



OPERATING INSTRUCTIONS

EN



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Translation of the original instructions

A4 SERIES

Multi-stage Roots pump for harsh applications

PFEIFFER  **VACUUM**

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1 About this manual

1.1 Validity

This operating manual is for customers of Pfeiffer Vacuum. It describes the functioning of the designated product and provides the most important information for safe use of the unit. The description follows applicable EU guidelines. All information provided in this operating manual refers to the current state of the product's development. The documentation remains valid as long as the customer does not make any changes to the product.

Up-to-date operating instructions can also be downloaded from www.pfeiffer-vacuum.com.

This document is a translation of the original French instructions.

This manual covers products with the following part numbers:

Part Number	Description
A4HxxCxxx6xxxxx	models for harsh applications
A4XxxCxxx6xxxxx	models for extremely harsh applications

1.1.1 Applicable documents

Operating instructions	Part number
Serial link Operating Instructions	122876
Declaration of conformity	included in is this manual
UL/CSA conformity (ETM Mark)	included in is this manual
Certificate of compliance to SEMI	included in is this manual

1.2 Conventions

1.2.1 Safety instructions

The safety instructions in Pfeiffer Vacuum operating instructions are the result of risk evaluations and hazard analyses and are oriented on international certification standards as specified by UL, CSA, ANSI Z-535, SEMI S2, ISO 3864 and DIN 4844. In this document, the following hazard levels and information are considered:

DANGER
Imminent danger Indicates an imminent hazardous situation that will result in death or serious injury.
WARNING
Possibly imminent danger Indicates an imminent hazardous situation that can result in death or serious injury.
CAUTION
Possibly imminent danger Indicates an imminent hazardous situation that can result in minor or moderate injury.
NOTICE
Command or note Command to perform an action or information about properties, the disregarding of which may result in damage to the product.

1.2.2 Pictographs



Prohibition of an action to avoid any risk of accidents, the disregarding of which may result in serious accidents



Warning of a displayed source of danger in connection with operation of the unit or equipment



Command to perform an action or task associated with a source of danger, the disregarding of which may result in serious accidents

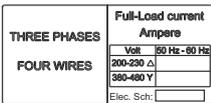


Important information about the product or this document

1.2.3 Instructions/Abbreviations used

⇒ or →	Work instructions: you must perform an operation here.
[XXXX]	HHR menus and sub-menus.
BF	Functional Block
HP	High Pressure
LP	Low Pressure
HHR	Hand Held Remote
FC	Frequency converter

1.2.4 Labels

I	Start
O	Stop
Power	Indicator light: pump powered
Running	Indicator light: pump started
Warning	Indicator light: warning presence
Alarm	Indicator light: alarm presence
HHR	Hand held Remote connection
WATER IN	Water circuit connection: input
PRESSURE MAX 101 PSI (7 bars)	Maximum pressure of water circuit
WATER OUT	Water circuit connection: output
NITROGEN	Nitrogen connection
EXHAUST	Pump exhaust connection
	Earth connection
200-230 V 380-480 V	This label indicates the mains voltage range of the installation on which the pump must be connected.
	This label indicates the full load current value at the exit of the motor depending on the mains voltage (see 14.1).
	Rating plate example (exemple).



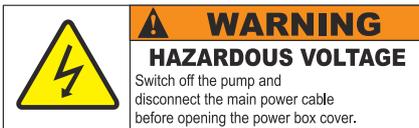
This label warns the user against possible risk of injury due to any hand contact with hot surfaces.
 ⇒ It states that protective gloves should be used before performing any intervention.



This label informs the user, that moving parts present inside the pump could cause personal injury, like crushing or cutting.
 ⇒ The user must keep all body parts away from moving parts.



This label indicates that due to its heavy weight, the product should not be handled manually,
 ⇒ but always through appropriate handling devices.



This label indicates that some of the internal parts are energized and could cause electrical shocks in case of contact.
 ⇒ It advises to disconnect the pump before any intervention or to properly lock-out and tag-out the equipment breaker before any intervention on the pump.



The main power supply must be switched off before connecting and/or disconnecting the pump.



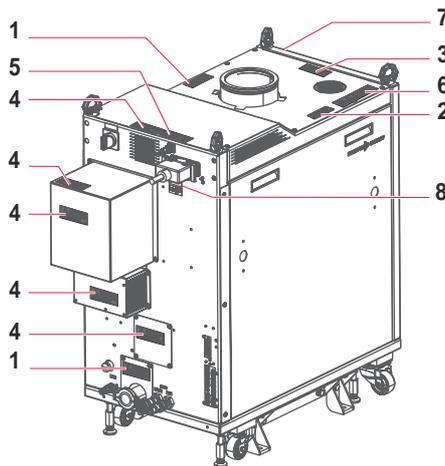
This label warns the user against pumped process gas that could be dangerous and toxic and could cause severe injuries or death. It specifies that only trained personnel can perform preventive maintenance operations.



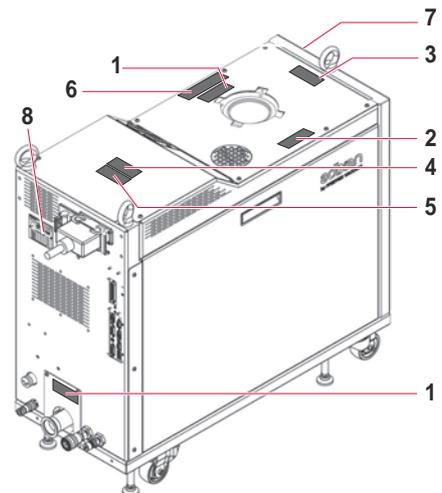
It informs the user of the need to fill the pumps with oil (see 5.2).

- 1 Hot surface label
- 2 Presence of moving part label
- 3 Heavy object label
- 4 Hazardous voltage label
- 5 Electrical safety label
- 6 Risk with toxic, corrosive or reactive materials label
- 7 Oil filling label
- 8 Rating plate

Example: A3004H



Example: A804H



1.2.5 User target group

This 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 may only be carried out by persons who have a suitable technical education (specialist staff) or have received appropriate training from Pfeiffer Vacuum.

2 Safety

2.1 Safety precautions



Obligation to inform

Any person responsible for installing, using or maintaining the product must first read the security instructions in this operating manual and comply with them.

- It is the operating customer's responsibility to protect all operators against the dangers associated with the product, with the media pumped and with the entire installation.



Installation and use of the accessories

The products can be fitted with special accessories. The installation, use and refurbishment of the connected accessories are described in detail in the respective manuals.

- Only use original accessories.
- Accessory part numbers: see **Accessories**.



WARNING

Hazards associated with non-compliant electrical installation

Safe operation after installation is the operator's responsibility.

- Connect the product to an installation that is compliant with local safety standards.
- Do not carry out any alterations or modifications to the product on your own initiative.
- Check that the pump is correctly connected to the emergency stop system for the equipment (or pumping installation).
- For specific questions, contact your service centers.



WARNING

Electric shock hazard in case of contact

When the main isolator is set at **O**, or when the emergency stop is activated, some internal components still have an electrical charge

- 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 all power sources before starting any work on the product.



WARNING

Danger due to lack of lock out/tag out (LO/TO) electrical device.

In order to properly secure the pump for installation and/or maintenance, it is required to lock out/tag out the pump properly in accordance with OSHA requirement 29 CFR.1910.147.



WARNING

Other localised hazardous energies

Electrical circuits and other pressurized circuits, such as nitrogen and water are potential hazards.

- Always lock out these energy sources before working on the product.



WARNING

Risk associated with process gases

The user and/or integrator of the product is/are fully responsible for the operational safety conditions of the equipment. The manufacturer has no control over the types of gases this pump is exposed to. Frequently process gases are toxic, flammable, corrosive, explosive and/or otherwise reactive. It is the user and/or the integrator's responsibility to follow the necessary safety requirements. Toxic gases can cause serious injury or death. Operators and users must:

- Take the appropriate safety recommendations to prevent injury. Consult the responsible department for instructions and safety information.
- **Hazardous gases from the pump can cause serious injury or death. Regulations require to connect the pump's exhaust to a facility hazardous gas exhaust system** which incorporates appropriate filters, scrubbers, etc. This system must meet all air and water regulations.
- Check that the pump is correctly connected to the equipment (see *Installation*). Contact the service center for further information.

The potential risks with a dry pumping system involve electricity, the chemical processes, hot surfaces, the pressurized nitrogen and water devices and the lubricant.

- Only qualified personnel trained in safety rules (EMC, electrical safety, chemical pollution) may carry out the installation and maintenance described in this manual. Our service centers can provide the necessary training.
- 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.
- 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 turn on the product if the covers are not in place.
- Keep the handles, the rubber caps on the covers as they protect the product against the intrusion of solids and liquids.

2.2 Safety for flammable/pyrophoric materials

Pumping of pyrophoric or flammable gases could create hazardous situations. The user and/or the integrator must respect safety instructions below and conduct risk assessments to address all risks in a safety procedure.



DANGER

Pyrophoric/flammable gas related risks

Semiconductor, photovoltaic panels, flat panel display or industrial processes may use pyrophoric or flammable gases. When mixed with oxidant species, these gases could react spontaneously (pyrophoric) or after ignition (flammable) in an uncontrolled chemical reaction. In the worst case, it could generate fire or explosion leading to metallic part projection and/or seriously injuring people working nearby. Ignition source could be inside pump : compression, heat, particle friction, flame due to pyrophoric + oxidant mixture. Responsibility for safe operation of the pump(s), the process tool, and the abatement device, always belongs to the user and/or the integrator. The user and/or the integrator is/are responsible for the application for which the Pfeiffer Vacuum product will be used.

- Always conduct a full risk assessment when planning the installation of the pump(s).
- Install safety devices in accordance with EN 50495.

The risk assessment must take into account the pumped gases, by-products and all components from the installation.

The following situations are hazardous and must be avoided:

- Flammable or pyrophoric gas concentration in the flammable range.
- Flammable or pyrophoric gas concentration over the flammable range (concentration could decrease somewhere in case of leak until crossing flammable range).
- Lack of dilution.
- Accumulation of reactive solids in exhaust.
- Exposure of chemically reduced species or reducing agents to oxidants.

General safety recommendations are as follows:

- Ensure leak-tightness throughout system, not only dry pump.
- Do not allow oxidant (air, other...) to mix with flammable/pyrophoric gases.
- Use dilution with inert gas to reduce pyrophoric/flammable gas to 0.25x lower explosive limit (LEL)¹.
- If dilution cannot guarantee safe conditions to reach 25% of the LIE, you must guarantee oxidant concentration is not over 0.6x maximum oxidant concentration (MOC)².
- Perform nitrogen gas purge prior to any maintenance on vacuum or exhaust lines.
- Clean exhaust lines from reactive by-products such as Silicon dust to prevent from clogging and possible explosion.
- Interlock 'gas purge fault' and 'pump fault' signals with tool in order to stop process gases in case of insufficient dilution.

For all these applications, install on the pump, the labels to identify the hazards (flammability, explosion, toxicity, corrosion, etc.) and meet the requirements of SEMI S1. This information must be added in the equipment manual dedicated to the end user.

For more details regarding safety instructions related to flammable and pyrophoric gases, contact Pfeiffer Vacuum Service.

2.3 Protective equipment

In some situations, personal protective equipment must be worn when handling the vacuum pump and its components. The owner must provide operators with the necessary equipment. This equipment must be checked regularly and used in accordance with the supplier's recommendations.



DANGER	
Health risk due to contact with toxic materials	
The vacuum pump, pumping line components, and operating media may be contaminated with toxic, corrosive, reactive, or radioactive materials, depending on the process.	
→ Wear appropriate safety equipment when pump is disconnected for maintenance, while it is being re-installed, and during filling and draining of operating media.	
WARNING	
Risk of injury due to hot surfaces	
For the operator's safety, the products are designed to avoid thermal risk. However, specific operating conditions may exist that require extra caution from users due to the high temperatures (external surfaces > 70°C on the exhaust pipe).	
→ Let the part cool before working on the product.	
→ If necessary wear protective gloves according to directive EN 420.	

1) Refer to NFPA 69-2002, chap 6.3.1 Combustible concentration limit.

2) Idem 1)

**WARNING****Risk of injury due to falling objects**

When transporting parts/components and during maintenance there is a danger of loads slipping and falling down.

- Carry small and medium-size parts/components with both hands.
- Carry parts/components > 20 kg with a suitable lifting device.
- Wear safety shoes with a steel toe in accordance with directive EN 347.

2.4 Proper use**NOTICE****EC conformity**

The manufacturer's declaration of conformity becomes invalid if the operator modifies the original product or installs additional components.

- Following installation into a plant and before commissioning, the operator must check the entire system for compliance with the valid EU directives and reassess it accordingly.

- The vacuum pump may only be used to generate a vacuum while pumping gases.
- The product may be used in an industrial environment.

2.5 Improper use

Improper use will cause all claims for liability and warranties to be forfeited. Improper use is defined as usage for purposes deviating from those mentioned above, especially:

- pumping of explosive media
- pumping of liquids
- pumping of dusts
- use of the vacuum pump to generate pressure
- operation in potentially explosive areas
- use of accessories or spare parts, which are not named in this manual

The product is not designed to carry people or loads and is not for use as a seat, step-ladder or any other similar purpose.

3 Transport and storage

Upon 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. In all situations we recommend:

- Keeping 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.
- Keeping the packaging (recyclable materials) in case the product needs to be transported or stored.
- Keeping the blanking plates in place on the inlet, exhaust and purge ports while the product is not connected to the pumping line.

3.1 Transport



WARNING
<p>Risk of injury associated with heavy loads</p> <p>Given the weight of the product, it should be removed from its packaging only by personnel qualified and trained in handling heavy materials.</p> <ul style="list-style-type: none"> → Use the lifting rings and devices provided with the product. → The manufacturer cannot be held liable for the consequences of using lifting devices other than those provided.



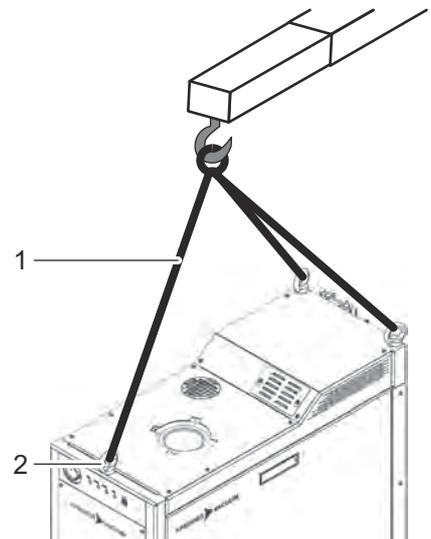
WARNING
<p>Risk of tilting</p> <p>Even though compliance with EEC safety rules is guaranteed, all necessary precautions should be taken when moving, installing and operating the product.</p> <ul style="list-style-type: none"> → Do not place the product on an inclined plane: its weight could cause the operator to be dragged. → Only use castors to move it short distances. → Place it on a flat, hard floor. → Do not push the product sideways. → Adjust the levelling feet for operation to make sure that the pump is not supported by the castors. (Refer to Technical data and dimensions in these operating instructions for location of the center of gravity.)

To lift the product:

- Use a lifting device suitable for the product's weight.
- Use a lifting sling (1) with several arms with the following characteristics:

	A 2404 to A 3004	A 124 to A 1804
Number of arms	4	3
Length of each arm	> 500 mm	> 500 mm
Load per arm	> 400 kg	> 350 kg

- Screw the hoisting rings (2) (delivered in the crate in separate packaging) in the suitable holes. With a sling (1), lift the pump using hoisting rings.
- Adjust the leveling pads of the frame and lower the pump on the castors to move it over short distances.



3.2 Storage



NOTICE

Duty to inform

In order to prevent moisture from entering the pump before installation, it has been pressurized before shipment with nitrogen and sealed with blanking plates.

- 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.

If the new pump is going to be put into storage:

- Keep the pump wrapped in its protective film.
- It is **absolutely necessary** to leave the inlet and exhaust blanking plates in place because the pump has been pressurized with dry nitrogen.
- Store the pump according to storage temperatures (see 14.2.1).

If the inlet and exhaust blanking plates have been removed, there is a risk of internal part corrosion. We advise you to pressurize the pump with nitrogen.

Provide a nitrogen supply with the required characteristics (see 14.2.3).

- Seal the inlet port with inlet blanking plate delivered with the pump.
- Connect the nitrogen to the gas connection located on the inlet blanking flange.
- Pressurize the pump with dry nitrogen to a relative pressure of 200 hPa.
- When the nitrogen flows out of the exhaust, seal it up with the provided accessories.
- Disconnect the nitrogen purge connection.
- Store the pump in a clean and dry area, at ambient temperature (see 14.2.1), for a maximum period of 1 year.

Never store a pump which has been used. Return it to a service center according to the product **Service** procedure (see 12).

4 Product description

4.1 Product identification

To correctly identify the product when communicating with Pfeiffer Vacuum, always have the information from the rating plate available.

4.1.1 Scope of delivery

- 1 vacuum pump
- 3 hoisting rings
- 4 hoisting rings (A 2404/A 3004 models)
- 1 funnel
- 1 EMO plug
- 2 water couplings
- 1 nitrogen coupling
- 1 electrical plug
- 1 hand-held remote module (HHR) + cable
- 1 operating instructions
- Oil can(s)

4.1.2 Differences between the pump versions

The pump manufacturer has developed a range of dry pumps **Series 4** adapted to the harshest processes used in the semiconductor industry. They are including a roughing-pump and, depending on model, a Roots blower.

Several compact pumping systems are available in **H** version (harsh applications):

A 124H, A 204H, A 604H, A 804H, A 1204H, A 1504H, A 1804H, A 2404H, A 2504H, A 3004H.

Other compact pumping systems are available in **X** version (extremely harsh applications): **A 204X, A 804X, A 1504X, A 1804X, A 2404X, A 2504X, A 3004X.**

These pumps are characterised by their resistance to corrosion, their robustness, their high inlet flows capability and an optimized thermal management.

Please contact Pfeiffer Vacuum to obtain more detailed information according to the applications.

STD version **STanDard** version for most of the applications.

EHT version **Extended High Temperature** version.

This version is recommended for all applications requiring the pump and gas temperature to be as high as possible to avoid any by-product condensation inside the pump.

ELT version **Extended Low Temperature** version.

This version is recommended for all applications requiring the pump and gas temperature to be as low as possible to avoid any by-product deposition inside the pump.

Options In order to adapt the products to the specifics of the applications, the manufacturer proposes different options configured to the order. The operation and use of these options are described as necessary in the chapters of this manual. These options concern:

- SEPM option (Silencer exhaust pressure management)
- SEMI option

4.2 Man/machine interfaces

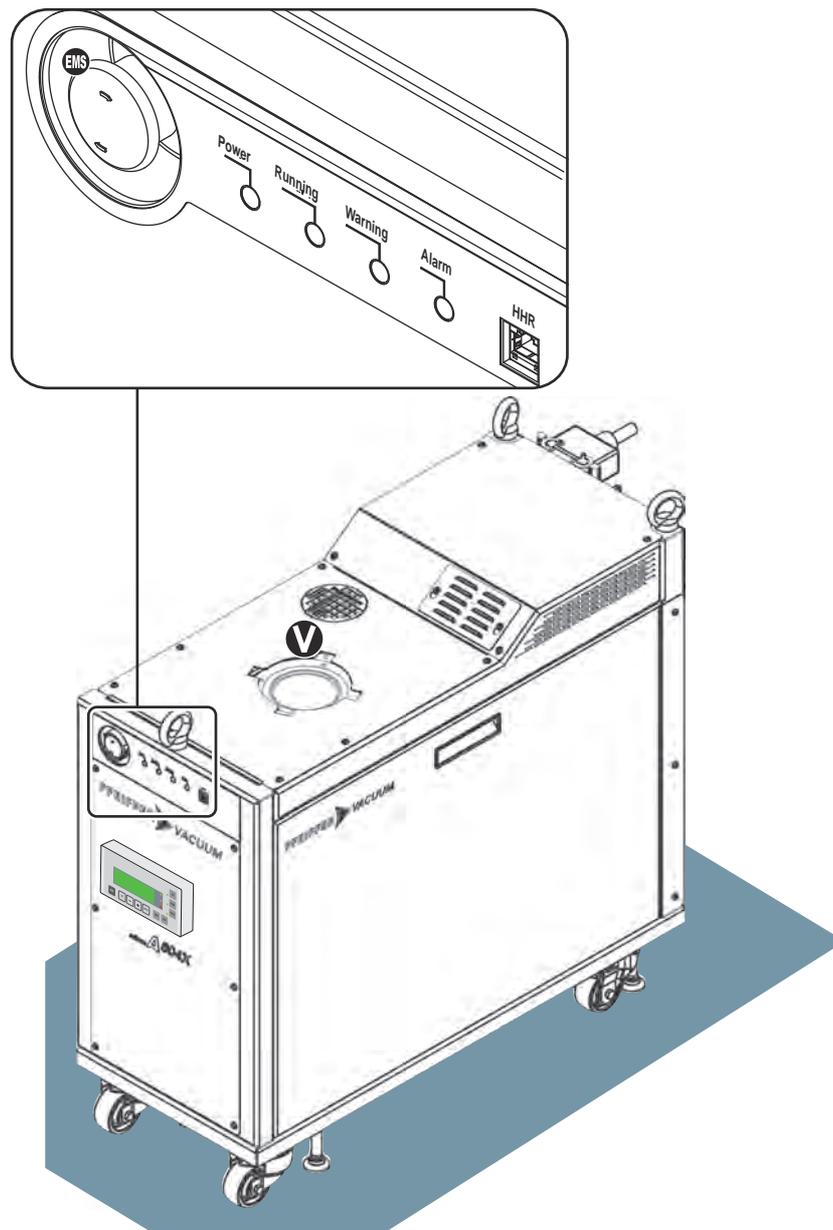


Fig. 1: Front panel

	Inlet
	Emergency stop button
Power	White indicator light: pump powered
Running	Green indicator light: pump started
Warning	Yellow indicator light: alert
Fault	Red indicator light: alarm
HHR	Hand-held remote module connector

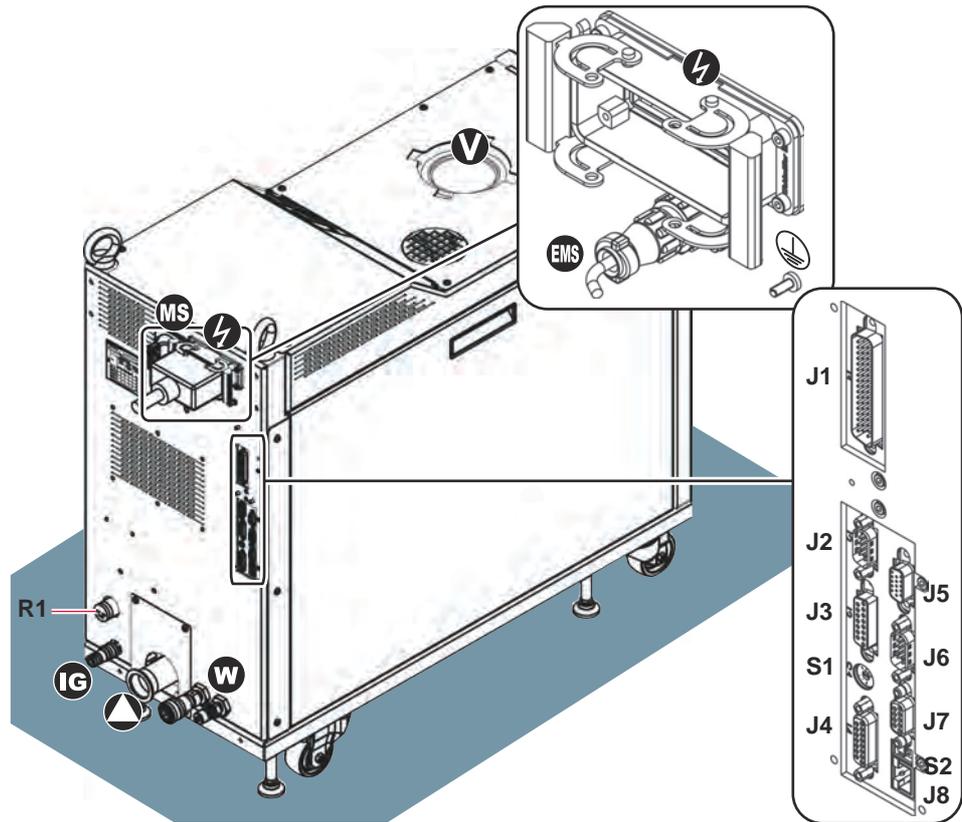


Fig. 2: Rear panel

	Main switch		Power supply
	Inlet		Exhaust
	Nitrogen inlet		Water inlet/outlet
	EMS Emergency stop connector		Earth connector
R1	Pressure regulator		
J1	REMOTE control connector	J5	Roots 2 connector
J2	RS-232 SERIAL LINK connector	J6	RS-232/485 SERIAL LINK connector
J3	USER connector	J7	RS-485 SERIAL LINK connector
S1	Coding wheel	S2	Configuration switch
J4	Inlet valve connector (accessory)	J8	Hand-held remote control connector

4.3 Hand-held remote module (HHR)

It interfaces with the pump. The keyboard is used to display and configure parameters.

