



Classic 600 G

High Vacuum Coating System

PC K00 128 – Thin Film Technology Moscow

Operating Instructions

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1 About this manual

1.1 Validity

This manual for the High Vacuum Coating System Classic 600 G is a customer document of Pfeiffer Vacuum. It describes the functions of the High Vacuum Coating System and provides the most important information for the safe use of the system.

Descriptions are in accordance with EC Directive "Machinery 2006/42/EC" of 17.05.2006. Special attention has been paid here to the increased information requirements concerning the functional principle and the new safety requirements.

The information provided in the operation manual for the High Vacuum Coating System Classic 600 G refers to the latest development version of the system.

The document shall remain valid provided that the customer does not make any changes to the system. If we should determine that it is necessary to make changes to these instructions, we will send you the necessary documents immediately.



WARNING

It is very important to read these operating instructions before operating the system.

Up-to-date operating manuals can also be downloaded from www.pfeiffer-vacuum.net.

Scope of the overall documentation

The documentation for the **High Vacuum Coating System Classic 600 G** has Pfeiffer Vacuum number PA 0436 DN and consists of several folders. These include:

- Operating manual PA 0392 BN
- Declaration of conformity
- Certificates
- Drawings
- Electronic documentation
- Operating manual for the individual components

1.2 Conventions

Safety instructions

Safety instructions in Pfeiffer Vacuum operating manuals are the result of the risk evaluations and danger analyses that were performed and that are based on international certification standards according to UL, CSA, ANSI Z-535, Semi-S1, ISO 3864 and DIN 4844. This document considers the following levels of danger and notes:

DANGER

Immediately pending danger

Death or serious injury may occur.

WARNING

Potential pending danger

Death or injuries may occur.

CAREFUL

Potential pending danger

Medium to slight injuries may occur.

NOTE

Order or note

Prompt for activity or information about features that can cause damage to the product if they are disregarded.

Pictograph definitions



Prohibition of an action or activity in connection with a source of danger, the disregarding of which may result in serious accidents.



Warning about the danger that is represented by the symbol.



Prohibition of an action or activity in the use of a source of danger, the disregarding of which may result in serious accidents.



Important information about the product, handling or a relevant part of the documentation to which special attention should be given.

Instruction in the text → Instruction: An action is required.

Abbreviations used

All component abbreviations refer to their designation in the relevant vacuum diagram of the coating system (see part 2 of this documentation). Examples:

P1: Vacuum pump P1 (in acc. with system diagram)

M1: Pressure measuring pipe M1

The numbering of components in the illustrations does not correspond to the numbering that may be given in individual operating manuals, drawings or bills of materials (spare parts lists).

2 Safety

2.1 Safety precautions

This section provides an overview of the safety concept of the Pfeiffer Vacuum product in accordance with the following EC directives:

- 2006/42/EC dated 17.05.2006
- 2014/30/EU dated 26.02.2014
- 2014/35/EU dated 26.02.2014

Important safety regulations

The system is built according to state of the art technology and is safe to operate. However, dangers can originate from the system if it is not used properly or as intended. The local safety and accident prevention regulations shall always apply to the operation of the system. The following notes should be observed in addition to the safety-relevant comments in the sections of the overall documentation:



NOTE

Obligation to provide information

Every person who is involved in the installation, operation or maintenance of the system has to have read and understood the safety-relevant parts of this documentation.

- We recommend that the operator obtains written confirmation of this from all users or operating personnel.
- The operator is obliged to make all operating personnel aware of the sources of danger that can arise from components or additions and enhancements to the system.

- The High Vacuum Coating System Classic 600 G may be operated, serviced and maintained only by trained and instructed staff. These staff members must have received special instruction regarding the dangers that can occur.
- The responsibilities for installation, operation and maintenance work have to be clearly defined and adhered to, so that there is no unclarity regarding safety responsibilities.
- For all work involving installation, start-up, operation and maintenance the deactivation procedures specified in these operating instructions must be observed.
- No operation shall be undertaken that impairs the safety of the operator and the High Vacuum Coating System Classic 600G.
- The operator must ensure that no unauthorised persons work on the system.
- The user is obliged to operate the system in a fully-functioning state at all times.
- The operator is obligated to report to the user immediately any changes that occur in the Coating System Classic 600 G that impair the safety of the system.
- The user must ensure that the system is kept clean by means of appropriate instructions and inspections.
- The customer may only modify the PLC software by agreement with Pfeiffer Vacuum. Any unauthorized modifications shall invalidate the warranty.
- None of the project documents may be passed to third parties.
- Unauthorised modifications or changes that can impair the safety of operating personnel and the system are not permitted without consulting the manufacturer.
- The system must be disconnected electrically for all installation and maintenance work.
- Before starting up the system after maintenance, verify that all of the safety devices are fitted and functioning properly.

- Protection equipment can only be removed if the system is at a standstill and electrically switched off.
- The complete High Vacuum Coating System Classic 600 G must only be transported using a forklift truck or a lifting crane. Ensure that the weight of the system is distributed evenly (danger of tilting!).
- The bell must be closed and secured with a steel belt while the system is being transported.
- The protection measures that are used shall be tested after the electrics have been assembled and maintained (example: earth resistance).
- The local safety and accident prevention regulations shall always apply to the operation of the system.
- Cooling water hoses and electric cables must be routed separately from the operator's supply to the Coating System Classic 600 G and must not interfere with electrical equipment.

Safety equipment

The following safety equipment provides protection against damage to persons and material:

- Master switch
- Emergency Stop button at the control panel and at the control cabinet
- Vacuum monitor
- Safety switch
- Door switch

The operator is responsible for implementing additional safety precautions and providing suitable protective clothing and other equipment for work with substances that pose a risk to health.

Master switch

On the control cabinet there is a master switch that, when pressed, switches off the entire power supply.

Emergency stop button

Located on the operator panel on the front of the High Vacuum Coating System Classic 600 G is a red mushroom head button that, when pressed, moves the system into a safe condition. There is a second Emergency Stop button with the same function at the control panel for opening and closing the bell.

Vacuum monitor

The vacuum monitor is a pressure-dependent switch. The switch point is set to 100 mbar but can be adjusted between 100 and 900 mbar. The pressure indication is dependent on the barometer level, but not from the type of gas. To ensure operational reliability, the monitor is integrated into the locking chain (if the pressure rises, the switch opens and the power supply is interrupted).

Safety switch

The safety switch over the bell disconnects the mains power to the high voltage components when the bell is open.

Operating personnel

The system is built according to state of the art technology and is safe to operate. However, dangers can originate from the system if it is not used properly, by untrained staff or is not used as intended. The operator must only employ trained staff to operate the system. The operator is obliged to inform all operating personnel of the dangers that can occur in the system. This applies especially to any modifications or additional equipment that are made or provided by the operator.

The responsibilities for installation, operation and maintenance work have to be clearly defined and adhered to, so that there are no unclear competencies with regard to safety. A basic requirement for operating personnel is that they know how to use the installed operating panel safely and that they know this operating manual. The operator and each operating person is obliged to ensure that workstations, the working environment and neighbouring traffic routes are all kept tidy and clean. The system must be visually inspected before starting work. It must be ensured that all safety equipment is installed and is function tested.

2.2 Proper use

- The High Vacuum Coating System Classic 600 G is designed exclusively for general vacuum experiments in the development field, and for use in small-series production.
- The high vacuum system can only be used to pump media against which the system and its pump system are chemically stable. If other media are used, the user has to qualify the system for these processes.
- Proper use also involves compliance with the installation, start-up, operation and maintenance regulations specified by the manufacturer.
- The High Vacuum Coating System Classic 600 G is designed as a single workstation.

2.3 Improper use

- Improper use refers to the use of the system for any purpose other than that described above.
- Other uses are possible only on a contractual basis and following consultation with Pfeiffer Vacuum.
- Improper use of the equipment automatically invalidates all warranty and liability claims.



DANGER

All operating personnel of the coating system must ensure that no living creatures are present in the vacuum chamber during a process. Danger to life!



NOTE

CE conformity

The installation of additional equipment and modifications made by the operator automatically invalidates the manufacturer's declaration of conformity.

→ Before operating additional equipment or modifications, the operator of the Pfeiffer Vacuum system is obliged to check conformity with the applicable EU regulations and to reassess this accordingly.

3 Transport and storage

3.1 Unpacking / repacking

The system is split into segments for transportation and secured in transportable wooden holders. Individual parts are packed securely in transport crates.



NOTE

Disposal of packaging materials

The wooden holders for transporting system components cannot be reused after unpacking.

→ Dispose of them according to the applicable regulations.

→ Before the system is relocated it must be completely dismantled and packed securely.

3.2 Transport

The system can be split into segments or individual parts for transportation. The segments must be moved horizontally using a suitable fork lift truck, lift truck or a lifting crane. Suspension eyes have been provided for transport via crane. The segments are:

- Basic system with process chamber
- Control cabinet
- Media wall
- Small parts



WARNING

There is a risk of injury if the system is not transported properly.

Danger to life from falling or protruding loads if the system is not properly secured to lifting devices or is not transported properly.

→ Use suitable lifting devices and tools.

→ Ensure that the weight is distributed evenly. Avoid danger of tipping.

→ Pay attention to attachments and superstructures.

3.3 Storage

The system is suitable for storage. Enclosed, dry and dust-free rooms are suitable storage locations.

→ Where necessary, cover the system before storage (for example with a plastic sheet).



CAREFUL

Note the risk of corrosion and stand times.

Long stand times and storage of vacuum pumps can lead to corrosion and ageing of lubricants/operating fluids and elastomer seals.

→ Observe the notes in the operating manuals for the individual components.

→ Change lubricants and operating fluids before restarting operation.

4 Product description

4.1 Product identification

The system described has been manufactured and assembled according to specified documents. Its basic construction can be seen from the following drawings:

- Complete system layout drawing
- Vacuum diagram
- Pneumatic diagram

➔ See the documents the documentation folder.

