



OPERATING INSTRUCTIONS

EN

Translation of the Original

ACP 15

Multi-stage Roots pump, air cooled

PFEIFFER  **VACUUM**

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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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 Applicable documents

Document	Reference
Declaration of conformity	included with these operating instructions
UL/CSA compliance (ETL mark)	included with these operating instructions

1.1.2 Products concerned

This document applies to products equipped with P0568E2 frequency converter, and with the following part numbers:

Part Number	Model	Description
V5SAXXXGXX V5VXXXXGXX	ACP 15 SD	Models for standard applications
V5VGXXXXGXX V5GAXXXGXX	ACP 15 G	Models for applications with traces of corrosive gases

1.2 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.

1.3 Conventions

1.3.1 Pictographs

Pictographs used in the document indicate useful information.



Note



Tip

1.3.2 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.

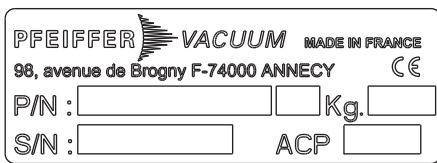
Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

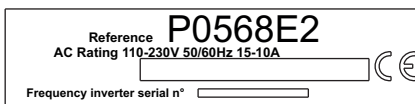
1. Step 1
2. Step 2
3. ...

1.3.3 Labels

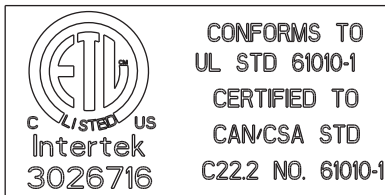
I/O	Pump Start/Stop
INLET	Pump inlet connection
PUMP EXHAUST	Pump exhaust



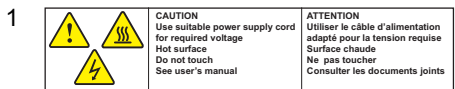
Product rating plate (example).



This label indicates the voltage of the equipment to which the pump is to be connected.



This label indicates that the pump is compliant with UL/CSA tests.



This label warns the user against potential risks associated with the use of this product. Any person responsible for installation or operation of the product must first refer to the operating manual.



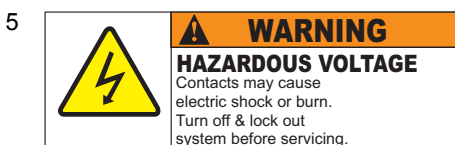
This label indicates that the power supply must be switched off before connecting and/or disconnecting the pump. Any person responsible for installation or operation of the product must first refer to the operating manual.



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 warns users that they risk being injured if their hands come into contact with a hot surface: wear protective gloves before any intervention.



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 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.

7

SEISMIC TIE DOWN
A 329 962 - 5

This label indicates the location of the holes for seismic bracket installation.

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:

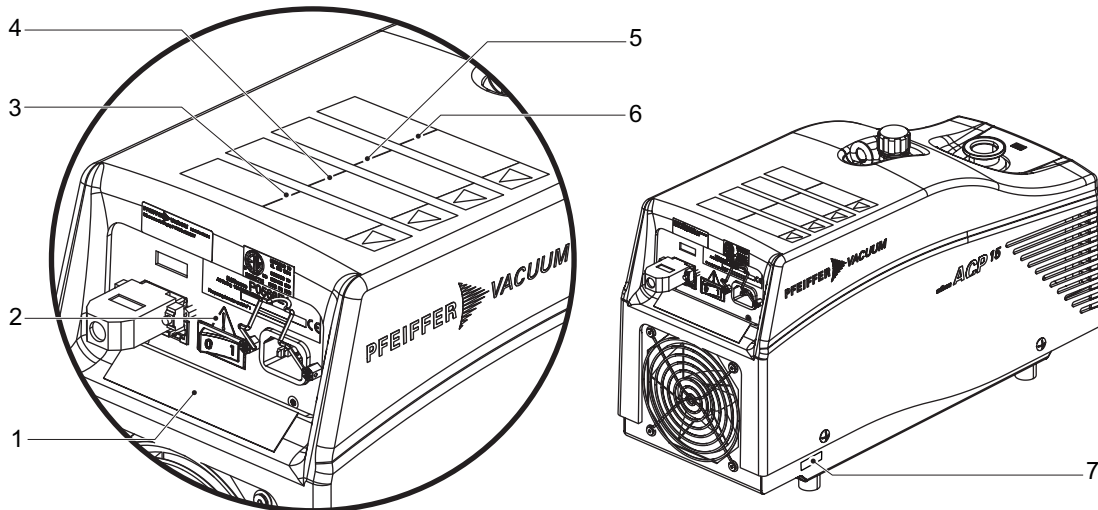


Fig. 1: Safety label locations

- | | |
|---------------------|---------------------------------|
| 1 Security warning | 5 Electric shock hazard |
| 2 Electrical safety | 6 Moving parts |
| 3 Heavy object | 7 Seismic brackets anchor point |
| 4 Hot surface | |

1.3.4 Abbreviations

- | | |
|------------|-----------------------|
| EMS | Emergency stop |
| LEL | Lower Explosive Limit |

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

2.1.1 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 suspended	
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 electrical 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.	

⚠ 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 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.
- ▶ **The pump exhaust must be connected** to the installation's dangerous gases 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 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 EN420.

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

The pump inlet flange is large enough for body parts (fingers or hands) 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.**

2.1.2 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.

- ▶ Do not expose any part of the human body to the vacuum.
- ▶ Comply with all safety and risk prevention instructions in accordance with local safety standards.
- ▶ 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.

2.2 Intended use

- The vacuum pump should only be used to generate a vacuum while pumping gases.
- The vacuum pump is designed to operate in industrial environments.
- The product may be used in a laboratory environment.
- The G version is used to pump **traces of corrosive gases**.

2.3 Foreseeable 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 of flammable and explosive mixtures
- Pumping of corrosive gases (exception: pumps in G version for traces of corrosive gases)
- Pumping liquids
- Pumping dust particles
- Using the vacuum pump to generate pressure
- Using the pump in potentially explosive areas
- Using accessories or spare parts not mentioned in these operating instructions

The product is not designed to carry people or loads and should not be used as a seat, stepladder or similar.

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

⚠ WARNING

Risk of crushing when the product is suspended

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:

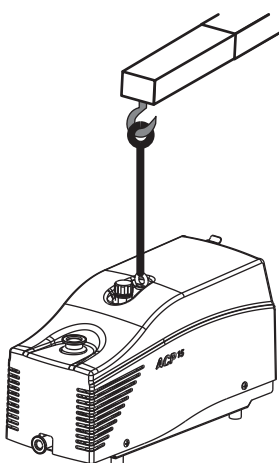
- ▶ Only qualified staff trained in handling heavy objects are authorized to handle the product.
- ▶ The lifting devices provided **must be used** and the procedures set out in this document must be followed.

⚠ WARNING

Risk of crushing related to product tilting

Although the product fully complies with the EEC safety regulations, there is a risk of tilting when it is moved over the floor or is not properly secured.

- ▶ Do not place the product on an inclined plane.
- ▶ Place it on a flat, hard floor.
- ▶ Do not push the product sideways.



Handling the pump using a hoist

1. Use a lifting device suitable for the product's weight.
2. Use a 1-strap sling with the following characteristics:
 - load per strap > **23 kg**
3. With the sling, lift the pump using the hoisting ring.

A wheel kit is available as accessory: fitted over the frame, it facilitates the movement of the pump over short distances (see chapter "Dimensions", page 42).

3.3 Storage



Pfeiffer Vacuum recommends storing the products in their original transport packaging.

Storing a new pump

1. Keep the pump wrapped in its protective envelope.
2. **Always** leave inlet, exhaust and purge protections in place.
3. Store the pump in line with the permitted storage temperatures for a maximum period of **1 year**.

Storing a new pump for longer than 1 year

Run the pump regularly **at least once a year**: factors such as temperature, degree of humidity, salt air, etc. may cause the deterioration of the pump components.

1. Let the pump run for 30 minutes with gas ballast opened or while injecting a dry neutral gas into the pump (G version).
2. Let the pump run for 30 minutes at ultimate pressure (inlet, gas ballast and purge ports closed).
3. Stop the pump.
4. Seal the pump inlet, exhaust and purge ports with included accessories.
5. Repeat this **at least once a year**.

Beyond 4 years, the pump must be reviewed at our service centers before commissioning (see chapter "Service solutions by Pfeiffer Vacuum", page 37).

For prolonged immobilization after use, see chapter "Extended Immobilization".

