carried out by our field service, fast replacement with mint condition replacement products, or repair carried out in a Service Center near you – you have various options for maintaining your equipment availability. You can find more detailed information and addresses on our homepage, in the Pfeiffer Vacuum Service section.

You can obtain advice on the optimal solution for you, from your Pfeiffer Vacuum representative.

For fast and smooth service process handling, we recommend the following:



1. Download the up-to-date form templates.
 - Explanations of service requests
 - Service requests
 - Contamination declaration



- a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
- b) If necessary, drain operating fluid/lubricant.
- c) If necessary, drain coolant.
2. Complete the service request and contamination declaration.



3. Send the forms by email, fax, or post to your local Service Center.

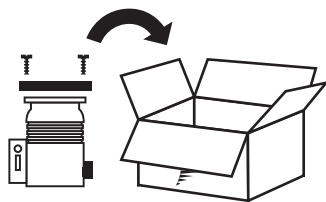


4. You will receive an acknowledgment from Pfeiffer Vacuum.

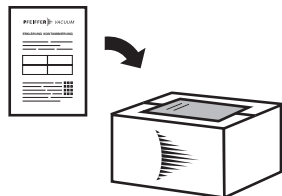
PFEIFFER VACUUM

Submission of contaminated products

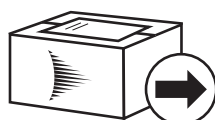
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination costs** may be incurred.



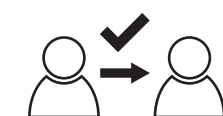
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
 - a) Neutralize the product with nitrogen or dry air.
 - b) Seal all openings with blind flanges, so that they are airtight.
 - c) Shrink-wrap the product in suitable protective foil.
 - d) Package the product in suitable, stable transport containers only.
 - e) Maintain applicable transport conditions.



6. Attach the contamination declaration to the **outside** of the packaging.



7. Now send your product to your local Service Center.



8. You will receive an acknowledgment/quotation, from Pfeiffer Vacuum.

PFEIFFER VACUUM

Our sales and delivery conditions and repair and maintenance conditions for vacuum devices and components apply to all service orders.

15 Technical data and dimensions

15.1 General

Basic principles for the Technical Data of Pfeiffer Vacuum turbomolecular pumps:

- ▶ Recommendations from PNEUROP committee PN5.
- ▶ ISO 21360; 2007: "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"
- ▶ Ultimate pressure: using a test dome and after 48 hours of baking out.
- ▶ Gas throughput: with water cooling.
- ▶ Cooling water consumption: at max gas throughput, water temperature 20 °C.
- ▶ Sound pressure level: distance of 1 m to the pump.
- ▶ Technical data measured without splinter shield at pump inlet.

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
bar	1000	1	$1 \cdot 10^5$	1000	100	750
Pa	0.01	$1 \cdot 10^{-5}$	1	0.01	$1 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$
hPa	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr mm Hg	1.33	$1.33 \cdot 10^{-3}$	133.32	1.33	0.133	1

$$1 \text{ Pa} = 1 \text{ N/m}^2$$

Tbl. 5: Conversion table: Pressure units

	mbar l/s	Pa m³/s	sccm	Torr l/s	atm cm³/s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m³/s	10	1	592	7.5	9.87
sccm	$1.69 \cdot 10^{-2}$	$1.69 \cdot 10^{-3}$	1	$1.27 \cdot 10^{-2}$	$1.67 \cdot 10^{-2}$
Torr l/s	1.33	0.133	78.9	1	1.32
atm cm³/s	1.01	0.101	59.8	0.76	1

