



OPERATING INSTRUCTIONS

EN

Translation of the Original

A 2504 - A 3004

Multi-stage Roots pump for harsh applications

PFEIFFER  **VACUUM**

Disclaimer of liability

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

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

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

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1 About this manual



IMPORTANT

Read carefully before use.

Keep the manual for future consultation.

1.1 Validity

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

1.1.1 Applicable documents

Document	Part number
Serial link operating instructions	122876
Vibration box operating instructions	128377
EC Declaration of Conformity	included with these operating instructions
UK Declaration of Conformity	included with these operating instructions
UL/CSA compliance (ETL mark)	included with these operating instructions
Certificate of conformity to SEMI	included with these operating instructions

1.1.2 Products concerned

This document applies to products with the following references, equipped with **V.3.04 software version and higher**:

Part Number	Description
F4 H b7cSSg6i01I0	Models for harsh applications
F4 X b7cSSg6i01I0	Models for corrosive applications
F4 N b7cSSg6i01I0	Models for very corrosive applications

Option	F4	a	b	7	c	S	S	g	6	i	0	1	I	0
Version	Harsh	H												
	Corrosive	X												
	Very corrosive	N												
Pump model	A 2504		J											
	A 3004		I											
Voltage	Low voltage 60 Hz							1						
	High voltage 60 Hz							6						
Exhaust	With check valve									1				
	With SEPM check valve									7				

"c" depend on the customer configuration.

Use the matrix to decode the product part numbers; not all combinations of options are available as products.

1.2 Target group

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

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

1.3 Conventions

1.3.1 Instructions in the text

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

Individual action step

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

- This is an individual action step.

Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

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

1.3.2 Pictographs

Pictographs used in the document indicate useful information.



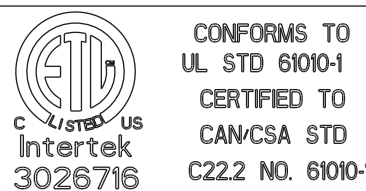
Note



Tip

1.3.3 Labels

I	Start								
O	Stop								
Power	Indicator light: pump power on								
Running	Indicator light: pump running								
Warning	Indicator light: warning present								
Alarm	Indicator light: alarm present								
HHR	Hand-Held Remote control connection								
WATER IN	Water circuit connection: inlet								
MAX PRESSURE 101 PSI (7 bar)	Maximum water circuit pressure								
WATER OUT	Water circuit connection: outlet								
NITROGEN	Nitrogen circuit connection								
EXHAUST	Pump exhaust circuit connection								
	CPC Earth connection								
200-230 V 380-480 V	This label indicates the mains voltage range of the installation the pump must be connected to								
THREE PHASES FOUR WIRES Full-Load current Ampere <table border="1"> <tr> <td>Volt</td><td>50/60 Hz</td></tr> <tr> <td>200-230 Δ</td><td></td></tr> <tr> <td>380-480 Y</td><td></td></tr> <tr> <td>Elec. Sch:</td><td></td></tr> </table>	Volt	50/60 Hz	200-230 Δ		380-480 Y		Elec. Sch:		This label indicates the full load current in relation to the mains voltage
Volt	50/60 Hz								
200-230 Δ									
380-480 Y									
Elec. Sch:									

 PFEIFFER VACUUM Made in France 98 avenue de Brogny F-74000 ANNECY 250 kg 200-230V SCCR:10kA 50/60Hz P/N : F4H1F1CSS16121112 Ind:- 2016 S/N : XYZXYSYSSZT 25A A604	Product rating plate (example)
 CONFORMS TO UL STD 61010-1 CERTIFIED TO CAN/CSA STD C22.2 NO. 61010-1	This label indicates that the pump is compliant with UL/CSA tests.

- 

WARNING
HOT SURFACE
Contact with pump bodies may cause burn.
Switch off and wait until pumps cooled before servicing.

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

WARNING
NOTICE
ROOTS PUMP SHIPPED WITHOUT OIL
DRY PUMP SHIPPED WITHOUT OIL
See Operating Instructions



This label informs users that the pumps must be filled with oil.
- 

WARNING
HEAVY OBJECT
Can cause muscle strain or back injury.
Use lifting aids and proper lifting techniques when removing or replacing.

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

WARNING
FLAMMABLE, CORROSIVE AND TOXIC
CHEMICALS LOCATED WITHIN THE ENCLOSURE
Exposure may result in severe injury or death.
Preventive maintenance must be done by trained personnel only.

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

WARNING
MOVING PARTS PRESENT
Moving parts can crush and cut.
Keep hands or feet away from moving parts.

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

WARNING
HAZARDOUS VOLTAGE
Switch off the pump and disconnect the main power cable before opening the power box cover.

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

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

This label indicates that the power supply must be switched off before connecting and/or disconnecting the pump.

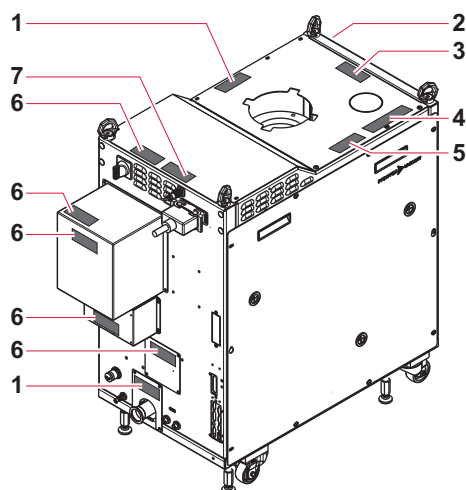


Fig. 1: Safety label locations

- | | |
|--------------------------|-------------------------|
| 1 Hot surface | 5 Moving parts |
| 2 Oil filling before use | 6 Electrical safety |
| 3 Heavy object | 7 Electric shock hazard |
| 4 Toxic substances | |

1.3.4 Abbreviations

BF/FB	Functional Block
HP	High pressure
BP/LP	Low pressure
FC	Frequency converter
IN	Inlet flange
EMS	Emergency stop
Exh.	Exhaust
HHR	Hand Held Remote
LEL	Lower Explosive Limit

[XXXX] The HHR remote control unit menus and settings are shown in bold between square brackets.

For example: **[DEFINITION] [LANGUAGE]** to select the display language.

2 Safety

2.1 General safety information

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

DANGER

Immediately pending danger

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

- ▶ Instructions to avoid the danger situation

WARNING

Potential pending danger

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

- ▶ Instructions to avoid the danger situation

CAUTION

Potential pending danger

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

- ▶ Instructions to avoid the danger situation

NOTICE

Danger of damage to property

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

- ▶ Instructions to avoid damage to property



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

2.2 Safety instructions

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

WARNING

Risk of crushing when the product is slung

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

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

WARNING

Risk of crushing when the pump is moved by hand on its casters

The kinetic energy generated by moving the pump can cause serious crushing injuries.

- ▶ **Always use a forklift truck when moving the pump over long distances, and never do it by hand.**
- ▶ Immobilize the pump by resting it on its feet when in position.

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

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

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

⚠ WARNING**Risk of electric shock in case of contact during a stop due to a fault or an emergency stop**

When the product is stopped unexpectedly due to a fault or an emergency stop, certain components located between the electrical connector and the breaker remain under power.

- ▶ Take care to ensure that the mains connection is always visible and accessible so that the pump can be disconnected at any time.

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

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

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

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

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

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

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

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

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

⚠ WARNING**Risk of burns in case of contact with hot surfaces**

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

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

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

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

- ▶ Apply the relevant safety instructions in accordance with local regulation. This information is available from the operator's safety department.
- ▶ **The pump exhaust must be connected** to the installation's dangerous gases extraction system.
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

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

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

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

2.3 Safety instructions relating to flammable/pyrophoric materials

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

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

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

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

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

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

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

The following general safety recommendations must be applied:

- ▶ Ensure that the entire installation is airtight, not just the dry pump.
- ▶ Do not allow oxidizing agents (air, other gases, etc.) to mix with flammable/pyrophoric gases ¹⁾

- ▶ Ensure that the oxidizing agent concentration does not exceed 60% of the maximum permissible concentration of the oxidizing agent gas (MOC) ²⁾, mainly when the dilution is not sufficiently high to reach 25% of the LEL.
- ▶ Perform a nitrogen gas purge prior to carrying out maintenance on the pumping line (inlet line, pump and exhaust lines).
- ▶ Regularly clean away reactive by-products such as silicon dust from the exhaust line to prevent clogging and/or explosion.
- ▶ If the dilution device is faulty, connect the equipment and process the 'purge flow fault' and 'pump fault' signals to stop the process gases.

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

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

2.4 Precautions



Duty to provide information on potential dangers

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

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



Infringement of conformity due to modifications to the product

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

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

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

- ▶ Do not expose any part of the human body to the vacuum.
- ▶ Follow the safety and accident prevention requirements.
- ▶ Regularly check compliance with all precautionary measures.
- ▶ Provide the operator with personal protective equipment (s) (PPE): personal protective equipment must be used in accordance with the manufacturer's instructions.
- ▶ 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 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.

2.5 Intended use

- The vacuum pump should only be used to generate a vacuum while pumping gases.
- The vacuum pump is designed to operate in industrial environments.

XN version products are classified as dual-use goods [Category 2B350i, according to EC regulation 428/2009]. They may be subject to specific regulations in the case of international transport. Refer to the applicable rules.

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

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

2.6 Foreseeable misuse

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

- Pumping reactive fluids
- Pumping liquids
- Pumping dust particles
- Using the vacuum pump to generate pressure
- Using the pump in potentially explosive areas
- Using accessories or spare parts not mentioned in these operating instructions

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

3 Transportation and Storage

3.1 Receipt of the product



Condition of the delivery

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

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



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

3.2 Handling the pump

WARNING

Risk of crushing when the product is slung

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

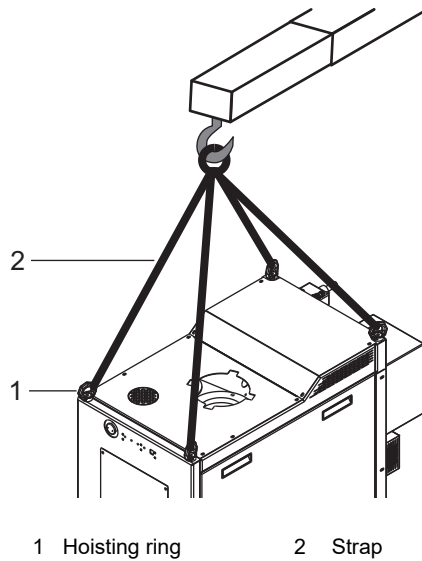
- ▶ Only qualified staff trained in handling heavy objects are authorized to handle the product.
- ▶ The lifting devices provided **must be used** and the procedures set out in this document must be followed.

WARNING

Risk of crushing related to product tilting

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

- ▶ Do not place the product on a slope: because of its weight, it will drag the operator with it.
- ▶ Only use the casters for moving the equipment over short distances.
- ▶ Place it on a flat, hard floor.
- ▶ Do not push the product sideways.
- ▶ To use the product, place it on its feet so that it no longer rests on its casters.
- ▶ Where necessary, install the seismic brackets when fixing the product to the floor.



Handling the pump using a hoist

When handling the pump, **a lifting device appropriate for the weight of the product must be used.** The weight and center of gravity vary according to model ([see chapter “Technical characteristics”, page 85](#)) and ([see page 89](#)).

1. With the strap, lift the pump using the hoisting rings.
2. Immobilize the pump on the installation ([see chapter “Installation”, page 22](#)).

Using the casters

The casters are **only** intended for moving the pump over short distances so that its position on the installation can be adjusted.

1. Retract the frame feet so that the 4 casters come into contact with the floor.
2. Move the pump to position it on the installation.
3. Immobilize the pump on the installation ([see chapter “Installation”, page 22](#)).

3.3 Storage

NOTICE

Damage to internal parts in a humid atmosphere

The internal parts may be damaged if moisture is allowed to enter the pump. Pumps are supplied pressurized with nitrogen and sealed with blanking plates.

- ▶ The pump inlet, exhaust and purge blanking plates must be kept in place until the pump is installed.
- ▶ Only remove the blanking plates when the pump is connected to the pumping line.

Storing a new pump

- ▶ Keep the pump wrapped in its protective envelope.
- ▶ The inlet and exhaust blanking plates **must** always be left in place because the pump is pressurized with Nitrogen.
- ▶ Store the pump for up to 1 year, according to the permitted storage temperatures ([see chapter “Environmental conditions”](#)).

If the inlet and exhaust blanking plates have been removed, the internal parts may be at risk of corrosion. In such cases:

1. Pressurize the pump with nitrogen in accordance with the following procedure.
2. Store the pump for up to 1 year in a clean and dry area, at ambient temperature ([see chapter “Environmental Conditions”](#)).



When a new pump has been stored for more than 1 year, contact our service center before starting the pump.

Pressurizing with nitrogen

To pressurize the pump, you will need a nitrogen supply with the required characteristics (see chapter "Nitrogen characteristics") and the blanking plates provided with the product or obtainable as accessories.

1. Seal the pump inlet with the airtight accessories.
2. Connect the nitrogen supply to the gas connector located on the inlet blanking plate.
3. Pressurize the pump with nitrogen to a relative pressure of 200 hPa.
4. When nitrogen starts flowing from the exhaust, seal it with the accessories provided.
5. Disconnect the nitrogen supply from the connector.

Never store a pump that has been used! Return it to the service center (see chapter "Service solutions by Pfeiffer Vacuum", page 82).

4 Product description

4.1 Product identification

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

4.1.1 Scope of delivery

- 1 vacuum pump
- 1 cover plug for the emergency stop connector
- 2 water connectors
- 1 nitrogen connector
- 1 electrical connector
- 1 hand-held remote control (HHR) + cable
- 1 set of operating instructions
- Oil can(s)

4.1.2 The product versions

The pump manufacturer has developed a range of **4 series** dry pumps that are purpose-built for the harshest processes used in the semi-conductor industry. They include a primary dry backing pump and a Roots pump on certain models.

Several models are available as:

- **H** versions (harsh applications): **A 2504H, A 3004H.**
- **X** versions (corrosive applications): **A 2504X, A 3004X.**
- **XN** versions (very corrosive applications): **A 2504XN, A 3004XN.**

These pumps are characterized by their resistance to corrosion, their robustness, their high inlet flow capability, and their optimized heat profile management.

Please contact us for more detailed information on specific applications.

The options

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

- Temperature management
 - **STD (STanDard)**: for most applications.
 - **EHT (Extended High Temperature)**: for any application requiring a high temperature, of the pump and gases, to avoid any condensation in the pump.
 - **ELT (Extended Low Temperature)**: for any application requiring the lowest possible temperature, of the pump and the gases, to avoid any deposit in the pump.
- SEPM (Silencer Exhaust Pressure Measurement)
- SEMI
- IHN (Internal Hot Nitrogen)
- V-Box

4.2 The Human/Machine Interface

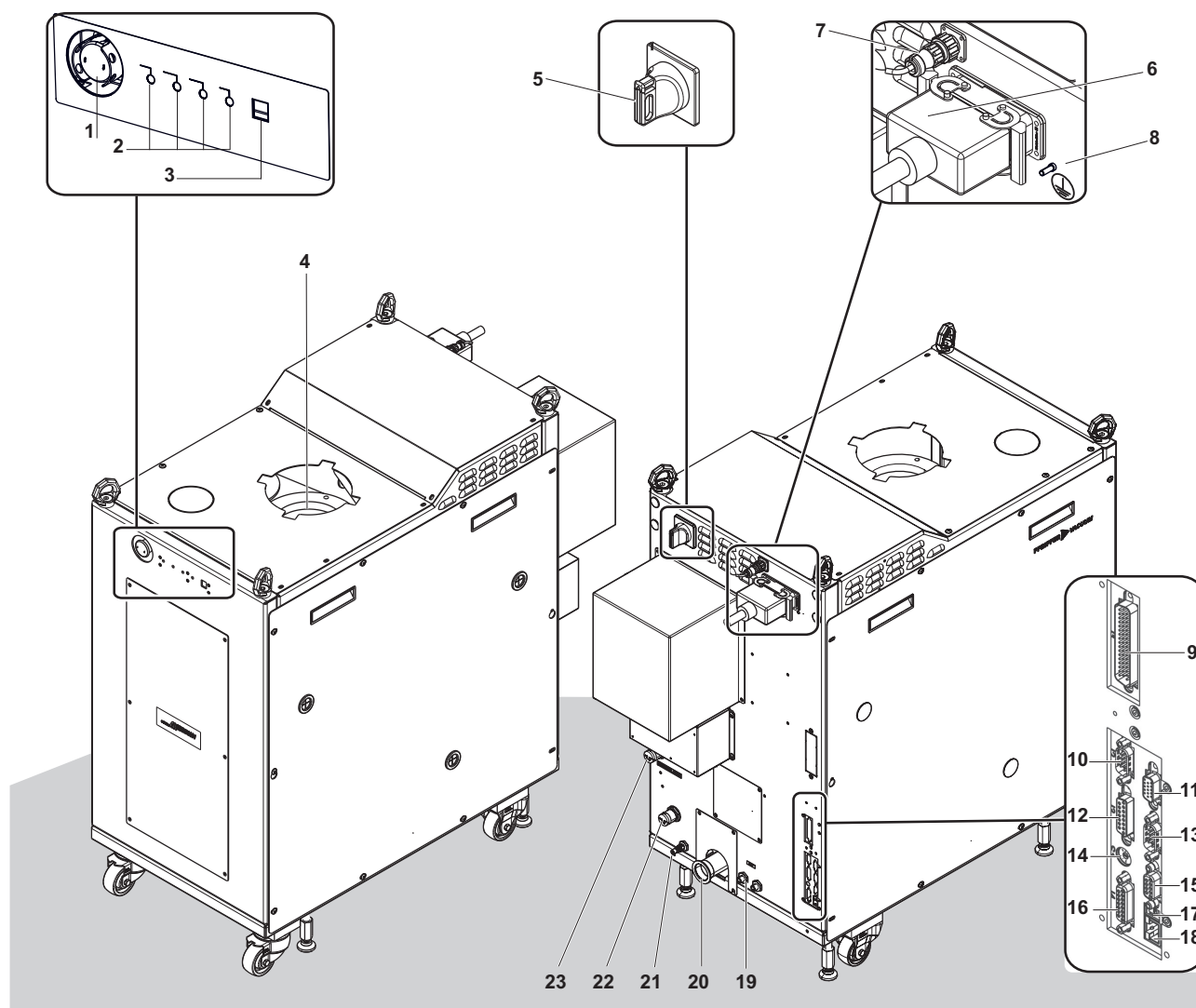


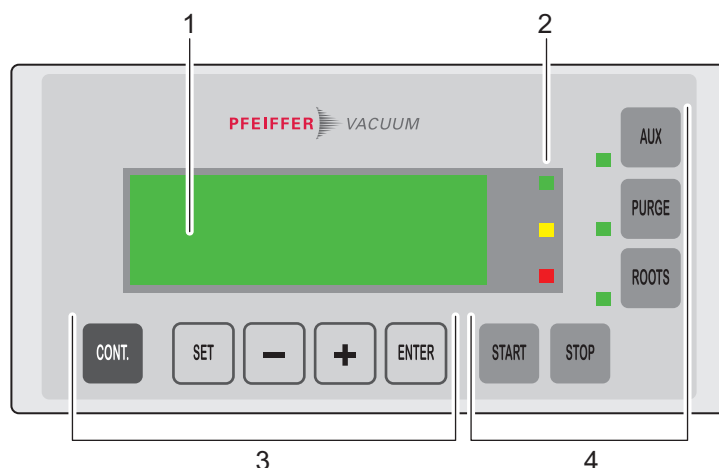
Fig. 2: Pump model description

- | | |
|---|--|
| 1 Emergency stop button | 13 RS-232/RS-485 serial link connector (J6) |
| 2 Indicator lights | 14 Coding wheel (S1) |
| 3 Hand-Held Remote control unit connector (HHR) | 15 RS-485 serial link connector (J7) |
| 4 Inlet flange | 16 Isolation valve connector (J4) |
| 5 Main switch | 17 Configuration switch (S2) |
| 6 Mains power supply | 18 Hand-Held Remote control connector (J8) |
| 7 Emergency stop connector (EMS) | 19 Water circuit input/output (Water IN/Water OUT) |
| 8 CPC Earth | 20 Exhaust flange (EXHAUST) |
| 9 REMOTE connector (J1) | 21 Nitrogen circuit inlet (NITROGEN) |
| 10 RS-232 serial link connector (J2) | 22 Nitrogen pressure regulator |
| 11 Roots 2 connector (J5) | 23 IHN pressure regulator (option) |
| 12 User connector (J3) | |

4.3 Hand-Held Remote control (HHR)

When connected to the pump, the HHR can be used to display and configure the settings.

4.3.1 Description of the front of the HHR remote control unit



- 1 Display
 2 Green indicator light: pump running
 Yellow indicator light: warning present
 Red indicator light: alarm present
 3 Parameter selection keys
 4 Manual control keys

Key	Functions	Key	Functions
CONT.	Used to take over pump control with the HHR remote control unit	ROOTS	Used to start/stop the Roots in local mode when [DEFINITION][ROOTS CMD] is [ENABLED]. The indicator is lit when the Roots is running.
SET	- Used to access configuration mode - Used to exit menus without confirming the functions	PURGE	Used to start/stop the purge in local mode when [DEFINITION][PURGE CMD] is [ENABLED]. Purge operation is described in the chapter "The nitrogen injection system". The indicator is lit when the purge is running.
+ -	- Used to move to the next or previous menu or setting in the menu displayed - Select or adjust the setting value	START STOP	Used to start/stop the pump in local mode [DEFINITION][CONTROL MODE][HHR].
ENTER	- Used to confirm a menu, setting or value selection - Used to confirm a question response	AUX	Used to open/close a valve connected to J4 when [DEFINITION][INLET VALVE] is [MANUAL INLET]. Valve operation is described in the chapter "Management of an inlet isolation valve". The indicator is lit when the valve is open.