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 vacuum pump
- 1 remote cover plug for remote connector (connected to the pump)
- 1 operating instruction manual
- 1 sheet of multilingual labels

According to the ordering configuration:

- 1 mains supply cable

4.1.2 Differences between pump versions

The multi-stage Roots pump technology in **the ACP series** meets the requirements of applications where a clean and dry vacuum is needed.

SD standard version

The pump is designed for clean (dust-free) and non-corrosive gas pumping applications. Standard pumps are equipped with a gas ballast device to improve pumping of light gases and avoid vapor condensation inside the pump.

G version

The pump is compatible with traces of corrosive gases. A purge gas stream protects low- and high-pressure ball bearings and dilutes trace amounts of corrosive gases.

Please contact Pfeiffer Vacuum for more detailed information on specific applications.

4.2 Human/Machine Interface

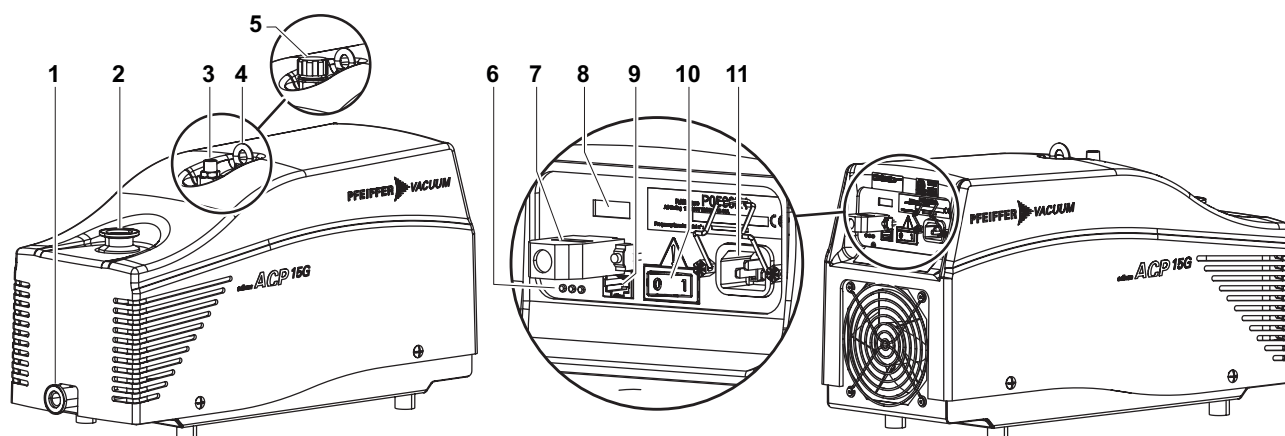


Fig. 2: ACP 15 pump description

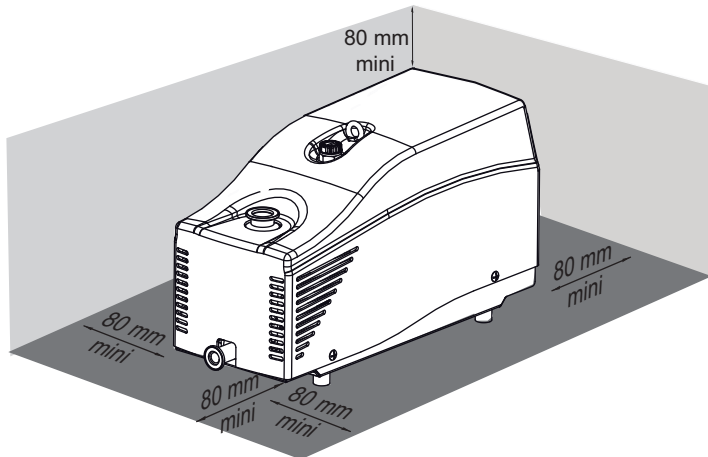
- | | |
|--|---|
| 1 Pump exhaust | 7 Remote connector and RS-485 connector |
| 2 Pump inlet | 8 Hour counter |
| 3 Inert gas purge connection (G version) | 9 RJ45 connector |
| 4 Hoisting ring | 10 I/O main switch |
| 5 Gas ballast | 11 Mains power supply |
| 6 Indicator lights | |

5 Installation

5.1 Installation

The pump needs to operate in a horizontal position resting on its feet, the pumping axis must be vertical, and the pump inlet must be on top.

1. Determine where the pump will be located.
2. Handle the pump using a hoist.
3. Install the pump so that the I/O main switch can be accessed by the operator.



Ventilation

To guarantee the characteristics and performances of the pump within the boundaries of the operating conditions:

- Do not obstruct the air vents.
- Keep the pump away from fixed walls, at a minimum using the value indicated on the diagram below.

5.2 Connecting to the pumping line

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

⚠ WARNING

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

The pump inlet flange is large enough for body parts (fingers or hands) 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 practices

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

1. Only use accessories on 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](http://Pfeiffer-Vacuum.com) website.
2. 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.).

3. The O-rings located under the blanking plates are not compatible with all applications. **Product users or integrators are responsible for installing O-rings that are compatible with their applications.**
4. Remove the blanking plates used to seal the inlet and exhaust ports.
5. Keep the blanking plates, screws and washers for reuse when transporting the pump.
6. Ensure that no screws, washers or other objects are dropped into the pump inlet.
7. Fit flexible tubes in the pumping line to reduce the transmission of vibration.
8. Perform a leak test on the entire pumping line after installation.

5.2.1 Connection on the pump inlet 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.

To achieve the optimum pumping speed, make the pumping line **as short and straight as possible and ensure that its inside diameter is not narrower than the pump inlet flange inside diameter.**

The product is not designed to withstand loads on its inlet flange which may compromise stability.

- Mechanically attach the vacuum chamber separately from the pump.
- Use only dry parts and clean, grease-free, dust-free pipelines.
- It may be necessary to install an inlet filter (particle filter or condensable filter).
- If necessary, install an isolation valve on the inlet which closes when the pump stops.

5.2.2 Connection on the pump exhaust side

⚠ 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 **may potentially be contaminated** with toxic, corrosive, reactive and/or radioactive substances related to the process and harmful to health.

- ▶ Always connect the pump exhaust to an exhaust extraction system.



Ensure that all components in the exhaust line have a maximum pressure rating that exceeds the highest pressure the pump can generate.

5.2.3 Connecting the purge circuit

The gas purge consists of 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 about the type of purge gas, contact your Pfeiffer Vacuum 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.



The effect of nitrogen injection continuity on the process

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

Version G

A gas purge circuit protects the low- and high-pressure ball bearings and dilutes trace amounts of corrosive gases.

The pump must be connected to a dry and filtered nitrogen supply that has the required characteristics (see chapter “Nitrogen characteristics”).

1. Connect the neutral gas pipe to the 1/4 BSPT connector provided for this purpose (flexible or rigid pipe supplied by the customer).
2. Install an isolation valve on the neutral gas injection circuit, as close as possible to the pump. This enables the pump to recover its initial pumping performances when gas injection is not used.
3. The purge maximum pressure must not exceed de 300 hPa (relative).

5.3 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.

5.4 Electrical connection

⚠ WARNING

Risk of electric shock due to non-compliant electrical installations

This product uses mains voltage for its electrical 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.

⚠ 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.

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 is equipped with an **I/O** main switch that isolates the product from the power line when it is in **O** position.

The pump is equipped with a frequency converter in compliance with EC standards that allows the pump to run automatically at high and low voltages. The frequency converter is protected against short-

circuits from power line. Once this safety process is activated, power is switched off and the pump is put into a safe condition.

Procedure for restarting the pump after a power failure

To restart the pump:

1. switch off the power supply: flip the main switch to position **O**,
2. eliminate the cause of the fault, then
3. wait for about 15 seconds,
4. flip the main switch to position **I**.

The pump has thermal sensors that prevent start-up at certain temperatures (see chapter "Preliminary precautions for use").

5.4.1 Customer electrical installation protection

The pump is connected to the mains with the mains power cable provided. The earth connection (frequency converter, cover, pump) is made via the power cable connected to a compliant electrical installation.

If the mains power cable is provided by the customer, use an EEC cable that is compliant with IEC 60227 and IEC 60245 standards with the following characteristics:

- heatproof (if it is in contact with hot surfaces),
- the section of conducting wires is suitable for the voltage (see chapter "Electrical characteristics"),
- and one of the wires must ensure grounding of the pump.

Installation protection with circuit breaker

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").



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.

5.4.2 Mains connection

- ▶ Connect the mains supply cable of the pump to the customer's electrical installation.