Rating plate

The information on the rating plate helps towards safe identification of the system and when communicating with Pfeiffer Vacuum should be to hand and used at all times. The rating plate is clearly visible on the rear or side covering of a control cabinet.



	
D-35614 Aslar Berliner Str. 43	
Typ Type	
Geräte - Nummer Serial number	
Spannung voltage	
Hauptsicherung main fuse	
Schaltplan circuit diagram	
Masse mass	Baujahr year of make
Made in Germany 	

Fig. 1: Pfeiffer Vacuum rating plate

Shipment

The coating system is a system for general vacuum experiments in the development field, and for use in small-series production. The shipment consists of the following components:

- Vacuum system
- Process chamber
- Control cabinet with electrical equipment
- Media supply
- Documentation

4.2 Construction and function

The High Vacuum Coating System Classic 600 G basically consists of a vacuum system, a process chamber as well as supply facilities and a control cabinet. The individual components are mounted on a section frame structure and wired to each other. All operating elements needed to operate the system are located at the front of the control cabinet. There is also another control panel with two-hand control for opening and closing.

The pump system can be accessed directly. The space under the vacuum chamber is covered, and houses the high-voltage components. Access is possible by opening the door using a switching cabinet key; this door and the door on the rear are protected by a safety switch. Before opening the panels, it is essential to make sure that the system has been switched off by means of the master switch.



WARNING

**For servicing work:
CAUTION: HIGH VOLTAGE!**

The system is prepared for cleanroom operation.

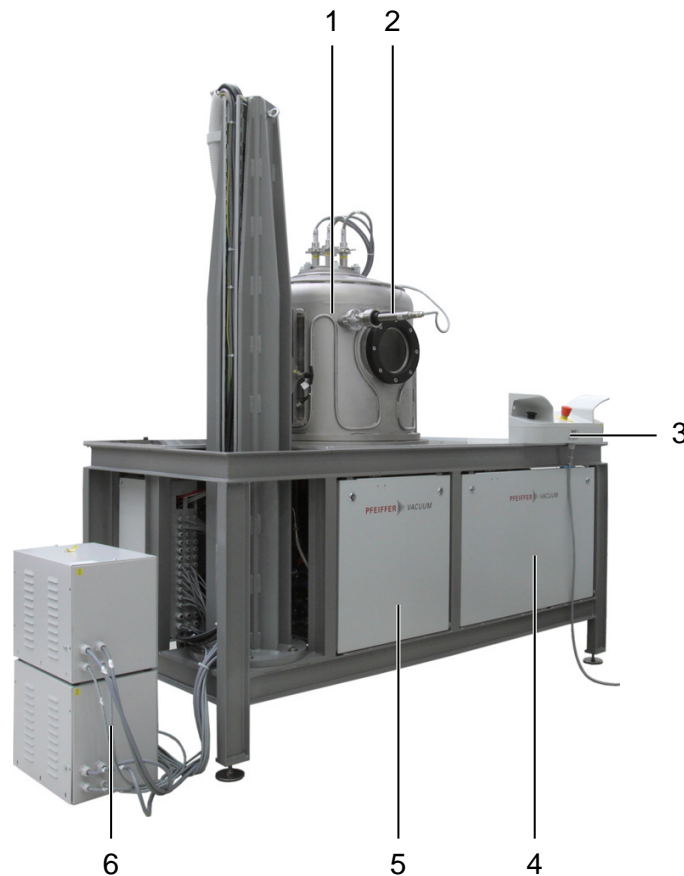


Fig. 2: Overview High Vacuum Coating System Classic 600 G

- | | | | |
|---|------------------|---|-------------------------|
| 1 | Process chamber | 4 | Pumping station |
| 2 | Pyrometer | 5 | High voltage components |
| 3 | Two-hand control | 6 | Power supply |

Process chamber

The interior of the stainless steel vacuum process chamber has a diameter of 600 mm. The vacuum chamber has been completely blasted with glass beads. The chamber and door can be cooled and heated by means of welded on tube coils. Two inspection windows DN 100 ISO in the door allow the process to be monitored. Appropriate flanges are available on the circumference of the vacuum chamber for gas inlet, vacuum and temperature measuring and monitoring. The substrate plate and the mask plate each have 6 openings for the substrate holders or the mask.

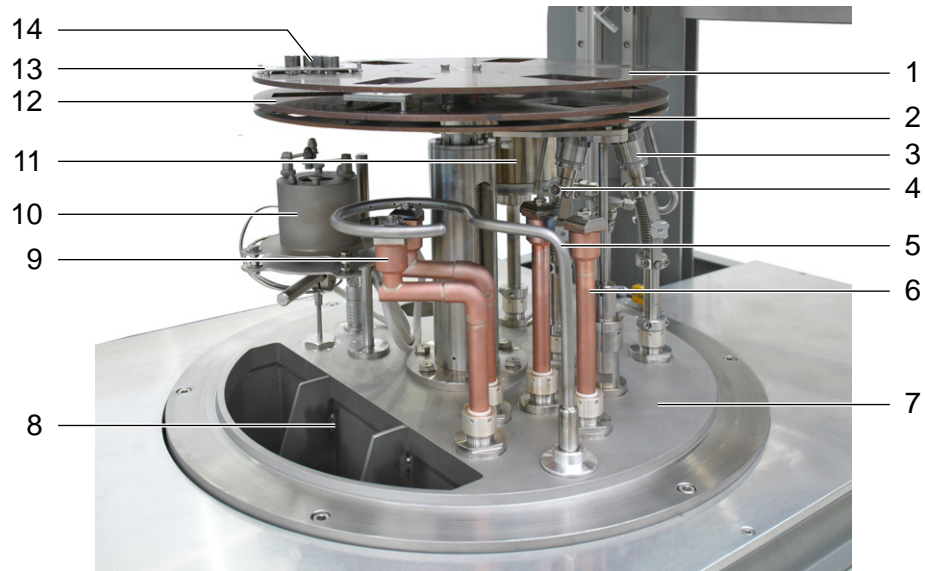


Fig. 3: Process chamber of the Coating System Classic 600 G

1	Substrate plate	7	Baseplate
2	Shutter	8	Chamber opening to the pumping station
3	Sputter source 1" (magnetizable) (position 3)	9	Boat 2 (position 5)
4	Sputter source 1" (not magnetizable) (position 3)	10	Ion source (position 1)
5	Gas inlet ring for resistance evaporator 2	11	Sputter source 4" (position 2)
6	Boat 1 (position 4)	12	Mask plate
		13	Substrate holder
		14	Substrates

The following coating equipment is provided for the Coating System Classic 600 G:

- 1 Ion source (position 1)
- 1 Sputter source 4" (position 2)
- 1 Sputter sources 1" for non-magnetizable target materials such as aluminum (position 3)
- 1 Sputter sources 1" for magnetizable target materials such as nickel (position 3)
- 1 Boat (position 4)
- 1 Boat resistance evaporator with gas inlet ring (position 5)

Pump equipment

The system is equipped with a vacuum pump station, which evacuates the process chamber.

Each vacuum pump station basically consists of the following:

- Backing pump
- Turbo pump
- Venting valve (in the event of power failure)

The pump stations are used for gradual evacuation of the vacuum chamber. A backing pump ACP 40 evacuates the vacuum chamber up to approx. 1×10^{-2} mbar. The turbomolecular pump HiPace 2300 is started at the same time as the backing pump. See also

the vacuum diagram in part 2 of the documentation. Important information on the function and maintenance of the backing pump and turbo pump are contained in the component operating manuals.

Remove the blind flanges from the high vacuum side and backing side immediately before connecting!

Vacuum measuring facilities

There is a connection for a vacuum gauge at the vacuum chamber. A gauge tube PKR 361 is installed here. Located at the top of the vacuum chamber is a mechanical pressure switch for monitoring the process pressure. Only when the pressure falls below the set minimum level does the vacuum switch enable the process components that are supplied with high voltage for the process chamber.

Control

The function of the coating system Classic 600 G was tested by us prior to delivery. The pump system is controlled via the PLC.

4.3 Media supply

Pneumatic equipment

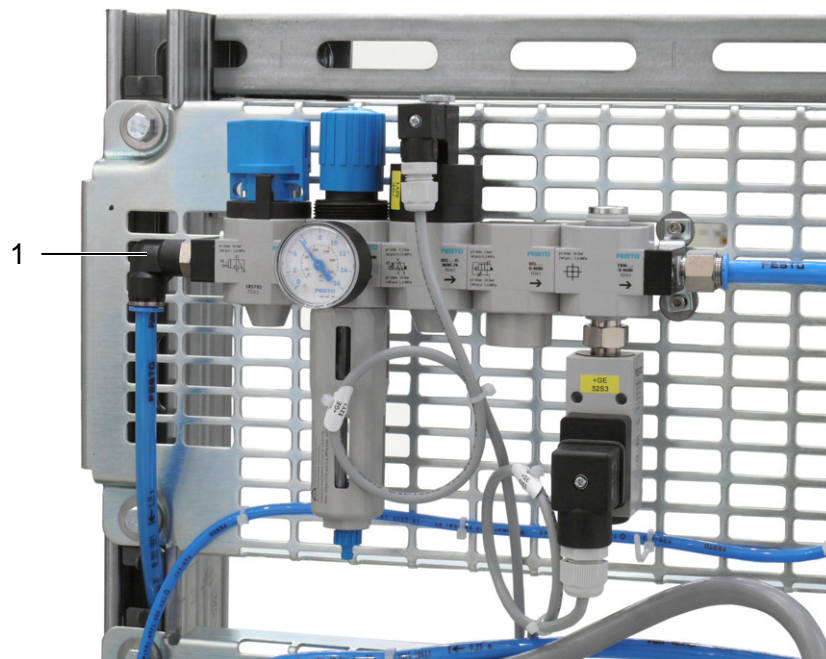


Fig. 4: Pneumatic connection

1 Main compressed air connection

The functions of the chamber components and the electropneumatic valves require an external supply of purified compressed air with a minimum overpressure of 6 bar. The compressed air supply for pneumatic components has a central inlet on the media wall. From there it is distributed via a valve cluster to all components according to the pneumatics diagram (see drawing in part 2 of the full documentation).