NOTICE

Risk of damage to the keypad

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

- Always use your hands to operate the keypad.

4.3.2 Description of the display

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

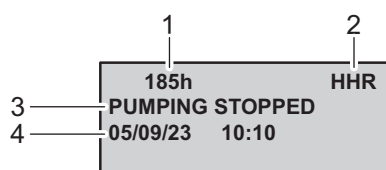


Fig. 3: The 'Power On' screen

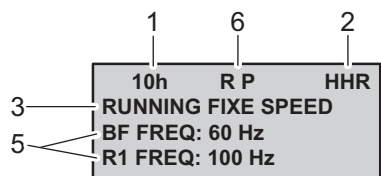


Fig. 4: The ‘Pumping enabled’ screen

1	Running time	4	Date and time
2	Control mode	5	Monitored parameters
3	Operating status/faults	6	Option(s) enabled on the pump • Roots control enabled: R • Purge control enabled: P • IHN control enabled: H • Stand-by purge control enabled: S • Inlet valve under manual control: I

5 Installation

5.1 Installation

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

1. Determine where the pump will be located.
2. Use the recommended lifting devices when handling the pump (see chapter "Handling the pump").
3. Move the pump into position and adjust the height of the four feet.
4. Use a spirit level to check that the pump is perfectly horizontal.

⚠ CAUTION

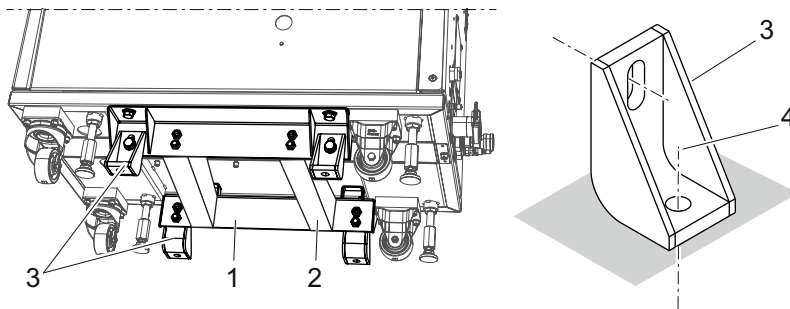
Risk of falling due to poorly-secured cables or pipework

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

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

5.2 Installing the pump in a seismic environment

To install the pump in a seismic region, it must be anchored to the floor with seismic brackets (see chapter "Accessories"). It is up to the customer to provide the appropriate bolts for fixing the pump to the floor such that the loads are evenly distributed through the feet and the type of floor is properly taken into account (see chapter "Weight distribution and center of gravity").



- | | |
|-------------------------------|---|
| 1 Support (qty 2) | 3 Fixing bracket (qty 4) |
| 2 Traverse de renfort (qty 2) | 4 Location of the fixing accessories (supplied by the customer) |

Installing the brackets

Move the pump into its operating position.

1. Fit the brackets under the frame and secure using the bolts and washers provided.
 - Torque down the bolts to 62 N·m.
2. Install the reinforcing rails between the brackets, secure them using screws and washers provided.
 - Torque down the screws to 62 N·m.
3. Position the fixing brackets over the supports and fix in place using the bolts and washers provided.
 - Place the brackets on the floor.
 - Torque down the bolts to 62 N·m.
4. Secure the fixing brackets to the floor.

5.3 Filling with oil

NOTICE

The product may be damaged if an unauthorized operating fluid is used

The pumps are tested at the factory using Pfeiffer Vacuum oil. Using any other oil may adversely affect the pump and its performance.

- It is **essential** that the oil recommended by the manufacturer is used.

Model	A113 oil quantity (litre)			
	FB	Roots housing gear side	Roots housing motor side	Total quantity
A 2504	0.28	0.55	0.38	1.21
A 3004				

Tbl. 1: Oil capacity per housing

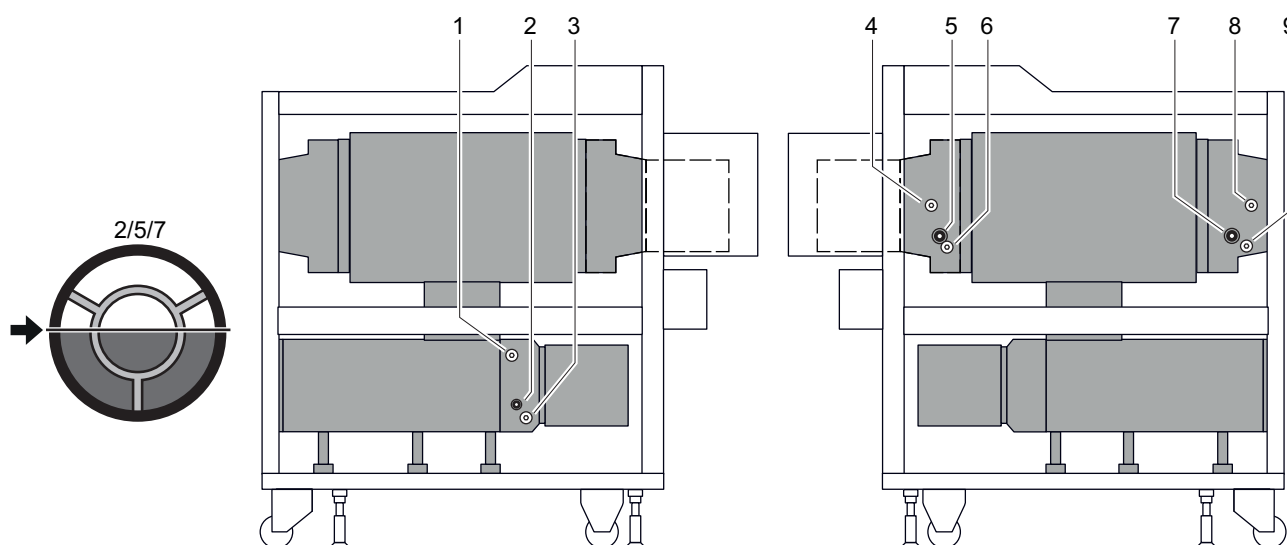


Fig. 5: Locations of the filling openings and sight glasses

- | | |
|--------------------------------|--------------------------------|
| 1 FB fill plug | 6 Roots motor side drain plug |
| 2 FB sight glass | 7 Roots gears side sight glass |
| 3 FB drain plug | 8 Roots gears side fill plug |
| 4 Roots motor side fill plug | 9 Roots gears side drain plug |
| 5 Roots motor side sight glass | |

⚠ DANGER

Risk of poisoning in case of contact with the operating fluid

There is a potential poisoning danger if the operating fluid comes into contact with the skin or the vapor is inhaled.

- Wear protective gear such as gloves, glasses and a mask when handling the oil.



Safety data sheets

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

Oil filling precautions

1. **Make sure that the pump is stopped** (main switch set to position **O**) and that **the power cable has been disconnected**.
2. **Make sure that the pump is in the horizontal position.**

Filling the oil housings

On certain models, the pumps may have several housings. A funnel with a flexible tube should be used to make filling easier. Proceed as follows **for each housing**:

1. Remove the side covers.
2. Remove the fill plug.
3. Put the funnel in the filling opening.
4. Fill the pump with oil **with the quantities indicated** in the above table.
 - **The oil level must be at the mid-point of the sight glass**; to obtain an accurate reading, wait a few minutes for the oil to trickle down the internal surfaces.
5. If necessary, adjust the oil level so that it is on the mark.
6. Replace the fill plug.

5.4 Connecting the water circuit

WARNING

Risk of injury in case of contact with pressurized water

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

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

NOTICE

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

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

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

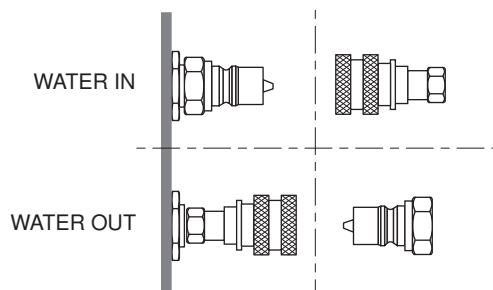
- ▶ Connect the water cooling circuit to a regulated water supply.
- ▶ Take appropriate measures to prevent the growth of such micro-organisms.



The effect of cooling continuity on the process

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

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



Connecting the water circuit

Water connectors specified on the order will be packaged separately. Other connectors are available as accessories.

1. Connect the water pipes to the connectors:
 - Water inlet = female connector
 - Water outlet = male connector
2. Connect the pipework to the pump's **WATER IN** and **WATER OUT** connectors.
3. Check that there are no leaks in the water circuit or the water circuit connections.

5.5 Connection to the nitrogen circuit

DANGER

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

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

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

WARNING

Risk of injury in case of contact with pressurized nitrogen

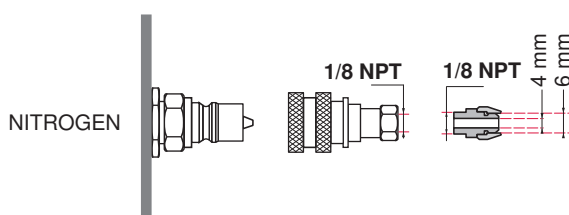
The product uses pressurized nitrogen as a flushing gas. Non-compliant installations or installations not done to professional standards may endanger the user's life.

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



The effect of nitrogen injection continuity on the process

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



Nitrogen circuit connection

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

The nitrogen connector is packaged separately and is designed to be connected to 6 mm OD/4 mm ID tubing (to be supplied by the customer).

1. Connect the nitrogen pipework to the connector provided.
2. Connect it to the pump's **NITROGEN** connector.

NOTICE**Risk of damage to the pump if purge flow pressure is too high**

A sudden influx of nitrogen into the purge flow can damage the internal parts of the pump.

- ▶ Close the pressure regulator **by turning the knob anti-clockwise** before pressurizing the nitrogen circuit.

Adjusting the nitrogen flow

1. Use the pressure regulator to adjust the nitrogen flow to suit the process in hand.
2. Check the flow on the HHR display.
 - The displayed value is guaranteed up to 120 slm. Beyond that, it is an indicative value.

5.6 Connecting to the pumping line

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

Users and/or product integrators are ultimately responsible for the equipment and must apply the specific safety instructions, in accordance with local regulation ([see chapter “Safety instructions relating to flammable/pyrophoric materials”, page 12](#)).

⚠ DANGER**Danger of death by fire when pumping flammable gases**

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

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

⚠ DANGER**Danger of death by explosion when pumping pyrophoric/flammable materials mixed with oxidizing agents or reagents**

Mixing pyrophoric/flammable materials with oxidizing agents or reagents generates reaction by-products that can build up in the pump and cause an explosion.

- ▶ Use exhaust gas extraction device monitoring to ensure that gas flow to the pump is stopped if the extraction system fails.

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

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

- ▶ Apply the relevant safety instructions in accordance with local regulation. This information is available from the operator's safety department.
- ▶ **The pump exhaust must be connected** to the installation's dangerous gases extraction system.
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

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

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

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

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

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

1. Only use accessories on the inlet and exhaust lines with materials and sealing properties that are compatible with the gases being pumped. Refer to the connection accessories catalog available at the [Pfeiffer-Vacuum](https://www.pfeiffer-vacuum.com) website.
2. When assembling the pumping line, include accessories for isolating the pump from the pumping line and making maintenance easier to carry out (pump inlet and exhaust isolation valves, purge valves, etc.).
3. The O-rings located under the blanking plates are not compatible with all applications. **Product users or integrators are responsible for installing O-rings that are compatible with their applications.**
4. Remove the blanking plates used to seal the inlet and exhaust ports.
5. Keep the blanking plates, screws and washers for reuse when transporting the pump.
6. Ensure that no screws, washers or other objects are dropped into the pump inlet.
7. Fit flexible tubes in the pumping line to reduce the transmission of vibration.
8. Perform a leak test on the entire pumping line after installation.

Pump inlet connection

- To achieve the optimum pumping speed, make the pumping line **as short and straight as possible and ensure that its inside diameter is not narrower than the pump inlet flange inside diameter.**
- Do not apply the weight of the pumping line on the inlet flange of the pump.
- If necessary, install an isolation valve (available as an accessory).



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

Pump exhaust connection

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



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

5.7 Cover venting

The cover is equipped with a device for venting the interior of the cover to extract any gas present towards an extraction system.

The device comprises a nozzle and a differential pressure sensor.

The gas extraction system must be capable of delivering of minimum flow so that a differential pressure can be generated (see chapter "SEMI pump configuration option", page 48).

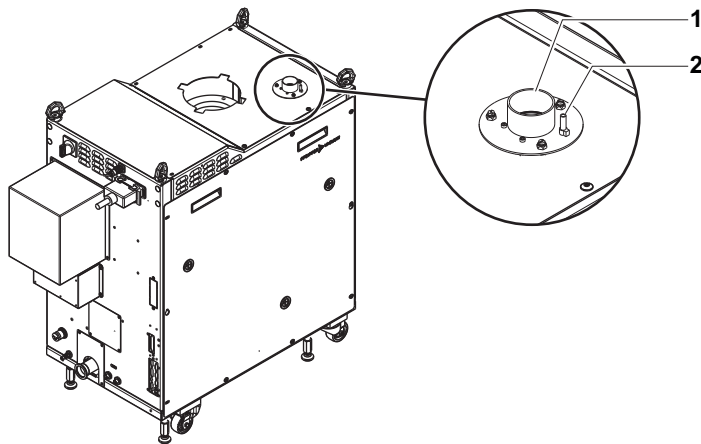


Fig. 6: Cover venting system

- | | |
|---------------------------|--------------------------------|
| 1 Nozzle (diameter 50 mm) | 2 Differential pressure sensor |
|---------------------------|--------------------------------|

To ensure proper cover venting, an exhaust box must be connected to the user's installation.

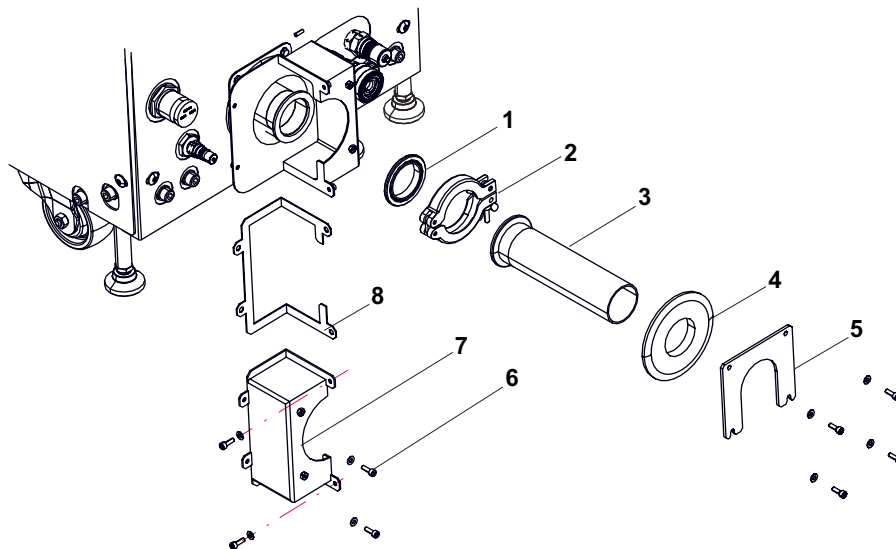


Fig. 7: Exhaust box connection

- | | |
|---------------------------|---------------------------|
| 1 Equipped centering ring | 5 Plate |
| 2 Quick-connect clamp | 6 M4 x 12 FHC screws (x8) |
| 3 Pipework | 7 Exhaust box half (x2) |
| 4 Ring | 8 Seal |

Connecting the exhaust box to the installation exhaust line

1. Undo the 8 screws.
2. Remove the box half and gasket, the centering ring and the plate.
3. Fit the ring to the pipework.
4. Connect the pipe to the pump exhaust port using the equipped centering ring and the quick connect clamp.
5. Fit the seal and box half and secure with the 4 screws.
6. Install the ring between the exhaust box and the plate using the 4 screws.

5.8 Check that the installation is leak tight

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

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

5.9 Electrical connection

WARNING

Risk of electric shock due to non-compliant electrical installations

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

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

WARNING

Danger of electrocution by contact during maintenance or overhaul

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

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

NOTICE

Risk of electromagnetic disturbance

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

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

Electrical safety

The pump motor is protected against overload by electromechanical-component circuit breakers.

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

When tripped, these breakers cut the electrical power and put the pump into a safe condition. To reset the breakers:

1. eliminate the cause of the fault, then
2. switch off the main power (main switch at position **O**),
3. open the electrical cabinet,
4. reset the breakers,
5. close the electrical cabinet.

5.9.1 Customer electrical installation protection measures

Circuit breaker protection

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

Differential circuit breaker

To protect individuals against insulation faults, you must install a differential circuit breaker (see chapter "Electrical characteristics"). If needed, contact our service center. The applicable local regulations must be complied with at all times.

Earthing

Users must provide a second circuit protective conductor (earth) whose cross-section is at least equal to that of the conductors.

The IEC 60417 #5019  symbol is marked on the rear panel to indicate where the CPC earth terminal is located.

- Connect the earth stud to a suitable installation earthing point such as the host system frame.

5.9.2 Connecting the emergency stop button

The pump is fitted with an EMS emergency stop system comprising an emergency stop button at the front and an EMS connector at the rear. When actuated, either of these will cut off the control circuit and stop the pump. The emergency stop uses electromechanical components; resetting the system does not restart the pump.

The pump is delivered with a cover plug **that must be installed for the pump to work**.

- Before powering on, connect the cover plug to the EMS connector.

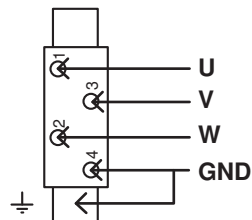
To integrate the pump into the equipment's emergency stop circuit, the EMS connector at the rear of the pump must be wired in ([see chapter "Emergency stop command", page 65](#)).

SEMI S2 requirements (Emergency off)

To meet the requirements of the SEMI S2 standard, customers must integrate the pump into the equipment's emergency stop circuit.

- Use the pump's EMS contact to control the equipment's power shut off system (EMO) ([see chapter "Emergency stop command", page 65](#)).

5.9.3 Mains connection



The pump is supplied with a female electrical connector which mates with the pump's power socket and need to be wired up. The customer must supply the cable. Check that the cable is suitably protected against grounding faults and that the earth wire is longer than the three conductor wires (see chapter "Electrical characteristics").

1. Connect the power cable to the connector as shown in the above diagram.
2. Connect the connector to the pump's electric socket.
3. Lock the electrical connector in place.

5.10 First time use (Commissioning)

1. Always check before starting the pump that the oil levels in the housings are at the mid-point of sight glasses.
 - **This check should be done when the pump is stopped.**
2. Check that the inlet and exhaust flanges have been properly connected to the pumping line.

5.10.1 Powering on



Fig. 8: The 'Power On' screen

1. Connect the HHR remote control unit.
2. Set the pump main switch to position **I**.
 - The white **Power** indicator comes on and the HHR displays the pump status.
3. Use the HHR remote control unit to take control of the pump with the **CONT.** key.
 - HHR flashes on the display.

5.10.2 Direction of rotation check at first pump start up

Direction of rotation OK

1. Start the pump by pressing **START** and confirming with **ENTER**:
 - The pump starts and PUMPING is displayed.
2. Stop the pump by pressing **STOP** and confirming with **ENTER**.

Direction of rotation Not OK

1. Start the pump by pressing **START** and confirming with **ENTER**:
 - The pump fails to start and the D19 UVW INVERTED message is displayed: there is a wiring problem.
2. Stop the pump by pressing **STOP** and confirming with **ENTER**.
3. Switch off the pump by setting the main switch to position **O**.
 - The white **Power** indicator goes out.
4. Unplug the power cable.
5. Invert two of the phases at the pump electrical connector.



WARNING

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

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

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

5.10.3 HHR remote control unit factory configuration

To ensure correct monitoring of the equipment, fault management and data saving, the commissioning time and date of the machine must be updated. This operation should be carried out at commissioning time with the pump powered on.

Updating the remote control unit clock

1. Press the **SET** key to enter the menu.
2. Enter the factory access code: initially 0.
3. Set the date and time in the corresponding menu.
4. Return to the main menu by pressing **SET**.

6 Operation

6.1 Preliminary precautions for use

WARNING

Risk of serious injury due to non-compliance with recommendations for use

If the recommendations for use are not followed, the protection of people and product security are impaired: there is a risk of serious injury or death.

- ▶ Respect the instructions for installing and using the product described in this manual.

WARNING

Risk of poisoning when process gases are present in the atmosphere

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

- ▶ Apply the relevant safety instructions in accordance with local regulation. This information is available from the operator's safety department.
- ▶ **The pump exhaust must be connected** to the installation's dangerous gases extraction system.
- ▶ Regularly check that there are no leaks where the pump connects to the exhaust pipework.

Pumping pyrophoric or flammable gases may be hazardous. Users and/or integrators must comply with the safety instructions (see chapter "Safety instructions relating to flammable/pyrophoric materials", page 12). Every time the pump is commissioned:

1. Check that the pump inlet is connected to the pumping line.
2. Check that the oil housing levels are at the mid-point of the sight glasses.
3. Start the water and nitrogen circuits.
4. Switch on the customer's electrical installation main switch.
5. Check that the exhaust pipework is not clogged and that all the extraction system valves are open.
6. Make sure that the emergency stop EMS connector cover plug is in place or that it is wired into the equipment's emergency stop installation.



The factory settings

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

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

NOTICE

Risk of pump seizure

Application processes require settings to evacuate generated gases. Without these settings, pumping conditions are degraded and the pump is damaged.

- ▶ Wait until the pump has reached its regulation temperature and full speed before pumping on the application.

6.2 Starting the pump



Instruction conventions used in this chapter

The following steps describe local mode operation with the HHR remote control unit controlling the pump.