5.5 Remote connector wiring

NOTICE

Safety Extra-Low Voltage circuits

The remote control circuits are equipped with dry contact outputs (30 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 30 V and the current less than 1 A.

Description

Connections to the (15-pin Male D-Sub) connector are used to:

- remotely control the start and stop functions,
- set the rotation speed.

The connector wiring is the customer's responsibility.

5.5.1 Logic input wiring

There are dry contact inputs. Do not add more connections than those provided: S1, S3, S4 and S5.

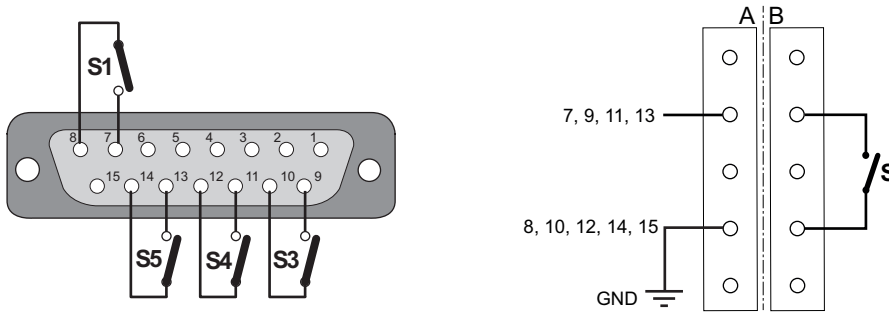


Fig. 3: Logic input wiring

A Internal wiring B Wiring from customer's side

Contact	Function	
S1 (7-8)	Pump Start/Stop	Contact open, S1=0: the pump stops Contact closed, S1=1: pump start-up
S3 (9-10) S4 (11-12) S5 (13-14)	Rotational speed setting	Depending on the contact status (open or closed), the rotation speed changes.

5.5.2 Setting of the rotation speed

Contact			Rotation speed	
S3	S4	S5	Hz	min ⁻¹
1	0	1	60	3600
1	0	0	70	4200
0	1	1	85	4800
0	1	0	90	5400
0	0	1	95	5700
0	0	0	100 ¹⁾	6000 ¹⁾

1) Corresponds to the speed set on the cover plug delivered with the pump.

Tbl. 1: Rotation speed

i **Influence of rotation speed on pump performances**

Pump performances are guaranteed for a nominal speed of **100 Hz**. Changing the rotation speed affects the pumping speed and the ultimate pressure of the pump. At low speed, it is the customer's responsibility to find the correct settings according to the pump and the process.

- Do not exceed the maximum frequency.
- Do not run the pump continuously at speeds **≤ 60 Hz**.

5.5.3 Logic output wiring

This is a dry contact output (24 V - 1 A).

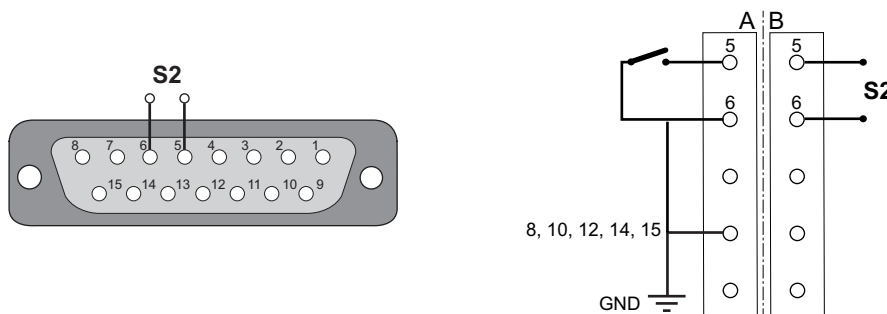


Fig. 4: Logic output wiring

A Internal wiring B Wiring from customer's side

Contact	Function
S2 (5-6)	Status of the rotation speed Contact closed: nominal speed reached

5.6 Wiring the 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.

5.6.1 Connections

The 15-pin Male D-Sub connector is used to control and monitor the pump using a computer. It also allows 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").

Description	Set Point
Serial link	RS-485
Transmission speed	9600 bauds
Data word length	8 bits
Parity	none (no parity)
Stop bit	1
Echo	no

Tbl. 2: Default serial link configuration

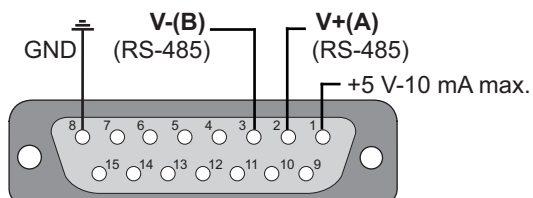


Fig. 5: Male 15-pin RS-485 connector

Pin	Assignment
8	GND
3	RS-485: V-

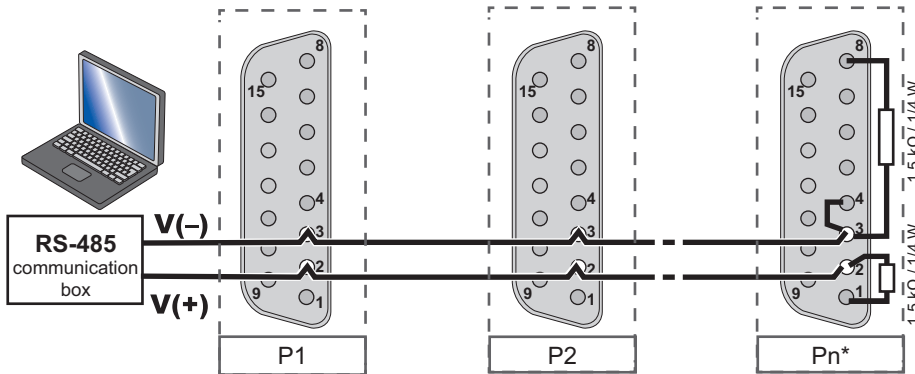
Pin	Assignment
2	RS-485: V+
1	+5 VDC -10 mA max (only for RS-485)

It is the user's responsibility to use shielded links and connections in compliance with EMC and electrical safety standards.

RS-485 connection

A computer manages several pumps (P1, P2, Pn, etc.) using the RS-485 serial link via the **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 (see figure below).



5.6.2 Setting

When the wiring is done, to allow pump control via serial link, proceed as follows:

1. Set the main switch to I.
2. Send an order via the serial link: this order has no priority on remote control mode via dry contacts.

The commands

Header character	The default setting is the decimal code 035 of the character #.
Address	Number given to the pump, 3 characters coded in ASCII.
Order	Command sent on serial link, 3 characters.
Parameter	The number of characters depends on the command.
End character	This is the message end character. Default setting: ASCII code 13 <CR>.

Example:

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

The responses

Header character	Pump address	Order	End character
#	adr	yyyxxxabc	<CR>

Interpretation of the responses

OK	If everything is OK, or specific response to the order sent
ERR0	Setting fault
ERR1	Context fault
ERR2	Parameter fault
ERR3	Order fault
ERR4	Parameter fault

Example of dialog

Order	#005ACPON<CR>
Response	#005,OK

5.6.3 Command list

Order	Parameter	Description	Details	Min	Max
ADR	xxx	Assign an address to a pump in the network.	The default factory setting for the address of a pump is 000 . This address can be modified pump stopped . Command: #adrADRxxx<CR> <ul style="list-style-type: none"> adr = pump address xxx = new address Response: #xxx,ok or #xxx,Errx (x=0/1/2/3/4) <i>Example: Assign address 004 to pump 000.</i> <i>Command: #000ADR004<CR></i> <i>Response: #004,ok</i>	0	255
			<i>Example: Assign address 004 to pump 000.</i> <i>Command: #000ADR004<CR></i> <i>Response: #004,ok</i>		
??? ADR	none	Search the address of a pump in the network.	Command: #???ADR<CR> Response: #adr,ok or #adr,Errx (x=0/1/2/3/4) <ul style="list-style-type: none"> adr = pump address 		
			<i>Example:</i> <i>Command: #???ADR<CR></i> <i>Response: #004,ok</i> Pump address is 004.		
IDN	none	Search the pump type and its software version.	Command: #adrIDN<CR> Response: #adr,VPtttt-Vx,zz or #adr,Errx (x=0/1/2/3/4) <ul style="list-style-type: none"> tttt: pump model (ACP15) x: software version zz: software edition 		
			<i>Example:</i> <i>Command: #adrIDN<CR></i> <i>Response: #004,ACP15-VB.05</i> Pump 004 is an ACP15 and its software version is VB.05.		
ACP	ON or OFF	Start/Stop the pump.	Command: #adrACPON<CR> to start the pump and #adrACPOFF<CR> to stop the pump. <ul style="list-style-type: none"> adr = pump address Response: #adr,ok or #adr,Err1 if the pump is already in the requested status.		
			<i>Example: start the pump 004.</i> <i>Command: #004ACPON<CR></i>		
RPM	nnnn ¹⁾	Set the pump setpoint speed.	Command: #adrRPMnnnn<CR> <ul style="list-style-type: none"> adr = pump address nnn= setpoint speed in min⁻¹ (set in steps of 1 min⁻¹) Response: #adr,ok or #adr,Errx (x=0/1/2/3/4) Note: Before changing the setpoint speed with the RPM order, the SBY order must be send.	2100 (35 Hz)	6000 (100 Hz)
			<i>Example: to set the setpoint speed of pump 004 to 4200 min⁻¹:</i> <i>Command: #004RPM4200<CR></i>		

1) Only speeds recommended in the rotational speed setting table are allowed .

