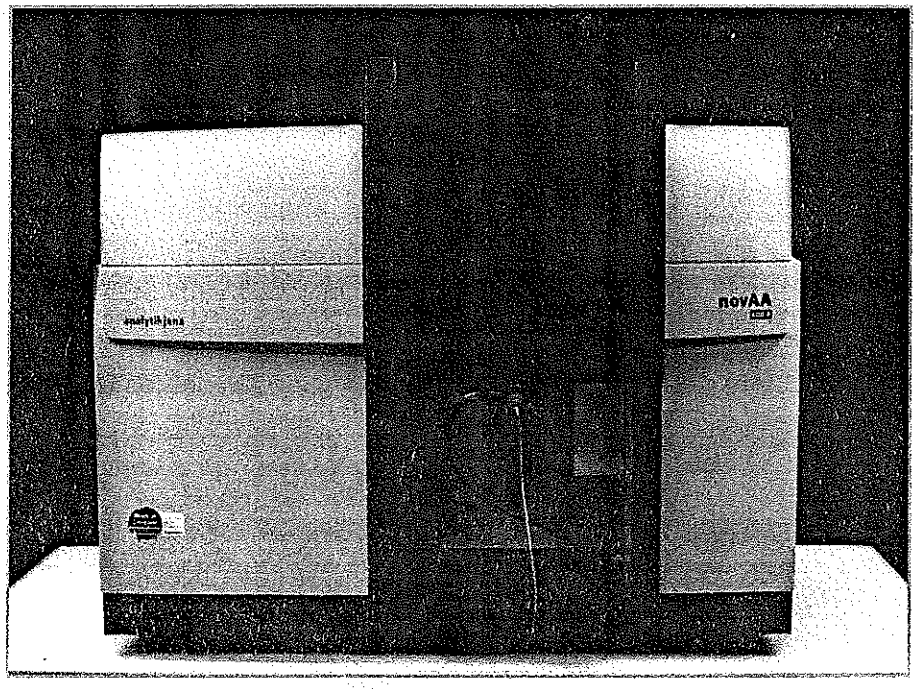
analytikjena

novAA 400 P

Atomic Absorption Spectrometer with Flame Atomization



Operating manual

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1 Basic information

1.1 Intended use of novAA 400 P

The atomic absorption spectrometer novAA 400P is a compact spectrometer with flame atomizer and deuterium background correction for the sequential trace and ultra-trace detection of metals and metalloids in liquid and solution samples in the routine analysis and for research purposes.

For the hydride technique, there are hydride systems available for batch and continuous operation.

The graphite tube furnace has an opening on the side for solid samples next to the pipette opening for liquid samples and, together with the manual or automatic solid autosampler, is designed for direct solid analysis.

High degree of automation

To satisfy the highest analysis expectations, all spectrometer settings and the burner height adjustments are motor driven. With the autosamplers of the respective technique, the measurement of liquid, solution and solid samples can be carried out fully automated.

Complex software control

The control software includes the complete instrument control from the spectrometer to the accessories and from the data recording to the evaluation. The control software includes default packages for method development and routine as well as comprehensive presentation and storage options for measured signals and parameters. In addition to GLP-suitable logging, quality control and diagnosis, data transfer to other programs is possible. For method development, the control software has a user interface, where application-specific parameters can be defined and saved as reproducible analysis programs. A user interface for the sequential multi-element routine ensures a high efficiency in routine analysis. Preconfigured methodical analysis proposals for elements of the periodic chart (also called cookbook) provide an introduction to the analysis of material compounds and can provide a basis for creating one's own element methods. Measurements in trace and ultra-trace analysis require special environmental conditions. Observe the requirements specified in Section "Installation conditions" p. 23.

Supported analytical methods

- Flame technique
- Hydride technique/mercury cold vapor technique

1.2 Notes on the manual

Instructions for actions which occur in chronological order are numbered and combined in action units.

Lists which are not in chronological order are shown as itemized lists, sub-listings as bullet points.

Safety notes are indicated by pictographs and signal words. The type and source of the danger are stated together with notes on preventing the danger. The meaning of the pictographs and signal words used is explained in the chapter "Safety notes".