Tbl. 6: Conversion table: Units for gas throughput

15.2 Technical characteristics

Technical data		ATH 2804 M	ATH 2804 MT	ATH 3204 M	ATH 3204 MT
Inlet flange		DN 250 ISO-F / VG 250	DN 250 ISO-F / VG 250	DN 320 ISO-F / VG 350	DN 320 ISO-F / VG 350
Exhaust flange ¹⁾		DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF
Purge flange ¹⁾		DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF
Pumping speed	N ₂	2300 l/s	2300 l/s	3050 l/s	3050 l/s
	Ar	2300 l/s	2300 l/s	2870 l/s	2870 l/s
	He	2300 l/s	2300 l/s	2500 l/s	2500 l/s
	H ₂	1630 l/s	1630 l/s	1850 l/s	1850 l/s
	SF ₆	1650 l/s	1650 l/s	2130 l/s	2130 l/s
Compression ratio	N ₂	$> 1 \cdot 10^9$	$> 1 \cdot 10^9$	$> 1 \cdot 10^9$	$> 1 \cdot 10^9$
	Ar	$> 1 \cdot 10^9$	$> 1 \cdot 10^9$	$> 1 \cdot 10^9$	$> 1 \cdot 10^9$
	He	$9 \cdot 10^4$	$9 \cdot 10^4$	$9 \cdot 10^4$	$9 \cdot 10^4$
	H ₂	$4.9 \cdot 10^3$	$4.9 \cdot 10^3$	$4.9 \cdot 10^3$	$4.9 \cdot 10^3$
	SF ₆	$1 \cdot 10^{10}$	$1 \cdot 10^{10}$	$1 \cdot 10^{10}$	$1 \cdot 10^{10}$

Technical data		ATH 2804 M	ATH 2804 MT	ATH 3204 M	ATH 3204 MT
Maximum flow with water flow 60 l/h ^{2) 3)}	N2	5000 sccm	2200 sccm	5000 sccm	2200 sccm
	Ar	2200 sccm	1400 sccm	2200 sccm	1400 sccm
	He	> 5000 sccm	> 2500 sccm	> 5000 sccm	> 2500 sccm
	H2	> 5000 sccm	> 2500 sccm	> 5000 sccm	> 2500 sccm
Maximum pressure at inlet ²⁾	N2	$4 \cdot 10^{-1}$ hPa	$3.7 \cdot 10^{-2}$ hPa	$3.7 \cdot 10^{-1}$ hPa	$3.6 \cdot 10^{-2}$ hPa
	Ar	$2.7 \cdot 10^{-2}$ hPa	$1.2 \cdot 10^{-2}$ hPa	$2.6 \cdot 10^{-2}$ hPa	$1.1 \cdot 10^{-2}$ hPa
Maximum pressure at exhaust ⁴⁾	N2	5 hPa	2.2 hPa	5 hPa	2.2 hPa
	Ar	3.5 hPa	1.8 hPa	3.5 hPa	1.8 hPa
Ultimate pressure ⁵⁾		$< 1 \cdot 10^{-8}$ hPa	$< 1 \cdot 10^{-8}$ hPa	$< 1 \cdot 10^{-8}$ hPa	$< 1 \cdot 10^{-8}$ hPa
Nominal rotation speed		25000 min ⁻¹ (417 Hz)	25000 min ⁻¹ (417 Hz)	25000 min ⁻¹ (417 Hz)	25000 min ⁻¹ (417 Hz)
Stand-by speed		15000–25000 min ⁻¹ (250–417 Hz)	15000–25000 min ⁻¹ (250–417 Hz)	15000–25000 min ⁻¹ (250–417 Hz)	15000–25000 min ⁻¹ (250–417 Hz)
Maxi. regulation temperature ⁶⁾		-	85 °C	-	85 °C
Maxi. bake-out temperature		90 °C	-	90 °C	-
Leak rate		$< 5 \cdot 10^{-8}$ hPa l/s	$< 5 \cdot 10^{-8}$ hPa l/s	$< 5 \cdot 10^{-8}$ hPa l/s	$< 5 \cdot 10^{-8}$ hPa l/s
Purge flow rate		50 sccm	50 sccm	50 sccm	50 sccm
Supply voltage ⁷⁾		200-240 V AC 50/60 Hz - 10 A			
Maximum current leakage ⁸⁾		< 3.5 mA	< 3.5 mA	< 3.5 mA	< 3.5 mA
Start-up time		< 8 mn	< 8 mn	< 8	< 8
Start up power		1100 W	1100 W	1100 W	1100 W
Power consumed at ultimate pressure		< 160 W	< 590 W	< 160 W	< 590 W
Power at minimum stand-by speed		< 130 W	< 560 W	< 130 W	< 560 W
Vibration level (at nominal speed)		< 0.01 µm	< 0.01 µm	< 0.01 µm	< 0.01 µm
Sound level		< 43 dB (A)	< 43 dB (A)	< 43 dB (A)	< 43 dB (A)
Weight		98 kg	101 kg	80 kg	103 kg
Electronic drive unit		integrated on the pump			