Order	Parameter	Description	Details	Min	Max
SBY	none	Change to stand-by speed.	Command: #adrSBY<CR> Response: #adr,ok or #adr,Errx (x=0/1/2/3/4) <ul style="list-style-type: none"> Stand-by speed = 2100 min⁻¹ (35 Hz) <i>Example: to change pump 004 to stand-by speed:</i> Command: #004SBY<CR>		
NSP	none	Change to nominal speed.	Command: #adrNSP<CR> Response: #adr,ok or #adr,Errx (x=0/1/2/3/4) <ul style="list-style-type: none"> Nominal speed = 6000 min⁻¹ (100 Hz) <i>Example: to change pump 004 to nominal speed:</i> Command: #004NSP<CR>		
DEB	ON or OFF	Unblock the pump.	Allows debonding a pump obstructed by dust. Command: #adrDEBON<CR> to activate debonding function and #adrDEBOFF<CR> to deactivate debonding function. Response: #adr,ok or #adr,Err1 if the pump is already in the requested status. <i>Example: activate debonding in pump 004.</i> Command: #004DEBON<CR>		

1) Only speeds recommended in the rotational speed setting table are allowed .

Order	Parameter	Description	Functions						
STA	none	Pump status	<i>Example: #adr,xxxxxx yyyyyy,zzzzz,sssss,iiii,www,ppp,vvv,tttt<CR></i> <ul style="list-style-type: none"> sssss = pump rotation speed (min⁻¹) iiii = motor power (W) www = reserved (by default 000) ppp = frequency converter temperature (°C) vvv = debonding number of the pump tttt = pump operating time (h) 						
			xxxxxx: status bits	Bit	5	4	3	2	1
			0	0	0	0	0	0	0
			1	-	-	1	1	1	-
						pump running	nominal speed set	stand-by speed reached	
	yyyyyy: fault bits	Bit	5	4	3	2	1	0	
		0	-	0	0	0	0	0	
		1	1	1	1	-	-	-	
				power transistor not powered (red LED copy = 1)	motor temperature too high	motor current too high			
	zzzzzz: alert bits	Bit	5	4	3	2	1	0	
		0	0	0	0	0	0	OFF	
		1	-	-	-	-	-	-	

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.
- ▶ **The pump exhaust must be connected** to the installation's dangerous gases extraction system.
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

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.

CAUTION

Auditory risk due to exposure to high noise emissions

When the chamber is in the fore pumping phase and the pressure is high, the pump noise level may exceed 70 dB (A).

- ▶ Connect the exhaust port to a chimney or to an exhaust pipe.
- ▶ Install an external silencer on the pump exhaust (see chapter "Accessories").
- ▶ Wear hearing protection.



Oil capacity

The pump is delivered with filled oil charge.

- Do not modify the oil level.
- Do not drain the pump: this operation is carried out during pump overhaul by our service centers.



Safety data sheets

You can obtain the safety data sheets for operating fluids from Pfeiffer Vacuum on request, or from the [Pfeiffer Vacuum Download Center](#).



Thermal safety

The pump is fitted with temperature sensors which prevent operation or start-up when the temperature of the pump body is **< 12°C or > 40°C**.

In order for the pump to operate:

- Operate the pump within the required temperature range.
- Avoid sudden changes of ambient temperature when the pump is running.

The pump automatically restarts when the thermal safety fault disappears.

Before the pump is switched on each time:

1. Check that the pump inlet is properly connected to the pumping line.
2. Check that exhaust pipe line is not clogged and that all the valves in the exhaust system are open.
3. Connect the pump to the mains supply.

4. Check that the inlet pressure is not higher than atmospheric pressure. If the pressure is too high, it can damage the product.
5. Check that the ambient temperature is well within the permitted operating range.
6. Check the exhaust line during pumping to prevent the risks related to excess overpressure.

6.2 Matrix gas/applications

You are advised to use the appropriate pump version according to the applications and the nature of the gases pumped and apply the usual precautions to guarantee the reliability and safety of the procedure.

- ▶ Ensure that the gases pumped are compatible with the various materials (see chapter “Environmental conditions”).

Type of gas or vapor pumped		Recommended equipment	Actions/Monitoring to be done	Minimum ACP configuration according to versions	
				SD	G
Neutral or inert gas	Air, nitrogen, CO ₂ , noble gas or permanently non-reactive gas	None	<ul style="list-style-type: none"> • See use of gas ballast for purging. 	Gas ballast closed	-
Gas containing condensable vapor	<ul style="list-style-type: none"> • Cyclic pumping of volume • Pumping large volumes • Presence of degassing material: plastic, elastomer, polymer, etc. • Drying 	Avoid condensation which reduces the performance and reliability of the pump	<ul style="list-style-type: none"> • Before and after pumping on the installation, allow the pump to run for 1 hour at ultimate pressure with the gas ballast open (inlet closed). 	Gas ballast open	-
Reactive and/or corrosive gas excluding halogens (F ₂ , Cl ₂ , Br ₂ , I ₂)	Pumping reactive gas: <ul style="list-style-type: none"> • Oxidizing • Base • Acid 	Dilute the corrosive gas to reduce its activity. Connect the gas ballast to a neutral gas source.	<ul style="list-style-type: none"> • Dilute the gas to lower its concentration and avoid any condensation. • Use the purge. • Avoid excess pressure at the exhaust. • Check that the pump materials and their sealing are compatible with the pumped vapors. 	-	Purge open
Inflammable or explosive gas		Work outside the flammability range of the product (ideal = 25 to 50 % of the LEL ¹⁾ and/or below the MOC ²⁾) Connect the gas ballast to a neutral gas source.	<ul style="list-style-type: none"> • Dilute the pumped gas upstream or in the pump to lower its concentration below the lower flammability limit via purges and/or the neutral gas ballast. • Dilute the gas discharged by the pump to lower its concentration to 25 % of the LEL via purge and/or the inert gas ballast. • Avoid any build-up of gas in the pumping line. • Avoid air or humidity backstreaming by maintaining a gas speed > 0.1 m/s in the exhaust line. • Check the sealing of the installation. 	-	Purge open

1) Reference NFPA 69-2019, § 7.7.2.5 chap.7 “Deflagration prevention by oxidant concentration reduction”. LEL = Lower Explosive Limit.

2) MOC = Maximum Oxygen Concentration.

6.3 Different control modes

This chapter describes the connections and protocols associated with each control mode. 3 control modes are available:

- **LOCAL**
The pump is controlled by a switch: **I/O**. The pump runs independently of the equipment into which it has been integrated.
- **REMOTE**
The pump is remote controlled by opening or closing different dry contacts. Its rotation speed is configured on the terminals of the remote control connector (see chapter “Remote mode operation”).
- **SERIAL LINK**
The pump is controlled by commands sent via serial link **RS-485** (see chapter “Use in RS-485 link mode”).

6.3.1 Local mode operation

In local mode, **the pump can run only if the cover plug is fitted on the remote control connector**. This cover plug is delivered with the pump.

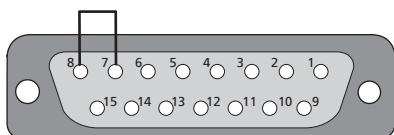


Fig. 6: Cover plug with strap for operation in local mode

Starting the pump

An hour counter displays the pump model and running time in hours.

1. Position the main switch to **I** position: pump starts **automatically**.
 - **G version**: operates the purge.

Shutting down the pump

1. Isolate the pump in the pumping line (isolation valve at pump inlet, closed) and let it **run for 1 hour with gas ballast or purge open**.
2. Position the main switch to **O** position, and/or activate the mains circuit breaker: pump stops.

