

Operating manual

PlasmaQuant 9200



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To ensure correct and safe use, follow these instructions. Keep these instructions for later reference.

General information <http://www.analytik-jena.com>

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1 Basic information

1.1 About this manual

This user manual describes the following device models:

- PlasmaQuant 9200
- PlasmaQuant 9200 Elite

The models are combined in the following text. Any differences between the models are explained in the relevant section.

The device is intended to be operated by qualified specialist personnel who must observe all instructions given in the operating manual.

The operating manual provides information about the design and operation of the device and provides operating personnel with the necessary know-how for safe handling of the device and its components. Furthermore, the operating manual includes information on the maintenance and servicing of the device as well as information on potential causes of malfunctions and their correction.

Conventions

Instructions for actions occurring in chronological order are numbered and combined into action units.

Warnings are indicated by a warning triangle and a signal word. The type, source and consequences of the hazard are stated together with notes on preventing the hazard.

Elements of the control and analysis program are indicated as follows:

- Program terms are in bold (e.g., the **System** menu).
- Menu items are separated by vertical lines (e.g., **System | Device**).

Symbols and signal words used in this manual

The user manual uses the following symbols and signal words to indicate hazards or instructions. These warnings are always placed before an action.



WARNING

Indicates a potentially hazardous situation which can cause death or very serious (possibly permanent) injury.



CAUTION

Indicates a potentially hazardous situation which can cause slight or minor injuries.



NOTE

Provides information on potential material or environmental damage.

1.2 Intended use

The optical emission spectrometer with inductively coupled plasma (ICP-OES) is used in a chemical analysis laboratory for the analysis of liquid, mainly aqueous samples, to determine concentrations of up to 75 elements up to the trace range.

The device may only be used for the processes described in the user manual. Only the specified use is regarded to be the intended use. Using the device for any other purpose may compromise the safety of the user and the device.

The device is not suitable for solutions containing hydrofluoric acid if the nebulizer or spray chamber are made of glass or quartz. Use hydrofluoric acid-resistant components for this purpose. Special provisions shall be made for operations involving organic solvents. In addition to apparatus-related and methodical aspects, fire and health protection for the particular organic solvent must be observed here.

High-energy electric fields are used to operate the device. The device may not be operated in an explosive environment. The responsible body at the installation site must ensure that the necessary safety precautions are taken when working with flammable or explosive samples.

Consult Analytik Jena before use if you are unsure about the potential hazards of a sample solution.

Modifications, conversions and extensions are only permitted after consultation with Analytik Jena. The responsible body at the installation site alone is liable for damage caused by unauthorized modifications, conversions and extensions.

2 Safety

For your own safety and to ensure error-free and safe operation of the device, please read this chapter carefully before commissioning.

Observe all safety instructions listed in this manual, as well as all messages and instructions displayed by the control- and analysis software on the monitor.

2.1 Safety labeling on the device

Warning and mandatory action labels have been attached to the device and must always be observed. Damaged or missing warning and mandatory action labels can cause incorrect actions leading to personal injury or material damage.

- Do not remove the warning and mandatory action signs.
- Replace damaged signs.

The following warning and mandatory action signs are used:

Warning/mandatory sign	Meaning
	General warning sign
	Warning against hot surface
	Warning of hand injuries
	Observe the operating manual.
	Disconnect the power supply before opening the device cover.
	The device contains controlled substances. Analytik Jena warrants that these substances will not be released from the device within the next 25 years provided the device is employed as intended.

2.2 Requirements for the operating personnel

The device must only be operated by qualified specialist personnel instructed in the use of the device. The operating personnel must meet the following requirements:

- Operate the device only after instruction and training.
- Know and avoid dangers when working with the device.
- Wear personal protective equipment such as protective gloves, lab coat and safety goggles.
- Training by Analytik Jena is recommended.

The responsible body at the installation site is accountable for compliance with safety and occupational health regulations. The responsible body must meet the following requirements:

- Provide information about national regulations on work safety and accident prevention and observe them during operation of the device.
- Instruct the operating personnel in the safe operation of the device. In doing so, also convey the contents of the manuals for the device system.

2.3 Safety instructions for transport and commissioning

Transport

The device is heavy and can tip over. There is a risk of injury when lifting and carrying, especially from unsecured parts.

- Empty the device. Secure the device components according to the instructions. Remove loose parts and pack them separately. Close the plasma compartment door.
- Only transport the device in its original packaging. Insert all transport locks.
- Use a pallet truck or other suitable lifting equipment such as a crane to transport the device.
- Only lift the device with four people. Position yourself on opposite sides of the device and hold it by the four permanently screwed-in transport handles.
- Decontaminate the device before returning it to the manufacturer. Document the cleaning measures in the decontamination record. The decontamination record is provided by customer service when a return is registered.

Ambient conditions during commissioning

The device is dangerous if it is installed in an unsuitable environment. If the device is installed in an unsuitable environment, its service life will be reduced, e.g., due to corrosion.

- Design the installation site in accordance with the requirements in the installation conditions with installation plan.
- The device must not be installed in an explosive environment.
- Only install the device on tabletops that are suitable for the load (at least 150 kg).
- Ensure free access to the main switch on the rear of the device and to the manual plasma deactivation switch on the right-hand side of the housing.
- Keep the ventilation slits clear.

Electrical conditions

The device may be dangerous if the conditions for the electrical connection are not met.

- Only the Analytik Jena customer service or trained and authorized specialist personnel are allowed to install and commission the device and its system components. Unauthorized assembly and installation is not permitted.
- Only use the supplied power cable or a cable of the same size with a protective earth conductor. Do not use an extension in the supply cable.
- Connect the power plug to a proper power outlet to ensure that the device meets protection class I (ground connector). Do not invalidate the protective effect by the use of an extension line which does not have a protective conductor.
- Check the electrical requirements of the device before connecting it to the mains.
- Only connect the device and its system components to the power grid when they are switched off.
- Only connect and disconnect the connection cables between the device and its system components when the device is switched off.

2.4 Safety instructions for operation

Safety circuits

The plasma compartment is shielded by the housing and the UV and EMC protective glass, as well as the metal grille on the plasma compartment door in such a way that high-frequency radiation and UV radiation are reduced to a safe level. At the same time, the plasma compartment can still be accessed for maintenance purposes.

To ensure safe plasma operation, the device monitors the following conditions using safety circuits.

- The plasma compartment door is closed.
- The plasma torch is in working position.
- Sufficient cooling is supplied.
- Exhaust air extraction is active.
- Argon supply is ensured.

Do not ignite the plasma unless all conditions are met. If one of the safety circuits reports a fault during operation, the device extinguishes the plasma.

- Never bypass the safety circuits.
- Work safely regardless of the function of the safety circuits: Always extinguish the plasma via the control software before opening the plasma compartment door.

Electrical hazard

Lethal voltages may occur in the device.

The induction coil operates under high voltage. An electrical discharge may occur across larger distances and cause fatal injuries, electrical shock and skin injuries.

- Before each start-up, make sure that the device and its safety devices are in proper working condition.
- In case of malfunctions of electrical components, switch off the device immediately and disconnect it from the electrical power supply.
- Do not remove or bypass any protective devices such as the housing.
- Prevent liquid from penetrating the device.
- Do not leave any movable, electrically conductive objects in the plasma compartment. This could cause a short circuit.

Danger due to high-frequency radiation

The plasma emits electromagnetic radiation and UV radiation. The high-frequency radiation can cause serious skin and eye damage.

- Extinguish the plasma via the control software before opening the plasma compartment door.

Thermal hazard

The plasma is very hot (up to 10,000 °C). Contact with the plasma torch shortly after operation will cause skin burns.

Flammable materials in the plasma compartment may ignite and cause a fire.

- Allow the plasma torch and surrounding area to cool for at least 5 minutes before touching.
- Do not leave any flammable materials in the plasma compartment.

The exhaust air is hot. The device's exhaust air connection is protected from contact by its plastic front and plastic panel. However, there is a risk of burns at the exhaust air connection in the laboratory.

- Do not touch the hot exhaust air connection during operation.

Mechanical hazard

There is a risk of crushing at the hose pump during operation. Long hair and loose clothing can become caught in the rotating pump and be pulled in.

- Maintain a safe distance from moving parts.
- Wear hair protection and close-fitting clothing.
- Only install or replace pump hoses when the hose pump is at a standstill.

The device is designed so that the plasma compartment protrudes beyond the sampling compartment with the sample feed system. When working on the sample feed system, there is a risk of bumping your head on the plasma compartment or the open plasma compartment door.

- Be aware of the risk of impact when working on the sample feed system. It is best to carry out work while seated.

The water connections are under high pressure. There is a risk of injury if a hose bursts due to material fatigue. The cooling water can leak into the laboratory and cause a slipping hazard. The biocide contained in the cooling water is a hazardous substance that can cause damage to health.

- Inspect water hoses and screw connections weekly for leaks and damage.

The glass parts can break. There is a risk of injury from broken glass and glass splinters.

- Handle glass parts with care.

Hazard from substances

The plasma leads to the formation of ozone, nitrous gases, and toxic vapors, which can cause breathing difficulties.

- Only operate the device with active extraction.

The responsible body at the installation site is in charge of monitoring air pollution emissions and minimizing harmful effects on the environment.

The device can be used to handle hazardous substances. The responsible body at the installation site is accountable for the safe handling and disposal of hazardous substances.

- Handle samples containing hydrofluoric acid with particular care.
- When working with samples dissolved in organic solvents, take the appropriate fire safety and health protection measures.
- If the device has been contaminated with hazardous substances, decontaminate it as described in the operating manual. Before using a cleaning or decontamination procedure other than that prescribed by the manufacturer, the user is required to check with Analytik Jena that the intended procedure will not damage the device.
- Handle the following operating and auxiliary materials with particular care:

Hazardous substance	Use
Methanol	Cleaning the nebulizer
Aqua regia	Cleaning the torch
Cooling water additive	Additive for cooling water to prevent corrosion and algae growth in the cooling system

- The waste container supplied is made of polyethylene and is resistant to aqueous waste solutions. When examining organic samples, check the resistance of the waste container to the solvent used. If in doubt, use a glass waste container.

Ergonomic hazard

The device has a modular design. Maintenance and wear parts such as the water filter are easy to access so that the ergonomic strain on operating personnel is low.

- The device must be installed in such a way that allows easy access from all sides.

The overhanging plasma compartment hangs over the sampling compartment. The relatively dark working environment can cause strain on the eyes of operating personnel over long periods.

- Ensure good local lighting.
- Switch on the optional sampling compartment lighting.

EMC compatibility

The device has been tested for interference immunity and interference emission in accordance with EN IEC 61326-1.

- The device meets the requirements for interference immunity in accordance with Table 2 (industrial environment).

- The device meets the requirements for interference emission in accordance with EN 55011 Group 1, Class A.

Electrical and electronic assemblies are shielded from interference emission by metal components.

Strong interference from other devices may disrupt the image of the plasma camera. A visual inspection of the plasma on the device is therefore recommended.

2.5 Safety instructions for the operation of compressed gas containers and compressed gas systems

The operating gases are taken from compressed gas containers or local compressed gas systems. The responsible body at the installation site is in charge of ensuring the safety of the gas system.

Among other things, the responsible body at the installation site must ensure that the connection type used on the outlet side of the gas pressure regulator complies with the applicable national regulations.

For safe operation, pay particular attention to the following points: Any leaks in gas systems and pipes, except for oxygen and air, can lead to an oxygen-deficient atmosphere. There is a risk of suffocation in unventilated rooms.

If oxygen accumulates in the atmosphere, flammable substances can ignite very easily and burn violently. Contact between oil or grease and oxygen under high pressure can cause explosions.

- Work on pressurized gas vessels and systems must only be carried out by trained and competent personnel. Do not carry out any unauthorized assembly or installation work.
- Only use pressure hoses and pressure reducers for the gases for which they are intended.
- Keep pipes, hoses, screw connections, and pressure reducers for oxygen free of oil and grease.
- Inspect all pipes, hoses, and screw connections regularly for leaks and damage. Repair leaks and damage without delay.
- Shut off the gas supply to the device before working on the pressurized gas vessels or the pressurized gas system. Only restart the device after completing the work and checking that it is functioning properly.

2.6 Safety instructions for maintenance and cleaning

There is a risk of electric shock if contact is made with live components, which may lead to serious injury.

Unauthorized servicing can lead to maladjustment or damage of the device and its system components.

- Work on electrical components inside the device may be carried out by customer service only.
- Cladding parts may only be removed by customer service, not by the customer.
- Only carry out the maintenance actions listed in the operating manual.
- Switch off the device before maintenance and cleaning. Only work on a switched-on device if this is expressly required by the operating manual.
- Before performing maintenance work inside the device, disconnect the power plug from the power outlet.

- Shut off the gas supply to the device before performing maintenance. Only leave the gas supply open if expressly required by the operating instructions.
- Use only original spare parts, wear parts and consumables. These have been tested and ensure safe operation.
- The website of Analytik Jena provides a list of consumables available for the PlasmaQuant 9200 device.
- After maintenance, ensure that all safety devices are fully functional again.
- Clean the device with a damp, non-dripping cloth. Do not use organic solvents, abrasive cleaners or bleach.

2.7 Behavior during emergencies

- In dangerous situations or in the event of accidents, immediately extinguish the plasma using the manual plasma deactivation switch on the right-hand side of the housing.
- If possible, only switch off the device at the power switch after allowing a cooling down period of 30 seconds. Then disconnect the mains plugs of the device and the system components from their power sockets.
- After switching off the device, close the gas supply.

3 Function and design

3.1 Design

The device is used to determine the elemental content in liquid, usually aqueous samples. A special sample feed system is used to extend the measuring range to organic solutions.

The device essentially consists of the following components:

- Components for plasma generation (HF generator, induction coil, plasma torch)
- Sample feed system with peristaltic pump, nebulizer, and spray chamber
- Optical system with transfer optics, spectral photometer and detector

The device is compatible with many accessories. The accessories increase the sample throughput and facilitate automatic measurement mode. The accessories ensure that the analysis system can be adapted to your needs.

The optional 21 CFR Compliance module provides complete data integrity and conforms to the pharmaceutical guidelines 21 CFR Part 11 and EudraLex Volume 4 Annex 11.

Sampling compartment and
plasma compartment

The sample feed system is freely accessible in the sampling compartment. The plasma torch and the induction coil, on the other hand, are housed in a shielded plasma compartment. This protects you from the high-frequency radiation and heat of the plasma and creates stable conditions for analyzing samples.

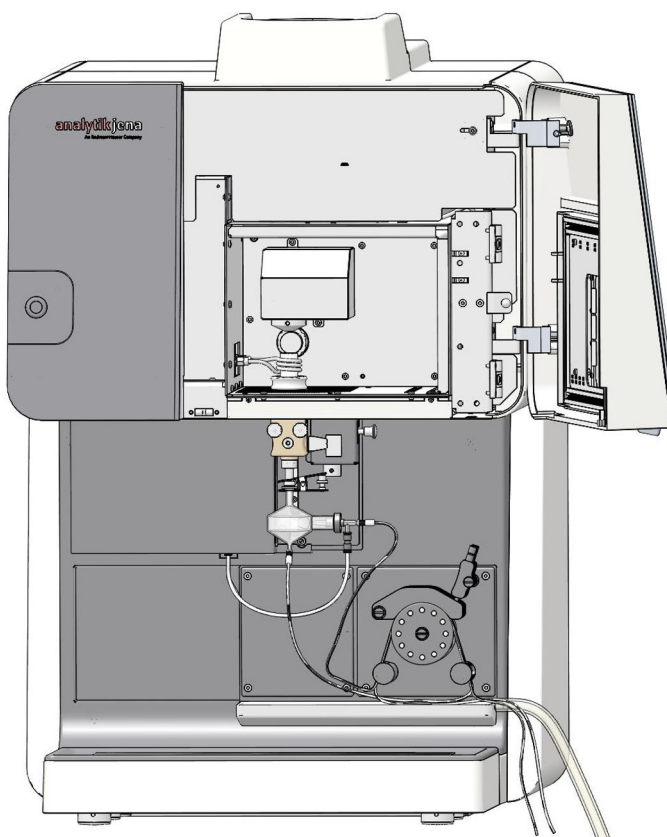


Fig. 1 Emission spectrometer with open plasma compartment

The sampling compartment can be illuminated for an ergonomic laboratory workstation design. The switch for the lighting is located on the left below the plasma compartment, in line with the standby switch.

The sample tray is held in place by two pins and can be removed if necessary.

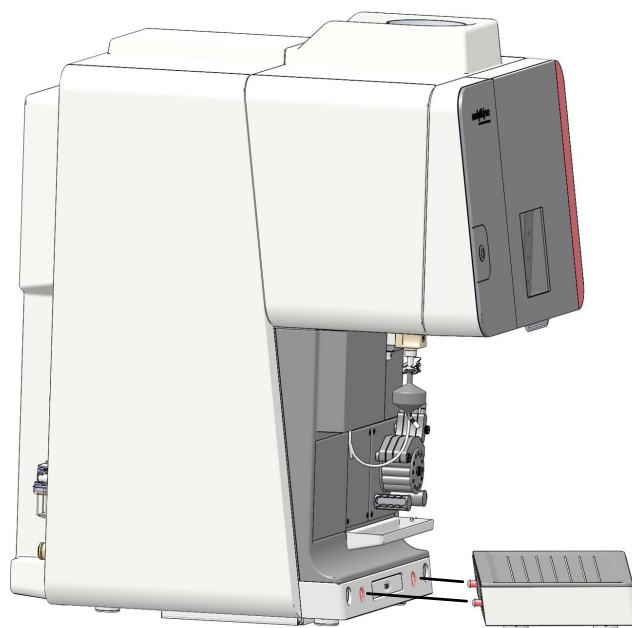


Fig. 2 Device with removable sample tray

Easy maintenance

The device has a modular design. Maintenance and wear parts are easily accessible. For example, you can replace the water filter on the rear of the device yourself and/or flush it regularly in accordance with the maintenance instructions.

Transporting the device

A pair of transport handles is securely screwed to the front and rear for transport and installation. The handles are unscrewed and removed after installation. Keep the transport handles for later transport.



Fig. 3 Transporting the device

There is an air barrier with edge protection under the device. Please note that the rubber edge protection could come loose if the device moved.

If you want to push the device up to 80 mm against the wall, you must remove the rear transport handles near the end position and replace them with the plastic mounting aids supplied. The installation aids are required by customer service for (dis)assembling the rear panel of the device. The installation aids are not suitable for transporting the device.

3.1.1 Plasma compartment

The plasma compartment is shielded by the housing and the UV protective glass, as well as the metal grille on the plasma compartment door in such a way that high-frequency radiation is reduced to a safe level.

At the same time, the plasma compartment can still be accessed for maintenance purposes via the plasma compartment door.

The induction coil with torch is located behind the plasma compartment door. Parts of the optical system are also located here: the windows for radial and axial observation.

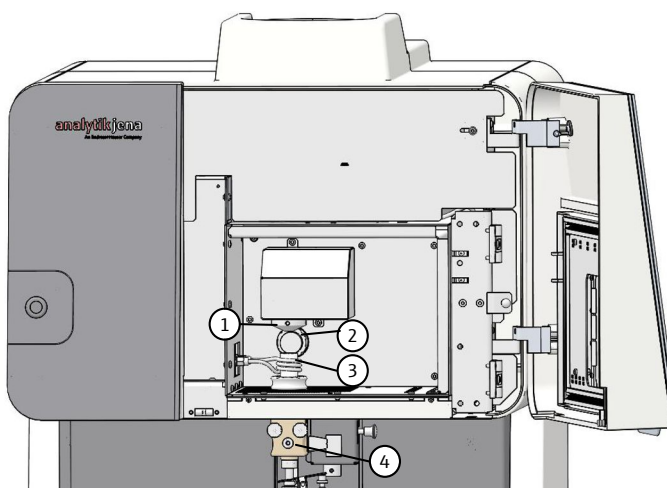


Fig. 4 The plasma compartment

- | | |
|------------------------------|---------------------------------------|
| 1 Cone for axial observation | 2 Window for radial observation |
| 3 Induction coil with torch | 4 Torch holder, mounted on guide rail |

The plasma is generated in the torch. The plasma atomizes or ionizes the elements contained in the samples and causes them to emit light. The upright arrangement of the plasma torch reduces the risk of clogging and soot formation.

Plasma torch

The plasma torch has a three-shell design and comprises an outer and inner tube and an injector.

Part of the plasma torch	Function
Outer tube	- Electrical insulation between the plasma and the induction coil - Shielding of the plasma from the ambient air
Inner tube	Location of plasma formation
Injector	- Injection of sample solution into the plasma - Connection to the sample feed system

The plasma gas flows into the space between the outer and inner tubes. The plasma gas cools the outer tube and prevents the glass parts from melting.

The plasma gas is ionized at the induction coil and converted into a plasma state.

The auxiliary gas flows in the intermediate space between the inner tube and the injector. It pushes the sample aerosol away from the injector.

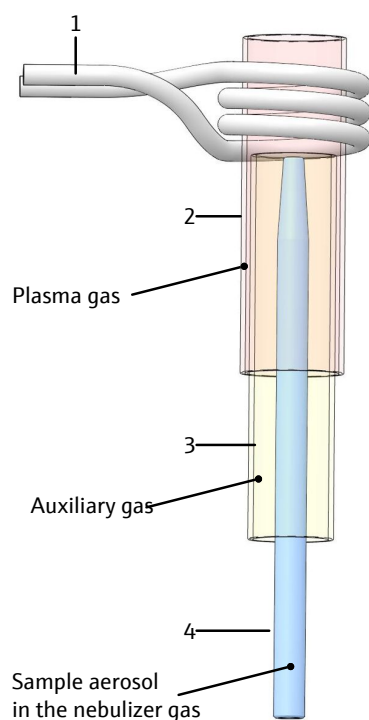


Fig. 5 Schematic diagram of the torch with gas flows

- | | |
|------------------|--------------|
| 1 Induction coil | 2 Outer tube |
| 3 Inner tube | 4 Injector |

Mount the plasma torch or torch with the holder (shuttle) on the guide rail of the mechanical height adjustment. When tightening the two knurled screws, you automatically connect the internal gas inlets for plasma gas and auxiliary gas. Then push the torch by hand along the guide rail into the plasma compartment. The torch engages in the adjusted working position.

There are three plasma torches:

- Demountable torch
- One-piece torch
- Ceramic torch

The ceramic torch is part of the optional HF Kit sample feed system.

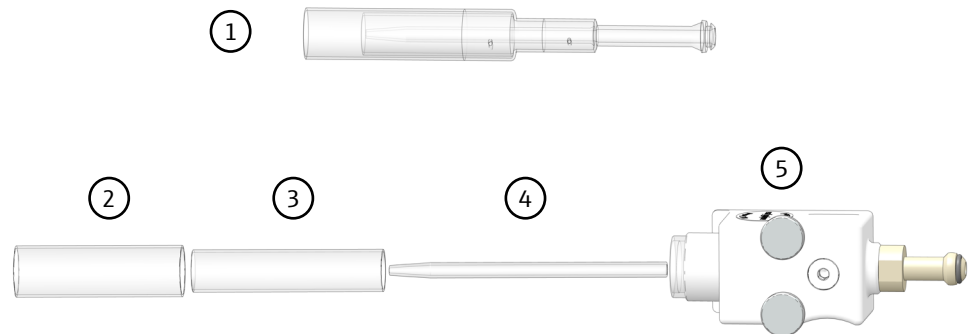


Fig. 6 One-piece torch and demountable torch (2 ... 5)

- | | |
|--------------------------------------|--------------|
| 1 One-piece torch | 2 Outer tube |
| 3 Inner tube | 4 Injector |
| 5 Torch holder with connecting piece | |

The outer tube is exposed to high thermal loads. With the demountable torch, you can replace the parts individually. However, during assembly, you must ensure that the individual parts are gas-tight and check that the injector is seated correctly.

You clean the one-piece torch as a whole. The subsequent installation is very simple. To do this, you must replace the entire torch when it is worn.

Plasma check

A high-resolution camera is integrated in the plasma chamber. The camera makes it possible to monitor the plasma state in real time. Real-time monitoring is particularly advantageous if the control computer is not installed in the immediate vicinity of the device.

If the camera is activated via the ASpect PQ software, the software constantly displays the camera image. You have the option of recording screenshots and videos. You can also configure the properties of the image source, such as image section and exposure.

3.1.2 Sample chamber

The sampling compartment contains the pump, nebulizer, and spray chamber.