1) The products that have customer specificities may have different characteristics.

2) With an exhaust pressure < 0.4 hPa, depends on external conditions (temperature, water flow rate, ambient temperature). For other conditions, contact us.

3) Temperature setpoint to 70 °C with pump version MT.

4) Reduced maximum flow rate, ultimate pressure at exhaust without loss of flow rate speed. Depends on environmental conditions.

5) With ISO-F flange (best with CF-F flange). Contact us.

6) This maximum temperature influences the maximum flow, contact us. Beside, for temperature values above 75 °C, a specific configuration is required for the pump, please contact us.

7) In accordance with EC regulations, the pumps can withstand a voltage variation of ± 10 %.

8) Value for the pump and integrated electronic drive unit; All the current leakage may not pass through the earth wire, this depends on the way the pump is connected to the earth via the equipment in which it is integrated.

15.3 Environmental characteristics

Use	indoor use
Installation altitude	up to 2000 m
Electronic drive unit protection rating	IP 54
Ambient operating temperature	5 – 45 °C
Storage temperature	-5 – +50 °C
Maximum relative humidity	80 % max. with T ≤ 31 °C, up to 50 % max. with T ≤ 40 °C

1) Transient overvoltages up to overvoltage category II levels. Temporary overvoltages that affect the mains supply.

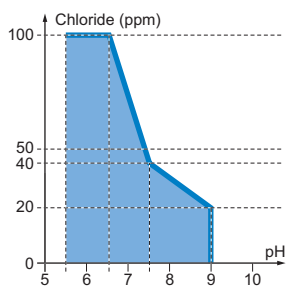
Pollution degree	level 2
Transient overvoltage protection ¹⁾	Category II
1) Transient overvoltages up to overvoltage category II levels. Temporary overvoltages that affect the mains supply.	

Tbl. 7: Environmental characteristics

15.4 Cooling water characteristics

The characteristics below concern only the turbomolecular pump with magnetic ball bearings. This pump is associated with a backing pump. To ensure the effective operation of the application:

- Comply with the most restrictive characteristics for the installation.
- Make sure the water coming from the equipment does not freeze.

	pH	5.5 to 9
	Chlorides ¹⁾	100 to 20 ppm depending on the pH
	Hardness	< 35 °fH (French degree) < 7 milliequivalent/L < 350 mg/L of CaCO ₃ (calcium carbonate)
	Total dissolved solids	< 100 mg/L
	LSI (Langelier saturation Index) = pH - pH _s	< 0 to 20 °C
	Particle size	< 0.2 mm
	Resistivity	R > 1 500 Ω cm
	Inlet temperature ²⁾	15-35 °C (M version) 15-25 °C (MT version)
	Relative inlet pressure	< 6 · 10 ³ hPa
	Input/output pressure difference	depends on flow
	Flow	> 60 l/h

1) The oxidizing action of the chlorine depends on the pH (aggressiveness of the water). The chloride content must be within the colored area on the graph.

2) According to the conditions of use, please contact us.