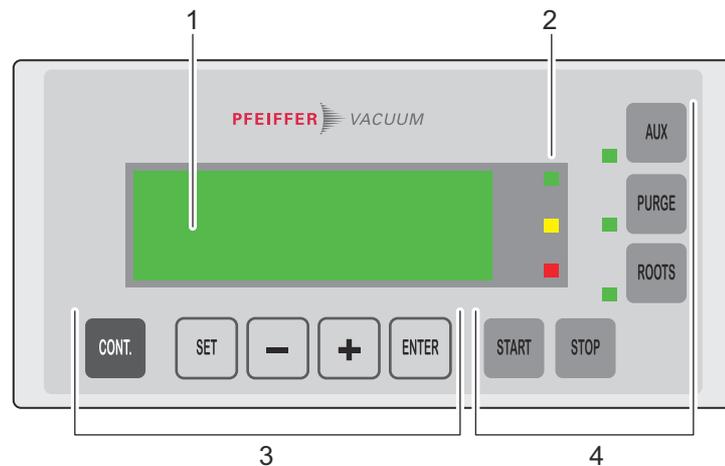


Fig. 3: Hand-held remote module

1	Display	3	Parameter selection and configuration keys
2	Indicator lights Green: the pump is running Yellow: warning presence Red: alarm presence	4	Manual control keys

4.3.1 Description of the keys

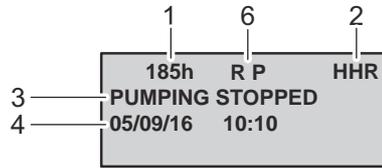
Touche	Fonctions	Touche	Fonctions
	– Prendre le contrôle de la pompe avec le boîtier HHR		– Permet de démarrer/arrêter le Roots en mode local quand [DEFINITION][CMD ROOTS] est [VALIDE] (see 8.2) Le voyant est allumé quand le Roots est en marche.
	– Accéder au mode paramétrage – Sortir des différents menus sans valider les fonctions		– Permet de démarrer/arrêter la purge en mode local quand [DEFINITION][CMD PURGE] est [VALIDE] (see 8.2). Le fonctionnement de la purge est décrit dans les Réglages avancés (see 7.1). Le voyant est allumé quand la purge est en marche.
 	– Accéder au menu suivant ou précédent, au paramètre suivant ou précédent du menu affiché – Choisir ou ajuster la valeur du paramètre	 	– Permet de démarrer/arrêter la pompe en mode local ([DEFINITION][ORGANE DE CONTRÔLE][HHR](see 8.2))
	– Valider le choix d'un menu, d'un paramètre ou d'une valeur – Confirmer une réponse à une question posée		– Permet d'ouvrir/fermer une vanne raccordée en J4 quand [DEFINITION][VANNE ASPI] est [ASPI MANUEL] (see 8.2). Le fonctionnement de la vanne est décrit dans les Réglages avancés (see 7.7). Le voyant est allumé quand la vanne est ouverte.

→ Select the keys by hand only and do not use hard objects such as pens, screwdrivers, etc., which could damage them.

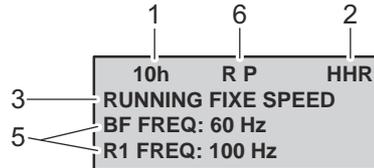
4.3.2 Display description

The monitoring displays the status of the pump and the operating parameters. Gain access to other operating parameters using + or – keys.

Switching on



Running



1	Running time machine	4	Date and hour
2	Control mode	5	Operating parameters
3	Pump status/fault messages	6	Active option(s) on the pump – Roots control active: R – Purge control active: P – Stand-by purge control active: S – Inlet valve manual control active: I

5 Installation

5.1 Set-up

The pump must be operated in the horizontal position in support on its feet, with the pumping axis vertical and the inlet opening upwards.

- Determine where the pump will be placed.
- Use the handling devices to position the pump in the desired location, lift the pump using hoisting rings (see 3.1).
- Lock the pump by adjusting the four leveling feet.
- Use a spirit level to check that the frame is in horizontal position in both axis.
- Remove the transport flange.

Removing the transport flange (except for A 124H, A 204H, A 204X, A 2404H, A 2404X)

- Remove the top cover.
- Remove the yellow transport flange by removing the screws (see 15.1).
- Keep this flange for reuse when transporting the pump.
- Install the cover.



CAUTION

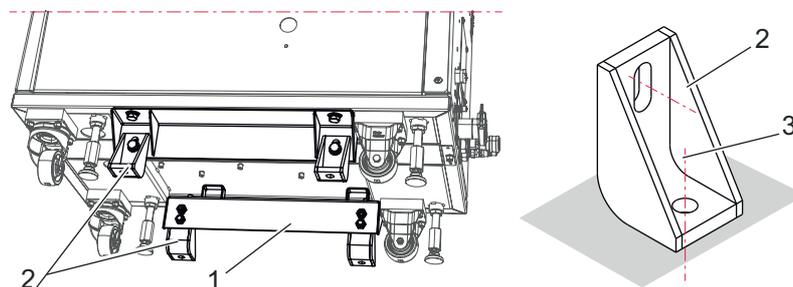
Risk of tear-out or trips

- Route and secure cables, hoses and pipework during installation to avoid any possible risk of tripping.

5.1.1 Seismic bracket installation

To install the pump in a seismic environment, it is necessary to anchor it to the floor with seismic brackets (see 13). When the pump is at the right location (see 5.1):

- Install the support bars (1) under the frame and tighten them with delivered screws and washers: maximum clamping torque 62 N·m.
- Position the 4 brackets (2) on the supports (1) using delivered washers and screws: make sure that the brackets are resting against the floor and tighten them with delivered screws and washers to maximum torque 62 N·m.
- Fasten the brackets to the floor with attachment accessories (3) (customer supplied). Choose the screws according to the foot distribution weight (see 14.4).



1	Support bar (quantity 2)
2	Bracket (quantity 4)
3	Attachment accessories location (customer supplied)

5.2 Oil filling



DANGER

Health risk in case of oil contact
 The pumps are delivered empty of oil: the oil is delivered in separate containers.
 → Wear mask, gloves, protective glasses to fill the pumps with oil.

NOTICE

Only use approved operating fluids
 The pumps are factory tested using Pfeiffer Vacuum oil.
 → The same oil **must be used** during operation. The oil safety data sheet is available on the Pfeiffer Vacuum website.

Model	A113 Oil quantity (liter)			Total
	FB	Roots housing		
		Gear side	Motor side	
A 124H	0.25	–	–	0.25
A 204H/A 204X	0.28	–	–	0.28
A 604H	0.25	0.45	0.18	0.88
A 804H/A 804X	0.28	0.45	0.18	0.91
A 1204H	0.25	1.00	0.55	1.80
A 1504H/A 1504X	0.28	1.00	0.55	1.83
A 1804H/A 1804X	0.28	1.00	0.55	1.83
A 2404H/A 2404X	0.28	0.9	0.6	1.78
A 2504H/A 2504X	0.28	0.9	0.6	1.78
A 3004H/A 3004X	0.28	0.9	0.6	1.78

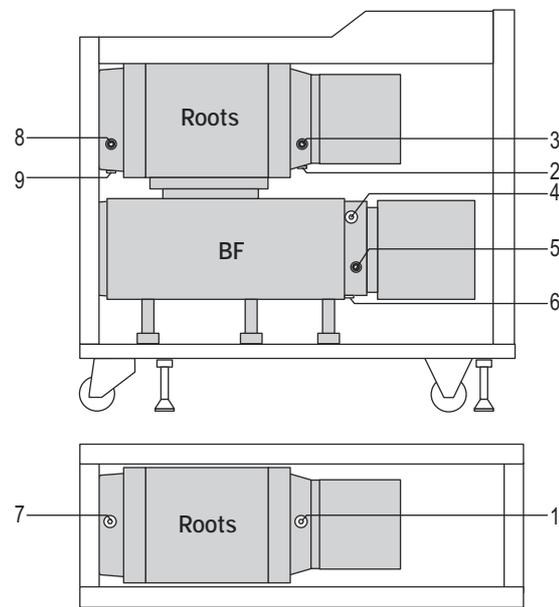


Fig. 4: Oil case filling

1	Roots motor side housing fill plug	6	FB drain plug
2	Roots motor side housing drain plug	7	Roots gear side housing fill plug
3	Roots motor side housing sight glass	8	Roots gear side housing sight glass
4	Functional block fill plug	9	Roots gear side housing drain plug
5	Functional block sight glass	BF	Functional block

5.2.1 Oil filling caution

- Make sure the pump is off (main switch **MS** on **O**) and the power line cable disconnected.
- Make sure the pump is **positioned horizontally**.
- Remove the pump covers.
- Use the funnel equipped with a flexible tube.

5.2.2 Procedure

Fill the housings:

- Roots motor side, and Roots gear side,
- Functional block (FB).

For each housing, proceed as follows:

- Remove the fill plug.
- Position the funnel in the oil fill neck.
- Fill the pump with oil **according to the recommended quantities**.
 - For this to be accurate, wait a few minutes for the oil to settle over all internal surfaces : **the oil level should be in the middle of the sight glass.**
 - If necessary, adjust the oil level so that it is opposite the mark.
- Replace the fill plug securely.

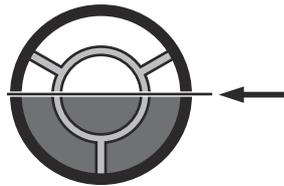


Fig. 5: Oil sight glass

5.3 Connection to the water circuit

In order to **limit corrosion and motor cooling circuit clogging**, it is recommended to use water with the required characteristics (see 14.2.2).

If the "solid particle size" and "solid pollution" water characteristic values cannot be reached, install a filter on the water input.



NOTICE

The use of uncontrolled city water can lead to water circuit clogging due to lime-scale deposition.

This may necessitate, in the worst case scenario, a complete cleaning and overhaul of the cooling circuit.

The presence of micro-organisms like aquatic weeds and micro-biological substances like bacteria can lead to cooling problems in the pump.

- An appropriate water treatment system must be used to prevent the growth of such microorganisms.

5.3.1 Procedure



NOTICE

Risk of water supply failure

If loss of cooling water creates a significant risk for the process:

- Control the cooling circuit using an external system able to take over in case of failure.



WARNING

Pressurised circuit
 In order to carry out operations on the product safely, the user must:
 → Fit a manual valve on the water circuit 3 m from the product allowing the cooling circuit to be locked.

- Connect the water pipes to the coupling connections (delivered with the pump):
 Water inlet = female connection,
 Water outlet = male connection.
- Connect the plugs on **WATER IN** and **WATER OUT**  (see 4.2).
- Check that there are no leaks in the pipes and connections of the water circuit.

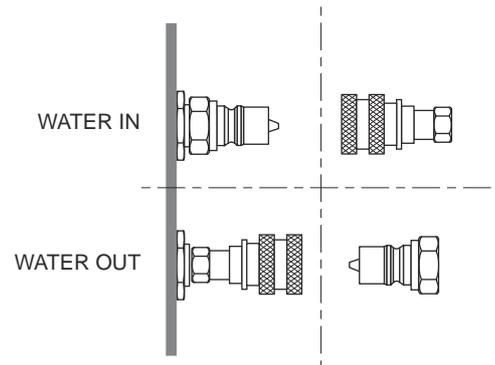


Fig. 6: Water circuit connection

5.4 Connection to the nitrogen circuit



DANGER

Risk of explosion
 If pyrophoric materials above the LEL (lower explosive limit) are sent to the pump, the nitrogen supply must make it possible to dilute this concentration.
 → Ensure there is a sufficient flow of nitrogen to lower the concentration below the LEL.
 → Provide in addition an interlock to ensure that gas flow towards the pump is stopped when nitrogen is lost.

A filtered dry nitrogen supply with the characteristics defined is required for optimum performance (see 14.2.3).



NOTICE

Risk of damage of internal parts
 A sudden inrush of nitrogen into the pressurization circuit may result in damage to internal parts.
 → Close the pressure regulator **R1** by turning the knob counterclockwise before pressurizing the circuit.

5.4.1 Procedure



NOTICE

Risk of nitrogen supply failure
 If loss of purge flow creates a significant risk for the process:
 → Control the nitrogen supply using an external system able to take over in case of failure.

**WARNING****Pressurised circuit**

To work safely on the product, the operator must:

- Install a manual valve on the nitrogen circuit at a distance of 3 m from the product, so that the nitrogen supply can be locked.
- Connect the nitrogen pipe to the coupling connection (delivered with the pump). Provide a 6.35 OD (1/4 inch) pipe tubing (supplied by the customer).
- Connect the plug on **Ⓞ** marked **NITROGEN** (see 4.2).

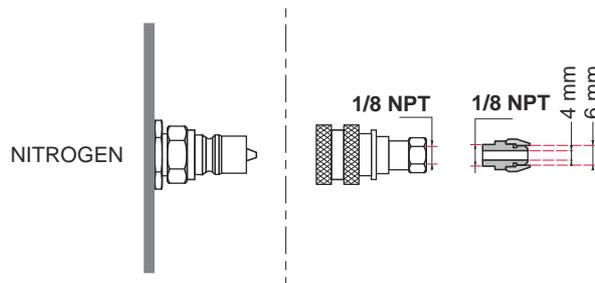


Fig. 7: Nitrogen circuit connection

5.4.2 Nitrogen flow rate adjustment

- Adjust nitrogen flow rate with the pressure regulator **R1** (see 4.2) according to the process.
- Read the flow on the display of the HHR.

5.5 Connection to the pumping line

When there are pyrophoric, inflammable or toxic materials in the pump, this may lead to additional risks, which the operator must assess and manage for the entire pumping system.

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

**DANGER****Risk of ignition**

When flammable materials are sent to the pump:

- Provide a hardware-based LEL detection in the exhaust 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.

**DANGER****Risk of explosion**

If any corrosive, reactive, flammable, pyrophoric, oxidizing processes gases can be sent to the pump:

- Use an exhaust gas monitoring to ensure that gas flow to the pump is stopped when exhaust gas device is lost.



WARNING

Risk of crushing or cutting related to the rotating parts

Do not expose any part of the human body to the vacuum. The product is supplied with the inlet and exhaust sealed.

- Remove these blanking plates when you are ready to connect the product to your vacuum system.
- Do not operate the product unless the inlet and exhaust are connected to a vacuum and exhaust pumping line.

- Use accessories on the inlet and exhaust lines whose materials and sealing properties are compatible with gases being used.
- Provide in the pumping line, accessories to isolate the pump from the vacuum and exhaust line, to make the maintenance easier (inlet and exhaust isolation valves, purges,...).
- Remove the blanking plates blocking the inlet and exhaust ports.
- Keep the blanking plates, screws and washers for reuse when transporting the pump.
- Ensure that no screws, washers or other objects are dropped into the pump inlet.
- Fit flexible flanged bellows in the pumping line to reduce the transmission of vibrations.

The O-rings located under the blanking plates are not compatible with all the applications. The user and/or product OEM is responsible for installing an O-ring compatible with the application.

Other types of connection accessories are available in the product catalogue. The inlet and exhaust connections must not cause stress that could lead to leaks in the pumping line.

5.5.1 Connection at pump inlet



NOTICE

Limit of operation

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

To improve pumping speed, the pumping line must be as short as possible and its internal diameter must not be less than the pump inlet flange.

To control the isolation valve (see 8.5).

5.5.2 Connection at pump exhaust



DANGER

Health risk in case of contact with toxic substances

Exhaust of corrosive, reactive, flammable, pyrophoric or oxidizing process gases may result in severe injury or death.

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



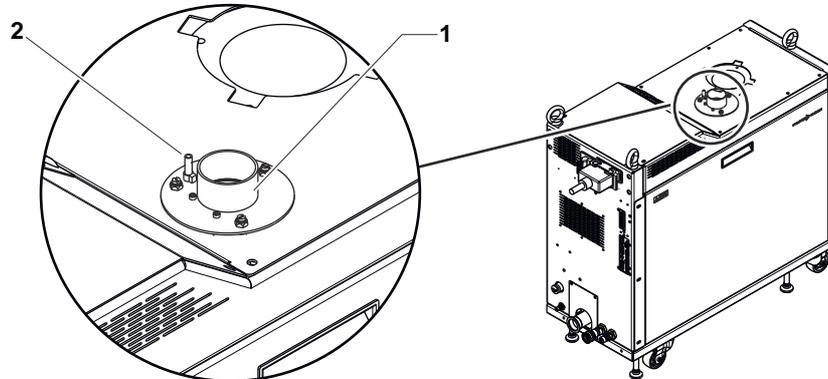
NOTICE

Limit of operation

- Ensure that all components in the exhaust pipeline have maximum pressure rating which is greater than the highest pressure that can be generated in your system.

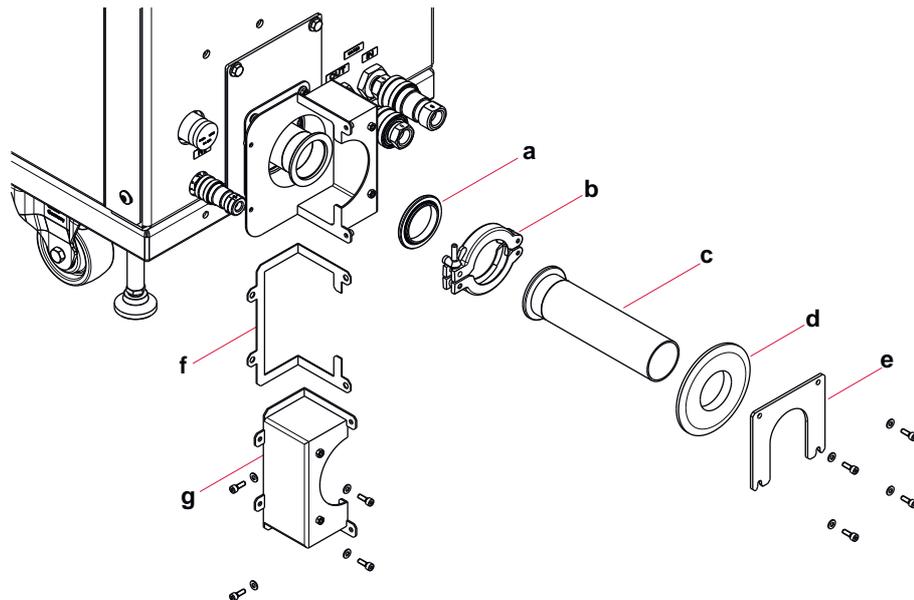
5.6 Exhaust ventilation of the cover

The pump is equipped with a device for ventilating the inside of the cover to extract any gas to an exhaust gas extraction system. This device consists of a pipe and a differential pressure sensor. The gas extraction system must guarantee a minimum flow rate of 85 m³/h in order to generate a differential pressure of 0.33 hPa (see 7.13).



1 - Pipe end (diameter 50 mm)
2 - Differential pressure sensor

It is necessary to connect the exhaust box to the customer's installation to warranty a complete inside ventilation of the cover.



- Remove the half-box (g) and the seal (f). Remove the ring (d) and the plate (e).
- Place the ring (d) on the pipe (c).
- Connect the pipe on the pump exhaust port using the equipped centering ring (a) and the connect clamp (b).
- Place the seal (f) and the half-box (g), secure it with 4 screws.
- Squeeze the ring (d) between the exhaust box and the plate (e) with 4 screws.

5.7 Leak test



WARNING

Leak-tightness of the equipment

It is the user's responsibility to ensure this level of leak tightness is maintained, especially when dangerous gases are pumped. The operator must maintain this level of tightness, particularly when pumping dangerous gases. Proceed as follows:

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

For more information concerning leak tests, please contact your service center.

5.8 Electrical connection



WARNING

Electric shock hazard

Voltage and current can cause electric shock. Only skilled, authorized operator trained in the relevant health and safety aspects (EMC, electrical hazards, chemical pollution, etc.) may carry out maintenance work.

- Isolate and lock out power line to the product by positioning the main switch on **O**.
- Disconnect the power line cable from all power sources before doing any work on the product and/or removing the covers.



WARNING

Risk of electromagnetic disturbance

The product's EMC behavior is guaranteed only if the relevant EMC standards are followed during installation.

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



WARNING

Hazards associated with non-compliant electrical installation

Safe operation after installation is the operator's responsibility.

- Connect the product to an installation that is compliant with local safety standards.
- Do not carry out any alterations or modifications to the product on your own initiative.
- Check that the pump is correctly connected to the emergency stop system for the equipment (or pumping installation).
- For specific questions, contact your service centers.



NOTICE

Safety interlock

The pump motors are protected against overload through solid state circuit breakers.

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

Once activated, power will be switched off and the pump will be put in a safe condition. To unlock these breakers, you must:

- delete the origin of the defect, then,
- switch power off (main switch **MS** to **O** position),
- open the electrical box,
- unlock the circuit breakers and,

→ close the electrical box.

5.8.1 Customer electrical installation protection

Installation protection with circuit breaker

The user must supply the pump from facilities equipped with main circuit breaker, curve D (IEC 60947-2), in accordance with local regulations and with at least a 10 kA short circuit cut-off capacity. This protection device should be in close proximity to the pump (no further than 7 m) within line of sight of the pump.

This circuit breaker supply and wiring is a customer's responsibility: main circuit breaker rating (see 14.2.4).

Differential circuit breaker

In the event of an insulation defect, you must install a differential circuit breaker on the main power supply to protect personnel (see 14.2.4). Contact your service center for advice. In all cases, comply with current local regulations.



CAUTION	
Risk of earth fault	<p>The user must provide a second protective earth (ground) conductor with a cross-sectional area at least equal to the conducting wire size.</p> <ul style="list-style-type: none"> → Connect the protective earth stud to the suitable installation earth point such as the host system frame or primary grounding point. → Ensure that the equipment and the electrical supply cable are suitably protected against earth defects and that the earth wire is longer than the 3 conducting wires.

An IEC 60417#5019  symbol is located on the rear panel for the main power supply earth terminal (see 4.2).

5.8.2 Connection to the mains power supply

The pump is supplied with a female plug (delivered with the product).

- Connect the mains cable to the power supply connector according following diagram, using wires with characteristics defined in (see 14.2.4).
- Connect the plug on  and lock it (see 4.2).

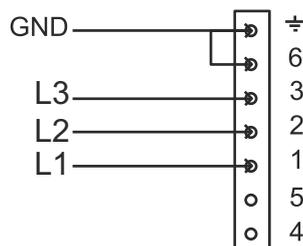


Fig. 8: Main supply connection

5.8.3 Emergency button

The pump is equipped with an emergency stop EMS located at the front of the pump through an emergency stop button and through an EMS stop connector located at the rear of the pump. When activated, these two elements cut off the control circuit and stop the pump.

The emergency stop circuit consists of electromechanical components: resetting them does not cause the pump's restart.

The pump can run only **if the cover plug is and fitted on connector** (delivered with the pump) .

→ Before switching on, connect the cover plug on EMS connector (see 4.2).

To integrate the pump into the emergency stop circuit of a equipment, wired the EMS connector at the rear of the pump (see 8.7).

Semi S2 requirements (EMO)

To meet the requirements of the Semi S2 standards, it is the customer's responsibility to integrate the pump into the equipment's emergency off circuit.

→ Use the EMS contact of the pump to control the equipment power failure (EMO) (see 8.7).

5.9 Operating for the first time

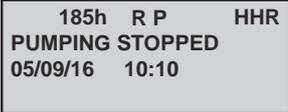
→ Check before each time the pump is started up that the oil levels in the housings are visible in the center of the sight glasses (see 5.2.2): carry out this check with the pump stopped.

→ Check that the connections to the pumping line, inlet and exhaust sides, have been made (see 5.5).

5.9.1 Switch on

→ Connect the hand-held remote module **HHR** (see 4.2).

→ Position the main switch **MS** to **I** position. The white **Power** indicator lights on, the HHR displays the status of the pump (see 4.3.2).



→ Take the pump control via the **CONT.** key: HHR flashes on the display.

5.9.2 Check of the rotation's direction at initial start-up

- Start-up the pump by pressing **START** and valid with **ENTER**:
 - the pump starts, **PUMPING** is displayed on the HHR. Stop the pump pressing **STOP** and valid with **ENTER**.
 - the pump doesn't start and the message **D19 REVERSE UVW** is displayed : there is a wiring problem. Stop the pump pressing **STOP**. Switch off the pump by positioning the main switch to **O**: the white indicator light **Power** turns off. Invert two phases at the main power input connector (see 5.8.2).



WARNING

Electric shock hazard in case of contact

When the main isolator is set at **O**, items located between the mains connection and the isolator are still under mains voltage.

→ Disconnect the power line cable from all power sources before doing any work on the product.



WARNING

Electric shock hazard

Some components have capacitors charged to over 60VDC. When power is switched off, they maintain this charge for some time. Residual voltages from the filter capacitors can cause electric shocks all the way back to the mains plug.

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

5.9.3 Default setting

When the pump is delivered, it runs according to the default setting: it depends on the product ordering guide.

The user or the integrator is responsible for the application for which the pump is used and must adapt the parameters accordingly (see 8.2).

5.9.4 Access code modification

The setting made at the factory is protected by an access code ("0" default setting) which disables parameter modification. Access code and parameters can be customized (see 8.2).

5.9.5 Reset the clock

To ensure correct fault monitoring and customized parameters, it is necessary to initialize time and date of the product (see 5.9.6).

5.9.6 Navigation in the menus

Fast scroll by continuously holding down the + and – keys. For the other keys, press several times.

Example of resetting the clock:

⇒ Press the **SET** key to enter the menu.

185H HHR
PUMPING STOPPED
06/05/13 10:10

SET

⇒ Validate with the **ENTER** key.

PASSWORD
0

ENTER

⇒ Access to the selected menu with the + or – keys.

DEFINITION
SETTING
MAINTENANCE
MANAGEMENT

+

⇒ Validate with the **ENTER** key.

DEFINITION
SETTING
MAINTENANCE
MANAGEMENT

ENTER

⇒ Access to the selected parameters with the + or – keys.

CONTRAST
PURGE
WATER FLOW
POWER

+

⇒ Select DATE AND TIME with the **ENTER** key.

Some parameters can only be modified when the pump is stopped.



⇒ Adjust the value with the + or – keys.
⇒ Validate with the **ENTER** key.



⇒ Return to the main menu by pressing the **SET** key.

6 Operation

The following steps describe the use when the pump is locally controlled: the **[CONTROL MODE]** is **[HHR]**. For other control modes, please refer to **Control Interfaces** (see 8) for instructions on how to wire and set the parameters of the other interfaces.

6.1 Prerequisites to use



WARNING

Risk associated with process gases

The user and/or integrator of the product is/are fully responsible for the operational safety conditions of the equipment. The manufacturer has no control over the types of gases this pump is exposed to. Frequently process gases are toxic, flammable, corrosive, explosive and/or otherwise reactive. It is the user and/or the integrator's responsibility to follow the necessary safety requirements. Toxic gases can cause serious injury or death. Operators and users must:

- Take the appropriate safety recommendations to prevent injury. Consult the responsible department for instructions and safety information.
- **Hazardous gases from the pump can cause serious injury or death. Regulations require to connect the pump's exhaust to a facility hazardous gas exhaust system** which incorporates appropriate filters, scrubbers, etc. This system must meet all air and water regulations.
- Check that the pump is correctly connected to the equipment (see **Installation**). Contact the service center for further information.