The elements of the control and analysis program are indicated as follows:

- Program terms are identified with SMALL CAPS (e.g., Menu FILE).

- Buttons are shown by square brackets (e.g., [OK] button)
- Menu items are separated by arrows (e.g., FILE ▸ OPEN).

1.3 Symbols and signal words used

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

WARNING

Indicates a potentially hazardous situation which might cause fatal or very serious injuries (deformities).

WARNUNG

Berührungsgefährliche elektrische Spannung!

CAUTION

Indicates a potentially hazardous situation which might cause light or minor injuries.

ATTENTION

Indicates a potentially hazardous situation which might cause damage to property.

1.4 Bestimmungsgemäße Verwendung

The novAA 400 P may only be used for atomic absorption spectrometry in the techniques described in this manual. Any departure from the instructions for proper use may lead to warranty restrictions and reduced manufacturer liability in the case of damage.

If the safety instructions are not observed in handling the novAA 400 P, this is taken to be a use which deviates from the intended purpose. Safety instructions are to be found especially on the equipment itself, in Section "Safety instructions", p. 7 and in the description of the relevant work steps.

1.5 Warranty and liability

The warranty and liability periods comply with the legal requirements and the provisions in the General Terms and Conditions of Analytik Jena AG.

Deviations from the intended use described in this user manual will result in limitations of warranty and liability in the event of damage. Damage to wearing parts or breakage of glass are not included in the warranty.

Warranty and liability claims are excluded for personal injury and property damage if resulting from one or several of the following causes:

- use of the novAA 400 P other than intended
- improper commissioning, operation and servicing of the device

- modifications to the equipment without prior consultation with Analytik Jena AG
- operation of the device with faulty safety equipment or improperly fitted safety and protection equipment
- inadequate monitoring of the equipment components subject to wear
- use of other than original spare parts, wearing parts or consumables
- improper repairs
- faults due to the non-observance of this user manual

2 Safety instructions

2.1 General notes

For your own safety and to ensure error-free and safe operation of the novAA 400 P, please read this chapter carefully before using the appliance.

Observe all safety notes listed in this user manual and all messages and notes displayed by the control and analysis program on the monitor.

Besides the safety instructions in this user manual and the local safety regulations that apply to the operation of the device, the general applicable regulations regarding accident prevention, occupational health and safety and environmental protection have to be observed and complied with.

References to potential dangers do not replace the work protection regulations which must be observed.

2.2 Requirements for the operating personnel

The novAA 400 P must only be operated by qualified specialist personnel instructed in the use of the device. The instruction must also include conveying the content of this user manual and the user manuals of other system components.

In addition to the safety at work instructions in this user manual, the generally applicable safety and accident prevention regulations of the respective country of operation must be observed and adhered to. The operator must ascertain the latest version of these regulations.

The user manual must be accessible to the operating and service personnel at any time!

2.3 Safety instructions, transport and installation

Observe the following notes:

- ❑ The novAA 400 P is always installed by the customer service department of Analytik Jena AG or its authorized and trained specialist personnel. Independent assembly and installation are not permitted. Incorrect installation can create serious hazards.
- ❑ The device weighs 110 kg. Use a lift truck to transport the device.
- ❑ Four people are required to move the device in the laboratory by holding the device on four firmly screwed-in support rods.

Protection against explosion and fire

- ❑ The novAA 400 P may not be operated in an explosive environment.
- ❑ Smoking or open flames in the operating room of the novAA 400 P are prohibited!
- ❑ The operator is responsible for establishing a control method to ensure that the N2O and acetylene connectors are leak-tight.

2.4 Safety instructions - operation

General

- ❑
- ❑ Before each commissioning, the operator of the novAA 400 P must make sure that the condition of the device including the safety equipment is sound. This applies in particular after each modification or extension of the device or its repair.
- ❑ The device must only be operated if all protective equipment (e.g. covers and doors) are in place, properly installed and fully operational. The sound condition of the protection and safety equipment must be checked regularly. Any defects must be corrected as soon as they occur. Protective and safety equipment must never be removed, modified or decommissioned during operation.
- ❑ During operation, free access to the connections, the power switch on the left chassis wall and the multiple adapter must be ensured.
- ❑ The ventilation equipment on the device must be in good working condition. Covered vents or ventilation slits etc. may cause the device to break down or may cause damage to it. The distance of the device and system components to the walls and neighboring installations must comply with the minimum distance requirement of 150 mm.