- From the **[DEFINITION]** menu, set the **[CONTROL MODE]** to **[HHR]**.

Other control modes: for wiring and for configuration (see chapter “Interfaces for control”, page 50).

6.2.1 Powering on



Fig. 9: The 'Power On' screen

1. Connect the HHR remote control unit.
2. Set the pump main switch to position **I**.
 - The white **Power** indicator comes on and the HHR displays the pump status.
3. Use the HHR remote control unit to take control of the pump with the **CONT.** key.
 - HHR flashes on the display.

6.2.2 Pumping start-up

When pumping start is actuated, monitoring automatically carries out the following operations:

- The FB pump is started.
- The purge valve is opened.
- The Roots is started.
- The inlet valve is opened if the pump is fitted with the relevant accessory and it is so configured.

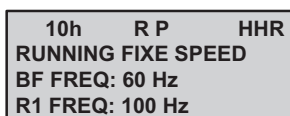


Fig. 10: The 'Pumping enabled' screen

1. Press **START** and confirm with **ENTER**.
 - The pump starts running and the green **Running** indicator light comes on. The operating parameters are displayed.
2. Press **+** or **-** to scroll through the operating parameters.

6.2.3 Auto-restart configuration

DANGER

Risk of injury if the pump is configured to restart automatically

If the pump has been configured to restart automatically after a power failure, the pump will restart automatically when the power supply is restored; any risks arising from these settings are the customer's responsibility.

- You must put the necessary measures in place to make this potentially hazardous mode of operation safe.

To prevent uncontrolled restarts from occurring, automatic restarting is disabled in the factory settings.

6.2.4 Restarting the pump after an emergency stop

To restart the pump after an emergency stop, you must:

1. Correct the problem.
2. Release the emergency stop button.
3. Set the pump main switch to position **O**, then to position **I**.
4. Start the pump by pressing **START** and confirming with **ENTER**.

6.2.5 Roots control (Option)

To start and stop the Roots pump when the FB is operating, the **ROOTS** key on the remote control unit must be enabled.

- Set **[ROOTS CMD]** to **[ENABLED]** when the pump is stopped.

This enables the Roots Start/Stop command using the **ROOTS** key if the **[CONTROL MODE]** is set to **[HHR]**, or using the **J1-S3** switch if the **[CONTROL MODE]** is set to **[REMOTE]**.

6.3 Shutting down the pump

6.3.1 Pumping shutdown

When the pumping shutdown command is sent, monitoring automatically carries out the following operations:

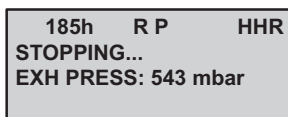
- The inlet valve is closed if the pump is fitted with the relevant accessory and it is so configured.
- The (FB and Roots) pump is stopped.
- Nitrogen is injected during the stopping phase if **[PURGE PROLONG]** is configured (0 to 120 min) (see chapter "Purge prolongation", page 38).

WARNING

Risk of burns in case of contact with hot surfaces

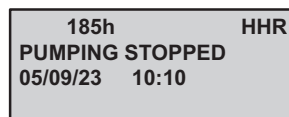
If the STOPPING... message is shown on the display, do not work on the pump.

1. Wait for the PUMPING STOPPED message to appear.
2. Power off the pump.
3. Wait for the pump to cool down.



Stopping...

Do not work on the pump.



Pumping stopped

The pump can be worked on once it has been powered off.

1. Press **STOP** and confirm with **ENTER**.
 - The STOPPING... message appears on the HHR display.
2. Wait for the PUMPING STOPPED message to be displayed before working on the pump. This message will appear on the HHR display:
 - when the prolonged purge time has elapsed or exhaust pressure > 1500 hPa,
 - and the pump has cooled down.

Forced pump shutdown

The pump can be forced to shut down to reduce stopping time: prolonged purge gas injection is interrupted and the temperature data is ignored.

Caution! Risk of injury due to contact with hot surfaces.

- Press **STOP** twice and confirm with **ENTER**.

6.3.2 Powering off

- Power off the pump by setting the main switch to position **O**:
 - The white **Power** indicator goes out.

6.3.3 Emergency stop

WARNING

Risk of injury due to the presence of energy during an emergency stop

The pump is not isolated electrically when an emergency stop is actuated: certain components stay charged and the water and nitrogen circuits are still fed and pressurized.

- Before working on the product, disconnect it from all sources of energy: the electricity supply, the water circuit and the nitrogen (purge gas) circuit.

- Push the **EMS** emergency stop button on the front panel of the pump.

The emergency stop can also be triggered if the EMS connector at the rear of the pump is connected to the equipment (see chapter “Emergency stop command”, page 65).

6.3.4 Prolonged stoppage

If the unit is to be shut down for a prolonged length of time, follow the relevant procedure (see chapter “Shutting down for longer periods”).

6.4 Using two remote control units

Two remote control units can be connected to the pump at the same time using the **HHR** connector on the front panel and the **J8** connector at the rear. The data and operating parameters can be read on both remote control units, whether they are controlling the pump or not. Only one remote control unit can take control of the pump at any given time.

1. Press the **CONT.** key on the remote control unit to take control.
 - HHR starts to blink in the top right-hand corner of the display. The pump cannot now be controlled by the other remote control unit.
2. To release control, press the **CONT** key again.

6.5 Operation monitoring

When a problem occurs, the user is warned by:

- The relevant indicator light coming on: yellow for warnings, red for alarms.
- An audible warning (if enabled).
- The fault contacts on the remote connector being actuated.
- The fault message being displayed on the HHR remote control unit.
- A message via the RS-232 or RS-485 serial link.

The fault messages are listed in table form (see chapter “Malfunctions”, page 73).

NOTICE

Overpressure in the exhaust line

The pump is equipped with an exhaust pressure sensor that monitors the pressure at the functional block exhaust, but **not** in the exhaust line. Users must:

- Monitor the installation to make sure there is no overpressure in the exhaust line.

6.6 Saving and downloading the product's configuration

At pump installation or replacement of a pump by a pump with the same configuration, it may be interesting to copy the configuration (set of all the parameters and operation setting programmed by the user) from a pump to another.

NOTICE

Risk of malfunction with the pump in operation

Loading and saving the parameters with the pump in operation may result in a software malfunction.

- Perform these operations when the pump is switched on but with pumping stopped.
- Load only configuration **between same models of pumps** to avoid any software conflict.

Saving the configuration

To store the configuration, from the pump, to the HHR memory:

1. Enter in the **[MAINTENANCE]** menu.
2. Go to **[PUMPS SETTING] [EXECUTE CMD] [SAVE]** menu.
3. Valid with **ENTER**.

Downloading the configuration

To load a configuration, from the HHR, into the pump:

1. Enter in the **[MAINTENANCE]** menu.
2. Go to **[PUMPS SETTING] [EXECUTE CMD] [RESTORE]** menu.
3. Valid with **ENTER**.

7 Advanced settings



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

7.1 The nitrogen injection system

The nitrogen injection system is used to flush out process by-products, dilute harmful gases in the compression stages and protect the mechanical parts of the pump.

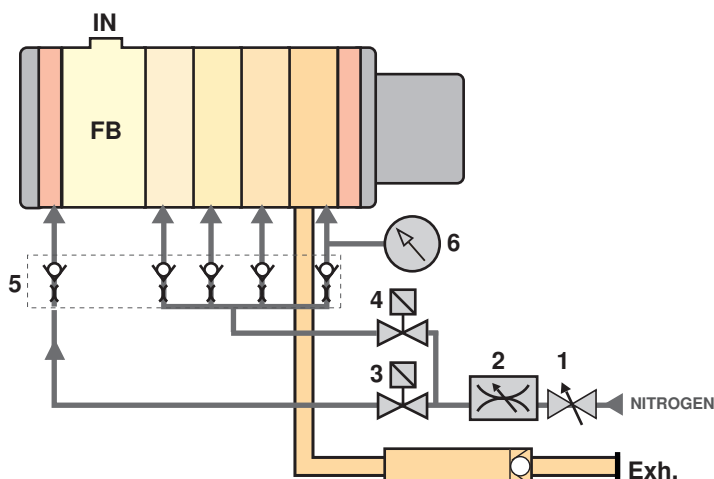


Fig. 11: Nitrogen injection system

1 Pressure regulator	Used to adjust the nitrogen flow
2 Mass flowmeter	Used to measure the nitrogen flow
3 Purge valve	Used to control the nitrogen flow
4 Stand-by valve	
5 Equipped injection manifold (anti-suckback valves + calibrated injectors)	Used to distribute the nitrogen flow to each stage
6 Exhaust pressure sensor	Used to monitor the exhaust pressure

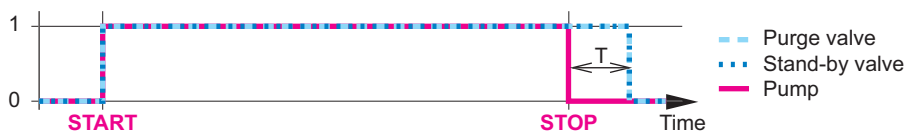
7.1.1 Management mode

Management mode is selected:

- using the HHR **[DEFINITION] [PURGE CMD]**.
- by the serial link (see *Serial link operating instructions*).

[PURGE CMD] [DISABLED]

Purging is automatic. The **standby** and **purge** valves open/close when the pump is started/stopped. When the pump stops, purging is extended by time T (see chapter "Purge prolongation", page 38).

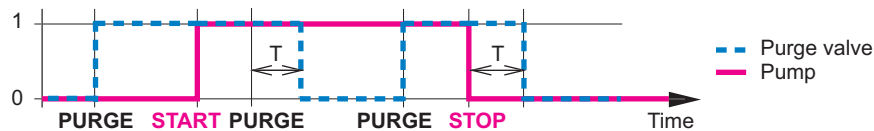


[PURGE CMD] [ENABLED]

The **standby** and **purge** valves open/close simultaneously following a **PURGE** command that is independent of pump start-up/shutdown:

- by pressing the **PURGE** key on the HHR.
- by remote control via **J1** connector.

To enable this mode, coding wheel **S1** must be set to position **1**.



⚠ WARNING

Risks associated with process gases

- You are strongly advised not to stop the purge when the pump is running
(see chapter "Safety instructions relating to flammable/pyrophoric materials", page 12).

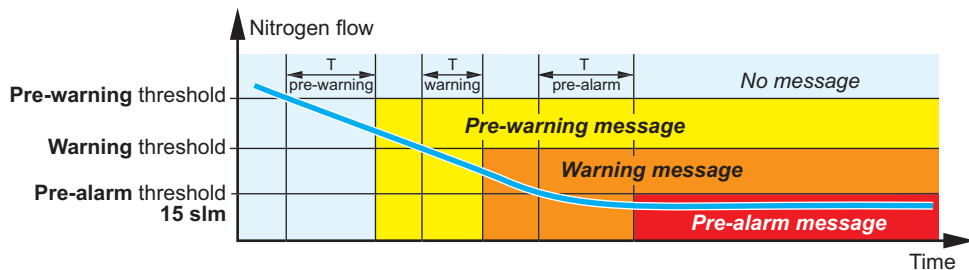
7.1.2 Nitrogen flow fault indication

3 monitoring thresholds and a delay linked to each threshold can be set in the [SETTING] [PURGE] [PURGE FLOW], [PRE-WARNING]/[WARNING]/[PRE-ALARM] menu.

If the measured flow of nitrogen is lower than the set threshold, a fault appears after the delay has elapsed. **None of these faults will stop the pump.**

The [PRE-ALARM] threshold cannot be adjusted: 15 slm.

The [PRE-ALARM] cannot be [DISABLED].

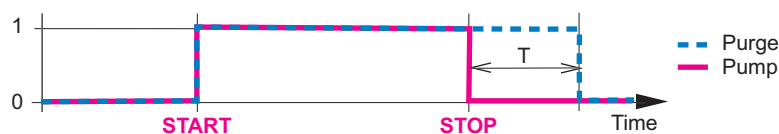


7.1.3 Purge prolongation

The system is automatically purged when the pump stops (normal stop or stop due to fault) if the system is programmed to retain the purge gas.

However, this will not take place if the pump is stopped due to a D01 exhaust pressure fault or a D34 emergency stop.

Purge time prolongation can be configured in the [SETTING] [PURGE] [PURGE PROLONG] [DELAY] menu, or see the *serial link operating instructions*.



7.2 Hot nitrogen injection system (IHN option)

The injection of hot nitrogen at the FB high pressure stage is used to flush out process by-products to prevent them from accumulating in the exhaust line.



The addition of a hot nitrogen flow has an impact on the pump technical characteristics: contact us.

NOTICE

Overpressure in the exhaust line

The settings of the IHN option depend on the process used.

- Contact our service center for the best settings.

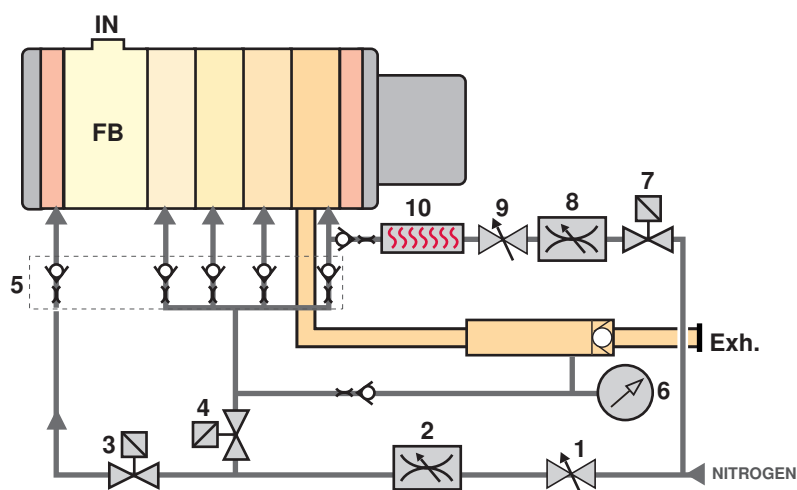


Fig. 12: Nitrogen injection system with IHN option

1	Pressure regulator	Used to adjust the nitrogen flow
2	Mass flowmeter	Used to measure the nitrogen flow
3	Purge valve	Used to control the nitrogen flow
4	Stand-by valve	Used to control the nitrogen flow
5	Equipped injection manifold (anti-suckback valves + calibrated injectors)	Used to distribute the nitrogen flow to each stage
6	Exhaust pressure sensor	Used to monitor the exhaust pressure
7	IHN valve	Used to control the hot nitrogen flow
8	IHN mass flowmeter	Used to read the nitrogen flow
9	IHN pressure regulator	Used to adjust the hot nitrogen flow
10	Heating element	Used to heat the nitrogen flow

7.2.1 Management mode

An additional function is available when the pump is equipped with the IHN option.

Management mode is selected:

- using the HHR [SETTINGS] [INTERNAL HOT N2].
- by the serial link (see Serial link operating instructions).

[INTERNAL HOT N2] [DISABLED] The function is not monitored.

[INTERNAL HOT N2] [ENABLED] The function is monitored.

Set the hot nitrogen flow.

The nitrogen flow can be set when the pump is operational.

1. Use the IHN pressure regulator to adjust the nitrogen flow to suit the process in hand.
2. Check the IHN flow on the HHR display.

Monitor the hot nitrogen temperature

1. Set the temperature setpoint.
2. Set the monitoring thresholds.

The IHN heater starts/stops when the pump starts/stops.

The IHN heater can be disabled at any time by setting the [SETTING] [INTERNAL HOT N2] [MAINTENANCE MODE] menu to [ENABLED].

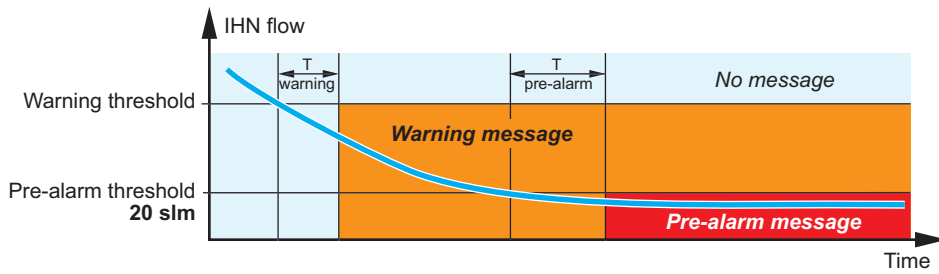
The IHN function is inactive if the purge IDLE STANDBY mode is selected.

7.2.2 IHN flow fault indication

It is possible to set the timer connected to each of the thresholds in the menu [SETTING] [INTERNAL HOT N2] [ENABLED] [HOT N2 FLOW] [LOW DEFAULTS] then [WARNING]/[PRE-ALARM].

If the flow rate is lower than the set threshold, a fault appears after the delay has elapsed. **None of these faults will stop the pump.**

The **[PRE-ALARM]** threshold cannot be adjusted: **20 slm**.

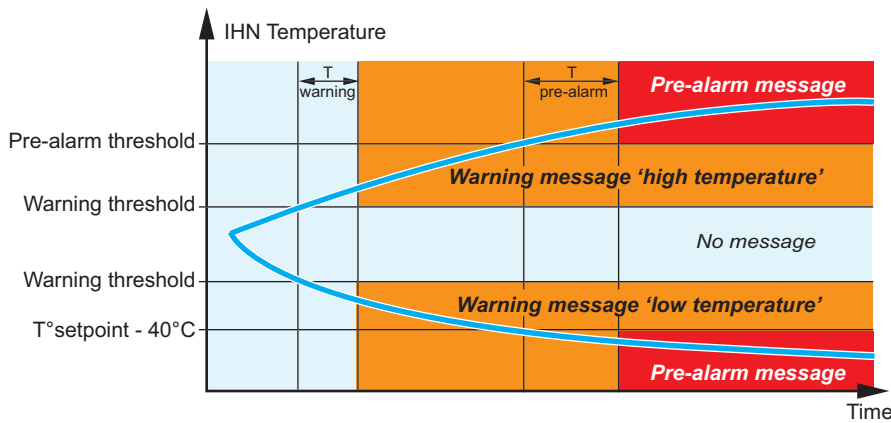


7.2.3 Regulation of the IHN temperature

The heating element regulates the nitrogen temperature.

The setpoint and threshold values are set via the **[SETTING] [INTERNAL HOT N2] [ENABLED] [HOT N2 T°]** menu.

- If the temperature is higher than the **[HIGH DEFAULTS] [WARNING]** threshold or lower the **[LOW DEFAULTS] [WARNING]** threshold, a warning appears.
- If the temperature is higher than the **[PRE-ALARM]** threshold set or 40°C lower than the setpoint, a pre-alarm appears. **None of these faults will stop the pump.**



7.3 Monitoring of the exhaust pressure

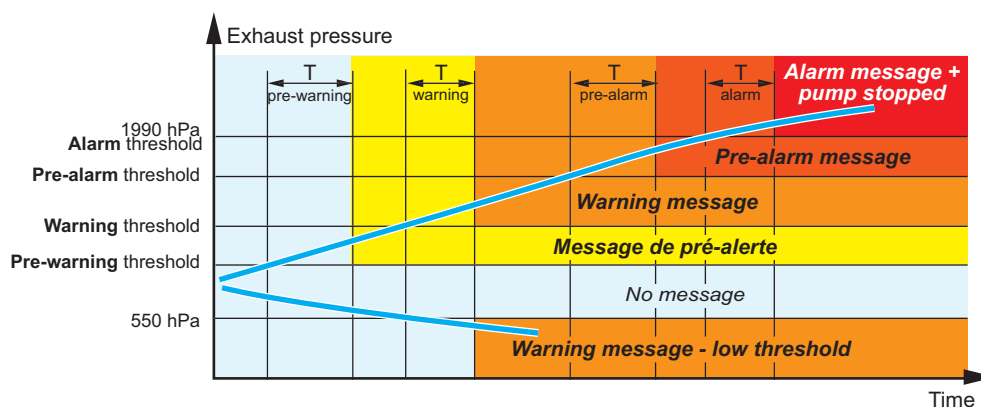
7.3.1 Management of the exhaust pressure warning/alarm

The nitrogen injection system is equipped with a sensor that:

- ensures that the exhaust line is not clogged,
- in certain cases, indicates the level of clogging in the exhaust line.

The sensor monitors pump exhaust pressure. Pre-warning, warning and pre-alarm set points and associated delays can be configured in **[SETTING] [EXH PRESS] [PRE-WARNING]/[WARNING]/[PRE-ALARM] [THRESHOLD]/[DELAY]**.

- The **[ALARM]** threshold cannot be adjusted: it is set at **1990 hPa**. A 5 second delay before pump shutdown can be set in the **[DELAY STOP ALARM] [ENABLED]** menu.
- A low pressure warning appears after a delay of **10 s** if the pressure drops below **550 hPa** (fixed value, cannot be changed).



7.3.2 Silencer Exhaust Pressure Measurement (SEPM option)

The SEPM (Silencer Exhaust Pressure Measurement) option measures the pressure in the exhaust silencer. This option is installed at the factory and does not need adjusting.

The SEPM option works in the same way as exhaust pressure monitoring described above.

7.4 Description of the 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 chapter "Regulation of the FB temperature").