Pumping of pyrophoric or flammable gases could create hazardous situations. The user and/or the integrator must respect safety instructions (see 2.2).

Before each pump start-up:

- Check that the pump inlet is connected to the pumping line.
- Check that oil levels of housings are visible in the middle of the sight glasses (see 5.2.2).
- Switch on the supplies of cooling water and nitrogen.
- Switch on the electrical supplies.
- Check that exhaust pipe line is not clogged and that all the valves in the exhaust system are open.
- Check that cover plug is connected on emergency stop connector or is wired into the equipment's emergency stop system.

6.2 Pump start-up

6.2.1 Switch on

- Position the main switch **MS** to **I** position. The white **Power** indicator lights on, the HHR displays the status of the pump (see 4.3.2).
- Take the pump control via the **CONT.** key: HHR flashes on the display.

185h	RP	HHR
PUMPING STOPPED		
05/09/16	10:10	

6.2.2 Pumping start-up

→ Press **START** key, valid with **ENTER**, the pumping starts. The **Running** green indicator lights on.

The following operations will perform automatically:

- FB pump starts up,
- purge gas valve opens,
- Roots pump starts up,
- inlet valve opens (if any and if set).

The operating parameters are displayed.

→ Gain access to other operating parameters using + or – keys.

Only installed and set functions are displayed.

10h	R P	HHR
RUNNING FIXE SPEED		
BF FREQ: 60 Hz		
R1 FREQ: 100 Hz		

6.2.3 Auto-restart configuration



DANGER

Risk due to auto-restart

When the pump has been set for automatic restart after a power failure, the pump restarts when the power is switched back on.

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

By default setting, automatic restart is set to **[DISABLED]** (see 8.2).

6.2.4 Start-up after an emergency stop

To restart the pump after an emergency stop, it is necessary to:

- fix the problem,
- rotate the emergency button **EMS** to unlock,
- position the main switch **MS** to **O** than to **I** position,
- press **START** to start the pump and valide with **ENTER**.

6.2.5 Option Roots command

To start or stop the Roots while the FB is running, set the **[CMD.ROOTS]** on **[ENABLED]** when the pump is stopped.

The Roots will start or stop by pressing the **ROOTS** key if **[CONTROL MODE]** is **[HHR]** (see 4.3) or with **J1-S3** contact if **[CONTROL MODE]** is **[REMOTE]** (see 8.3.2).

6.3 Pump shut-down

6.3.1 Pumping stop

→ Press on **STOP** key and valid with **ENTER**.

The following operations will perform automatically:

- inlet valve closes (if any and if set),
- pump(s) stop(s) (FB and Roots),
- injection of purge gas continues during the shutdown phase if timing of **[PURGE PRO-LONG]** has been set (0 to 120 min) (see 8.3.2) and (see 7.1.3).



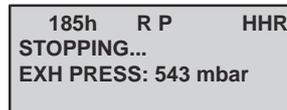
NOTICE

Risk of injury

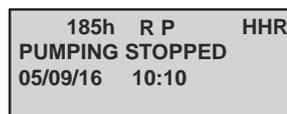
When the STOPPING message appears on the display, don't intervene on the pump.

- Wait for the PUMPING STOPPED message before intervening on the pump.
- Switch off the pump.
- Wait for the pump cooling.

The message STOPPING appears on the HHR display.



The message PUMPING STOPPED appears on the HHR display:



- When timing of **[PURGE PROLONG]** expires (if selected) or if pressure > 1500 hPa, and
- when the pump is cooled.

It is possible to force the shutdown of the pump to reduce the duration of the shutdown phase: the injection of purge gas is interrupted, the temperature information is no longer taken into account.

→ Press twice on **STOP** key and valid with **ENTER**.

Warning! possible risk of injury due to any contact with hot surfaces.

6.3.2 Switching off

→ Switch off the pump by positioning the main switch  to **O**: the white indicator **Power** turns off.

6.3.3 Emergency stop

→ Push emergency stop button  in front panel of the pump.

The emergency stop can be activated by the equipment via the emergency connector (see 8.7).



WARNING

Other localised hazardous energies

When the EMO is activated, some internal electrical parts are energized and water-cooling line and nitrogen purge line are always supplied.

→ Before any intervention, disconnect the product from any energy supply: electricity, water and purge.

6.3.4 Prolonged stop

If the pump has to be stopped for a prolonged period, apply the **Decommissioning** procedure (see 10).

6.4 Use with two HHRs

Two HHR can be connected to the pump (**HHR** on pump front panel, **J8** at the rear panel (see 4.2)). Reading of data and parameters can be done on both HHR, even if they do not control the pump. Only one HHR can control the pump.

- To take the control with a HHR, press the **CONT.** key: then, the text HHR flashes on the right corner of the display. The control of the pump is now not possible from another HHR.
To give the control back, press on the **CONT.** key.

6.5 Operation monitoring

When a problem occurs, the user is informed through:

- the relevant fault indicator light: yellow lit in case of warning, red lit in case of alarm,
- the audible buzzer warning (if preselected),
- the fault contacts on **J1** remote connector are activated,
- display of fault message on the HHR,
- a message via the RS-232 or RS-485 serial link.

Messages are listed in the **Malfunctions** chapter (see 11.3).



NOTICE

Overpressure in the exhaust line

The pump is equipped with an exhaust pressure monitoring sensor that monitors the pressure at the fonctionnal block exhaust, but not in the exhaust line. It is the responsibility of the user to:

- Prevent the risks related to excess overpressure in the pumping installation.

7 Advanced settings

This chapter describes the available functions and their respective operating modes to help the user configure the parameters according to the operating specifications during processes.

7.1 Nitrogen injection device

The nitrogen injection device is used to facilitate the evacuation of pollutants produced by the process, to dilute harmful gases in the compression stages and to protect the mechanical parts of the pump.

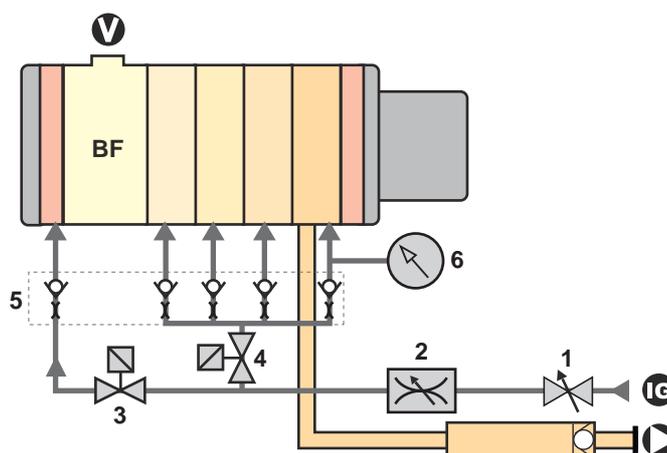


Fig. 9: Nitrogen injection device

1	Pressure regulator	<i>Nitrogen flow adjustment</i>
2	Mass flowmeter	<i>Nitrogen flow reading</i>
3	Purge valve	<i>Nitrogen flow check</i>
4	Stand-by valve	
5	Injection manifold fitted with check valves and calibrated injectors	<i>Nitrogen flow distribution in each stage</i>
6	Exhaust pressure sensor	<i>Exhaust pressure check</i>
BF	Functional block	

7.1.1 Management modes

The management mode is selected when the pump is stopped:

- from HHR [DEFINITION] [PURGE CMD](see 8.2),
- from serial link (see **Serial link** Operating instructions).

DISABLED The purge operated automatically.

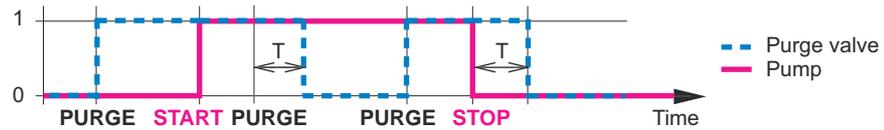
The **stand-by (4)** and **purge (3)** valves open/close when the pump is started/stopped. When the pump stops, purging is extended by a time T (see 7.1.3).



ENABLED The **stand-by (4)** and **purge (3)** valves open/close simultaneously following a **PURGE** command independent of the pump being started/stopped:

- from HHR by pressing **PURGE** button (see 4.3),
- from remote control (see 8.3).

To activate this mode, the coding wheel **S1** must be in position **1**.



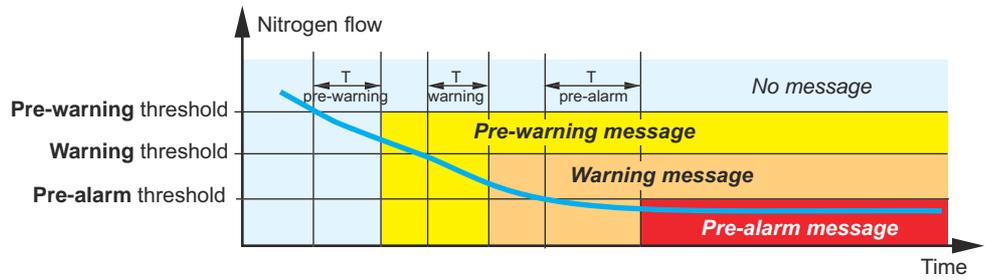
WARNING
Risk due to process gases → It is highly recommended not to stop the purge when the pump is running.

7.1.2 Indicating a nitrogen flow defect

3 monitoring thresholds and a delay linked to each threshold can be set in menu [SETTING] [PURGE] [PURGE FLOW] then [PRE-WARNING]/[WARNING]/[PRE-ALARM] (see 8.2).

If the measured flow of nitrogen is lower than the set threshold, a fault appears after the expiry of a time delay. **None of these defects stops the pump.**

The [PRE-ALARM] can't be set to [DISABLED] neither be modified.



7.1.3 Prolonging the purge

The system is automatically purged when the pump stops (normal stop or stop due to defect) if the system is set to maintain the purge gas.

But it is not purged if the pumps stops in case of an alarm of exhaust pressure D01 or emergency stop D34.

Program [SETTING] [PURGE] [PURGE PROLONG] [DELAY] according to the process (see 8.2) or see *Serial link Operating instructions*.



7.2 Exhaust pressure monitoring

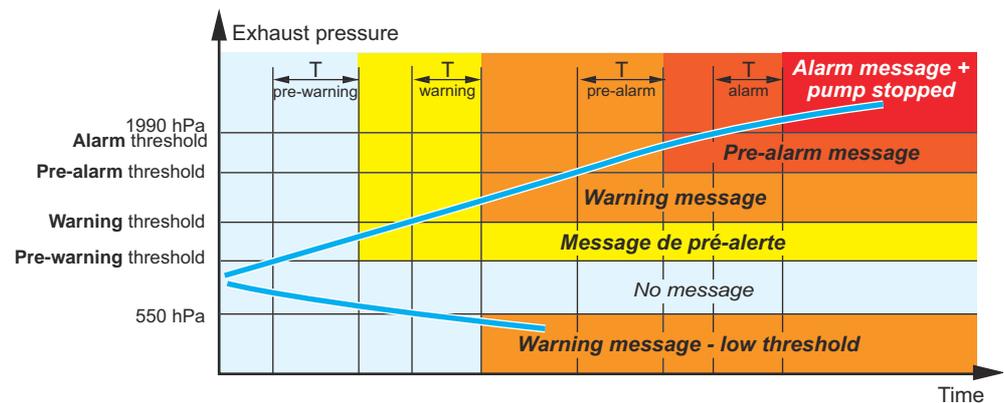
Exhaust pressure monitoring is used to control the level of clogging in the functional block. The nitrogen injection system is equipped with a pressure sensor that measures the pump exhaust pressure. A pre-warning, a warning, a pre-alarm thresholds and their associated delay can be set in **[SETTING] [EXH PRESS] [PRE-WARNING/WARNING/PRE-ALARM] [THRESHOLD]/[DELAY]** (see 8.2).

The alarm threshold cannot be adjusted. A 5 s time delay can be set on menu **[DELAY STOP ALARM] [ENABLED]** before stopping the pump.

- alarm threshold: 1990 hPa (high threshold).

If the pressure drops below 550 hPa (not adjustable value), a warning is triggered (pressure sensor non-operational) after the expiry of a 10 s time delay (not adjustable value).

- warning threshold: 550 hPa (low threshold).



7.2.1 Silencer exhaust pressure measurement (option SEPM)

The SEPM (Silencer Exhaust Pressure Measurement) option measures the pressure in the exhaust silencer. Installed in the factory, this option requires no adjustment.

The operation of this SEPM option is the same as the operation of the exhaust pressure monitoring described in chapter above.

7.3 Water circuit

The water circuit dissipates heat from the functional block to protect the mechanical and electrical components (motors and frequency converters). It is also used for thermal regulation of the high pressure (HP) and low pressure (LP) stages of the functional block (FB) (see 7.4.1).

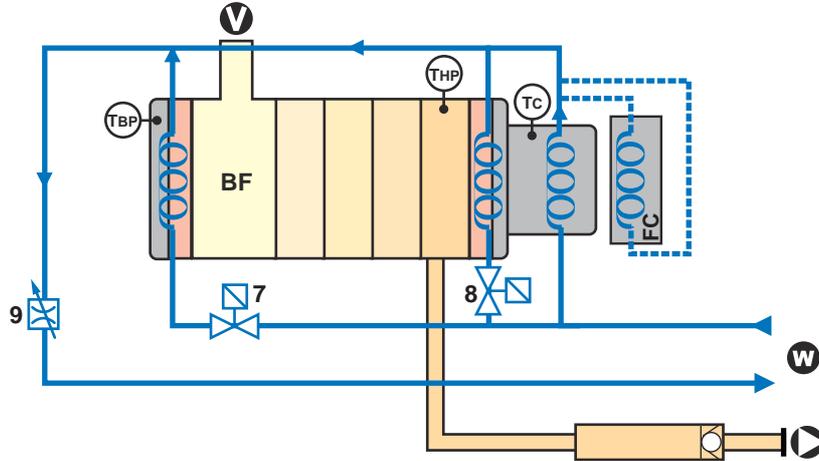


Fig. 10: A 124H/A 204H/A 204X water circuit

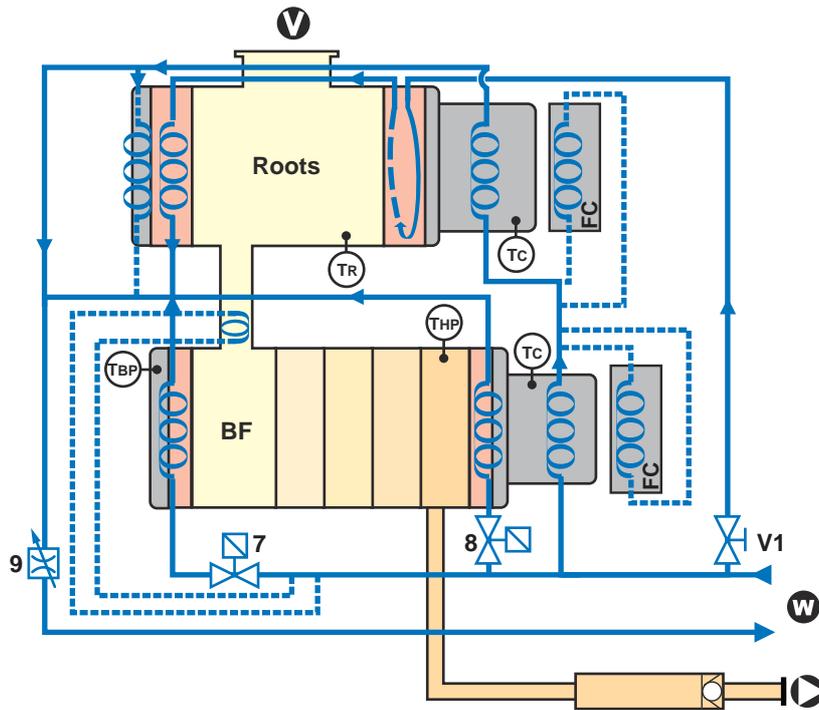


Fig. 11: Water circuit for other models

7	LP water valve	Temperature of the HP/LP stages regulation
8	HP water valve	
9	Water Flowmeter	Water flow measurement
10	Manual valve	Roots cooling authorization
T _C	Temperature sensor	Motor temperature measurement
T _R	Temperature sensor	Roots motor temperature measurement (A 604/A 804)
T _{HP}	HP temperature sensor	FB temperature measurement
T _{BP}	LP temperature sensor	
BF	Functional block	

7.4 Functional block temperature management

7.4.1 Thermostatic control of the functional block

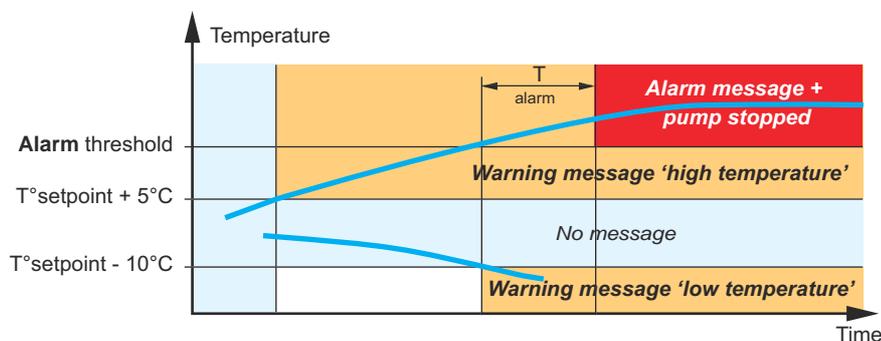
The temperature regulation in the FB prevents deposits or condensation of process by-products in the pump and limits corrosion.

The water circuit regulates the heat in the HP and LP stages of the functional block. It is composed of following components, figure (see 7.3):

7	LP water valve (if present)	Regulate the temperature of the HP and LP stages
8	HP water valve	
T _{HP}	HP temperature sensor	Measure the stage temperature
T _{LP}	LP temperature sensor (if present)	

Thresholds are set in **[SETTING] [TEMPERATURE] [LP FB T°]/[HP FB T°] [CONTROL]**.

The water valves are supplied independently of pump start-up according to temperature setpoints. If the temperature is lower than the setpoint, the valve closes. If the temperature exceeds the setpoint, the valve opens. If the measured temperature is higher by 5°C or lower by 10°C than the setpoint, a warning appears. If the temperature exceeds the set threshold, an alarm appears..



This monitoring is possible once at least the setpoint temperature is reached. Otherwise the valve remains closed and the temperature faults are not managed.

7.4.2 Functional block temperature

The measure of the FB temperature is available by setting the menu **[SETTING] [TEMPERATURE] [LP FB T°]/ [HP FB T°]** on **[MEASUREMENT]**. 2 monitoring thresholds (warning and alarm) and associated delay can be set.

The choice of measurement mode applies to both valves HP/LP. Switching to measurement mode automatically opens the solenoid valves of the FB.

7.5 Roots temperature

The Roots cooling circuit is fitted with a manual valve **10** which allows the Roots body to be cooled or not, depending on the application. A temperature probe **TR** measures the Roots temperature (on A 604/A 804), figure (see 7.3).

2 monitoring thresholds (warning and alarm) and associated delay can be set, **[SETTING] [TEMPERATURE] [ROOTS 1 T°] [MEASUREMENT] [WARNING]/[ALARM] [THRESHOLD]/[DELAY]**(see 8.2). If the temperature exceeds the set threshold, a fault appears after the expiry of the delay.

7.6 Heating

The heating system eliminates any cold points in the pumping system to avoid gas condensation. The system can manage up to 3 different heating elements inside the pump.

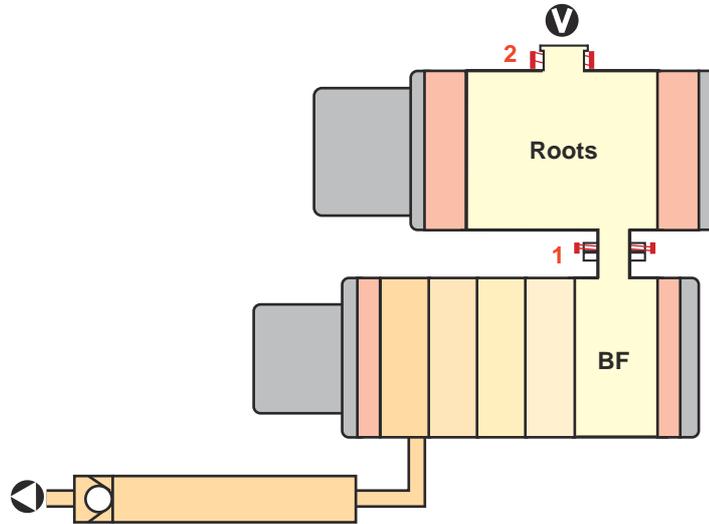


Fig. 12: Heating

7.6.1 Management modes

The management mode is selected with the pump stopped :

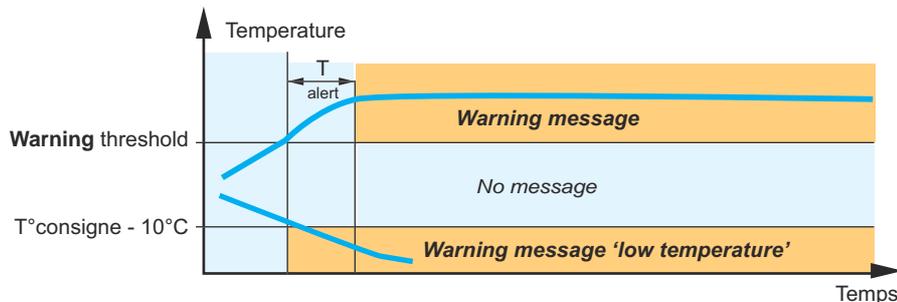
- from HHR **[SETTING] [TEMPERATURE] [HEATER 1 T°]/[HEATER 2 T°]/[HEATER 3 T°]** (see 8.2),
- from serial link (see *Serial link Operating instructions*).

DISABLED No heating management.

CONTROL The heating element is thermally regulated. The heating is supplied independently of pump start-up in accordance with temperature setpoints **[CONTROL] [THRESHOLD]**. If the temperature is lower than the setpoint, the heating is switched on. If the temperature exceeds the setpoint, the heating is switched off.

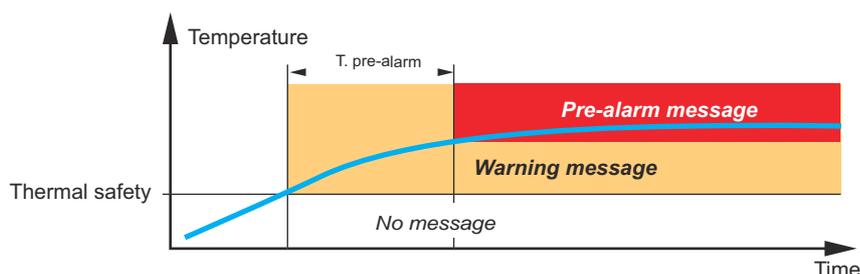
7.6.2 Indicating a temperature defect

The setpoint temperature is set from HHR or by serial link. If the measured temperature is higher than warning threshold value or lower by 10°C than the setpoint, a warning appears. A warning threshold and the associated delay can be set **[SETTING] [TEMPERATURE] [HEATER 1 T°/HEATER 2 T°/HEATER 3 T°] [CONTROL] [DEFAULT HIGH/LOW] [WARNING] [ENABLED] [DELAY]**.



The heating system is equipped with a thermal safety which cause a fault in case of overload. A warning appears. A delay can be set for a pre-alarm: **[SETTING] [TEMPERATURE] [HEATER ALARMS] [DEFAULTS] [PRE-ALARM] [ENABLED] [DELAY]**.

A pre-alarm message appears but the pump doesn't stop.



7.7 Management of an inlet isolation valve

The inlet isolation valve is used to isolate the pump in the pumping line. A **J4** connector (see 8.5) is used to supply and manage an inlet isolation valve (accessory).

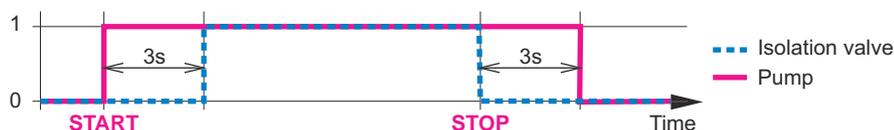
7.7.1 Management modes

The management mode is selected when the pump is stopped:

- from HHR **[DEFINITION] [INLET VALVE]** (see 8.2),
- from serial link (see **Serial link Operating instructions**).

DESABLED No isolation valve management (no isolation valve fitted to the inlet).

AUTO INLET The isolation valve is controlled automatically by the pump when it stops or starts. When the pump starts, the valve opens 3 seconds after the message RUNNING FIXED SPEED is displayed on HHR. When the pump stops, the valve closes immediately, then the pump stops after a delay of 3 seconds.



MANU. INLET The isolation valve is controlled by the selected control mode set in menu **[DEFINITION] [CONTROL MODE]**:

- from HHR with **AUX** button (see 4.3),
- from **J1** remote control connector (see 8.3),
- from serial link (see **Serial link Operating instructions**).

The valve control can be activated when the pump is stopped or running.

Control by the AUX button

The contacts J1-S1 and J1-S7 must be closed (see 8.3.2).

→ Press the **AUX** button on the HHR and confirm with **ENTER** to open or close the valve.

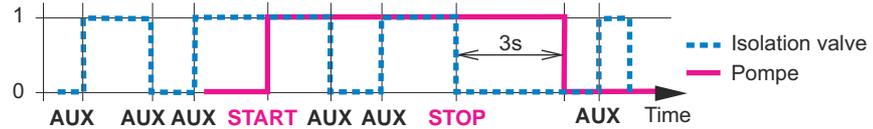
Control from the user's equipment (REMOTE mode: J1)

The contact J1-S1 is open and the contact J1-S7 is closed (see 8.3.2).

- The valve closes if the J1-S6 contact is closed.
- The valve opens if the J1-S6 contact is open.