Safety instructions - electrical equipment

Work on the electrical components of the novAA 400 P may only be performed by a qualified electrical technician according to applicable electro-technical regulations. Lethal voltages may occur in the device! Contact with live components may cause death, serious injury or painful electrical shock.

Observe the following notes:

- ❑ The auxiliary components have to be connected to the multiple adapter supplied. Observe the maximum allowable drain current, when connecting up your own components to the multiple adapter (See Section "Energy supply" p. 24).
- ❑ The novAA 400 P and its system components must always be switched off before being connected to each other.
- ❑ Before opening the device, it must be switched off from the device switch and the mains connector must be disconnected from the mains outlet!
- ❑ The novAA 400 P must be switched off and the mains plug must be disconnected, before carrying out any electrical work. Safe disconnection from the mains can only be achieved by pulling out the mains plug. Power is still supplied to the multiple adapter, even when the novAA 400 P is switched off at the mains switch on the right side wall. The multiple adapter socket connection of the novAA 400 P is protected by a fuse in both wires, both in the L-line (phase) and in the N-line (neutral). This means that in case of a fault, connected components are supplied with voltage via the L-line, but no current can flow through the N-line, i.e., without a more thorough check, the connected devices appear to be voltage-free, which is not true.
- ❑ Any work on the electronics (behind the device enclosure) may only be carried out by the customer service of Analytik Jena AG and specially authorized technicians.

Hazards during flame operation

Observe the following notices during flame operation:

- ❑ Do not allow the flame to burn unattended.
- ❑ Pure oxygen or oxygen-enriched air may not be used as an oxidant.
- ❑ Ensure that the flame guard is in perfect working order.
- ❑ The novAA 400 P must be switched off when non-gastight gas lines, burner gas valve defects or safeguard defects are detected. It must remain off until the defect has been repaired.
- ❑ Operate the acetylene cylinder only in an upright position and secured against falling over. When the cylinder pressure is lower than 1 bar, the cylinder must be replaced to avoid acetone from entering the automatic gas control.
- ❑ Keep cups with combustible solvents or with sample material containing easily evaporating or combustible components away from flame.
- ❑ Only ignite and operate the flame when the safety glass of the sample chamber is closed.
- ❑ The nebulizer pressure must not drop below 0.7 bar.
- ❑ When working with the nitrous oxide flame, use a scraper or remove carbon deposits manually with the scraper from the burner slot. For combustion gas flows exceeding 250 NL/h pay attention to stubborn deposits. Remove these where necessary to ensure the functionality of the scraper.
- ❑ During maintenance work on the burner-nebulizer system, clean all contaminated parts.

Safety notes relating to high temperatures

During flame operation high temperatures occur.

- ❑ Observe the required cooling times!
- ❑ Do not touch the hot components during, or directly after, a measurement.
- ❑ Undertake maintenance work and change components only after an adequate cooling period: Burner head, cell, lamps.
- ❑ Keep all combustible material away from the device.

Safety notes relating to the formation of ozone and toxic vapors

The UV radiation of the hollow cathode lamp (HCL, D2E) and the N_2O (nitrous oxide)/acetylene flame lead to an interaction with the surrounding air to form toxic concentrations of ozone exceeding the permissible limit. Additionally, toxic byproducts may be included in the samples and occur during sample processing.

- ❑ The novAA 400 P may only be operated with an active exhaust unit.

Safety notes relating to the possible sound level

If the nitrous oxide/acetylene flame blows back into the mixing chamber, the momentary sound level lies below 130 dBA.

Safety notes relating to UV radiation and danger of dazzling

The HCL, D2-HCL and burner flame emit optical radiation (UV and visible range).

Observe the following notes:

- ❑ Protect your eyes!
- ❑ Never look at radiation from the hollow cathode lamps (HCL, D2HCL) or the burner flame without UV protection glasses.
- ❑ The door to the sample chamber must always be closed when the flame is ignited.