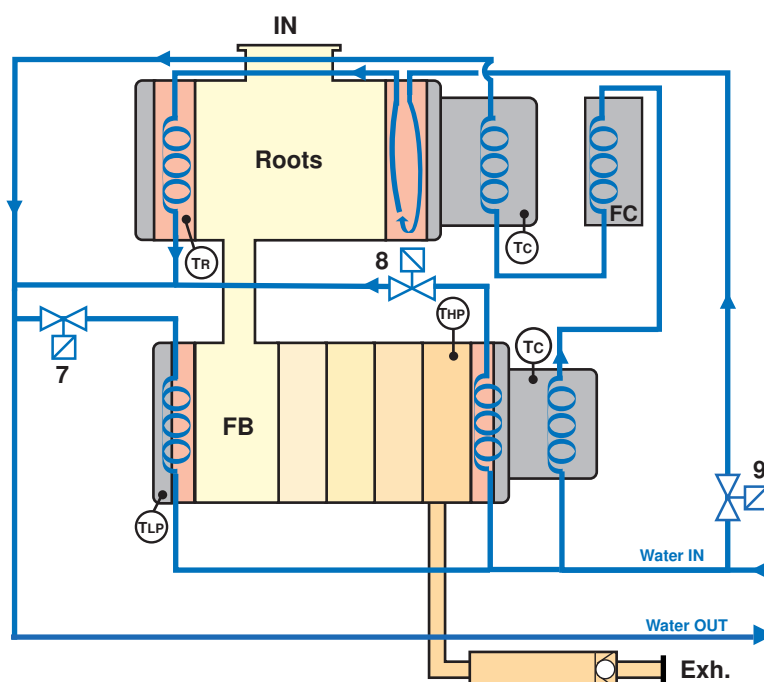


Fig. 13: Description of the water circuit

7	LP water valve	Used to regulate the temperature of the HP and LP stages of the FB
8	HP water valve	
9	Roots water valve	Used to cool the Roots pump
T_C	Temperature sensor	Used to notify the motor overtemperature
T_R	Temperature sensor	Used to measure the Roots temperature
T_{HP}	HP temperature sensor	Used to measure the temperature of the stages
T_{LP}	LP temperature sensor	

7.5 Regulation of the FB temperature

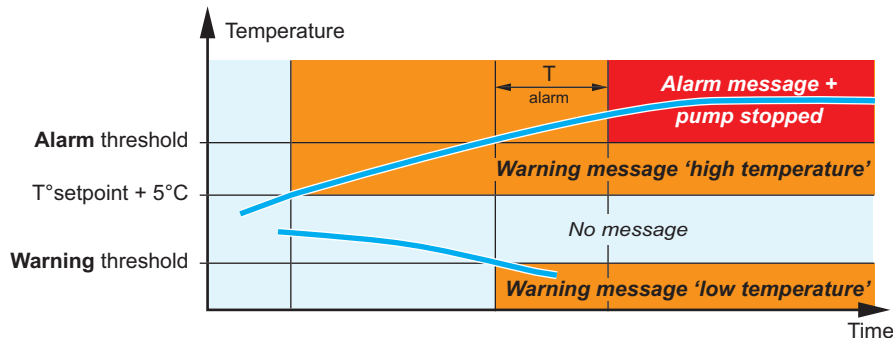
Functional block temperature regulation limits process by-product deposits and condensation inside the pump and reduces corrosion.

The water circuit regulates the temperature of the HP and LP stages of the functional block. It includes the components described in the previous chapter.

The setpoints are configured in the **[SETTING] [TEMPERATURE] [FB LP T°]/[FB HP T°] [REGULATION]** menu.

The actuation of water valves is independent of pump start up and depends on setpoint temperature.

- If the temperature is lower than the setpoint, the valve closes.
- If the temperature is higher than the setpoint, the valve opens.
- If the temperature is 5 °C higher than the setpoint or lower than the **[LOW DEFAULTS] [WARNING]** threshold, a warning appears.
- If the temperature exceeds the **[HIGH DEFAULTS] [ALARM]** threshold, an alarm appears.



Only when the setpoint temperature has been reached at least once is monitoring possible. Otherwise, the valve remains closed and the temperature faults are ignored.

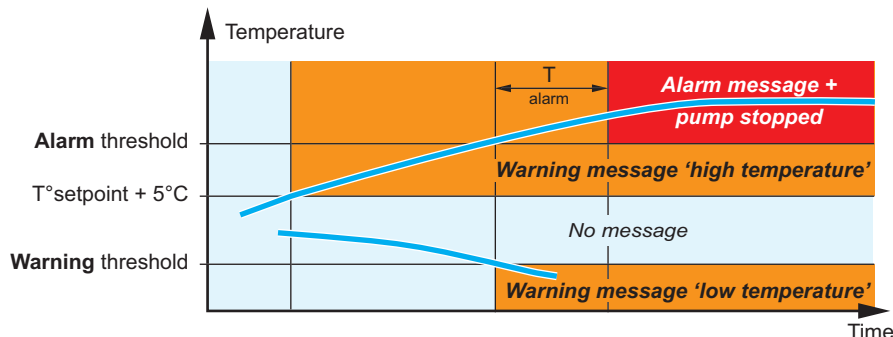
7.6 Regulation of the Roots temperature

The water circuit regulates the temperature in the Roots housings. It includes the components described in the previous chapter.

The thresholds and setpoint are configured in the **[SETTING] [TEMPERATURE] [ROOTS 1 T°] [REGULATION]** menu.

The actuation of the water valve is independent of pump start up and depends on setpoint temperature.

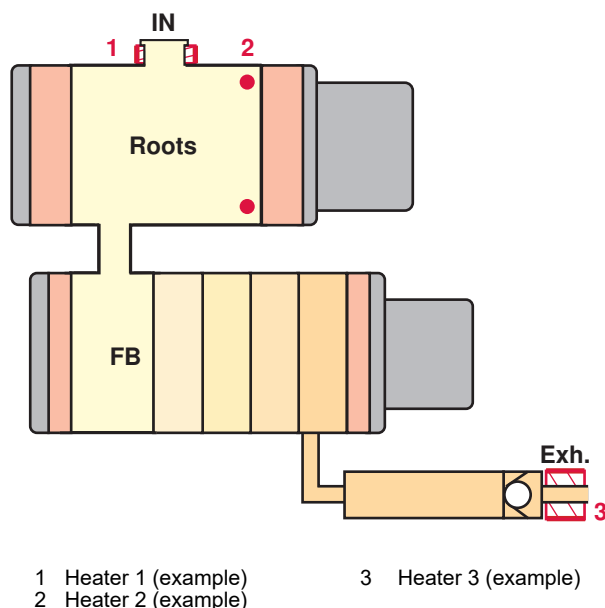
- If the temperature is lower than the setpoint, the valve closes.
- If the temperature is higher than the setpoint, the valve opens.
- If the temperature is 5 °C higher than the setpoint or lower than the **[LOW DEFAULTS] [WARNING]** threshold, a warning appears.
- If the temperature exceeds the **[HIGH DEFAULTS] [ALARM]** threshold, an alarm appears.



Only when the setpoint temperature has been reached at least once is monitoring possible. Otherwise, the valve remains closed and the temperature faults are ignored.

7.7 Pump heating

The heating system is used to eliminate cold points from the pumping system and prevent gas condensation. The system can control up to 3 different heating elements inside the pump.



7.7.1 Management mode

Management mode is selected:

- using the HHR [SETTING] [TEMPERATURE] [HEATER 1 T°]/[HEATER 2 T°]/[HEATER 3 T°].
- by the serial link (see *Serial link operating instructions*).

[HEATER 1 T°]/[HEATER 2 T°]/[HEATER 3 T°] [DISABLED]

Heating not managed.

[HEATER 1 T°]/[HEATER 2 T°]/[HEATER 3 T°] [CONTROL]

The heating element is thermally regulated. Heating works according to the setpoint temperatures and is independent of pump start-up [REGULATION] [SETPOINT].

- If the temperature is lower than the setpoint, the heater is supplied with power.
- If the temperature is higher than the setpoint, heater power is cut.

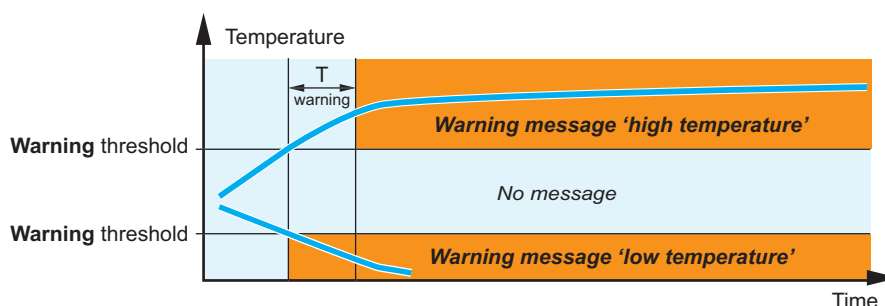
7.7.2 Temperature fault indication

The setpoint temperature is set using the HHR remote control box or by serial link.

- If the temperature is higher than the [HIGH DEFAULTS] [WARNING] threshold or lower than the [LOW DEFAULTS] [WARNING] threshold, a warning appears.

Heating control

A warning threshold and associated delay can be set via the [SETTING] [TEMPERATURE] [HEATER 1 T°/HEATER 2 T°/HEATER 3 T°] [CONTROL] [HIGH/LOW DEFAULT] [WARNING] [DELAY] menu.

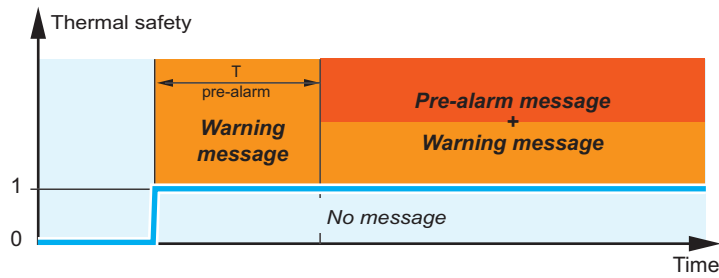


Thermal safety

The heating system is equipped with a thermal safety system that triggers a fault if the unit overheats. A warning appears.

A pre-alarm delay can be set in the [SETTING] [TEMPERATURE] [HEATER ALARM] [DEFAULTS] [PRE-ALARM] [ENABLED] [DELAY] menu.

Although a pre-alarm message appears, the pump is not stopped.



7.8 Management of an inlet isolation valve

Pump inlet isolation valve is used to isolate the pump from the pumping line.

A connector, J4, is used to supply and manage a pump inlet isolation valve (see chapter “Using connector J4 to control an isolation valve”, page 63).

Management mode can only be selected with the pump is stopped:

- using the HHR **[DEFINITION] [INLET VALVE]**.
- by the serial link (see “Serial link” operating instructions).

[INLET VALVE] [DISABLED]

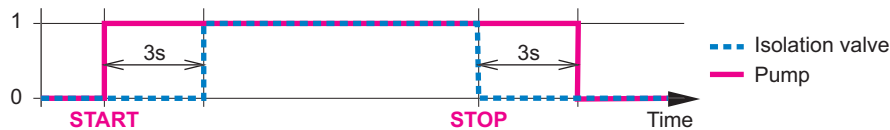
Isolation valve management is disabled (no isolation valve fitted to the pump inlet).

[INLET VALVE] [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 FIXED SPEED PUMPING is displayed on the HHR.

When the pump stops, the valve closes immediately while the pump stops after a delay of 3 seconds.



[INLET VALVE] [MANUAL INLET]

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

- using the **AUX** button on the HHR.
- by the remote control via the **J1** connector.
- by the serial link (see “Serial link” operating instructions).

Valve control can be enabled with the pump stopped or running.

Using the AUX button to control the valve

Contacts J1-S1 and J1-S7 must be closed.

- To open or close the valve, press the **AUX** key on the HHR remote control unit and confirm with **ENTER**.

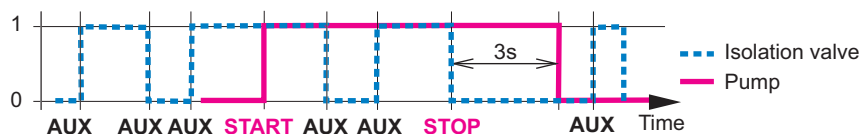
Using the user's equipment to control the valve (remote control mode via J1)

Contacts J1-S1 and J1-S7 are open.

- Closing contact **J1-S6** closes the valve.
- Opening contact **J1-S6** opens the valve.

Control by serial link

The valve open/close command will only be taken into account if contact J1-S7 is closed.

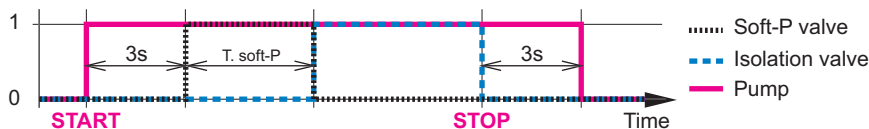


[INLET VALVE] [SOFT P AUTO]

The pump automatically controls either a valve incorporating the “soft pumping” function or two valves in parallel. 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 FIXED SPEED PUMPING message is displayed. The cycle ends when the pump shutdown command is sent, leading to the valve closing 3 seconds after the pump stops.

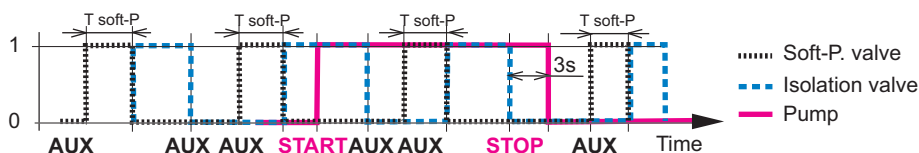
The soft pumping valve opening time can be configured by setting the delay in the **[SETTING] [SOFT P VALVE] [DELAY]** menu.

**[INLET VALVE] [SOFT P MANU]**

The soft pumping valve opening/closing cycle can be manually controlled whether the pump is stopped or running. The valve opening delay can be set in the **[SETTING] [SOFT P VALVE] [DELAY]** menu.

The soft pumping valve can be controlled:

- using the **AUX** button on the HHR. In which case, contacts J1-S1 and J1-S7 must be closed.
- by the remote control via the **J1** connector. Whereby contact J1-S1 is open and J1-S7 is closed. To open the valve, open contact J1-S6; to close the valve, close the contact.
- by the serial link (see “Serial link” operating instructions). In which case, contact J1-S7 must be closed.

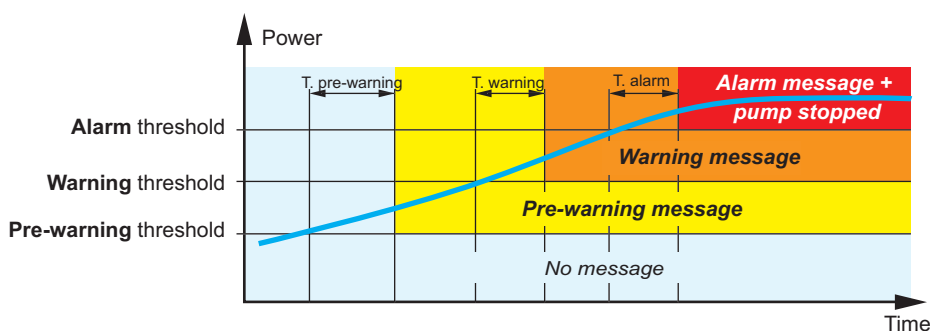


7.9 Monitoring of motor power

The power of each of the motors (functional block and Roots if there is one) is measured.

The pre-warning, warning and alarm set points and associated delays can be configured for each motor **[SETTING] [POWER] [FB POWER]/[R1 POWER]**.

- If the measured power exceeds the set point, a fault appears when the delay has elapsed.
- If the parameter is set to **DISABLED**, there is no set point to configure and the fault is ignored.



7.10 Management of the motor rotation frequency

Rotation frequency monitoring allows the pump's rotation speed to be varied to accommodate the application performance requirements.

When the functional block and/or Roots motors are powered by a frequency converter, FIXED or ANALOG management mode can be selected to suit the application. These modes are used to define the rotation frequencies: minimum, intermediate or maximum.

Management mode is selected with the pump stopped:

- using the HHR: **[SETTING] [FREQUENCY] [FB INVERTER]/[R1 INVERTER] [FIXE FREQ.]/[ANALOG FREQ.]**,
- by the serial link (see *Serial link operating instructions*).

[FB INVERTER]/[R1 INVERTER] [FIXE FREQ.]

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

[FB FREQ]/[R1 FREQ] [ANALOG FREQ.]

Analog management mode is only available if **[IDLE MODE]** is **[DISABLED]**. The rotation frequency is defined by an analog input on the **J3** (user connector). The selected rotation frequency depends on the input voltage applied.

	Rotation frequency selected (analog mode)		
	Minimum	Intermediate	Maximum
FB (all models)	50 Hz	50 Hz	60 Hz
Roots (A 2504)	30 Hz	60 Hz 65 Hz 70 Hz	75 Hz
Roots (A 3004)	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

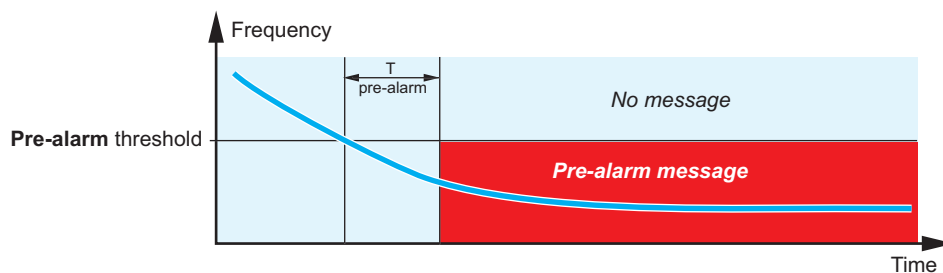
Tbl. 2: Motor rotation frequencies

7.11 Monitoring of seizing

The failure is based on a lowering of the FB rotation frequency.

When the function is active, a pre-alarm threshold and associated delay can be set in **[SETTING] [SEIZING DETECTION] [MODE] [ENABLED] [LOW DEFAULTS] [PRE-ALARM] [THRESHOLD]/[DELAY]** menu.

- If the measured frequency is lower than the threshold, a fault appears when the delay has elapsed.
- If the parameter is set to **[DISABLED]**, there is no set point to configure and the fault is ignored.



7.12 Operating principle of the IDLE mode

This mode is used to reduce electricity consumption by lowering the speed of rotation of the pumps (if the product is fitted with the frequency converter option) and/or nitrogen consumption by closing the standby valve independently of the purge valve, when the equipment is not running a process.

When this mode is configured in the **[DEFINITION] [IDLE MODE] [ENABLED]** menu, various options can be selected via the User1, User2 and User3 digital inputs on the **J3** connector:

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

The option selected is displayed on the HHR.



When IDLE mode is enabled while STAND-BY mode is enabled (see chapter “Remote control via the J1 connector”), IDLE mode takes priority.



When exiting the IDLE mode **[DEFINITION] [IDLE MODE] [DISABLED]**, the pump returns in the last control mode configured (Purge enabled or Purge disabled).

⚠ DANGER

Risk of process gas build-up

- ▶ **Never enable IDLE mode when the pump is running a process**
- ▶ (see chapter “Safety instructions relating to flammable/pyrophoric materials”, page 12).

7.13 Management of the analog input

A 0-10 volt analog signal sent on the ANA1 socket (monitoring sensor) is managed with **[ANA 1]** menu.

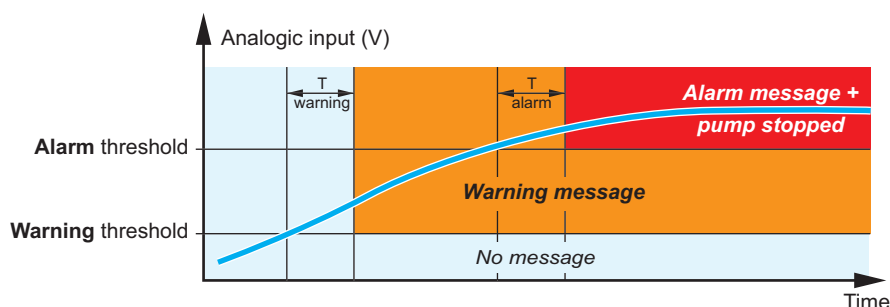
A 0-10 volt analog signal sent on **J3** socket is managed with **[USER ANA]** menu.

2 monitoring set points (warning and alarm) and associated delays can be set using the **[SETTING] [ANALOG INPUT] [ANA1]/[USER ANA] [ENABLED]** menu.

A PT100 temperature probe can be connected to the **J3** connector.

2 monitoring thresholds (warning and alarm) and associated delays can be set using set points in the **[SETTING] [TEMPERATURE] [USER T°]** menu.

- If the measured value exceeds the set threshold, a fault (warning or alarm) appears when a delay has elapsed. If an alarm message is triggered, the pump will shut down.
- If the fault is set to **[DISABLED]**, there is no set point to configure and the fault is ignored.



7.14 Management of the logic inputs

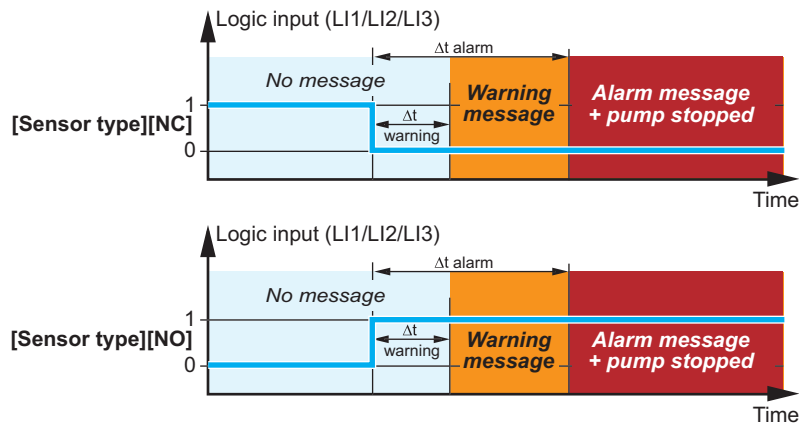
Two logic inputs are available on the LI2 and LI3 connectors (monitoring sensors).

LI2 and LI3 can be configured as normally open or normally closed logic inputs **[SENSOR TYPE] [NO]/[NC]**.

Two monitoring delays can be set (warning and alarm) in the **[SETTING] [LOGIC INPUT] [LOG2]/[LOG3] [ENABLED]** menu.