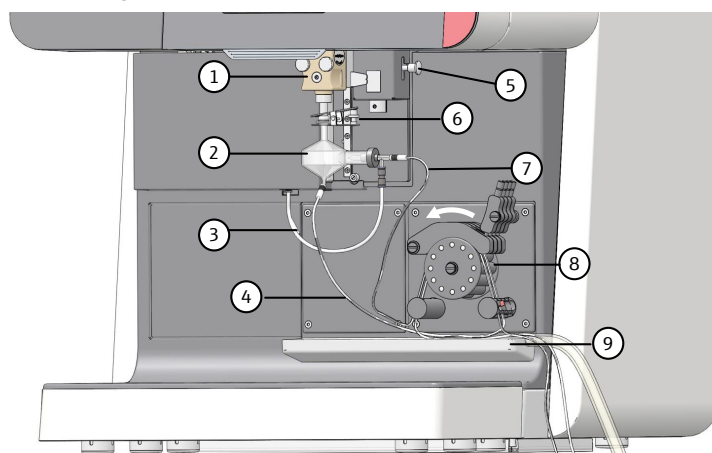


Fig. 7 The sampling compartment

- | | |
|---|-------------------------------|
| 1 Torch holder | 2 Spray chamber |
| 3 Argon tube to nebulizer | 4 Waste hose to spray chamber |
| 5 Height adjustment for torch with spring pin | 6 Fork clamp |
| 7 Nebulizer with sample aspiration tube | 8 Hose pump (4-channel) |
| 9 Collecting pan with drain hose | |

Pump

The hose pump evenly feeds the measuring solution to the nebulizer and pumps the waste solution out of the spray chamber. The rotational speed of the pump and the diameter of the pump hoses used determine the quantity of liquid pumped.

Nebulizer

The pneumatic concentric nebulizer generates the sample aerosol. Argon is directed past the sample nozzle of the nebulizer as nebulizer gas. The gas flow continuously tears the surface of the liquid at the nozzle and produces small sample droplets. The argon gas hose is screwed onto the nebulizer.

The optional ultrasonic nebulizer delivers a high aerosol yield with aqueous solutions. The ultrasonic nebulizer uses temperature control to remove organic solvents from the sample gas (heating range: 120 to 160 °C, cooling range: -20 to +10 °C).

The optional parallel path nebulizers have a particularly large internal diameter and therefore do not clog even with sample solutions containing particles.

Spray chamber

The nebulizer gas carries the sample aerosol through the spray chamber to the plasma. The cyclone spray chamber separates large droplets by centrifugal force. The rest of the sample flows out through the waste outlet.

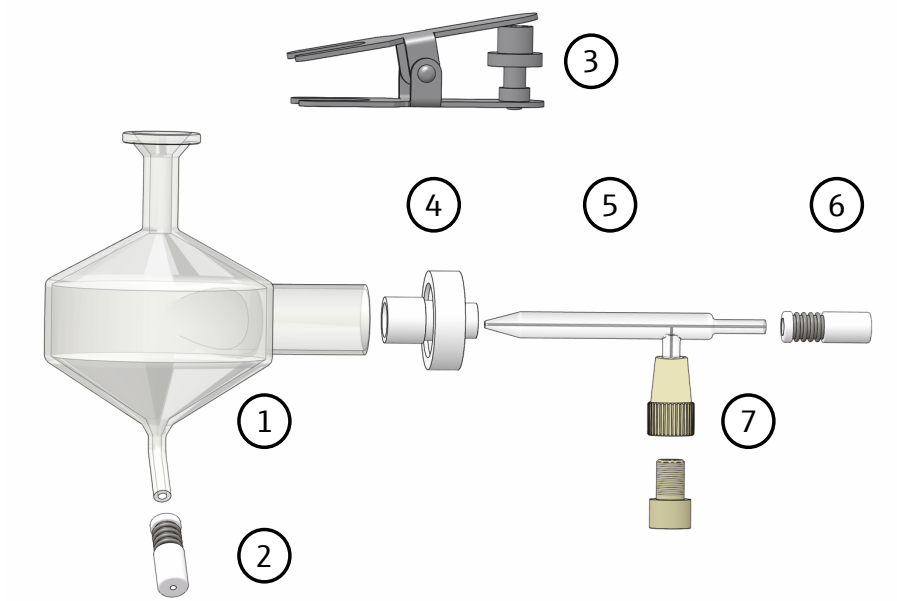


Fig. 8 Spray chamber and nebulizer

- | | |
|----------------------------|----------------------------|
| 1 Spray chamber | 2 Waste hose connection |
| 3 Fork clamp | 4 Plastic nut |
| 5 Nebulizer | 6 Sample tube connection |
| 7 Gas connection (argon) | |

The waste bottle for collecting the sample solutions is included. The plastic bottle (polyethylene, 2 liters) has a screw cap with holes for the hoses.

Special sample feed systems

Sample introduction system	Application/application examples
Standard Kit	Standard applications: Environmental samples, foodstuffs, pharmaceuticals
HF Kit	Digestions containing hydrofluoric acid: Metals, ceramics, rare earths, geological samples
Organic Kit	Organic samples: Crude oil, petrochemical products such as kerosene, organic solvents
Salt Kit	Highly saline samples: Brine, seawater
Precision Kit	Standard applications: Environmental samples, foodstuffs, pharmaceuticals. For optimum detection limits.

3.2 Media connections and interfaces

Customer service connects the supply lines during initial commissioning.

The following components are located on the rear of the device:

- Mains input and mains switch (bottom left)
- Interfaces for PC and accessories (left side)
- Media connections for gas and cooling water with water filter (right side)
- Ventilation grille for waste heat from the device
- Inspection hatch (for maintenance on the neon lamp)

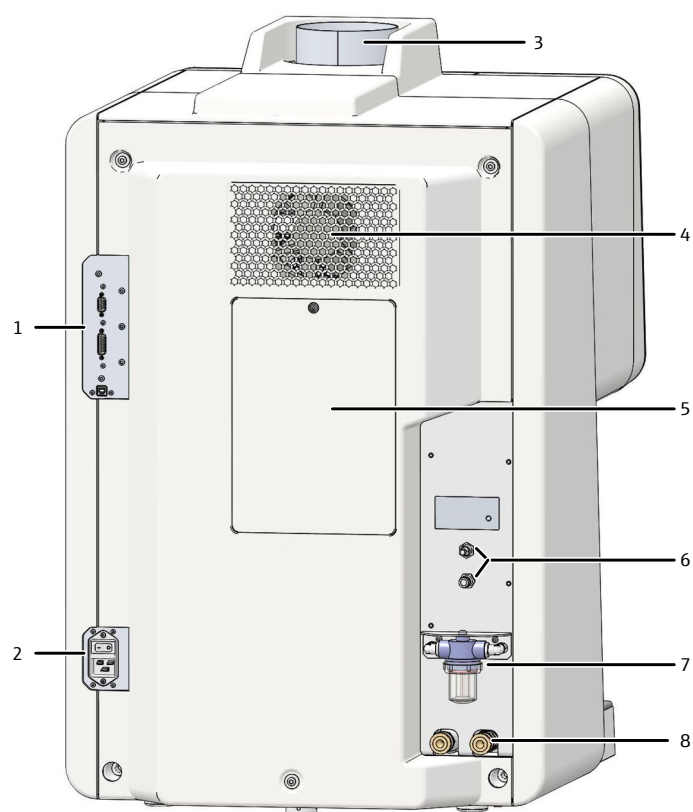


Fig. 9 Rear of the device

- | | |
|--|--|
| 1 Interfaces | 2 Power switch, power connection |
| 3 Exhaust connection | 4 Ventilation grille |
| 5 Inspection hatch (customer service only) | 6 Gas connections (bottom: argon, top: oxygen) |
| 7 Water filter | 8 Cooling water connection |

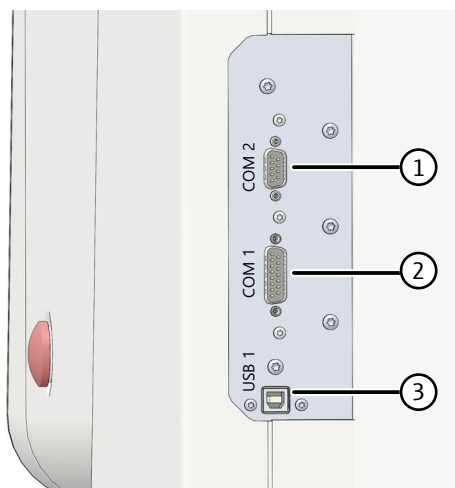


Fig. 10 Interfaces

- | | |
|------------------------|---|
| 1 COM 2: Autosampler | 2 COM 1: Recirculating chiller (remote control) |
| 3 USB 1: Connection PC | |

The COM 1 interface on the rear of the device allows you to optionally control the recirculating chiller above the emission spectrometer.



Fig. 11 Gas connections

- 1 Connection for oxygen (additive gas)
- 2 Argon connection

The device draws in ambient air for air cooling from below at the rear of the device. Ensure that the air can flow freely.

Gases

Argon is used as a gas for the torch and nebulizer and for purging the spectrometer. The purge gas is then fed via the cone for axial observation as a counter gas in order to reduce the thermal load on the cone and plasma window. Optionally, you can connect oxygen as an additive gas.

Insert the gas tubes into the quick-release couplings as far as they will go. To disconnect the gas connections, press the colored ring inwards and pull the tube out of the connection at the same time.

Cooling water

The hoses for cooling water are equipped with quick-release couplings with a nominal width of 7.2 mm (1/4"). The valves in the quick-release couplings prevent cooling water from flowing out.

Insert the hose connectors into the sockets until they click into place. To disconnect the connections, push the ring on the socket backwards and pull the hose out of the connection.

Device switch

Switch	Function	Location
Power switch	- Switch on the device. - Disconnect the device from the mains when switching off.	Rear of the device
Manual plasma deactivation switch	Extinguish the plasma in an emergency.	Right-hand housing wall
Standby switch	Switch the device to standby during measurement breaks.	Front of the device
Push-button for sampling compartment lighting	Light the sampling compartment	Bottom of the plasma compartment, aligned with the standby switch

The standby switch lights up green when in operation.

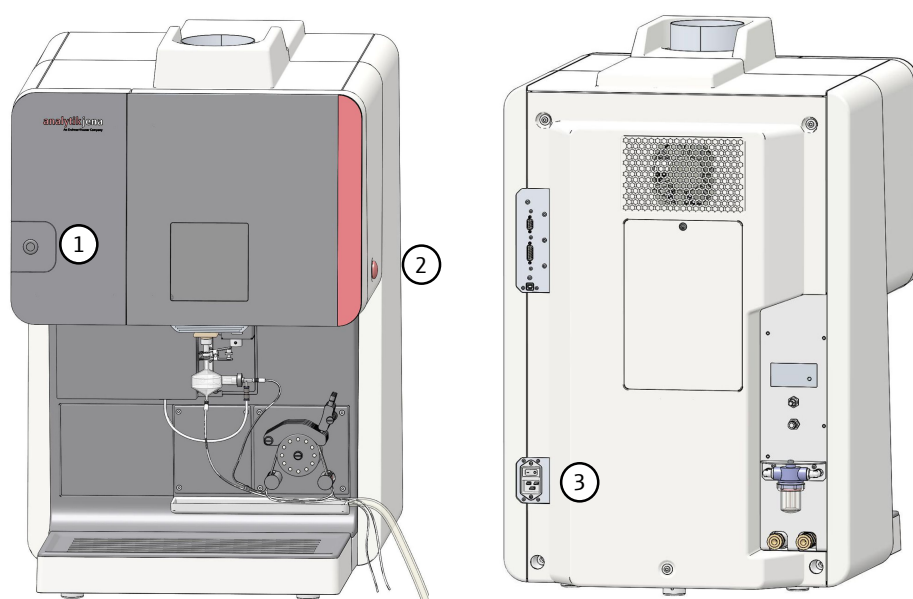


Fig. 12 Switching the device on and off

- | | |
|---|--|
| <p>1 Standby switch</p> <p>3 Power switch, power connection</p> | <p>2 Manual plasma deactivation switch</p> |
|---|--|

Type plate

The type plate is located on the rear of the device. A label with the device serial number is also affixed to the inside of the plasma compartment door.

The type plate contains the following information:

- manufacturer address, trademark
- Designation of the device, serial number
- Electrical connection data
- Conformity markings
- WEEE marking

3.3 Other accessories

Accessories for fast sample feed

- Cetac ASXPress Plus aqueous accessory
- Cetac ASXPress Plus oil accessory

The two accessories for aqueous samples and oils shorten the sample aspiration and purge times. They therefore enable a high sample throughput.

Hg/hydride systems

Two Hg/hydride systems are available for determining mercury and hydride-forming metals:

- HS Pro PQ – for the specific determination of Hg/hydrides with maximum detection sensitivity
- HS PQ – for the simultaneous determination of Hg/hydrides in addition to the classic elements

Autosampler

- Teledyne Cetac ASX-560 autosampler
- Cetac ASX-280 autosampler
- Cetac Oils 7400 autosampler
- Cetac XLR-860 autosampler

The Teledyne Cetac ASX-560 autosampler and the smaller Cetac ASX-280 are suitable for aqueous solutions and have an integrated purge station. They can be equipped with various sample racks.

The Cetac XLR-860 autosampler can hold up to 720 samples.

The Cetac Oils 7400 autosampler enables the automatic feed of oils and coolants. The autosampler includes a stirring function and a purge station for handling different sample types.

The autosamplers can be coupled with a Cetac ASXPress Plus switching valve.

Dilution systems

- Teledyne Cetac SDX(HPLD) dilution system
- Teledyne Cetac SimPrep dilution system

The Teledyne Cetac SDX(HPLD) dilution system can dilute samples up to 1:5000. The integrated vortex mixer mixes the samples with the dilution solution. The dilution system is coupled with the Teledyne Cetac ASX-560 autosampler.

The Teledyne Cetac SimPrep dilution system can be coupled with the Teledyne Cetac ASX-560 and Cetac ASX-280 autosamplers. In addition to diluting samples, the accessory allows the addition of internal standards and the creation of calibration curves through automatic dilution of standards. This results in a high degree of automation of the measurements.

Temperature-controlled spray chamber

The temperature-controlled IsoMist XR spray chamber features an integrated Peltier element with which the spray chamber temperature can be adjusted in a range between -25 °C to +80 °C (increments of 1 °C).

It is particularly suited for organic analyses. It increases the temperature stability of the sample fed system. It also reduces the amount of solvent vapor generated in the spray chamber by cooling the samples.

The spray chamber temperature is controlled using the software, which is enclosed with the accessory. The data transmission between the spray chamber and PC is carried out via USB cable or radio technology (Bluetooth).

Argon humidifier with bypass

The argon humidifier is suitable for the analysis of samples with a high salt content. By humidifying the nebulizer gas, the argon humidifier prevents salts from crystallizing in the nebulizer or injector and causing blockages. The argon humidifier improves signal stability and recovery.

Argon flows via a membrane coil through deionized water and is saturated with water vapor on its way. The argon humidification can be easily switched on and off using the bypass valve without having to disconnect any hose lines.

Inline filter

The in-line filter is suitable for the analysis of samples with a high solids content. The inline filter prevents solid particles depositing in the nebulizer or injector, causing blockages. In addition, it improves the stability of the signal and the recovery.

Kit for internal standard (KIS)

The KIS is suitable for the analysis of samples in which the matrix has an influence on the measurement. If the standards and samples have a different viscosity, for example, this may influence the measurement result.

The KIS enables the online addition of an internal standard to each calibration standard and sample. The precision and accuracy of the analysis are improved by calculating a correction factor for every individual measurement.

Description of accessories

The descriptions of the accessories can be found in the corresponding accessory manuals. Please also note the additional information on installation and maintenance in this manual.

4 Installation and commissioning

4.1 Installation conditions

4.1.1 Installation location requirements

The emission spectrometer may only be operated in closed rooms. The location must have the quality of a chemical laboratory (indoor use).

- Avoid direct sunlight and radiation from heaters onto the device. If necessary, provide air conditioning.
- The cool air emanating from the air conditioning unit should not be directed at the device.
- Avoid mechanical shocks and vibrations.
- A separate room is recommended for sample preparation and storing liquid chemicals.
- The installation site must be free of drafts, dust and caustic fumes. Dust and corrosive vapors can cause damage to the device, e.g., due to corrosion.
- Keep the ventilation slits free and do not obstruct them with other devices.

The following requirements are placed on the climatic conditions in the operating room:

Temperature range	+15 °C to +35 °C, optimal +22 °C to +26 °C Temperature as constant as possible during measurement mode, maximum temperature drift $\Delta T_{\max} = 2 \text{ K/h}$, climate control recommended
Dew point (relative humidity)	< 15 °C (20 to 80 % at 20 °C) Prevent condensation
Air pressure	0.7 bar to 1.06 bar
Max. permissible altitude	2000 m
Storage	Temperature: -40 °C to +70 °C Use drying agent
Protection type	IP 20
Degree of contamination	2

4.1.2 Power supply

Only connect the device to a properly grounded socket which complies with the voltage indicated on the device's rating plate. At the connection point, an electrical current in accordance with the standard IEC 60038 must be available.

The device is not suitable for direct connection to line voltages of 115 V/120 V/127 V. In this case, the connection must be made via two phases or a transformer. Contact Analytik Jena if required. Installation may only be carried out by customer service or by specialist personnel authorized and trained by Analytik Jena.

The analyzer must be connected to a separately fused circuit as a heavy-duty consumer. All other additional devices, such as the autosampler and the cooling system, must be supplied with power via their own separate circuit.

Operating voltage	200 to 240 V AC $\pm 10\%$
Frequency	50/60 Hz
Power connection	Device connection: ■ C19 input socket Mains connection cable: ■ CEE 7/7 (EU) ■ NEMA 6-20 (due to 240 V, NEMA L6-20 plug) (USA, Canada) ■ Connection cable with open ends, e.g. Japan
Fuse protection (mains side)	16 A circuit breaker, tripping characteristic type B
Maximum power consumption	2500 VA
Protection class	I
Overvoltage category	II

4.1.3 Gas supply

The following gases are used in the emission spectrometer:

- Argon as the gas for the torch (plasma gas, additive gas, nebulizer gas)
- Argon as the purge gas for the spectrometer and as the cone gas
- Oxygen as optional additive gas

The standard length of the hose is 3 m. If you require other hose lengths, please consult customer service.

Gas	Inlet pressure	Total consumption	Connection
Argon ≥ 4.6 Permitted components: Oxygen ≤ 3 ppm Nitrogen ≤ 10 ppm Hydrocarbons ≤ 0.5 ppm Moisture ≤ 5 ppm	500 to 700 kPa (5 to 7 bar)	13 to 21 l/min	Connection for hose inner diameter 4 mm or Swagelok 6 mm with reinforcing sleeve
Oxygen ≥ 4.5 (optional)	600 kPa (6 bar)	≤ 0.05 l/min	Connection for hose inner diameter 2 mm or Swagelok 4 mm with reinforcing sleeve

4.1.4 Exhaust unit

The extraction device must be switched on while the emission spectrometer is running. Before igniting the plasma, the device's internal safety circuits check whether the extraction is switched on. If there is a fault, the plasma will not be ignited.

Correct extraction requires the form-fitting connection of an extraction hose to the smokestack of the emission spectrometer.

The extraction unit removes gases that are harmful to health, such as ozone or nitrous gases, which can be generated during plasma operation. Use an exhaust unit made of heat-resistant and corrosion-resistant material. The first 6 m of the exhaust air system should be made of metal or a heat-resistant material ($> 85^\circ\text{C}$). The first meter should be made of a flexible material so that it can reach the device from above.

Material	Heat-resistant and corrosion-resistant (recommended: V2A steel)
External pipe diameter	125 mm

Extraction output	3.5 m ³ /min (min.), 5.5 m ³ /min (max.) Optimal: 4.0 to 4.5 m ³ /min
Adapter using flexible aluminum pipe	Pipe diameter: 125 mm Pipe length: 1000 mm

4.1.5 Recirculating chiller

The HF generator is cooled by the cooling circuit of the external recirculating chiller. Please observe the information provided in the recirculating chiller's operating instructions.

The recirculating chillers supplied by Analytik Jena are adapted to the required cooling capacity of the emission spectrometer.

Recirculating chillers not purchased from Analytik Jena must meet the following requirements:

Water return flow in the cooling water circuit	1.5 to 2.0 l/min
Cooling water temperature range at device cooling water inlet	18 to 20 °C
Recommended temperature setting	20 °C
Temperature stability	± 0.1 °C
Conductivity of the cooling water	50 to 200 µS/cm
Cooling performance	≥ 2.5 kW
Pressure setting (max.)	600 kPa (6 bar)



NOTE

Danger of corrosion in the cooling water circuit

In addition to the risk of corrosion, base metals increase the conductivity of the cooling water.

- When selecting the recirculating chiller, ensure that no base metals are used in components that carry water.

The recirculating chiller must be filled with coolant mixed with the Analytik Jena coolant additive. The coolant additive prevents damage to the emission spectrometer that can be caused by corrosion and biological contamination. Damage to the device due to operation without coolant additive is excluded from the warranty.

For night-time and constant operation the recirculating chiller can be controlled via the emission spectrometer. Analytik Jena supplies a matching communication cable with the recirculating chiller. The cable connects the "Chiller Remote" connection on the left-hand side of the emission spectrometer to the interface on the back of the chiller. The chiller is then switched on and off automatically as the plasma ignites and goes out.

See also

- ▢ Maintenance of the recirculating chiller: Replacing the cooling water [► 80]
- ▢ Media connections and interfaces [► 19]

4.1.6 Device layout and space requirements

The emission spectrometer is a compact device designed for table-top operation. The required space depends on all components that make up the measuring station.

Components of the measuring station:

- Autosampler
- Recirculating chiller
- Waste bottle (under the bench)
- The PC and printer may be placed on a separate side table.

The workbench must meet the following requirements:

- The minimum floor area (W x D) for the device and autosampler is 1200 mm x 800 mm. In addition, a minimum gap of 80 mm must be maintained between the back of the device and the nearest wall.
- The height can be chosen according to ergonomic aspects.
- The device must be freely accessible from all sides. The power switch on the rear of the device must be easily accessible in an emergency.
- The workbench must be designed for a load capacity of at least 150 kg.
- The workbench surface must be wipe, scrape and corrosion resistant and must not absorb moisture.

Component	Width x height x depth [mm]	Mass [kg]
On the workbench		
Base device (including sample tray)	600 mm x 932 mm x 809 mm	115 kg
Sample tray, removable	514 mm x 82 mm x 239 mm	
ASPQ 3300 autosampler	285 mm x 510 mm x 490 mm	15 kg
Teledyne Cetac ASX-560 autosampler	580 mm x 620 mm x 550 mm	12 kg
Cetac ASX-280 autosampler	360 mm x 620 mm x 550 mm	8.1 kg
Cetac Oils 7400 autosampler	570 mm x 490 mm x 540 mm	23 kg
Teledyne Cetac SDX(HPLD) dilution system	132 mm x 254 mm x 117 mm	4.4 kg
Teledyne Cetac SimPrep dilution system	580 mm x 620 mm x 550 mm	11.7 kg
Switch valve Cetac ASXPress Plus	58 mm x 128 mm x 217 mm	1.3 kg
with separate control unit	83 mm x 254 mm x 200 mm	1.4 kg
Outside the laboratory or next to the workbench		
Water-air cooler (LabTech)	460 mm x 703 mm x 735 mm	92 kg
Water-air cooler (Van der Heijden)	530 x 740 x 580 mm	73 kg
Water-water cooler	360 mm x 590 mm x 470 mm	33 kg (empty)
Under the workbench		
Waste bottle (Ø x height)	120 mm x 250 mm	

To ensure unimpeded intake and exhaust of cooling air and effective cooling, the surfaces of the housing sides of the water-air cooler require a minimum distance of 60 cm from adjacent objects.

Due to the waste heat generated and the possible noise pollution, it is recommended to place the water-air cooler outside the laboratory. An extension of the cooling water hoses is permitted if minimum pressure and flow volume are maintained. The cooler must be located on the same floor as the basic device. If this is not the case, additional

check valves must be installed in the water circuit. Otherwise the water tank can run empty when the device is at a standstill. These adjustments will not be carried out by Analytik Jena.