Prolonged stoppage

If the pump is subject to a prolonged stop:

- ▶ Apply the **Decommissioning** procedure.

Restarting after emergency stop (using the equipment)

The emergency stop is managed by the equipment in which the pump is integrated. To restart the pump after an emergency stop, you must:

1. Correct the problem,
2. Unlock the emergency button on the equipment/tool: the pump restarts automatically.

Restarting following a power failure

- ▶ After a power failure, the pump restarts automatically when the power is restored.

⚠ DANGER

Risk of injury when power is restored to the pump

In local mode, permanent contact between terminals 7 and 8 (cover plug strap) triggers an auto-restart when the mains power supply is restored to the pump.

- ▶ Take all the measures required to prevent risks resulting from this type of operation.

6.3.2 Remote control mode operation

- ▶ Wire and connect the remote control connector located at the rear of the pump.

Starting the pump

1. Position the main switch to **I** position: the pump is powered.
2. Send a **'Start'** pump order via the S1 contact:
 - The pump starts up and **runs at the speed set on the contacts of the remote connector.**
 - **G version:** operates the purge.

Note: when the S1 contact is closed, sending the **'ACPON'** or **'ACPOFF'** command via the serial link doesn't disturb the operation ('context error' response on serial link).



Influence of rotation speed on pump performances

Pump performances are guaranteed for a nominal speed of **100 Hz**. Changing the rotation speed affects the pumping speed and the ultimate pressure of the pump. At low speed, it is the customer's responsibility to find the correct settings according to the pump and the process.

- Do not exceed the maximum frequency.
- Do not run the pump continuously at speeds ≤ 60 Hz.

Shutting down the pump

1. Isolate the pump in the pumping line (isolation valve at pump inlet, closed) and let it **run for 1 hour with gas ballast or purge open.**
2. Send a **'Stop'** pump order via S1 contact: the pump stops.

Powering off

- ▶ Set the switch to the **O** position.

Prolonged stoppage

If the pump is subject to a prolonged stop:

- ▶ Apply the **Decommissioning** procedure.

Restarting after emergency stop (using the equipment)

The emergency stop is managed by the equipment in which the pump is integrated. To restart the pump after an emergency stop, you must:

1. Correct the problem,
2. Unlock the emergency button on the equipment/tool: the pump restarts automatically.

Restarting after power failure

- ▶ After a power failure, the pump restarts automatically when the power is restored.

⚠ DANGER

Risk of injury when power is restored to the pump

In remote control mode, contact S1 (terminals 7 and 8 on the remote control connector) switches the pump on/off. The S1 contact wiring is the customer's responsibility.

- ▶ Provide adequate wiring that can authorize or prevent auto-restart.
- ▶ Take all the measures required to prevent risks resulting from this type of operation.

6.3.3 Operation in RS-485 link mode

- ▶ Wire and connect the serial link pins to the remote control connector.

Starting the pump

1. Position the main switch to **I** position: the pump is powered.
2. Send an **'ACPON'** order via the serial link:
 - The pump starts and **runs at the speed set on the serial link parameters.**
 - **G version:** operates the purge.

Note: when **'ACPON'** is activated, if the S1 dry contact is closed then opened on the remote control connector, then the pump stops.



Influence of rotation speed on pump performances

Pump performances are guaranteed for a nominal speed of **100 Hz**. Changing the rotation speed affects the pumping speed and the ultimate pressure of the pump. At low speed, it is the customer's responsibility to find the correct settings according to the pump and the process.

- Do not exceed the maximum frequency.
- Do not run the pump continuously at speeds ≤ 60 Hz.

Shutting down the pump

1. Isolate the pump in the pumping line (isolation valve at pump inlet, closed) and let it run for 1 hour with gas ballast or purge open.
2. Send an '**ACPOFF**' order via the serial link: the pump stops.

Restarting after emergency stop (using the equipment)

The emergency stop is managed by the equipment in which the pump is integrated. To restart the pump after an emergency stop, you must:

1. Correct the problem.
2. Unlock the equipment's emergency stop button.
3. Send an '**ACPON**' order via the serial link.

Powering off

- ▶ Set the switch to the **O** position.











Prolonged stoppage

If the pump is subject to a prolonged stop:

- ▶ Apply the **Decommissioning** procedure.

6.4 Operation monitoring

Pumps are equipped with 3 indicator lights at the rear that indicate the pump operating status.

Indicator light	Status	Display	Meaning
Blue 	Off		The pump is not supplied with power.
	ON, fixed		The pump is supplied with power.
Green 	ON, flashing		During pump start-up, the indicator light flashes when the selected rotation speed has not yet been reached.
	ON, fixed		The pump has reached the selected speed.
Red 	Off		No fault
	ON, flashing		The debonding mode of the pump is activated.
	ON, fixed		Presence of a fault which prevents the pump rotation (see chapter "Malfunctions").

Tbl. 3: Meaning of the indicator lights

6.5 Gas ballast operation

Principle

The user must take the appropriate measures when pumping condensable vapors or when use of the gas ballast is required. When condensable vapors or moist air are being pumped, gas is compressed beyond its saturated vapor pressure in the compression phase. It can condense, impairing pump performance. The gas ballast can be used to inject a certain quantity of air (neutral or dry gas) into the pump during the 'compression' phase so that the partial pressure of the pumped gas is less than its saturated vapor pressure at the pump's operating temperature. Condensation is therefore impossible if this limit is not reached. The saturated vapor pressure of a body is higher when the system is hot than when it is cold; therefore, the pump must reach operating temperature before pumping condensable vapors. **Using the gas ballast increases the ultimate pressure of the pump as well as the temperature.**

Commissioning

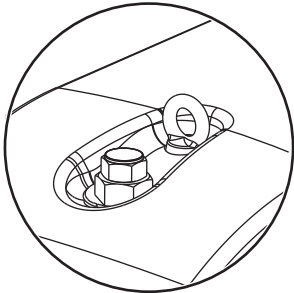
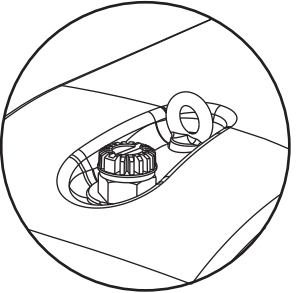
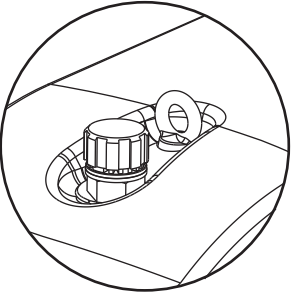
To better pump condensable vapours or moist air, it is necessary to operate with a hot pump. Proceed as follows:

- Isolate the pump from the system (inlet isolation valve closed) and **allow it to operate for 1 hour with the gas ballast open.**
- Then, open the isolation valve: the pump operates under the best conditions by reducing the risk of condensation inside the pump.

Recommendations

To ensure that condensable gases are correctly removed by the exhaust, we do not recommend connecting an ES 25 S.

The gas ballast function can be automated: this accessory is available upon request (see chapter “Accessories”). Likewise, the gas ballast can be supplied with filtered dry air. Contact our service center.

Gas ballast with permanent filter	Gas ballast closed with a plug	ON/OFF manual gas ballast
		

Tbl. 4: Various gas ballast models

6.6 Purge operation

Principle

A gas purge circuit protects the low- and high-pressure ball bearings and dilutes trace amounts of corrosive gases.

Commissioning

To operate the purge, there must be a neutral gas supply with the required characteristics (see chapter “Nitrogen characteristics”).

When the neutral gas supply is connected to a purge connection:

- Start the purge according to the recommended flow rate values.

Recommendations

To ensure the appropriate removal of corrosive gases by the exhaust, we do not recommend connecting an ES25S.

Also refer to the “Matrix gas/applications” chapter.

7 Maintenance

7.1 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 equipment 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

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 EN420.

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.

General maintenance recommendations


- Ensure that the maintenance technician is trained in the safety regulations that cover the pumped gases.
- Disconnect the power cable from all sources of power before working on the product.
- Wait 5 minutes after powering off before working on the electrical components.
- 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.

7.2 Maintenance frequency

Operation	Frequency	ACP 15
Pump overhaul by our service center	20,000 hours or 4 years	All versions

Maintenance frequencies are typical values for non-corrosive applications. For applications using G version, values can be reduced. Contact our service center (see chapter “Service solutions by Pfeiffer Vacuum”, page 37).

No maintenance is generally required before product overhaul in a service center.