When the LI2 or LI3 contact opens or closes, a fault (warning or alarm) appears after a delay has elapsed.

If an alarm message is triggered, the pump will shut down. If the fault is set to **[DISABLED]**, there is no setpoint to configure and the fault is ignored.



The pump is equipped with a fan. This fan is connected to the LI1 plug.
A fan malfunction is indicated as a fault if [SETTING] [LOGIC INPUT] [LOG1] is [ENABLED].

7.15 SEMI pump configuration option

The SEMI option comes with accessories that allow the pump to comply with the requirements of the SEMI S2-1016 standard, namely:

- a sensor-equipped cover for venting and an exhaust box for connection to the customer's installation (see chapter "Cover venting", page 27),
- dry contact safety sensors **that immediately stop the pump with an alarm** when they detect any of the following faults:
 - an exhaust pressure fault.
 - a nitrogen pressure fault.
 - a pressure fault inside the pump cover.

Sensor	Function	Set point	Pump status
1 - Exhaust pressure	Detects overpressure at the pump exhaust	$P \geq 2000 \text{ hPa}$	If the pressure exceeds the set point, an alarm stops the pump
2 - Nitrogen pressure	Detects a purge fault	$P < 1200 \text{ hPa}$	If the pressure drops below the set point, an alarm stops the pump
3 - Cover venting pressure	Detects an internal cover venting fault	$\Delta P < 1.41 \text{ hPa}$ $F > 83 \text{ m}^3/\text{h}$	If the pressure difference between the interior and the exterior of the cover drops below the set point, an alarm stops the pump

These sensors are installed at the factory and do not need adjusting. The following diagram shows where the sensors are located.

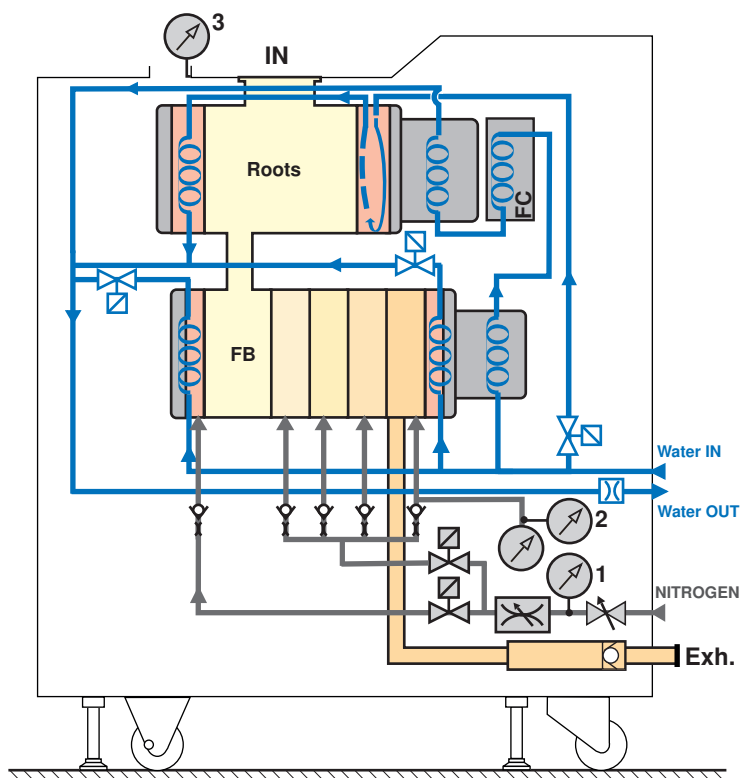


Fig. 14: Location of the SEMI option safety sensors

To fully meet the SEMI requirements, customers must install a retention tank under the pump

- with at least 10% greater capacity than the volume of oil in the pump,
- and that is large enough to collect any water leaks at the **WATER IN** and **WATER OUT** connectors.

The retention tank must be fitted with a fluid detection sensor that alerts the equipment and stops the pump and the water supply in case of leakage. This retention tank is not part of the scope of delivery.

8 Interfaces for control

8.1 The control modes

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

- **HHR**
The pump is controlled **locally** from the Hand-Held Remote unit (HHR) connected to the front or rear of the pump (HHR and J8 connectors). For safety reasons, the pump can only be controlled by one HHR at a time.
- **REMOTE**
The pump is controlled by opening and closing different dry contacts or applying a voltage via connector **J1** (see chapter "Control via J1 connector").
- **SERIAL LINK**
The pump is controlled by commands sent via the **J2, J7 or J6 serial link connectors**, see the *serial link operating instructions*.
- **USER**
The pump is controlled by opening and closing different dry contacts or applying a voltage via connector **J3** (see chapter "Control via J3 connector").

Selecting the control mode

The control mode is selected from the HHR remote control unit when the pump is stopped:

1. Power on the pump (see chapter "Powering on", page 31).
2. Select the **[DEFINITION] [CONTROL MODE]** menu and set the interface control mode.

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 and functional settings.
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 last events.

DEFINITION		
Selection	Choice	Description
LANGUAGE	ENGLISH FRENCH	Select the language.
TEMPERATURE UNIT	°C °F	Select the temperature unit.
PRESSURE UNIT	mbar Torr PSI hPa kPa	Select the pressure unit.
POWER UNIT	W kW	Select the power unit.

1) Modification possible only with pump stopped.

DEFINITION		
Selection	Choice	Description
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). XN models are set up link X.
FREQUENCY INVERTER ¹⁾	FB INVERTER: V1000/ DISABLED INVERTER R1: V1000/ DISABLED INVERTER R2: V1000/ DISABLED	Select the FB frequency inverter, and the Roots 1/ Roots 2 frequency inverter (if present).
AUTO-START ¹⁾	DISABLED	
	ENABLED	Activate the pump to restart automatically after a power cut. Danger! Risk due to auto-restart (see chapter "Auto-restart configuration", page 33).
ROOTS CMD ¹⁾	DISABLED	
	ENABLED	Activate the Roots control separate from the FB. Instead of simultaneous start-up, the Roots is started/ stopped by the command ROOTS .
PURGE CMD ¹⁾	DISABLED	
	ENABLED	Activate the purge separate from the FB start-up. The purge is started/stopped by the command PURGE .
IDLE MODE	DISABLED	
	ENABLED	Activate the reduction of energy consumption (electricity and/or nitrogen) when the pump is not running in process.
INLET VALVE ¹⁾	DISABLED	
	AUTO INLET	Activate the type of inlet isolation valve.
	MANUAL INLET	
	AUTO SOFT PUMPING MANUAL SOFT PUMPING	
ROOTS 2 OPTION ¹⁾	DISABLED	
	ENABLED	Activate the external Roots management.
CONTROL MODE	HHR REMOTE SERIAL LINK USER	Select the control mode.
DEFAULT STORAGE	DISABLED	
	ENABLED	Pre-warning/warning is still displayed and the warning indicator light flashes until ENTER is pressed.
DELAY STOP ALARM	DISABLED	
	ENABLED	Activate a delay of 5 s between an alarm and the pump stop.
REMOTE CONFIG. FCT ¹⁾	Pre-warning pump	Activate the signaling of a 'pre-warning' or 'pump running' on the output contact of J1 connector.
	Pumping	
BUZZER	DISABLED	Activate the acoustic signal in case of defect. To stop the signal, press ENTER .
	ENABLED	

¹⁾ Modification possible only with pump stopped.

SETTING	
Function	Choice
PURGE	PURGE FLOW
	PURGE PROLONG
POWER	FB POWER
	R1 POWER
	R2 POWER ²⁾
FREQUENCY ¹⁾	FB INVERTER
	R1 INVERTER
	R2 INVERTER ²⁾
TEMPERATURE	HP FB T°
	LP FB T°
	ROOTS 1 T°
	ROOTS 2 T° ²⁾
	HEATER 1 T°
	HEATER 2 T°
	HEATER 3 T°
	USER T°
EXH PRESSURE	HEATER ALARMS ⁵⁾
	HIGH DEFAULTS
INTERNAL HOT N2 ³⁾	LOW DEFAULTS
	MAINTENANCE MODE
	HOT N2 FLOW
U LINE	HOT N2 T°
	HIGH DEFAULTS
SOFT PUMPING VALVE ⁴⁾	LOW DEFAULTS
SEIZING DETECTION	MODE
LOGIC INPUT	LOG1
	LOG2
	LOG3
ANALOGIC INPUT	ANA 1
	USER ANA
SERIAL LINK	J2 LINK
	J6 LINK
	J7 LINK
DATE AND TIME ¹⁾	DAY
	YEAR
	MONTH
	HOUR
	MINUTE

1) Modification possible only with pump stopped.

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

3) Menu available if the IHN option is installed on the pump.

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 1 T°], [HEATER 2 T°] or [HEATER 3 T°] is set on [CONTROL].

Setting of nitrogen flow rate monitoring

→ [SETTING MENU] [PURGE] [PURGE FLOW] [LOW DEFAULTS]

Thresholds		Settings	Setting range
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

Setting of nitrogen purge prolongation time

→ [SETTING] [PURGE] [PURGE PROLONG]

Parameter	Settings	Setting range
PURGE PROLONG	DELAY	0-7200 s

Setting of FB power monitoring

→ [SETTING] [POWER] [FB POWER] [HIGH DEFAULTS]

Thresholds		Settings	Setting range
ALARM	DISABLED		
	ENABLED	THRESHOLD	4000-20000 W
		DELAY	0-600 s
WARNING	DISABLED		
	ENABLED	THRESHOLD	500-4900 W
		DELAY	0-600 s
PRE-WARNING	DISABLED		
	ENABLED	THRESHOLD	500-4000 W
		DELAY	0-600 s

Setting of Roots 1 and 2 power monitoring→ [SETTING] [POWER] [R1 POWER]/[R2 POWER] ²⁾

Thresholds		Settings	Setting range
ALARM	DISABLED		
	ENABLED	THRESHOLD	3000-20000 W
		DELAY	0-600 s
WARNING	DISABLED		
	ENABLED	THRESHOLD	500-4000 W
		DELAY	0-600 s
PRE-WARNING	DISABLED		
	ENABLED	THRESHOLD	500-3000 W
		DELAY	0-600 s

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

Setting of rotation frequency

→ [SETTING] [FREQUENCY] [FB INVERTER]/[R1 INVERTER]/[R2 INVERTER] ²⁾

Choice	Setting range
MODE	FIXE/ANALOG
FIXE FREQ.	MIN/INTER/MAX ⁶⁾
ANALOG FREQ. ⁷⁾	

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

6) Values depend on the pump model (see chapter "Management of the motor rotation frequency").

7) Values depend on the pump model and voltage applied (see chapter "Management of the motor rotation frequency").

Setting of HP FB temperature monitoring

→ [SETTING] [TEMPERATURE] [HP FB T°]

Parameter			Threshold		Settings	Setting range	
CONTROL	SETPOINT					H: 70-130 °C X: 50-130 °C XN: 70-130 °C	
	DEFAULTS	HIGH DEFAULTS	ALARM		THRESHOLD	80-140 °C	
					DELAY	0-600 s	
			WARNING		THRESHOLD	SETPOINT + 5 °C	
					DELAY	0 s	
		LOW DEFAULTS	WARNING	DISABLED			
				ENABLED	THRESHOLD	30 °C to (SETPOINT - 10 °C)	
	DELAY				0-600 s		

Setting of LP FB temperature monitoring

→ [SETTING] [TEMPERATURE] [LP FB T°]

Parameter			Threshold		Settings	Setting range
CONTROL	SETPOINT					H: 70-120 °C X: 50-120 °C XN: 70-120 °C
	DEFAULTS	HIGH DEFAULTS	ALARM		THRESHOLD	80-130 °C
					DELAY	0-600 s
			WARNING		THRESHOLD	SETPOINT + 5 °C
					DELAY	0 s
	LOW DEFAULTS	WARNING	DISABLED			
			ENABLED	THRESHOLD	30 °C to (SETPOINT - 10 °C)	
				DELAY	0-600 s	

Setting of Roots 1 temperature monitoring

→ [SETTING] [TEMPERATURE] [ROOTS 1 T°]

Parameter			Thresholds		Settings	Setting range	
DISABLED ¹⁾							
CONTROL	SETPOINT					50-90 °C	
	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED			
				ENABLED	THRESHOLD	60-100 °C	
					DELAY	0-600 s	
			PRE-ALARM	DISABLED			
				ENABLED	THRESHOLD	55-100 °C	
					DELAY	0-600 s	
			WARNING	THRESHOLD	SETPOINT + 5 °C		
				DELAY	0 s		
		LOW DEFAULTS	WARNING	DISABLED			
				ENABLED	THRESHOLD	30 °C to (SET-POINT - 10 °C)	
					DELAY	0-600 s	
MEASURE- MENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED			
				ENABLED	THRESHOLD	60-100 °C	
					DELAY	0-600 s	
			PRE-ALARM	DISABLED			
				ENABLED	THRESHOLD	55-100 °C	
					DELAY	0-600 s	
			WARNING	DISABLED			
				ENABLED	THRESHOLD	55-100 °C	
					DELAY	0 s	
		VALVE STATUS	OPEN VALVE				
			CLOSE VALVE				

1) Modification possible only with pump stopped.

Setting of Roots 2 temperature monitoring

→ [SETTING] [TEMPERATURE] [ROOTS 2 T°] ²⁾

Parameter			Thresholds		Settings	Setting range
DISABLED ¹⁾						
MEASUREMENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED		
				ENABLED	THRESHOLD	110-140 °C
					DELAY	0-600 s
			WARNING	DISABLED		
				ENABLED	THRESHOLD	70-140 °C
					DELAY	0 s

1) Modification possible only with pump stopped.

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

Setting of heater 1, 2 and 3 monitoring

→ [SETTING] [TEMPERATURE] [HEATER 1 T°]/[HEATER 2 T°]/[HEATER 3 T°]

Parameter			Thresholds	Settings	Setting range
DISABLED					
CONTROL	SETPOINT				80-140 °C
	DEFAULTS	HIGH DEFAULTS	WARNING	THRESHOLD	90-150 °C
				DELAY	0-600 s
		LOW DEFAULTS	WARNING	THRESHOLD	30 °C to (SETPOINT - 10 °C)
				DELAY	0-600 s

Setting of user temperature monitoring

→ [SETTING] [TEMPERATURE] [USER T°]

Parameter			Thresholds		Settings	Setting range
DISABLED						
MEASUREMENT	DEFAULTS	HIGH DEFAULTS	ALARM	DISABLED		
				ENABLED	THRESHOLD	0-200 °C
					DELAY	0-600 s
			WARNING	DISABLED		
				ENABLED	THRESHOLD	0-150 °C
					DELAY	0-600 s

Setting of heater alarm monitoring

→ [SETTING] [TEMPERATURE] [HEATER ALARMS] ⁵⁾

Parameter	Thresholds		Settings	Setting range
DEFAULTS	PRE-ALARM	DISABLED		
		ENABLED	DELAY	0-600 s
	WARNING	DISABLED		
		ENABLED	DELAY	0 s

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

Setting of exhaust pressure monitoring

→ [SETTING] [EXH PRESSURE]

Thresholds			Settings	Setting range
HIGH DEFAULTS	WARNING		THRESHOLD	550-1990 mbar
			DELAY	0-600 s
	PRE-WARNING	DISABLED		
		ENABLED	THRESHOLD	550-1650 mbar
			DELAY	0-600 s
	ALARM		THRESHOLD	1990 mbar
			DELAY	0-5 s
	PRE-ALARM	DISABLED		
		ENABLED	THRESHOLD	1650-1650 mbar
			DELAY	0-600 s
LOW DEFAULTS	WARNING		THRESHOLD	550 mbar
			DELAY	10 s

Setting of IHN monitoring→ [SETTING] [INTERNAL HOT N2]³⁾

Parameter		Thresholds		Settings	Setting range
DISABLED ¹⁾					
MAINTENANCE MODE					ENABLED/DISABLED
HOT N2 FLOW	DEFAULTS	LOW DEFAULTS	WARNING	THRESHOLD	15-150 slm
				DELAY	0-600 s
			PRE-ALARM	THRESHOLD	20 slm
				DELAY	0-600 s
HOT N2 T°	SETPOINT				50-150 °C
	DEFAULTS	HIGH DEFAULTS	WARNING	THRESHOLD	(SETPOINT + 10 °C) to 170 °C
				DELAY	5-600 s
			PRE-ALARM	THRESHOLD	(WARNING THRESHOLD) to 180 °C
				DELAY	5-600 s
		LOW DEFAULTS	WARNING	THRESHOLD	30 °C to (SETPOINT - 10 °C)
				DELAY	0-600 s
			PRE-ALARM	THRESHOLD	SETPOINT - 40 °C (MIN 30 °C)
				DELAY	10-600 s

1) Modification possible only with pump stopped.

3) Menu available if the IHN option is installed on the pump.

Setting of mains voltage monitoring

→ [SETTING] [U LINE]

Thresholds		Settings		Setting range
HIGH DEFAULTS	WARNING	DISABLED		
		ENABLED	THRESHOLD	180-550 V
			DELAY	0-600 s
LOW DEFAULTS	WARNING	DISABLED		
		ENABLED	THRESHOLD	160-265 V
			DELAY	0-600 s

Setting of the valve opening time→ [SETTING] [SOFT PUMPING VALVE]⁴⁾

Parameter	Settings	Setting range
SOFT PUMPING VALVE	DELAY	0-600 s

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

Setting of FB seizing monitoring

→ [SETTING] [SEIZING DETECTION] [MODE]

Parameter		Thresholds	Settings	Setting range
DISABLED				
ENABLED	LOW DEFAULTS	PRE-ALARM	THRESHOLD	20-60 Hz
			DELAY	0-180 s

Setting of logic input monitoring

→ [SETTING] [LOGIC INPUT] [LOG1]/[LOG2]/[LOG3] [MODE]

Parameter	Thresholds	Settings	Setting range
DISABLED ¹⁾			
ENABLED	SENSOR TYPE ¹⁾		NO/NC
	DEFAULTS	WARNING	DISABLED
		ENABLED	DELAY 0-600 s
	ALARM	DISABLED	
		ENABLED	DELAY 0-600 s

1) Modification possible only with pump stopped.

Setting of analog input monitoring

→ [SETTING] [ANALOG INPUT] [ANA 1]/[USER ANA]

Parameter	Thresholds	Settings	Setting range
DISABLED ¹⁾			
MEASUREMENT	HIGH DEFAULTS	ALARM	DISABLED
		ENABLED	THRESHOLD 0-10000 mV
			DELAY 0-600 s
		WARNING	DISABLED
	WARNING	ENABLED	THRESHOLD 0-10000 mV
			DELAY 0-600 s

1) Modification possible only with pump stopped.

MAINTENANCE ¹⁾

Selection	Display	
RUNNING TIME	Total running time (XXXXX h)	
MAINTENANCE TIME	VALUE	Running time after the last maintenance.
	WARNING	YYYYY h: Setting of warning threshold (value to be adjusted depending on the process).
WATER DRAINING	DISABLED ENABLED ⁸⁾	Allows the water cooling circuit to be drained.
ANALOG VALUES	Display of measured values: temperature, purge flow, exhaust pressure, etc.	
PUMP SETTINGS	SAVE	To save the monitoring parameters in the HHR.
	RESTORE	To load the HHR parameters into the monitoring system.
MODULE SAFETY CHECK	DISABLED	
	COMPLETE CHECK ⁸⁾	Allows testing of all safety sensors.
	QUICK CHECK ⁸⁾	Allows individual testing of each safety sensor: HP FB T°, LP FB T°, FB POWER, R1 POWER, N2 PURGE, EXH PRESS

1) Modification possible only with pump stopped.

8) Accessible with Service password.

MANAGEMENT ¹⁾		
Selection	Choice	Setting range
PASSWORD		0 to 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⁾	
	R2 INVERTER SOFT REV ²⁾	
	R2 INVERTER SPECIF ²⁾	

1) Modification possible only with pump stopped.

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

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

8.3 Control via J1 connector

NOTICE

Safety Extra-Low Voltage circuits

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max). Overvoltages and overcurrents can result in internal electrical damage. Users must observe the following wiring conditions:

- ▶ Connect these outputs in accordance with the rules and protection of Safety Extra-Low Voltage (SELV) circuits.
- ▶ The voltage applied to these contacts should be less than 30 V and the current less than 1 A.

Description

Connecting via the **J1** connector (50-pin Male D-Sub) provides:

- remote control of the following 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.

Logic input wiring

The inputs are active when a DC voltage between 5 and 30 V is applied (wiring customer supplied).

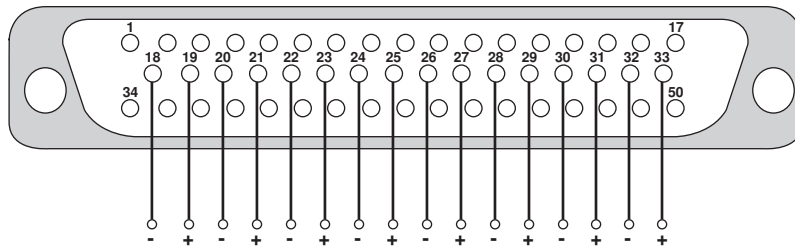


Fig. 15: J1 connector: controlled by DC voltage

To control these inputs by external contacts of the host equipment, power these inputs by pins 47, 48 (0 V) and 49, 50 (24 V) (wiring customer supplied).