Electrical equipment

The electrical equipment consists of a switch and control cabinet mounted in a rack separate to the system itself.

Connection of the components is via busses up to the sockets and distribution boxes in the frame.

Water supply

The turbo pumps, the process chamber and the sputter sources are supplied with hot resp. cold water. The water supply is on the media wall. This contains the water distribution to the individual components.

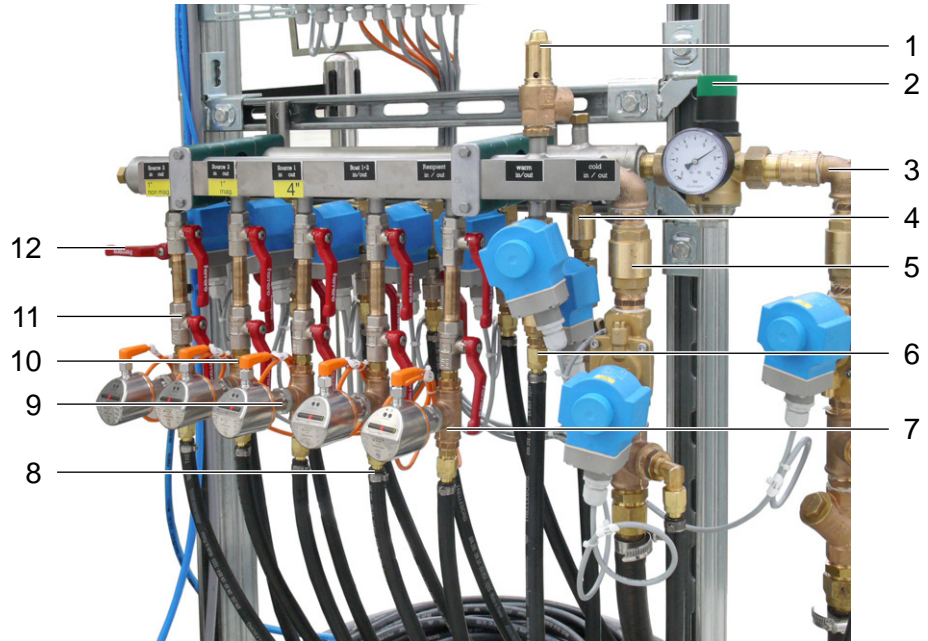


Fig. 5: Water connection

- | | | | |
|---|------------------------|----|--------------------------------------|
| 1 | Pressure relief valve | 7 | Recipient |
| 2 | Pressure reducer | 8 | Boat 1 and 2 |
| 3 | Cold water supply line | 9 | Sputter source 4" |
| 4 | Hot water supply line | 10 | Sputter source 1" (magnetizable) |
| 5 | Cold water return line | 11 | Sputter source 1" (not magnetizable) |
| 6 | Hot water return line | 12 | Compressed air shut-off valve |

Process gas

Process gases (argon, nitrogen, or "air") can be introduced into the process chamber for the coating process. The connections are located in the rack below the vacuum chamber in front of the mass flow controllers.

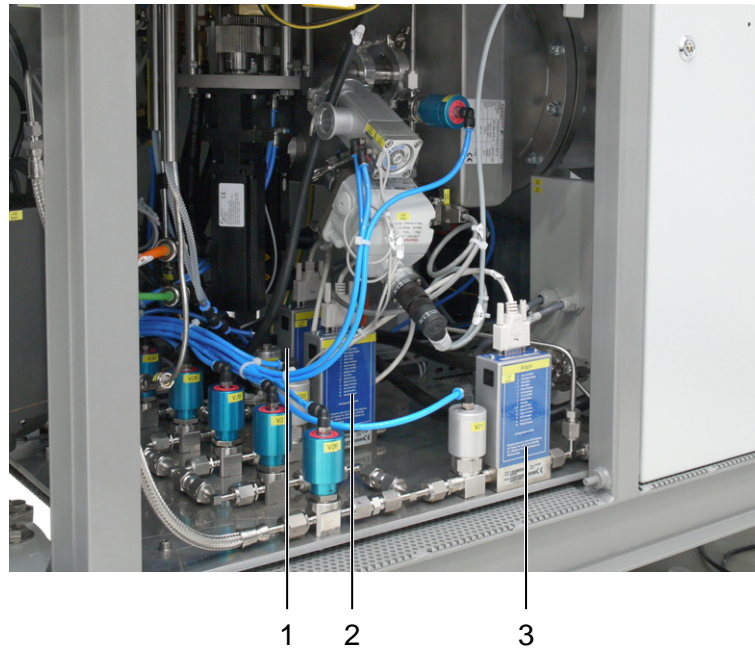


Fig. 6: Mass flow controllers for process gas

- | | |
|---|-------------------------|
| 1 | Controller for argon |
| 2 | Controller for nitrogen |
| 3 | Controller for air |

Venting gas

Instead of ambient air, venting can be carried out using an alternative gas, typically oxygen or argon. This minimises the amount of moisture admitted to the process chamber as it is being vented. The appropriate connection is located at the venting valve in the rack below the vacuum chamber.



Fig. 7: Connection for venting gas on the process chamber

- 1 Venting gas connection

4.4 Display and operation elements

The operating and control elements in the control cabinet are used to operate the coating system. These enable control of the following process components:

- Pump system
- Ion sources
- Boats
- Sputter source
- Rotary drive for the substrate plate and the mask plate
- Gauge tubes
- Valves
- Additional process accessories

See also the diagram of the rack cabinet layout in part 2 of this documentation.

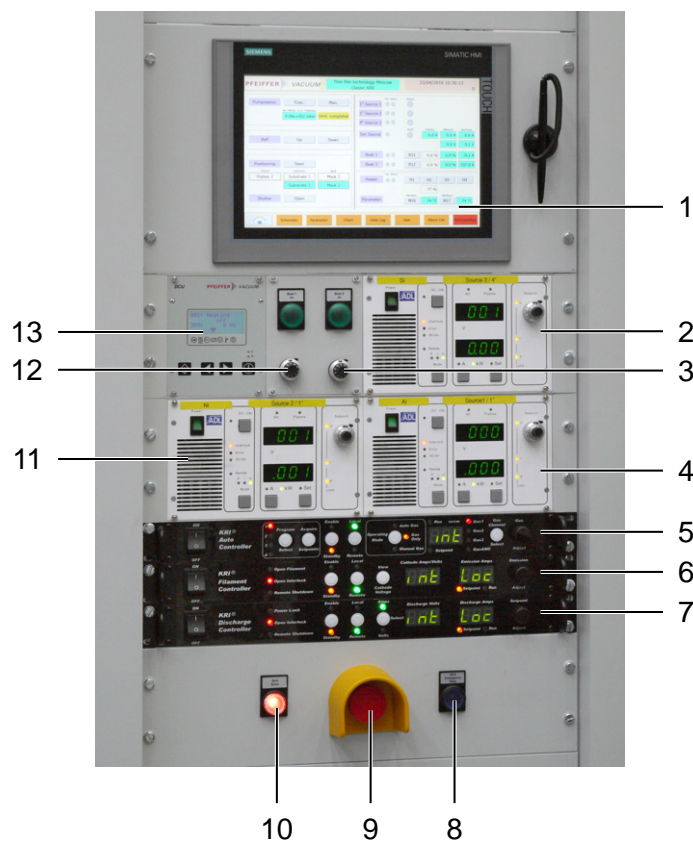


Fig. 8: Display and operation elements

- | | | | |
|---|--|----|--|
| 1 | Graphical User Interface | 8 | Illuminated button "Quit Emergency Stop" |
| 2 | Sputter source 4" | 9 | Emergency stop button |
| 3 | Power controller for resistance evaporator 2 | 10 | Illuminated button "Quit Error" |
| 4 | Sputter source 1" (not magnetizable) | 11 | Sputter source 1" (not magnetizable) |
| 5 | Auto Controller Ion source | 12 | Power controller for resistance evaporator 1 |
| 6 | Filament Controller Ion source | 13 | Controls for the turbopump (DCU) |
| 7 | Discharge Controller Ion source | | |

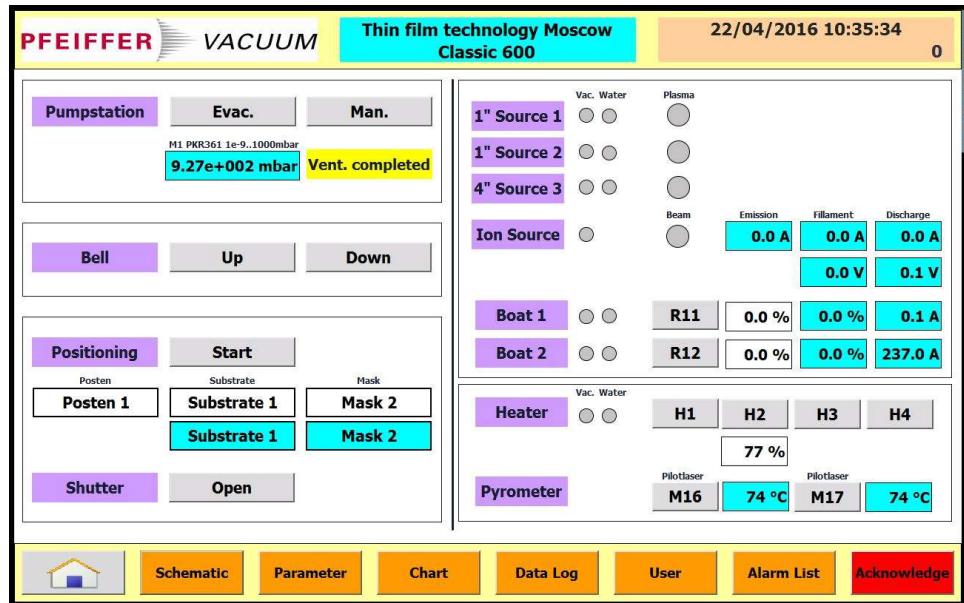
4.5 User Interface

General Information

This chapter gives an overview of the menu guidance on the user interface of the Coating System Classic 600 G. The function and operation of the coating system are described in Chapter 6 "Operation".