Tbl. 8: Cooling water characteristics

Type of connection

Water input	1/4" NPT female
Water output	1/4" NPT female

15.5 Nitrogen characteristics

H ₂ O concentration	< 10 ppm v
O ₂ concentration	< 5 ppm v
Dust	< 1 µm
Oil	< 0.1 ppm v
Absolut pressure	1 · 10 ³ to 1.5 · 10 ³ hPa

Tbl. 9: Nitrogen characteristics

Purge gas inlet (on valve)	1/8" NPT female
Nitrogen inlet on the blanked-off flange (pressurization)	1/8" NPT female

15.6 Electrical characteristics

Characteristics of the three-phase motor	ATH 2804 M/MT	ATH 3204 M/MT
Voltage between phases	69 Vrms	69 Vrms
Power frequency	833 Hz	833 Hz
Phase current	14A	14A

Tbl. 10: Electrical characteristics of the pump

Main switch short circuit cut-off capacity	10 kA
Main circuit breaker rating	16 A (for 200-240 V - 50/60 Hz voltage)
GFI (or RCD) type B differential circuit breaker compatible with TT ¹⁾ electrical networks	30 mA
1) for TN and IT networks, use appropriate protection measures	

Tbl. 11: Electrical characteristics of the customer's network

15.7 Dimensions

The products with customer specificities may have different dimensions (see chapter "Products concerned").