Safety notes for handling flammable and explosive gases

Observe the following notes:

- ❑ Acetylene is used as fuel gas. It is an explosive gas, clearly detectable by its smell. With leaking gas systems, defects in valves for combustible gas or the safety equipment of the gas automatic control, the novAA 400 P must be taken out of operation.
- ❑ Do not bring vessels with flammable solvents or sample material containing highly volatile flammable substances in the proximity of flames.

Safety instructions for compressed gas containers and systems

Observe the following notes:

- ❑ Acetylene and nitrous oxide are taken from compressed air containers or local compressed air system. The required purity of the gases must be ensured.
- ❑ Work on compressed gas containers and systems must only be carried out by individuals with specialist knowledge and experience in compressed gas systems.
- ❑ For operating the compressed air container or system, the safety instructions and guidelines which are valid at the operating location must be strictly complied with.
- ❑ High pressure hoses and pressure reducers may only be used for the assigned gases.
- ❑ Incoming piping, screwed joints and pressure reducers for N_2O (nitrous oxide) must be kept free of grease.
- ❑ The operator must carry out weekly safety checks regarding the status and for leaks on all gas supplies and connectors up as far as the device itself. Possible pressure losses from closed systems and lines under pressure are to be determined. Leaks and damages must be repaired without delay.
- ❑ The gas supply must be closed prior to inspections, service and repairs!
- ❑ After successful repair and service of the components of the compressed air containers or system, the device must be checked for sound operation prior to recommissioning!
- ❑ Independent assemblies and installations are not permitted!
- ❑ Thoroughly ventilate the cylinder location after changing the gas cylinder.

Handling of samples, auxiliary and operating materials

The operator is responsible for the selection of substances used in the process as well as for their safe handling. This is particularly important for radioactive, infectious, poisonous, corrosive, combustible, explosive and otherwise dangerous substances.

Observe the following notes:

- ❑ When handling dangerous substances local safety codes and guidelines must be observed.
- ❑ Warnings on the labels must always be observed. Only use clearly marked containers. Use suitable body protection (coat, safety glasses and rubber gloves) when handling samples.
- ❑ The novAA 400 P may only be operated under an active laboratory exhaust hood (danger from formation of ozone, combustion gases given off by the samples, poisonous and combustible by-products from sample reparation processes).
- ❑ Cleaning with hydrofluoric acid must be carried out in an **exhaust chamber**. When handling hydrofluoric acid, **rubber aprons, gloves and face masks** must be worn.
- ❑ Sodium borohydride (NaBH4) is strongly corrosive, hygroscopic and, in solution, extremely aggressive. Avoid dripping and spilling of reduction agent.
- ❑ Biological samples must be handled according to local guidelines regarding the handling of infectious material.
- ❑ When measuring material containing cyanide you have to make sure that prussic acid cannot be generated in the waste bottle, i.e. the waste solution must not be acidic.
- ❑ Ensure that all residue liquid from the nebulizer and the automatic sampler is directed into the waste bottle supplied.
- ❑ The operator is responsible for ensuring that **waste materials** such as drained coolant and residue liquid from the waste bottle are disposed off in an environmentally responsible manner and according to local regulations.

Examples of dangerous organic solvents

Methyl isobutyl ketone (MIBK)	Highly volatile, noxious-smelling
Toluene	Danger to health
Kerosene	Flammable, low vapor pressure
Methanol, ethanol, propanol	Combustible, partly dangerous to health
Tetrahydrofuran (THF)	Highly volatile, easily ignited, dissolves polyethylene ya styrene

This list is in so far incomplete that other solvents could also come into consideration for use in the novAA 400 P. In cases of uncertainty about an unnamed fluid, this may only be used when the manufacturer has confirmed that there is no danger to safety.

Safety notes for cleaning and decontamination measures

Observe the following notes:

- ❑ The operator is responsible for carrying out suitable decontamination should the device be contaminated externally or internally with dangerous substances.

- Spots, drops or larger spillages should be removed and cleaned using an absorbent material such as cotton wool, laboratory wipes or cellulose. The affected areas are then to be wiped with an Incidin Plus solution.
- Before using a cleaning or decontamination procedure other than that prescribed by the manufacturer, the user is required to check with the manufacturer that the intended procedure will not damage the device. Safety labels attached to the novAA 400 P must not be wetted by methanol.