Control from serial link

The serial link valve opening/closing command is only taken into account if the J1-S7 contact is closed.

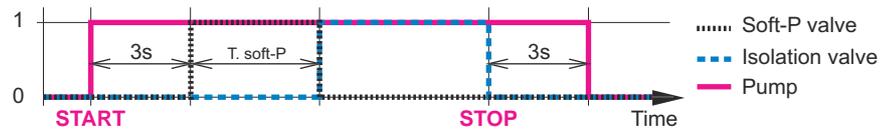


AUTO. SOFT PUMPING

The pump controls either a valve incorporating the “soft pumping” function or two valves in parallel. The opening and closing of the « soft pumping » valve is controlled automatically by the pump when it starts or stops.

The « soft pumping » valve opening cycle starts 3 seconds after the message RUNNING FIXED SPEED is displayed on HHR and stops when a pump stop order is launched: the valve closes 3 seconds before the pump stops.

The opening delay of « soft pumping » valve can be set in menu [SETTING] [VALVE SOFT P] [DELAY] (see 8.2).

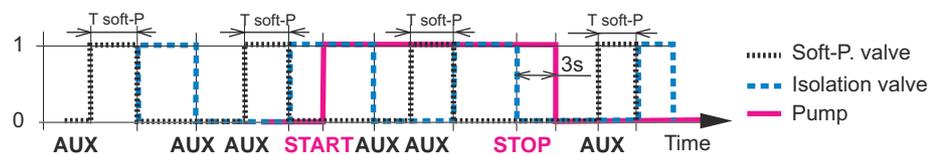


MANU. SOFT PUMPING

The « soft pumping » valve opening/closing cycle is manually controlled when the pump is stopped or running. An opening delay can be set in menu [SETTING] [VANNE SOFT P] [DELAY] (see 8.2).

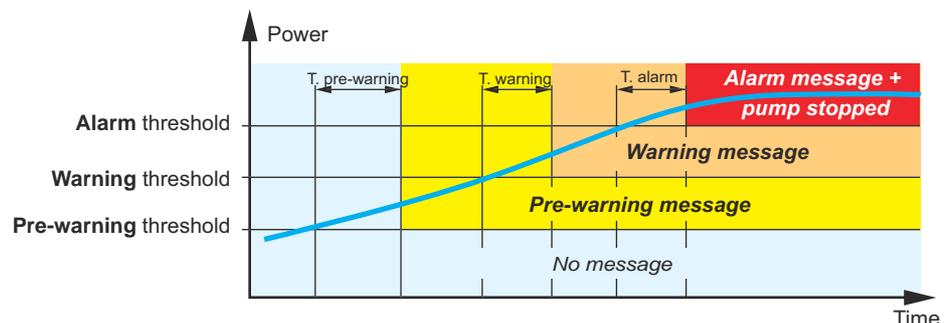
The « soft pumping » valve can be controlled:

- from HHR with **AUX** button (see 4.3): in this case, J1-S1 contact and J1-S7 contact must be closed.
- from **J1** remote control connector (see 8.3): in this case, the contact J1-S1 is opened, J1-S7 is closed. Open the contact J1-S6 to open the valve, and close it to close the valve.
- from serial link (see *Serial link Operating instructions*): in this case, J1-S7 contact must be closed.



7.8 Motor power monitoring

The power of each of the functional block motors and/or Roots is measured. Pre-warning, warning and alarm thresholds delays associated with them can be set for each motor [SETTING] [POWER] [FB POWER]/[R1 POWER](see 8.2). If the measured power exceeds the threshold, a defect appears after the expiry of the delay. If the fault is set to [DISABLED], there is no threshold to configure and the fault is not managed.



7.9 Management and monitoring of the motor rotation frequencies

When the motors of the functional block and/or Roots are powered by a frequency variator, the management mode can be selected (FIXED or ANALOG) depending on the application. These modes are used to define the rotation frequencies: minimum, intermediate or maximum. These values depend on the model.

The management mode is selected with the pump stopped using:

- from HHR **[SETTING] [FREQUENCIES] [FB FREQ]/[R1 FREQ] [FIXE]/[ANALOG]** (see 8.2), or
- from serial link (see *Serial link operating instructions*).

FIXE In this mode, the rotation frequency parameters are set using the HHR or by RS. Preprogrammed frequencies can be selected

ANALOG The analog management mode is only possible if **[IDLE MODE]** is **[DESABLED]**. The rotation frequency is defined by an analog input **J3** (user connection) (see 8.4.3). The selected rotation frequency depends on the input voltage applied.

	Chosen rotation frequency analog mode)				
	Minimum	Intermediate			Maximum
BF (all models)	50 Hz	50 Hz	50 Hz	50 Hz	60 Hz
Roots (A 604H/A 804H/A 804X)	30 Hz	50 Hz	-	-	60 Hz
Roots A 1204H	30 Hz	55 Hz	-	-	80 Hz
Roots (A 1504H/A 1504X)	30 Hz	55 Hz	-	-	75 Hz
Roots (A 1804H/A 1804X)	30 Hz	55 Hz	75 Hz	-	100 Hz
Roots (A 2404H/A 2404X)	30 Hz	65 Hz	75 Hz	85 Hz	95 Hz
Roots (A 2504H/A 2504X)	30 Hz	60 Hz	65 Hz	70 Hz	75 Hz
Roots (A 3004H/A 3004X)	30 Hz	65 Hz	75 Hz	85 Hz	90 Hz
[ANALOG]: voltage to apply	7 to 10 V	3 to 7 V			0 to 3 V

7.10 IDLE mode

This mode allows electricity consumption to be reduced by lowering the speed of rotation of the pumps (if the product is fitted with the frequency converter) and/or the nitrogen consumption by closing the stand-by valve (4) (see 7.1) independently of the purge valve, when the equipment is not on a process.

When this mode is set in menu **[DEFINITION] [MODE IDLE] [ENABLED]** (see 8.2), different options can be selected via the status of the logic inputs User1, User2 and User3 (**J3** connector) (see 8.4.2):

- STANDBY purge + minimum rotation speed
- STANDBY purge + intermediate rotation speed
- STANDBY purge only
- Minimum rotation speed only.

The option selected is displayed on HHR (see 8.2).

Note : when the IDLE mode is activated while the STAND-BY mode is activated, the IDLE mode becomes a priority.



DANGER

Risk of process gases' build-up

→ Never activate IDLE mode when the pump is running in process!

7.11 Analog input management

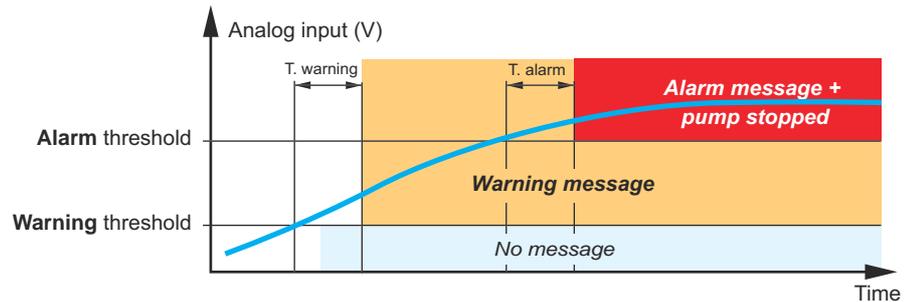
An analog input (0-10 Volt) **[ANA1]** is available on the ANA1 plug (see 15.4).

An analog input (0-10 Volt) **[USER ANA]** is available on the **J3** connector (see 8.4.3). 2 monitoring thresholds (warning and alarm) and a delay linked to each threshold can be set **[SETTING] [ANALOGIC INPUT] [ANA1]/[USER ANA] [ENABLED]** (see 8.2).

A temperature probe PT100 can be connected on **J3** connector (see 8.4.3). 2 monitoring thresholds (warning and alarm) and a delay linked to each threshold can be set **[SETTING] [TEMPERATURE] [USER T°]**(see 8.2).

If the measured value exceeds the set threshold, a defect (warning or alarm) appears after the expiry of a delay. An alarm message leads to pump shutdown.

If **[SETTING] [ANALOGIC INPUT] [ANA1]/[USER ANA] [DISABLED]** is set, there is no threshold to configure and the fault is not managed.



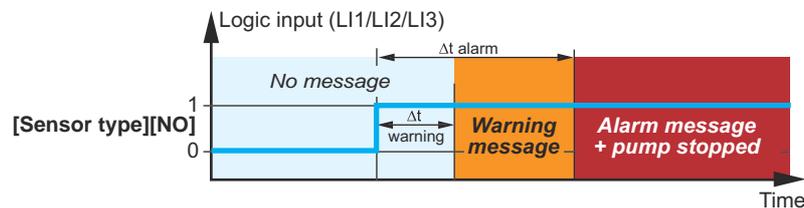
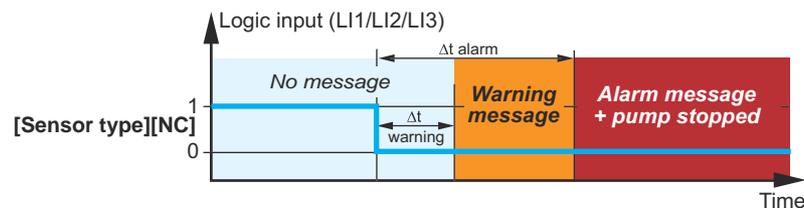
7.12 Logic input management

Three logic inputs are available on the LI1, LI2 and LI3 plugs (see 15.4).

LI1, LI2 and LI3 can be set opening or closing logic input **[SENSOR TYPE] [NO]/[NC]**. Two monitoring delays can be set (warning and alarm) **[SETTING] [LOGIC INPUT] [LOG1]/[LOG2]/[LOG3] [ENABLED]**(see 8.2).

When the contact LI1, LI2 or LI3 opens or closes, a fault (warning or alarm) appears after the expiry of a delay.

If the fault is set to **[DISABLED]**, the fault is not managed.



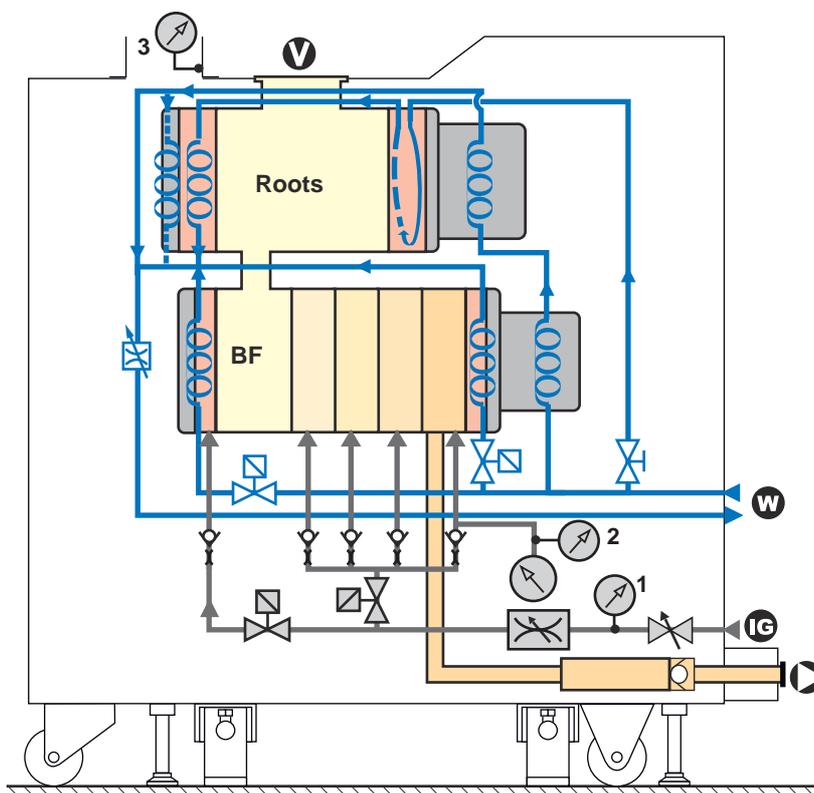
7.13 SEMI pump configuration (Option)

The SEMI option pump (factory configuration) is equipped with a cover that allows compliance with the requirements of SEMI S2-0712 and SEMI S6-070:

- a cover equipped with a sensor for ventilation and an exhaust box for connection to the customer's installation (see 5.6),
- dry contact safety sensors **which immediately stop the pump on alarm** when they detect one of the following faults:
 - failure of the exhaust pressure,
 - lack of nitrogen pressure,
 - pressure inside the pump cover.

Installed in the factory, these sensors require no adjustment. They are positioned as follows:

Sensor	Function	Threshold	Pump status
1 Exhaust pressure	Detect an overpressure at the pump exhaust	$P \geq 2000 \text{ hPa}$	When the pressure is upper than the threshold, the alarm stops the pump.
2 Nitrogen pressure	Detect a defect of purge	$P < 1200 \text{ hPa}$	When the pressure is lower than the threshold, the alarm stops the pump.
3 Exhaust ventilation pressure	Detect a defect of exhaust ventilation	$\Delta P < 0.33 \text{ hPa}$	When the pressure difference between inside and outside cover is lower than the threshold, the alarm stops the pump.



To meet the requirements of the Semi Standards, it is the customer's responsibility to install under the pump a retention tank:

- with a volume at least 10% higher than the volume of oil in the pump.,
- with dimensions of which makes it possible to collect a possible water leak at the **WATER IN** and **WATER OUT** (W) connectors.

The retention tank must be equipped with a fluid presence sensor that alerts the equipment and stops the pump and the water circuit in case of leakage..

8 Control interfaces

This chapter describes the connections and protocols associated with each control mode.

8.1 Different control modes

4 control mode are available:

- HHR: **locally** controlled by the hand-held remote,
- REMOTE: **remote controlled** by **J1** connector,
- SERIAL LINK: **remote controlled** by serial link **J2, J7, J6**,
- USER: **remote controlled** by **J3** connector.

HHR The pump is controlled with the hand held remote connected in front **HHR** or at the rear panel of the pump **J8**. For safety reasons, the pump can be controlled only by one HHR at the same time.

REMOTE The pump is remote-controlled through the opening or closing of different dry contacts wired on remote control connector **J1**(see 8.3).

SERIAL LINK The pump is remote-controlled by the commands transmitted via the serial link (see **Serial link Operating instructions**).

USER The pump is remote-controlled through the opening or closing of different dry contacts wired on remote control connector **J3**(see 8.4).

The control mode is selected with HHR **[DEFINITION] [CONTROL MODE]**(see 8.2):

To make the pump running, **it is essential to install the cover plug delivered with the pump to the emergency connector** or connect the pump to the emergency stop circuit of the equipment (see 8.7).

8.2 HHR control

When the pump is delivered, it runs according to the default setting: it depends on the product ordering guide.

Menu	Description
DEFINITION	To set the pump model, functional settings, and external sensor management.
SETTING	To adjust the monitoring parameters.
MAINTENANCE	To read or adjust the pump maintenance time.
MANAGEMENT	To change the password, register the pump serial number and software versions.
LAST EVENTS	To display the events recorded.

DEFINITION		
Selection	Choice	Description
LANGUAGE	ENGLISH FRENCH	Select the language.
TEMPERATURE UNIT	°C °F	Select the temperature unit.
PRESSURE UNIT	mbar Torr PSI hPa	Select the pressure unit.
PUMP MODEL ⁽¹⁾	A124 / A204/ A604 / A804 /A1204 / A1504 /A1804 /A2504 /A3004	Select the pump model (reserved for service).
PUMP TYPE ⁽¹⁾	H X	Select the pump type (reserved for service).
FREQUENCY INVERTER ⁽¹⁾	FB INVERTER: V1000/DISABLED R1 INVERTER: V1000/DISABLED R2 INVERTER: V1000/DISABLED	Select the FB frequency converter, and the Roots 1, Roots 2 frequency converters (if present).
AUTO-START(1)	DISABLED ENABLED	Activate the pump to restart automatically after a power cut. Risk due to auto-restart (see 6.2.3).
ROOTS CMD(1)	DISABLED ENABLED	Activate the Roots control separate from the FB start-up: instead of simultaneous start-up, the Roots is started/stopped using ROOTS command.
PURGE CMD ⁽¹⁾	DISABLED ENABLED	Activate the purge control separate from the FB start-up: instead of simultaneous start-up, the purge is started/stopped using PURGE command.
IDLE MODE	DISABLED ENABLED	Activate the reduction of energy consumption (electricity and/or nitrogen) when the pump is not running a process.
INLET VALVE	DISABLED AUTO INLET MANUAL INLET SOFT P AUTO SOFT P MANUAL	Activate the type of inlet isolation valve.
ROOTS 2 OPTION ⁽¹⁾	DISABLED ENABLED	Activate an external Roots management.
CONTROL MODE ⁽¹⁾	HHR REMOTE SERIAL LINK USER	Select the control mode.
DEFAULT STORAGE ⁽¹⁾	DISABLED ENABLED	Pre-warning/warning is still displayed and the warning indicator light flashes until ENTER is activated.
DELAY STOP ALARM(1)	DISABLED ENABLED	Activate a delay of 5 s between an alarm and the pump stop.
REMOTE CONFIG. FCT(1)	Pre-warning pump Pumping	Activate the signaling of a 'pre-warning' or 'pump running' on the output contact of REMOTE connector.
BUZZER	DISABLED ENABLED	Activate the acoustic signal in case of defect. To stop the signal, press on ENTER .

(1) Modification possible only with pump stopped

Control interfaces

SETTING ⁽¹⁾							Setting range			
Selection										
CONTRAST							30-250			
PURGE	PURGE FLOW	LOW DEFAULTS	PRE-WARNING	DISABLED						
				ENABLED	Threshold		20-120 slm			
			Delay			0- 600 s				
	WARNING	DISABLED								
		ENABLED	Threshold		15-120 slm					
	Delay				0- 600 s					
	PRE-ALARM			Threshold			15 slm			
Delay						0- 600 s				
PURGE PROLONG							Delay	0-7200 s		
WATER FLOW	SENSOR TYPE/ ANA. SENSOR	LOW DEFAULTS	WARNING	DISABLED						
				ENABLED	Threshold		130 to 960 l/h			
	Delay				0-600 s					
DISABLED										
POWER	FB POWER	HIGH DEFAULTS	ALARM	DISABLED						
				ENABLED	Threshold		4000-20000 W			
			Delay				0-6500 s			
			WARNING	DISABLED						
				ENABLED	Threshold		500-4900W			
			Delay				0-600 s			
	PRE-WARNING	DISABLED								
		ENABLED	Threshold		500-4000W					
		Delay				0-600 s				
	R1 POWER			ALARM	DISABLED					
					ENABLED	Threshold		3000-20000 W		
				Delay				0-600 s		
				WARNING	DISABLED					
					ENABLED	Threshold		500-4000W		
				Delay				0-600 s		
PRE-WARNING	DISABLED									
	ENABLED	Threshold		500-3000W						
	Delay				0-600 s					
R2 POWER ⁽²⁾			ALARM	DISABLED						
				ENABLED	Threshold		3000-20000 W			
			Delay				0-600 s			
			WARNING	DISABLED						
				ENABLED	Threshold		500-4000W			
			Delay				0-600 s			
PRE-WARNING	DISABLED									
	ENABLED	Threshold		500-3000W						
	Delay				0-600 s					
FREQUENCY	FB INVERTER	MODE					FIXE			
							ANALOG			
		FIXE FREQ. ANALOG FREQ.	values depend on model (see 7.9)				Min/Inter./Max			
	R1 INVERTER	MODE						FIXE		
								ANALOG		
		FIXE FREQ. ANALOG FREQ.	values depend on model (see 7.9)				Min/Inter./Max			
		MODE						FIXE		
	R2 INVERTER ⁽²⁾	FIXE FREQ.						ANALOG		
		ANALOG FREQ.						High /Low		
	TEMPERATURE	HP FB T°	DISABLED							
			CONTROL	SETPOINT				H: 70-130 °C X: 50-130 °C		
DEFAULTS			HIGH DEFAULTS	ALARM	Threshold			80-140 °C		
				Delay			0-600 s			
			WARNING	Threshold			setpoint +5 °C			
				Delay			0 s			
LOW DEFAULTS			DISABLED							
			WARNING	ENABLED	Threshold			setpoint - 10 °C		
Delay							0 s			
MEASUREMENT			DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED				
	ENABLED	Threshold				H: 75-140 °C X: 55-140 °C				
	Delay				0-600 s					
	WARNING	DISABLED								
ENABLED		Threshold		H: 75-140 °C X: 55-140 °C						
Delay				0-600 s						

SETTING ⁽¹⁾							Setting range		
Selection									
TEMPERATURE	LP FB T°	ENABLED CONTROL	SETPOINT				H: 70-120 °C X: 50-120 °C		
				DEFAULTS	HIGH DEFAULTS	ALARM	Threshold	80-130 °C	
							Delay	0-600 s	
					WARNING	Threshold	setpoint +5 °C		
						Delay	0 s		
			LOW DEFAULTS	DISABLED					
		ENABLED		Threshold	setpoint - 10 °C				
		MEASUREMENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED			
						ENABLED	Threshold	H: 75-130 °C X: 55-130 °C	
							Delay	0-600 s	
					WARNING	DISABLED			
						ENABLED	Threshold	H: 75-130 °C X: 55-130 °C	
	Delay					0-600 s			
TEMPERATURE	ROOTS 1 T°	DISABLED CONTROL	SETPOINT				50-100 °C		
				DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED		
							ENABLED	Threshold	60-110 °C
						Delay	0-600 s		
			PRE-ALARM	DISABLED					
				ENABLED	Threshold	55-110 °C			
				Delay	0-600 s				
		WARNING	Threshold		setpoint +5 °C				
			Delay		0 s				
			LOW DEFAULTS	WARNING	DISABLED				
				ENABLED	Threshold	setpoint - 10 °C			
					Delay	0s			
MEASUREMENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED					
				ENABLED	Threshold	60-110 °C			
					Delay	0-600 s			
			PRE-ALARM	DISABLED					
				ENABLED	Threshold	55-110 °C			
					Delay	0-600 s			
WARNING	DISABLED								
	ENABLED	Threshold	55-110 °C						
		Delay	0-600 s						
VALVE STATUS				OPEN VALVE					
				CLOSE VALVE					
TEMPERATURE	ROOTS 2 T° ⁽²⁾	DISABLED							
		MEASUREMENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED			
						Threshold	110-140 °C		
						Delay	0-600 s		
		WARNING	DISABLED						
			Threshold		70-140 °C				
	Delay		0 s						
	HEATER 1 T°	DISABLED CONTROL	SETPOINT				80-140 °C		
				DEFAULTS	HIGH DEFAULTS	WARNING	Threshold	90-150 °C	
							Delay	0-600 s	
			LOW DEFAULTS	WARNING	Threshold	setpoint - 10 °C			
					Delay	0 s			
HEATER 2 T°			DISABLED CONTROL	SETPOINT				80-140 °C	
	DEFAULTS	HIGH DEFAULTS			WARNING	Threshold	90-150 °C		
						Delay	0-600 s		
	LOW DEFAULTS	WARNING		Threshold	setpoint - 10 °C				
				Delay	0 s				
	HEATER 3 T°	DISABLED CONTROL		SETPOINT				80-140 °C	
DEFAULTS			HIGH DEFAULTS		WARNING	Threshold	90-150 °C		
						Delay	0-600 s		
LOW DEFAULTS			WARNING	Threshold	setpoint - 10 °C				
				Delay	0 s				
USER T°			DISABLED MEASUREMENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED		
	Threshold	0-200 °C							
	Delay	0-600 s							
	WARNING	DISABLED							
		Threshold				0-150 °C			
		Delay				0-600 s			

Control interfaces

SETTING ⁽¹⁾							Setting range	
Selection								
TEMPERATURE	HEATER ALARMS (5)	DEFAULTS		PRE-ALARM	DISABLED			
					ENABLED	Delay	0-600 s	
EXH PRESSURE	HIGH DEFAULTS			WARNING	DISABLED			
					ENABLED	Delay	0 s	
					Threshold		500-1990 mbar	
					Delay		0-600 s	
	LOW DEFAULTS				PRE-WARNING	DISABLED		
						ENABLED	Threshold	500-1650 mbar
						Delay		0-600 s
						ALARM	Threshold	1990 mbar
U LINE	HIGH DEFAULTS			PRE-ALARM	DISABLED			
					ENABLED	Threshold	1650-1990 mbar	
					Delay		0-600 s	
					WARNING	Threshold	550 mbar	
SOFT PUMPING VALVE ⁽⁴⁾	LOG1			WARNING	DISABLED			
					ENABLED	Delay	10 s	
					Threshold		185-550 V	
					Delay		0-600 s	
LOGIC INPUT	LOG2			WARNING	DISABLED			
					ENABLED	Delay	0-600 s	
					Threshold		160-265 V	
					Delay		0-600 s	
LOGIC INPUT	LOG3			WARNING	DISABLED			
					ENABLED	Delay	0-600 s	
					Threshold		160-265 V	
					Delay		0-600 s	
ANALOGIC INPUT	ANA 1	MEASUREMENT	HIGH DE-FAULTS	ALARM	DISABLED			
					ENABLED	Threshold	0-10000 mV	
					Delay		0-600 s	
					WARNING	Threshold	0-10000 mV	
	USER ANA	MEASUREMENT	HIGH DE-FAULTS		ALARM	DISABLED		
						ENABLED	Threshold	0-10000 mV
						Delay		0-600 s
						WARNING	Threshold	0-10000 mV
SERIAL LINK	SERIAL J2	(see Serial link Operating instructions)						
	SERIAL J6	(see Serial link Operating instructions)						
	SERIAL J7	(see Serial link Operating instructions)						
DATE AND TIME			DAY			0-31		
			MONTH			1-12		
			YEAR			0-99		
			HOUR			0-23		
			MINUTE			0-59		

(1) Menu possible only with pump stopped.

(2) Menu accessible only if [ROOTS 2 OPTION] is [ENABLED].

(3) Menu accessible only if [DELAY STOP ALARM] is [ENABLED].

(4) Menu available if [INLET VALVE][AUTO SOFT PUMPING] or [MANU SOFT PUMPING] is activated.