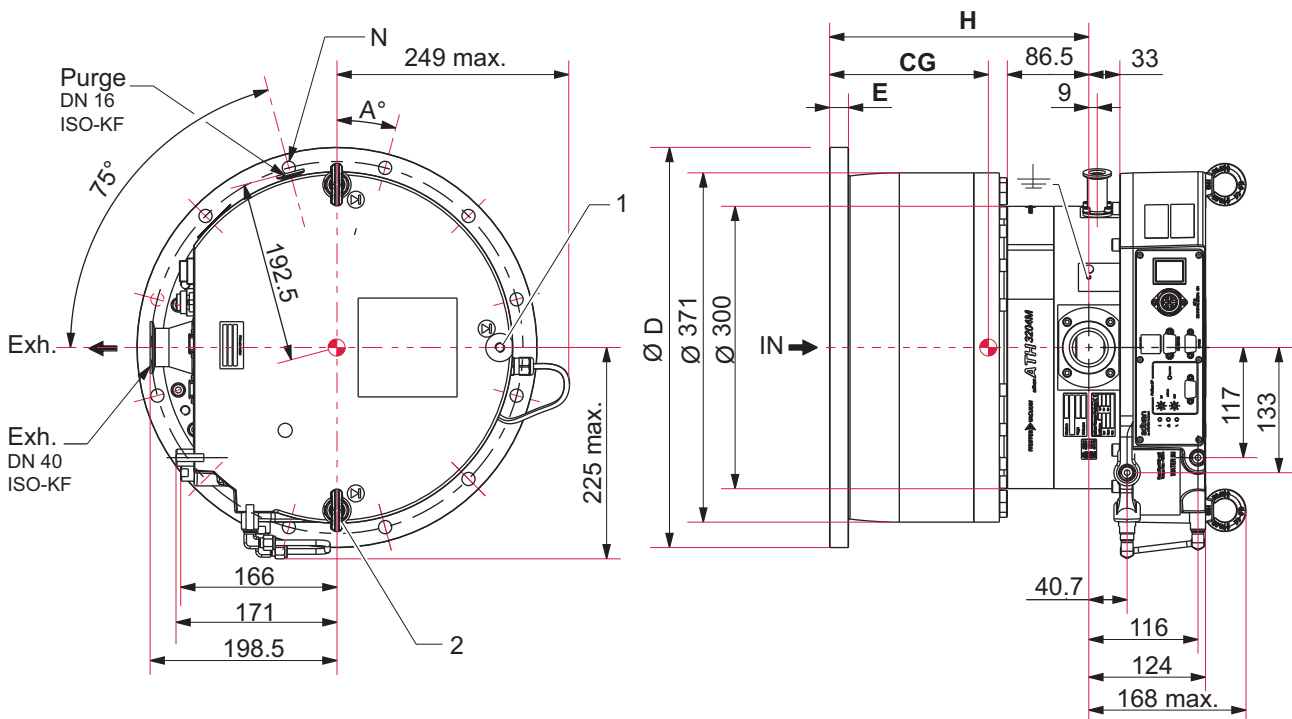


Fig. 15: ATH 2804 M - ATH 3204 M - Dimensions



Center of gravity

CPC ground connection



Equidistant holes Ø d2 on Ø d1

1 3 M10 holes for handling

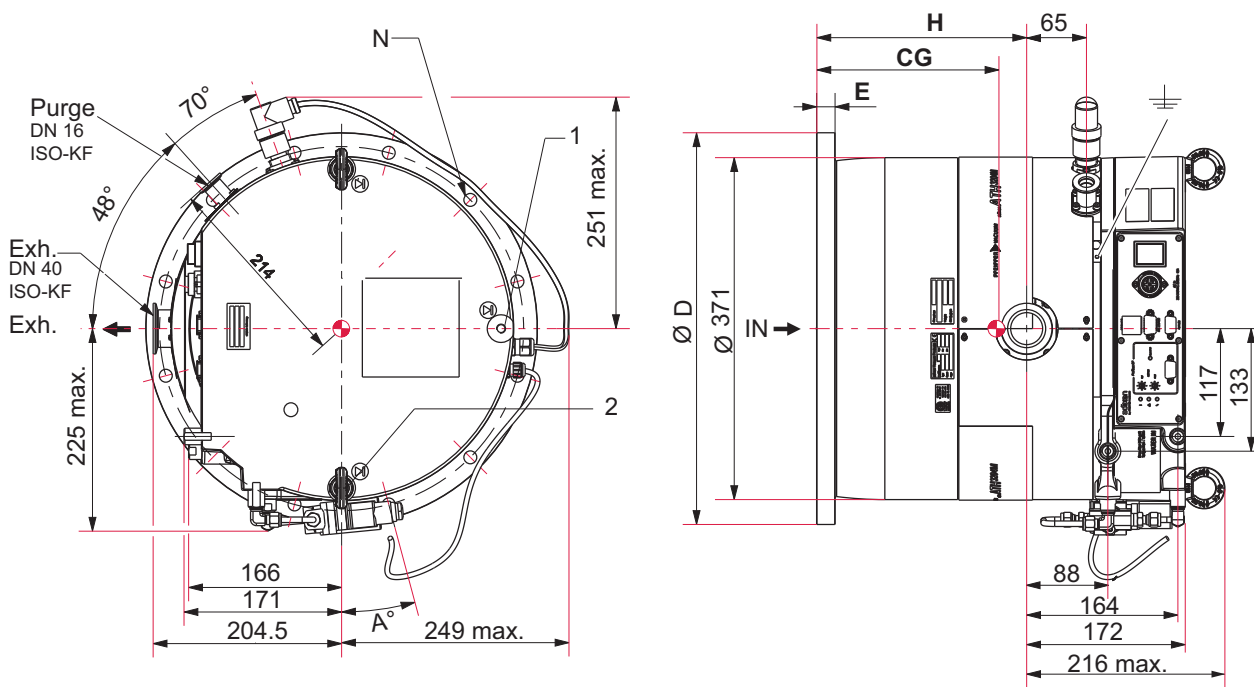
2 Lifting rings (Qty: 2)

ATH 2804 M model - Dimensions (mm)

Inlet flange	E	H	D	A° (degree)	d1	d2	CG
DN 250 ISO-F	16	347.3	355	15	310	11	234.9
DN 250 CF-F	24	363.3	304.8	5.625	284	8.4	249.9
VG 250	16	347.3	350	15	320	15	230.9

ATH 3204 M model - Dimensions (mm)

Inlet flange	E	H	D	A° (degree)	d1	d2	CG
DN 320 ISO-F	20	275.3	425	15	395	14	195.5
VG 350	20	275.3	450	15	420	15	192.6
VG 300	16	288.3	400	15	370	15	189
DN 300 CF-F	28.5	357.3	355.6	12	325.4	10.5	237.5


Fig. 16: ATH 2804 MT - ATH 3204 MT - Dimensions


Center of gravity

CPC ground connection

N Equidistant holes Ø d2 on Ø d1

1 3 M10 holes for handling

2 Lifting rings (Qty: 2)

ATH 2804 MT model - Dimensions (mm)