2.5 Safety instructions - service and repair

Observe the following notes:

- The novAA 400 P is always serviced by the customer service department of Analytik Jena AG or its authorized and trained specialist personnel. Independent servicing can maladjust or damage the device. Therefore, the operator may only carry out the tasks listed in the chapter "Service and care".
- The exterior of the novAA 400 P may only be cleaned with a lightly damped, but not dripping wet, cloth. Use only water and, if required, customary surfactants.
- For cleaning the sample chamber and transport channels (hose system) of the novAA 400 P, the operator must establish appropriate safety precautions – particularly in terms of contaminated and infectious materials.

2.6 Switching off the device in the event of danger

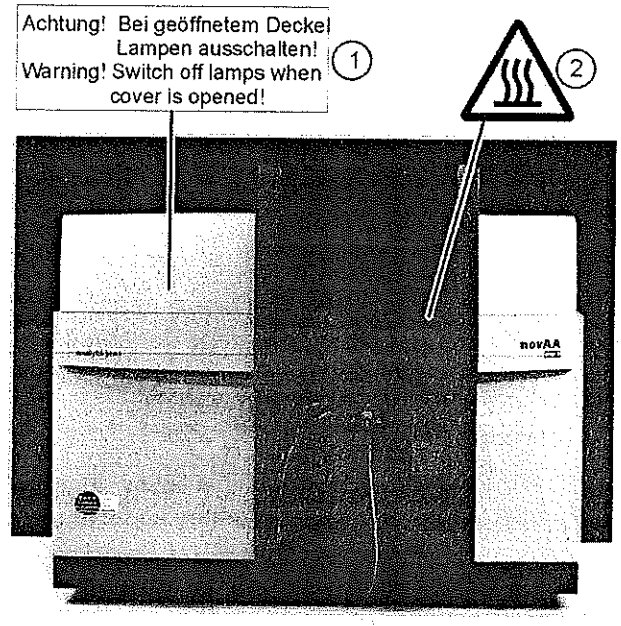
Observe the following notes:

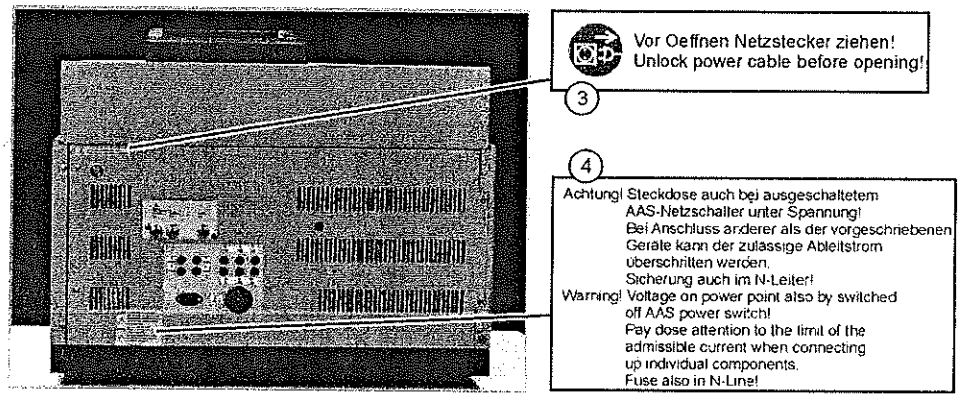
- Switch off the novAA 400 P using the mains switch on the right side wall. Disconnect the mains plug from the mains socket.
- Make sure that the mains plug is readily accessible.
- Switch off the installed components using the mains switch of the connected multiple adapter. Ensure that the multiple adapter is positioned in such a way to allow quick access.

Caution! Risk of data loss and damage to the operating system!

2.7 Warning signs on the novAA 400 P

Observe the warning signs on the device! The following warning signs are displayed on the novAA 400 P:





1 Warning sign on the inside of the door to the lamp chamber
2 Warning sign on the height adjustment inside the sample chamber
3 Warning sign on the rear of the novAA 400 P
4 Warning sign next to the connection socket

Fig. 1 Warning signs on the novAA 400 P

3 Specification

3.1 Technical data

3.1.1 Data for the novAA 400 P

Techniques

- ❑ Flame technique in single or double-beam operation with deuterium background correction.
- ❑ Hydride and mercury cold vapor technique in single-beam operation with deuterium background correction.