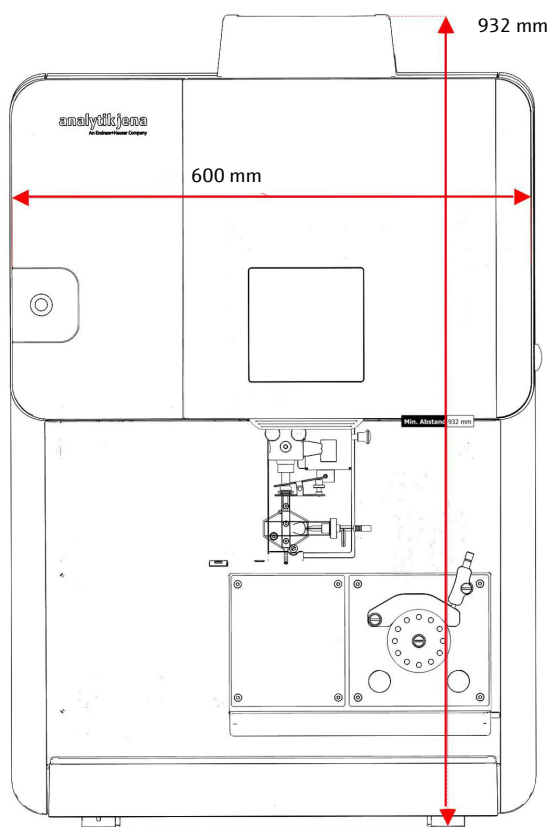


Fig. 13 Space requirements (viewed from the front)

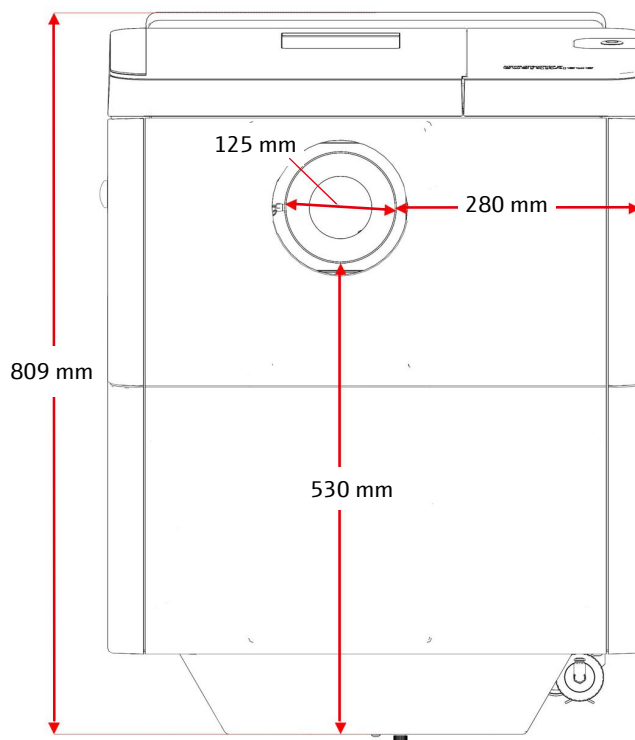


Fig. 14 Space requirements (view from above)

4.2 Installing the sample supply system

The sample feed systems, the torch and the nebulizer with spray chamber, as well as the autosampler, must be installed by the customer during maintenance work.

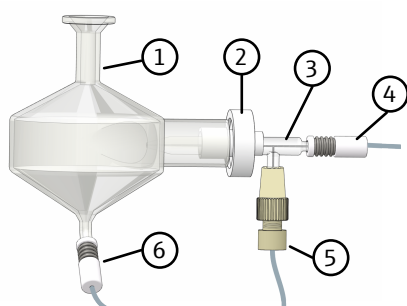


CAUTION

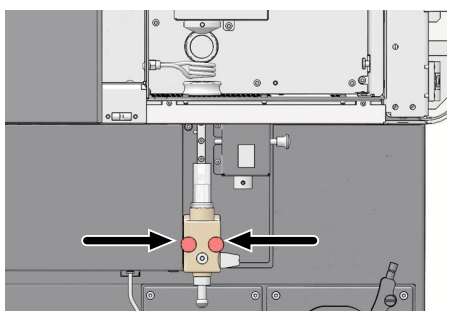
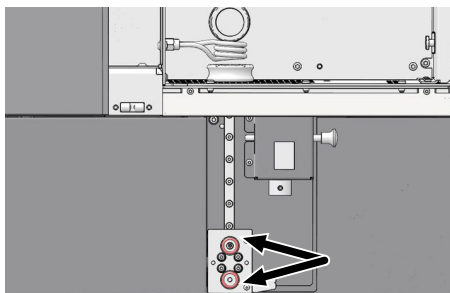
Risk of injury

A risk of injury due to broken glass is present when handling glass parts.

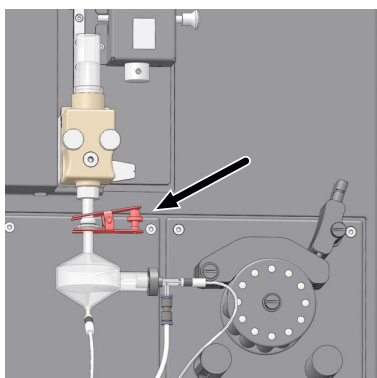
- Handle glass parts with extreme caution.
- Wear non-slip glass handling gloves that allow a firm and secure grip.



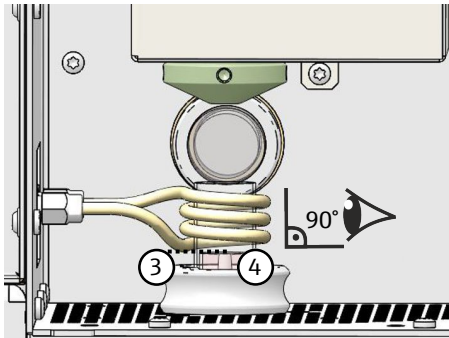
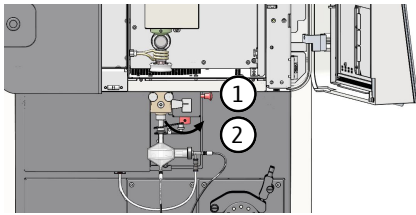
- ▶ Attach the sample hose (4) and the carrier gas hose (5) to the nebulizer. Depending on the nebulizer model supplied, either plug in or screw on the carrier gas hose (5).
- ▶ Loosen the plastic nut (2) on the spray chamber (1). Push the nebulizer (3) into the spray chamber as far as possible and tighten the plastic nut hand-tight.
The connection for the carrier gas to the nebulizer should point downwards.
- ▶ Attach the waste hose (6) to the bottom connector of the spray chamber.
- ▶ Check on the carriage that the O-rings are in the gas connections.
(The O-rings may stick to the torch holder when the torch is removed).



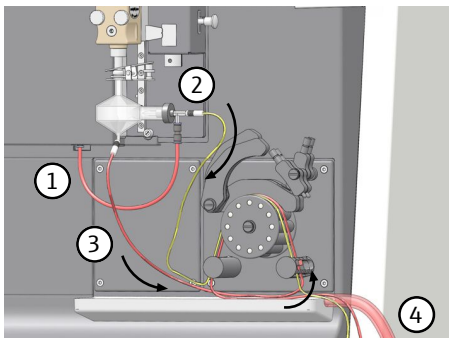
- ▶ Place the torch on the carriage of the mounting rail in the sampling compartment and screw it in place.
i NOTE! Tighten the screws firmly so that the gas supply is connected leak-proof.



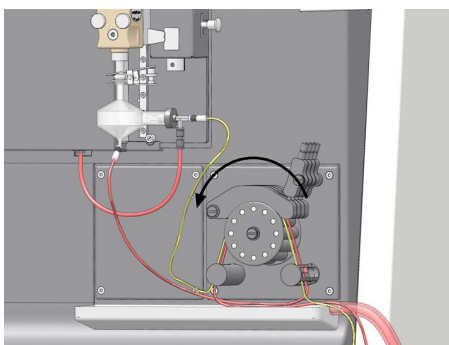
- ▶ Fit together the spherical joint connection of the torch and the spray chamber and secure the connection with the fork clamp.



- ▶ Push the torch upwards on the rail until it engages over the holder with the spring pin (1) on the height adjustment. The height adjustment is factory set so that the zero point on the scale corresponds to the optimum setting for standard applications.
- ▶ For manual adjustment: Use the height adjustment (2) to adjust the torch so that the outer edge of the inner tube (4) is at the same height as the lowest point of the lowest coil of the induction coil (3). When adjusting, look at the coil from the front at a 90° angle. The height setting can be adjusted depending on the application.
- ▶ The outer tube must be removed for manual adjustment of the ceramic torch (HF kit).
 - Adjust the torch using the manual height adjustment (2) so that the outer edge of the inner tube is at the same height as the lowest point of the lowest coil of the induction coil (3).
 - After adjustment, reinsert the outer tube. Move the torch back in the adjusted position.



- ▶ Connect the carrier gas hose (1) to the gas connection in the sampling compartment.
- ▶ Cut the sample and waste hoses so that the torch with spray chamber and nebulizer can still move freely on the rail. Slightly chamfer the ends of the hoses.
- ▶ Connect the sample hose of the nebulizer (2) to the pump hose with the black stoppers.
- ▶ Connect the waste hose (3) to the pump hose with the red stoppers. To enable the waste to be pumped out of the sample feed system, route the waste hose from the lower connection on the nebulizer compartment to the stopper on the right-hand side of the pump.
- ▶ Push the hose ends several millimeters into the pump hoses. To get a better grip on the hoses and prevent them from slipping, rub them a little with fine sandpaper.
- ▶ Connect the thick waste hose (4) to the collecting tray under the hose pump. Feed the hose into the waste container.



- ▶ Clamp each of the pump hoses between two stoppers into the pump.
 - i** NOTE! Note the pump direction! The pump rotates in a counterclockwise direction!
- ▶ Place the clamping brackets over the hoses so that the hoses lie in the groove of the clamping brackets. Secure the clamping brackets with the levers. The levers must lock into place.
- ▶ Connect the sample pump hose to the hose of the autosampler (for automatic operation) or a hose leading directly into the sample (manual operation).
- ▶ At the waste pump hose, connect the waste hose to the waste container.
 - i** NOTE! The waste hose must not dip into the liquid! This prevents waste solution from being pumped into the sample feed system if the pump hose is connected incorrectly.

Notes on the pump hoses

Different materials can be selected for the pump hoses depending on the sample. The inner diameter of the waste hose is one and a half times that of the sample pump hose. This ensures that droplets separated from the aerosol are quickly removed.

Pump hose	Inside diameter	Designation (stopper)
Sample supply	0.762 mm/0.03 inch	black/black
Waste	1.143 mm/0.045 inch	red/red

Adjust the contact pressure on the pump hose as follows:

- ▶ Loosen the screw on the lever so that no liquid is conveyed.
- ▶ Slowly tighten the screw until liquid begins to flow through the hose.
- ▶ Tighten the screw one more half turn.

When the pump is not in operation, loosen the clamping brackets. This will extend the service life of the pump hoses.

4.3 Putting the ASPQ 3300 into operation

Connections

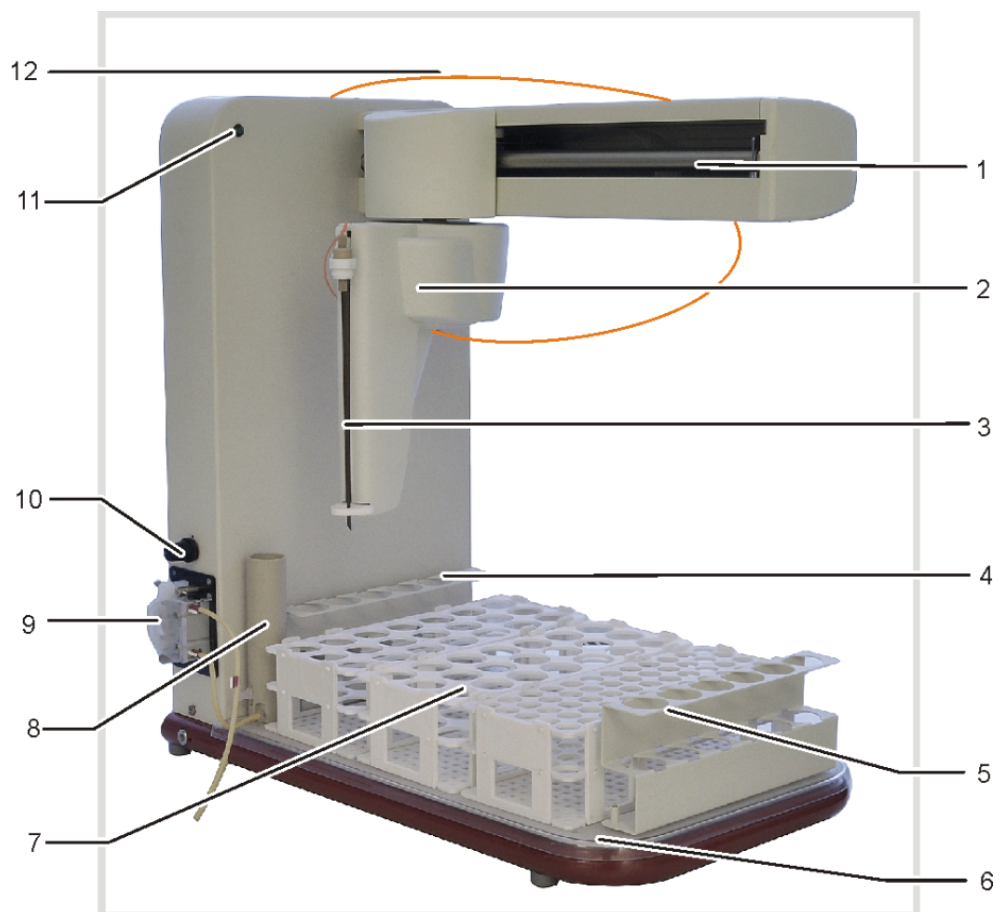


Fig. 15 ASPQ 3300 sampler

- | | |
|----------------------------|---------------------------------------|
| 1 Sampler arm | 2 Sampler head with cannula holder |
| 3 Cannula | 4 Rack for special samples |
| 5 Rack for special samples | 6 Base plate for racks |
| 7 Sample racks | 8 Purging vessel |
| 9 Purging vessel pump | 10 Controller for purging vessel pump |
| 11 Power LED | 12 Sample intake hose |

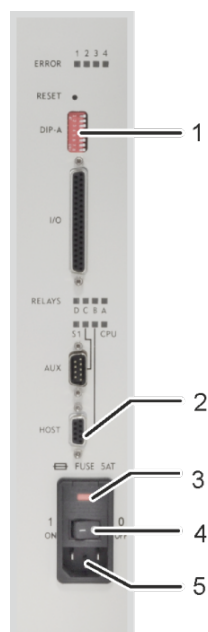


Fig. 16 Connection panel on the right side of the sampler

- | | |
|--------------------|---|
| 1 DIP switch | 2 "HOST" connection (to the basic device) |
| 3 Power switch | 4 Fuse holder |
| 5 Power connection | |

Note: DIP switch 5 is set to "ON".

Only the aforementioned connections are required for the use of the sampler together with the basic device. All other connections and displays are for service purposes or not in use.

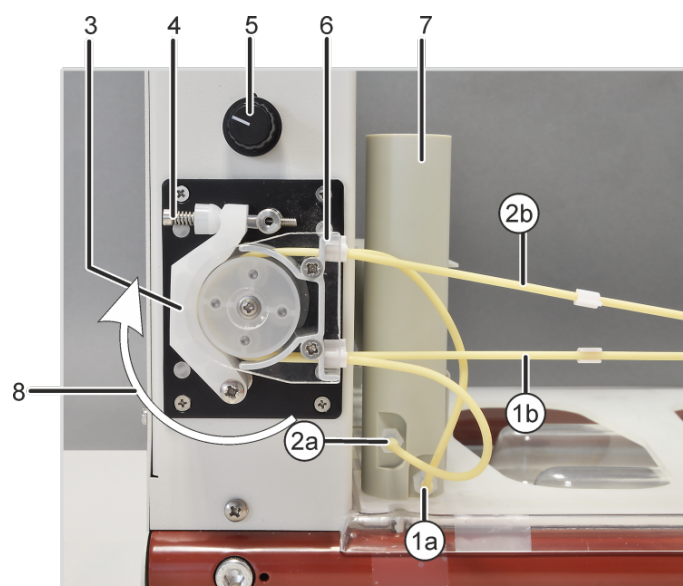


Fig. 17 Purging vessel and pump on the sampler

- | | |
|---|--|
| 1a Intake connection for purging solution on the purging vessel | 1b Purging solution hose |
| 2a Waste connection on the purging vessel | 2b Hose to the waste container |
| 3 Clamping bracket | 4 Clamping lever with spring |
| 5 Pump speed controller | 6 Hose block for clamping the pump hoses |
| 7 Purging vessel | 8 Pump direction |

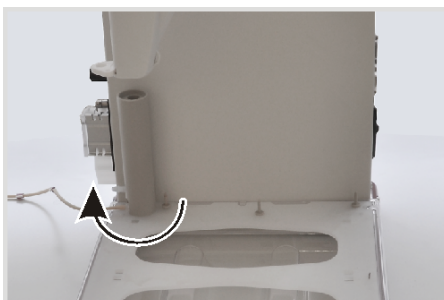
Installing the sampler

**NOTE****Risk of damage to the sensitive electronics**

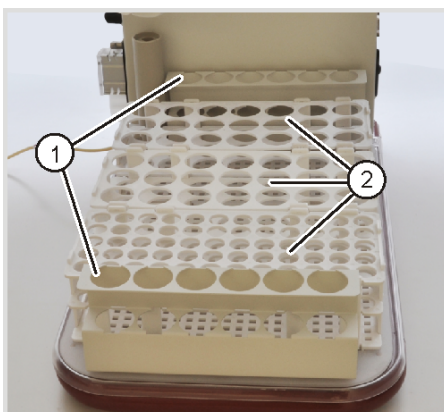
- Only connect the sampler to the electrical grid after installation.



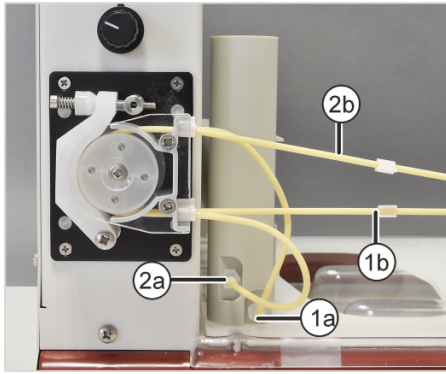
- ▶ Place the tray on the automatic sampler foot, and place the base plate for holding the sample racks on that. In this case, the place for the purging vessel must be located on the left to the rear. The base plate is correctly mounted if it fails to move after light shaking.



- ▶ Installing the purge vessel: Insert the purging vessel into the rear left recess and turn it clockwise by 90°.



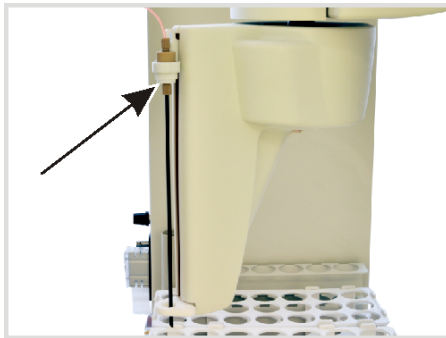
- ▶ Fit the racks for special samples (1) on the base plate and attach the required sample racks (2). The sample positions are coded with a three-digit number (e.g. 108) in the control software. The first number indicates the sample rack itself, the following numbers the position on the rack. The first sample rack is located in front of the purging vessel, followed by the second and third. In the software the positions are only shown for illustration.



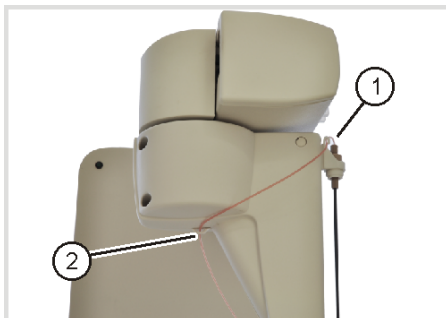
- ▶ Connect the pump hose for the purging solution to the lower intake connection (1a) of the purging vessel. Place the pump hose over the hose block from above and clamp it between two stoppers. Connect the intake hose for purging solution to the other end of the hose (1b). Immerse the intake hose in purging solution.
- ▶ Connect the pump hose for waste to the top outlet connection (2a) of the purging vessel. Place the pump hose over the hose block from below and clamp it between two stoppers. Connect the waste hose to the other end of the hose (2b). Insert the waste hose in the waste bottle.

i NOTE! Note the pump direction! The pump moves in a clockwise direction.

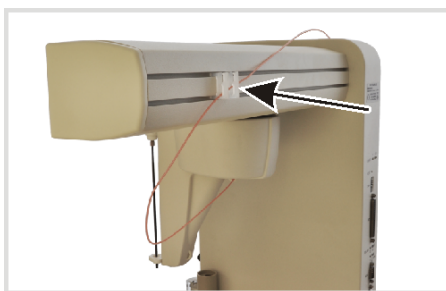
- ▶ Fasten the clamping bracket over the pump hoses via the clamping lever.



- ▶ Insert the cannula into the holder on the sampler head.
 - Move the holder along the Z-axis (down and up) and check whether the cannula fits through the guide at the lower end of the head.
 - Fasten the cannula on the holder with the nut (arrow in figure on the left).



- ▶ Initially guide the sample hose in an arc through the eyelet on the cannula holder (1).
- ▶ Thread the hose from the left side through the eyelet (2) on the lower end of the head.



- ▶ Place the hose to the rear in the eyelets on the rear of the sampler arm.
- ▶ Connect the hose with the sample hose of the basic device.



- ▶ Check the DIP switch (1). Set switch 5 to "ON"; all other switches remain at their initial positions.
- ▶ Connect a USB cable to the "Host" connection and to the "Autosampler" connection on the basic device.
- ▶ Connect the power supply cable to the power connection (3) and to a grounded power outlet.
- ▶ Set the pump speed on the sampler so the liquid level remains constant and not too much purging liquid overflows.

4.4 Installing other accessories

4.4.1 Coupling the Teledyne Cetac ASX-560 autosampler to the Cetac ASXPress Plus switching valve

When delivered together with the emission spectrometer, the accessories are commissioned with the base device. The user only needs to carry out the installation themselves if they order the accessories separately and the accessories are delivered later.

Contact customer service to help with configuration of the accessories in the ASpect PQ software. Customer service can set up the configuration via remote maintenance.

Refer to the user manuals supplied for a detailed description of how to install the accessories.

- ▶ Connect the Teledyne Cetac ASX-560 autosampler to the separate control unit of the switching valve via the RS 232 interface (COM 1).
- ▶ Connect the control unit to the other components of the analysis system via the following interfaces:

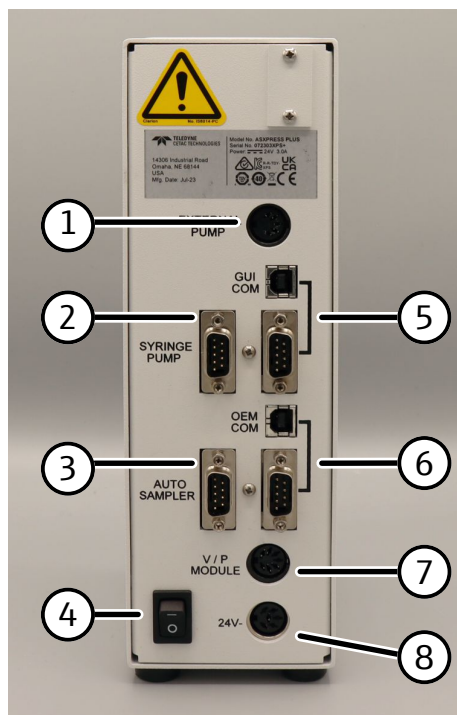


Fig. 18 Connections on the control unit of the switching valve

- | | |
|--|---|
| 1 Optional connection for an external pump | 2 RS 232 interface (not used) |
| 3 RS 232 interface to the autosampler | 4 Power switch |
| 5 Interface to PC (use USB interface only, transmission of Cetac Dashboard commands) | 6 Interface to PC (use USB interface only, transmission of autosampler commands via ASpect PQ software) |
| 7 Interface to switching valve | 8 Power connection |
- ▶ Connect the autosampler and control unit to the control computer via USB cables and a hub. Use both interfaces:
 - For transmitting commands from the Dashboard software
 - For communication between the autosampler and the switching valve via the ASpect PQ software (see diagram)

- ▶ Connect the control unit and autosampler to the electrical mains.

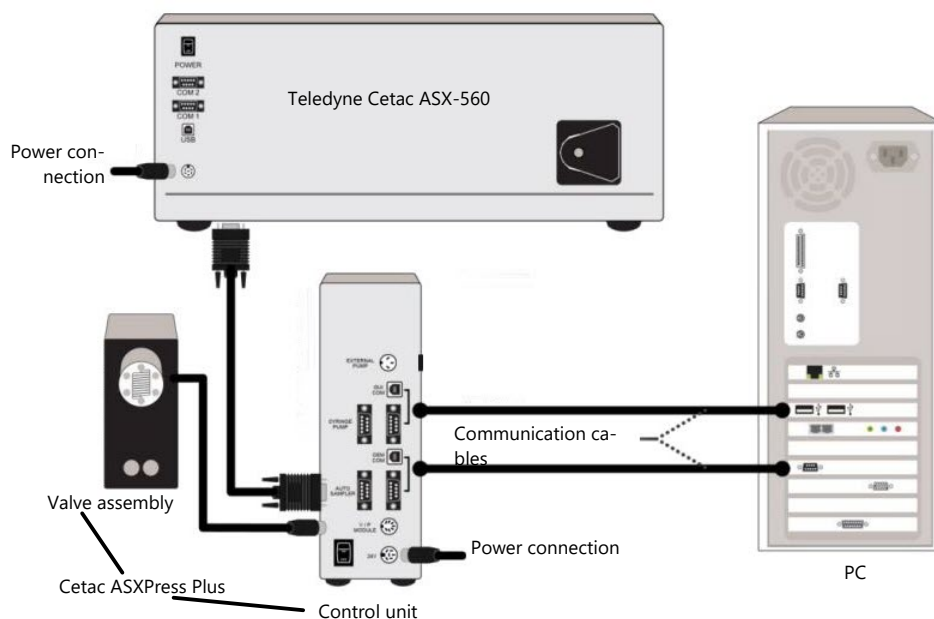


Fig. 19 Diagram: Connections between PC and accessories

- ▶ Connect the switching valve to the autosampler and emission spectrometer using the following hoses:
 - Connect the switching valve to the sample tube of the autosampler via hose connection 2 ("Autosampler") on the 6-port valve.
 - Connect the switching valve to the sample tube of the emission spectrometer via hose connection 5 ("Nebulizer").