Inlet flange	E	H	D	A° (degree)	d1	d2	CG
DN 250 ISO-F	16	299.9	335	15	310	11	238.9
DN 250 CF-F	24	363.3	304.8	5.625	284	8.4	253.9
VG 250	16	299.9	350	15	320	15	234.9

ATH 3204 MT model - Dimensions (mm)

Inlet flange	E	H	D	A° (degree)	d1	d2	CG
DN 320 ISO-F	20	227.9	425	15	395	14	187.8
VG 350	20	227.9	450	15	420	15	190.7
VG 300	16	244.9	400	15	370	15	208.9
DN 300 CF-F	28	309.9	368.3	4.5	338.1	10.8	261.4

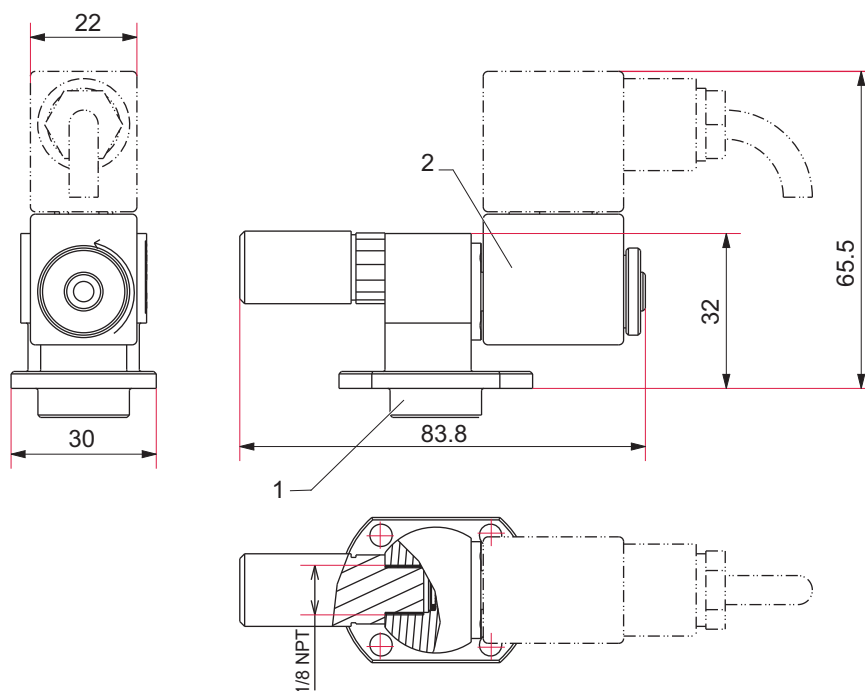


Fig. 17: Purge solenoid valve - Dimensions

- 1 Connection to pump 2 Possible rotation

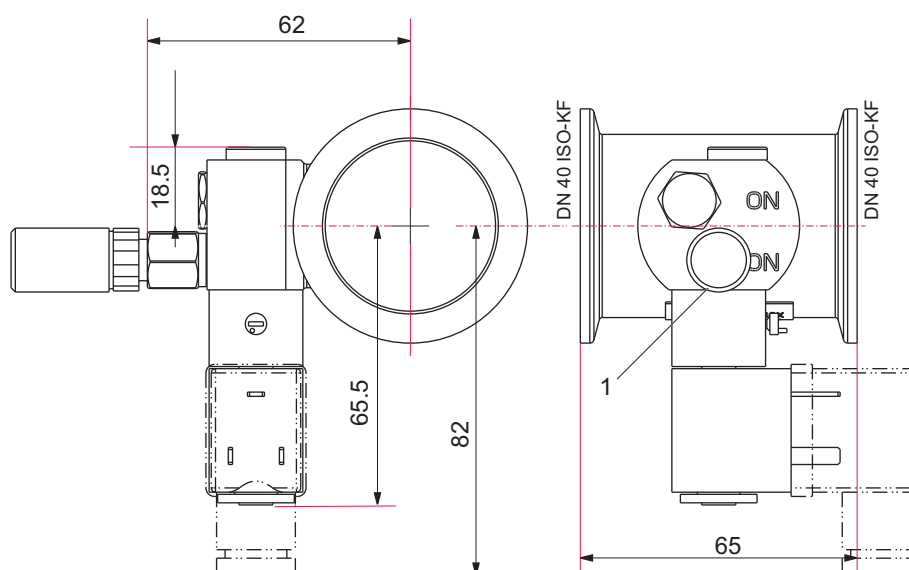


Fig. 18: Air inlet solenoid valve - Dimensions

- 1 1/8" NPT female connector

EC Declaration of Conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

Magnetically levitated turbomolecular pump

ATH 2804 M ¹⁾

ATH 2804 MT ¹⁾

ATH 3204 M ¹⁾

ATH 3204 MT ¹⁾

1) Pump connected to an electronic drive unit OBC V5.

We hereby declare that the listed product satisfies all relevant provisions of the following **European Directives**.

Machinery 2006/42/EC (Annex II, no. 1 A)

Electromagnetic compatibility 2014/30/EU

Restriction of the use of certain hazardous substances 2011/65/EU

The objectives of the Low Voltage Directive 2014/35/EU are complied with in accordance with Annex I, No. 1.5.1 of the Machinery 2006/42/EC

Harmonized standards and national standards and specifications which have been applied:

NF EN 1012-2 : 1996/A1 : 2009

NF EN 61010-1 : 2010/A1 : 2019

NF EN 61000-6-2 : 2019

NF EN 61000-3-2 : 2014 et 2018

NF EN 61000-3-3 : 2014/A1 : 2019

NF EN 61000-6-4 : 2019

The person authorized to compile the technical file is Mr. Varennes Nicolas, Pfeiffer Vacuum SAS (Simplified joint stock company), 98, avenue de Brogny B.P. 2069, 74009 Annecy cedex.

Signature:



Pfeiffer Vacuum SAS
98, avenue de Brogny
74009 Annecy cedex
France
B.P. 2069

Tobias Stoll
Product Group Turbo Pumps
Director

Annecy 2021/11/30



This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

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Applicant: PFEIFFER VACUUM SAS