Background correction

- ❑ Deuterium background correction with current-controlled D2HCL.

Photometer

- ❑ Dual-beam arrangement with beam splitter and rotating sector mirror for coupling in the reference beam path
- ❑ High light yield and base line stability
- ❑ Quartz-improved mirror optics
- ❑ Wide-range photomultiplier, R928, 9 stages.

Monochromator

Assembly	Modified Czerny-Turner layout with a flat hologrid, automatic wavelength and slit width setting
Wavelength range	185 to 900 nm
Slit width	0.2 nm, 0.5 nm, 0.8 nm, 1.2 nm

Lamp turret for HCL

PC-controlled 8-lamp turret for fully automated operation with a write/read unit (RFID) for the use of coded lamps.

Hollow-cathode lamps HCL, coded

The use of uncoded lamps is possible.

Lamp type: Glow discharge lamps for 68 elements with line radiation in the UV/VIS range

Lamp current	2 to 20 mA
Mode	Electrical timing - in flame mode 50 Hz - in hydride mode 100 Hz
Power supply	2 power packs, electrically stabilized - for active lamps - for preheating

Super hollow cathode lamps, coded

Attention! Use only 10 V super hollow cathode lamps from Analytik Jena AG.

Lamp type: Glow discharge lamps with additional discharge. Line radiation in the UV/VIS range.

The use of uncoded lamps is possible.

Lamp current	2 to 20 mA	
Boost current	0 to 50 mA	
Mode	Electrical timing	
	- in flame mode	50 Hz
	- in hydride mode	100 Hz

Deuterium hollow-cathode lamp D_2-HCL

Lamp type: Glow discharge lamp with continuum radiation in the UV range

Lamp current	5 to 35 mA	
Mode	Electrical timing	
	- in flame mode	50 Hz
	- in hydride mode	100 Hz

Analytical working modes in absorption

Total absorption

Specific and unspecific absorption

Display modes

Absorbance	–0.01 to 3.00
Concentration	Value range: 5 characters (0.001 to 99999), unit freely selectable
Emission	0 to 1; possible in flame mode
Standard energy	0 % to 100 %

Measurement value processing

Measurement frequency (single value order)	- in hydride mode 100 Hz (corrected single values) - Flame mode 100 Hz (corrected single values)
Signal detection	Microprocessor measurement acquisition system optimized for signal/noise ratio on the basis of correlated double sampling technique (CDS technique)
Signal evaluation, integration type	Mean value Mean value (repeated) Maximum value: Maximum value of the absorbance Integral value: Time-integrated absorbance
Integration time	0.1 to 600 s
Autozero (AZ measuring time)	0.1 to 600 s
Delay	0 to 600 s
Energy measuring time	0.3 s

Smoothing	Weighted average: (Method of the smallest error squared, according to Golay-Savitzky)
Type of measurement value displays	Absorbance, emission, concentration
Number of digits	3, 4 or 5
Units of concentration	mg/L, µg/mL, ng/mL, µg/L, ng/L or user defined
Results display window	Alphanumerical values Bar chart of integrated values (bar graph) Time run of the single peaks Overlapping peaks Graphical peak overview
Special windows	Temperature-time program (furnace program) Optimization of the furnace program Mercury/hydride report Concentration values in the reference curve Peak plots with variable integration limits
QC window (Quality Check)	QC blank – Blank QC chart QC control samples – Mean value chart – Recovery chart QC duplicate measurement sample/matrix – Differences chart (trend chart) – Range chart (range chart) – Precision chart (SD chart) QC spike sample – Percentage recovery chart
Statistical methods	Sigma statistics – Mean value with standard deviation (SD) and relative standard deviation (RSD) Median statistics – Media value with range (R) and relative range (R%)
Confidence interval	Can be selected: Absolute, relative or none Selectable confidence interval: 68.3% (1 σ) 90% (1.6 σ) 95.4% (2 σ) 99% (2.6 σ) 99.7% (3 σ) 99.9% (3.6 σ)

Calibration

Calibration techniques	Standard calibration (recalibration) Bracketing calibration Standard addition Addition calibration
Fit reference curve	Linear, variable weighting functions