(5) Menu available if at least one of the [HEATER 1T],[HEATER 2T] or [HEATER 3T] is set on CONTROL.

MAINTENANCE ⁽¹⁾

Selection	Display	
RUNNING TIME	(XXXXX h): total functioning time	
MAINTENANCE TIME	VALUE	XXXXX h: functioning time after the last maintenance
	WARNING	YYYYY h : warning THRESHOLD (Threshold adjustment depending on process type)
WATER DRAINING	DISABLED	Allows to drain the water cooling circuit (access with password)
	ENABLED	

(1) Modification possible only with pump stopped.

MANAGEMENT ⁽¹⁾

Selection	Choice	Setting range
PASSWORD		0 à 65535
VERSIONS AND S/N	HHR SOFT REV	
	HHR S/N	
	ELEC SOFT REV	
	ELECTRONIC S/N	
	FRAME S/N	
	FB S/N	
	FB INVERTER SOFT REV	
	FB INVERTERSPECIF	
	ROOTS 1 S/N	
	R1 INVERTER SOFT REV	
	R1 INVERTER SPECIF	
	ROOTS 2 S/N ⁽²⁾	
	R1 INVERTER SOFT REV ⁽²⁾	
	R2 INVERTER SPECIF ⁽²⁾	

(1) Modification possible only pump stopped.

(2) Menu accessible only if the [ROOTS 2 OPTION] is [ENABLED].

LAST EVENTS

Selection	Display	
LAST EVENT 1	UUnnn: xxxxxxxxxxxx	UU: action type : C=command, PW= pre-warning, W=warning, D=alarm nnn: fault number xxx: fault name vvv: mode control
LAST EVENT 2	vvv	
...	DATE TIME	
LAST EVENT X		

8.3 Remote control J1 connector

8.3.1 Description



NOTICE	
Extra low voltage circuit	
The remote control circuits are equipped with dry contact outputs (30 V - 1 A max.). Any overvoltage or overcurrent can result in internal electrical damage. The installer must:	
→ Connect these outputs in accordance with the rules and protection of safety extra low voltage (SELV) circuits,	
→ Supply these contacts with voltage of less than 30 V and current of less than 1 A.	

Connection made via the connector **J1** (Male D-Sub - 50 pin connector) (see 4.2), allows:

- Remote control of pumping functions start, stop, purge, Roots and inlet valve.
- Remote pump status through auxiliary dry contacts.

Remote control mode is active when **[DEFINITION] [CONTROL MODE] [REMOTE]** is selected (see 8.2).

8.3.2 Wiring of digital inputs

These inputs are considered active when a DC voltage between 5 and 30 V is applied (wiring is customer's responsibility).

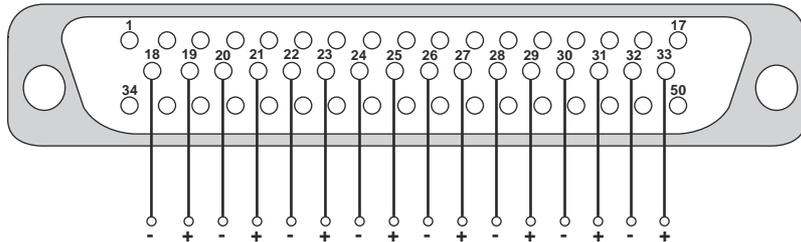


Fig. 13: J1 connector : control with DC voltage

These inputs can be powered by pins 47, 48 (0V) and pins 49, 50 (24V), in order to be controlled by external contacts of the customer equipment (wiring is customer's responsibility).

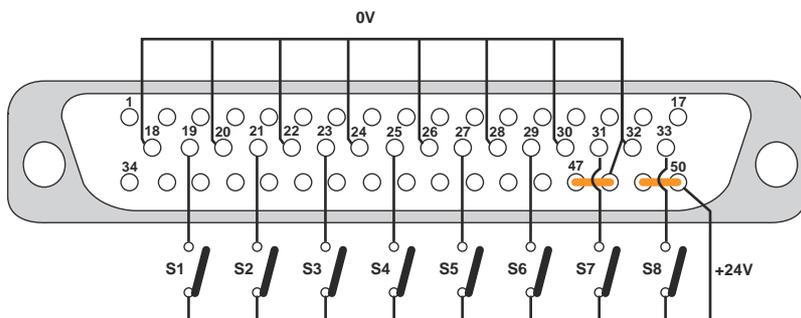


Fig. 14: J1 connector : control with dry contacts

Contact	Function	
S1 (18-19)	HHR or REMOTE mode	Contact closed: local mode. Contact open: remote control mode. This function is valid when [DEFINITION] [CONTROL MODE] [REMOTE] is selected.

Contact	Function	
S2 (20-21)	Pump Start/Stop	Contact closed: pump starts. Contact open: pump stops. This function is valid when REMOTE mode is validated: S1 contact open.
S3 (22-23)	Roots Start/Stop	Contact closed: Roots starts. Contact open: Roots stops. This function is valid when: – REMOTE mode is validated with S1 contact open – [DEFINITION][ROOTS CMD] is [ENABLED]
S4 (24-25)	Nitrogen purge Start/Stop	Contact closed: nitrogen purge starts. Contact open: nitrogen purge stops. This function is valid when: – REMOTE mode is validated with S1 contact open – coding wheel S1 on 1 (see 4.2) – [DEFINITION][PURGE CMD] is [ENABLED]
S5 (26-27)	Stand-by purge Start/Stop	This function allows nitrogen consumption to be reduced by closing the stand-by (4) valve (see 7.1) independently of the purge valve when the equipment is not on a process. No purge warnings or alarms are managed when the stand-by valve is closed. Contact closed: N2 stand-by purge starts after a delay (time programmed by RS232 see Serial link Operating instructions). Contact open: N2 stand-by purge stops. This function is valid when: – REMOTE mode is validated with S1 contact open – [DEFINITION][IDLE MODE] is [DISABLED] – [DEFINITION][PURGE CMD] is [ENABLED]
S6 (28-29)	Opening/closing of inlet valve	Contact closed: closing of inlet valve. Contact open: opening of inlet valve. This function is valid when: – REMOTE mode is validated with S1 contact open – [DEFINITION][INLET VALVE] is [MANU VALVE] – Inlet valve control authorization is validated: S7 contact closed
S7 (30-31)	Authorization to close or not the inlet valve	Contact closed: authorization to close the inlet valve. Contact open: no authorization to close the inlet valve. This function is valid when [DEFINITION][INLET VALVE][MANU VALVE] is selected . This function is not related to contact S6 and enables to function independently in HHR or REMOTE mode.
S8 (32-33)	Warning Reset	If [DEFINITION] [FAULT STORAGE] is [ENABLED] , this input is used to reset this memorisation.

8.3.3 Wiring of the digital outputs

These contacts open in the presence of a defect:

Contact	Function
1-34	Pump fail (pump running, valve opened, no warning)
2-3	Warning presence
4-5	Alarm presence
6-7	Roots running
8-9	Pump running and inlet valve opened
12-13	Pump in stand-by mode
14-15	Pump running (FB + Roots running)
16-17	Status of inlet valve
35-36	Motor temperature warning
37-38	Purge warning
39-40	Exhaust pressure warning
43-44	FB running
45-46	Pre-Warning* or Pump running (FB + Roots)**

* Default setting

** Can be modified via Serial link (See *serial link operating instructions*)

This contact closes in the presence of a defect:

Contact	Function
10-11	Alert presence

8.4 Remote control J3 connector

8.4.1 Description



NOTICE	
Extra low voltage circuit	
The remote control circuits are equipped with dry contact outputs (30 V - 1 A max.). Any overvoltage or overcurrent can result in internal electrical damage. The installer must:	
→ Connect these outputs in accordance with the rules and protection of safety extra low voltage (SELV) circuits,	
→ Supply these contacts with voltage of less than 30 V and current of less than 1 A.	

Connection made via the connector **J3** (Male D-Sub - 15 pin connector) (see 4.2) allows:

- Remote control of pump functions: start, stop and IDLE mode,
- input of the speed setpoint and its monitoring,
- input of a temperature probe and monitoring of this temperature.

8.4.2 Wiring of digital inputs

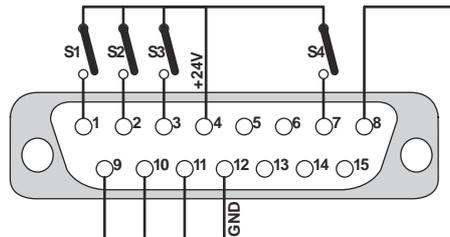


Fig. 15: J3 connector : digital input wiring

Contact	Function	
S1 (1-9)	USER1	[DEFINITION] [IDLE MODE] [ENABLED] Selection mode IDLE, see table below.
S2 (2-10)	USER2	
S3 (3-11)	USER3	
S4 (7-8)	Pump Start/Stop	Contact closed: pump starts. Contact open: pump stops. This function is valid when [DEFINITION] [CONTROL MODE] [USER] is selected (see 8.2).

IDLE option	Contact status			Stand-by valve	Rotation speed	HHR display
	S1	S2	S3			
Full	1	0	0	closed	minimum	IDLE MODE
Intermediate	0	1	0	closed	intermediate	STD BY N2
Reduce speed	0	0	1	opened	minimum	IDLE MODE
Stand-by purge	1	1	1	closed	maximum	STD BY N2
Standard	0	0	0	opened	maximum	--

8.4.3 Wiring of analog inputs

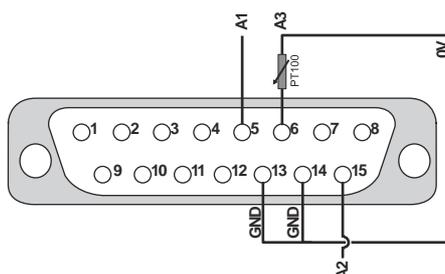


Fig. 16: J3 connector: analog output wiring

Contact	Function	
A1 (5-13)	IN_ANA_SPEED	Rotation frequency setpoint (0/10 V input) (see 7.9): <ul style="list-style-type: none"> – for the maximum frequency: the voltage applied is between 0 and 3 V, – for the intermediate frequency: the voltage applied is between 3 and 7 V, – for the minimum frequency: the voltage applied is between 7 and 10 V.
A2 (15-13)	IN_ANA_USER	Setpoint between 0 and 10 V. Used to monitor data by setting warning and alarm thresholds and a triggering timer: see parameter setting [SETTINGS] [ANALOGIC INPUT] [USER ANA] (see 8.2).
A3 (6-13)	IN_TEMP_USER	Used to connect a temperature probe and to monitor it, setting warning and alarm thresholds and a triggering timer, see parameter setting [SETTINGS] [TEMPERATURE] [USER T°] (see 8.2).

8.5 Command of an inlet isolation valve via J4 connector

8.5.1 Description



NOTICE

Extra low voltage circuit

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max.). Any overvoltage or overcurrent can result in internal electrical damage. The installer must:

- Connect these outputs in accordance with the rules and protection of safety extra low voltage (SELV) circuits,
- Supply these contacts with voltage of less than 30 V and current of less than 1 A.

Connection made via the connector **J4** (Female D-Sub - 15 pin connector) (see 4.2) allows:

- the opening and closing remote control of the inlet isolation valve(s),
- monitoring of the status of the valve(s).

The control mode and type of valves concerned must be set in **[DEFINITION] [INLET VALVE]** menu, the timer must be set in **[SETTING] [SOFT P VALVE]** menu (see 8.2).

8.5.2 Wiring of digital inputs

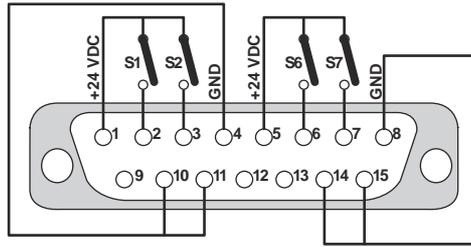


Fig. 17: J4 connector: digital input wiring

Contact	Function	
S1 (2-10)	IN_IN_VALVE_OPEN	Contact open in end of travel not reached: warning triggered.
S2 (3-11)	IN_IN_VALVE_CLOSE	Contact open in end of travel not reached: warning triggered.
S6 (6-14)	IN_SOFT_VALVE_OPEN	Contact open in end of travel not reached: warning triggered.
S7 (7-15)	IN_SOFT_VALVE_CLOSE	Contact open in end of travel not reached: warning triggered.

8.5.3 Wiring of the digital outputs

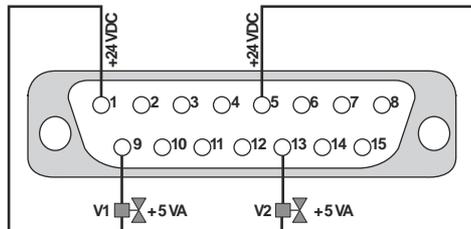


Fig. 18: J4 connector: valve wiring

Contact	Function	
1-9	OUT_INLET_VALVE	Inlet valve V1 connection. Valve opens when the pump is switching on.
5-13	OUT_SOFT_VALVE	“Soft pumping” valve V2 connection. Valve opens when the pump is switching on.

8.6 Remote control J5 connector

8.6.1 Description



NOTICE

Extra low voltage circuit

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max.). Any overvoltage or overcurrent can result in internal electrical damage. The installer must:

- ➔ Connect these outputs in accordance with the rules and protection of safety extra low voltage (SELV) circuits,
- ➔ Supply these contacts with voltage of less than 30 V and current of less than 1 A.

Connection made via the connector **J5** (Male D-Sub -15 pin connector) (see 4.2) allows :

- remote control of external Roots (Roots 2) pumping functions, start, stop and IDLE mode,
- input of the external Roots speed setpoint, temperature and its monitoring.

8.6.2 Wiring of digital inputs

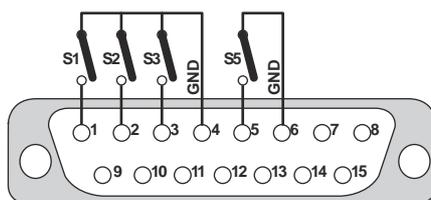


Fig. 19: J5 connector: digital input wiring

Contact	Function	
S1 (1-4)	Roots 2 frequency converter status	Contact closed: Roots 2 starts. Contact open: Roots 2 stops.
S2 (2-4)	Roots 2 frequency converter warning	Contact closed: no warning Contact open: there is a warning on Roots 2.
S3 (3-4)	not used	

8.6.3 Wiring of analog inputs

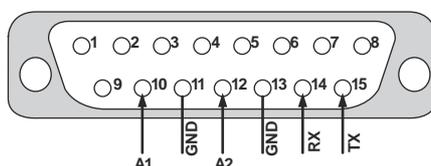


Fig. 20: J5 connector: wiring of analog inputs

Contact	Function	
A1 (10-11)	Roots 2 temperature	Used to connect a temperature probe and to monitor it, setting warning and alarm thresholds and a triggering timer, see parameter setting [SETTINGS] [TEMPERATURE] [ROOT 2 T°] (see 8.2).
A2 (12-13)	Roots 2 power	Setpoint between 0 and 10 V. Used to monitor Roots 2 power by setting warning and alarm thresholds and a triggering timer: see parameter setting [SETTINGS] [POWER] [R2 POWER] (see 8.2).
RX /TX (14-15)	RS485 Reception/ Transmission data	RS485 communication.

8.6.4 Wiring of the digital outputs

Contact	Function	
7-9	Roots 2 start-up (contact closed when Roots starts)	
8-9	IDLE mode management	– contact open: maximum speed of rotation – contact closed: reduced speed of rotation
5-6 (S5)	Roots 2 frequency converter alarm	Contact closed: no alarm. Contact open: there is an alarm on Roots 2. If Roots 2 alarm musn't stop the pump, contact 5-6 must be strapped.

8.7 Emergency stop connector

8.7.1 Description



NOTICE

Extra low voltage circuit

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max.). Any overvoltage or overcurrent can result in internal electrical damage. The installer must:

- Connect these outputs in accordance with the rules and protection of safety extra low voltage (SELV) circuits,
- Supply these contacts with voltage of less than 30 V and current of less than 1 A.

This emergency connector(see 4.2) allows:

- to connect the pump emergency stop to the emergency stop of the equipment (or pumping installation),
- to inform about the status of the emergency stop located in the front panel of the pump.

The pump can run only if the cover plug (delivered with the pump) is wired and fitted on the emergency connector.

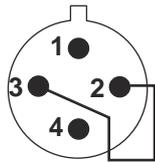


Fig. 21: Wiring viewed under soldered side

8.7.2 Wiring of digital inputs

The input is considered activated when the pins are linked.

Contact	Function
2-3	Contact open, emergency stop command is activated, pump is stopped.

8.7.3 Wiring of the digital outputs

The output contact connected by the customer allows to control the equipment emergency stop from the pump emergency stop button.

Contact	Function
1-4	Contact open, pump emergency stop command is activated.

9 Maintenance

9.1 Safety and maintenance information



Duty to inform

Every person who is involved in maintenance and servicing work on the pump must read and follow the safety-relevant parts of all associated documents.



NOTICE

Exclusion of liability

Pfeiffer Vacuum accepts no responsibility concerning equipment damage, disrupted service or physical injury resulting from maintenance carried out by technicians who have not been trained in safety rules (EMC, electrical hazards, chemical pollution). Liability and warranty claims shall be inadmissible in this case.



DANGER

Risk due to pumping conditions

Remaining process gases in the pump may cause severe injury or death. Before removing the pump from the installation:

- Continue nitrogen flow from the process tool for 30 min. Nitrogen pressure and flow rate should be identical to the programmed values during process.



DANGER

Risk to the health in the event of contact with toxic substances

The vacuum pump, pumping line components, and operating media may be contaminated with toxic, corrosive, reactive, or radioactive materials, depending on the process.

- Wear appropriate safety equipment when pump is disconnected for maintenance, or reinstalled, and also for oil filling and draining.
- Ventilate the premises well.
- Do not eliminate maintenance waste via standard disposal channels. Have it destroyed by a qualified company if necessary.
- Install the inlet and exhaust blanking plates, accessories delivered with the pump or available as accessories (see chapter **Accessories**).



WARNING

Electric shock hazard in case of contact

Voltage and current can cause electric shock.



- Isolate and lock out power line to the product by positioning the main switch on **O**.
- Only skilled, authorized people may carry out maintenance work. Take care! Items located between the mains connection and the isolator are still under mains voltage.
- **Disconnect the mains cable from all power sources.**



WARNING

Tightness after maintenance

Insufficient tightness after servicing could result in chemical hazards.

- Always perform a leak test after maintenance.



WARNING

Risk of injury due to hot surfaces

The exhaust temperature remains high even after the pump has stopped.

- Wait for the product to cool completely before carrying out any operations on it.



WARNING

Other localised hazardous energies

Electrical circuits and other pressurized circuits, such as nitrogen and water are potential hazards.

→ Always lock out these energy sources before working on the product.

- Ensure that the maintenance technician is trained in the safety rules concerning pumped gases.
- Surrounding lighting in maintenance area must be sufficient to work or make maintenance on the pump: higher than 300 lux.
- Allow the product to cool down before removing the covers for maintenance.
- Disconnect the mains cable on the product from all sources of power before carrying out any work on the product.
- Wait 5 minutes after switching off the electricity supply before carrying out any operations on the electrical components.
- Route and secure cables, hoses and pipework to avoid any possible risk of trips.
- Wear suitable protective equipment and dismantle the product in a ventilated area or under a ventilated hood.
- Collect the residues from the processes and call in a competent organisation to destroy them.
- Always protect the inlet and exhaust surfaces.
- Seal the inlet and exhaust orifices and pressurize the pump using nitrogen (see 9.5.3).

9.1.1 How to contact us

Personnel trained by the manufacturer must perform the overhaul. Contact your nearest service center at the following e-mail address: support.service@pfeiffer-vacuum.fr

9.2 Maintenance frequency

Depending on the maintenance parameter programmed, when the operating time before maintenance has expired, the screen display alternates between operating parameters and the corresponding warning message. The indicator light **Warning** is lit on front panel (see 4.2). This information can be read at any time using the **[MAINTENANCE]** menu.

In general no maintenance is required before product overhaul in your service center (see 12).

Maintenance times can change according to processes and equipment used. Contact your service center (see 12).

9.3 Maintenance on the customer's site

The pump does not require any maintenance on the customer's site apart from that described in this manual. All other maintenance must be carried out by your service center (see 12).

- 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.
- Check that exhaust pipe line is not clogged.
- Check the condition of the pipes and their connections and repair them if there is any sign of corrosion or leaks.
- Compare the colour of the oil with a sample of new oil. This will allow you to check the level of pollution or the extent to which the lubricant has deteriorated. The oil is changed by our service center.
- Unclog if the message D03 or D38 is displayed (see 9.4).

- Check the oil level via the holes provided for this purpose. For it, remove the rubber caps on the side covers and put them back in place after oil check: they protect the product against the intrusion of solids and liquids.
- **Semi Option:** check the proper operation of safety interlocks [N2 pressure, exhaust overpressure, exhaust ventilation pressure, FB and Roots motor temperature (FB MOT, RSV1 MOT)] **once every 6 months.**

9.4 Freeing up the FB



DANGER
<p>Risk to the health in the event of contact with toxic substances</p> <p>During pump disconnection, operator could be in contact with process residues on the exhaust that could cause severe injury or death.</p> <p>→ Take the appropriate safety measures to prevent injury. Consult the department manager for instructions and safety information.</p>

By-products generated by processes clogg the pump by deposition. When the FB rotation is no more possible, an alarm is displayed and the pump stops. It may be possible to free it up manually.

- Switch off the pump by positioning the main switch **MS** to **O**: the white indicator **Power** turns off.
- Remove the front cover (1).
- Remove the protective cover (2) and the O-ring (3) by removing the three M4 x 10 CHc screws.
- Using a 21 mm female elbow wrench, move the driving shaft in both directions of rotation until free rotation is obtained.

NOTICE
<p>Risk of damage to the pump</p> <p>Using excessive force to rotate the FB may damage the pump.</p>

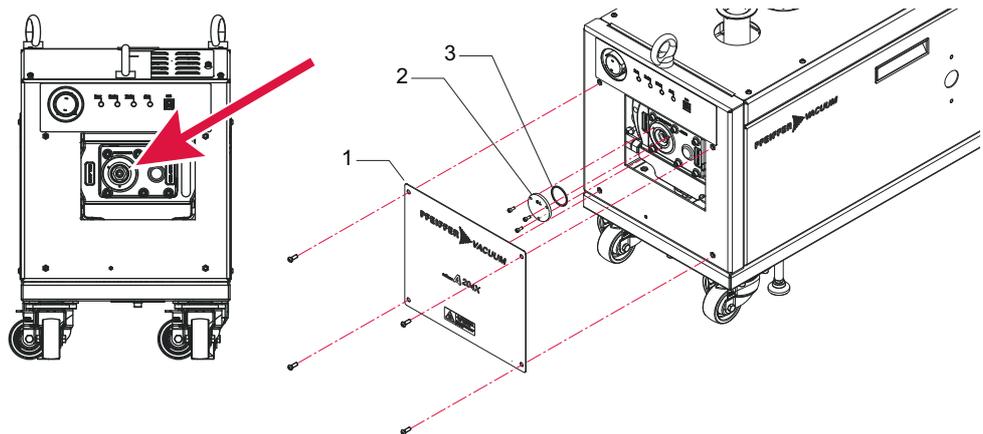


Fig. 22: Freeing up the FB

- Clean the O-ring and grease it lightly with vacuum grease.
- Reinstall the O-ring (3) and the protective cover (2).
- Reinstall the front cover (1).
- Restart the pump (see 6).

9.5 Standard repair exchange

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

- Disconnecting the pump from the installation (see 9.5.1)
- Draining the water circuit (see 9.5.2)
- Conditioning the pump for shipping (see 9.5.3)
- Declaration of contamination (see 12)
- Handling the new pump (see 3)
- Installing the new pump (see 5)
- Operating parameter setting (see *Serial link operating instructions*)

When returning a product to our service center, please consult the **Service** procedure (see 12) and fill in the contamination declaration available on our website.

9.5.1 Disconnecting the pump from the installation



DANGER

Risk to the health in the event of contact with toxic substances

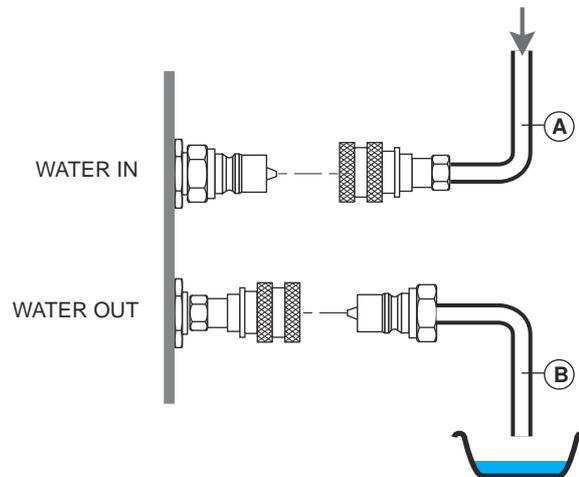
During pump disconnection, operator could be in contact with process residues on the exhaust that could cause severe injury or death.

→ Take the appropriate safety measures to prevent injury. Consult the department manager for instructions and safety information.

- Switch off the pump by positioning the main switch **MS** to **O**: the white indicator **Power** turns off.
- Switch off your main circuit breaker.
- Disconnect the main plug (see 5.8.2).
- Disconnect all electrical connectors. Do not forget to connect the cover plug on connector (delivered with the pump).
- Disconnect the nitrogen purge connection.
- Disconnect the **WATER IN** connection then the **WATER OUT** connection **W** (see 4.2).
- Disconnect the pump from the inlet piping and fit a blanking plate on the inlet (see 13).
- Disconnect the pump from the exhaust and fit a blanking plate on the exhaust port (see 13).
- Adjust the levelling feet so that the pump rests on the castors.
- Remove the pump from the installation.

9.5.2 Draining the water circuit

Water must be drained to prevent hoses freezing during shipment.