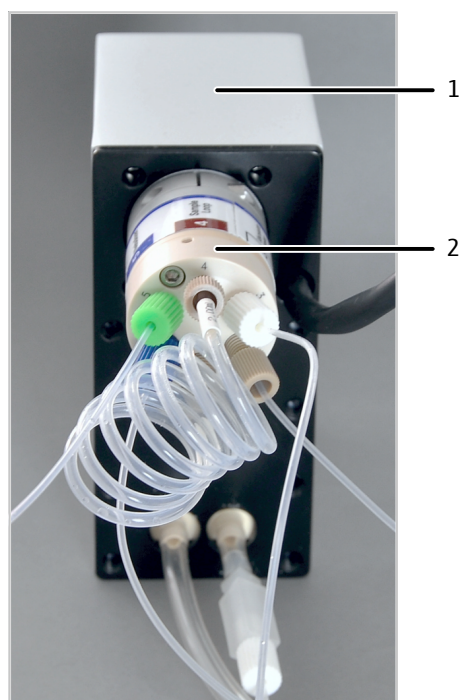


Fig. 20 Connect the hoses to the switching valve

1 Switching valve

2 6-port valve with labeled hose connections

When the autosampler and switching valve are connected (without dilution system), the Dashboard software controls the switching valve. Control of the switching valve is not integrated in the ASpect PQ software.

For operation of the autosampler and switching valve **without** dilution system:

- ▶ Install the Dashboard software; see the user manual for the accessories.
- ▶ Operate the switching valve in automatic mode (default setting).
- ▶ During commissioning: Adjust settings to the analysis system via the Dashboard software, such as the sample loop loading time.

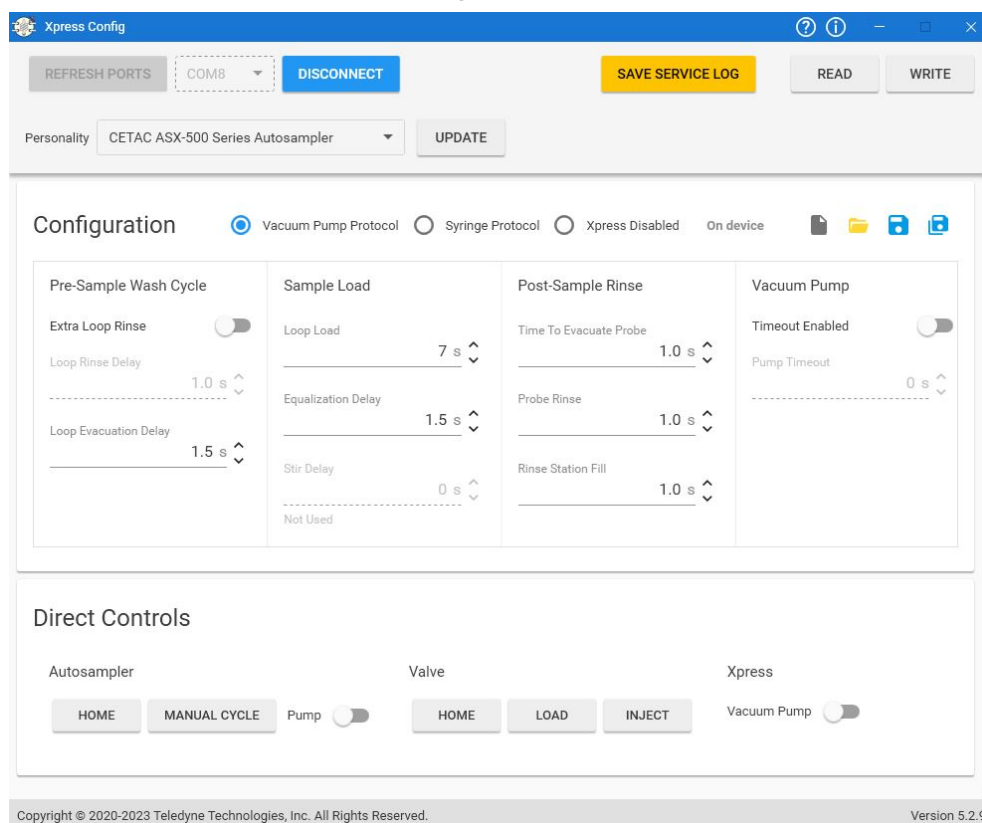


Fig. 21 Configuration of the switching valve in the Dashboard software

4.4.2 Coupling the Teledyne Cetac ASX-560 autosampler to the Teledyne Cetac SDX(HPLD) dilution system

When delivered together with the emission spectrometer, the accessories are commissioned with the base device. The user only needs to carry out the installation themselves if they order the accessories separately and the accessories are delivered later.

Contact customer service to help with configuration of the accessories in the ASpect PQ software. Customer service can set up the configuration via remote maintenance.

Refer to the user manuals supplied for a detailed description of how to install the accessories.

Connecting autosampler and dilution system

- Connect the autosampler and dilution system via the following interfaces and connect to the electrical network:

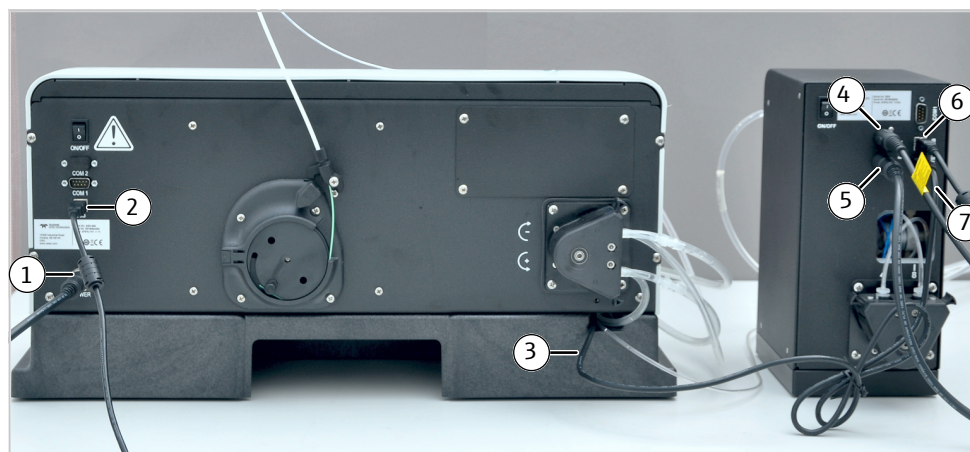


Fig. 22 Connect autosampler and dilution system

Connections on the rear of the autosampler:

- | | |
|--|---------------------------------|
| 1 Power supply for autosampler (via dilution system) | 2 USB interface to PC (via hub) |
| 3 Vortex cable (to dilution system) | |

Connections on the rear of the dilution system:

- | | |
|------------------------------------|--|
| 4 Power supply for dilution system | 5 Connection for power supply to autosampler |
| 6 USB interface to PC (via hub) | 7 Connection for vortex cable |

- Connect the autosampler and dilution system to the control computer via a hub.

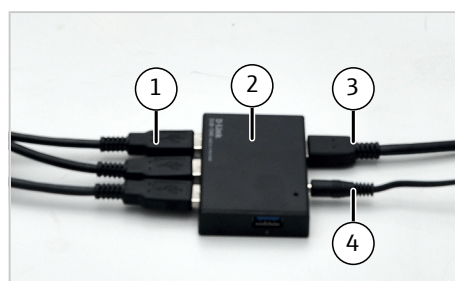


Fig. 23 Connection to control computer via hub

- | | |
|--|-----------------------|
| 1 Connection of the USB cables from autosampler, dilution system, etc. | 2 Hub |
| 3 USB cable to the PC | 4 Power supply to hub |

- Connect the autosampler and dilution system to each other and to the emission spectrometer using the following hoses:

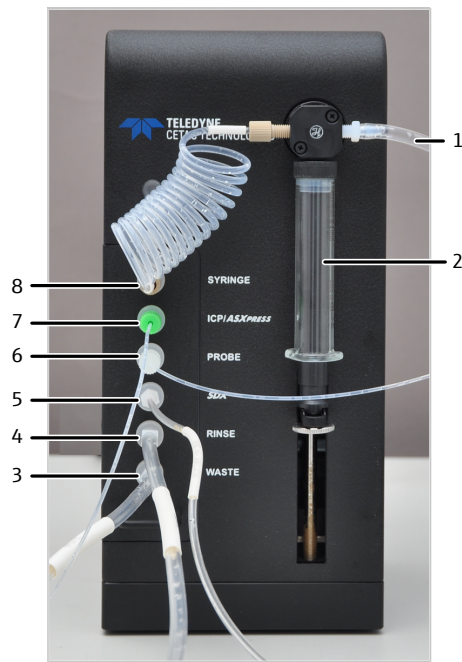


Fig. 24 Hose connections on the dilution system

- 1 Connection to the storage bottle with dilution solution

2 Syringe pump

3 Connection to the waste bottle

4 Connection to storage bottle with rinsing liquid (for vortex mixer vessel)

5 Connection to vortex mixer vessel (placed on the autosampler)

6 Connection to autosampler needle

7 Connection to sample tube of the emission spectrometer (via hose pump and nebulizer)

8 Connection to syringe pump (via hose loop)

Software support for commissioning and maintenance

The control of the autosampler and dilution system is integrated in the ASpect PQ software.

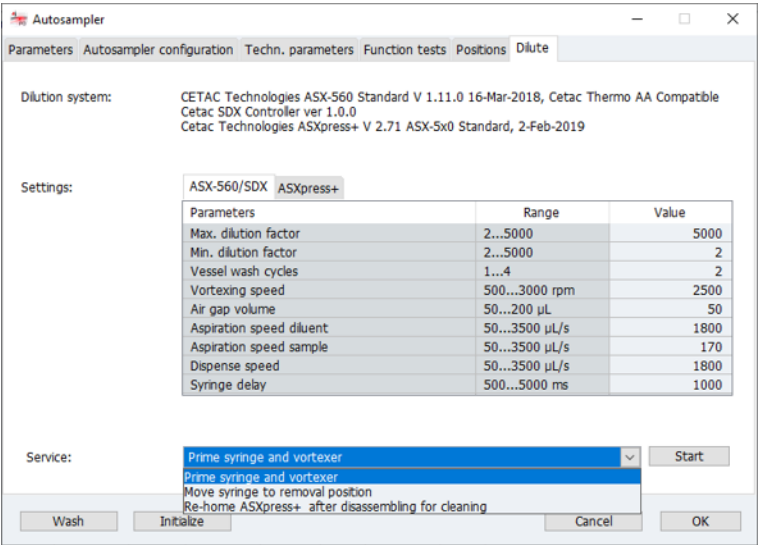


Fig. 25 Autosampler screen, Dilute tab

For commissioning and maintenance of the dilution system, use the following software commands on the **Dilute** tab, in the **Service** section:

Time	Measure	Software command
- Installation of the dilution system - When changing the syringe	Insert the syringe into the syringe pump of the dilution system. To do this, move the syringe piston to the ½ position.	Move syringe to removal position
- Commissioning the dilution system after installation or maintenance - After changing the dilution solution - For cleaning after using a strongly acidic or alkaline rinsing solution or an organic solvent	Rinse the syringe pump, tubes, and vortex mixer vessel with rinsing solution. Remove air bubbles from the tubes.	Prime syringe and vortexer

The user can set the following dilution parameters in the **Autosampler** window, **Dilute** tab:

- Max. dilution factor and Min. dilution factor
- Vessel wash cycles
- Vortexing speed
- Air gap volume
- Aspiration speed diluent, Aspiration speed sample and Dispense speed
- Syringe delay

4.4.3 Connect the Teledyne Cetac ASX-560 autosampler to the dilution system and switching valve

When delivered together with the emission spectrometer, the accessories are commissioned with the base device. The user only needs to carry out the installation themselves if they order the accessories separately and the accessories are delivered later.

Contact customer service to help with configuration of the accessories in the ASpect PQ software. Customer service can set up the configuration via remote maintenance.

Refer to the user manuals supplied for a detailed description of how to install the accessories.

Connect the autosampler and dilution system with the switching valve

- ▶ Connect the autosampler and dilution system via the following interfaces and connect to the electrical network:

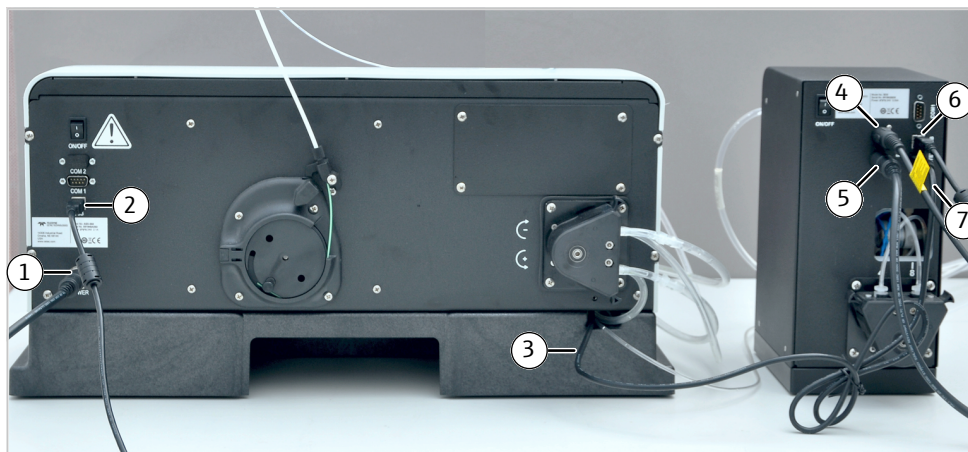


Fig. 26 Connect autosampler and dilution system

Connections on the rear of the autosampler:

- | | |
|---|---------------------------------|
| 1 Power supply for autosampler
(via dilution system) | 2 USB interface to PC (via hub) |
| 3 Vortex cable
(to dilution system) | |

Connections on the rear of the dilution system:

- | | |
|------------------------------------|---|
| 4 Power supply for dilution system | 5 Connection for power supply to au-
tosampler |
| 6 USB interface to PC (via hub) | 7 Connection for vortex cable |

- ▶ Connect the autosampler to the control unit of the switching valve via the RS 232 interface (COM 1).
- ▶ Plug the following connections into the control unit of the switching valve:



Fig. 27 Connect the control unit of the switching valve

Connections on the rear of the autosampler:

- | |
|--|
| 1 RS 232 interface (COM 1) to the control unit |
|--|

Connections on the rear of the control unit of the switching valve:

- | | |
|---------------------------------------|--------------------------------|
| 2 RS 232 interface to the autosampler | 3 Control unit power supply |
| 4 USB to the PC (via hub) | 5 Interface to switching valve |

- ▶ Connect the autosampler, dilution system, and switching valve to the control computer via a hub.

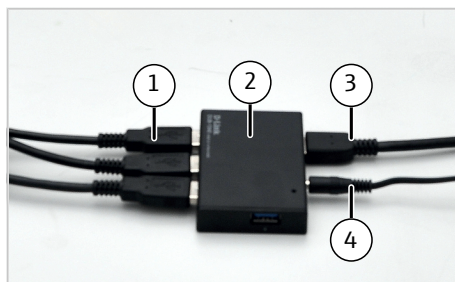


Fig. 28 Connection to control computer via hub

- | | |
|---|-----------------------|
| 1 Connection of the USB cables from autosampler, dilution system, and switching valve | 2 Hub |
| 3 USB cable to the PC | 4 Power supply to hub |

- Connect the dilution system to the autosampler and Cetac ASXPress Plus switching valve using the following hoses:

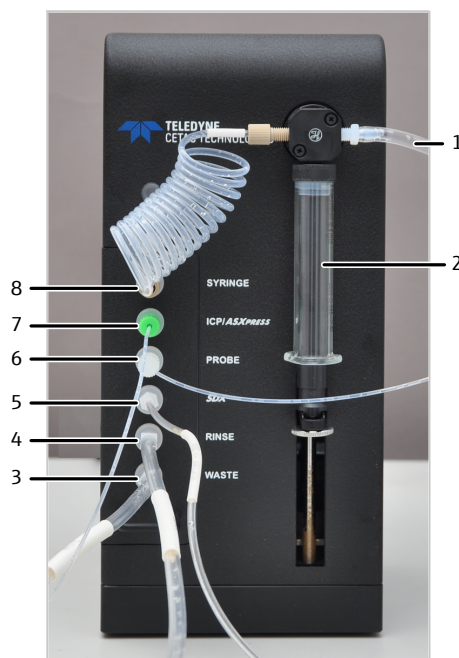


Fig. 29 Hose connections on the dilution system

- | | |
|---|--|
| 1 Connection to the storage bottle with dilution solution | 2 Syringe pump |
| 3 Connection to the waste bottle | 4 Connection to storage bottle with rinsing liquid (for vortex mixer vessel) |
| 5 Connection to vortex mixer vessel (placed on the autosampler) | 6 Connection to autosampler needle |
| 7 Connection to Cetac ASXPress Plus switching valve | 8 Connection to syringe pump (via hose loop) |

- Connect the Cetac ASXPress Plus switching valve to the dilution system and emission spectrometer using the following hoses:
- Connect the switching valve to the dilution system via tube connection 2 ("Autosampler") on the 6-port valve (connection "ICP/ASXpress").
 - Connect the switching valve to the sample tube of the emission spectrometer via hose connection 5 ("Nebulizer").

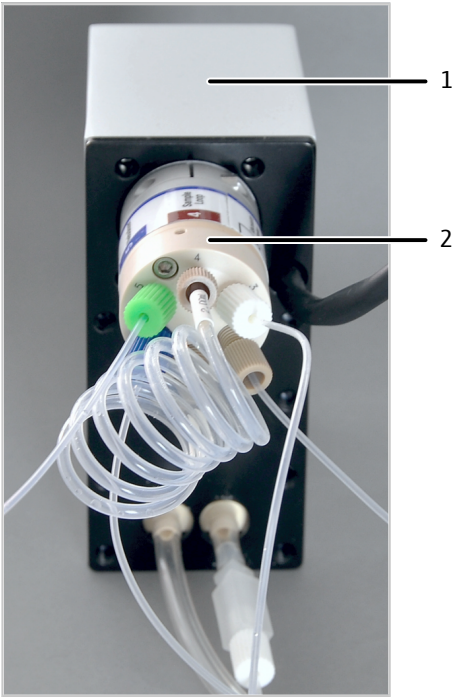


Fig. 30 Connect the hoses to the switching valve

- 1 Switching valve
- 2 6-port valve with labeled hose connections

Software support for commissioning and maintenance

The control of the autosampler, dilution system, and switching valve is integrated into the ASpect PQ software.

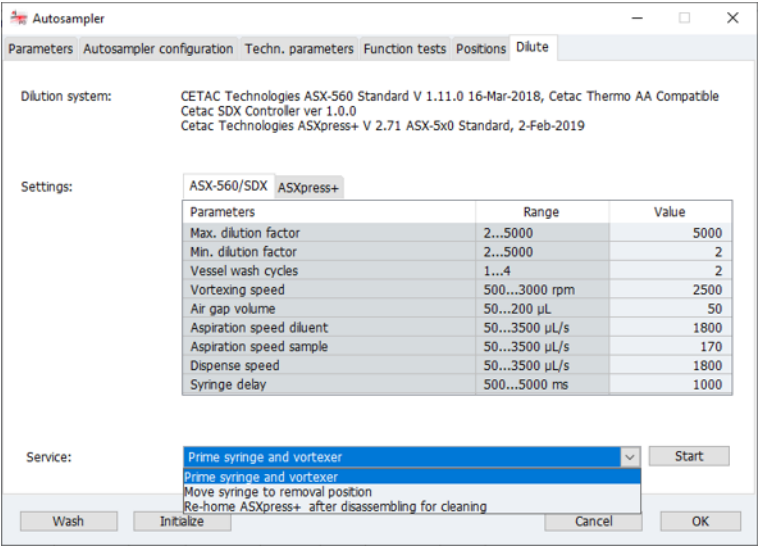


Fig. 31 Autosampler screen, Dilute tab

For commissioning and maintenance of the dilution system and switching valve, use the following software commands on the **Dilute** tab, in the **Service** section:

Time	Measure	Software command
- Installation of the dilution system - When changing the syringe	Insert the syringe into the syringe pump of the dilution system. To do this, move the syringe piston to the ½ position.	Move syringe to removal position

Time	Measure	Software command
- Commissioning the dilution system after installation or maintenance - After changing the dilution solution - For cleaning after using a strongly acidic or alkaline rinsing solution or an organic solvent	Rinse the syringe pump, tubes, and vortex mixer vessel with rinsing solution. Remove air bubbles from the tubes.	Prime syringe and vortexer
After weekly cleaning and after changing the 6-port valve on the switching valve	Initialize the switching valve. The control electronics adjust the internal valve stops and determine the correct stroke.	Re-home ASXpress+ after disassembling for cleaning

When commissioning the switching valve in the ASpect PQ software, adjust the following settings in the **Autosampler** window, **Dilute** tab:

- Loop Rinse Delay and Extra Loop Rinse
- Loop Evacuation Delay and Loop Load Time
- Equalization Delay
- TimeTo Evacuate Probe and Probe Wash
- Rinse Station Fill

The settings do not usually need to be changed during operation.

The Dashboard software is not required for commissioning.

The user can set the following dilution parameters in the **Autosampler** window, **Dilute** tab:

- Max. dilution factor and Min. dilution factor
- Vessel wash cycles
- Vortexing speed
- Air gap volume
- Aspiration speed diluent, Aspiration speed sample and Dispense speed
- Syringe delay

4.4.4 Installing IsoMist XR temperature-controlled spray chamber



CAUTION

Risk of freezer burn

The spray chamber and the inner surfaces of the Peltier element can become very cold (temperature range: -25 °C to +80 °C).

- Do not touch the spray chamber or Peltier element during operation or immediately afterwards.

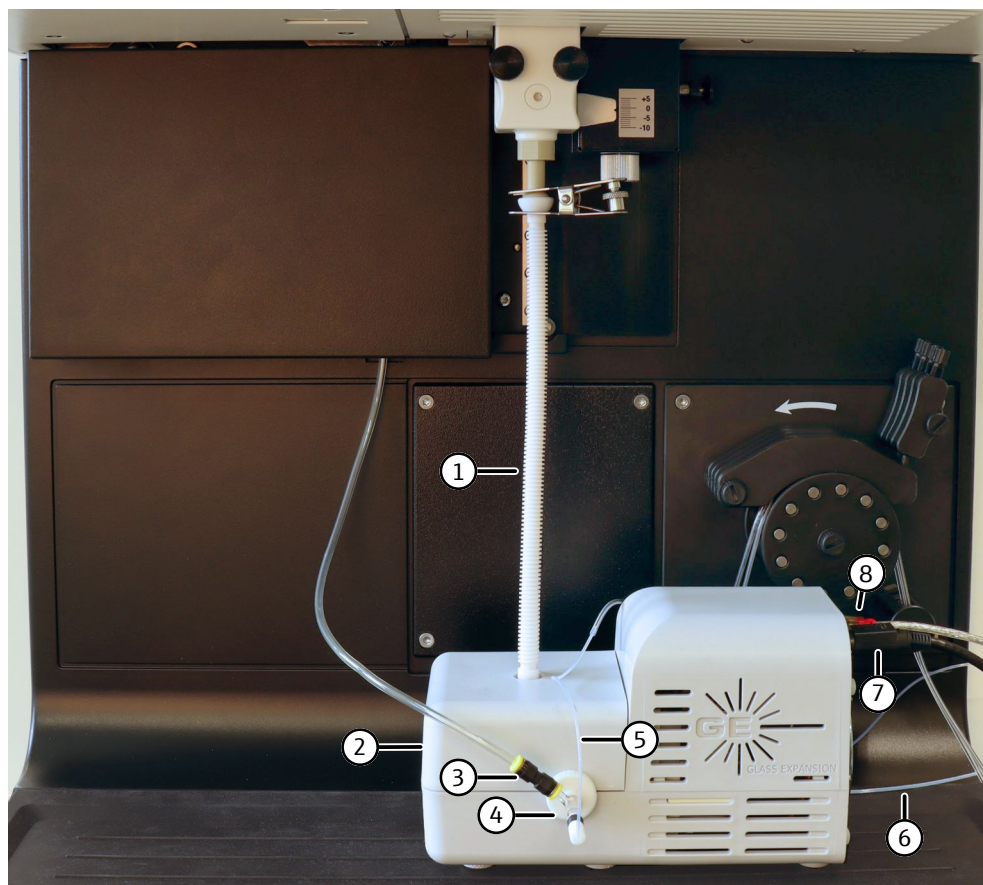


Fig. 32 Install temperature-controlled spray chamber

- | | |
|-----------------|--|
| 1 Transfer tube | 2 Temperature-controlled spray chamber |
| 3 Argon hose | 4 Nebulizer |
| 5 Sample hose | 6 Waste hose |
| 7 Power cable | 8 USB cable (to the PC) |

- ▶ Place the temperature-controlled spray chamber (2) in the sampling compartment of the emission spectrometer.
- ▶ Attach the waste hose (6) to the connection on the underside of the temperature-controlled spray chamber (2).
- ▶ Insert the nebulizer (4) into the spray chamber via the screw connection on the front and screw in tight.
- ▶ Attach the argon hose (3) and sample hose (5) to the nebulizer.
- ▶ Mount the pump hoses for sample and waste between two stoppers in the tube pump. Observe the pump direction (see arrow).
- ▶ Immerse the sample hose into the sample or connect it with the sampler.
- ▶ Lead the waste hose into the waste container.
- ▶ Connect the temperature-controlled spray chamber to the PC via the USB cable (8). Alternatively, connect the USB Bluetooth adapter with the PC.
- ▶ Mount the transfer tube (1) on the top outlet of the spray chamber.
- ▶ Attach the transfer tube to the torch with the fork clamp.
- ▶ Connect the temperature-controlled spray chamber to the mains power supply via the power cable (7).
- ▶ When removing: first remove the transfer tube, then move the carriage with the torch. Otherwise, the transfer tube could break.