	Non-linear, variable weighting functions
Number of standards	1 to 30
Number of addition concentrations	1 to 30
Recalibration	Two-point recalibration with display of the recalibration factor

Power supply

Supply voltage Frequency	110 / 170 / 230 V ± 10 % factory adjustable 50/60 Hz
Power consumption	max. 250 VA
Output socket	Like input socket For connection of accessories: PC, compressor, hydride system
Overvoltage category	II according to DIN EN 61010-1
Degree of contamination	2 according to DIN EN 61010-1
Safety class	I
Safety type	IP 20

Instrument fuses

G-Instrument fuse fittings (5×20 mm²) according to IEC 60127.

Fuse number	Type	Protected circuit
F1	T 3.15 A/H	Transformer, primary side, SNT
F2	T 3.15 A/H	Transformer, primary side, SNT
F3	T 6.3 A/H	Socket for external accessories
F4	T 6.3 A/H	Socket for external accessories
F5	T 0.08 A	D2-HCL
F6	T 0.25 A	HCLs
F7	T 0.08 A	Boost current
F8	T 1 A	Heating for boost current
F9	T 0.032 A	Analog
F10	T 3.15 A	Filament

Environmental conditions

according to DIN ISO 90022-2:2003 / 01

Corrosion protection	The device is corrosion-proof for the samples used in the analysis
Working temperature	+10 °C to +35 °C
Humidity during operation	Max. 90% at +30 °C
Storage temperature (use drying agent)	- 40 °C to +70 °C

Dimensions and weights

Weight	140 kg
Dimensions (W x H x D):	790 mm × 650 mm × 735 mm
Transport of device	Only possible using the corresponding carrying handles which must be securely screwed into place

3.1.2 Data for the control computer

Computer (minimum requirements)	PC Pentium 1 GHz with 512 MByte RAM 40 GByte hard disk, 43 cm color monitor (17") VGA graphic card Resolution 800x600 pixels or higher CD ROM Ports: – USB port (USB 1.1 or 2.0*) Mouse Printer
Operating system	Windows XP Professional/VISTA

3.1.3 Data for the flame technique

Types of flame

Acetylene/air	One-slit burner 50 mm, coded (standard) One-slit burner 100 mm, coded (optional)
Acetylene/nitrous oxide	One-slit burner 50 mm, coded

Oxidant

Compressed air and N_2O (nitrous oxide)	Inlet pressure: 4 to 6 bar
Nebulizer flow Air N_2O	 400 to 600 NL/h 320 to 480 NL/h
Additional oxidant (air or N_2O) Air N_2O	 3 levels: 75 / 150 / 225 NL/h 3 levels: 60 / 120 / 180 NL/h

Fuel gas

Acetylene	Inlet pressure: 0.8 to 1.5 bar Consumption: 40 to 315 NL/h

Nebulizer

Mode of action	Pneumatic radial clearance nebulizer
Material	Platinum/rhodium canula, graphite
Nebulizer	Throughput rate 4 to 6 mL/min

Siphon monitoring

Mode of action	Float, corrosion proof

Burner adjustment

Height	5 to 15 mm, automated
Rotation	0 to 90 deg., manual

Safety circuits

Monitoring of	Burner and burner type Fuel gas pressure Oxidant input pressure (air and N_2O) Siphon level Flame

3.1.4 Data for Accessories

Autosampler AS-F

Autosampler without dilution function, completely PC-controlled

Sample tray 139/ 15 Sample cups Special cups	 129 pieces, 15 mL 10 pieces, 50 mL
Sample tray 54/ 50 Sample cups	 54 pieces, 50 mL
Power supply	Via AAS basic instrument
Wash bottle	2 L
Mass	6.5 kg

Autosampler AS-FD

Autosampler with dilution function, completely PC-controlled

Sample tray 139/ 15 Sample cups Special cups	 129 pieces, 15 mL 10 pieces, 50 mL
Sample tray 54/ 50 Sample cups	 54 pieces, 50 mL
Dosing unit in the Fluidik module	5 mL
Power supply	Via AAS basic instrument
Wash bottle	2 L
Bottle for diluent	2 L