The system is operated via various menus on different menu levels. The buttons at the bottom of the screen are used to switch back and forth among the menus.

The main menu screen appears after the coating system is switched on.



- Press one of the buttons at the bottom of the screen to open the respective menu.
- Press the first button ("Home") to return to the main menu screen.

On the main menu screen, the pumps of the coating system can be started in "Evacuation" or in "Manual" mode. Raising or lowering the bell at the process chamber can also be enabled on this screen. The positioning of the substrate plate and mask plate to the coating source is also specified here. The present statuses of the coating devices and of the heater and pyrometer are also displayed here.



NOTE

Risk of Injury or Material Damage If Operated Improperly

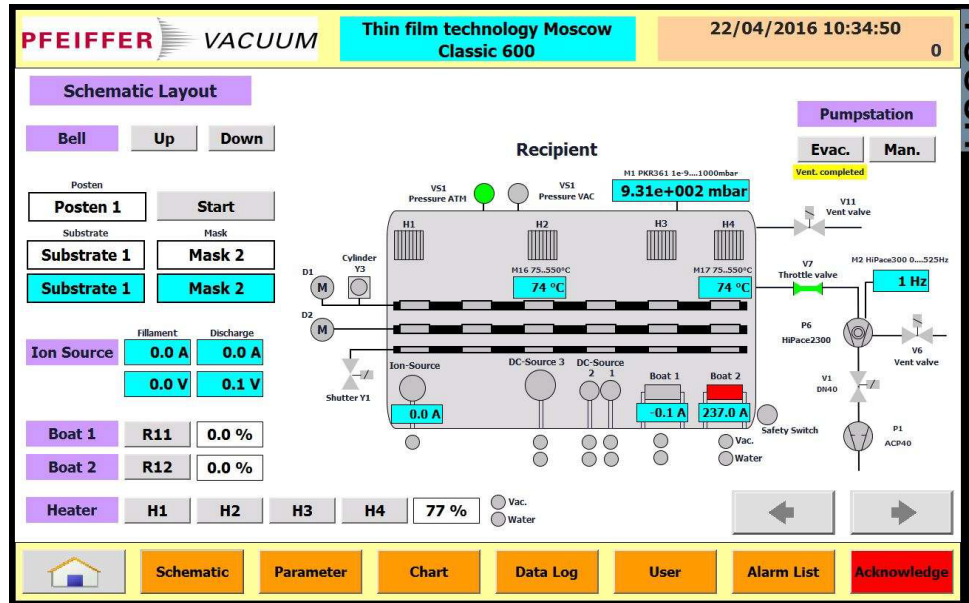
In "Manual" mode, switching of all components is possible (even absurd ones). Pfeiffer Vacuum accepts no liability nor accepts any warranty claims whatsoever for damage caused by improper operation of the coating system in Service mode.

- Only authorized personnel trained by Pfeiffer Vacuum may operate the system Service mode.

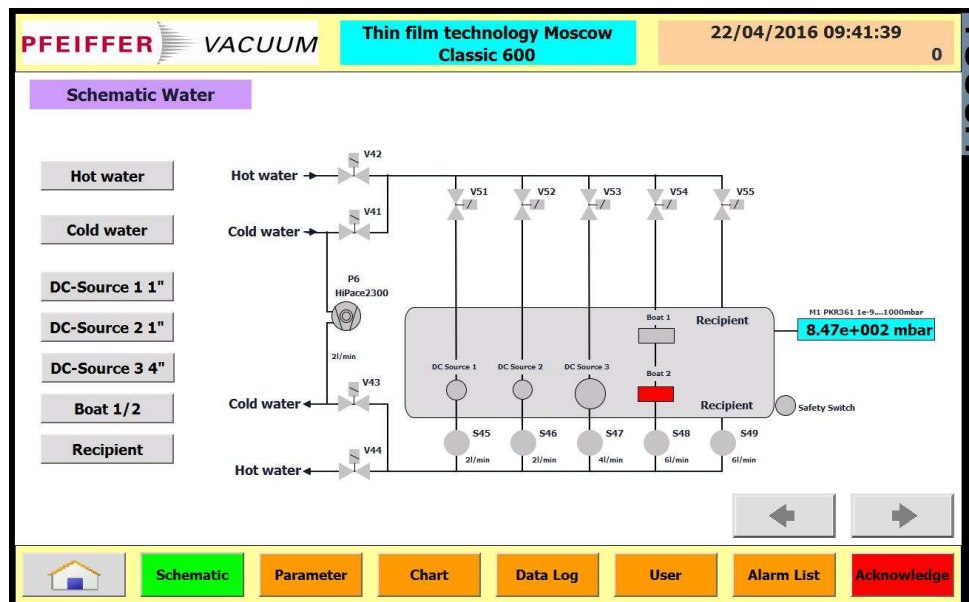
Menu "Schematic"

The "Schematic" menu shows a schematic diagram of the coating system and of the individual measurements. Individual components of the coating system can also be switched on or off here. To open any of the other screens within the "Schematic" menu, press the arrow keys at the bottom of the screen.

- Press the button "Schematic".

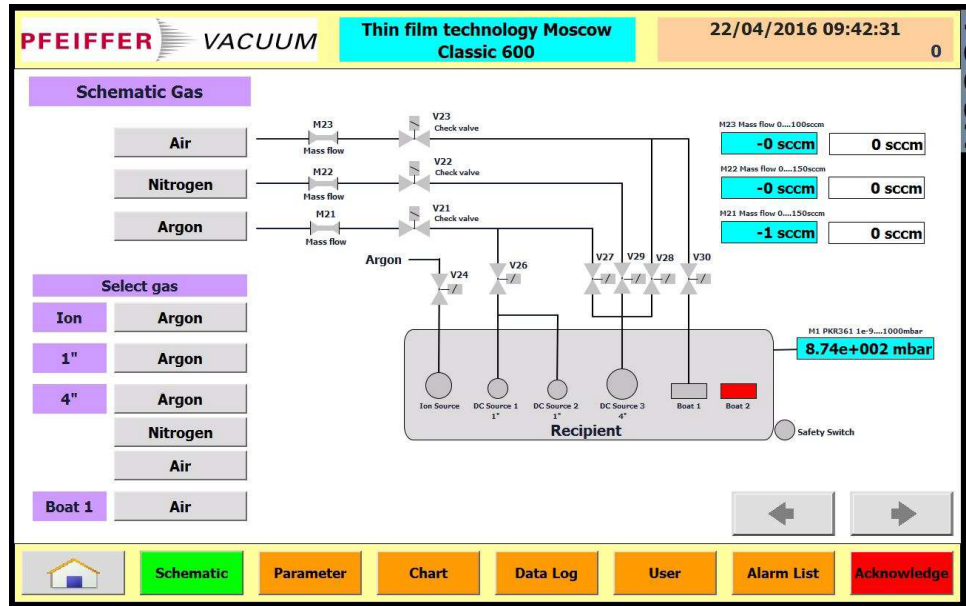


→ When you press the "right" arrow button, the following screen opens.



You can switch the hot or cold water supply for the individual coating devices on or off here. Always make sure that the water supply is switched on for the coating source that is to be used in the process.

→ Press the "right" arrow button again.



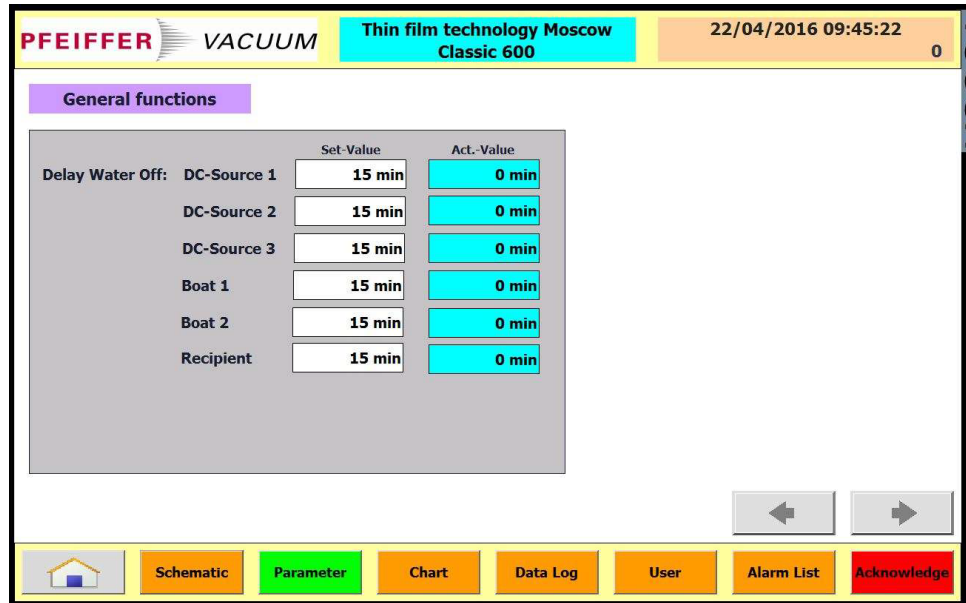
Here you can set the assignment of the process gases to the individual coating devices and can open or close the respective valves.

Menu "Parameter"

The individual parameters of the coating system can be set or viewed in the "Parameters" menu. To switch to the other screens within the "Parameters" menu, press the arrow buttons at the bottom of the screen.