	<p>How to contact us</p> <p>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.</p>
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Life-time

Under normal operating conditions (at ambient temperature, low humidity and neutral pumped gas), in a non-polluted environment, a new pump which is regularly maintained according to the instructions in this manual (subject to the components becoming obsolete) **has a lifetime greater than 10 years.**

7.3 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. Any other maintenance operation must be carried out by our service center (see chapter “Service solutions by Pfeiffer Vacuum”, page 37).

- ▶ Clean the outer surfaces of the product using a clean, lint-free cloth and a product that will not damage the screen-printed surfaces and adhesive labels.
- ▶ Remove dust from the air ventilation grids with a cloth. Do not use a compressed air blower.

7.4 Exchange procedure for replacement products

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

1. Disconnecting the pump from the installation.
2. Preparing the pump for shipping.
3. Complete the declaration of contamination.
4. Handling the new pump.
5. Installing the new pump.

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 37).

7.4.1 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.

Procedure

1. Power off the pump by setting the switch to position **O**.
2. Switch off your main circuit breaker.
3. Disconnect the power cable at the electrical connector.
4. Disconnect the nitrogen supply and protect the purge port with the plug.
5. Disconnect the pump from the pumping line and blank off the inlet port with the airtight connection accessories.
6. Disconnect the pump from the exhaust and blank off the exhaust port with the airtight connection accessories.
7. Remove the pump from the installation.

7.4.2 Preparing the pump for shipping

After use in clean applications

- Install the connecting accessories provided with the pump on delivery. Contact the service center to order accessories if necessary.
- Connect the cover plug (delivered with the pump) to the remote connector.

After use with traces of corrosive gases

- Respect safety instructions before working on the product.
- Install the connecting accessories to make the pump airtight.
- Connect the cover plug (delivered with the pump) to the remote connector.

Product transport and shipping

For product transport and shipping, pack it in the original packaging and follow the instructions from the Service procedure ([see chapter "Service solutions by Pfeiffer Vacuum", page 37](#)).

8 Decommissioning

8.1 Extended Immobilization

Storage after use

1. Stop the pump according to the pump shut-down procedure.
2. Disconnect the pump from the installation.
3. Seal the pump inlet, exhaust and purge ports with included accessories.
4. Store the pump in a clean, dry, non-polluted area for a maximum of **6 months** according to the storage temperatures.

Extended storage beyond 6 months after use

Run the pump regularly because factors such as temperature, degree of humidity, salt air, etc. may cause the deterioration of the pump components.

1. Let the pump run for 30 minutes with gas ballast opened or while injecting a dry neutral gas into the pump (G version).
2. Let the pump run for 30 minutes at ultimate pressure (inlet, gas ballast and purge ports closed).
3. Stop the pump.
4. Seal the pump inlet, exhaust and purge ports with included accessories.
5. Repeat this at least **every 6 months**.

Beyond 2 years, the pump must be revised before commissioning.

Return the pump to the service center ([see chapter "Service solutions by Pfeiffer Vacuum", page 37](#)).

8.2 Recommissioning

To restart the pump after a prolonged stop, refer to the installation instructions ([see chapter "Installation", page 16](#)).

8.3 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 37](#)).



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 different materials which must be recycled (see chapter "Environmental conditions"). Take particular precautions for:

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

9 Malfunctions

9.1 Trouble at pump start-up

Read the safety instructions for maintenance.

Symptom	Cause	Remedy
The pump does not start and the fan does not run. The red indicator light is lit.	Main switch	<ul style="list-style-type: none"> Check that the main switch is at the I position.
	The pump supply voltage is not compatible with the equipment's power configuration	<ul style="list-style-type: none"> Check the equipment's voltage corresponds to required power voltage.
	Main cable not correctly connected or damaged	<ul style="list-style-type: none"> Check / replace the main power cable.
	Other problem	<ul style="list-style-type: none"> Contact our service center.
The pump does not start but the fan runs. The red indicator light is lit.	Temperature	<ul style="list-style-type: none"> Check the pump ventilation conditions. Wait for 1 hour at ambient temperature between 12 °C and 40 °C. The pump must start automatically
	Remote control connector wiring	<ul style="list-style-type: none"> Check that the cover plug is properly connected to the connector at the rear of the pump.
	Other problem	<ul style="list-style-type: none"> Pump blocked: Contact our service center.

9.2 The pump runs incorrectly

Read the safety instructions for maintenance.

Symptom	Cause	Remedy
Pump runs intermittently	Temperature	<ul style="list-style-type: none"> Check the pump ventilation conditions.
	The pump supply voltage is not compatible with the equipment's power configuration	<ul style="list-style-type: none"> Check that the voltage corresponds to required power voltage.
	Other problem	<ul style="list-style-type: none"> Contact our service center.
Pump noisy	Gas ballast	<ul style="list-style-type: none"> Check if the gas ballast is open. Warning: if the application requires it, the gas ballast must remain open despite the noise!
	The pressure does not go down - leak in the installation	<ul style="list-style-type: none"> Check the pressure at the pump inlet.
	Vibration	<ul style="list-style-type: none"> Check that the pump is properly attached to the frame.
	Other problem	<ul style="list-style-type: none"> Contact our service center.

Malfunctions

Symptom	Cause	Remedy
Bad ultimate pressure	Gas ballast	<ul style="list-style-type: none"> Check if the gas ballast is open. Warning: if the application requires it, the gas ballast must remain open at the expense of the limit pressure!
	Purge (if present)	<ul style="list-style-type: none"> If the purge is used: check the purge connection between pump and installation. If the purge is not used: check the tightness of the plug installed on the purge port.
	Rotation speed	<ul style="list-style-type: none"> If remote controlled via RS-485: check the setpoint speed. If remote controlled via dry contacts: check the contact setting.
	Pumping of condensable vapors	<ul style="list-style-type: none"> If the application allows it, let the pump run for 30 minutes to 1 hour with the gas ballast open; this removes the condensable vapors.
	Defective measurement gauge	<ul style="list-style-type: none"> Check the accuracy of the measurement means.
	Leak in the installation	<ul style="list-style-type: none"> Perform a leak test on the pumping line.
	Other problem	<ul style="list-style-type: none"> Contact our service center.

10 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](#).

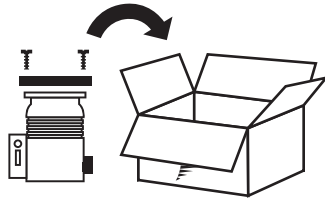


4. You will receive an acknowledgment from Pfeiffer Vacuum.

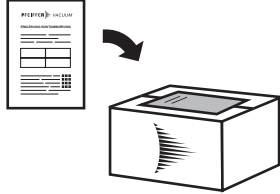
PFEIFFER VACUUM

Submission of contaminated products

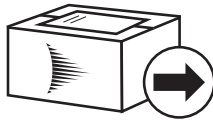
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination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



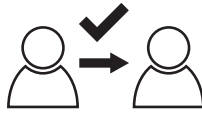
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
 - a) Neutralize the product with nitrogen or dry air.
 - b) Seal all openings with blind flanges, so that they are airtight.
 - c) Shrink-wrap the product in suitable protective foil.
 - d) Package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

11 Accessories

Refer to the accessory operating instructions to install the accessory.

Accessory	Description	Model Dimension	P/N
Inlet filter	Stops particles and dust with a diameter greater than 25 microns.	IPF 25 DN 25 ISO-KF	111649
Exhaust silencer	Reduces the noise level at the exhaust when the pump operates at high pressures on clean applications. Noise reduction (-12 dBA) at atmospheric pressure.	ES 25 S DN 25 ISO-KF	109873
Noise reduction cover	Noise reduction (-5 dBA) at a maximum ambient temperature of 35 °C.	NRC 15	111968
Set of sound enclosure	Noise reduction (-10 dBA) at a maximum ambient temperature of 32 °C.	SEK 15	122480
Set of pump fastening	Fastens the pump to the equipment with plates (M6 screws for frame assembly not supplied).		112846
Set of casters	Facilitates handling and positioning in the equipment using the 4 casters.		111138S
Automatic gas ballast	Ensures tightness when the pump stops or it can be used to remotely control cyclical air inlets on the pump.	24 VDC	114816
		100 V 50/60 Hz	114814
		110 V 60 Hz	114813
		200 V 50/60 Hz	114815
		230 V 50/60 Hz	114812
Isolation valve	Returns the pump to atmospheric pressure by isolating the pumping line; it is installed upstream of the pump.	ISV 25	
		100 V 50/60 Hz	115900
		110 V 50/60 Hz	115901
		200 V 50/60 Hz	115897
		220 V 50/60 Hz	115898
		240 V 50/60 Hz	115899
	24 VDC	115902	

For blanking plates, claw clamps and quick connect clamps, please refer to the connection accessories catalog on the Pfeiffer-Vacuum site. Select material properties compatible with the application.