4.4.5 Installing the argon humidifier



Fig. 33 Installing the argon humidifier

- | | |
|---------------------------------------|-----------------------------------|
| 1 Gas inlet: Argon hose from ICP-OES | 2 Bypass valve (ON/Bypass) |
| 3 Gas outlet: Argon hose to nebulizer | 4 Glass vessel with membrane coil |

- ▶ Assemble the argon humidifier as described in the enclosed data sheet. Be careful not to damage the membrane coil.
- ▶ Fill the glass vessel with membrane coil (4) with deionized water up to the mark.
- ▶ At the gas outlet of the argon humidifier (3), connect the hose to the nebulizer via a plug connector.
- ▶ Connect the hose at the gas inlet (1) to the argon hose of the emission spectrometer using a plug connector.
- ▶ Turn the bypass valve (2) until the colored marking points to "ON".

The argon humidification can be switched on and off using the bypass valve without having to disconnect any hose lines.

4.4.6 Installing the inline filter

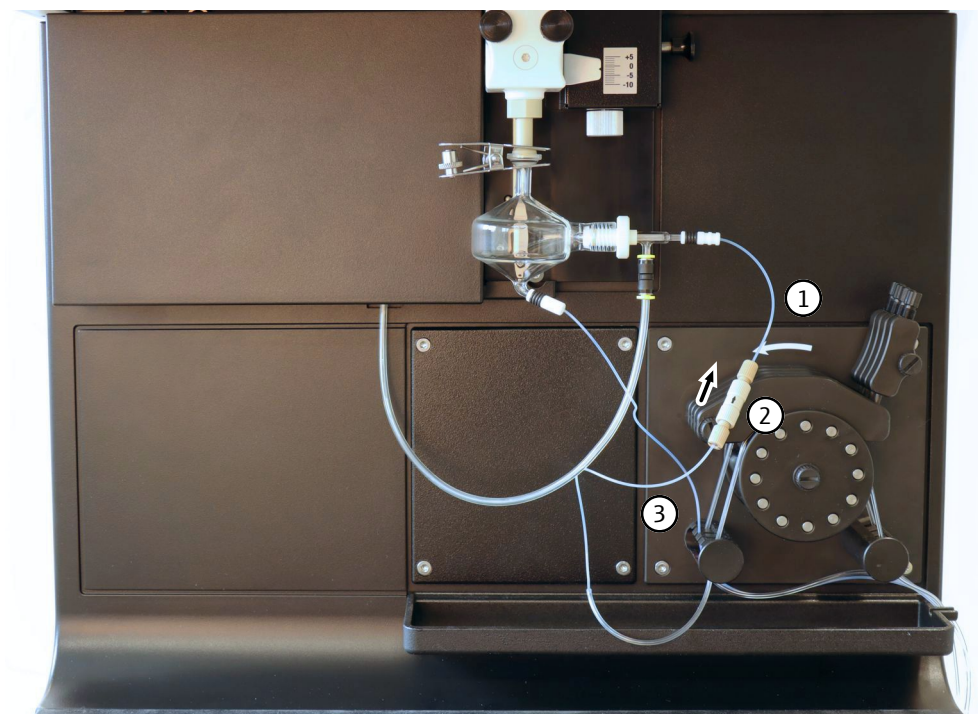


Fig. 34 Installing the in-line filter

- | | |
|----------------------------|-------------------------------------|
| 1 Sample hose to nebulizer | 2 Filter block with hose connectors |
| 3 Pump hose for sample | |

- ▶ Insert the in-line filter into the hose path such that the arrow on the filter block points in the direction of flow (i.e. in the direction of the nebulizer).
- ▶ Assemble the in-line filter as described on the enclosed data sheet.
- ▶ Insert the nebulizer hose into the banjo bolt using a ferrule. The conical side of the ferrule must face the banjo bolt, see image.
- ▶ Screw the hose connector into the outlet of the filter block.
- ▶ Screw the short capillary hose into the inlet of the filter block via the hose connector.
- ▶ Connect the capillary hose with the pump hose for the sample. To do so, push the capillary hose into the pump hose.
- ▶ Connect the nebulizer hose with the nebulizer.

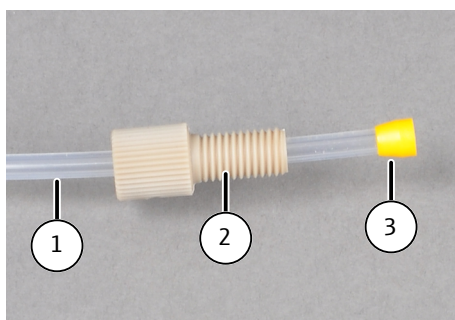


Fig. 35 Fingertight screw connection

- | | |
|-----------|--------------|
| 1 Hose | 2 Banjo bolt |
| 3 Ferrule | |

4.4.7 Installing the kit for internal standard (KIS)

The KIS is suitable for the analysis of samples in which the matrix has an influence on the measurement. If the standards and samples have a different viscosity, for example, this may influence the measurement result.

The KIS enables the online addition of an internal standard to each calibration standard and sample. The precision and accuracy of the analysis are improved by calculating a correction factor for every individual measurement.

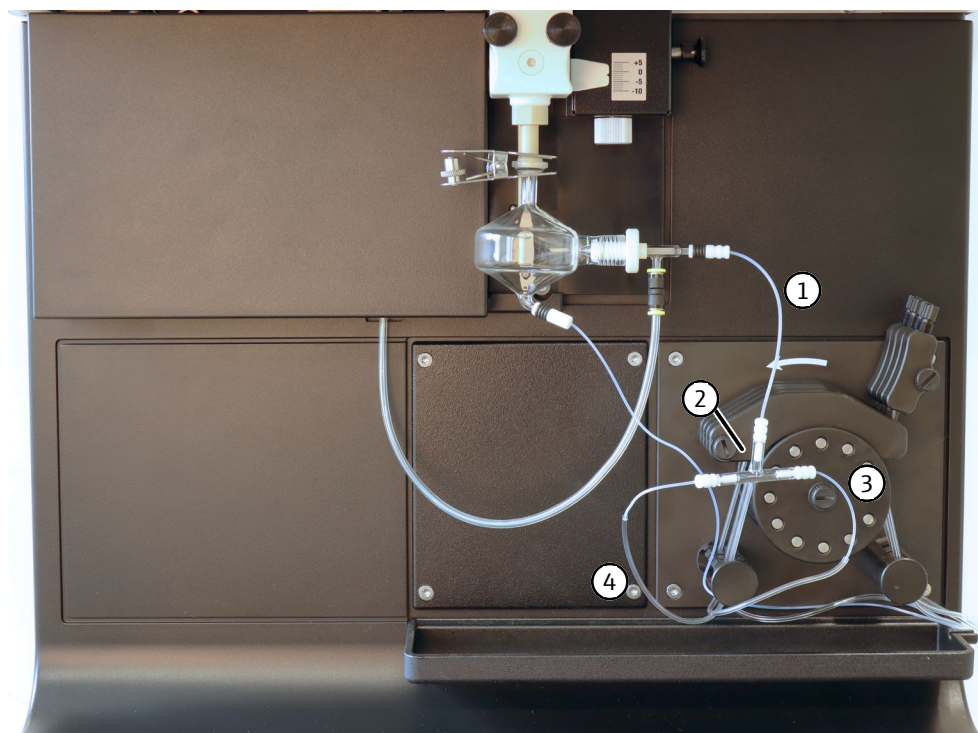


Fig. 36 Install the kit for internal standard

- | | |
|------------------------|---|
| 1 Nebulizer hose | 2 T-piece made of glass with hose connections |
| 3 Pump hose for sample | 4 Pump hose for internal standard |

- ▶ Clamp a pump hose for sample between two stoppers in the hose pump. Connect the pump hose to the autosampler or sample vessel.
- ▶ Mount a pump hose for the internal standard between two stoppers in the tube pump. Connect the pump hose with the storage vessel for the internal standard.
- ▶ Connect two short capillary hoses to the connectors of the T-piece using tube connectors.
- ▶ Push the two capillary hoses into the pump hoses for sample and internal standard.
- ▶ Connect the nebulizer hose with the T-piece using a tube connector.

5 Operation

5.1 Switching on the spectrometer and igniting the plasma



CAUTION

Risk of poisoning due to ozone and nitrous gases

- Switch on exhaust unit prior to igniting the plasma.
- Leave the exhaust unit switched on during operation.

To ensure safe plasma operation, the device monitors the following conditions using safety circuits.

- The plasma compartment door is closed.
- The plasma torch is in working position.
- Sufficient cooling is supplied.
- Exhaust air extraction is active.
- Argon supply is ensured.

Do not ignite the plasma unless all conditions are met. If one of the safety circuits reports a fault during operation, the device extinguishes the plasma.

Igniting the plasma

- ▶ Switch on the PC at the power switch and wait for the operating system to initialize.
- ▶ Switch on the ICP-OES device using the power switch. For PlasmaQuant 9200/PlasmaQuant 9200 Elite: Additionally, switch on the device using the standby switch on the front of the device.
- ▶ Open the argon supply. Set the preliminary pressure to 500 to 700 kPa (5 to 7 bar).
- ▶ Switch on the exhaust unit.
- ▶ Switch on the recirculating chiller using the power switch.
- ▶ Open the plasma compartment door. Check if the torch is in starting position. The injector tip must be situated approx. 1 to 2 mm below the bottom edge of the induction coil.
- ▶ Inspect the cone of the window for axial observation for contamination and wear. Use the hook wrench supplied to check whether the cone is firmly seated.
 - i** NOTE! If the cone is loose, it is not cooled sufficiently and will corrode.
- ▶ Close the plasma compartment door.
- ▶ For PlasmaQuant 9200 Elite: Switch on the optional sampling compartment lighting.
- ▶ Check the tube hoses. Replace tubes that are no longer flexible or show signs of heavy abrasion.
- ▶ Clamp each of the tube hoses between the stoppers in the pump on the ICP-OES device.
- ▶ Place the clamping brackets over the tubes and fasten the guides with the clamping levers. Make sure that the clamping levers engage!
 - i** NOTE! Pay attention to the pumping direction. This pump rotates anti-clockwise.
- ▶ Ensure that sufficient wash solution is in the bottle for the analysis.
 - i** NOTE! The wash solution should have the same acid content as the samples and standards. Use a 2 % nitric acid solution unless specified differently.

- ▶ Check the filling level of the waste bottle and empty the bottle if there is not enough reservoir available for analysis.
- ▶ For manual operation without an autosampler, immerse the sample aspiration tube in the wash solution. No air must follow during the plasma ignition process.
- ▶ Start the ASpect PQ program.
- ▶ In the **Quick Start** window, make the following settings:
 - Select the **Routine** or **Method development** option.
 - If using the HF kit, under **Torch material** select the **Ceramic** option to adjust the sensitivity of the optical plasma sensor.
 - Optionally: In the **Worksheet** area, select the worksheets prepared for the Quick Start, e.g., for the analysis of elemental impurities in pharmaceutical products according to USP 232/233. The worksheets contain method settings and prepared sequences.
- ▶ If you start the software with a worksheet, complete the Quick Start in the **Quick Start** window with **OK**.
- ▶ If you start the software without a worksheet, click on **Skip Quick Start** to go to the ASpect PQ interface.
- ▶ If the system has been out of service for an extended period or the nebulizer chamber was dismantled, purge the nebulizer chamber and the torch using nebulizer gas to expel any air from the system. Click on  to open the **Plasma | Control** window and click on **Purge spray chamber**.
- ▶ Ignite the plasma. In the **Plasma | Control** window, click on the **Ignite plasma** button.
 - ✓ This is followed by an initial phase in which the torch is purged with argon and the safety circuits of the ICP-OES device are checked. If everything is OK, the plasma is ignited.
- ▶ Observe whether the plasma has formed correctly. The plasma must be conical, extend beyond the induction coil, and taper towards the top.
- ▶ If a ring plasma forms, the plasma is only forming within the induction coil, or a crackling noise will be heard. In this case, press the red plasma off button on the device.
- ▶ Before the next ignition attempt, check that the sample tube is immersed in the wash solution and that the gas supply and recirculating chiller are working properly.
 - ✓ The spectrometer is only cooled after successful ignition and stable plasma formation. After 1 to 2 min the ignition routine is complete and the tube pump starts. The emission spectrometer is ready to measure.
- ▶ Only now make further settings on the analysis system and start the measurement routine.

5.2 Extinguishing the plasma and switching off the spectrometer

- ▶ After the end of the analysis, pump the wash solution through the system for approx. 3 min followed by water for 1 min. Then let the device run dry. If you need to replace the tubes, there will be no acid left in them!
- ▶ Extinguish the plasma in the ASpect PQ program by clicking on  in the toolbar. Alternatively, use  to open the **Plasma** window and click on **Extinguish plasma**.
- ▶ Exit the ASpect PQ program with **File | Quit**.

- ▶ Confirm the query to turn off the purge gas for the detector with **Yes** if you want to turn off the purge gas.
If you are only interrupting work for a short time (up to 30 min) or are working in the UV range, do not turn off the purge gas. This saves you the waiting time during the ignition process until the detector is sufficiently purged. Leave the device switched on during the measurement break.
- ▶ Wait for the message to appear that the device and the cooling can be switched off.
- ▶ Switch off the ICP-OES device and, if applicable, the autosampler using the power switches.
- ▶ During daily measuring operations, you can alternatively switch off the ICP-OES device using the standby switch on the front of the device. The device is still connected to the power supply. The gas supply is switched off in standby mode.
- ▶ Release the pump tubes on the ICP-OES device. Loosen the pressure levers so that the clamping brackets no longer press on the tubes and pull the tube stoppers on one side of the pump out of the lock.
- ▶ If using the autosampler, release the pump tube in the same way.
- ▶ After switching off the devices, close the gas supply.
- ▶ Switch off the recirculating chiller using the power switch.
- ▶ Switch off the exhaust unit.
- ▶ Shut down Windows and switch off the PC.
 - ✓ The analyzer is now switched off.



NOTE

Wait for the ICP-OES device to cool down before switching it off!
After extinguishing the plasma, wait at least 30 s before switching the device off using the power switch.

5.3 Switching off the device via the plasma deactivation switch in an emergency

Immediately switch off the plasma using the plasma deactivation switch on the right-hand side of the device if one of the following faults occur:

- A rattling sound can be heard
- A ring plasma forms (plasma forms only in the induction coil)
- The quartz glass of the outer tube of the torch starts to glow.
- No communication with the PC

Wait for a cooling down period of at least 30 s before switching off the emission spectrometer at the power switch.

After the plasma has been switched off manually or shut down automatically by one of the safety circuits in the device: Check that all switch-on conditions are met before reigniting the plasma.

5.4 Starting a measurement routine

In preparation for a measurement, create a method and a sequence or use one of the prepared worksheets.

If necessary, prepare a sample ID containing additional sample information such as dilutions.

Prepare the samples for measurement, e.g., on the autosampler tray.

Start measurement

- ▶ Switch on the PC. Switch on the emission spectrometer and the accessories.
- ▶ Ignite the plasma.
- ▶ Load a method:
 - In the toolbar, click on the folder icon next to the **Meth** field. Select the method in the **Open Method** window.
- ▶ Create a new sequence or load an existing sequence:
 - Perform a calibration at the beginning of the sequence.
 - When loading the sequence, make sure that the calibration matches the method. The analysis lines of the calibration standards must match the analysis lines that you selected in the method on the **Calibration** tab.
 - After calibration, measure a QC sample to verify the correctness of the calibration.
- ▶ If necessary, create a sample ID table with additional information about the samples.
- ▶ Start the measurement routine by clicking on  or using the **Routine | Run sequence** menu item.
- ▶ In the **Start** window, select a file name for the results file.

You can save the result in a new file or append it to an existing file. Overwriting an existing file is not possible.

 - ✓ After selecting the file name, the measurement routine starts according to the settings in method and sequence. When using the autosampler, the measurement runs automatically.
- ▶ For manual sample introduction without an autosampler, follow the sample preparation instructions on the screen.

6 Troubleshooting

6.1 Fault messages in the software



NOTE

Risk of device damage

Contact customer service in the following cases:

- The troubleshooting measures described do not eliminate the error.
- The error occurs repeatedly.
- The error message is not featured in the following list or the list refers to customer service for troubleshooting the error.

The system is monitored as soon as the device is switched on. After starting the control software, all malfunctions of the device are reported using error messages. Error messages consist of an error code and an error message.

The following section describes a number of possible malfunctions which the operator can partly troubleshoot without the help of a customer service technician. Confirm the error message and carry out the troubleshooting measures.

Error code/error message

3762: Wavelength correction error!

3765: No neon correction peak found!

3766: Correction range exceeded!

3782: No neon peaks found!

3783: Too many neon peaks found!

3783: No prim peak available!

Cause	Remedy
■ Faulty neon correction or prism adjustment	■ Switch the device off and on again ■ If the error occurs again, determine which correction is faulty in the Spectrometer Parameters window in the Corrections section ■ Inform customer service department
3811: No factory data found in instrument storage (FINFO)!	
Cause	Remedy
■ No production data for line storage available in the device memory ■ Faulty RAM memory	■ Contact service for line offsets ■ Inform customer service department
3870: No purge gas available!	
Cause	Remedy
■ No argon gas pressure is present	■ Check the gas pressure ■ Check the seat of the cone of the window for axial observation

Error code/error message	
3871: No cooling water available (detector cooling)!	
Cause	Remedy
■ The recirculating chiller is not switched on ■ The cooling water flow is too low	■ Switch on the recirculating chiller ■ Check the cooling water flow at > 0.85 l/min
3872: CCD cooling is inactive!	
Cause	Remedy
■ A termination occurred during plasma ignition	■ If plasma is burning, activate the CCD cooling option in the Spectrometer Parameters window and click on Set
3874: Spectrometer purging is still active!	
Cause	Remedy
■ The Ar purging of the spectrometer is not yet complete	■ Wait until the error message disappears and purging is complete
4003: Plasma shut-down because emergency switch has been activated!	
Cause	Remedy
■ The red plasma deactivation switch on the right-hand side of the device has been pressed	■ Reignite the plasma
4004: Plasma shut-down by plasma sensor!	
Cause	Remedy
■ Air is present during the ignition of the plasma in the spraying chamber ■ The plasma is flickering and unstable due to the sample matrix	■ Before ignition, close the clamping brackets of the hose pump, immerse the hoses in water, purge the spray chamber with Ar via the nebulizer gas ■ Dilute the sample matrix ■ Adjust the plasma conditions
4005: Plasma shut-down! Torch positioning error	
Cause	Remedy
■ No torch is installed ■ The torch has not been pushed up to the working position	■ Install a torch ■ Push the torch to the working position
4006: Plasma shut-down because water flow is too low!	
Cause	Remedy
■ The recirculating chiller is not switched on ■ The cooling water flow is too low	■ Switch on the recirculating chiller ■ Determine the cooling water flow ■ Service the coolant
4007: Plasma shut-down! Generator error (enable)	
Cause	Remedy
■ Communication has been interrupted ■ The generator is faulty	■ Restart the device and PC ■ Inform service
4009: Plasma shut-down because cooling water temperature is too high (in)!	
Cause	Remedy
■ The cooling temperature setting at the recirculating chiller is too high	■ Set the recirculating chiller to a cooling temperature of 20 °C

Error code/error message

4010: Plasma shut-down because cooling water temperature too high (out)!

Cause	Remedy
■ The cooling water flow is too low ■ The cooling temperature setting at the recirculating chiller is too high ■ High temperature in the operating room has heated the water in the coolant hoses	■ Determine the coolant flow, replace the coolant ■ Set the recirculating chiller to a cooling temperature of 20 °C ■ Set the recirculating chiller to 20 °C. Wait briefly until the water temperature at the device inlet is within the range of 18 to 20 °C and repeat ignition.

4011: Plasma shut-down! Cooling water temperature!

Cause	Remedy
■ The cooling water temperature is > 25 °C (inlet) or < 22 °C (outlet)	■ The cooling water flow is too low. Determine the cooling water flow, service the coolant ■ Set the recirculating chiller to a cooling temperature of 20 °C

4013: Plasma shut-down: gas flow control error (MFC)!

4015: Argon inlet pressure too low!

Cause	Remedy
■ No Ar gas flow is present	■ Open the Ar gas cylinder ■ Set Ar inlet pressure to 500 to 700 kPa (5 to 7 bar)

4023: Ignition failed! RF generator!

Cause	Remedy
■ Generator shutdown due to error during plasma build-up	■ Check sample feed ■ Restart the device

4031: Cooling water stopped because temp. is too low.

Cause	Remedy
■ The cooling temperature setting at the recirculating chiller is too low	■ Set the recirculating chiller to 20 °C. Wait briefly until the water temperature at the device inlet is within the range of 18 to 20 °C and repeat ignition.

4032: Plasma shut-down: not stable!

Cause	Remedy
■ The plasma is unstable due to the sample matrix or entry of oxygen (leaks)	■ Adjust the plasma conditions (increase performance) ■ Reduce the nebulizer gas flow ■ Reduce the pump speed ■ Increase the distance of the torch to the cone; reduce the distance to the induction coil; search for leaks in the Ar gas line, if necessary

4301: Firmware update communications error

4302: Invalid checksum of firmware application!

4303: Invalid firmware block!

4304: Invalid firmware block sequence

4305: Write-error firmware update

Cause	Remedy
■ Firmware update has failed	■ Repeat the firmware update ■ Inform customer service department

Error code/error message	
5204: Status: Plasma error!	
Cause	Remedy
- Device communication error - The step motor for grating, prism, shutter is faulty	- Restart the device (and PC if relevant) - Inform service
5206: Status: One or more safety interlocks are open!	
Cause	Remedy
- There is no cooling water flow - The plasma compartment door is open - The torch is not in measuring position - No Ar gas pressure is present - The extraction output is not sufficient - Manual generator shutdown by pressing the red plasma deactivation switch	- Switch on recirculating chiller. Check whether cooling water flow is > 0.85 l/min - Close the plasma compartment door - Check the torch position - Check the Ar gas pressure - Check the extraction - Reignite the plasma
5208: Status: CCD cooling error! Please check purge gas flow!	
Cause	Remedy
No Ar gas flow is present	If plasma is burning, activate the CCD cooling option in the Spectrometer Parameters window and click on Set

6.2 Device faults and analytical problems

This section describes a number of device errors and analytic problems, some of which the user can rectify himself. Most of the device errors described are easy to identify. Most of the analytic problems lead to implausible measurement results. If the suggested solutions do not eliminate the errors/problems, and if such problems occur frequently, contact the customer service department of Analytik Jena.