Manufacturer: PFEIFFER VACUUM SAS

Address: 98, avenue de Brogny
74000 Annecy

Address: 98, avenue de Brogny
74000 Annecy

Country: France

Country: France

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Intertek Italia SpA

[Signature]

Control Number: 3026716

Authorized by:

for L. Matthew Snyder, Certification Manager



This document supersedes all previous Authorizations to Mark for the noted Report Number.

This Authorization to Mark is for the exclusive use of Intertek's Client and is provided pursuant to the Certification agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Authorization to Mark. Only the Client is authorized to permit copying or distribution of this Authorization to Mark and then only in its entirety. Use of Intertek's Certification mark is restricted to the conditions laid out in the agreement and in this Authorization to Mark. Any further use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. Initial Factory Assessments and Follow up Services are for the purpose of assuring appropriate usage of the Certification mark in accordance with the agreement, they are not for the purposes of production quality control and do not relieve the Client of their obligations in this respect.

Intertek Testing Services NA Inc.
545 East Algonquin Road, Arlington Heights, IL 60005
Telephone 800-345-3851 or 847-439-5667 Fax 312-283-1672

Standard(s):	Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements [UL 61010-1:2012 Ed.3+R:19Jul2019]
	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials [UL 61010-2-010:2019 Ed.4]
	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements [CSA C22.2#61010-1-12:2012 Ed.3+U1;U2;A1]
	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials [CSA C22.2#61010-2-010:2019 Ed.4]
Product:	Secondary vacuum pump on magnetic bearings with integrated controller
Brand Name:	PFEIFFER VACUUM and Adixen
Models:	ATH2804M, ATH2804MT, ATH3204M, ATH3204MT



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perfect vacuum solution?
Please contact us

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