12 Technical data and dimensions

12.1 General

Basic principles for the Technical Data of Pfeiffer Vacuum dry compact multi-stage Roots pumps:

- Recommendations of PNEUROP committee PN5
- ISO 21360; 2007: "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"
- Sound pressure level at ultimate pressure according to EN ISO 2151

12.2 Technical characteristics

Characteristics	ACP 15 SD	ACP 15 G
Inlet flange	DN 25 ISO-KF	
Exhaust flange	DN 16 ISO-KF	
Pumping speed max.	14 m ³ /h	
Maximum ultimate pressure: without purge or gas ballast	5 · 10 ⁻² hPa	
Maximum ultimate pressure: with gas ballast open	3 · 10 ⁻¹ hPa	-
Maximum ultimate pressure: with purge ³⁾	-	3 · 10 ⁻¹ hPa
Max. pumping capacity of pure water vapor at 20 °C, gas ballast open ²⁾	80 g/h	
Continuous inlet pressure	1013 hPa	
Maximum exhaust pressure	1200 hPa	
N ₂ purge flow ³⁾	-	5 slpm
Gas ballast flow at atmospheric pressure	0,5 m ³ /h	-
Sound level (gas ballast and purge closed)	< 65 dB(A)	
Max. Helium leak rate ⁴⁾⁵⁾	5 · 10 ⁻⁷ hPa l/s	
Power supply ¹⁾ (according to ordering guide)	110-230 V- 1-phase or 200-440 V- 3-phase	
Power consumption at ultimate pressure	450 W	
Power consumption at atmospheric pressure	550 W	
Dimensions	(see chapter "Dimensions", page 42)	
Weight	23 kg	

1) In accordance with IEC/UL/CSA regulations, the pumps can withstand a voltage variation of ± 10 %.

2) At ambient temperature: 20 °C.

3) Inert gas flushing 300 hPa relative pressure.

4) Test by Helium spray.

5) Overall leak test.

Tbl. 5: Technical characteristics

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	1 · 10 ⁻³	100	1	0.1	0.75
bar	1000	1	1 · 10 ⁵	1000	100	750
Pa	0.01	1 · 10 ⁻⁵	1	0.01	1 · 10 ⁻³	7.5 · 10 ⁻³
hPa	1	1 · 10 ⁻³	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr mm Hg	1.33	1.33 · 10 ⁻³	133.32	1.33	0.133	1

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

Tbl. 6: Conversion table: Pressure units

	mbar l/s	Pa m ³ /s	sccm	Torr l/s	atm cm ³ /s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m ³ /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 cm ³ /s	1.01	0.101	59.8	0.76	1

Tbl. 7: Conversion table: Units for gas throughput

12.2.1 Environmental conditions

Use	indoor use
Installation altitude	up to 2000 m
Protection rating	IP 20
Ambient operating temperature	12 – 40 °C
Storage temperature	-10 – +60 °C
Maximum relative humidity	max. 80 % with T ≤ 31 °C, up to max. 50 % with T ≤ 40 °C
Transient overvoltage protection	Category II
Pollution degree	2

The materials

Our products contain different materials which must be recycled:

Description	Version SD	Version G
Jet	-	Brass
Purge line	-	Stainless steel
Valves	FPM	
O-rings, lip seals	FPM / NBR / PTFE	
Shaft, spring, inlet filter	Stainless steel	
Stators, lobes	Aluminum, aluminum alloy + Al ₂ O ₃ coating	
Screws, worked pins, deflectors	Stainless steel	
Ball bearings	Steel, PFPE grease	
Inlet and exhaust flanges	Aluminum	

12.2.2 Nitrogen characteristics

H ₂ O concentration	< 10 ppm v
O ₂ concentration	< 5 ppm v
Dust	< 1 µm
Oil	< 0.1 ppm v
Relative pressure	$2 \cdot 10^3$ to $6 \cdot 10^3$ hPa

Tbl. 8: Nitrogen characteristics

Connector types

Nitrogen inlet	1/4 BSPT male connector	Stainless steel
----------------	-------------------------	-----------------

12.2.3 Electrical characteristics

Main switch short circuit cut-off capacity	10 kA
GFI (or RCD) type B, differential circuit breaker compatible with TT electrical networks	30 mA ¹⁾
1) for TN and IT networks, use appropriate protection measures	

Tbl. 9: Electrical network protection

Mains power supply	Single-Phase		Three-Phase	
	LV (100-115V)	HV (200-230V)	LV (200-240V)	HV (240-440V)
Main circuit breaker rating (minimum values)	12 A	6 A	5 A	3 A
Conductor cross-section sizes	2.5 mm ²	1.5 mm ²	1.5 mm ²	1 mm ²

12.3 Dimensions

Dimensions in mm

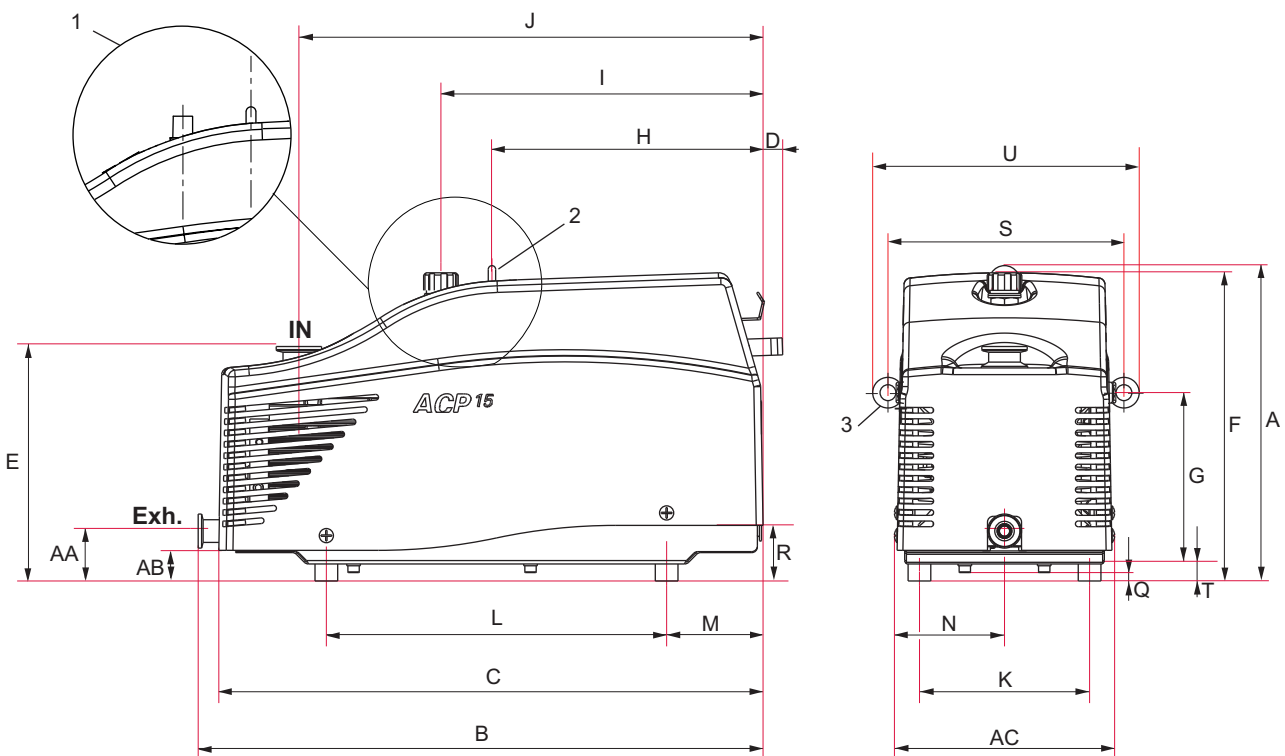


Fig. 7: Dimensions ACP 15 versions SD - G

1. Inert gas purge connection (version G)
2. Hoisting ring (Single-Phase model)
3. Hoisting rings (Three-Phase model)

ACP 15/ACP 15 G	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Q
Single-Phase	272	498	475	11	207	-	-	239	284	409	150	300	85	93	7
Three-Phase	272	497	477	18	207	266	170	238	283	408	150	300	84	95	7

ACP 15/ACP 15 G	R	S	T	U	AA	AB	AC
Single-Phase	-	-	15	-	44	-	190
Three-Phase	52	208	15	235	44	30	190