→ Press the button "Parameter".

"General Functions" screen



A time for which the water must continue to be supplied before the system can be switched off is specified here for the individual coating sources.



NOTE
<p>Risk of damage due to improper operation</p> <p>If the selected delay for shutting off the water is too short, the temperature of the sources when the system is switched off could still be so high that the sources sustain damage.</p> <p>→ Set a delay of at least 15 minutes.</p>

"Heating" screen

On this screen, you make the settings for the substrate heaters in the top of the bell.

- **Set value Output Heater:** Set value for all heaters.

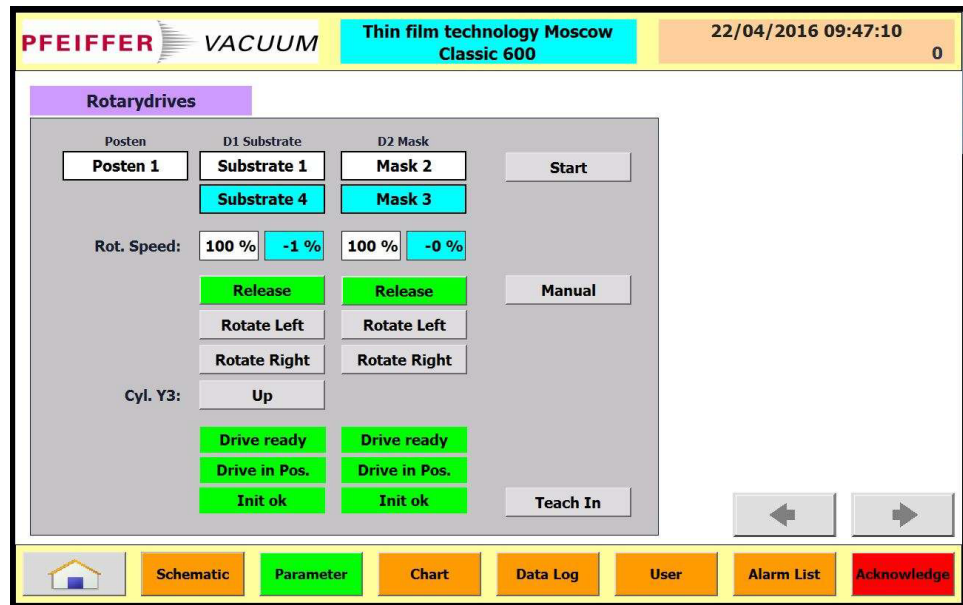
The following settings are entered or displayed separately for each heater. The respective heater can be switched on or off by pressing the buttons.

- **Max.-Value:** Maximum output of the heater. Act. Value is the present temperature range of the heater.
- **Act.-Value:** Actual value of the output of the heater.

The following values are displayed for both pyrometers. The respective pyrometer can be switched on or off by pressing the buttons.

- **Act.-Value:** Actually measured temperature at the respective pyrometer.

"Rotarydrives" screen



In the same way as on the main menu screen, you can assign the coating source, substrate and mask to one another here. You can also set the rotary drives for rotating the substrate and mask and their alignment with each other here.

The set value for the speed at which the rotary drives rotate is displayed in the white fields "Rot. Speed". The actual speed of rotation is displayed in the coloured fields at the right of the set value.

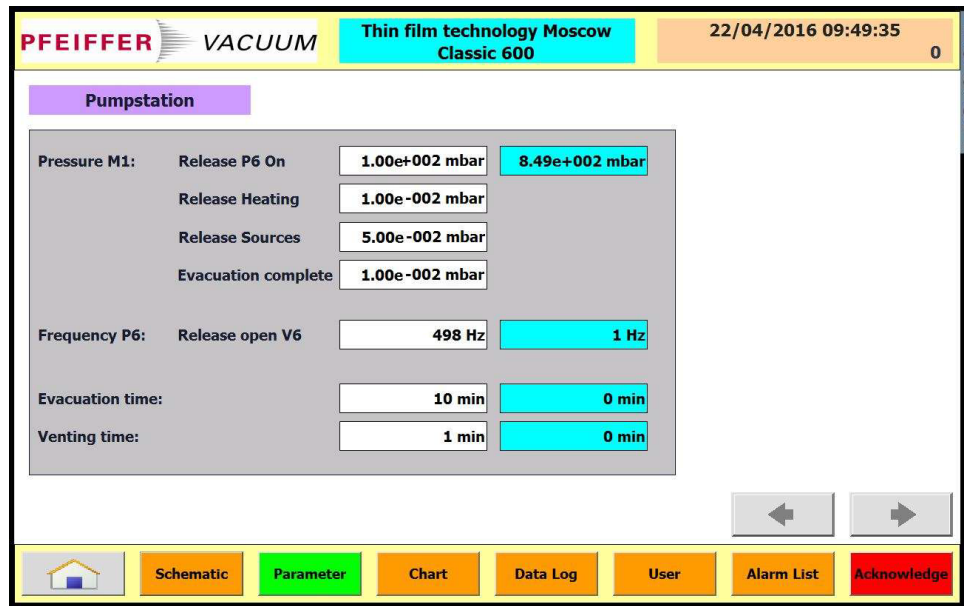
After the "Manual" button has been pressed, the rotary drives can be rotated in the respective direction by pressing the button "Rotate Left" or "Rotate Right" accordingly. Travel continues for as long as the respective button is pressed.

The substrate plate can be moved upwards away from the mask plate by pressing the button "Up" in the "Cyl. Y3" area.

The two rotary drives for the substrate plate and the mask plate can also be aligned with each other, if necessary. For this purpose, there is a hole in both plates, in which a centering pin can be inserted from above.

- Press the "Release" button to switch off the plate drives (the buttons do **not** light up green).
- Insert the centering pin into the substrate plate from above.
- Rotate the substrate plate into position by hand, so that the centering pin sits in the appropriate hole in the mask plate.
The two plates are now correctly aligned with each other.
- Now rotate both plates together by hand over source 4 (resistance evaporator 1).
Look down through the openings in the substrate plate and in the mask plate to check that these openings are centered over the source.
- When the plates are correctly aligned: Press the "Release" button to re-activate enabling of the rotary drives.
- Finally, press the button "Teach In" to take over the present position of the plate drive into the controller as the new reference position.

"Pumpstation" screen



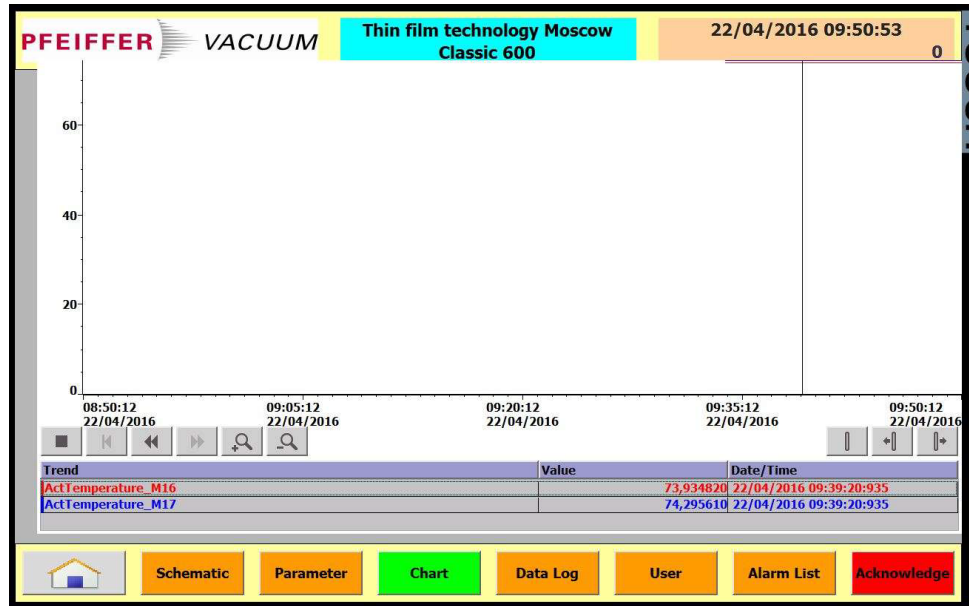
The settings for pumping out or venting the vacuum chamber are made here.

- **Release P6 on:** Pressure at gauge M1 at which the turbopump is switched on. The actual pressure is displayed in the coloured field.
- **Release Heating:** Pressure at gauge M1 at which enabling of the heaters takes place.
- **Release Source:** Pressure at gauge M1 at which enabling of the coating devices takes place.
- **Evacuation complete:** Pressure at the gauge M1 at which the evacuation of the process chamber ends.
- **Frequency P6 – Release open V6:** Frequency of the turbopump at which the venting valve V6 is opened to vent the pump.
- **Evacuation time:** If the set pressure is not reached within the time entered here, an error message is issued accordingly. The time that has elapsed since evacuation started is displayed in the coloured field.
- **Venting time:** If atmospheric pressure is not reached in the vacuum chamber within the time entered here, an error message is issued accordingly. The time that has elapsed since venting started is displayed in the coloured field.

Menu "Chart"

The heat curves during the complete process cycle are displayed in the "Chart" menu, You can navigate through the diagram in steps of seconds or minutes by pressing the arrow buttons below the diagram. You can zoom in and out of the diagram by pressing the + / - buttons accordingly.