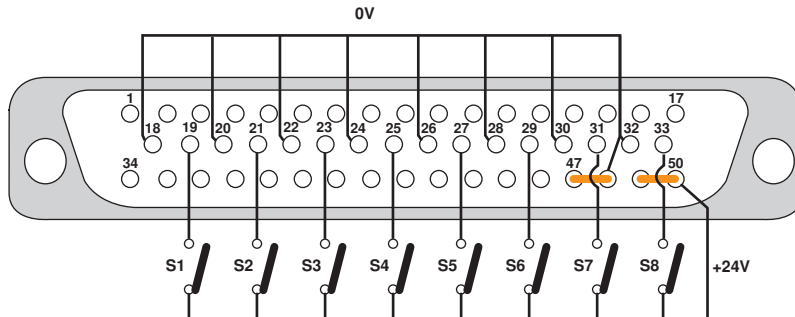


Fig. 16: J1 connector: Dry contact control

Contact	Function	
S1 (18-19)	HHR or RE-MOTE mode	Contact closed: HHR mode. Contact open: REMOTE mode. This function is enabled when [DEFINITION] [CONTROL MODE] is set to [REMOTE] .
S2 (20-21)	Pump Start/Stop	Contact closed: pump starts. Contact open: pump stops. This function is enabled when REMOTE mode is selected: S1 contact open.
S3 (22-23)	Roots Start/Stop	Contact closed: Roots starts. Contact open: Roots stops. This function is enabled when: - REMOTE mode is selected: S1 contact open [DEFINITION] [ROOTS CMD] is [ENABLED]
S4 (24-25)	Nitrogen purge pump start/stop	Contact closed: Nitrogen purge starts. Contact open: Nitrogen purge stops. This function is enabled when: - REMOTE mode is selected: S1 contact open - coding wheel S1 is set to 1. [DEFINITION] [PURGE CMD] is [ENABLED]
S5 (26-27)	Stand-by purge start/stop	This function allows nitrogen consumption to be reduced by closing the standby valve independently of the purge valve when the equipment is not running a process . Purge warnings and alarms are ignored when the standby valve is closed (see chapter "The nitrogen injection system"). Contact closed, standby starts after a delay (time programmed by RS-232, see <i>Serial link operating instructions</i>). Contact open: stand-by stops. This function is enabled when: - REMOTE mode is selected: S1 contact open [DEFINITION] [IDLE MODE] is [DISABLED] [DEFINITION] [PURGE CMD] is [ENABLED]

Contact	Function	
S6 (28-29)	Open/close inlet valve	Contact closed: inlet valve closes. Contact open: inlet valve opens. This function is enabled when: • REMOTE mode is selected: S1 contact open • [DEFINITION] [INLET VALVE] is [MANUAL VALVE] • inlet valve control authorization is selected: S7 contact open.
S7 (30-31)	Authorization/No Authorisation to control the inlet valve	Contact closed: no authorization to control the inlet valve. Contact open: authorization to control the inlet valve. This function is enabled when [DEFINITION] [INLET VALVE] is set to [MANUAL INLET]. This control mode is not affected by the S6 contact and can function independently in HHR or REMOTE mode.
S8 (32-33)	Warning reset	If [DEFINITION] [WARNING STORAGE] is [ENABLED], this input is used to reset this memory.

Logic output wiring

Contact	Function
These contacts open when a fault appears:	
1-34	Pump fault (pump running, valve open, no warning)
2-3	Warning present
4-5	Alarm present
6-7	Roots running
8-9	Pump running, correct purge and inlet valve open
12-13	Pump in stand-by mode
14-15	Pump running (FB + Roots) at selected speed
16-17	Inlet valve status
35-36	Motor temperature warning
37-38	Purge warning
39-40	Exhaust pressure warning
43-44	FB running at selected speed
45-46	Pre-Warning ¹⁾ or Pump running (BF + Roots) ²⁾
This contact closes when a fault appears:	
10-11	Warning present
1) Factory setting	
2) Can be modified by serial link (see "Serial link" operating instructions).	

8.4 Control via J3 connector

NOTICE

Safety Extra-Low Voltage circuits

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max). Overvoltages and overcurrents can result in internal electrical damage. Users must observe the following wiring conditions:

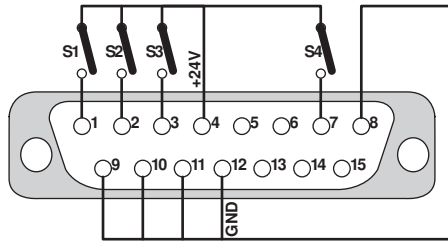
- Connect these outputs in accordance with the rules and protection of Safety Extra-Low Voltage (SELV) circuits.
- The voltage applied to these contacts should be less than 30 V and the current less than 1 A.

Description

Connections to the **J3** (15-pin Male D-Sub) connector are used to:

- remotely control the start, stop and IDLE mode functions,
- input the speed setpoint and monitoring,
- input a temperature probe and monitor its temperature.

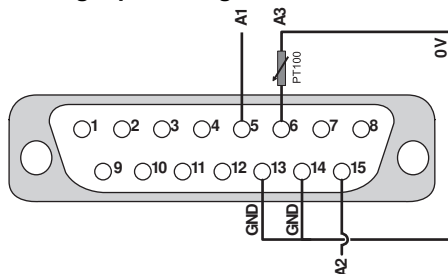
Logic input wiring



Contact	Function	
S1 (1-9)	USER1	[DEFINITION] [IDLE MODE] [ENABLED] See the table below when selecting IDLE mode.
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 enabled when [DEFINITION] [CONTROL MODE] [USER] is selected.

IDLE option	Contact statuses			Stand-by valve	Rotation speed	HHR display
	S1	S2	S3			
Total (FULL)	1	0	0	closed	minimum	IDLE MODE
Intermediate	0	1	0	closed	intermediate	STD BY N2
Reduced speed	0	0	1	open	minimum	IDLE MODE
Stand-by purge	1	1	1	closed	maximum	STD BY N2
Standard	0	0	0	open	maximum	--

Analog input wiring



Input	Function	
A1 (5-13)	IN_ANA_SPEED	Rotation frequency setpoint (0-10 V input) (see chapter "Management of the motor rotation frequency"): - for the maximum frequency: the voltage applied must be between 0 and 3 V, - for the intermediate frequency: the voltage applied must be between 3 and 7 V, - for the minimum frequency: the voltage applied must be 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 in the [SETTING] [ANALOG INPUT] [USER ANA] menu.
A3 (6-13)	IN_TEMP_USER	Used to connect a temperature probe and monitor it by setting warning and alarm thresholds and a triggering timer in the [SETTING] [TEMPERATURE] [USER T°] menu.

8.5 Using connector J4 to control an isolation valve

NOTICE

Safety Extra-Low Voltage circuits

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max). Overvoltages and overcurrents can result in internal electrical damage. Users must observe the following wiring conditions:

- ▶ Connect these outputs in accordance with the rules and protection of Safety Extra-Low Voltage (SELV) circuits.
- ▶ The voltage applied to these contacts should be less than 30 V and the current less than 1 A.

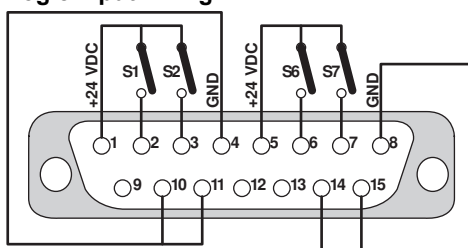
Description

Connections via the **J4** (15-pin Female D-Sub) connector can be used to:

- remotely control pump inlet isolation valve opening and closing,
- monitor the operating status of the valve(s).

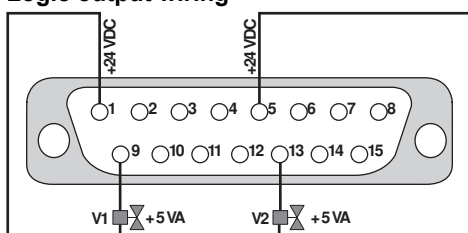
The control mode and type of valves concerned must be configured in the **[DEFINITION] [INLET VALVE]** menu and the timer must be set in the **[SETTING] [SOFT P VALVE]** menu.

Logic input wiring



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

Logic output wiring



Contact	Function	
1-9	OUT_ILET_VALVE	V1 inlet valve V1 connection. The valve opens when the pump is powered on.
5-13	OUT_SOFT_VALVE	V2 "soft pumping" valve connection. The valve opens when the pump is powered on.

8.6 Control via the J5 connector

NOTICE

Safety Extra-Low Voltage circuits

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max). Overvoltages and overcurrents can result in internal electrical damage. Users must observe the following wiring conditions:

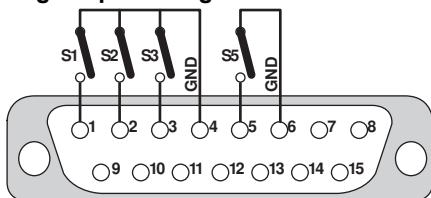
- ▶ Connect these outputs in accordance with the rules and protection of Safety Extra-Low Voltage (SELV) circuits.
- ▶ The voltage applied to these contacts should be less than 30 V and the current less than 1 A.

Description

Connections via the **J5** (15-pin Male D-Sub) connector are used to:

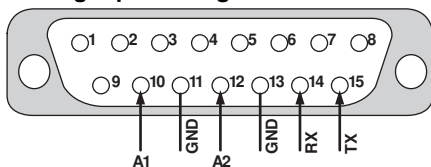
- remotely control the Roots 2 start, stop and IDLE mode functions,
- monitor the Roots 2 speed setpoint, temperature and status.

Logic input wiring



Contact	Function	
S1 (1-4)	Roots 2 frequency converter status	Contact closed: start Roots 2. Contact open: stop Roots 2.
S2 (2-4)	Roots 2 frequency converter warning	Contact closed: no warning. Contact open: warning present on Roots 2.
S3 (3-4)	Not used	

Analog input wiring



Contact	Function	
A1 (10-11)	Roots 2 temperature	Used to connect a temperature probe and monitor it by setting warning and alarm thresholds and a triggering timer in the [SETTING] [TEMPERATURE] [ROOTS 2 T°] menu.
A2 (12-13)	Roots 2 pump power	Setpoint between 0 and 10 V. Used to monitor Roots 2 power by setting warning and alarm thresholds and a triggering timer in the [SETTINGS] [POWER] [R2 POWER] menu.
RX / TX (14-15)	RS-485 Receive/Transmit	RS-485 communication port.

Logic output wiring

Contact	Function
7-9	Roots 2 start-up (contact closed when Roots is started).
8-9	IDLE mode management • contact open: maximum speed. • contact closed: reduced speed.
5-6 (S5)	Roots 2 frequency converter safety • contact closed: no alarm. • contact open: alarm present on Roots 2. If you do not want the Roots 2 alarm to stop the pump, contacts 5-6 must be strapped.

8.7 Emergency stop command

NOTICE

Safety Extra-Low Voltage circuits

The remote control circuits are equipped with dry contact outputs (30 V - 1 A max). Overvoltages and overcurrents can result in internal electrical damage. Users must observe the following wiring conditions:

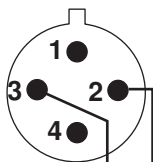
- ▶ Connect these outputs in accordance with the rules and protection of Safety Extra-Low Voltage (SELV) circuits.
- ▶ The voltage applied to these contacts should be less than 30 V and the current less than 1 A.

Description

The **EMS** connector at the rear of the pump is used to:

- connect the pump's emergency stop to the equipment's or pumping installation's emergency stop,
- relay information about the status of the emergency stop located at the front of the pump.

The pump is **only able to run if the cover plug (provided with the pump)** is wired in or connected to the **EMS** connector.

**Logic input wiring**

The input is treated as active when the pins 2 and 3 are connected.

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

Logic output wiring

The output contact is wired up by the customer and is used to control the equipment emergency stop from the pump **EMS** emergency stop button.

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

9 Maintenance

9.1 Maintenance safety instructions

DANGER

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

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

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

DANGER

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

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

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

WARNING

Danger of electrocution by contact during maintenance or overhaul

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

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

WARNING

Risk of burns in case of contact with hot surfaces

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

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

WARNING

Poisoning risk in case of process gas leakage

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

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

General maintenance recommendations

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

9.2 Maintenance frequency

Depending on how the maintenance settings are programmed, when the operating time before maintenance has elapsed, the screen display will alternate between the operating parameters and the corresponding warning message. The **Warning** indicator on the Human/Machine Interface comes on (see chapter "Description of the display"). This data can be accessed at any time via the **[MAINTENANCE]** menu.

No maintenance is generally required before product overhaul at our service center.

Maintenance frequency depends on the process and equipment used. Contact our service center ([see chapter "Service solutions by Pfeiffer Vacuum", page 82](#)).



How to contact us

Product overhauls must be carried out by personnel with manufacturer training. Contact our nearest service center at the following e-mail address: service.fr@pfeiffer-vacuum.com.

9.3 On-site maintenance

The pump does not require any maintenance on the customer's premises other than the day-to-day servicing described in this manual. All other maintenance must be carried out by our service center ([see chapter "Service solutions by Pfeiffer Vacuum", page 82](#)).

- ▶ Clean the outer surfaces of the product using a clean, lint-free cloth and a product that will not damage the screen-printed surfaces or adhesive labels.
- ▶ Check the exhaust line for clogging.
- ▶ Check the condition of the pipework and connections and repair if you find any corrosion or leaks.
- ▶ Check the color of the oil against a sample of new oil. This will allow you to check the level of contamination and the extent to which the lubricant has deteriorated. Oil changes are carried out by our service centers.
- ▶ 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.
- ▶ Free up the functional block if message D03 or D38 is displayed.

The SEMI option

Safety interlocks must remain operational at all times [nitrogen pressure, exhaust pressure, cover venting pressure, FB and Roots temperature (FB MOT, RSV1 MOT)].

- ▶ Check that the safety interlocks are working properly **once every 6 months**.

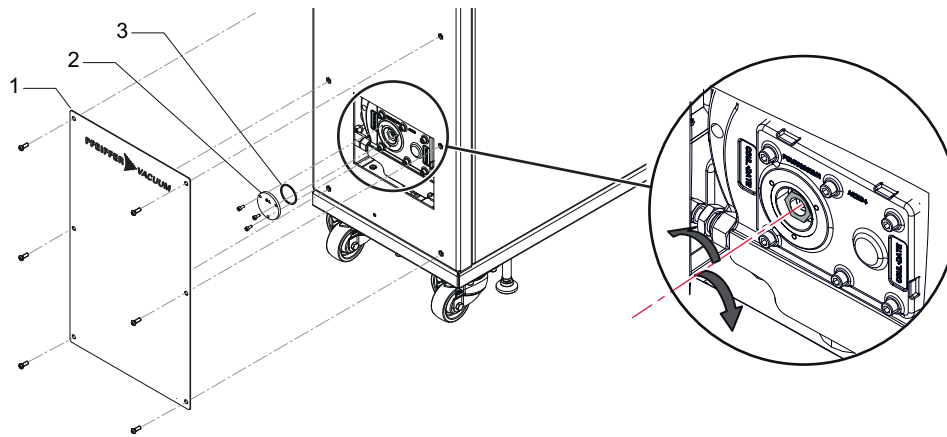
9.4 Freeing up the functional block



Reminder of the risks and safety measures

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

Process by-products can form deposits inside the pump leading to the FB becoming clogged. If the FB is prevented from rotating, a fault appears and the pump is stopped. The FB can be freed up by hand.



- 1 Front panel
2 Protective cover
3 O-ring

Freeing up procedure

1. Power off the pump by setting the main switch to position **O**:
 - The white **Power** indicator goes out.
2. Remove the front panel.
3. Remove the protective cover by unscrewing the 3 screws, then remove the O-ring.
4. Use the 21 mm female elbow Allen key to rotate the shaft backward and forward until it rotates freely.
5. Clean the O-ring and lightly grease with vacuum grease.
6. Install the O-ring and the protective cover (apply a tightening torque of 2 N·m).
 - When reassembling, **make sure that the O-ring is in a properly installed in the groove and not pinched**: this will cause pump leakage and failure.
7. Refit the front panel.
8. Perform a tightness test.
9. Restart the pump.



Never force the Allen key to unblock the FB as this can damage the shaft.
If the pump cannot be freed up, contact the service center.

9.5 Exchange procedure for replacement product

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

1. Disconnecting the pump from the installation.
2. Draining the water circuit.
3. Preparing the pump for shipping.
4. Completing the declaration of contamination ([see chapter “Service solutions by Pfeiffer Vacuum”, page 82](#)).
5. Handling the new pump ([see chapter “Handling the pump”](#)).
6. Installing a new pump ([see chapter “Installation”](#)).
7. Configuring the pumping parameters ([see serial link operating instructions](#)).

Familiarize yourself with the service request procedure and fill in the declaration of contamination when returning products to our service centers ([see chapter “Service solutions by Pfeiffer Vacuum”, page 82](#)).

9.5.1 Disconnecting the pump from the installation



Reminder of the risks and safety measures

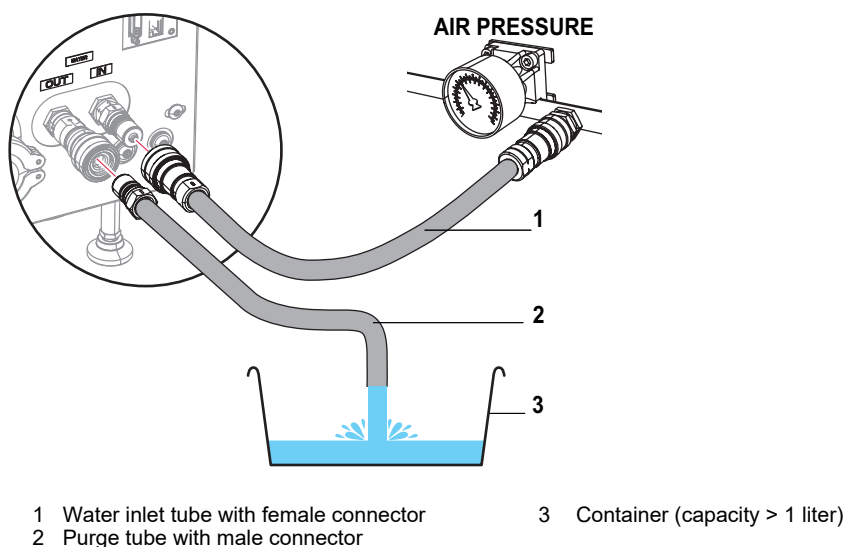
- Follow the maintenance safety instructions.
- Apply the specific safety instructions in accordance with local laws; this information is available from the customer's health and safety department.

Disconnection procedure

1. Power off the pump by setting the main switch to position **O**:
 - The white **Power** indicator goes out.
2. Switch off your main circuit breaker.
3. Disconnect the power cable at the electrical connector.
4. Disconnect all the connectors on the electrical interface panel.
 - Do not forget to include the cover plug provided with the pump to the **J1** connector.
5. Disconnect the nitrogen supply.
6. Disconnect the **WATER IN** connector followed by the **WATER OUT** connector.
7. Disconnect the pump from the pumping line and blank off the inlet port with the airtight connection accessories (available as accessories).
8. Disconnect the pump from the exhaust and blank off the exhaust port with the airtight connection accessories (available as accessories).
9. Retract the 4 supporting feet.
 - To leave the pump resting on its casters.
10. Remove the pump from the installation.

9.5.2 Draining the water circuit

Any water that has accumulated must be drained to prevent the pipework from freezing during transport. To do this, users will need to provide flexible tubes and a compressed air circuit (pressure 2 to 5 · 10³ hPa).



Water circuit drainage procedure

1. Connect the drainage tube to the **WATER OUT** connector and put the other end in the container.
2. Connect the inlet tube to the **WATER IN** connector and connect the other end to the compressed air circuit.
3. Set the main switch to position **I**.
 - The white **Power** indicator comes on.
4. Set the **[MAINTENANCE] [WATER DRAIN]** menu to **[ENABLED]**:
 - The solenoid valves open.
5. Inject compressed air into the pump until the water has been completely evacuated from the circuit.
6. Power off the pump by setting the main switch to position **O**:
 - The white **Power** indicator goes out.

9.5.3 Preparing the pump for shipping

- ▶ Install the airtight connecting accessories included with the pump at first delivery.
- ▶ Pressurize the pump with nitrogen in accordance with the following procedure.

Pressurizing with nitrogen

To pressurize the pump, you will need a nitrogen supply with the required characteristics (see chapter "Nitrogen characteristics") and the blanking plates provided with the product or obtainable as accessories.

1. Seal the pump inlet with the airtight accessories.
2. Connect the nitrogen supply to the gas connector located on the inlet blanking plate.
3. Pressurize the pump with nitrogen to a relative pressure of 200 hPa.
4. When nitrogen starts flowing from the exhaust, seal it with the accessories provided.
5. Disconnect the nitrogen supply from the connector.



Draining the oil of the pump before transferring it to another site

If the pump is transferred to another site as part of new installation, **the housings must be drained before transport.**

Keep the oil and follow the oil filling procedure before restarting the pump.

10 Decommissioning

10.1 Shutting down for longer periods

NOTICE

Process gas accumulation in stopped equipment

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

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

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

1. Start at the process chamber and purge the pumping line by injecting nitrogen into the pump inlet for 30 minutes.
2. Stop injecting the nitrogen and leave the pump to run at ultimate pressure for 5 minutes.
3. Stop the pump and close off the inlet port with the appropriate airtight blanking plates.
4. Configure using the **[PURGE PROLONG]** menu and set the duration to 30 minutes.
5. Perform a pump start/stop cycle.
 - Wait for the 30 minute prolonged flushing cycle to elapse.
6. Close off the pump exhaust with the airtight blanking plates.
7. Stop the water circuit.
8. Power off the pump by setting the main switch to position **O**.
 - The white **Power indicator** goes out.

10.2 Recommissioning

The only guaranteed solution by Pfeiffer Vacuum to recommission a process pump after a prolonged stoppage is to perform a complete overhaul of the pump. Contact our service center ([see chapter "Service solutions by Pfeiffer Vacuum", page 82](#)).

10.3 Disposal

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

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

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

Familiarize yourself with the service request procedure and fill in the declaration of contamination when returning products to our service centers ([see chapter "Service solutions by Pfeiffer Vacuum", page 82](#)).