- Prepare a flexible pipe (A) with a female connection and another flexible pipe (B) with a male connection (supplied by the customer).
- Connect one end of pipe (B) on **WATER OUT** connection and place the other end in a vessel (total water volume will be greater than 1 liter).
- Connect one end of pipe (A) on **WATER IN** connection and connect the other end to a compressed air circuit ($2 \text{ to } 5 \cdot 10^3 \text{ hPa}$).
- Switch on the pump (see 6.2.1).
- Set the menu **[MAINTENANCE] [WATER DRAIN]** on **[ENABLED]**: water valves open.
- Inject compressed air into the pump until the water has been completely evacuated from the circuit.
- Switch off the pump by positioning the main switch **Ⓜ** to **O**: the white indicator **Power** turns off.

9.5.3 Conditioning the pump for shipping

- Install the transport flange (except for A 124H, A 204H, A 204X, A 2404H, A 2404X models) (see 15.1).
 - Remove the top cover.
 - Attach the yellow transport flange using the screws: 1 screw (or 2) on the pump flange and 2 on the frame rails.
 - Reinstall the cover.
- Install the connecting accessories provided with the pump when it was first delivered. Contact the service center to order accessories if necessary (see 13).

Provide a nitrogen supply with the required characteristics (see 14.2.3).

- Seal the inlet port with inlet blanking plate delivered with the pump.
- Connect the nitrogen to the gas connection located on the inlet blanking flange.
- Pressurize the pump with dry nitrogen to a relative pressure of 200 hPa.
- When the nitrogen flows out of the exhaust, seal it up with the provided accessories.
- Disconnect the nitrogen purge connection.

Note: In case of a pump transfer to another plan/site for reinstallation, it is necessary to drain the oil from the pump housings before shipment. Keep the oil and perform the oil filling before pump start-up.

10 Decommissioning

10.1 Shutting down for longer periods



NOTICE

Risk of build-up of process residues

All process pumps are designed for continuous operation in pumping process gas and should not be stopped. Pfeiffer Vacuum will be released from any warranty and liability claims if a process pump is stopped for a prolonged time leading to condensation of by-products, powder build-up or corrosion inside the pump. The only guaranteed solution by Pfeiffer Vacuum to restart a process pump after a prolonged stop is to perform a complete overhaul of the pump.

Despite this recommendation, if the pump is shut down for a prolonged time, it is advisable to follow the precautions mentioned below in order to reduce the risks of condensation, powder build-up and corrosion inside the pump.

- From the process chamber, flush the pump using a dry inert gas, such as nitrogen, through the inlet port during 30 minutes.
- Stop inert gas supply and let the pump running at ultimate pressure for 5 minutes.
- Stop the pump and close inlet port with the appropriate blank-off flange.
- Configure [**PURGE PROLONG**](see 8.2) and set it on 30 minutes, then perform a cycle start/stop of the pump. Wait till end of purge prolonged cycle (30 minutes).
- Put appropriate blank-off flange at exhaust of the pump.
- Turn off the cooling water supply.
- Switch off the pump by positioning the main switch  to **O**: the white indicator **Power** turns off.

10.2 Re-starting

The only guaranteed solution by Pfeiffer Vacuum to restart a process pump after a prolonged stop is to perform a complete overhaul of the pump. In case of trouble, contact your **service center**.

10.3 Disposal

According to the regulations 2012/19/EC about Waste of electrical and electronic equipment, and 2011/65/EC about Restriction of Hazardous substances, the manufacturer provides a paid recycling service for the end of life of the equipment.

Any obligation of the manufacturer to take back such equipment shall apply only to complete not amended or modified equipment, using Pfeiffer Vacuum SAS original spare parts, delivered by Pfeiffer Vacuum, containing e.g. all its components and subassemblies.

This obligation will not cover the shipping cost to a Pfeiffer Vacuum reclamation facility.

Before returning the product, please consult the **Service** procedure (see 12). Fill in the declaration of contamination form available on our website. Attach it to the product before shipping to the closest service-repair office.



WARNING

Environmental protection

The product or 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 waste and preventing pollution.

Our products contain various materials which can be recycled: steel, stainless steel, cast iron, brass, aluminum, nickel, copper, fluoroelastomers, perfluorinated synthetic oil.

Take particular precautions for:

- fluoroelastomers which may breakdown if they are subjected to high temperatures,
- components in contact with the products resulting from the processes which may have been contaminated,
- lithium batteries.

11 Malfunctions

Study the safety instructions related to maintenance (see 9.1).

11.1 What happens in the event of a defect

When a problem occurs, the user is informed through:

- the relevant fault indicator light: yellow lit in case of warning, red lit in case of alarm,
- the audible buzzer warning (if preselected),
- the fault contacts on **J1** remote connector are activated,
- display of fault message on the HHR,
- a message via the RS-232 or RS-485 serial link.

Messages are listed in the **Malfunctions** chapter (see 11.3).

11.1.1 Meaning of light indicators

Indicator light	Name	Status	Pump status
White 	Power	 Off	The pump is not powered
		 Lit	The pump is powered
Green 	Running	 Off	The pump is not running (Pump shut-down)
		 Lit	The pump is running
Yellow 	Warning	 Off	No warning
		 Blinking	Pre-warning. ⇒ Read the fault message on HHR. ⇒ Reset the fault pushing ENTER key.
		 Flashing	It was a pre-warning. . ⇒ Read the fault message on HHR. ⇒ Remedy to the trouble to delete the fault.
		 Lit	Warning presence. ⇒ Read the fault message on HHR. ⇒ Remedy to the trouble to delete the fault.
Red 	Alarm	 Off	No alarm
		 Blinking	There is a pre-alarm, pump is running. ⇒ Read the fault message on HHR. ⇒ Reset the fault pushing ENTER key.
		 Flashing	It was a pre-alarm. ⇒ Read the fault message on HHR. ⇒ Remedy to the trouble to delete the fault.
		 Lit	Alarm presence. The pump is stopped. ⇒ Read the fault message on HHR. ⇒ Remedy to the problem to delete the defect. ⇒ Switch power off and restart the pump (see 6).

11.2 Pump or Roots does not start

11.2.1 The white indicator light Power does not switch on

Incident	Cause	Remedy
Power indicator light does not switch on	No mains	⇒ Check power supply.
	Main switch on position O	⇒ Switch it on I .
	External emergency stop engaged	⇒ Check the presence of cover plug EMS or check its locking.
	Unit emergency stop engaged	⇒ Rotate to unlock the emergency stop on the front panel.
	Other problem	① Contact your service center.

11.2.2 HHR display is not lighting up

Incident	Cause	Remedy
HHR display is not lighting up, but Power indicator light is lit	Twisted cable incorrectly connected	⇒ Check the connection.
	Other problem	① Contact your service center.

11.3 The pump is running and HHR is showing a fault message

Incident	Cause	Remedy
PW01/W01/PD01 EXH. PRESS	Exhaust pressure > Thresholds	⇒ Check the nitrogen flow rate setting value (see 5.4.2). ⇒ Check that exhaust pipe line is not clogged.
	Exhaust pressure < 550 hPa	⇒ Check the connection of the sensor on FB PRESS plug (see 15.4) : – Pressure sensor is faulty, replace it.
	Exhaust pressure sensor faulty	⇒ Check the displayed pressure on HHR, if the reading is inconsistent, replace the sensor.
	Monitoring faulty	⇒ If the pressure sensor is operating but the displayed pressure is inconsistent, replace the monitoring.
	Other problem	① Contact your service center.
D01 EXH. PRESS	Exhaust pressure > 1990 hPa or The pump does not start and the exhaust pressure > 1500 hPa	⇒ Check the nitrogen flow rate setting value (see 5.4.2). ⇒ Check the exhaust pipe is not clogged.
	Pressure sensor faulty	⇒ Check the displayed pressure on HHR, if the reading is inconsistent, replace the sensor.
	Monitoring faulty	⇒ If the pressure sensor is operating but the displayed pressure is inconsistent, replace the monitoring.
	Other problem	① Contact your service center.
	PW03/W03/D03 FB P DRIVE	Incorrect FB threshold setting
FB mechanical problem		⇒ Check the rotation of the FB shafts (see 9.4) ⇒ Free the FB manually.
Problem with power reading		⇒ Check current and voltage on the monitoring and/or at the frequency inverter output. ⇒ If there is no frequency inverter, check the current sensor.
Communication problem between monitoring and FB frequency inverter		⇒ Depending on the trouble, replace the monitoring or the frequency inverter.
Communication problem (pump without frequency inverter)		⇒ Check the current sensor: – the sensor is faulty, replace it.
Other problem		① Contact your service center.
W04/D04 IN ANA1 W50/D50 USER ANA	Incorrect monitoring configuration Inconsistent analog reading feedback	⇒ Check that [ANA 1], [ANA 2] or [ANA USER] is [DISABLED] if input is not used. ⇒ Check the warning or fault thresholds. ⇒ Check that the voltage is in accordance with monitoring display.
	Sensor faulty	⇒ Check the proper operation of the sensors connected to these analog inputs.
	Other problem	① Contact your service center.

Malfunctions

Incident	Cause	Remedy
W05/D05 LOG IN.1 W06/D06 LOG IN.2 W12/D12 LOG IN.3	Incorrect monitoring configuration	⇒ Check that [LOG 1], [LOG 2] or [LOG 3] is [DISABLED] if input is not used. ⇒ Check the warnings or fault delays.
	Connection not present or cut	⇒ Check the sensors connection on LI1, LI2 and LI3 plug (see 15.4).
	Other problem	① Contact your service center.
D07 LOW SPEED FB	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [FB Inverter] is set on [V1000] or [DISABLED].
	Wiring problem on EMS emergency stop connector	⇒ Check that there is a strap between pins 2 and 3 of emergency stop terminal EMS (see 8.7.1).
	Rotor rotation is difficult or FB mechanical problem	⇒ Check the rotation of the FB shafts. ⇒ Free the FB manually (see 9.4).
	Frequency inverter trouble	⇒ Replace the frequency inverter, or ① Contact your service center.
W09 LOW VOLTAGE	Main power is not correct	⇒ Check the main power.
	Other problem	① Contact your service center.
W10/D10 T° MOT FB	FB temperature is > 120°C The cooling circuit is clogged	⇒ Check the water cooling supply on the pump. ⇒ Check that the motor is correctly cooled. ⇒ Check that the cooling pipes are not clogged.
	Sensor or wiring faulty	⇒ Check the sensor connection on FB MOTOR plug (see 15.4).
	Problem on FB motor temperature sensors	⇒ Check the proper operation of FB motor temperature sensors (NC contacts).
	Other problem	① Contact your service center.
	W11 INLET VALVE	Incorrect monitoring configuration
PW13/W13/PD13/D13 PURGE FLOW	Faulty wiring	⇒ Check the valve connection on the J4 connector (see 8.5.3).
	Malfunction	⇒ Check the proper operation opening/closing of the valve.
	Other problem	① Contact your service center.
	No purge flow	⇒ Check nitrogen supply. ⇒ Check the valve connection on N2 VALVES plug (see 15.4).
PW14/W14/D14 R1 P DRIVE	Insufficient purge flow	⇒ Check the setting of nitrogen flow using pressure regulator. ⇒ Check that there is no leak.
	Incorrect threshold setting	⇒ Check the warning and alarm thresholds in [SETTING][PURGE][PURGE FLOW][LOW DEFUALTS].
	Flowmeter not connected	⇒ Check the flowmeter connection on FLOW CONT plug (see 15.4).
	Other problem	① Contact your service center.
	Roots 1 incorrect threshold setting	⇒ Check the warning and alarm thresholds in [SETTING][POWER][R1 POWER].
W15 /D15 HP FB T° either HP T° > setpoint T +5°C	Roots 1 mechanical problem	⇒ Check the rotation of the Roots 1 rotors (if possible).
	Problem with power reading	⇒ Check current and voltage on the monitoring and/or at the frequency inverter output. ⇒ If there is no frequency inverter, check the current sensor.
	Problem on frequency inverter	① Contact your service center.
	Other problem	① Contact your service center.
	FB HP water valve problem	⇒ Check the proper operation and the connection of the FB HP water valve (see 15.4). ⇒ Check the power supply of HP water valve coil on FB.
W15 /D15 HP FB T° either HP T° > setpoint T +5°C	Cooling problem	⇒ Check the water cooling supply on the pump. ⇒ Check that the cooling pipes and /or the cooling plate are not clogged.
	Temperature sensor and/or wiring faulty	⇒ Check the temperature reading on HHR as well as the connections of the sensor on FB HP TEMP plug and of the valve on FB VALVES plug (see 15.4).
	Other problem	① Contact your service center.

Incident	Cause	Remedy
or HP T° < setpoint T -10°C	HP FB water valve problem	⇒ Check the condition of the solenoid valve diaphragm and its operation.
	Temperature sensor problem	⇒ Check the proper operation and the connection of the sensor on FB HP TEMP plug (see 15.4).
	Other problem	① Contact your service center.
W17/D17 T° R1 MOT	Roots 1 motor temperature is > 120°C	⇒ Check the water cooling supply on the pump. ⇒ Check that the Roots 1 motor is correctly cooled. ⇒ Check that the cooling pipes are not clogged.
	Sensor or wiring faulty	⇒ Check the connection of the sensor on RSV1 MOTOR plug (see 15.4) and in the motor terminal box.
	Problem on Roots 1 motor temperature sensors	⇒ Check the proper operation of Roots 1 motor temperature sensors (NC contacts).
	Other problem	① Contact your service center.
D19 REVERSED UVW	Main power supply problem: two inverted phases	⇒ Check the wiring at the main power input connector.
	Other problem	① Contact your service center.
W21 SOFT P. VALVE	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [INLET VALVE] is set on [DISABLED] when no valve is connected.
	Wrong connection	⇒ Check the valve connection on the J4 connector (see 8.5.3).
	Malfunction	⇒ Check the proper operation opening/closing of the valve.
	Other problem	① Contact your service center.
W31 SUPPLY 15V	15V supply problem	① Contact your service center.
W32 MAINTENANCE	Incorrect monitoring configuration	⇒ Check the maintenance thresholds.
	The maintenance threshold is reached	⇒ Contact your service center for pump overhaul.
D33 SUPPLY 24VS	24V supply problem	⇒ Check that the EMS is not switched on. ⇒ Check the EMS wiring circuit. ⇒ Check the 24 V power supply and the 24 V PCboard.
D34 EMO	Pump emergency stop is engaged	⇒ Rotate to unlock the emergency stop on the front panel display.
	Emergency cover plug is missing	⇒ Check that the cover plug is fitted on the emergency connector at the rear of the pump.
	Problem with 24 V power supply	⇒ Check the EMO power circuit.
	Other problem	① Contact your service center.
D36 FB CONTACTOR	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [FB INVERTER] is set on [DISABLED].
	KM1 contactor not closed	⇒ Check that there is a strap between pins 2 and 3 of emergency stop terminal EMS (see 8.7.1). ⇒ The FB does not start: check the 24 V power supply on A1 and A2.
	Other problem	① Contact your service center.
D37 R1 BREAKER	Incorrect monitoring configuration	⇒ Check that the [DEFINITION] [PUMP MODEL] is set on [A204] or [A124]. ⇒ Change the setting by sending an order via Modbus communication protocols (see Serial link operating instructions).
	RT2 (Roots) breaker switched off	⇒ Check RT2 setting (see 15.3). Switch RT2 on. ⇒ Check that the presence of current and voltage on the phases.
	Roots 1 mechanical problem	⇒ Check the rotation of the Roots 1 rotors (if possible).
	Other problem	① Contact your service center.
D38 FB BREAKER	Incorrect monitoring configuration	⇒ Check that the [DEFINITION] [FREQUENCY INVERTER][R1 INVERTER] is set on [DISABLED].
	RT1 (BF) breaker switched off	⇒ Check RT1 (see 15.3). Switch RT1 on. ⇒ Check that the presence of current and voltage on the phases.
	FB mechanical problem	⇒ Free the FB manually (see 9.4).
	Other problem	① Contact your service center.
D39 R1 CONTACTOR	Incorrect monitoring configuration	⇒ Check that the [DEFINITION] [FREQUENCY INVERTER][R1 INVERTER] is set on [DISABLED].
	KM2 (Roots) contactor not closed	⇒ The Roots 1 does not start: check the 24 V power supply on A1 and A2.
	Other problem	① Contact your service center.

Incident	Cause	Remedy
D40 HAZ T° R1 MOT	Roots 1 motor temperature is > 150°C	⇒ Check the water cooling supply on the pump. ⇒ Check that the Roots 1 motor is correctly cooled. ⇒ Check that the cooling pipes are not clogged.
	Sensor not connected	⇒ Check the connection of the sensor on RSV1 MOTOR plug (see 15.4).
	Other problem	① Contact your service center.
D41 HAZ T° FB MOT	BF motor temperature is > 150°C	⇒ Check the water cooling supply on the pump. ⇒ Check that the FB motor is correctly cooled. ⇒ Check that the cooling pipes are not clogged.
	Sensor not connected	⇒ Check the connection of the sensor on FB MOTOR plug (see 15.4).
	FB mechanical problem	⇒ Free the FB manually (see 9.4).
	Other problem	① Contact your service center.
D42 HAZ EXT PRESS	SEMI safety sensor problem (overpressure at exhaust)	⇒ Check the sensor cable condition and sensor operation (see 7.13). ⇒ Replace the sensor if necessary.
D43 EXH PRESS	SEMI safety sensor problem (nitrogen pressure)	⇒ Check the sensor cable condition and sensor operation (see 7.13). ⇒ Replace the sensor if necessary.
D44 FRAME PRESS	SEMI safety sensor problem (exhaust ventilation)	⇒ Check the sensor cable condition and sensor operation (see 7.13). ⇒ Replace the sensor if necessary.
D46 ALARM T° FB	FB temperature problem	⇒ Check the water cooling supply on the pump. ⇒ Check the temperature setpoints and alarm threshold ⇒ Check that the water pipe are not clogged.
W51/D51 USER T°	Incorrect monitoring configuration	⇒ Check that the [SETTING][TEMPERATURE][USER T°] is set on [DISABLED].
	Incorrect threshold setting	⇒ Check the warning or fault thresholds.
	Other problem	① Contact your service center.
W52/D52 ROOTS 1 T°	Incorrect monitoring configuration	⇒ Check that the [SETTING][TEMPERATURE][Roots 1 T°][CONTROL] or [MEASUREMENT] menu has set thresholds.
	Incorrect threshold setting.	⇒ Check the warning or fault thresholds.
	Cooling problem	⇒ Check the water cooling supply on the pump. ⇒ Check that the cooling pipes are not clogged.
	Sensor faulty	⇒ Check the temperature reading on HHR as well as the connections of the sensor on RSV1 TEMP plug and of the valve on RSV1 VALVES plug (see 15.4).
	Other problem	① Contact your service center.
W54/D54 HEATER	Heater controller disconnected	⇒ Check the cable connection on WH plug or if here is a strap on WH plug (see 15.4).
	Heater disconnected	⇒ Check the cable connection on J2 heater controller connector.
	Other problem	① Contact your service center.
W57/D57 LP FB T° either LP T° > setpoint T +5°C or LP T° < setpoint T -10°C	FB LP temperature control valve supply problem	⇒ Check the proper operation and the connection of the FB LP water valve (see 15.4).
	Cooling problem	⇒ Check the water cooling supply on the pump. ⇒ Check that the cooling pipes are not clogged.
	Temperature sensor and/or wiring faulty	⇒ Check the temperature reading on HHR as well as the connections of the sensor on FB LP TEMP plug and of the valve on FB VALVES plug (see 15.4).
	Other problem	① Contact your service center.
	FB LP water valve problem	⇒ Check the condition of the solenoid valve diaphragm and its operation.
PW59/W59/D59 R2 POWER	Temperature sensor and/or wiring faulty	⇒ Check the running and the connection of the sensor on FB LP TEMP plug (see 15.4).
	Other problem	① Contact your service center.
	Roots 2 incorrect threshold setting.	⇒ Check the power threshold setting in menu [SETTING][POWER][R2 POWER].
	Roots 2 mechanical problem	⇒ Check the rotation of the Roots 2 rotors (if possible).
	Other problem	① Contact your service center.

Incident	Cause	Remedy
W60/D60 ROOTS 2 T°	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [ROOTS R2 OPTION] is set on [DISABLED].
	Cooling problem	⇒ Check the water cooling supply on the pump. ⇒ Check that the Roots 2 motor is correctly cooled. ⇒ Check that the cooling pipes are not clogged.
	Sensor or wiring faulty	⇒ Check the condition of the sensor and its connection in the motor terminal box.
	Other problem	① Contact your service center.
W62/D62 LOW SPEED R1	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [R1 INVERTER] is set on [V1000] or [DISABLED].
	Roots 1 mechanical problem	⇒ Check the rotation of the Roots rotors (if possible).
	Other problem	① Contact your service center.
W63/D63 LOW SPEED R2	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [R2 INVERTER] is set on [V1000] or [DISABLED].
	Roots 2 mechanical problem	⇒ Check the rotation of the Roots 2 rotors (if possible).
	Other problem	① Contact your service center.
W64/D64 HEATER 1 T°	Incorrect monitoring configuration	⇒ Check that [SETTING][HEATER 1 T°] menu is set on [DISABLED].
	Heater 1 problem	⇒ Check the operation of heater 1.
	Other problem	① Contact your service center.
W65/D65 HEATER 2 T°	Incorrect monitoring configuration	⇒ Check that [SETTING][HEATER 2 T°] menu is set on [DISABLED].
	Heater 2 problem	⇒ Check the operation of heater 2
	Other problem	① Contact your service center.
W66/D66 HEATER 3 T°	Incorrect monitoring configuration	⇒ Check that [SETTING][HEATER 3 T°] menu is set on [DISABLED].
	Heater 3 problem	⇒ Check the operation of heater 3.
	Other problem	① Contact your service center.
W68/D68 R1 DRIVE FAULT	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [R1 INVERTER] is set on [V1000 or [DISABLED].
	Probable mechanical problem on Roots 1	⇒ Check the rotation of the Roots 1 rotors or visually check if there is no mechanical touch (if possible).
	Other problem	① Contact your service center.
W69/D69 FB DRIVE FAULT	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [FB INVERTER] is set on [V1000] or [DISABLED].
	Probable mechanical problem on FB	⇒ Check the rotation of the FB shafts and if there is no mechanical constraint ⇒ Free the FB manually (see 9.4).
	Other problem	① Contact your service center.
W70/D70 R2 DRIVE FAULT	Incorrect monitoring configuration	⇒ Check that [DEFINITION] [FREQUENCY INVERTER] [R2 INVERTER] is set on [V1000] or [DISABLED].
	Other problem	① Contact your service center.
D71 FB I DRIVE	FB frequency inverter overcurrent	⇒ Check the rotation of FB, Roots 1 or Roots 2 according to the displayed message. ⇒ Check that the frequency inverter is not overloaded or if the pump is not mechanically blocked. ⇒ Check the message on frequency inverter display, or if the frequency inverter is in default (V1000 Yaskawa operating manual is available on the website).
W72 R2 I R1 DRIVE	Roots 1 frequency inverter overcurrent	
W73 R2 I R2 DRIVE	Roots 2 frequency inverter overcurrent	
D74 FB U+ DRIVE	FB frequency inverter overvoltage	
W75 R2 U+ R1 DRIVE	Roots 1 frequency inverter overvoltage	
W76 R2 U+ R2 DRIVE	Roots 2 frequency inverter overvoltage	
D77 FB P DRIVE	FB frequency inverter overload	
W78 P R1 DRIVE	Roots 1 frequency inverter overload	
W79 P R2 v DRIVE	Roots 2 frequency inverter overload	
D80 FB T DRIVE	FB frequency inverter overheat	
W81 R1 T DRIVE	Roots 1 frequency inverter overheat	⇒ Check the proper operation of the water circuit. ⇒ Check that the cooling plate(s) on frequency inverter(s) is not clogged.
W82 R2 P DRIVE	Roots 2 frequency inverter overheat	
D83 FB M DRIVE	FB motor frequency inverter overload	
W84 R1 M DRIVE	Roots 1 motor frequency inverter overload	⇒ Check the rotation of FB, Roots 1 or Roots 2 according to the displayed message ⇒ Check that the frequency inverter is not overloaded or if the pump is not mechanically blocked.
W85 R2 M DRIVE	Roots 2 motor frequency inverter overload	
D86 FB U- DRIVE	FB frequency inverter undervoltage	
W87 R1 U- DRIVE	Roots 1 frequency inverter overcurrent	⇒ Check the stability of the customer's electrical network
W88 R2 U- DRIVE	Roots 2 frequency inverter overcurrent	

Incident	Cause	Remedy
D89 FB PH DRIVE	Phase loss of FB frequency inverter	⇒ Check the power supply wiring of the concerned frequency inverter (presence of voltage on R, S and T terminal plugs) ⇒ Check that there is no power cut-off on power-phases upstream the frequency inverter
W90 R1 PH DRIVE	Phase loss of Roots 1 frequency inverter	
W91 R2 PH DRIVE	Phase loss of Roots 2 frequency inverter	
D92 FB RS DRIVE	FB frequency inverter memory error	⇒ Check the power supply wiring of the concerned frequency inverter (presence of voltage on R, S and T terminal plugs) ⇒ Check that there is no power cut-off on power-phases upstream the frequency inverter
W93 R1 RS DRIVE	Roots 1 frequency inverter memory error	
W94 R2 RS DRIVE	Roots 2 frequency inverter memory error	
W95/D95 R1 SPEED	Roots 1: absence of speed information	⇒ Check the cable or sensor on Li4 (see 15.4).
W102/D102 R1 OIL T° W102 T° Roots 1 > setpoint T + 5°C)	Cooling problem	⇒ Check the water cooling supply on the pump. ⇒ Check that the cooling pipes are not clogged.
	Sensor or wiring faulty	⇒ Check the temperature reading on HHR as well as the connections of the sensor on RSV1 TEMP plug and of the valve on RSV1 VALVES plug (see 15.4).
	Roots 1 solenoid water valve problem	⇒ Check the operation and the connection of the Roots 1 solenoid valve (see 7.5). ⇒ Check the power supply of Roots 1 solenoid valve coil.