No signal	
Cause	Remedy
The pump does not deliver any sample	Check the hose / hose pump
The nebulizer is clogged; the mass-flow rate is very high (in the Plasma report window)	Check with Na solution (1 g/L) if necessary. If no plasma coloration (orange) is observed: - Check the nebulizer for blockages and clean the nebulizer - Filter or dilute the solutions or use an in-line filter - Use an argon humidifier
The injector is clogged	Check with Na solution (1 g/L). If no plasma coloration (orange) is observed: - Check the injector tip for deposits and clean it - Increase the distance between the injector and plasma, to do this move the torch down on the height adjustment or increase auxiliary gas flow - Use argon humidifier or inline filter
The nebulizer gas is set too low	Optimize the carrier gas flow

Adjustment on the analyte channel	Adjust the x/y offset of the method parameter in the Plasma Optimize plasma view position window (see on-line help or software manual)
Leak in the sample feed system (e.g., in sample and pump hoses)	Check the sample and pump hoses and their plug connectors
The windows in the plasma compartment are dirty	Replace the windows
The transparency in the UV vacuum is missing	Check the duration of the purge gas flow. Wait until the purge gas has completely purged the spectrometer compartment
The sensitivity is too low	
Cause	Remedy
Same causes and troubleshooting measures as described for the "No signal" error	
The measured value is too low	
Cause	Remedy
Incorrect calibration	Check calibration solutions and repeat calibration
- Poorly soluble substances lead to low concentrations - Poorly soluble substances are not completely broken down	Optimize sample preparation
Volatile substances escape during sample preparation	Optimize sample preparation
There is a spectral interference in the calibration standard	- Use a different analysis line - Use a single element standard
Matrix-related signal suppression	- Dilute sample solutions more - Perform matrix adjustment for calibration standards - Use standard addition method or addition calibration
Error in the background correction	- Select background correction points that are not spectrally disturbed - Better adjustment of a curved background using a non-linear correction function
Error when using an internal standard	- Standard incorrectly dosed - Concentration of the internal standard is not in the linear range. Select a lower concentration for the standard - Insufficient adjustment of the response to changes in plasma temperature. Perform matrix adjustment - Select a more suitable internal standard that exhibits similar chemical and physical behavior to the analyte
Contamination/carry-over in the calibration/zero solution	Remedy the cause of carry-over/contamination
The sample solution is viscous / has a higher density than the calibration solution	- Adjust the matrix (add to calibration solutions or dilute) - Use one/several internal standards
The spray chamber is filled	- Empty the spray chamber - Check the pump hose for drainage; if necessary, select a larger cross-section

The measured value is too high	
Cause	Remedy
■ Error in calibration	■ Check the calibration solutions
■ Matrix-related spectral overlay, measurement is performed on a peak shoulder	■ Select another undisturbed analysis line ■ Perform spectral correction (correction model)
■ Contamination/carry-over	■ Find and remedy the cause for contamination/carry-over
■ Volatile substances simulate higher concentrations	■ Optimize sample preparation
■ The analyte is an alkali metal (or an easily excitable atomic line)	■ Alkali effect. Optimize the plasma temperature (nebulizer gas flow and/or output) and plasma observation
■ Error when using an internal standard	■ Standard incorrectly dosed ■ Insufficient adjustment of the response to changes in plasma temperature. Perform matrix adjustment ■ Select a more suitable internal standard that exhibits similar chemical and physical behavior to the analyte
■ The warm-up phase is not observed	■ Wait for warm-up phase before calibration
■ The sample foams when shaken	Surfactants in the measuring solutions: ■ Optimize sample preparation ■ Add surfactants to the calibration solutions as well
Precision is poor	
Cause	Remedy
■ The pump fast mode was activated up to shortly before the measurement	■ Limit the fast mode to the time that is required to pass the measurement solution up to the nebulizer
■ The prewash time is too short	■ Extend the prewash time
■ The nebulizer or injector is clogged	Check with Na solution (1 g/L) if necessary. If no plasma coloration (orange) is observed: ■ Check the nebulizer for blockages and clean the nebulizer ■ Filter or dilute the solutions or use an in-line filter ■ Use an argon humidifier
■ The nebulizer gas flow is not optimal	■ Optimize the nebulizer gas flow
■ There are leaks in the argon supply	■ Seal the leaks
Signal drift	
Cause	Remedy
■ Temperature change in the spray chamber	■ A change of 1 °C causes a drift of approx. 1 % ■ Use a temperature-controlled spray chamber or air-condition the laboratory
■ The transparency in the UV vacuum is not sufficient	■ Check whether the argon purging of the spectrometer is complete (activate the purge gas flow long enough)

7 Maintenance and care of the emission spectrometer

The operator may not undertake any service or maintenance work to this device and its components other than that specified in these instructions.

Observe the information in the "Safety instructions" section for all maintenance work. Compliance with the safety instructions is a prerequisite for the error-free operation of the device. Always observe all warnings and instructions that are displayed on the device itself or indicated by the control software.

To ensure faultless and safe functioning, Analytik Jena recommends an annual inspection and servicing by its Service department.



WARNING

Risk of electric shock

- Always switch off the device and disconnect the power plug before performing maintenance work.
Power to the device is only disconnected by disconnecting the power plug. After the device is switched off, some parts are still live.
 - Only leave the device and the software on as the maintenance instructions explicitly demand.
-



CAUTION

Risk of damage to skin and eyes due to UV and electromagnetic radiation

Plasma emits UV radiation and high-frequency electromagnetic radiation which can cause serious eye and skin injuries as well as other health problems.

- Do not bypass the safety circuits with any maintenance work.
 - Check the function of the safety circuits after completing maintenance work.
-



CAUTION

Risk of burns from the hot torch

Plasma is extremely hot. The torch is still very hot after the plasma has been extinguished. Contacting these hot surfaces can cause burns.

- Wait 5 minutes after extinguishing the plasma. Only touch the torch after this time.
-

7.1 Maintenance overview

Basic device

Maintenance interval	Maintenance task
Daily and after maintenance	- Check the filling level of the wash solution bottle, replenish - Check the filling level of the waste bottle, empty - Remove contamination from the sampling compartment and plasma compartment, empty the drip tray - Check the induction coil and insulator ring for contamination, clean if necessary - Check the windows of the transfer optics in the plasma compartment for corrosion and contamination. Clean or replace if necessary. - Check the pump tubes for tightness and flexibility, replace with new tubes if necessary
Weekly	- Check the gas connections for leaks - Clean the valve assembly of the optional sample introduction system Cetac ASXPress Plus - Check the cooling water tubes for wear
Monthly	Check the air filter in the drawer on the front of the device for soiling, replace if necessary
Annually	- Check the water filter in the cooling water circuit for soiling, rinse if necessary and replace at least once a year - Have the air filter below the plasma compartment replaced by customer service at least once a year. Replace more frequently if the dust load in the installation room is high
If necessary	Replace the windows of the transfer optics in the plasma compartment: - If streaks and burnt-in residues are visible - If losses in energy occur Also check the gas connections for leaks: - After renewing connections - If the manometer indicates a distinct pressure loss - If the plasma fails to ignite or is accompanied by loud noise Replace the argon tube if it has become discolored. Replace the input filter of the optional sample introduction system Cetac ASXPress Plus: - If the wash water flow decreases - If the autosampler wash station does not fill completely

Sample introduction system

Maintenance interval	Maintenance task
If necessary	- Clean the torch if visible soiling can be seen (particularly a metallic film or if the quartz glass appears very milky and white). The cleaning intervals depend on the sample material and vary from daily to annually. - Clean the nebulizer if reproducibility deteriorates significantly without other reasons or if the baseline drifts. Contamination is particularly common in samples with a high salt content or with suspended sediments. - Clean the spray chamber according to the enclosed instructions if analytical performance decreases and, for example, the detection limits deteriorate.

Maintenance interval	Maintenance task
	Replace the glass body of the demountable torch if it is cracked. Replace the one-piece torch completely if it is damaged.

Autosampler

Maintenance interval	Maintenance task
Daily and after maintenance	- Cleaning surfaces - Remove residual liquid from the tray - Check the sample tube and cannula for sediment build-up - Check the pump tubes for flexibility and tightness, replace if necessary
Weekly	Clean the wash cup

Recirculating chiller

Maintenance interval	Maintenance task
Weekly and after maintenance	Check the coolant level at the level indicator and replenish
Every six months	Check the conductivity of the cooling water
Annually	Replace the coolant annually and whenever the conductivity rises above 50 to 200 $\mu\text{S}/\text{cm}$

7.2 Cleaning the dismantleable torch



WARNING

Risk of chemical burns from aqua regia

Aqua regia is a 3:1 mixture of concentrated hydrochloric acid and nitric acid. Aqua regia is highly corrosive and has an oxidizing effect.

- Wear protective glasses and clothing when creating and working with aqua regia. Work under an extraction hood.
- Observe all instructions and specifications in the safety data sheets for the basic materials.



CAUTION

Risk of burns from the hot torch

Plasma is extremely hot. The torch is still very hot after the plasma has been extinguished. Contacting these hot surfaces can cause burns.

- Wait 5 minutes after extinguishing the plasma. Only touch the torch after this time.



CAUTION

Risk of injury

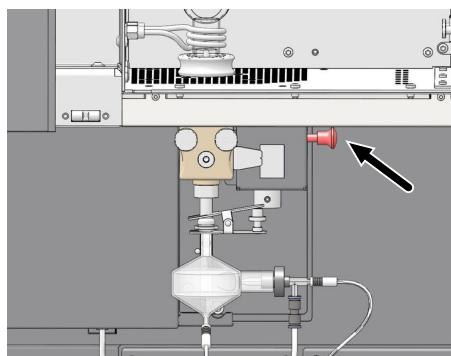
A risk of injury due to broken glass is present when handling glass parts.

- Handle glass parts with extreme caution.
- Wear non-slip glass handling gloves that allow a firm and secure grip.

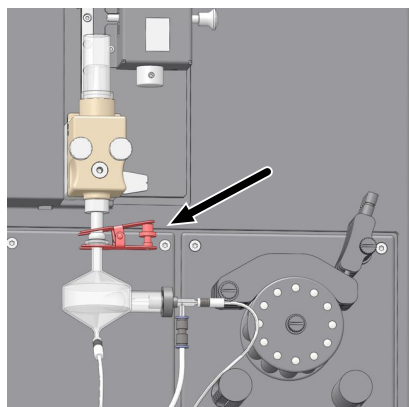
Clean the torch in case of visible soiling (deposits or scaling). Depending on the sample matrix, this may have to be performed on a daily basis or at much longer intervals (monthly).



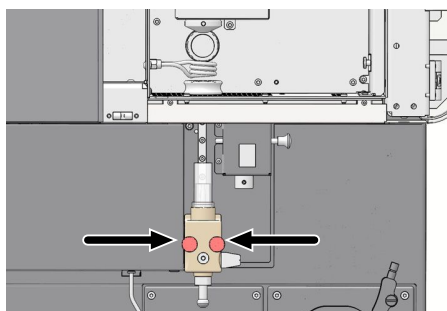
Fig. 37 Video: Cleaning the demountable torch (available in the online help)



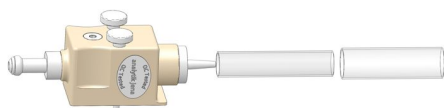
- ▶ Pull out the spring bolt at the height adjustment and allow the carriage with the torch on the adjusting rail to slide carefully down.



- ▶ Remove the fork clamp and take off the spray chamber with nebulizer.
- ▶ Carefully place the spray chamber with nebulizer to one side.

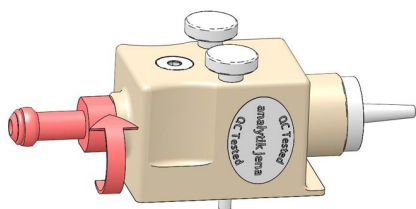


- ▶ Unscrew the torch from the carriage on the rail guide.

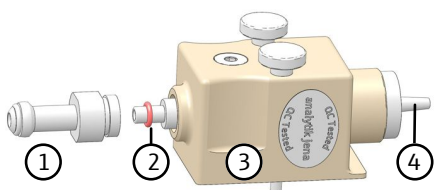


- ▶ Remove first the outer and then the inner tube carefully from the holder in a twisting motion.

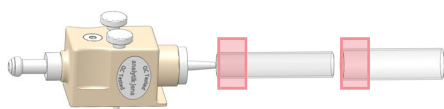
⚠ CAUTION! The quartz tubes are very fragile and are firmly mounted in the ground glass connector of the holder. Put on glass handling gloves to dismantle the torch.



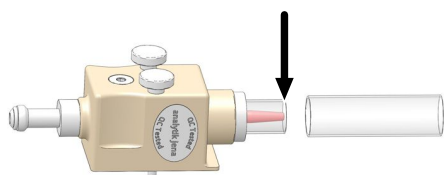
- ▶ Unscrew the connecting piece from the holder.
- ▶ Remove the injector from the connecting piece in a twisting motion.
- ▶ Place all glass components in aqua regia for approx. 12 h.
- ▶ Rinse the glass components with deionized water ($< 1 \mu\text{S}/\text{cm}$) and dry them with compressed air or argon.



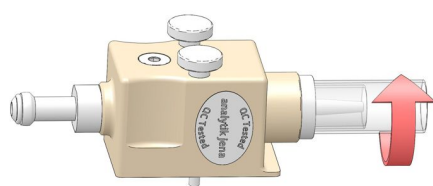
- ▶ Push the O-ring (2) about 1 cm onto the wide side of the injector (4).
- ▶ Insert the injector with O-ring into the connecting piece (1).
- ▶ Push the connecting piece with injector into the holder (3). Screw the connecting piece (1) on as far as it will go. This will seal and adjust the injector properly.



- ▶ Grease the ground joint of the inner and outer tube in the lower quarter with the oiled cloth supplied. Apply oil sparingly. Stand the tubes upright and allow the oil to soak in for approx. 2 minutes.



- ▶ Carefully insert the inner tube into the glass body in the holder as far as it will go. Turn the tube slightly so that it does not tilt and the ground glass joint is sealed.
- ▶ The injector tip must be flush with the outer edge of the inner tube. The injector tip must not protrude beyond the outer edge. The tip may end no more than 1 mm below the outer edge.
- ▶ If the injector tip could not correctly:
 - Pull the inner tube out of the holder and release the screw connection of the connecting piece.
 - Push the injector into the holder as far as it will go. Hereby a slight resistance caused by the O-ring seal must be overcome.
 - Afterwards reinsert the inner tube and check that the injector is seated correctly.



- ▶ Insert the outer tube into the glass body with a twisting motion. Make sure that the ground joint seal is tight.
- ▶ Reinstall the torch.

7.3 Replacing the glass body

The glass body of the demountable torch only needs to be replaced if it is cracked. When cleaning the torch, check the glass body for contamination by particles or solvents. Clean the glass body if necessary.

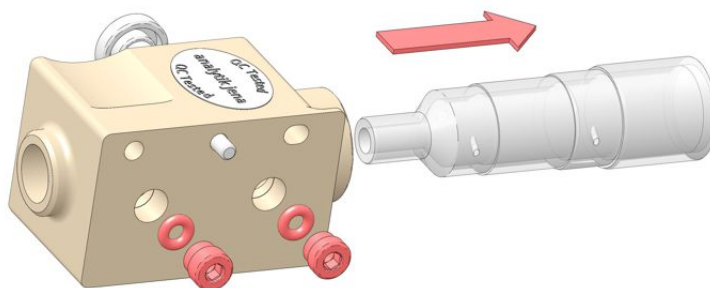
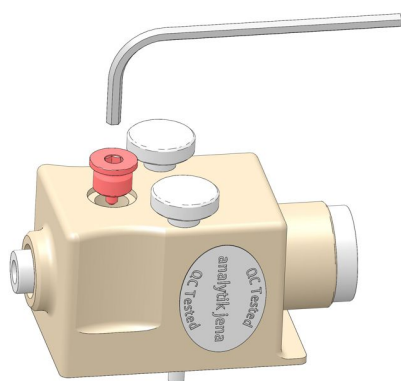
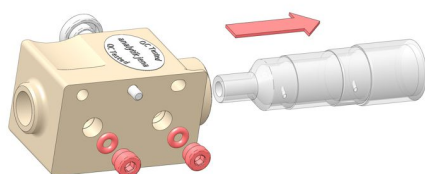


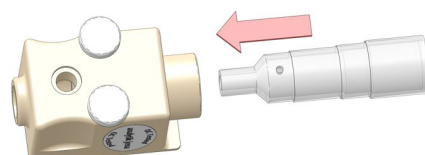
Fig. 38 Animation: Replacing the glass body (available in the online help)



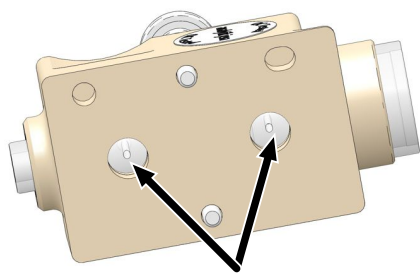
- ▶ Dismantle the torch as described.
- ▶ Unscrew the white Allen screw on the front of the holder. The screw secures the glass body in the correct position.



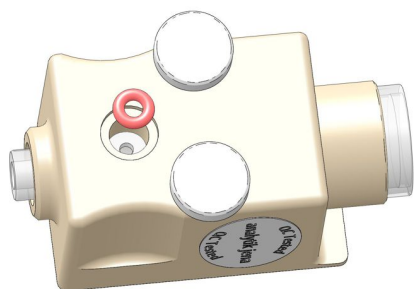
- ▶ Unscrew both connections for the argon supply on the back of the holder.
- ▶ Pull the glass body from the holder. Remove any shards if necessary.
- ▶ Press the O-rings out of the holder.
- ▶ Clean the holder to remove dust and deposits.



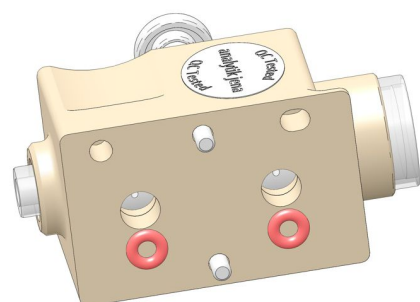
- ▶ Push the new or cleaned glass body into the holder. Align the glass body to make sure that the individual bore is visible centered in the front opening of the holder.



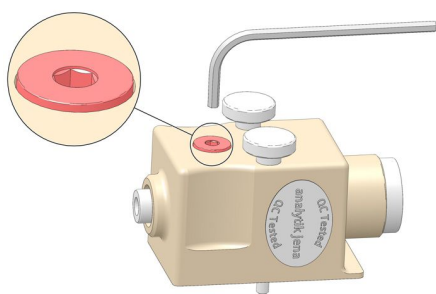
- ▶ The glass body is correctly aligned when the two slanted bores for the argon inlet are centered in the openings on the back of the holder.



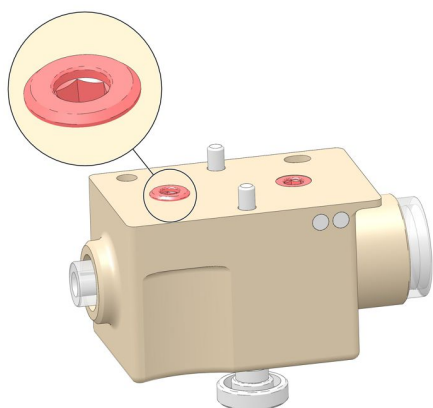
- ▶ Check the O-rings. Renew worn O-rings.



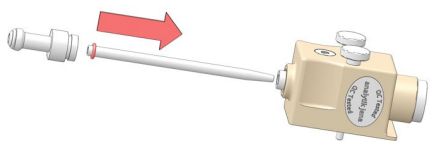
- ▶ Insert the three O-rings and carefully press them onto the glass body. One O-ring is located on the front of the holder, two o-rings on the back.



- ▶ Screw the white Allen screw into the front opening until it protrudes approx. 1 mm above the surface of the holder. The O-ring must not yet press against the glass body. The pin of the screw must protrude into the bore of the glass body and thus pre-center the glass body.
- ▶ Check that the slanted bore for the argon inlet is centered with the O-ring.



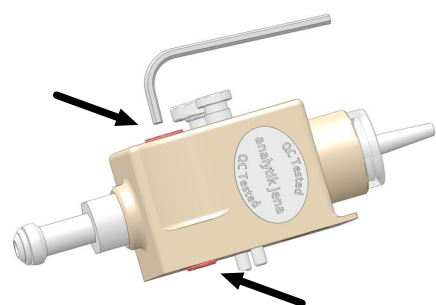
- ▶ Screw the shorter gas connection (approx. 7 mm) into the top opening to be flush with the surface of the holder.
- ▶ Screw the longer gas connection (approx. 8 mm) into the bottom opening to protrude approx. 1 mm above the surface of the holder.
- i** NOTE! The gas connections are of different lengths and must not be swapped. Only screw in the gas connections until they are flush with the surface of the holder. Otherwise the glass body can break when the gas connections are screwed in.
- ▶ Check again that the two slanted bores are centered with the screwed-in gas connections.



- ▶ Push the O-ring about 1 cm onto the injector.
- ▶ Push the injector into the holder with a twisting motion.



- ▶ Screw the connecting piece onto the holder as far as it will go. This will seal and adjust the injector properly. During the screw process only the friction resistance of the thread must be noticeable. No pressure should be exerted on the glass body.



- ▶ Screw in the gas connection (8 mm) and the white Allen screw alternating using half-turns. The Allen screw must protrude slightly. The gas connection must end flush with the upper edge of the holder.
- ▶ To check, slightly unscrew the connecting piece and screw it back in.
- ▶ If there is a noticeable resistance against the glass body, unscrew the gas connection and Allen screw by approx. 1 mm and repeat the alternating screwing in process.
- ▶ Install the inner and outer tubes Cleaning the dismantlable torch.

7.4 Maintenance of the one-piece torch



WARNING

Risk of chemical burns from aqua regia

Aqua regia is a 3:1 mixture of concentrated hydrochloric acid and nitric acid. Aqua regia is highly corrosive and has an oxidizing effect.

- Wear protective glasses and clothing when creating and working with aqua regia. Work under an extraction hood.
- Observe all instructions and specifications in the safety data sheets for the basic materials.



CAUTION

Risk of burns from the hot torch

Plasma is extremely hot. The torch is still very hot after the plasma has been extinguished. Contacting these hot surfaces can cause burns.

- Wait 5 minutes after extinguishing the plasma. Only touch the torch after this time.



CAUTION

Risk of injury

A risk of injury due to broken glass is present when handling glass parts.

- Handle glass parts with extreme caution.
- Wear non-slip glass handling gloves that allow a firm and secure grip.

Cleaning the one-piece torch

You need to clean the torch if it is visibly dirty. You only need to replace the sealing rings if the torch is not gas-tight.

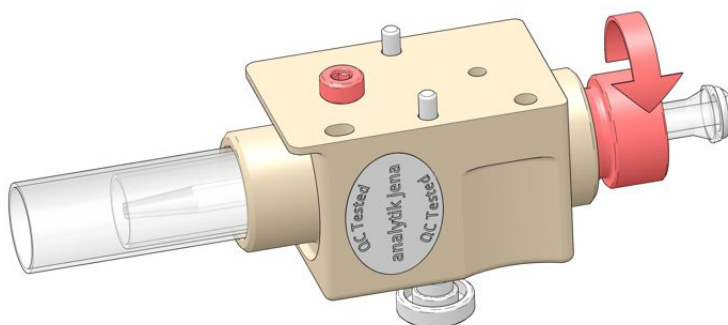
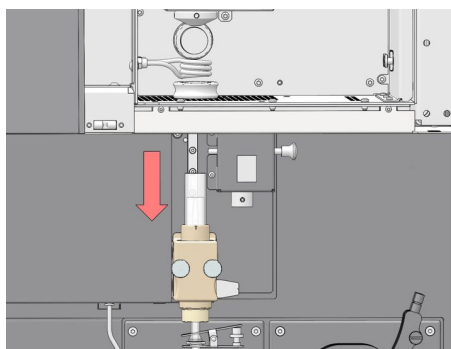
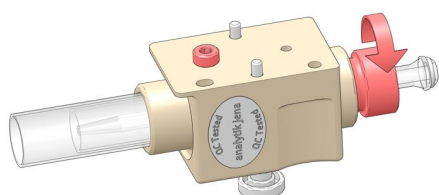


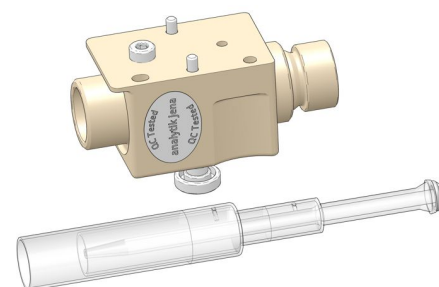
Fig. 39 Animation: Cleaning the one-piece torch, including replacing the sealing rings (available in the online help)



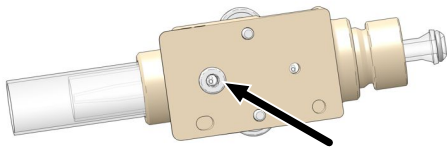
- ▶ Pull out the spring bolt at the height adjustment and allow the carriage with the torch on the adjusting rail to slide carefully down.
- ▶ Remove the fork clamp and take off the spray chamber. Carefully place the spray chamber to one side.
- ▶ Unscrew the torch from the carriage. Cleaning the dismantlable torch.