Environmental protection

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

Our products contain various materials that can be recycled: mild steel, stainless steel, cast iron, brass, aluminium, nickel, copper, fluoroelastomers and perfluorinated synthetic oil. Take special precautions for:

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

11 Malfunctions

11.1 Malfunction and fault indication

When problems occur, users are informed by:

- The relevant indicator light coming on: yellow for warnings, red for alarms.
- An audible warning (if enabled).
- The fault contacts on the **J1** remote connector being actuated.
- The fault message being displayed on the HHR remote control unit.
- A message via the RS-232 or RS-485 serial link.

Indicator light	Name	Status	Pump status
White 	Power	 OFF	The pump is not supplied with power.
		 ON	The pump is supplied with power.
Green 	Running	 OFF	The pump is not running (pump shutdown).
		 ON	The pump is running.
Yellow 	Warning	 OFF	No warning.
		 Blinking slowly	A pre-warning or warning has occurred. • Read the fault message on the HHR. • Reset the fault by pressing ENTER.
		 Blinking fast	Pre-warning present. • Read the fault message on the HHR. • Rectify the problem to delete the fault.
		 ON	Warning present. • Read the fault message on the HHR. • Rectify the problem to delete the fault.
Red 	Alarm	 OFF	No alarm.
		 Blinking slowly	A pre-alarm has occurred. • Read the fault message on the HHR. • Reset the fault by pressing ENTER.
		 Blinking fast	There is a pre-alarm, the pump is running. • Read the fault message on the HHR. • Rectify the problem to delete the fault.
		 ON	Alarm presence. The pump is stopped. • Read the fault message on the HHR. • Rectify the problem to delete the fault. • Cut the power supply. • Restart the pump.

Tbl. 3: The indicator lights

11.2 The pump or Roots fails to start

Symptom	Cause	Remedy
The Power indicator fails to come on	No mains power	• Check power supply.
	Main switch set to position O	• Switch to position I.
	External emergency stop engaged	• Check for the EMS cover plug and interlock.
	Pump emergency stop engaged	• Rotate to unlock the emergency stop on the front panel.
	Other problem	Contact our service center.

Symptom	Cause	Remedy
HHR display stays off although Power indicator light is lit	Coiled cable incorrectly connected	Check the connection.
	Other problem	Contact our service center.

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

Symptom	Cause	Remedy
PW01/W01/PD01 EXH. PRESS	Exhaust pressure > Threshold	- Check the nitrogen flow rate setting value (see chapter "Connection to the nitrogen circuit", page 25). - Check that exhaust pipe line is not clogged.
	Exhaust pressure < 550 hPa	- Check the connection of the sensor on FB PRESS plug (see page 92): - Pressure sensor is faulty, replace it.
	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	Contact our service center.
D01 EXH. PRESS.	Exhaust pressure > 1990 hPa The pump does not start and the exhaust pressure is > 1500 hPa	- Check the nitrogen flow rate setting value (see chapter "Connection to the nitrogen circuit", page 25). - Check that exhaust pipe line 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	Contact our service center.
PW03/W03/D03 FB P DRIVE	Incorrect FB power threshold setting	Check the power threshold setting in menu [SETTING] [POWER] [FB POWER].
	FB mechanical problem	- Check the FB rotation. - Free up the FB manually.
	Problem with power reading	- Check the phases at the input of the frequency converter. - Check the voltage, current and frequency displayed on HHR. - If there is no information, check the communication between the frequency converter and the monitoring.
	Communication problem between monitoring and FB frequency converter	Depending on the trouble, replace the monitoring or the frequency converter.
	Communication problem (case without frequency converter)	- Check the current sensor: - The sensor is faulty, replace it.
	Other problem	Contact our service center.
W04/D04 IN ANA 1 W50/D50 USER ANA	Incorrect monitoring configuration Inconsistent analog reading feedback	- Check that [ANA 1], [ANA 2], or [USER ANA] is [DISABLED] when the input is not used. - Check the warning and alarm 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	Contact our service center.

Symptom	Cause	Remedy
W05/D05 LOG IN 1 W12/D12 LOG IN 3 W06/D06 LOG IN 2	Incorrect monitoring configuration	- Check that [LOG 1], [LOG 2], or [LOG 3] is [DISABLED] when the input is not used. - Check the warning or alarm delays.
	Connection not present or cut	Check the sensor connections on LI1, LI2 and LI3 (see page 92).
	Water leak is detected (if option installed)	The message W06 LOG IN.2 is displayed in case of water leak when menu [SETTING] [LOGIC INPUT] [LOG2] [ENABLED].
	Fan defective	A pump including a frequency converter is equipped with a fan. The message W05 LOG IN 1 is displayed when the fan, connected to LI1 (see page 92), is faulty: replace the fan.
	Other problem	Contact our 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 connector	Check that there is a strap between EMS terminals 2 and 3 (see chapter "Emergency stop command", page 65).
	Rotor rotation is difficult or FB has mechanical problem	- Check the FB rotation. - Free up the FB manually.
	Frequency converter trouble	Replace the frequency converter, or Contact our service center.
W10/D10 T° MOT FB	FB motor temperature is > 120 °C The cooling circuit is clogged	- Check the water cooling supply on the pump. - Check that the motor is properly cooled. - Check that the pipes are not clogged.
	Sensor or wiring faulty	Check the connection of the sensor on FB MOTOR plug (see page 92).
	Problem on FB motor temperature sensors	Check the proper operation of FB motor temperature sensors (NC contacts).
	Other problem	Contact our service center.
W11 INLET VALVE	Incorrect monitoring configuration	Check that the [INLET VALVE] is [DISABLED] if no valve is installed.
	Wrong connection	Check the connection on J4 connector (see chapter "Using connector J4 to control an isolation valve", page 63).
	Malfunction	Check the proper operation of the valve (opening/close).
	Other problem	Contact our service center.
PW13/W13/PD13/D13 PURGE FLOW	No purge flow	- Check the nitrogen supply. - Check the solenoid valve connection on N2 VALVES plug (see page 92).
	Insufficient purge flow	- Check the nitrogen flow setting using pressure regulator. - Check that there is no leak.
	Incorrect threshold setting	Check the warning and alarm thresholds in [SETTING] [PURGE] [PURGE FLOW] [LOW DEFAULT].
	Flowmeter not connected	Check the flowmeter connection on FLOW CONT plug (see page 92).
	Other problem	Contact our service center.
PW14/W14/D14 R1 P INVERTER	Roots 1 incorrect threshold setting	Check the warning and alarm thresholds in [SETTING] [POWER] [R1 POWER].
	Roots 1 mechanical problem	Check the Roots 1 rotation (if possible).
	Problem with power reading	- Check the current and voltage on the monitoring and/or at the frequency converter output. - If there is no frequency converter, check the current sensor.
	Problem on frequency converter	Contact our service center.
	Other problem	Contact our service center.

Symptom	Cause	Remedy
W15 /D15 T° HP FB with HP T° > setpoint T +5 °C	HP FB water valve problem	- Check the proper operation and the connection of the water valve on FB HP plug (see page 92). - Check the power supply of HP water valve coil on FB.
	Cooling problem	- Check the water cooling supply on the pump. - Check that the cooling pipes and/or the cooling plate are not clogged.
	Sensor 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 page 92).
	Other problem	Contact our service center.
W16 /D16 LOW HP FB T°	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 page 92).
	Other problem	Contact our service center.
W17/D17 T° R1 MOT	Root 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 pipes are not clogged.
	Sensor or wiring faulty	Check the connection of the sensor on RSV1 MOTOR plug (see page 92) and in the motor terminal.
	Problem on Roots 1 motor temperature sensors	Check the proper operation of the Roots 1 motor temperature sensor (NC contacts).
	Other problem	Contact our service center.
D19 REVERSED UVW	Main power supply problem: two inverted phases	Check the wiring at the main power input connector.
	Other problem	Contact our 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 connection on J4 connector (see chapter "Using connector J4 to control an isolation valve", page 63).
	Malfunction	Check the proper operation of the valve (open/close).
	Other problem	Contact our service center.
W24/D24 LOW HEATER 1 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [HEATER 1 T°] is set on [DISABLED].
	Heater 1 faulty	- Check the heater connection on HEAT 1 TEMP plug (see page 92). - Check the operation of the heater.
	Other problem	Contact our service center.
W25/D25 LOW HEATER 2 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [HEATER 2 T°] is set on [DISABLED].
	Heater 2 faulty	- Check the heater connection on HEAT 2 TEMP plug (see page 92). - Check the operation of the heater.
	Other problem	Contact our service center.
W26/D26 LOW HEATER 3 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [HEATER 3 T°] is set on [DISABLED].
	Heater 3 faulty	- Check the heater connection on HEAT 3 TEMP plug (see page 92). - Check the operation of the heater.
	Other problem	Contact our service center.
W31 SUPPLY 15V	15 V supply problem	Contact our service center.
W32 MAINTENANCE	Incorrect monitoring configuration	Check the warning threshold.
	The maintenance threshold is reached	Contact our service center for pump overhaul.
D33 24VS SUPPLY	24 V supply problem	- Check that the emergency stop is not switched on. - Check the emergency stop wiring circuit. - Check the 24 V power supply and the 24 VDC PC board.

Symptom	Cause	Remedy
D34 EMERGENCY STOP	Pump emergency stop is engaged	Rotate to unlock the emergency stop on the pump front panel.
	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 VDC power supply	Check the wiring of the emergency stop.
	Other problem	Contact our 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 EMS terminals 2 and 3 (see chapter "Emergency stop command", page 65). - FB does not start: check the 24 V power supply on A1 and A2.
	Other problem	Contact our service center.
D37 R1 BREAKER	Incorrect monitoring configuration	- Check that [DEFINITION] [PUMP MODEL] is set on [A204] or [A124]. - Change the setting by sending an order via Modbus communication protocol (see <i>Serial link operating instructions</i>).
	RT2 (Roots) breaker switched on	- Check RT2 value . Switch RT2 on. - Check the presence of current and voltage on the phases.
	Roots 1 mechanical problem	Check the Roots 1 rotation (if possible).
	Other problem	Contact our service center.
D38 FB BREAKER	Incorrect monitoring configuration	Check that [DEFINITION] [FREQUENCY INVERTER] [FB INVERTER] is set on [DISABLED].
	RT1 (FB) breaker switched off	- Check the value of RT1 . Switch RT1 on. - Check the presence of current and voltage on the phases.
	FB mechanical problem	Free up the FB manually.
	Other problem	Contact our service center.
D39 R1 CONTACTOR	Incorrect monitoring configuration	Check that [DEFINITION] [FREQUENCY INVERTER] [R1 INVERTER] is set on [DISABLED].
	KM2 (Roots) contactor not closed	Roots 1 does not start: check the 24 V power supply A1 and A2.
	Other problem	Contact our service center.
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 pipes are not clogged.
	Sensor not connected	Check the connection of the sensor on RSV1 MOTOR plug (see page 92).
	Other problem	Contact our service center.
D41 HAZ T° FB MOT	FB motor temperature is > 150 °C	- Check the water cooling supply on the pump. - Check that the FB motor is correctly cooled. - Check that the pipes are not clogged.
	Sensor not connected	Check the connection of the sensor to the FB MOTOR plug (see page 92).
	FB mechanical problem	Free up the FB manually.
	Other problem	Contact our service center.
D42 HAZ EXT PRESS	SEMI safety sensor problem (overpressure at exhaust)	- Check the sensor cable condition and the sensor operation . - Replace the sensor if necessary.
D43 HAZ PURGE FLOW	SEMI safety sensor problem (nitrogen pressure)	- Check the sensor cable condition and the sensor operation . - Replace the sensor if necessary.
D44 FRAME PRESS	SEMI safety sensor problem (Exhaust ventilation)	- Check the sensor cable condition and the sensor operation . - Replace the sensor if necessary.
D46 ALARM T° FB	FB Temperature problem	- Check the water cooling supply on the pump. - Check the setpoint temperatures and alarm threshold. - Check that the pipes are not clogged.

Symptom	Cause	Remedy
W51/D51 USER T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [USER T°] is set on [DISABLED].
	Incorrect temperature threshold setting	Check the warning and alarm thresholds.
	Other problem	Contact our service center.
W52/D52 ROOTS 1 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [Roots 1 T°] [CONTROL] or [MEASUREMENT] menu has set thresholds.
	Incorrect temperature threshold setting	Check the warning and alarm thresholds.
	Cooling problem	- Check the water cooling supply on the pump. - Check that the 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 page 92).
	Other problem	Contact our service center.
W53/D53 LOW ROOTS 1 T°	Incorrect monitoring configuration	Check that [SETTING][TEMPERATURE][ROOTS 1 T°] [CONTROL] or [MEASUREMENT] menu has set thresholds.
	Incorrect temperature threshold setting	Check the warning and alarm thresholds.
	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 page 92).
	Other problem	Contact our service center.
W54/D54 HEATER	Heater controller disconnected	Check the cable connection on WH plug or if there is a strap on WH plug (see page 92).
	Heater disconnected	Check the cable connection on J2 heater controller connector.
	Other problem	Contact our service center.
W57/D57 LP FB T° with LB T° > (setpoint T +5°C)	LP FB temperature control valve supply problem	Check the proper operation and the connection of the FB LP water valve (see page 92).
	Cooling problem	- Check the water cooling supply on the pump. - Check that the pipes are not clogged.
	Sensor 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 page 92).
	Other problem	Contact our service center.
W58/D58 LOW LP FB T°	LP FB temperature control valve supply problem	Check the condition of the solenoid valve diaphragm and its operation.
	Sensor or wiring faulty	Check the running and the connection of the sensor on FB LP TEMP plug (see page 92).
	Other problem	Contact our service center.
PW59/W59/D59 R2 POWER	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	Contact our service center.
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 pipes are not clogged.
	Sensor or wiring faulty	Check the condition of the sensor and its connection in the motor terminal box.
	Other problem	Contact our service center.

Symptom	Cause	Remedy
W61/D61 LOW ROOTS 2 T°	Incorrect monitoring configuration	Check that [DEFINITION] [ROOTS R2 OPTION] is set on [DISABLED].
	Sensor or wiring faulty	Check the condition of the sensor and its connection in the motor terminal box.
	Other problem	Contact our 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 Roots 1 rotation (if possible).
	Other problem	Contact our service center.
W63/D63 LOW SPEED R2	Incorrect monitoring configuration	Check that [DEFINITION] [FREQUENCY INVERTER] [R2 INVERTER] is set on [DISABLED] or [V1000].
	Roots 2 mechanical problem	Check the Roots 2 rotation (if possible).
	Other problem	Contact our service center.
W64/D64 HEATER 1 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [HEATER 1 T°] is set on [DISABLED].
	Heater 1 faulty	Check the operation of heater 1.
	Other problem	Contact our service center.
W65/D65 HEATER 2 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [HEATER 2 T°] is set on [DISABLED].
	Heater 2 faulty	Check the operation of heater 2.
	Other problem	Contact our service center.
W66/D66 HEATER 3 T°	Incorrect monitoring configuration	Check that [SETTING] [TEMPERATURE] [HEATER3 T°] is set on [DISABLED].
	Heater 3 faulty	Check the operation of heater 3.
	Other problem	Contact our 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 Roots 1 rotation or visually check if there is no mechanical touch (if possible).
	Other problem	Contact our 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 FB rotation and if there is no mechanical constraint, free up the FB manually .
	Other problem	Contact our 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	Contact our service center.

Symptom	Cause	Remedy
D71 FB I DRIVE	FB frequency converter overvoltage	- Check the rotation of the FB shafts, Roots 1 or Roots 2 according to the displayed message. - Check that the frequency converter is not overloaded or if the pump is not mechanically blocked. - Check the message on frequency converter display, or if the frequency converter is in default (V1000 Yaskawa operating manual is available on the website).
W72 R2 I R1 DRIVE	Roots 1 frequency converter overcurrent	
W73 R2 I R2 DRIVE	Roots 2 frequency converter overcurrent	
D74 FB U+ DRIVE	FB frequency converter overvoltage	
W75 R2 U+R1 DRIVE	Roots 1 frequency converter overvoltage	
W76 R2 U+R2 DRIVE	Roots 2 frequency converter overvoltage	
D77 FB P DRIVE	FB frequency converter overload	
W78 P R1 DRIVE	Roots 1 frequency converter overload	
W79 P R2 DRIVE	Roots 2 frequency converter overload	
D80 FB T DRIVE	FB frequency converter overheat	- Check the proper operation of the water circuit. - Check that the cooling plate(s) on frequency converter(s) is/are not clogged.
W81 R1 T DRIVE	Roots 1 frequency converter overheat	
W82 R2 P DRIVE	Roots 2 frequency converter overheat	
D83 FB M DRIVE	FB motor frequency converter overload	- Check the rotation of the FB shafts, Roots 1 or Roots 2 according to the displayed message. - Check that the frequency converter is not overloaded or if the pump is not mechanically blocked.
W84 RI M DRIVE	Roots 1 motor frequency converter overload	
W85 R2 M DRIVE	Roots 2 motor frequency converter overload	
D86 FB U-DRIVE	FB frequency converter undervoltage	Check the stability of the customer's electrical network.
W87 RI U-DRIVE	Roots 1 frequency converter undervoltage	
W88 R2 U-DRIVE	Roots 2 frequency converter undervoltage	
D89 FB PH DRIVE	Phase loss of FB frequency converter	- Check the power supply wiring of the concerned frequency converter (presence of voltage on R, S, and T terminal plugs). - Check that there is no power cut-off on power phases upstream the frequency converter.
W90 RI PH DRIVE	Phase loss of Roots 1 frequency converter	
W91 R2 PH DRIVE	Phase loss of Roots 2 frequency converter	
D92 FB RS DRIVE	FB frequency converter memory error	Replace the frequency converter because the PC board is defective. <i>Contact our service center.</i>
W93 R1 RS DRIVE	Roots 1 frequency converter memory error	
W94 R2 RS DRIVE	Roots 2 frequency converter memory error	
W95/D95 R1 SPEED	Roots 1: absence of speed information	Check the cable or sensor on LI4 (see page 92).
W102/D102 R1 OIL T° W102 T° Roots 1 > T° setpoint +5°C)	Cooling problem	- Check the water cooling supply on the pump. - Check that the cooling pipes are not clogged.
	Roots 1 solenoid water valve problem	- Check the operation and the connection of the Roots 1 solenoid valve - Check the power supply of Roots 1 solenoid valve coil.
	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 page 92).
	Other problem	<i>Contact our service center.</i>

Symptom	Cause	Remedy
W106 ROTARY SWITCHES	Coding wheel incorrectly set	Position the coding wheel to position 0 or 1 (see chapter "Management mode", page 37).
W107 IHN T° HIGH	Heating element faulty	- Check the heater connection on HEAT 3 TEMP plug (see page 92). - Check the operation of the heater.
W108 IHN FLOW	Insufficient IHN flow rate	- Check the hot nitrogen flow setting using a pressure regulator. - Check that there is no leak.
W109 IHN T° LOW	Heating element faulty	- Check the heater connection on HEAT 3 TEMP plug (see page 92). - Check the operation of the heater.
PD110 SEIZING DETECTED	Lowers the frequency of the FB inverter	- Check the FB rotation. - Free up the FB manually.

11.4 The pump runs but performance is inadequate

Symptom	Cause	Remedy
Vacuum poor or non-existent	Contaminated or clogged pumps	FB maintenance: <i>Contact our service center.</i>
	Internal oil leaks	
Mechanical noise	Damaged bearings	FB maintenance: <i>Contact our service center.</i>
	Pistons seized	
	Gears out of synch	
No N2 purge	Incorrect configuration	Reconfigure monitoring ([PURGE CMD] setting) or purge manually (PURGE key on HHR).

12 Service solutions by Pfeiffer Vacuum

We offer first-class service

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

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

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

Make use of Pfeiffer Vacuum service

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

You can obtain advice on the optimal solution for you, from your [Pfeiffer Vacuum representative](#).

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



1. Download the up-to-date form templates.
 - [Explanations of service requests](#)
 - [Service requests](#)
 - [Contamination declaration](#)



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



3. Send the forms by email, fax, or post to your local [Service Center](#).

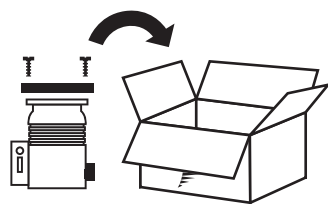


4. You will receive an acknowledgment from Pfeiffer Vacuum.

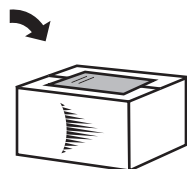
PFEIFFER VACUUM

Submission of contaminated products

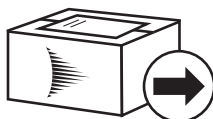
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination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



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



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



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



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

PFEIFFER VACUUM

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

13 Accessories

Accessory	Description	Dimension	Part number
Pump inlet isolation valve	Automatic 24 VDC stainless steel valve	DN 100 ISO-F	-
		DN 160 ISO-F	-
	Electro-pneumatic valve cable	Length 1.2 m	A335263
Seismic brackets	Set of 4 brackets		128262
Hand-held remote control	EDR HHR remote control unit and 1.5 m cable		125540S
	HHR coiled cable	Length 1.5 m	A468325
	HHR cable	Length 15 m	107079
OEM interface/Remote control panels *	Lonworks communication interface		122404
	Profibus communication interface		123767
	EtherCAT® communication interface		122088
	Interface mount (securing panel)		A610511
Emergency stop cover plug			106587
Remote control connector cover plug	Female 50-pin D-Sub		107222
Female 3/8" NPT connector	Water inlet		115509
3/8" NPT male connector	Water outlet		115510
Female 1/4" NPT connector	Water inlet		076721
1/4" NPT male connector	Water outlet		076720
Female 1/8" NPT connector	Nitrogen inlet		104084
Connecting accessories	Centering ring + FPM72 O-ring + PTFE barrier	DN 40 ISO-KF	108785
		DN 100 ISO-K	123717
		DN 160 ISO-K	123718
	Inlet blanking plate + 1/8" gas connector	DN 100 ISO-K	090467 + 082981
		DN 160 ISO-K	104456 + 082981
	Centering ring with fitted FPM72 O-ring	DN 40 ISO-KF	068230
		DN 100 ISO-K	068349
		DN 160 ISO-K	068186
Pump inlet pipework extension		DN 160/DN 160 ISO-K	A217052
		DN 160/DN 100 ISO-K	A217051
Funnel - Oil Filling			107381

For blanking plates, claw clamps and quick connect clamps: please refer to the connection accessories catalog at [Pfeiffer-Vacuum](#). Select material properties compatible with the application.