11.4 The pump is running but the performance is not correct

Incident	Cause	Remedy
Bad vacuum or no vacuum	Polluted or clogged pump	⇒ FB maintenance ① Contact your service center.
	Internal oil leak	⇒ FB maintenance ① Contact your service center.
Mechanical noise	Damaged ball bearing	⇒ FB maintenance ① Contact your service center.
	Rotors seizing	⇒ FB maintenance ① Contact your service center.
	Unsynchronized gears	⇒ FB maintenance ① Contact your service center.
No N2 purge	Incorrect configuration	⇒ Reset monitoring configuration ([PURGE CMD] [ENABLED]) or set the purge manually (PURGE key on HHR).

12 Service

Pfeiffer Vacuum offers first-class customer service!

- On-Site maintenance for many products
- Overhaul/repair at the nearby Service Location
- Fast replacement with refurbished exchange products in mint condition
- Advice on the most cost-efficient and quickest solution

Detailed information, addresses and forms at: www.pfeiffer-vacuum.com (Service).

Overhaul and repair at the Pfeiffer Vacuum Service Center

The following general recommendations will ensure a fast, smooth servicing process:

- Fill out the "Service Request/Product Return" form and send it to your local Pfeiffer Vacuum Service contact.
- Include the confirmation on the service request from Pfeiffer Vacuum with your shipment.
- Fill out the declaration of contamination and include it in the shipment (mandatory!). The Declaration of contamination is valid for any product/device including a part exposed to vacuum.
- Dismantle all accessories and keep them.
- Close all the flange opening ports by using the original protective covers or metallic airtight blank flanges for contaminated devices.
- If possible, send the pump or unit in its original packaging.

Sending contaminated pumps or devices

No devices will be accepted if they are contaminated with micro-biological, explosive, or radioactive substances. "Hazardous substances" are substances and compounds in accordance with the hazardous goods regulations (current version).

- Neutralize the pump by flushing it with nitrogen or dry air.
- Close all openings airtight.
- Seal the pump or device in suitable protective film.
- Return the pump/device only in a suitable and sturdy transport container and send it in while following applicable transport conditions.

Pump or device returned without declaration of contamination form fully completed and/or not secured in suitable packaging will be decontaminated and/or returned at the shipper's expense.

Exchange or repair

The factory operating parameters are always pre-set with exchange or repaired devices. If you use specific parameters for your application, you have to set these again.

Service orders

All service orders are carried out exclusively according to our general terms and conditions for the repair and maintenance, available on our website.

13 Accessories

Accessory	Type		Dimension	P/N	
Isolation valve at pump inlet	Auto valve 24 VDC	Stainless steel	DN 100 ISO-F	-	
			DN 160 ISO-F	-	
	Cable for electropneumatic valve		Length 1,2 m	A335263	
Seismic bracket	Set of two seismic brackets			122339S	
Hand-held remote control	HHR EDR and cable (length 1.5 m)			125540S	
	Spiral cable		Length 1.5 m	A468325	
	Cable alone		Length 15 m	107079	
Interface boards OEM/Remote control	① Contact the service center.				
Lonworks Interface				122404	
Profibus interface				123767	
Ethercat interface				122088	
Interface support (holding plate)				A601511	
Other protocols	① Contact the service center.				
Mains plug	35 A female connector			108141	
Emergency stop plug EMS				106587	
Remote control plug (Sub-D 50 pins female)				107222	
3/8" NPT female connector	Water input			115509	
1/4"NPT female connector	Water input			076721	
3/8" NPT male connector	Water output			115510	
1/4" NPT male connector	Water output			076720	
1/8" NPT female connector	Nitrogen input			104084	
Shipping clamp kit	for A 604 / A804 models			123466	
	for A 1204/ A 1504 /A 1804 model			123467	
Connecting accessories	Centering ring with FPM72 O-ring + PTFE protection		DN 40 ISO-KF	108785	
			DN 50 ISO-KF	123716	
			DN 100 ISO-K	123717	
			DN 160 ISO-K	123718	
	Inlet blank-off flange +1/8" gas injector		DN 50 ISO-KF	106314 + 082981	
			DN 100 ISO-K	090467 + 082981	
			DN 160 ISO-K	104456 + 082981	
	Centering ring with FPM72 O-ring		DN 40 ISO-KF	068230	
			DN 50 ISO-KF	087168	
			DN 100 ISO-K	068349	
			DN 160 ISO-K	068186	
	Inlet adapter	A 604/A 804	DN 100/DN 100 ISO-K	106302	
		A 1204/A 1504/A 1804	DN 160/DN 100 ISO-K	A330731	
		A 1804	DN 160/DN 160 ISO-K	A331857	
	Exhaust blanking plates, quick-connect clamp, claw clamps: see manufacturer's catalog				

14 Technical data and dimensions

14.1 Technical data

Characteristics	Unit	A 204H /A 204X	A 804H/ A 804X	A 1504H/ A 1504X	A 1804H/ A 1804X	A 2404H/ A 2404X
Peak pumping speed (50/60 Hz)	m ³ /h	130/160	600/700	1100/1200	1650/1700	2300
Maximum ultimate pressure (without N ₂ purge) (50/60 Hz)	hPa	2 · 10 ⁻¹ /2.2 · 10 ⁻²	8 · 10 ⁻³ /4 · 10 ⁻³	8 · 10 ⁻³ /4 · 10 ⁻³	8 · 10 ⁻³ /4 · 10 ⁻³	7/4 · 10 ⁻³
Maximum ultimate pressure (with N ₂ purge 50 slm) ⁽⁷⁾ (50/60 Hz)	hPa	7 · 10 ⁻¹ /2 · 10 ⁻¹	2 · 10 ⁻² /9 · 10 ⁻³	2 · 10 ⁻² /9 · 10 ⁻³	2 · 10 ⁻² /9 · 10 ⁻³	7/9 · 10 ⁻³
Maximum pumped volume ⁽³⁾	m ³	1	1	1	1	1
Maximum continuous inlet flow ⁽⁵⁾	slm	150	100	100	70	30
Supply voltage ⁽¹⁾	V	200-230 V / 380-480 V - 3 phases - 50/60 Hz				
Power consumption at ultimate pressure (50/60 Hz) (no exhaust heater)	kW	1.6/1.8	2.1/2.3	2.4/2.6	2.4/2.6	7/2.6
Power consumption at max. inlet flow	kW	3.5	4.5	5	8	8
Full load current (200-230 V)	A	20	27	32	32	32
Full load current (380-480 V)	A	10	20	21	21	21
Maximum exhaust pressure	hPa	1200	1200	1200	1200	1200
Cooling water flow ⁽⁴⁾	l/h	120-240	150-300	150-300	150-300	150-300
N ₂ purge flow	slm	10 to 120	10 to 120	10 to 120	10 to 120	10 to 120
Oil fluid capacity	l	BF : 0.28	BF : 0.28 Roots : 0.63	BF : 0.28 Roots : 1.55	BF : 0.28 Roots : 1.55	BF : 0.28 Roots : 1.5
Helium localized leak rate	hPa l/s	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵
Inlet flange ⁽⁶⁾		DN 50 ISO-KF	DN 100 ISO-K	DN 160 ISO-K	DN 160 ISO-K	DN 160 ISO-K
Exhaust flange		DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF
Dimensions		(see 14.3)	(see 14.3)	(see 14.3)	(see 14.3)	(see 14.3)(see 14.3)
Weight	kg	250	380	540	540	640
Typical vibration level at inlet flange	g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	mm/s	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Maximum sound level ⁽²⁾	dB(A)	< 65	< 68	< 69	< 69	< 71

- (1) According to CE regulations. Pumps can withstand a supply voltage variation of ± 10 %.
- (2) Measured at 1 m length. and 1.6 m height. according to ISO 9614-2 standard (pump equipped with a silencer and a check valve).
- (3) This pump is certified for pumping a volume of 1 m³, with 20-minute cycling. In case of larger volume or a higher cycling frequency, consult us.
- (4) Subject to pump temperature setting.
- (5) At maximum rotational speed.
- (6) Without inlet pipe extension, inlet flange is ISO-F type.
- (7) With standard N₂ injection device. In case of specific N₂ injection device, consult us

Characteristics	Unit	A 2504H/A 2504X	A 3004H/A 3004X
Peak pumping speed (60 Hz)	m ³ /h	2500	3000
Maximum ultimate pressure (without N ₂ purge) (60 Hz)	hPa	4 · 10 ⁻³	4 · 10 ⁻³
Maximum ultimate pressure (with N ₂ purge 50 slm) ⁽⁷⁾ (60 Hz)	hPa	9 · 10 ⁻³	9 · 10 ⁻³
Maximum pumped volume ⁽³⁾	m ³	2	2
Maximum continuous inlet flow ⁽⁵⁾ 50Hz / 60Hz ⁽⁵⁾	slm		
EHT version (DSB 3000 hot)		90	80
ELT version (DSB 3000 cold)		100	100
Supply voltage ⁽¹⁾	V	200-230 V / 380-480 V - 3 phases - 50/60 Hz	
Power consumption at ultimate pressure (50/60 Hz) (no exhaust heater)	kW	2,4/2,6	2,4/2,6
Power consumption at max. inlet flow	kW	8	8
Full load current (200-230 V)	A	32	32
Full load current (380-480 V)	A	21	21
Maximum exhaust pressure	hPa	1200	1200
Cooling water flow ⁽⁴⁾	l/h	150-300	150-300
N ₂ purge flow	slm	10 à 120	10 à 120
Oil fluid capacity	l	BF : 0,28 Roots : 1,5	BF : 028 Roots : 1,5
Helium localized leak rate	hPa l/s	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵
Inlet flange ⁽⁶⁾		DN 160 ISO-K	DN 160 ISO-K
Exhaust flange		DN 40 ISO-KF	DN 40 ISO-KF
Dimensions		(see 14.3)	(see 14.3)
Weight	kg	800	800
Typical vibration level at inlet flange	g	< 0,1	< 0,1
	mm/s	< 1,5	< 1,5
Maximum sound level ⁽²⁾	dB(A)	< 72	< 72

(1) According to CE regulations. Pumps can withstand a supply voltage variation of ± 10 %.

(2) Measured at 1 m length. and 1.6 m height. according to ISO 9614-2 standard (pump equipped with a silencer and a check valve).

(3) This pump is certified for pumping a volume of 1 m³, with 20-minute cycling. In case of larger volume or a higher cycling frequency, consult us.

(4) Subject to pump temperature setting.

(5) At maximum rotational speed.

(6) Without inlet pipe extension, inlet flange is ISO-F type.

(7) With standard N2 injection device. In case of specific N2 injection device, consult us.

Characteristics	Unit	A 124H	A 604H	A 1204H
Peak pumping speed (50/60 Hz)	m ³ /h	95/110	480/560	1050/1150
Maximum ultimate pressure (without N ₂ purge) (50/60 Hz)	hPa	5 · 10 ⁻² /2 · 10 ⁻²	3 · 10 ⁻³ /2 · 10 ⁻³	4 · 10 ⁻³ /2.2 · 10 ⁻³
Maximum ultimate pressure (with N ₂ purge 50 slm) ⁽⁷⁾ (50/60 Hz)	hPa	3 · 10 ⁻¹ /1 · 10 ⁻¹	9 · 10 ⁻³ /6 · 10 ⁻³	1,2 · 10 ⁻² /6 · 10 ⁻³
Maximum pumped volume ⁽³⁾	m ³	1	1	1
Maximum continuous inlet flow ⁽⁵⁾	slm	80	60	55
Supply voltage ⁽¹⁾	V	200-230 V / 380-480 V - 3 phases - 50/60 Hz		
Power consumption at ultimate pressure (50/60 Hz) (non exhaust heater)	kW	1.3/1.5	1.8/2.0	2.1/2.3
Power consumption at max. inlet flow	kW	-	-	-
Full load current (200-230 V)	A	10	20	25
Full load current (380-480 V)	A	5	11	17
Maximum exhaust pressure	hPa	1200	1200	1200
Cooling water flow ⁽⁴⁾	l/h	120-180	150-240	150-240
N ₂ purge flow	slm	10 to 120	10 to 120	10 to 120
Oil fluid capacity	l	0.25	BF : 0.25 Roots : 0.63	BF : 0.25 Roots : 1.55
Helium localized leak rate	hPa l/s	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵	< 1 · 10 ⁻⁵
Inlet flange ⁽⁶⁾		DN 50 ISO-KF	DN 100 ISO-K	DN 160 ISO-K
Exhaust flange		DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF
Dimensions		(see 14.3)	(see 14.3)	(see 14.3)
Weight	kg	250	370	530
Typical vibration level at inlet flange	g	< 0.1	< 0.1	< 0.1
	mm/s	< 1.5	< 1.5	< 1.5
Maximum sound level ⁽²⁾	dB(A)	< 65	< 68	< 69

- (1) According to CE regulations. Pumps can withstand a supply voltage variation of ± 10 %.
- (2) Measured at 1 m length. and 1.6 m height. according to ISO 9614-2 standard (pump equipped with a silencer and a check valve).
- (3) This pump is certified for pumping a volume of 1 m³, with 20-minute cycling. In case of larger volume or a higher cycling frequency, consult us.
- (4) Subject to pump temperature setting.
- (5) At maximum rotational speed.
- (6) Without inlet pipe extension, inlet flange is ISO-F type.
- (7) With standard N₂ injection device. In case of specific N₂ injection device, consult us.

Conversion table: pressure units

	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

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

Conversion table: gas throughput units

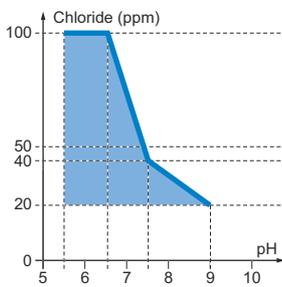
	mbar·l/s	Pa·m ³ /s	sccm	Torr·l/s	atm·cm ³ /s
mbar·l/s	1	0.1	59.2	0.75	0.987
Pa·m ³ /s	10	1	592	7.5	9.87
sccm	1.69 · 10 ⁻²	1.69 · 10 ⁻³	1	1.27 · 10 ⁻²	1.67 · 10 ⁻²
Torr·l/s	1.33	0.133	78.9	1	1.32
atm·cm ³ /s	1.01	0.101	59.8	0.76	1

14.2 Facilities characteristics

14.2.1 Environmental conditions

Use	indoor use
Installation altitude	up to 2000 m
Ingress protection	IP 30
Ambient operating temperature	5-40 °C
Storage temperature	-25-+55 °C
Relative humidity	max. 80% at T ≤ 31°C, up to max. 50% at T ≤ 40°C
Pollution degree	rate 2
Overvoltage protection ¹⁾ 1) Transient overvoltage up to the levels of overvoltage category II. Temporary overvoltage occurring on the mains supply.	category II

14.2.2 Water characteristics



pH	5.5 to 9
Chlorine ⁽³⁾	100 to 20 ppm depending on the pH
Hardness	< 10 °fH (french degree) < 2 milli-equivalent/L < 100 mg/L of CaCO ₃ (Calcium carbonate)
Total dissolved solids	< 300 mg/L
LSI (LANGELIER Saturation Index)	- 0.5 < LSI < 0 to +20°C
Particles size	< 0.2 mm
Resistivity	2000 Ω·cm < R < 1000000 Ω·cm
Input temperature ⁽⁴⁾	10-35 °C
Relative input pressure	2 · 10 ³ to 6 · 10 ³ hPa
Differential pressure (inlet/outlet)	> 2 · 10 ³ hPa

- (3) The oxidising action of the chlorine depends on the pH (aggressiveness of the water). The chlorine content must be within the coloured area on the graph opposite.
- (4) Depend on pumping conditions. Contact Pfeiffer Vacuum.

Connection

Water inlet	3/8" NPT male connection	Stainless steel
Water outlet	3/8" NPT female connection	Stainless steel

14.2.3 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 · 10 ³ to 6 · 10 ³ hPa

Connection

Nitrogen inlet	1/8" NPT male connection	Stainless steel
----------------	--------------------------	-----------------

14.2.4 Electrical characteristics

Circuit breaker with a minimum interrupting short circuit current	10 kA
GFI (or RCD) type B, differential circuit breaker compatible with type T.T electrical network	100 mA ¹⁾
1) For other networks, types T.N or I.T, use the proper protection device	

Model		Main circuit breaker rating * (minimum values)	Cable wire specifications	
A 124H	200-230V 50/60 Hz	15 A	2.5 mm ²	AWG-14
	380-480V 50/60 Hz	10 A	1.5 mm ²	AWG-14
A 204H/A 204X	200-230V 50/60 Hz	25 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	15 A	2.5 mm ²	AWG-14
A 604H	200-230V 50/60 Hz	25 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	15 A	2.5 mm ²	AWG-14
A 804H/A 804X	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10
A 1204H	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10
A 1504H/A 1504X	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10
A 1804H/A 1804X	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10
A 2404H/A 2404X	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10
A 2504H/A 2504X	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10
A 3004H/A 3004X	200-230V 50/60 Hz	32 A	6 mm ²	AWG-10
	380-480V 50/60 Hz	25 A	6 mm ²	AWG-10

For any change of power supply voltage in relation to the initial configuration, contact your service center.
 * UL 489 certified circuit breaker, supplied by the customer.

14.3 Dimensions

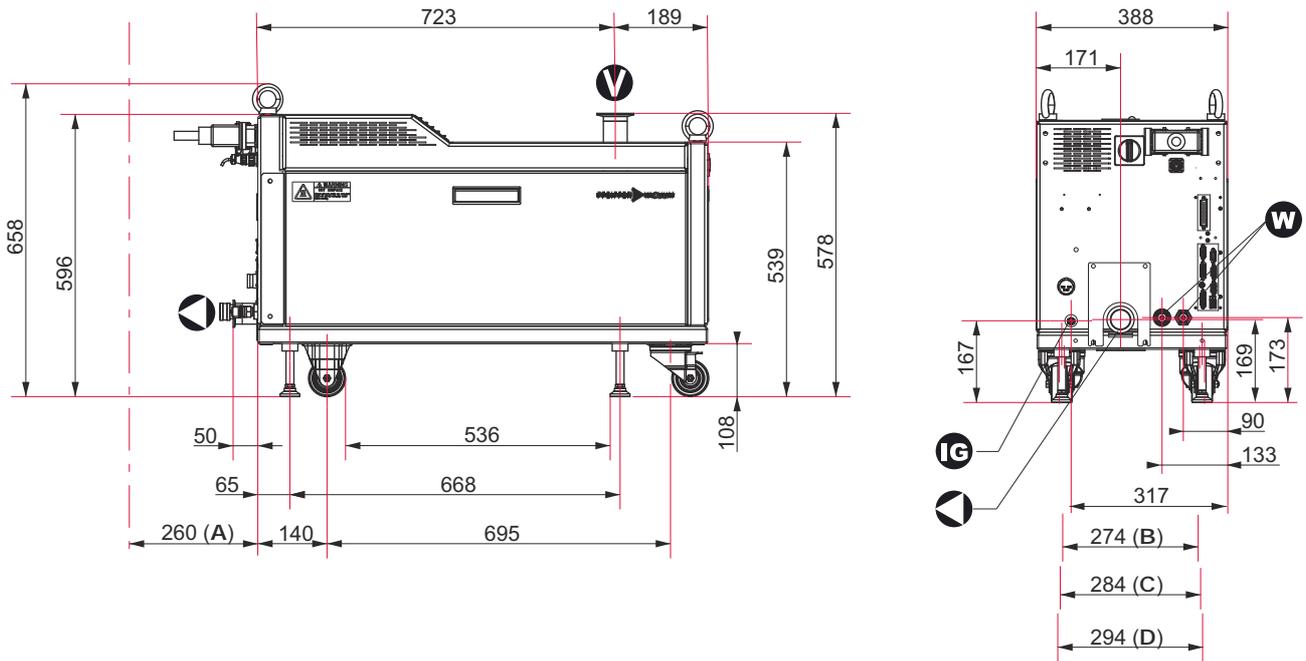


Fig. 23: A 124H, A 204H, A 204X - Dimensions (mm)

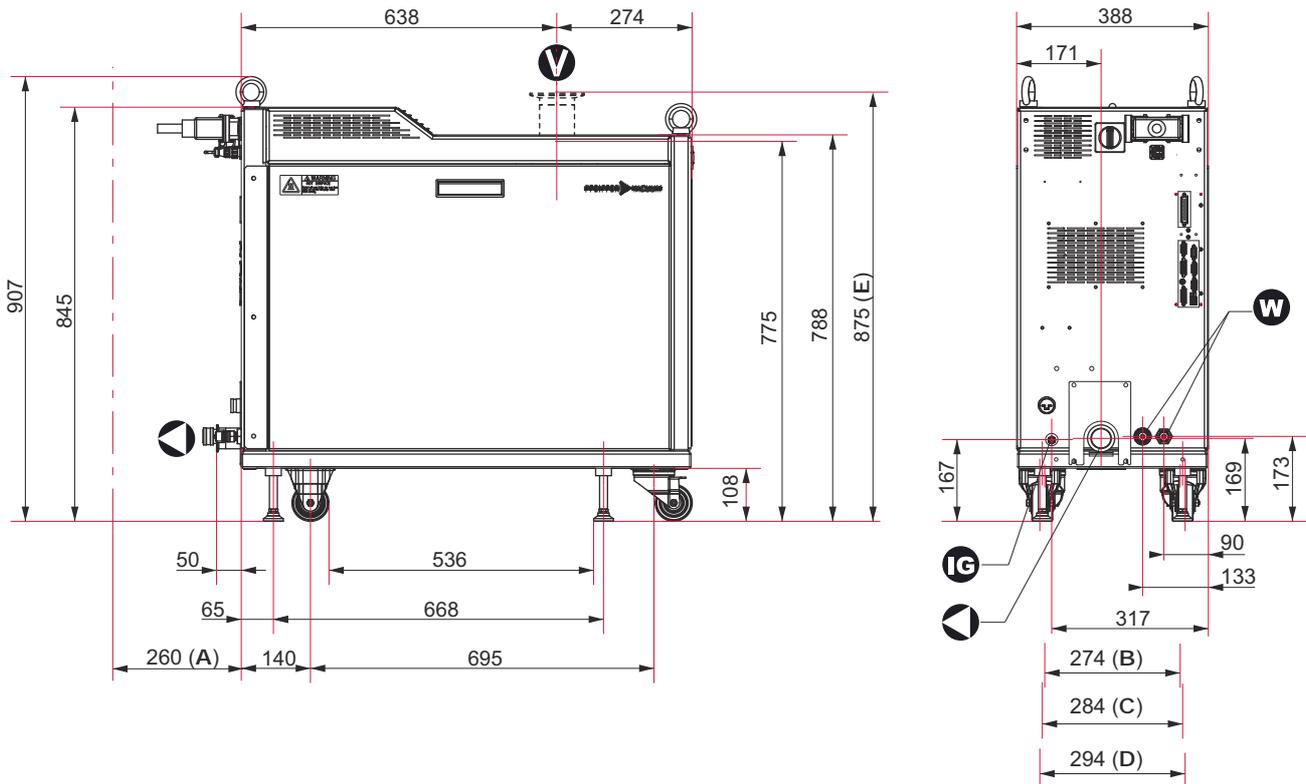


Fig. 24: A 604H, A 804H, A 804X - Dimensions (mm)

A	Minimum space for connection
B	Space between front castors
C	Space between feet
D	Space between rear castors
E	Inlet pipe extension (option)

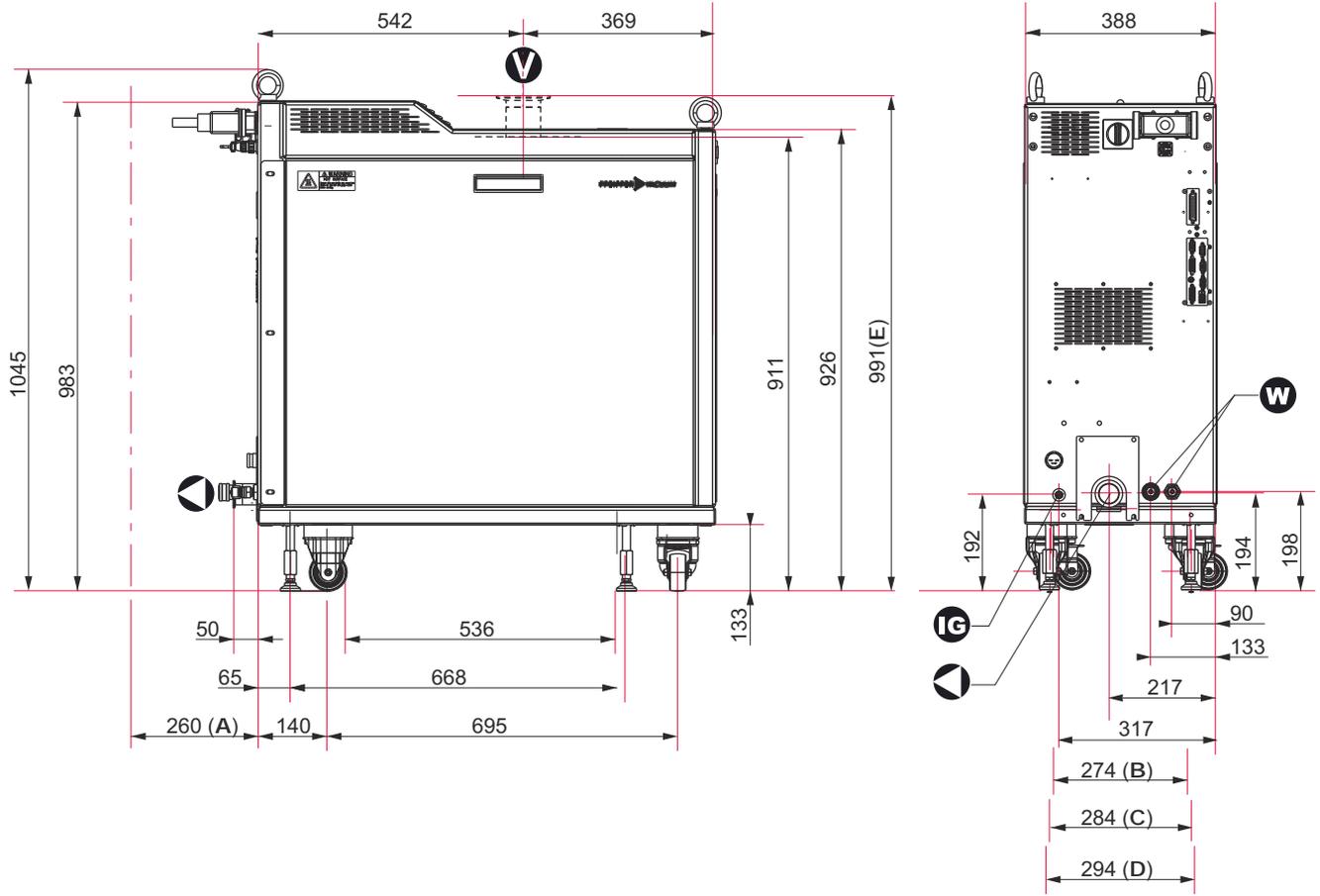


Fig. 25: A 1204H, A 1504H, A 1504X, A 1804H, A 1804X - Dimensions (mm)