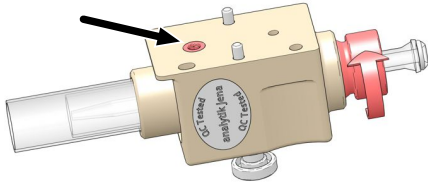
- ▶ Slightly unscrew the gas connection on the back of the holder.
- ▶ Loosen the connecting piece on the torch holder by turning it once.



- ▶ Carefully pull the one-piece torch from the holder while turning it slightly.
- ▶ **i** NOTE! The torch may be firmly stuck in the holder. Wear glass handling gloves to be able to grip the torch safely. When pulling out the torch, ensure it does not become jammed.
- ▶ To clean the torch, place it in aqua regia for approx. 12 h.
- ▶ Rinse the torch with deionized water ($< 1 \mu\text{S}/\text{cm}$) and dry it with compressed air or argon.



- ▶ Insert the torch into the holder as far as it will go. Align the torch so that the gas inlet opening of the torch is centered in the gas connection of the holder, see arrow.



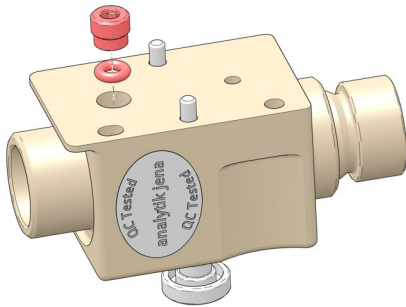
- ▶ Screw the gas connection into the holder so that it is flush with the surface of the holder.

i NOTE! Danger of glass breakage! Do not screw in the gas connection any further under any circumstances.

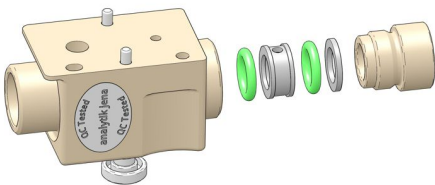
- ▶ Screw the connecting piece into the holder as far as it will go. To ensure gas tightness in the lower part of the torch, the gap between the clamp screw and the holder must not exceed 0.5 mm in width.

Replacing the sealing rings

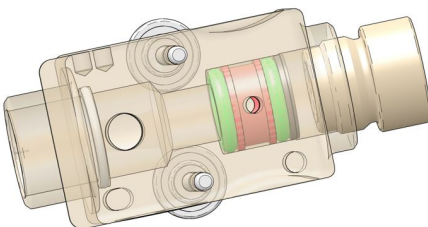
If the torch is not gas-tight, problems will occur during plasma ignition. In this case, you must check the sealing rings for wear and replace them.



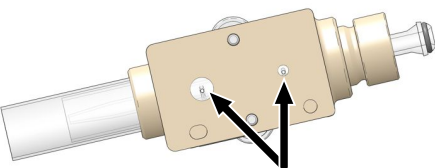
- ▶ Remove the torch from the torch holder.
- ▶ Unscrew the gas connection and remove the O-ring.



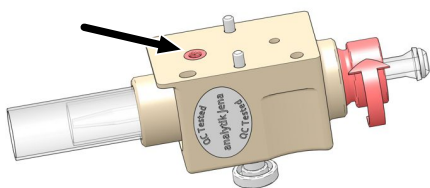
- ▶ Unscrew the connecting piece from the torch holder.
- ▶ Remove the retaining ring, 2 O-rings and the spacer ring from the holder.
- ▶ Check the O-rings. Replace worn rings.



- ▶ Reinsert the rings into the lower opening of the torch holder. Observe the following sequence:
green O-ring – spacer ring – green O-ring – flat retaining ring – clamp screw
- ▶ Turn the spacer ring so that one of the two bore holes is aligned with the small gas inlet opening in the torch holder.



- ▶ Push the torch into the holder as far as it will go. Turn it so that the gas inlet openings are centered in the openings of the holder.
- ▶ Insert the O-ring into the larger opening.



- ▶ Screw the gas connection into the holder so that it is flush with the surface of the holder.

i NOTE! Danger of glass breakage! Do not screw in the gas connection any further under any circumstances.

- ▶ Screw the connecting piece into the holder as far as it will go. To ensure gas tightness in the lower part of the torch, the gap between the clamp screw and the holder must not exceed 0.5 mm in width.

7.5 Cleaning the nebulizer

The nebulizer must be cleaned if particles or high concentrations of salt in the samples have clogged it up. An indicator that the nebulizer has clogged up is increased carrier gas pressure.



Fig. 40 Video: Cleaning the nebulizer (available in the online help)

Checking the carrier gas pressure

- ▶ Use  to open the **Plasma | Control** window.
- ▶ Compare the current percentage (pressure) of the nebulizer gas with the value achieved after installation of the new or cleaned nebulizer.
- ▶ Clean the nebulizer as described below if the percentage has increased significantly, e.g., by more than half the original value, at the latest however if 75 % is reached.

Cleaning the nebulizer

Clean the nebulizer using the nebulizer cleaning tool. This tool can be ordered from Analytik Jena. The tool is suitable for standard nebulizers with or without a permanently installed gas connection.

A special nebulizer cleaning tool is available for the PFA nebulizer (HF Kit) and the optional parallel path nebulizer.

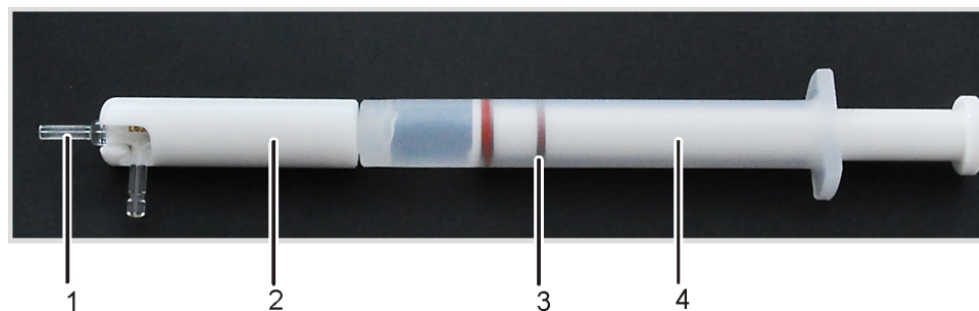


Fig. 41 Nebulizer cleaning tool

- | | |
|------------------|--------------------|
| 1 Nebulizer | 2 Nebulizer holder |
| 3 1st red O-ring | 4 Syringe |



WARNING

Risk of methanol poisoning

Methanol is poisonous if inhaled, swallowed or on skin contact. The liquid and its vapors are highly flammable.

- Wear protective glass and clothing when working with methanol. Work under an extraction hood.
- Keep methanol away from heat, sparks, open flames and hot surfaces.
- Observe all notes and specifications in the safety data sheet.

- ▶ Unscrew the syringe from the nebulizer holder.
- ▶ Insert the nebulizer into the holder. Push the nebulizer with the tip first into the holder until the lateral carrier gas connection comes to rest in the holder groove.
- ▶ Fill the syringe with methanol. Pull the plunger out to the first red O-ring.
- ▶ Screw the syringe onto the nebulizer holder.
- ▶ Hold the nebulizer cleaning tool over a receptacle and push the plunger into the syringe. The methanol should flow out of both connection pieces.
- ▶ To remove stuck particles from the nebulizer:
 - Close the sample inlet with a finger to remove particles from the carrier gas connector.
 - Then close the carrier gas connector with a finger. This increases the pressure at the sample inlet.
- ▶ Unscrew the syringe from the nebulizer holder. Draw air into the syringe.
- ▶ Screw the syringe back onto the nebulizer holder.
- ▶ Push the plunger into the syringe to remove methanol residue from the nebulizer.
- ▶ Remove the nebulizer from the holder. Connect the nebulizer to the spray chamber.
- ▶ Let argon flow through the nebulizer for at least 3 min before using it for the next analysis.

7.6 Cleaning and decontaminating the sampling compartment and the plasma compartment

The operator is responsible for carrying out suitable decontamination should the device become contaminated externally or internally with dangerous substances. Work particularly carefully and cleanly with infectious material because the device cannot be decontaminated as a whole.

- ▶ Extinguish the plasma via the software. After extinguishing the plasma, wait at least 5 min before touching the components in the plasma compartment.

 **CAUTION!** Risk of burns from hot components in the plasma compartment.

- ▶ Clean the sampling compartment and the plasma compartment daily with a damp, non-dripping cloth. Use a commercial surfactant to remove stubborn contamination.
- ▶ Splashes, drops or spilled substances should be removed immediately using an absorbent material such as absorbent cotton, laboratory wipes or cellulose.
- ▶ In case of biological contamination, wipe the affected areas with a suitable disinfectant, such as an Incidin Plus solution. Then wipe the cleaned areas so that they are dry.
- ▶ The only suitable cleaning method for the housing is wipe disinfection. If the disinfectant has a spray nozzle, apply disinfectant to a suitable cloth before using it on the device.

Clean the plasma compartment windows and cone if the components are visibly contaminated with sample deposits.

- ▶ Use a damp paper towel to wipe off the windows and cone.
- ▶ Dry with paper towels.

Solid deposits can form on the surface of the induction coil due to corrosion. Do not remove the solid deposits, as any force could damage the coil. The deposits do not impair the function and analytical performance.

7.7 Cleaning and replacing the plasma compartment windows

The windows situated in the plasma compartment in front of the transfer optics must be replaced if their transmission has greatly deteriorated, especially in the UV range. Cleaning the windows does not usually completely restore UV permeability. The cleaning effect varies with the wavelength. Average losses of around 30 % have to be expected in the UV vacuum. In the visible range, transparency can generally be fully restored.



WARNING

Risk of chemical burns from aqua regia

Aqua regia is a 3:1 mixture of concentrated hydrochloric acid and nitric acid. Aqua regia is highly corrosive and has an oxidizing effect.

- Wear protective glasses and clothing when creating and working with aqua regia. Work under an extraction hood.
- Observe all instructions and specifications in the safety data sheets for the basic materials.



CAUTION

Risk of burns from the induction coil and torch

Plasma is extremely hot. The induction coil and torch are still very hot after the plasma has been extinguished. Contact with the hot surfaces can cause burns.

- Extinguish the plasma via the software before maintaining the plasma compartment windows.
- Wait for 5 min after extinguishing the plasma. Only then carry out work in the plasma compartment.



NOTE

Risk of damaging the quartz windows due to sweat from hands and ultrasound

Fingerprints can burn into the surface of the quartz windows, reducing visibility.

- Do not touch the fronts of the quartz windows with your fingers. Wipe off any fingerprints immediately with ethanol.
- Do not clean the quartz windows in an ultrasonic bath. This may lower the UV permeability of the windows.

Cleaning the windows

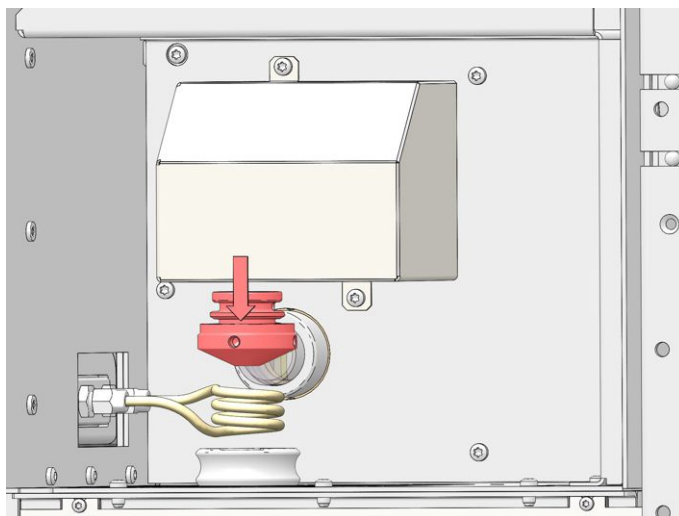


Fig. 42 Animation: Cleaning and replacing the plasma compartment windows (available in the online help)

- ▶ Remove the windows from the device before thorough cleaning, see description.
- ▶ Clean the window with water and a commercially available surfactant and a cotton swab.
- ▶ Optionally clean the windows with aqua regia.
 - ⚠ **WARNING!** Observe the safety instructions when handling the concentrated acid.
- ▶ Rinse the cleaned windows with water.
- ▶ Dry in the gas flow (argon or compressed air).

Checking permeability

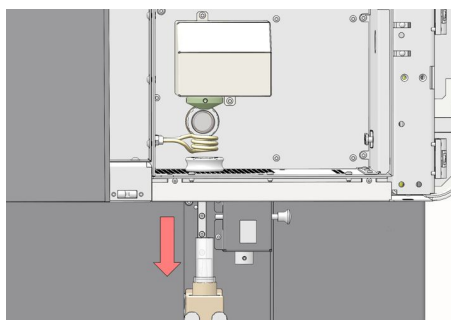
After cleaning, check the permeability of the windows in the UV range.

- ▶ Select a routine method.

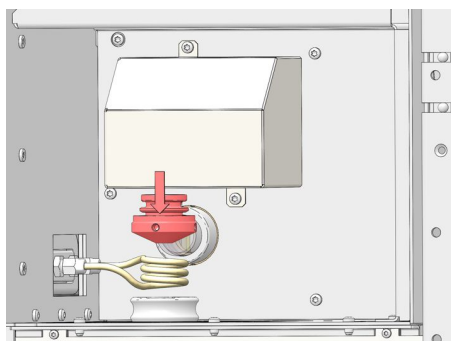
- ▶ Select 3 lines, one line each in the low UV range, in the medium and in the high wavelength range.
- ▶ For a QC sample, determine the intensities at these 3 wavelengths and record the results in a QC card or a table.
- ▶ If the required detection limits are no longer reached, clean or replace the windows.

Maintaining the window in the cone

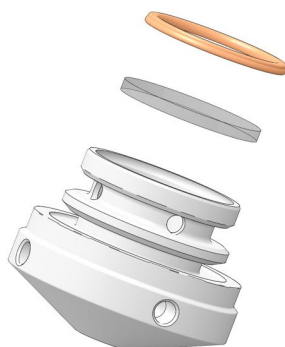
The window in the cone is used for axial observation.



- ▶ Before cleaning: Extinguish the plasma via the ASpect PQ software by clicking on  in the toolbar. Alternatively, use  to open the **Plasma** window and click on **Plasma off**. Allow the induction coil and torch to cool down for 5 min.
- ▶ In the software, in the **Spectrometer** window, on the **Parameters** tab, activate the quick rinse of the optics using the **on** button. Rinsing prevents contamination of the spectrometer by laboratory air. If possible, switch off the laboratory exhaust unit during cleaning.
- ▶ Move the torch from the working position downwards. This precautionary measure prevents the glass parts from becoming damaged during installation of the cone.



- ▶ Clean the cone with a damp cloth and dry it.
- ▶ Unscrew the cone by turning it clockwise using the supplied hook wrench. If the window is stuck in the frame, see description above.
- ▶ If possible, close the opening to the optics during cleaning, e.g., with plastic film, to prevent contamination of the optics.



- ▶ Clean or replace the window.
 - ▶ Insert a new or cleaned window into the cone and fit a sealing ring.
 - ▶ Replace the worn sealing ring.
 - ▶ Tightly screw the cone into the cone opening in the plasma compartment.
- i** NOTE! If the cone only fits loosely, it will not be cooled sufficiently and corrode quickly.

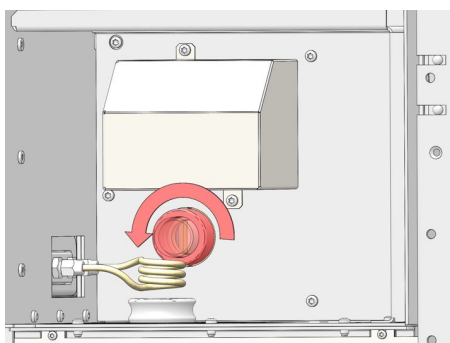
If the window is stuck in the frame:

- ▶ Hold one gloved hand under the cone opening.
- ▶ Carefully insert a fingernail (gloved) or a rod (wooden or plastic) into the gap between the window and the frame and lever the window out. The window falls out downwards.
- ▶ Catch the window as it falls out.
- ▶ Remove the sealing ring from the frame.

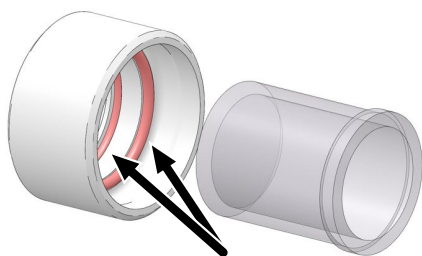
Maintaining the horizontal window

The horizontal window is used for radial observation.

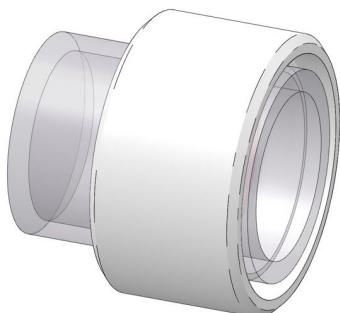
- ▶ Before cleaning: Extinguish the plasma via the ASpect PQ software by clicking on  in the toolbar. Alternatively, use  to open the **Plasma** window and click on **Plasma off**. Allow the induction coil and torch to cool down for 5 min.
- ▶ In the software, in the **Spectrometer** window, on the **Parameters** tab, activate the quick rinse of the optics using the **on** button.
Rinsing prevents contamination of the spectrometer by laboratory air.
If possible, switch off the laboratory exhaust unit during cleaning.
- ▶ Move the torch from the working position downwards.
This precautionary measure prevents the glass parts from becoming damaged during installation of the cone.



- ▶ Remove the cone with the window to better access the horizontal window.
- ▶ Unscrew the window holder in a counterclockwise direction.
- ▶ Press the window from the holder.
- ▶ Clean the window if necessary:
 - Clean with water and a commercial surfactant using a cotton swab.
 - Rinse with water and dry in the gas flow (argon or compressed air).



- ▶ Check the sealing rings for wear and replace if necessary.



- ▶ Insert a new or cleaned window into the holder. See the note on the seating of the window below. Do not touch the end faces with your fingers.
The front can be covered with the protective cap provided to prevent contamination during insertion.
- ▶ Screw the holder back into the plasma compartment opening of the device.

Notes on the seating of the horizontal window:

- The window can be inserted variably in the holder. The holder is designed so that the window can be moved by 9.5 mm for optimum positioning.
- Slide the window to the rear as far as possible to keep the window fogging up from the plasma as low as possible.
- Only slide the window as close to the torch as possible if you want to achieve the lowest possible detection limits in the vacuum UV with radial observation. However, there is then a risk of the window fogging up more quickly, causing a drift as a result. It is therefore better to measure in the vacuum UV with axial observation to achieve the lowest possible detection limits.

7.8 Checking the gas system for leaks

Check for leak tightness weekly and whenever the device has been disconnected from the gas supply system. For this purpose, close the shut-off valve of the gas supply system and check the pressure at the downstream manometer. If the pressure drops sharply, search for leaks in the gas supply.

- ▶ Open the shut-off valve.
- ▶ Brush connections with a heavily foaming liquid (e.g., soap solution). If foam bubbles form at the gas connections when starting up, disconnect the gas supply.
- ▶ Check the gas connection for correct fitting. Unscrew the quick-release connector and check the sealing ring. Replace worn out sealing rings.
- ▶ Reinsert the tube into the gas connection, observing the correct positioning and check again for gas leaks.

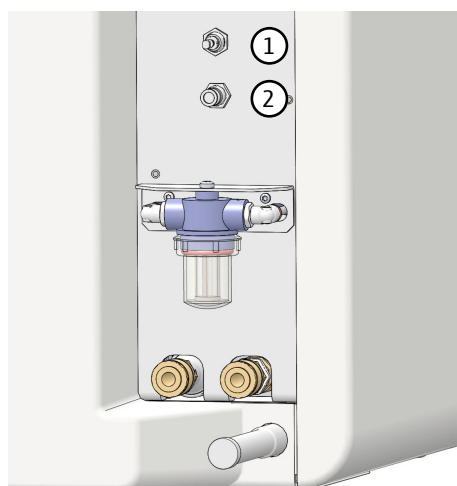


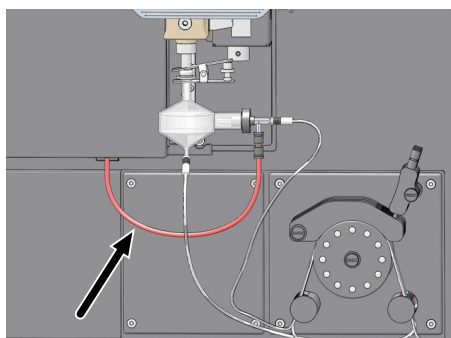
Fig. 43 Gas connections

1 Auxiliary gas (oxygen)

2 Argon

7.9 Replacing the argon hose

The argon supply hose for the nebulizer may become discolored. In this case, the hose must be replaced.



- ▶ Disconnect the argon tube from the connection in the sampling compartment. To do this, press the colored ring on the plug connector up and pull the tube down.
- ▶ Disconnect the argon tube including the plug connector from the nebulizer gas inlet. Or: Unscrew the argon tube including the screw connector from the nebulizer.
- ▶ Connect a new tube with a plug connector to the nebulizer.
- ▶ Insert the argon tube into the connection in the sampling compartment.

7.10 Replacing the air filter

The air inlet filter is located in a drawer on the front of the device. Check the filter monthly and replace it if heavily soiled. Check the underside of the filter for dirt.

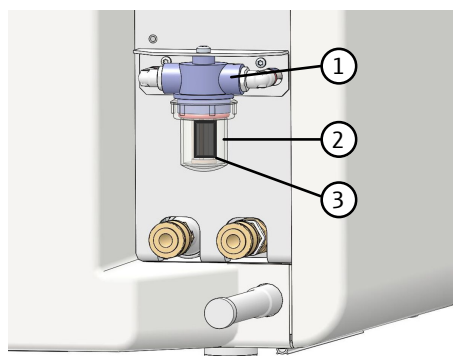
A heavily soiled filter can reduce heat dissipation from the device. Overheating can damage components.



- ▶ Remove the sample tray.
- ▶ Open the drawer.
- ▶ Remove dirty filters from the holder in the drawer.
- ▶ Insert new filters into the drawer.
- ▶ Push the drawer back into the device.
- ▶ Reattach the sample tray to the device using the pins.

7.11 Replacing the water filter

The water filter is located on the back of the device. Check the filter cartridge in the filter monthly for contamination and clean the cartridge as required. Replace the cartridge at least once a year and if heavily contaminated. Only use filter cartridges supplied by Analytik Jena.



- ▶ Switch off the basic device and the recirculating chiller using the power switch.
- ▶ Have a large beaker ready.
- ▶ Unscrew the filter cup (2) clockwise from the water filter (1). Hold a paper towel underneath.
- ▶ Place the filter cup in the beaker.
- ▶ Remove the filter cartridge (3).
- ▶ Rinse the filter cup and cartridge under running water. Replace the cartridge if necessary.
- ▶ Insert the cleaned or a new filter cartridge into the water filter from below. Screw the filter cup back on.

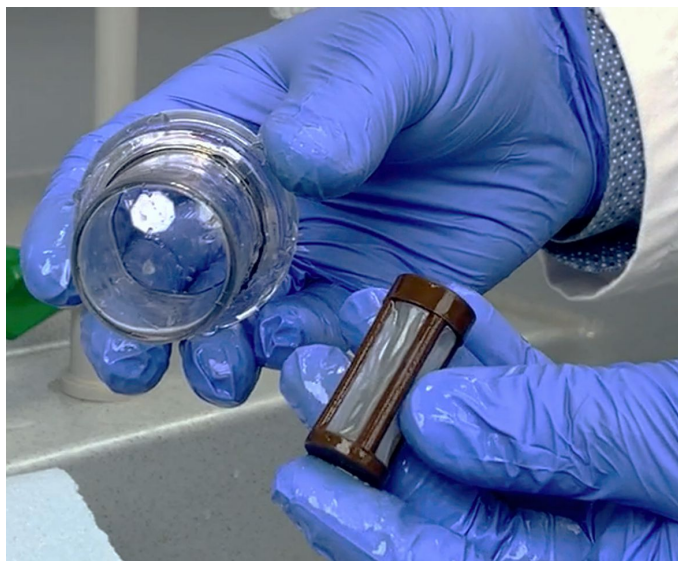


Fig. 44 Video: Cleaning the water filter under running water (available in the on-line help)

7.12 Maintenance on the ASPQ 3300 autosampler

7.12.1 Replacing the cannula and sample hose

The autosamplers are delivered with a cannula to which the sample tube is attached. Cannula and sample tube are always replaced at the same time.