* Contact your service center for other communication protocols.

14 Technical data and dimensions

14.1 General

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

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

Tbl. 4: Conversion table: Pressure units

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

Tbl. 5: Conversion table: Units for gas throughput

14.2 Technical characteristics

Model	A 2504H A 2504X	A 2504XN	A 3004H A 3004X	A 3004XN
Frequency	60 Hz	60 Hz	60 Hz	60 Hz
Max.pumping speed	2500 m³/h	2400 m³/h	3000 m³/h	2900 m³/h
Ultimate pressure without N2 gas purge	$4 \cdot 10^{-3}$ hPa	$4 \cdot 10^{-3}$ hPa	$4 \cdot 10^{-3}$ hPa	$4 \cdot 10^{-3}$ hPa
Max.ultimate pressure with N2 purge ⁷⁾	$9 \cdot 10^{-3}$ hPa	$9 \cdot 10^{-3}$ hPa	$9 \cdot 10^{-3}$ hPa	$9 \cdot 10^{-3}$ hPa
Max. pumped volume ³⁾	2 m³	2 m³	2 m³	2 m³
Continuous inlet flow, max. ⁵⁾	EHT version: 80 slpm (0 °C) ELT version: 100 slpm (0 °C)	Standard version 80 slpm (0 °C)	EHT version: 70 slpm (0 °C) ELT version: 100 slpm (0 °C)	Standard version 75 slpm (0 °C)
Mains requirement ¹⁾	200 – 230 / 380 – 480 V AC - 3-phase motor			
Power consumption at ultimate pressure	2.6 kW	2.7 kW	2.6 kW	2.7 kW
Power consumption at max. inlet flow	6 kW	6 kW	6 kW	6 kW
Full load current (200-230 V)	32 A	32 A	32 A	32 A
Full load current (380-480 V)	21 A	21 A	21 A	21 A
Exhaust pressure max.	1200 hPa	1200 hPa	1200 hPa	1200 hPa
Cooling water flow ⁴⁾	150 – 300 l/h	150 – 300 l/h	150 – 300 l/h	150 – 300 l/h
N2 purge flow	10 – 120 slpm (0 °C)	10 – 120 slpm (0 °C)	10 – 120 slpm (0 °C)	10 – 120 slpm (0 °C)

Model	A 2504H A 2504X	A 2504XN	A 3004H A 3004X	A 3004XN
Frequency	60 Hz	60 Hz	60 Hz	60 Hz
Lubricant filling	FB: 0.28 l Roots: 0.93 l	FB: 0.28 l Roots: 0.93 l	BFB: 0.28 l Roots: 0.93 l	FB: 0.28 l Roots: 0.93 l
Helium localized leak rate	$1 \cdot 10^{-5}$ hPa·l/s	$1 \cdot 10^{-5}$ hPa·l/s	$1 \cdot 10^{-5}$ hPa·l/s	$1 \cdot 10^{-5}$ hPa·l/s
Weight	800 kg	800 kg	800 kg	800 kg
Flange (IN) ⁶⁾	DN 160 ISO-K	DN 160 ISO-K	DN 160 ISO-K	DN 160 ISO-K
Flange (OUT)	DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF
Typical vibration acceleration (at inlet flange 10-1000 Hz)	< 0.1 g	< 0.1 g	< 0.1 g	< 0.1 g
Typical vibration speed (at inlet flange 10-1000 Hz)	< 1.5 mm/s	< 1.5 mm/s	< 1.5 mm/s	< 1.5 mm/s
Noise level max. ²⁾	72 dB(A)	72 dB(A)	72 dB(A)	72 dB(A)

1) According to IEC/UL/CSA regulations. Pump can withstand a supply voltage variation of $\pm 10\%$.

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) Measured at maximum rotational speed. Depends on setting.

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

7) With standard N2 injection device and 50 slm purge. In case of specific N2 injection device, consult us.

Tbl. 6: Technical data for A 2504 - A 3004

14.3 Environmental characteristics

Use	indoor use
Installation altitude	up to 2000 m
Protection rating	IP 33
Ambient operating temperature	5 – 40 °C
Storage temperature	-25 – +55 °C
Maximum relative humidity	max. 80 % with T ≤ 31 °C, up to max. 50 % with T ≤ 40 °C
Pollution degree	2
Transient overvoltage protection ¹⁾	Category II

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

Tbl. 7: Environmental characteristics

The pumps are made of different materials that are suitable for the processes used in the semiconductor industry. The following materials come into contact with the process gases:

Cast iron | Stainless steel | Fluoroelastomers | Nickel | Perfluorinated synthetic oil

Tbl. 8: Materials in contact with the process gases

The A113 oil safety sheet is available from [Pfeiffer Vacuum Download Center](#).

14.4 Cooling water characteristics

	pH	5.5 to 9
	Chlorides ¹⁾	100 to 20 ppm depending on the pH
	Hardness	< 10 °fH (French degree) < 2 milliequivalent/L < 100 mg/L of CaCO ₃ (calcium carbonate)
	Total dissolved solids	< 300 mg/L
	LSI (Langelier saturation Index) = pH - pH _s	- 0.5 < LSI < 0 to 20 °C
	Particle size	< 0.2 mm
	Resistivity	2,000 Ω·cm < R < 1,000,000 Ω·cm
	Inlet temperature ²⁾	10-35 °C
	Relative inlet pressure	2 · 10 ³ to 6 · 10 ³ hPa
	Input/output pressure difference	> 2 · 10 ³ hPa

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

2) Depends on pumping conditions. Contact us.

Tbl. 9: Cooling water characteristics

Connector types

Water inlet	1/4" NPT or 3/8" NPT male connector	Stainless steel
Water outlet	1/4" NPT or 3/8" NPT female connector	Stainless steel

14.5 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

Tbl. 10: Nitrogen characteristics

Connector types

Nitrogen inlet	1/8" NPT male connector	Stainless steel
Nitrogen inlet	Male connector for 1/4" tube	Stainless steel

14.6 Electrical characteristics

Main switch short circuit cut-off capacity	10 kA
GFI (or RCD) type B, differential circuit breaker compatible with TT electrical networks	100 mA ¹⁾

1) for TN and IT networks, use appropriate protection measures

Tbl. 11: Electrical network protection

Model	Main circuit breaker rating (minimum values)*		Conductor cross-section sizes	
A 2504	200-230 V 50/60 Hz	32 A	8.4 mm ²	AWG-8
A 3004	380-480 V 50/60 Hz	25 A	8.4 mm ²	AWG-8

* UL489 certified breakers recommended.

If the power supply voltage is changed from the factory configuration, please contact our service center.

Tbl. 12: Main circuit breaker rating and cable cross-section size

14.7 Dimensions

Dimensions in mm

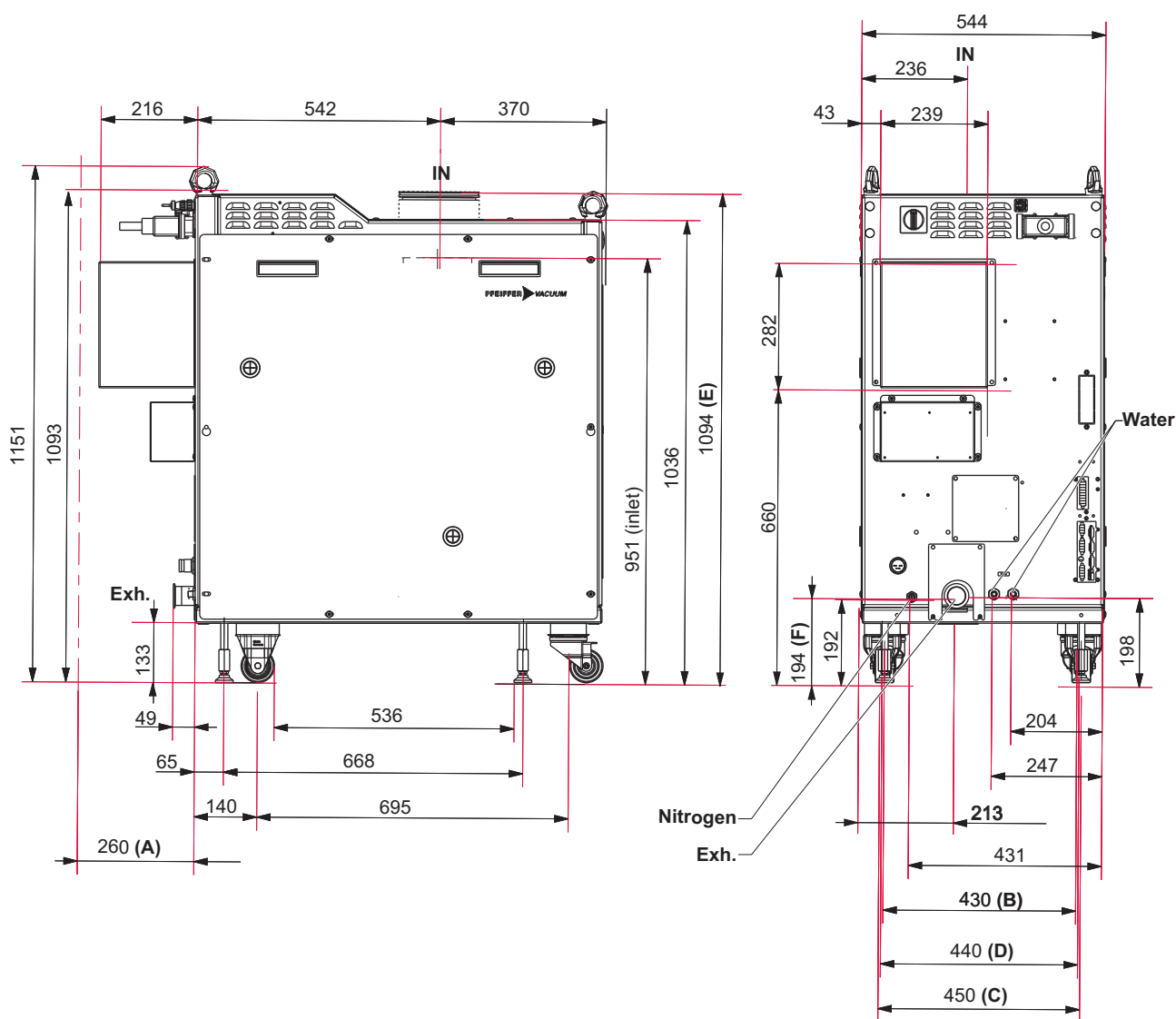
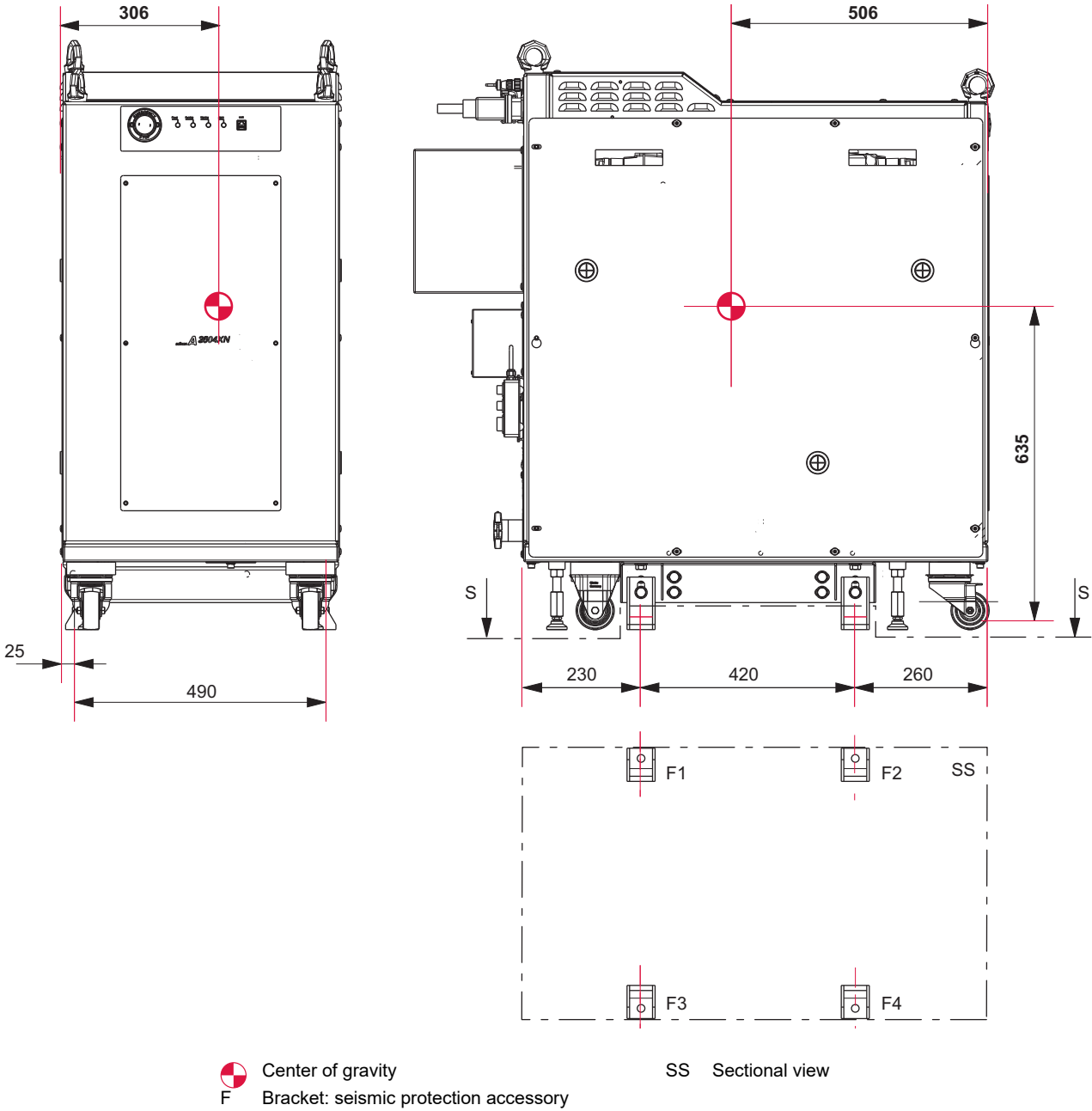


Fig. 17: A 2504, A 3004 dimensions

A	Minimum space for connection
B	Space between front casters
C	Space between feet
D	Space between rear casters
E	Inlet pipe extension (option)
F	Exhaust axis position

14.7.1 Weight distribution and center of gravity

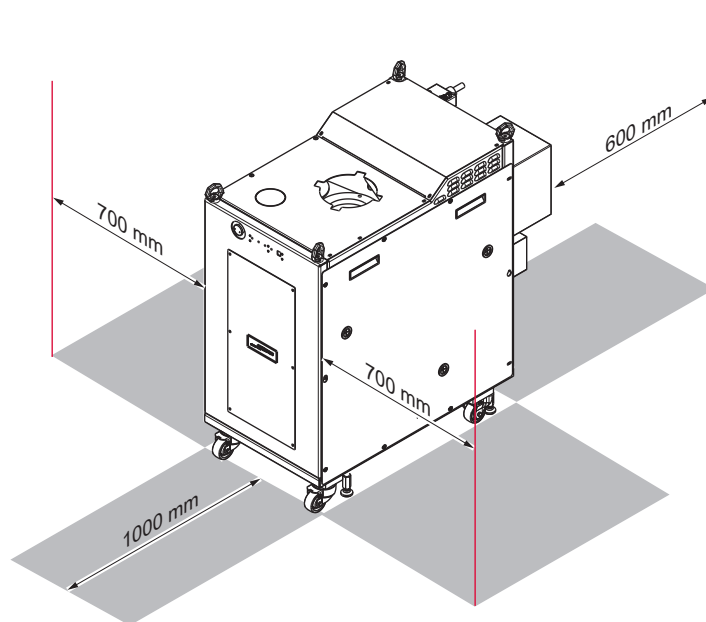


Bracket anchoring points

- number of bolts: 4
- bolt diameter: M12

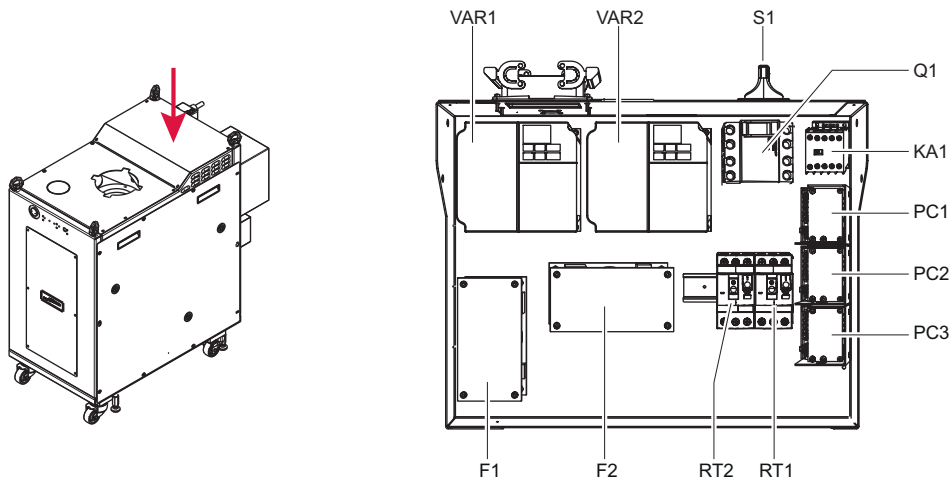
Weight per foot (DaN)			
F1	F2	F3	F4
235	245	172	179

14.7.2 Maintenance space required



15 Appendix

15.1 Location of the electrical components

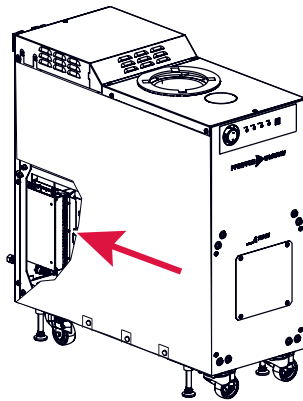


Mark	Description
VAR1/VAR2	Frequency converter
F1/F2	Three-phase filter
S1	Main switch
Q1	Main breaker
RT1	FB breaker
RT2	Roots breaker
RT3	Heating circuit breaker (option)
KA1	Heater contactor
PC1/PC2/PC3	Heater control box

15.2 Adjusting the circuit breakers

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

15.3 Location of the monitoring sensors



N2 VALVES
RSV1 VALVES
FB VALVES
LI1
LI2
LI3
LI4
WH
RSV1 MOTOR
FB MOTOR
H2O FLOW
HEAT3 TEMP
HEAT2 TEMP
HEAT1 TEMP
RSV1 TEMP
FB HP TEMP
FB PRESS
FB SAFETY
FB LP TEMP
FLOW CONT
ANA1



Certificate of Conformance
Salus Engineering International
Has Found The Pfeiffer Vacuum
Vacuum Dry Pump A2504/A3004
to be in Conformance with the Requirements of
SEMI® S2-1016 as Configured and Assessed in
Report Number: 6591-OE-AS1

Chris Evanston, PE

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".

Date: April 13th, 2018

Serial Number: AS0276

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

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.

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

Applicant: Pfeiffer Vacuum SAS

Address: 98, avenue de Brogny
74000 Annecy

Country: France

Manufacturer: Pfeiffer Vacuum SAS

Address: 98, avenue de Brogny
74000 Annecy

Country: France

Party Authorized To Apply Mark: Same as Manufacturer

Report Issuing Office: Intertek Italia SpA

Control Number: 3026716

Authorized by:



for L. Matthew Snyder, Certification Manager



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

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

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

Standard(s):	Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements [UL 61010-1:2012 Ed.3+R:06Jun2023] Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements [CSA C22.2#61010-1:2012 Ed.3+U1;U2;A1;U3]
Product:	Vacuum pump
Brand Name:	PFEIFFER  VACUUM
Models:	A3004 followed by up to two letters.

UK Declaration of Conformity

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

Declaration for product(s) of the type:

Multi-stage Roots pumps

A 2504H - A 2504X - A 2504XN

A 3004H - A 3004X - A 3004XN

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

Supply of Machinery (Safety) Regulations 2008

Electromagnetic Compatibility Regulations 2016

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Applied standards and specifications:

EN 1012-2: 2009

EN 61010-1: 2011

EN IEC 61000-6-2: 2016

EN IEC 61000-6-4: 2016

EN 60204-1: 2006

The manufacturer's authorized representative in the United Kingdom and the authorized agent for compiling the technical documentation is Pfeiffer Vacuum Ltd, 16 Plover Close, Interchange Park, MK169PS Newport Pagnell.

Signature:



(Guillaume Kreziak)
Managing Director

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

Annecy, 2023/03/10

**UK
CA**

EC Declaration of Conformity

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

Declaration for product(s) of the type:

Multi-stage Roots pumps

A 2504H - A 2504X - A 2504XN

A 3004H - A 3004X - A 3004XN

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

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

Electromagnetic compatibility 2014/30/EU

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

Harmonized standards and national standards and specifications applied:

EN 1012-2: 2009

EN 61010-1: 2011

EN IEC 61000-6-2: 2016

EN IEC 61000-6-4: 2016

EN 60204-1: 2006

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

Signature:



(Guillaume Kreziak)

Managing Director

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

Annecy, 2023/03/10



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Ed 06 - Date 2024/11 - P/N:127855OEN



Are you looking for a
perfect vacuum solution?
Please contact us

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