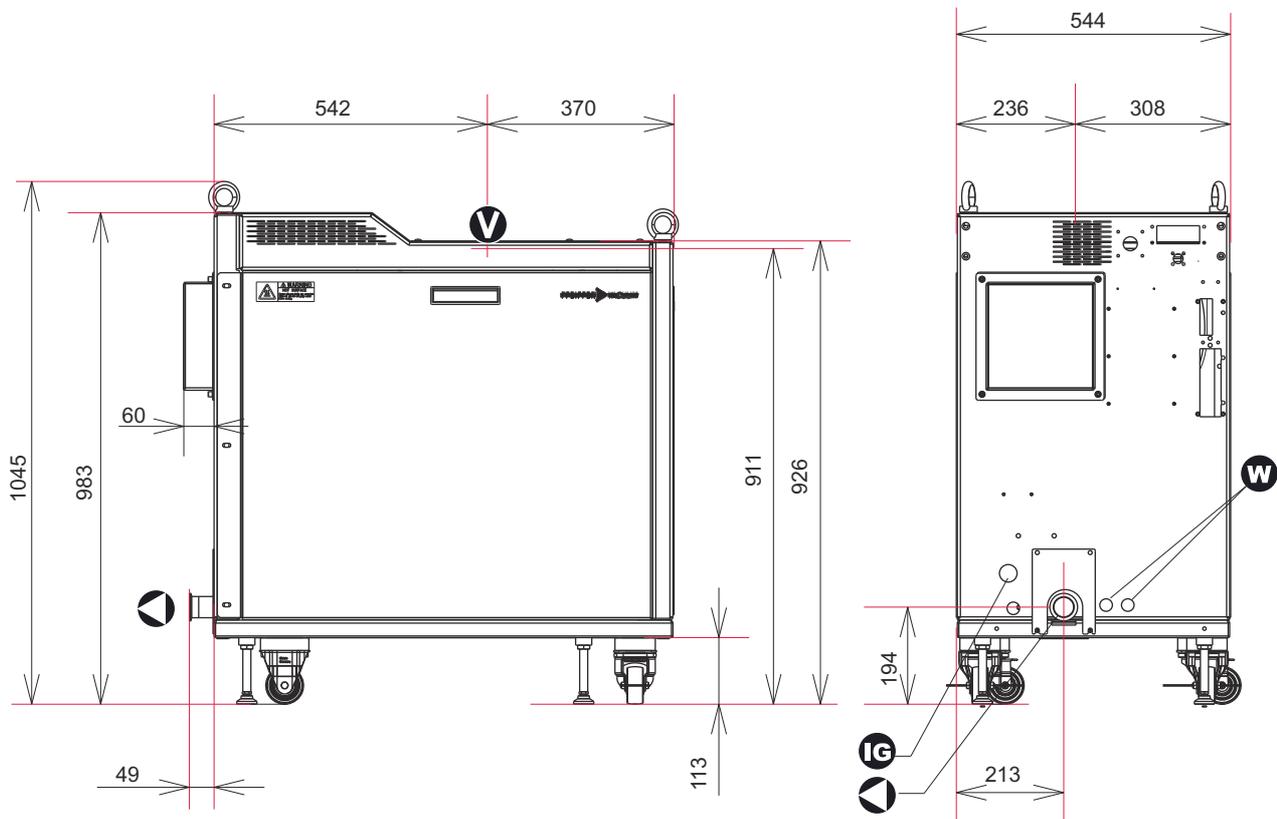
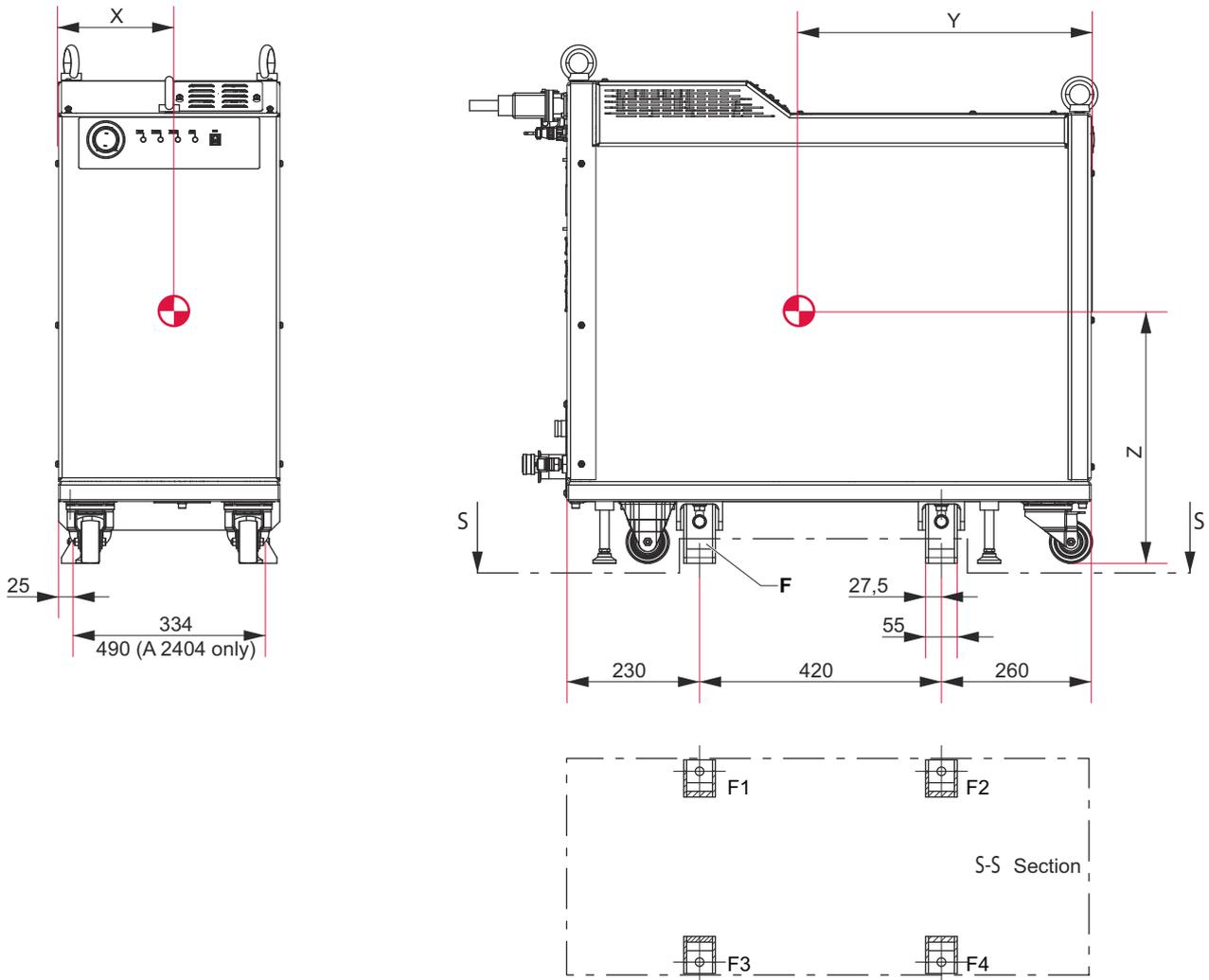


Fig. 26: A 2404H, A 2404X - Dimensions (mm)

14.4 Weight distribution and seismic brackets



	Center of gravity
F	Bracket: seismic accessory

Seismic anchorage points

- Screw number: 4
- Screw diameter: M12

Pump model	Center of gravity (mm)		
	X	Y	Z
A 124H	206	395	324
A 204H/A 204X	202	435	325
A 604H	206	380	440
A 804H/A 804X	203	406	434
A 1204H	202	404	558
A 1504H/A 1504X/ A 1804H/A 1804X	202	422	552
A 2404H/A 2404X	305	425	583
A 2504H/A 2504X/ A 3004H/A 3004X	306	506	635

Pump model	Load by foot (DaN)			
	F1	F2	F3	F4
A 124H	40,7	87,7	35,3	76,3
A 204H/A 204X	56,0	80,0	51,1	72,9
A 604H	54,1	138,5	47,0	120,4
A 804H/A 804X	68,6	131,4	61,7	118,3
A 1204H	92,0	180,1	83,8	164,1
A 1504H/A 1504X/ A 1804H/A 1804X	107,6	174,9	98,1	159,4
A 2404H/A 2404X	135,5	232,5	100,2	171,8
A 2404H/A 2404X/ A 3004H/A 3004X	234,5	244,7	171,7	179,2

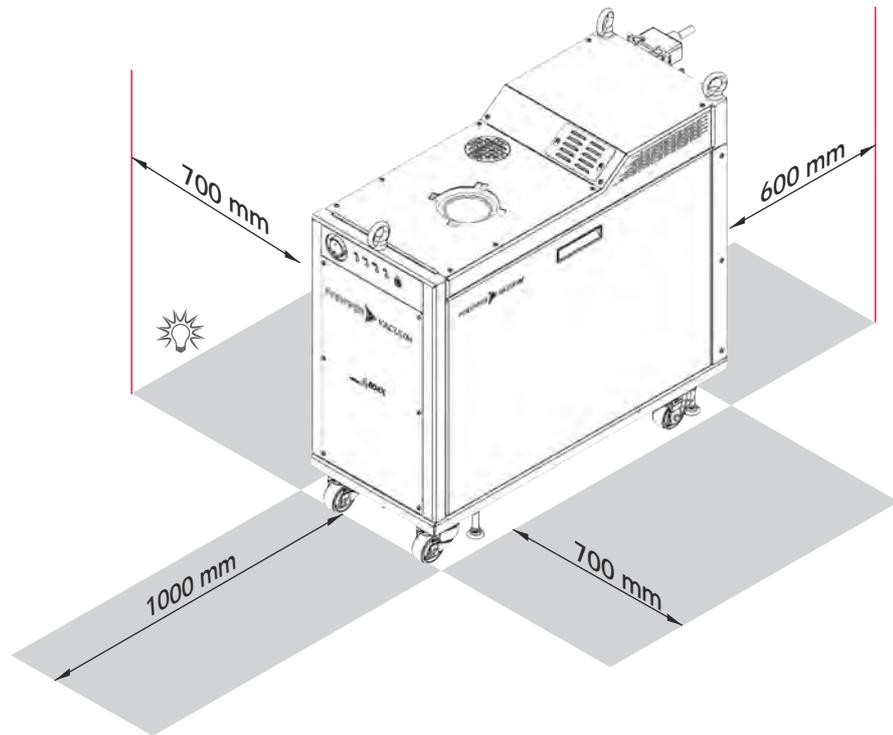
14.5 Materials

The pumps are made in different materials adapted to the processes used in the semi-conductor industry. The material in contact with the process gases are the followings: iron, stainless steel, fluoroelastomer, nickel and perfluorinated synthetic oil. The safety data sheet of A113 oil is available our website Pfeiffer Vacuum.

14.6 Maintenance area

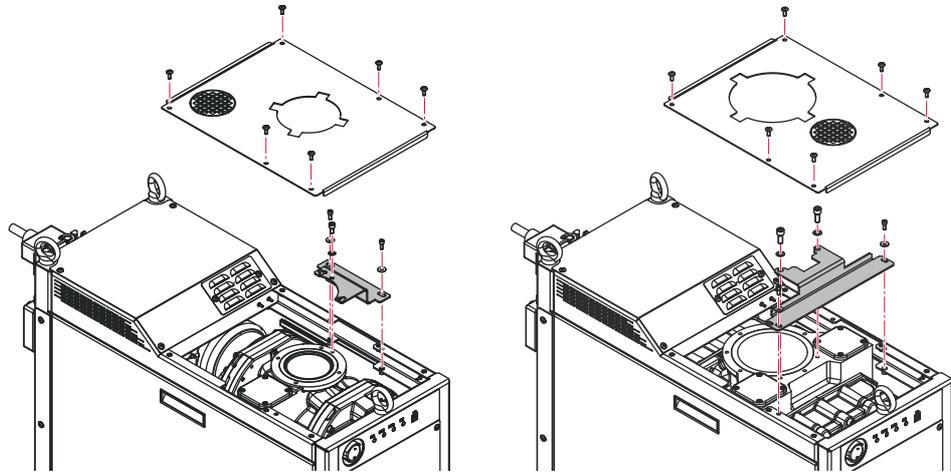


Luminosity > 300 lux



15 Appendix

15.1 Location of transport flange



15.2 Location of electrical components

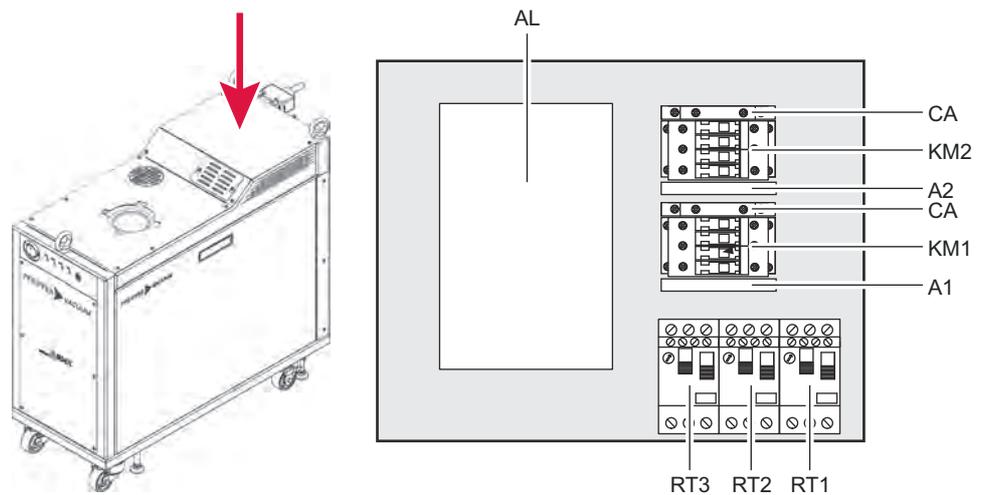


Fig. 28: Location of electrical components : pump without frequency converter

AL	24V power supply (A 204H/A 204X only)	A1/A2	Current sensor
CA	Auxiliary contact	RT1	FB circuit breaker
KM1	FB command	RT2	Roots circuit breaker
KM2	Roots command	RT3	Heating circuit breaker (option)

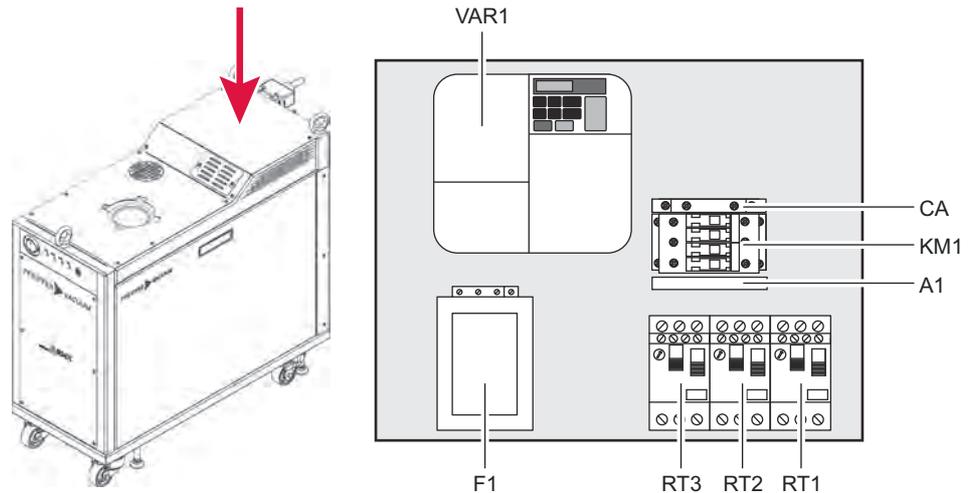


Fig. 29: Location of electrical components: pump with one frequency converter

VAR1	Frequency converter	A1	Current sensor
F1	Power filter	RT1	FB circuit breaker
CA	Auxiliary contact	RT2	Roots circuit breaker
KM1	FB command	RT3	Heating circuit breaker (option)

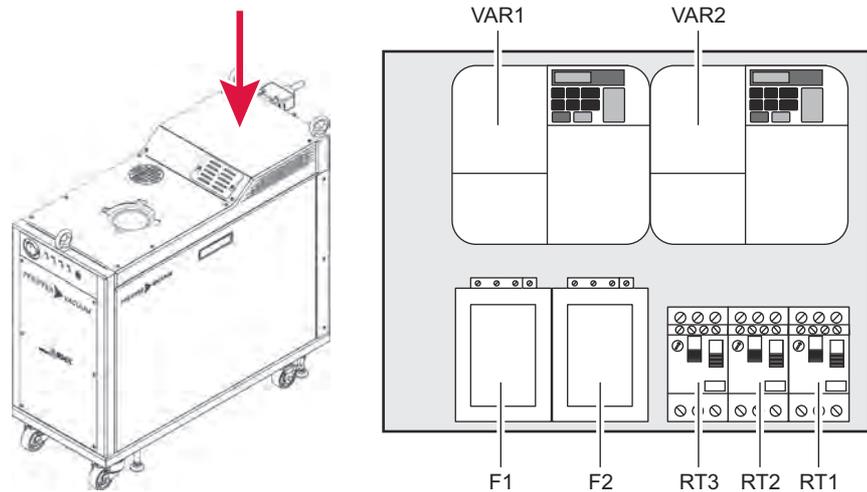


Fig. 30: Location of electrical components: pump with two frequency converters

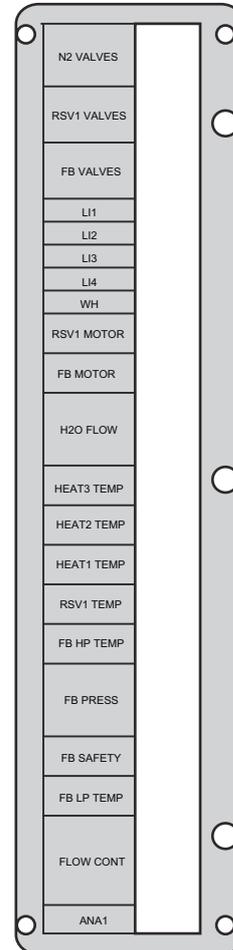
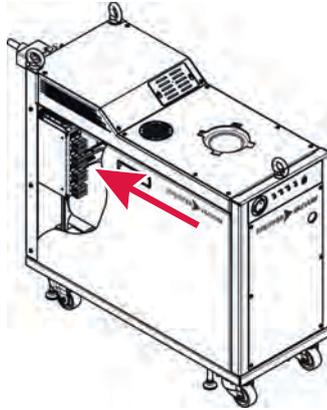
VAR1/VAR2	Frequency converter	RT1	FB circuit breaker
F1/F2	Power filter	RT2	Roots circuit breaker
		RT3	Heating circuit breaker (option)

15.3 Circuit breaker setting

Pump	Voltage		RT1	RT2	RT3
A 124H	LV	200-230 V - 50/60 Hz	14 A	-	4 A
	HV	380-480 V - 50/60 Hz	9 A	-	2.5 A
A 204H/A 204X	LV	200-230 V - 50/60 Hz	16 A	-	4 A
	HV	380-480 V - 50/60 Hz	13 A	-	2.5 A
A 604H	LV	200-230 V - 50/60 Hz	14 A	10 A	4 A
	HV	380-480 V - 50/60 Hz	9 A	6 A	2.5 A
A 804H/A 804X	LV	200-230 V - 50/60 Hz	16 A	10 A	4 A
	HV	380-480 V - 50/60 Hz	13 A	6 A	2.5 A
A 1204H	LV	200-230 V - 50/60 Hz	14 A	18 A	4 A
	HV	380-480 V - 50/60 Hz	9 A	13 A	2.5 A
A 1504H/A 1504X/A 1804H/A 1804X	LV	200-230 V - 50/60 Hz	16 A	18 A	4 A
	HV	380-480 V - 50/60 Hz	13 A	13 A	2.5 A

Pump	Voltage		RT1	RT2	RT3
A 2404H/A 2404X/A 2504H/A 2504X/A 3004H/A 3004X	LV	200-230 V - 50/60 Hz	16 A	16 A	4 A
	HV	380-480 V - 50/60 Hz	13 A	13 A	2.5 A

15.4 Sensor connectors lay-out



AUTHORIZATION TO MARK

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
Address: 98 avenue de Brogny - BP 2069
74009 Annecy - Cedex

Country: France
Contact: Mr. Yannick Grenier
Phone: 0033 (0)450 657 482
FAX: 0033 (0)450 657 576
Email: yannick.grenier@pfeiffer-vacuum.fr

Manufacturer: PFEIFFER VACUUM SAS
Address: 98 avenue de Brogny - BP 2069
74009 Annecy - Cedex

Country: France
Contact: Mr. Frederic Rouveyre
Phone: 0033 (0)450 657 748
FAX: -
Email: frederic.rouveyre@pfeiffer-vacuum.fr

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

Control Number: 3026716

Authorized by: _____


Ulla-Pia Johansson-Nilsson
for Dean Davidson, Certification Manager



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

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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):	Safety Requirements For Electrical Equipment For Measurement, Control, And Laboratory Use – Part 1: General Requirements [UL 61010-1:2012 Ed.3 +R:29Apr2016] Safety Requirements For Electrical Equipment For Measurement, Control, And Laboratory Use – Part 1: General Requirements (R2017) [CSA C22.2#61010-1-12:2012 Ed.3+U1;U2]
Product:	Vacuum Pumps
Brand Name:	 Or 
Models:	Range Serie 4: A124H, A204H, A204X, A604H, A804H, A804X, A1204H, A1504H, A1504X, A1804H, A1803H, A1803X, A1804X, A2404H and A2404X. Suffixes H and X only for ironcast quality for pumps (no safety relevant)

Certificate of conformance to SEMI



Global Semiconductor Safety Services

CERTIFICATE OF CONFORMANCE

To SEMI S2-0712 and SEMI S8-0712 Guidelines

August 17, 2015

Company Name & Location:	adixen Vacuum Products 98 avenue de Brogny 74009 Annecy France
Manufacturing Location	Annecy, France
Document Number:	101507523MPK-001
Model:	Multi-Stage Roots Pump, Models A124, A204, A604, A804, A1204, A1504, A1804 and A2404
Investigated in accordance with:	SEMI S2-0712 / SEMI S8-0712

Intertek

Global Semiconductor Safety Services

Certificate of conformance to SEMI



Certificate of Conformance
Salus Engineering International
Has Found The Pfeiffer Vacuum
Vacuum Dry Pump A3004

to be in Conformance with the Requirements of
SEMI® S2-1016 as Configured and Assessed in
Report Number: 6591-OE-AS1

A handwritten signature in black ink, appearing to read "Chris Evanston", is positioned above the name "Chris Evanston, PE".

Chris Evanston, PE

Date: April 13th, 2018

Serial Number: AS0276

Reference Standards and Guidelines:

SEMI S1-0708 "Safety Guideline for Visual Hazard Alerts".
SEMI S6-0707 "Environmental, Health, and Safety Guideline for Exhaust Ventilation of Semiconductor Manufacturing Equipment"
SEMI S8-1116 "Safety Guideline For Ergonomics/Human Factors Engineering or Semiconductor Manufacturing Equipment".
SEMI S10-0815, "Safety Guideline for Risk Assessment."
SEMI S12-0211, "Guideline for Equipment Decontamination".

SEMI S13-0113 "Safety Guideline for Operation and Maintenance Manuals Used with Semiconductor Manufacturing Equipment".
SEMI S14-1016 "Safety Guidelines for Fire Risk Assessment and Mitigation for Semiconductor Manufacturing Equipment".
SEMI S22-0715 "Safety Guideline for the Electrical Design of Semiconductor Manufacturing Equipment"
ANSI Z535.4-2007 "Product Safety Signs and Labels".
NFPA 79: "Electrical Standard for Industrial Machinery".

National Electric Code: (NFPA 70)
UL 508: "The Standard for Safety of Industrial Control Equipment".
UL 1262: "The Standard for Safety of Laboratory Equipment", third edition.
2015 TLVs and PELs, "American Conference of Governmental Industrial Hygienists".
29 CFR 1910, Occupational Safety and Health Standards
ANSI/RIA 15.06-1999 "American National Standard for Industrial Robots and Robot Systems – Safety Requirements".

Salus Engineering International Certificate No: 0633

Report No. 6591-OE-AJ1



Declaration of conformity

We hereby declare that the product cited below satisfies all relevant provisions according to the following **EC 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 technical file is drawn up by Mr Frédéric ROUYEYRE, Pfeiffer Vacuum SAS, [simplified joint stock company], 98, avenue de Brogny · B.P. 2069, 74009 Annecy cedex.

**A 124H / A 204H / A 604H / A 804H / A 1204H / A 1504H / A 1804H / A 2404H /
A 2504 H / A3004 H
A 204X / A 804X / A 1504X / A 1804X / A 2404X / A2504 X / A 3004 X**

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

Standard NF EN-61000-6-2: 2016
Standard NF EN-61010: 2011
Standard NF EN-61000-6-4 : 2016
Standard NF EN-60204-A1: 2009
Standard NF EN-1012-2: 2009

Signature:

Pfeiffer Vacuum SAS
98, avenue de Brogny
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74009 Annecy cedex
France

(Guillaume Kreziak)
Director of Products, Technology & Projects

03/01/18

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