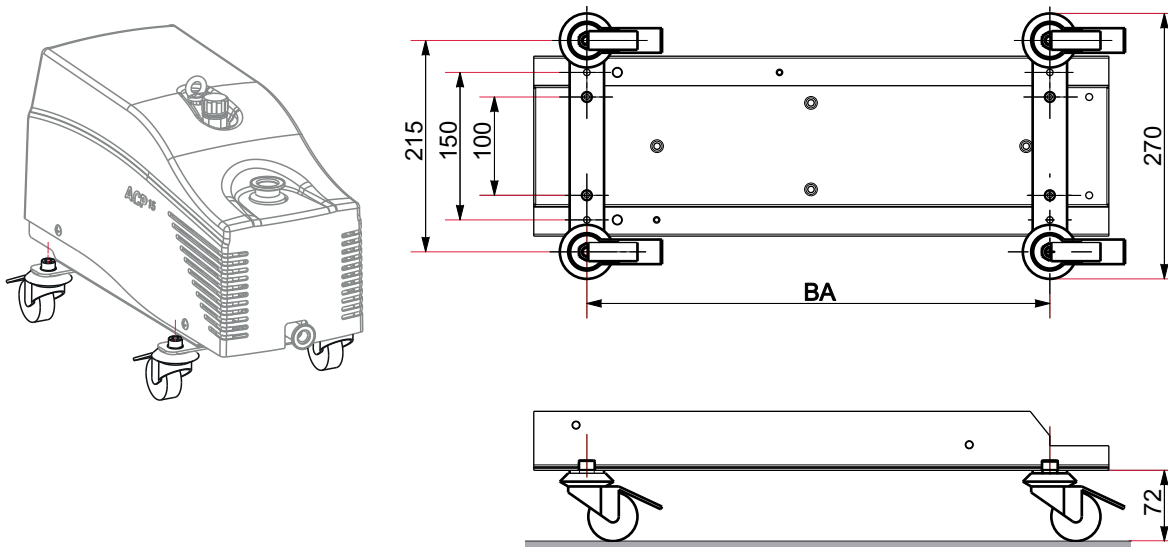


Fig. 8: Wheel set dimensions

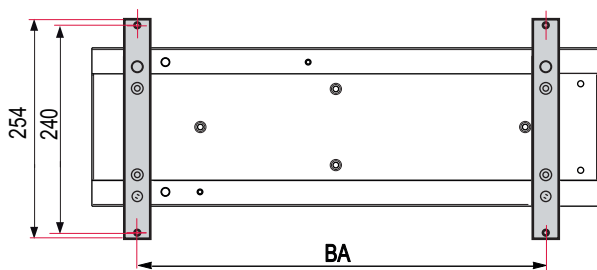
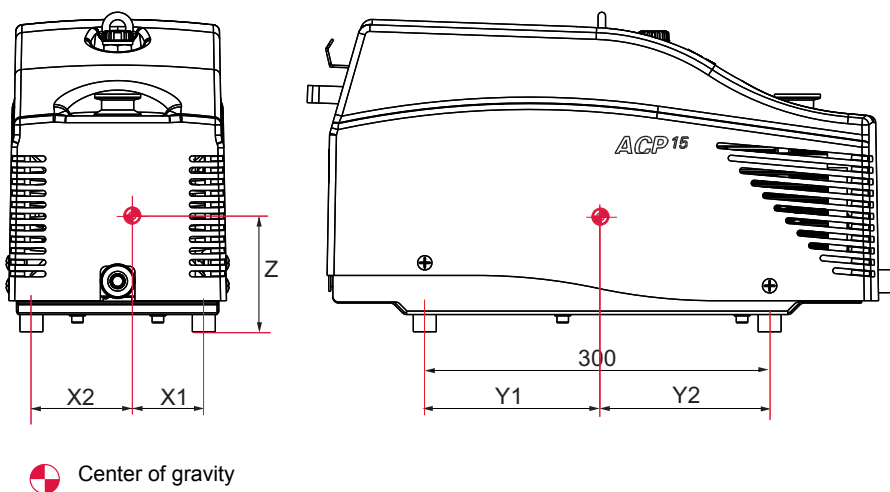


Fig. 9: Fastening set dimensions

BA = 300 mm

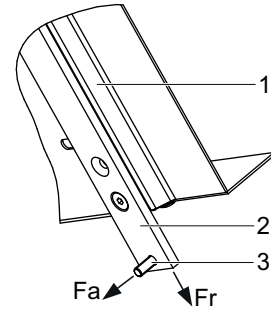
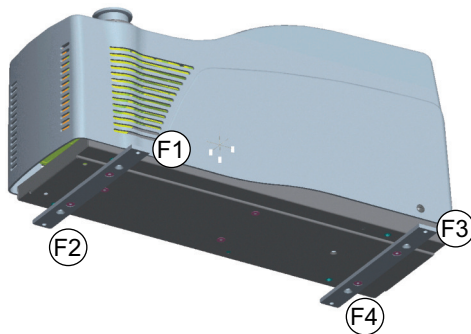
12.4 Weight distribution and center of gravity



Model	Center of gravity (mm)					Weight per foot (DaN)			
	X1	X2	Y1	Y2	Z	F1	F2	F3	F4
ACP 15/ACP 15 G Single-phase	65	85	156	144	110	6.8	5.2	6.3	4.8
ACP 15/ACP 15 G Three-phase	67	83	157	143	116	6.7	5.4	6.1	4.9

12.5 Load on foot with fastening set

We strongly recommended you secure the pump on the equipment with 4 screws (supply of these screws is the customer's responsibility, at least 2 screws per fixation plate). The screw material must comply with foot load specifications, given in the table below.



1 Pump frame

2 Fastening plate, thickness: 6 mm (delivered in the fastening set)

3 M6 x 20 screw, qty 4, grade 12-9


Model		Load by foot (N)			
		F1	F2	F3	F4
ACP 15/ACP 15 G Single-phase / Three-phase	Traction (Fa)	120	-13	72	31
	Shearing (Fr)	85	25	87	52

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.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

Applicant: PFEIFFER VACUUM SAS	Manufacturer: PFEIFFER VACUUM SAS
Address: 98, avenue de Brogny 74009 Annecy	Address: 98, avenue de Brogny 74009 Annecy
Country: France	Country: France
Contact: Mr. Sébastien Bouchot	Contact: Mr. Olivier Boulon
Phone: 0033 (0)450 657 768	Phone: 0033 (0)450 657 956
FAX: -	FAX: -
Email: sebastien.bouchot@pfeiffer-vacuum.fr	Email: olivier.boulon@pfeiffer-vacuum.fr

Party Authorized To Apply Mark: Same as Manufacturer
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Control Number: 3026716 **Authorized by:** 
for L. Matthew Snyder, Certification Manager



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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 1: General Requirements [CSA C22.2#61010-1-12:2012 Ed.3+U1;U2;A1]
Product:	Electrical Dry Primary Pumps
Brand Name:	PFEIFFER  VACUUM
Models:	ACP15 may be followed by G ACP28 may be followed by G, i, LG, CV, CP, SH or GF ACP40 may be followed by G, i, LG, CV, CP, SH or GF

Declaration of conformity

We hereby declare that the product mentioned below complies with all the applicable provisions of the following **EU 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 person responsible for drawing up the technical file is Mr. Frédéric Rouveyre, Pfeiffer Vacuum SAS, 98, avenue de Brogny B.P.2069, 74009 Annecy cedex, France.

Multi-stage Roots Pump, air cooled

ACP 15 - ACP 15 G

Harmonized standards and national standards and specifications applied:

NF EN 1012-2 : 2009
NF EN 61010-1 : 2011
NF EN 61000-6-2 : 2005
NF EN 61000-6-4 : 2007
NF EN 61000-3-2 : 2014
NF EN 61000-3-3 : 2013

Signature:



Pfeiffer Vacuum SAS
98, avenue de Brogny
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B.P. 2069

Bertrand Seigeot
Pumps Product Group Director
Pfeiffer Vacuum SAS

2020/10/01





VACUUM SOLUTIONS FROM A SINGLE SOURCE

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

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From a single component to complex systems:

We are the only supplier of vacuum technology that provides a complete product portfolio.

COMPETENCE IN THEORY AND PRACTICE

Benefit from our know-how and our portfolio of training opportunities!

We support you with your plant layout and provide first-class on-site service worldwide.

Ed 03 - Date 2021/03 - P/N:128853OEN



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perfect vacuum solution?
Please contact us

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