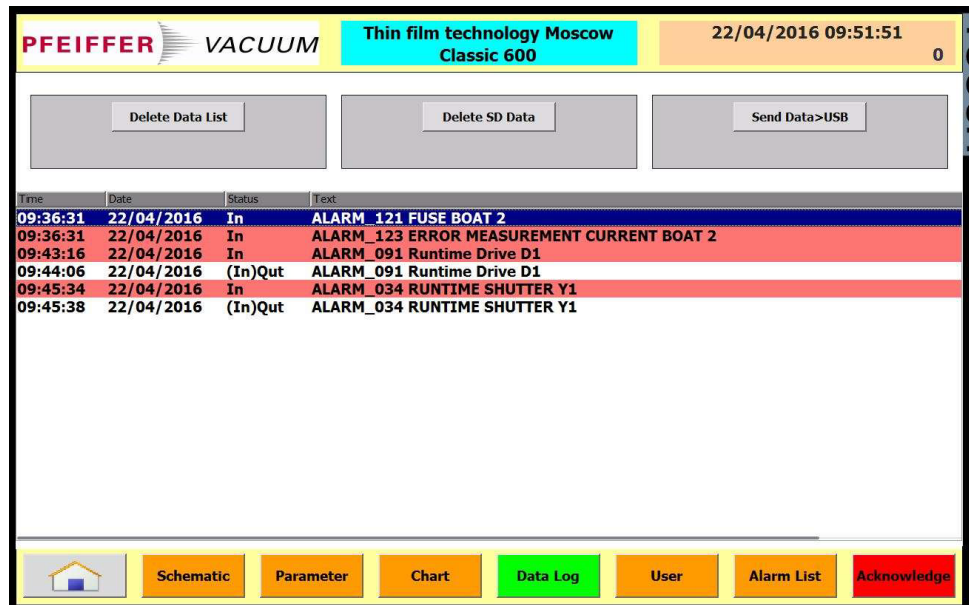
→ Press the button "Chart".



Menu "Data log"

While the coating system is in operation, all events are logged and are saved to an SD card. These events can be viewed in the "Data log" menu and can be saved to an external USB stick for further evaluation.

→ Press the button "Data log".



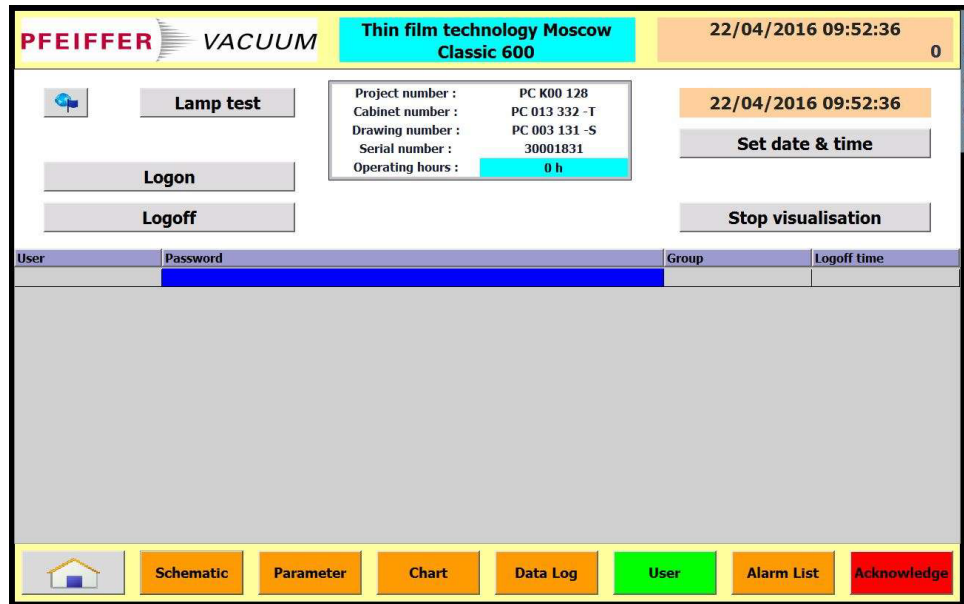
To save the events to an external USB stick:

- Plug a USB stick into the port in the control cabinet.
- Press the button "Send Data>USB". All of the entries saved on the SD card are transmitted to the external USB stick.
- Disconnect the USB stick from the port and evaluate the data on a PC, if necessary.
- To delete all of the displayed events from the present view, press the button "Delete Data List". In that case, the data remain on the SD card
- To delete all of the events from the SD Card, press the button "Delete SD Data".

Menu "User"

In the "User" menu, you can view various information about the stored users and can log users on or off.

→ Press the button "User".

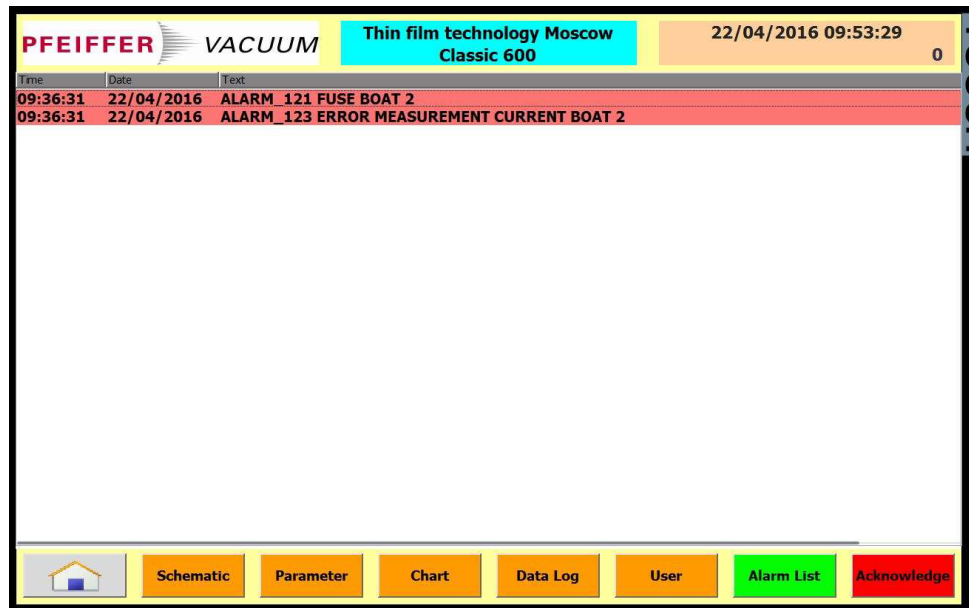


- To log on a user, press the "Logon" button. The drop-down menu "Logon" then opens.
- To log out the presently logged on user, press the button "Logout".
- Press the "Lamp test" button to conduct a lamps test. All of the lamps at the control cabinet light up continuously while the button is being pressed.
- Press the "Language" button to change the visualisation language. The selected language remains active after you exit the menu.
- To end the visualisation, press the button "Stop visualisation" (with the appropriate user authorization)
- To set the date and time, press the button "Set date & time" (with the appropriate user authorization).

Menu "Alarm List"

The presently active error messages are displayed in the "Alarm List" menu.

→ Press the button "Alarm List".



→ After the cause of the alarm has been rectified, press the "Acknowledge" button to cancel the error message.

5 Installation

5.1 Installation location

The installation location is to be chosen so that components that need servicing are freely accessible at all times. No special base is necessary for setting up. Usage in the open air is not permitted. The following conditions must be met:

- level, vibration-free surface
- ambient temperature < 35 °C
- distance from possible rear wall at least 1700 mm

5.2 Preparatory work

Before installing and commissioning the system the installation location must be equipped.

- Fit out media supply according to specification.
- Fit out media disposal according to specification.



NOTE

Connection information

Note information on supply and disposal of relevant media to be provided such as electricity, coolant, compressed air or exhaust gas quantities.

- See "Technical data" chapter
- See rating plate
- See technical data for individual components

5.3 Assembly

The system is set up, assembled and commissioned by Pfeiffer Vacuum. All base parameters of the vacuum pump and measuring system and also control are preset and should only be changed by agreement with the manufacturer.



CAREFUL

Danger of destruction and damage to the system or to components through faulty media supply

Changes without consent or agreement can cause considerable damage to the system and can lead to cancellation of the warranty by Pfeiffer Vacuum.

- Any subsequent adjustments to the media supply are to be done only after consulting with Pfeiffer Vacuum.
- Any subsequent adjustments to the media supply are to be recorded.



CAREFUL

System component resource and lubricant supply

Danger of damage to equipment due to lack of supply

- Before first commissioning, fill the relevant components with sufficient operating material and lubricant.
- See component name plate and individual operating manuals.



CAREFUL

If the pump is tipped, the resource material will spill!

Spilt resource material leads to slippery floors, damage to the pump and contamination of the workstation.

- Clear up spilt resource material with a suitable cloth or binder.
- Incline the pump to max. 10° in all directions.

- Pour operating fluid into the vacuum pumps.



CAREFUL

The data in the operating manual for the backing pumps must be observed when installing the exhaust line. The emitted gases and vapours can be damaging to both health and environment.

- Make internal and external electrical connections.
- For the exhaust-side connection, see the operating manual for the backing pump in part 3 of the documentation.
- The system is designed for three phase current 230/400 V ± 5% TN-S mains in acc. with IEC 8, 50/60 Hz. The max. electrical power input is 30 kVA, depending on the equipment. The mains connection must be designed according to the amperage. Before making the mains connection, the mains voltage must be compared with the voltage indicated on the rating plate.
- Other than for the backing pump and the diaphragm pump, the phase sequence is of no relevance for the other components. If the direction of rotation is wrong, two phases must be swapped on the terminal box of the backing pump (see instructions in the associated operating manual).

5.4 Connections

The coating system internal connections are basically fitted with quick couplings and are ready set up.

Water connection

The complete cooling water system is connected ready for operation.

- Make the cooling and hot water connection at the labelled inlets and outlets.
- Set a pressure of 4 bar at the pressure control valve for the water supply.



NOTE

Risk of damage due to improper operation

If the water pressure is too high, there is a risk of damage to the coating sources.

- Make sure that the water pressure is limited to max. 4 bar at the pressure control valve.

For operational reliability, flow monitors are integrated into the locking chain. If the water flow falls below the set level, a contact opens and the process operation is interrupted. See also the system diagram in part 2 of the overall documentation.