- ▶ Switch off the autosampler using the power switch.
- ▶ Disconnect the connection between the sample tube of the autosampler and the basic device.
- ▶ Carefully pull the sample tube out of the tube guides on the autosampler.
- ▶ Unscrew the cannula from the holder on the autosampler. Remove the cannula with sample tube and connecting pieces from the holder in the autosampler.
- ▶ Prepare the new cannula with sample tube:
 - Attach the connecting piece (1) to the sample tube.
 - Push the narrow end of the conical nipple downward into the cannula. Position the conical nipple near the upper edge of the cannula.
 - Push the banjo bolt (3) from below onto the cannula. Screw the banjo bolt and connecting piece (1) together.
- ▶ Insert the cannula into the holder in the autosampler. Use the connecting piece (4) to fix the cannula from below in the holder. To do this, screw the connecting pieces (1) and (4) together.
- ▶ Attach the sample tube to the tube guides on the autosampler. Putting the sampler into operation.

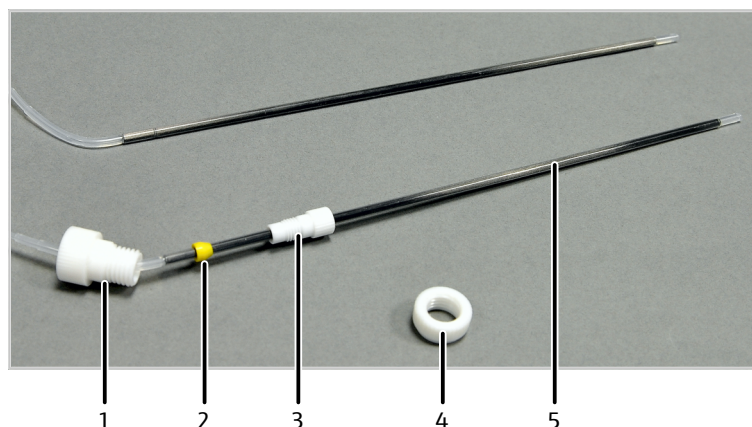


Fig. 45 Replacing the cannula and sample tube of the autosampler

- | | |
|---|---|
| 1 Connecting piece (attachment to the holder) | 2 Sealing cone |
| 3 Banjo bolt | 4 Connecting piece (attachment to the holder) |
| 5 Cannula with sample tube (one piece) | |

7.12.2 Replacing the pump hoses of the purging pump



CAUTION

Risk of chemical burns during hose replacement

Small quantities of acidic solutions can still be in the hoses.

- Wear protective gloves and clothing when replacing the hoses.
- Collect any leaking liquids with an absorbent sheet.

Replacing tubes

- ▶ Switch off the autosampler using the power switch.
 - ▶ Place a flat container or absorbent material underneath the wash cup.
 - ▶ Release the clamping brackets on the pump and fold them down.
 - ▶ Release the tension on the pump tubes and remove them from the wash cup connections.
 - ▶ Remove the connecting tubes for wash solution and waste from the pump tubes.
 - ▶ Connect the pump tube for wash solution to the lower inlet connection (1a) of the wash cup. Place the pump tube over the tube block from above and clamp it between two stoppers. Connect the intake tube for wash solution to the other tube end (1b). Immerse the intake tube into the wash solution.
 - ▶ Connect the pump tube for waste to the upper outlet connection (2a) of the wash cup. Place the pump tube over the tube block from below and clamp it between two stoppers. Connect the waste tube to the other tube end (2b). Insert the waste tube into the waste bottle.
- i** NOTE! Note the pump direction! The pump moves in a clockwise direction.
- ▶ Fasten the clamping bracket over the pump tubes via the clamping lever.
 - ▶ Check the pumping rate and adjust it if necessary via the contact pressure or pump speed.

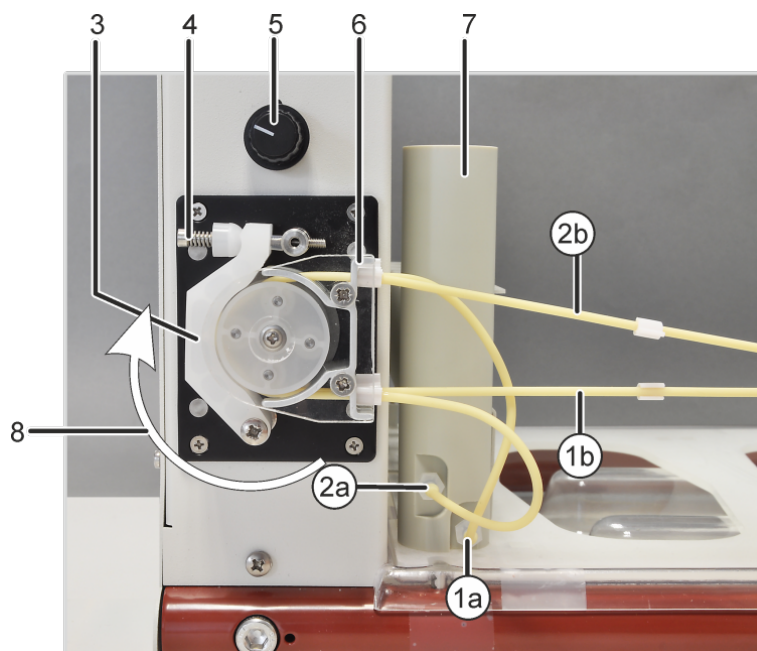


Fig. 46 Purging vessel and pump on the sampler

- | | |
|---|--|
| 1a Intake connection for purging solution on the purging vessel | 1b Purging solution hose |
| 2a Waste connection on the purging vessel | 2b Hose to the waste container |
| 3 Clamping bracket | 4 Clamping lever with spring |
| 5 Pump speed controller | 6 Hose block for clamping the pump hoses |
| 7 Purging vessel | 8 Pump direction |

Setting the contact pressure and flow rate

The effective pressure on the tube is set via the clamping lever. To maximize the service life of the tubes and the pump performance, set the contact pressure as follows:

- ▶ Loosen the screw on the clamping lever until the clamping bracket no longer presses on the tube.
- ▶ Immerse the intake tube into the wash solution. Insert the waste tube into the waste bottle.
- ▶ Switch on the basic device and the autosampler using the power switch. Start the control software.
- ▶ Click on the **Autosampler** button and in the **Autosampler** window switch to the **Function tests** tab. Activate the **Wash pump** option and exit the window with **OK**.
- ▶ Tighten the screw on the clamping lever until the wash solution begins to flow. Tighten the screw by one further turn.
- ▶ Set the contact pressure on the pump tube for waste in the same manner.
- ▶ Adjust the flow rate of the pump via the rotary knob. The liquid level in the autosampler should remain constant. Not too much washing solution should overflow.
- ▶ In the **Autosampler** window deactivate the **Wash pump** option.

7.12.3 Replacing fuses

Replace the fuses of the sampler as follows:

- ▶ Switch off the sampler via the power switch.
- ▶ Pull out the fuse holder. To do so, insert a screwdriver blade into the slot in the fuse holder and carefully pry out the holder.

- ▶ Replace defective power fuses. Only use T 5 A H 250 V. 5 x 20 mm type fuses.
- ▶ Insert the fuse into the clip marked with an arrow (see image).
- ▶ Connect the power cable and the serial connection (HOST) to the sampler.
- ▶ Switch on the sampler via the power switch.

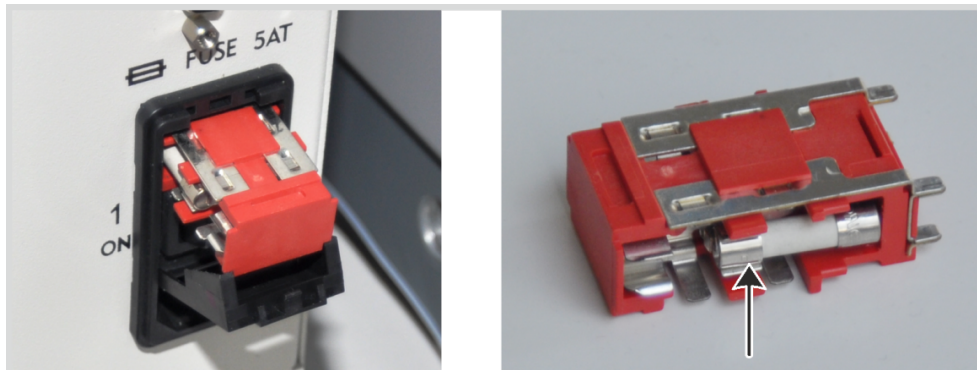


Fig. 47 Replacing the fuses on the sampler

7.13 Maintenance of the recirculating chiller: Replacing the cooling water



WARNING

Risk to health due to cooling water additives

The biocide used is corrosive and can cause an allergic reaction on skin contact.

- When handling the cooling water additive, wear protective glasses, clothing, and, in particular, gloves.
- Observe all notes and specifications in the safety data sheet.



NOTE

Risk of device damage due to corrosion and algae growth

Only the use of the cooling water additive can effectively prevent damage due to corrosion or biological contamination of the device.

Damage to the device caused by operation of the device without cooling water additive is excluded from the warranty.

- Always add the cooling water additive (418-13-410-540) supplied by Analytik Jena to the cooling water.

The cooling water must be replaced at least once per year. The cooling water must always be replaced if the conductivity rises above 50 to 200 $\mu\text{S}/\text{cm}$.

⇒ Required equipment: 10 l of distilled/deionized water, cooling water additive set for recirculating chiller, suitable glass, plastic or stainless steel container for mixing the cooling water, bucket for collecting the drained coolant

- ▶ Dissolve the contents of both bottles of the cooling water additive set (biocide and corrosion protection) in 10 l of water.
- ▶ Start the wizard to replace the cooling water in the ASpect PQ control software. To do this, select the **Extras | Maintenance** menu item and click on the **Change** button.
- ▶ Follow the instructions in the wizard:

- Switch off the recirculating chiller.
- On the recirculating chiller, disconnect the cooling water return flow connection and hold the tube in the receptacle (bucket).
- Switch the recirculating chiller back on and allow it to run until the flow of cooling water ends and only mist comes out.
- Reconnect the tube to the cooling water return flow connection on the recirculating chiller.
- Unscrew the sealing cap from the filling opening on the tank and insert the funnel.
- Pour the coolant into the tank until the level mark is reached.
- Switch on the recirculating chiller and observe the level indicator. The level drops when the pump is operating.
- Continue to slowly fill the tank with the coolant until the level stabilizes slightly below the mark.
- Remove the funnel and seal the filling opening with the screw cap.
- Confirm the closing step in the wizard.
- ▶ Wait for the message in the wizard indicating that the coolant has been changed.
- ▶ Exit the wizard.

8 Transport and storage

8.1 Preparing the device for transport

- ▶ Switch on the device and start the control software.
- ▶ Remove cooling water from the system:
 - Start the wizard to replace the cooling water in the control software.
 - Drain the cooling water and exit the wizard.
- ▶ Exit the control software. Switch off the device and PC.
- ▶ After cooling, remove and pack away the torch, spray chamber, and nebulizer.
- ▶ Remove the pump hoses from the pump.
- ▶ Remove the waste hose from the collection tray under the pump.
- ▶ Remove the sample tray.
- ▶ Disconnect the electrical connection cables from the device, PC, and autosampler.
- ▶ Disconnect the cooling water hoses from the device. Place an absorbent cloth underneath the connections to catch dripping liquid. Press the ring on the quick-release connector inwards and pull the hose from the connection.
- ▶ Disconnect the argon hose and hose for additive gas from the device. Press the colored ring inward on the quick-release fasteners on the rear of the device and pull out the hose.
- ▶ Disconnect the interface cables of the electrical components (autosampler, PC) from the sockets on the rear of the device.
- ▶ Screw in the four transport handles as far as they will go.
- ▶ Lift the device and pack it in its original packaging.

See also

📖 Maintenance of the recirculating chiller: Replacing the cooling water [▶ 80]

8.2 Moving the device in the laboratory



CAUTION

Risk of injury due to falling device

- Screw the four transport handles into the device as far as possible. Only this allows you to grip and carry the device safely.

Observe the following when moving the device within the laboratory:

- Insufficiently secured components pose a risk of injury!
Before moving the device, remove all loose parts and disconnect all connections from the device.
- For safety reasons, four persons are required to transport the device, one person at each corner of the device.
- Firmly grip the device with both hands by the transport handles. Lift the device simultaneously.

- Observe the guide values and adhere to the legally mandated limits for lifting and carrying loads without auxiliary means.
- Observe the installation conditions at the new location.

8.3 Transport

When transporting the device, observe the safety instructions in the "Safety instructions" section.

Avoid the following during transport:

- Impact and vibration
Risk of damage due to shock, impact or vibration!
- Large temperature fluctuations
Risk of condensation!

8.4 Storage



NOTE

Risk of device damage due to environmental conditions

Environmental influences and condensation can destroy individual components of the device.

- Only store the device in air-conditioned rooms.
- Ensure that the atmosphere is free of dust and corrosive vapors.

If the device is not installed immediately after delivery or not required for longer periods, it should be stored in its original packaging. A suitable desiccant should be added to the equipment to prevent damage from moisture.

The requirements for the climatic conditions of the storage location can be found in the specifications.

8.5 Recommissioning the device

- ▶ Unscrew the two rear carrying handles and store them.
- ▶ Attach the sample tray to the two front carrying handles.
- ▶ Connect the aspiration hose to the smokestack on the top of the device so that it fits snugly.
- ▶ Install the gas supply: Plug the argon hose into the lower gas connection on the rear of the device. If necessary, plug the hose for additive gas (oxygen) into the upper gas connection.
- ▶ Connect the autosampler and PC to the device via the labeled interfaces.
- ▶ Connect the device to the power supply.
- ▶ Install the torch and the other components of the sample feed system.
- ▶ Install the recirculating chiller.
- ▶ Install the autosampler and other optional accessories.

- ▶ Switch on the device and start the control software on the PC.

See also

- 📖 Installation and commissioning [▶ 24]

8.6 Installing the recirculating chiller



NOTE**Risk of damage to the device due to incorrect operation of the recirculating chiller**

- Follow the operating instructions for the recirculating chiller.
 - Always add the Analytik Jena cooling water additive to the cooling water.
-
- ▶ Connect the device and the recirculating chiller via the cooling water hoses:
For better allocation of the connections, one of the hoses is marked with hose clips at both ends.
 - Connection for cooling water inlet on the recirculating chiller to device connection “In”
 - Connection for cooling water return on the recirculating chiller to device connection “Out”
 - ▶ Electrically connect the recirculating chiller and switch it on.
For water-water coolers, install the building-side cooling water circuit.
 - ▶ Prepare the cooling water:
 - Start the ASpect PQ control software and open the wizard for changing the cooling water.
 - Switch on the emission spectrometer.
 - Pour in the cooling water with the help of the wizard. Skip the step in the wizard for draining the old cooling water.
 - ▶ Set the following parameters at the recirculating chiller:
 - Temperature: 20 °C
 - Set the cooling water pressure so that a water flow of 1.5 to 2.0 l/min is achieved in the cooling water circuit. The maximum pressure must not be exceeded. Pressure (max.): 600 kPa (6 bar)

See also

- 📖 Maintenance of the recirculating chiller: Replacing the cooling water [▶ 80]

9 Disposal

Most waste produced via analysis is in the form of aqueous solutions. Aside from metal and heavy metal ions, these primarily contain various mineral acids used in sample preparation.

For safe disposal of this waste, all solutions must be neutralized with an alkaline solution such as a diluted sodium hydroxide solution. The neutralized waste must be disposed of correctly in accordance with statutory regulations.

Organic waste solutions must be disposed of separately and in accordance with statutory regulations.

The cooling water contains a biocide. Dispose of used cooling water properly.

At the end of its service life, the device and its electronic components must be disposed of as electronic waste in accordance with the applicable regulations.

10 Specifications

10.1 Technical data

10.1.1 Basic device technical data

PlasmaQuant 9200 Elite	Monochromator	Echelle grating double monochromator with a focal length of F= 400 mm and variable gap; pre-monochromator with quartz prism, wavelength selection via additional reflected neon radiator
	Wavelength range	160 to 900 nm
	Wavelength accuracy	< 0.4 pm
	Spectral resolution	0.002 nm at 200 nm
	Experimental half-width	≤ 3.5 pm for As 193.696 nm, P 231.618 nm, Cd 228.022 nm
	Grating	Mechanically scratched grating, 79 grooves/mm, blaze angle 74.6° to 75°
	Optical bank encapsulation photometer	Modular optics on a compact cast baseplate for stability and endurance Protection against moisture, exhaust fumes, and chemical environmental influences
	Detector	Two-dimensional FFT backside illuminated CCD with high quantum efficiency and increased UV sensitivity Peltier cooled to -10 °C
PlasmaQuant 9200	Monochromator	Echelle grating double monochromator with a focal length of F= 400 mm and variable gap; pre-monochromator with quartz prism, wavelength selection via additional reflected neon radiator
	Wavelength range	160 to 900 nm
	Wavelength accuracy	< 0.4 pm
	Spectral resolution	0.006 nm at 200 nm
	Experimental half-width	≤ 5.0 pm for As 193.696 nm, P 231.618 nm, Cd 228.022 nm
	Optical bank encapsulation photometer	Modular optics on a compact cast baseplate for stability and endurance Protection against moisture, exhaust fumes, and chemical environmental influences
	Detector	Two-dimensional FFT backside illuminated CCD with high quantum efficiency and increased UV sensitivity Peltier cooled to -10 °C
Display types	Emission	Counts (ct)
	Intensity	Counts/seconds (ct/s)
	Concentration	Value range 5 digits (0.0001to 99999), unit freely selectable

Signal evaluation	Spectrally resolved	Spectra of 20 to 200 pixels width		
Analytic data	Sample type	Liquid		
	Type of nebulizer	Concentric nebulizer		
	Spray chamber	Cyclone chamber		
Power supply	Operating voltage	200 to 240 V AC ±10 %		
	Frequency	50/60 Hz		
	Power connection	Device connection: ■ C19 input socket Mains connection cable: ■ CEE 7/7 (EU) ■ NEMA 6-20 (due to 240 V, NEMA L6-20 plug) (USA, Canada) ■ Connection cable with open ends, e.g. Japan		
	Fuse protection (mains side)	16 A circuit breaker, tripping characteristic type B		
	Maximum power consumption	2500 VA		
	Protection class	I		
	Overvoltage category	II		
Safety circuits	Monitoring	■ Plasma compartment door closure ■ Torch working position ■ Power HF generator ■ Cooling ■ Argon supply ■ Exhaust air extraction ■ Plasma (optical monitoring)		
Gas supply	Gas	Inlet pressure	Total consumption	Connection
	Argon ≥ 4.6 Permitted components: Oxygen ≤ 3 ppm Nitrogen ≤ 10 ppm Hydrocarbons ≤ 0.5 ppm Moisture ≤ 5 ppm	500 to 700 kPa (5 to 7 bar)	13 to 21 l/min	Connection for hose inner diame- ter 4 mm or Swagelok 6 mm with reinforcing sleeve
	Oxygen ≥ 4.5 (optional)	600 kPa (6 bar)	≤ 0.05 l/min	Connection for hose inner diame- ter 2 mm or Swagelok 4 mm with reinforcing sleeve
Ambient conditions	Temperature range	+15 °C to +35 °C, optimal +22 °C to +26 °C Temperature as constant as possible during measure- ment mode, maximum temperature drift ΔT _{max} = 2 K/ h, climate control recommended		
	Dew point (relative humidity)	< 15 °C (20 to 80 % at 20 °C) Prevent condensation		

	Air pressure	0.7 bar to 1.06 bar
	Max. permissible altitude	2000 m
	Storage	Temperature: -40 °C to +70 °C Use drying agent
	Protection type	IP 20
	Degree of contamination	2
Extraction	Material	Heat-resistant and corrosion-resistant (recommended: V2A steel)
	External pipe diameter	125 mm
	Extraction output	3.5 m ³ /min (min.), 5.5 m ³ /min (max.) Optimal: 4.0 to 4.5 m ³ /min
	Adapter using flexible aluminum pipe	Pipe diameter: 125 mm Pipe length: 1000 mm
Dimensions, weight, sound pressure level	Dimensions (W x H x D)	600 mm x 932 mm x 809 mm
	Dimensions excluding sample tray (W x H x D)	600 mm x 932 mm x 570 mm
	Weight	115 kg
	Sound pressure level (in normal working position in front of device)	< 85 dB(A)
	Sound pressure level (at a distance of 1 m)	< 80 dB(A)

10.1.2 Control computer technical data

Minimum requirements for the control computer	PC with Windows 11 or Windows 10 (32/64 Bit) Various graphics resolutions possible, e.g., 1280 x 720; 1920 x 1080; 2560 x 1440. 3840 x 2160 Graphics card: Graphics card compatible with at least DirectX 12; WDDM 2.0 (Windows 11), DirectX 9; WDDM 2.0 (Windows 10) Processor: 1.6 GHz Dual Core CPU Working memory: 2 GB RAM (32 Bit). 4 GB RAM (64 Bit) Free disk space: ≥ 64 GB (SSD recommended) Further requirements for Windows 11: ■ System firmware: UEFI ■ Trusted Platform Module (TPM) Version 2.0 PC: 2 x USB 2.0 interfaces Mouse / trackball, keyboard A CD/DVD drive is required for installation.
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10.1.3 Recirculating chiller technical data

Water-air cooler

(Manufacturer: LabTech)

Tank capacity	3.5 l
Dimensions (W x H x D)	460 mm x 703 mm x 735 mm

Supply voltage / frequency	110 V / 60 Hz 230 V / 50/60 Hz
Typical average power consumption	2900 VA
Cooling performance	3000 VA at 25 °C
Mass (empty)	92 kg
Silent version (optional), sound pressure level	≤ 57 dB(A)
■ Length of the water tubing ■ Length of the mains cable (For placement in adjacent room)	■ 3.5 m ■ 2.7 m

Water-water cooler

(Manufacturer: Van der Heijden)

Tank capacity	5 l
Dimensions (W x H x D)	360 mm x 590 mm x 470 mm
Supply voltage / frequency	230 V / 50 Hz
Typical average power consumption	160 VA
Cooling performance	3500 VA at 20 °C
Mass (empty)	33 kg
Sound pressure level	≤ 50 dB
Max. water flow temperature (primary side)	15 °C
Required quantity of water	610 l/h (at 15 °C water temperature at inlet side, 20 °C outlet side and $\Delta p = 40$ kPa)

10.1.4 Technical data for the ASPQ 3300 autosampler

Dimensions (W x H x D)	285 mm x 510 mm x 490 mm
Mass	15 kg
Supply voltage, frequency	100 to 240 V, 50/60 Hz
Fuse	T 5 A H 250 V. 5 x 20 mm
Typical average power consumption	75 VA
Racks	3 (sample vessels), 2 (special cups)
Purging bottle	2 l

10.1.5 Technical data for other accessories

Autosampler

Teledyne Cetac ASX-560	Dimensions (W x H x D)	580 mm x 620 mm x 550 mm
	Mass	12 kg
Cetac ASX-280	Dimensions (W x H x D)	360 mm x 620 mm x 550 mm
	Mass	8.1 kg

	Cetac XLR-860	Dimensions (W x H x D)	920 x 667 x 595 mm
		Mass	20.4 kg
	Cetac Oils 7400	Dimensions (W x H x D)	570 mm x 490 mm x 540 mm
		Mass	23 kg
Dilution system	Teledyne Cetac SDX(HPLD)	Dimensions (W x H x D)	132 mm x 254 mm x 117 mm
		Mass	4.4 kg
	Teledyne Cetac SimPrep	Dimensions (W x H x D)	580 mm x 620 mm x 550 mm
		Mass	11.7 kg
Accessories for fast sample feed	Cetac ASXPress Plus	Dimensions (W x H x D)	
		Switching valve	58 mm x 128 mm x 217 mm
		Control unit	83 mm x 254 mm x 200 mm
		Mass	
		Switching valve	1.3 kg
		Control unit	1.4 kg
Electrical connection data	The electrical connection data applies to all accessories listed.		
	Voltage	100 to 240 V (power supply of power supply unit)	
		24 V (operating voltage of accessory)	
	Frequency	47 to 63 Hz	
	Interfaces	USB	
		RS 232	

10.2 Guidelines and standards

Compliance with the following guidelines and regulations applicable to the product is declared:

- Low Voltage Directive – 2014/35/EU
- EMC Directive – 2014/30/EU
- RoHS Directive – 2011/65/EU

Applied harmonized standards are:

- EN 61010-1:2010+A1:2019
- EN IEC 61010-2-061:2018
- EN IEC 61326-1:2021
- EN IEC 63000:2018

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I Revision overview

Version A First edition of the document (06/2025)

Version B Revision (10/2025)

Chapter	Changes
Function and design	Sampling compartment lighting as equipment for all models
Installation and commissioning	▪ New note that the analyzer must be connected to a separately fused circuit as a heavy-duty consumer. ▪ Change the minimum cooling capacity of the recirculating chiller to ≥ 2.5 kW ▪ Corrected minimum floor space and minimum distance to the rear wall
Maintenance and care	Supplementary care instructions for induction coil
Specifications	▪ Specification of the experimental half bandwidth at different wavelengths of the elements As, P, Cd ▪ Reduction of the supply to two recirculating chillers instead of the previous three