Compressed air connection

The complete compressed air system is connected ready for operation. To increase operational reliability and life expectancy of pneumatic elements, only conditioned compressed air with at least 6 bar, class 5 in acc. with DIN ISO 8573-1 should be used.

- Connect the compressed air supply to the main compressed air connection fitting on site with a compressed air hose (refer to the "Technical Data" for the inside diameter).
- Provide compressed air supply of at least 6 bar.

Exhaust connection

It is the responsibility of the system user to provide an exhaust gas line leading out from the backing pump. The port for the exhaust gas line is located on top of the backing pump.



Fig. 9: Exhaust connection at the backing pump

1 Exhaust connection DN 40



WARNING

High pressure in the exhaust line!

Injury hazard from bursting parts. Danger of damage to components.

→ Do not obstruct external exhaust lines with anything that might block them off.

→ Design cross-sections of the exhaust lines at least equivalent to the nominal width of the vacuum pump inlet flange.

→ Lay pipes from the system falling outwards so as to avoid return of condensate into the pumps.

→ If necessary install condensate falls into the exhaust lines (e.g. KAS 040).

Electrical connection

Before the system is put into operation the customer must be sure to provide adequate earthing (at least 25 mm²).



DANGER

Voltage-bearing elements

Danger to life from electric shock.

→ The electrical connection can be carried out only by trained and authorised electricians.

→ Ensure the system is adequately earthed.

→ The energy is fed to the terminals in the control cabinet. The control cabinet is separated from the system for transport. Before commissioning the connections must be made acc. to the wiring diagram.

Electrical wiring diagrams

The applicable wiring diagram for the system can be found in part 2 of the overall documentation

Process gas connection

The coating system must be supplied with argon, air or nitrogen for the actual coating process. A gas inlet valve is provided for each of these gasses.

→ The provision of process gas in the form of gas bottles and the connection thereof at the process chamber are the responsibility of the system user.

Venting gas connection

In order to admit as little moisture as possible into the process chamber, a venting gas, e.g. argon, can be used instead of the ambient air. The process chamber is equipped with a gas inlet valve.

→ The provision of venting gas in the form of gas bottles and the connection thereof at the process chamber are the responsibility of the system user.

6 Operation

6.1 Commissioning

The commissioning instructions also serve as guidelines for every new start-up after maintenance shut-downs.

- Make full internal system connections and check for leaks.
- Fill vacuum pumps as appropriate with operating fluid or lubricant.
- Repair casings and protective installations.
- Switch on external compressed air supply.
- Establish mains connection.
- Check pump rotational direction.

6.2 Switching on and off

Switching on the coating system

- Establish compressed air supply, check and adjust if necessary.
- Establish cooling and hot water connections and switch them on.
- Check operating fluid levels of all vacuum pumps and top up if necessary.
- Check the levels of all consumables, e.g. process gas. Exchange the gas bottles, if necessary.
- Switch on the master switch on the control cabinet.
- If applicable, switch on the control units on the control cabinet.



NOTE

To prevent process errors, the manufacturer recommends switching on all of the control units on the coating system. Connection or disconnection from the mains supply should only be by operating the master switch.

- Reset any fault and malfunction messages (e.g. Emergency Stop message) if necessary, by pressing the "Quit Error" button and the "Quit Emergency Stop" button at the control panel.
- After the PC has booted up, log on with the user name "Operator", without entering a password.
 - The graphic user interface of the coating system starts.
- In the user interface, log on with a valid user name and password.

Switching off the coating system

The system can be shut down from any desired condition. The manufacturer, however, recommends that you wait for an active coating cycle to end.

After venting the process chamber:

- Shut down the PC by pressing the appropriate button in the visualisation.
- Switch off the complete Coating System Classic 600 G by placing the master switch in the "0" position.

In an emergency:

- Press emergency stop button. This leads to an immediate shutdown of the system.
- Switch off the system completely at the master switch.

Always:

- Close supply lines and connected gas cylinders.

6.3 Operation of the System

Conditions

For safety reasons, process operations is safeguarded by the mechanical safety circuit and the following parameters:

- Bell is closed
- Pump system running
- Vacuum in vacuum chamber < 100 mbar
- Vacuum chamber cooling water flow o.k.
- Process installations cooling water flow o.k.

All additional safety measures are the responsibility of the system user.

Loading the process chamber

The high vacuum coating system is loaded with the bell of the process chamber open.

- ➔ Insert the substrate holder with the substrates into the openings in the substrate plate from the top.
- ➔ Load the appropriate mask into the mask plate. For this purpose:
 - On the visualisation screen "Parameters", press the button "Up" in the area "Cyl. Y3" to move the substrate plate to the fully up position.
 - Alternatively, after loosening the four fastening screws, remove the substrate plate by pulling it upwards.
 - Loosen the retaining clips on the mask plate and push the masks into the plate at the desired position below the retaining clips.
- ➔ Swing the chamber bell to its end position and lock it.
The bell can only be moved downwards in the next step at this position.
- ➔ On the main menu screen, press the "Down" button in the "Bell" area. .
This enables closing of the bell.
- ➔ Move the bell fully down with the two-hand control.

Align the Substrates With the Source and Mask

Before or after the bell is closed, the substrates must be aligned with the desired mask and the desired source. For this purpose:

- ➔ On the main menu screen, press the button "Posten" in the "Positioning" area and select the desired coating source.
- ➔ Press the white button "Substrate X" and select the desired substrate that is to be coated with the previously selected coating source.
The substrate that is presently over this coating source is displayed in the coloured field below that.
- ➔ Press the white button "Mask X" to select the mask that is to be over the previously selected coating source (and thus under the previously selected substrate) .
The mask that is presently over that coating source is displayed in the coloured field below that.
- ➔ Finally, press the "Start" button in the "Positioning" area.
The substrate plate and the mask plate rotate to the selected position.

Switching on the pumping system

- ➔ Switch on the turbopump for the process chamber by pressing the "Evac" button in the "Pumpstation" area on the main menu screen of the visualisation.
 - The process chamber is evacuated.
 - The coating devices are enabled after a preset vacuum pressure has been reached, provided that the corresponding water supply has also been switched on.



NOTE

The achieved vacuum plays an important role in the cleanliness of the process. The system user is responsible for determining the point in time or the final pressure in the vacuum chamber at which the coating process is to start.

Switch On Other Components

For the actual coating process, the shutter must also be opened via the visualisation.

→ Press the "Open" button in the "Shutter" area on the main menu screen.

You can also operate the substrate heaters, the water and the gas supply via the visualisation. The coating devices are operated directly via the respective control units.



NOTE

To switch on a coating source, the corresponding water supply must also be switched on. Otherwise the source will not be released for operation.

6.4 Process Operation



WARNING

Never vent the running turbomolecular pumps against atmospheric pressure!



WARNING

The operator must be proficient in the safe operation of all process-related components of the coating system in compliance with the individual operating manuals (see overall documentation).



WARNING

The process-relevant parameters in the control units of the Classic 600 G may only be changed by duly authorized employees of the user.



NOTE

All power supply systems are safety-monitored. If a preset pressure is exceeded in the vacuum chamber, a pressure switch shuts off the power supply to all relevant units of the vacuum chamber.



NOTE

For information about performing the actual coating process, please read the separate operating manuals for the coating sources and control units.

7 Maintenance

The work described merely gives an overview of the complete maintenance work on the high vacuum coating system and may be carried out by the system operator. Beyond this, maintenance and service work may be carried out only by authorised Pfeiffer Vacuum staff.

7.1 Upkeep and maintenance cycles



NOTE

The Pfeiffer Vacuum coating system may be operated, serviced and maintained only by trained and instructed staff.

These staff members must have received special instruction. Maintenance work that involves greater intervention into the system should be carried out only by Pfeiffer Vacuum Service.



WARNING

Pfeiffer Vacuum will be released from all warranty and liability claims if the customer makes any changes without prior agreement.



NOTE

Create safe work conditions

Before most upkeep and maintenance work the system must be brought to a safe condition.

- Close the system down and switch it off at the master switch.
- Lock the master switch.
- Close supply leads. Relieve overpressure.



DANGER

Danger from electric current

Hazard when electricity supply is switched on when using readily available electrical resources.

- Dismantle protective casings only in cases of emergency.
- Maintenance and repair work is permitted only by persons authorised and trained by Pfeiffer Vacuum.



WARNING

High temperatures and hot surfaces

Injury hazard through contact with hot parts and components

- Carry out work after cooling down to safe temperature.
- Otherwise wear appropriate heatproof protective clothing.
- If necessary provide suitable protection against contact.

Maintenance intervals for Classic 600 G

Regular maintenance ensures perfect working of your system. For maintenance of components, the relevant sections in the corresponding component operating manuals apply. The maintenance intervals greatly depend on use and ambient conditions and can vary considerably depending on the process.



NOTE

We recommend that the user determine maintenance intervals in consultation with the manufacturer's specialists.

7.2 Cleaning and decontamination

Cleaning agents

The manufacturer recommends the use of industrial alcohol or ethyl alcohol as a cleaning agent.



WARNING

Cleaning agents can lead to health and environmental damage. When using cleaning agents, note the relevant regulations and adhere to protective measures with regard to handling and disposal.



WARNING

Explosion hazard

The use of volatile or combustible cleaning agents in vacuum systems can lead to explosive vapour-air mixtures.

→ After cleaning ventilate and dry components adequately.

Cleaning work

Coating protection of the process chamber

→ To protect against metallization of the vacuum chamber, linings are employed on the sidewalls. They are easy to remove, and can be cleaned outside the system. Another possible protective measure is lining the bottom plate and the installations with aluminium foil, which should then be replaced when it becomes heavily coated.

Cleaning the process chamber

→ The coating created in the vacuum space from metallizing causes the pumping times to become longer. The system should therefore be cleaned at specific intervals. The simplest cleaning is with fine emery paper. Thicker coatings can be removed with a scraper. After that the chamber should be washed with alcohol.

Cleaning the sightglasses

→ On the vacuum side the sightglasses are covered by a protective glass. The metallized protective glass can be exchanged by releasing the circlip.

Decontamination notes



WARNING

Pump parts can be contaminated by the pumped media!

Poisoning hazard through contact with materials that damage health.

→ Decontaminate pump before carrying out maintenance work.

→ In the case of a contamination carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.

7.3 Maintenance tasks that can be carried out

Checking operating fluids

Fill level

Pfeiffer Vacuum rotary vane pumps are operated as standard with the organic operating fluid and lubricant P3.

- Shut down the system. Switch off the main switch.
- Dismantle metal casing in front of the vacuum pumps.
- Check operating fluid level at operating temperature at the sightglasses of the pumps.

The fill level of the operating fluid must lie between the two markings of the sightglass.

Establish any deterioration

The ageing process of the operating fluid is determined according to the area of operation of the rotary pumps and the characteristic of the pumped media. A colour plate is available in the full documentation on the extra sheet PK 0219 BN for determining the degree of ageing of organic operating fluids.



WARNING

Hot operating fluid!

Scalding hazard when draining through contact with the skin.

- Wear suitable protective clothing.

- Shut down the system. Switch off the main switch.
- Dismantle metal casings of the vacuum pumps.
- Put a suitable vessel or pan under the operating fluid drain.
- Open the operating fluid drain for a short time.
- Fill a sample amount of the operating fluid into a test tube.
- Close the operating fluid drain again.
- Determine the colour of the operating fluid sample in back light.
- Carry out operating fluid change also outside the recommended maintenance cycles if the discolouration of the operating fluid is dark yellow to ruddy-brown (corresponds with colour code 4 - 5).
- If the colour code is below 4 reuse the operating fluid.
- Refill the operating fluid level!
- Screw in the operating fluid fill screw; pay attention to the O-ring.

Changing operating fluid

The manufacturer recommends carrying out an operating fluid change regardless of the degree of ageing in accordance with the guidelines in the maintenance plan and in the individual operating instruction. The time taken for an operating fluid change depends on the temperature and fill amount.



WARNING

Hot operating fluid!

Scalding hazard when draining through contact with the skin.

- Wear suitable protective clothing.

- Switch off the system.
- Dismantle metal casings of the vacuum pumps.
- Put a suitable vessel or pan under the operating fluid drain.
- Open operating fluid fill screw.
- Unscrew operating fluid drain screw and drain operating fluid.



WARNING

Environmental contamination from operating fluid

Operating fluids can be toxic and environmentally hazardous.

- Dispose of operating fluid in a manner safe for the environment according to locally applicable regulations.
- Note the operating fluid safety data sheet.

- Screw in the operating fluid drain screw; pay attention to the O-ring.
- Let the pump run for max. 5 seconds with an open vacuum flange.
- Drain remaining operating fluid.
 - If the operating fluid is badly contaminated, several operating fluid changes are to be carried out (washing).
- Screw in the operating fluid drain screw; pay attention to the O-ring.
- Pour in the operating fluid and inspect fill level.
- Screw in the operating fluid fill screw; pay attention to the O-ring.

8 Decommissioning

Decommissioning of a Pfeiffer Vacuum System should be carried out only according to the recommendation of the Pfeiffer Vacuum Service. See also the notes on shutdown of components in the individual operating manuals and chapter 3.3 in this manual.

9 Service

9.1 General

For the system to function perfectly the system must be operated according to regulations and maintained regularly. Steps should be taken according to the maintenance regulations in section 7 and the regulations in the operating instructions for the individual components in the appendix. To ensure a high availability of systems and accompanying productivity we offer various different support services.

9.2 Maintenance contract

For regular and correct maintenance of a Pfeiffer Vacuum System, suitable maintenance contracts can be completed with the Pfeiffer Vacuum agent responsible. These refer product- and use-specifically to the system and the components employed therein. The Pfeiffer Vacuum agent is pleased to give information on the multiple advantages and forms of a suitable maintenance contract.

9.3 Spare parts

In the case of a repair it is possible to obtain rapid availability of stock spare parts. Some Pfeiffer Vacuum components can be repaired with the aid of spare part packages. These packages are tailored to the repair case and contain all parts necessary for repair. The order numbers are listed in the spare parts lists of the component operating manuals. To keep the stoppage times for maintenance and repair as short as possible, we recommend keeping stock of spare parts, spare part packages and consumer material used according to the contract. If repairs are carried out by the customer, the necessary special tools should be used. A detailed offer regarding the articles needed can be worked out accordingly.

Spare part lists

Spare part lists for Pfeiffer Vacuum Systems can be found attached to the full documentation.

9.4 Repair / Exchange

If a repair is required, the following possibilities exist:

- On-site repair by Pfeiffer Vacuum Service technicians.
- Exchange of defective components.
- Repair of components in a ServiceCenter or at the manufacturer.



WARNING

Observe the corresponding regulations if you carry out repair or maintenance work yourself on equipment which has come in contact with harmful substances.

For exchanged equipment and equipment repaired at the manufacturer the same test criteria apply as for new equipment. Work capacity is completely identical. In the case of an exchange, equipment is always supplied that reflects the current status of production manufacturing. Exchange is in general against a faulty but repairable piece of equipment.

For equipment that you send to us for repair or maintenance work please note the following:

- Contaminated equipment (radioactive, chemical etc.) is to be decontaminated before shipping in accordance with radioactive protection regulations.
- Equipment going in for repair must be clearly labelled "Free from contaminants". The same endorsement is also to be made on the delivery note and correspondence.

➔ Please use the attached acknowledgement.

- You have the option of having the equipment decontaminated by us (except for radioactively contaminated equipment). The repair contract then has to be extended appropriately and the process gases with which the equipment has been in contact are to be indicated. If this is missing, we will identify them at your cost. Special transport regulations must be observed.
- We will carry out a decontamination and charge you if you have not attached the notation "Free from contaminants" on the equipment or in the accompanying papers.
- "Contaminants" are: Materials and preparations in accordance with EU directive of 18.09.1979, article 2.

Service address

Pfeiffer Vacuum GmbH

Berlinerstr. 43

D-35614 Asslar

Telephone+49 6441 802 -1192

Fax +49 6441 802 -1199

Internet: <http://www.pfeiffer-vacuum.de>

email: service.systems@pfeiffer-vacuum.de

10 Technical Data

Installation	Unit	Classic 600 G
Diameter of the vacuum chamber bell	mm	600
Rack cabinet (W x D x H)	mm	1200 x 800 x 2100
Overall system (W x D x H)	mm	3091 x 1963 x 2100
Weight	kg	approx. 16.000
Foundation		No special foundation is necessary. The surface loading of the complete system is approx. 600 kg/m ² .

Electrics connection data	Unit	
Power	kVA	25
Pre-fuse	A	3 x 32
Frequency	Hz	50
Voltage	V	3 x 230/400 ± 5% TN-S-Netz gem. IEC 8
Control voltage	VDC	24

Pneumatics connection data	Unit	
Pressure	bar	4 - 6
Connection	mm	Hose nozzle: Festo 3/8

Cooling water connection data	Unit	
Pressure	bar	4 - 6
Input temperature	°C	max. 20 - 22 for turbo pump
System flow rate*	l/min	21
Flow rate turbo pump	l/min	2
Connection	"	3/4 nipple
Outlet		against atmospheric pressure
Drop in pressure	mbar	500-800

Hot water connection data	Unit	
Pressure	bar	4 - 6
Input temperature	°C	max. 70
System flow rate*	l/min	8
Connection	"	3/8 nipple
Outlet		against atmospheric pressure
Drop in pressure	mbar	500

Exhaust gas	Unit	
Exhaust connection		DN 40 ISO-KF

Ambient temperature	Unit	
max. Ambient temperature	°C	30

Pumping station	Unit	
Backing pump process chamber		ACP 40
Turbo pump process chamber		HiPace 1500 (2 units)

* Subject to greater consumption due to process accessories.

Valves	Unit	
Fore-vacuum valve	DN 25 / DN 40 KF	HV angle valve, series 24.4
Venting valve (in the event of power failure)	DN10 KF	Venting valve for HiPace

Technical Data

Noise emission	Unit	
Volume in operation	db(A)	< 85

11 Notes



Declaration of Conformity

according to the EC directives:

- **Machinery 2006/42/EC**
- **Electromagnetic Compatibility 2014/30/EU**
- **Low Voltage 2014/35/EU**

We hereby declare that the product cited below satisfies all relevant provisions of the EC directive Machinery **2006/42/EC**, the EC directive Electromagnetic Compatibility **2014/30/EU** and the EC directive Low Voltage **2014/35/EU**.

The agent responsible for compiling the technical documentations Mr. Andreas Würz, Pfeiffer Vacuum GmbH, Berliner Str. 43, 35614 Asslar.

High Vacuum Coating System Classic 600 G PC K00 128

Guidelines, harmonized standards and national standards and specifications which have been applied:

EN 349:1993+A1:2008	EN ISO 13849-1:2015
EN 894-1:2009	EN ISO 13850:2015
EN 894-2:2009	EN ISO 13857:2008
EN 894-3:2010	EN 60204-1:2006
EN ISO 13855:2010	EN 61000-6-2:2005
EN 1012-2:1996+A1:2009	EN 61000-6-3:2007
EN ISO 12100:2010	EN 61496-1:2013

Signatures:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Deutschland

(M. Bender)
Managing Director

(Dr. M. Wiemer)
Managing Director

CE/2016

**Leading. Dependable.
Customer Friendly**

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide. For German engineering art, competent advice and reliable services.

Ever since the invention of the turbopump, we've been setting standards in our industry. And this claim to leadership will continue to drive us in the future.

**You are looking for a
perfect vacuum solution?
Please contact us:**

Germany
Pfeiffer Vacuum GmbH
Headquarters
Tel.: +49 (0) 6441 802-0
info@pfeiffer-vacuum.de