Mass (total)	10.0 kg
Autosampler	6.5 kg
Fluidik module	3.5 kg

Injection module SFS 6

PC-controlled

Sample volume for individual analysis	300 µL (minimum volume)
Power supply	Via AAS basic instrument

Piston compressor JUN-AIR 6/S Standard

Tank capacity	15 L
Measurements (diameter × height)	400 mm × 480 mm
Power supply	230 V, 50 Hz or230 V, 60 Hz
Weight	28 kg

Scraper

PC-controlled

Power supply	Via AAS basic instrument

Mercury/hydride systems

HS 60 modular, HS 55 modular, HS50

Hydride und HydrEA technique (see the instruction manual for mercury/hydride systems)

3.2 Guidelines and standards

Safety class and safety type

The novAA 400 P belongs to safety classI.
The casing is safety type IP 20.

Device safety

The novAA 400 P conforms to the safety standards

- ❑ DIN EN 61010-1 (VDE 0411T.1; IEC 61010-1)
- ❑ DIN EN 61010-2-061 (IEC 61010-2-061)

EMC compatibility

The novAA 400 P has been tested for radio interference elimination and interference immunity and fulfills the requirements stipulated by

- ❑ DIN EN 61326

Environmental compatibility

The novAA 400 P has been tested for environmental compatibility and fulfills the requirements stipulated by

- ❑ DIN ISO 9022-3:2000
- ❑ DIN ISO 9022-32-03-0
- ❑ DIN ISO 9022-2:2003/01

EC directives

The novAA 400 P is built and tested according to standards that fulfill the requirements stipulated by the EC directives 2006/95/EC and 2004/108/EC. Each device leaves the manufacturer in a pristine and technically safe state. To maintain this condition and to ensure safe operation, the operator must strictly observe the safety and operating instructions contained in this manual. For accessories which have also been supplied, and system components from other manufacturers, their operating instructions should be referred to.

4 Installation conditions

IMPORTANT

The device may only be assembled, installed and repaired by service engineers from Analytik Jena AG or by technical personnel authorized by Analytik Jena AG. Any unauthorized interference limits warranty entitlements.

When setting up assistance is needed for part of the time. The service engineer will test the device and document the test in the test report of the novAA 400 P.

The operator is responsible for everything which is not included in the original delivery, but which is necessary for operation of the novAA 400 P. Operation of the novAA 400 P demands certain local and system-specific requirements:

- ❑ Suitable place for assembly
- ❑ Space
- ❑ Environmental conditions
- ❑ Supply of inert gas, fuel gas and oxidant
- ❑ Exhaust unit
- ❑ Mains connection

CAUTION!

Observe the safety instructions in Chapter "Safety instructions" p. 8.
Observe work protection regulations. Warnings regarding potential dangers do not replace valid work protection regulations!

Possible dangers when working with the novAA 400 P are:

- ❑ Danger of burning by flame and hot burner and furnace parts
- ❑ Danger from electric current
- ❑ Danger of UV radiation
- ❑ Danger of ozone or nitride oxide formation
- ❑ Danger when handling pressure cylinders
- ❑ Danger from toxic and chemically aggressive substances

4.1 Environmental conditions

- ❑ Operate the novAA 400 P in closed rooms. Do not set it up directly beside a door or a window. The work space of the novAA 400 P should be free of draft, dust, corrosive vapor and also vibrations.
- ❑ Do not set up the novAA 400 P close to any electromagnetic source.
- ❑ Avoid direct sunlight and heater radiation on the novAA 400 P. In extreme cases, provide acclimatized conditions in the room.

- ❑ A separate room is recommended for preparing samples and storing wet-chemical materials.
- ❑ There is a no smoking policy in the room where the novAA 400 P is operated.
- ❑ Temperature range during oper. +10 °C to +35 °C
- ❑ Maximum permissible altitude 2000 m
- ❑ Temperature range during storage and transport -40 °C to +70 °C , use drying agent
- ❑ Humidity during operation Max. 90% at +30 °C
- ❑ Humidity during storage 10% to 30%, use drying agent

4.2 Energy supply

WARNING! Observe the mains connection!

During electrical installation observe the VDE (German Association for Electrical Engineers) guidelines and local regulation requirements!
The mains supply must be correctly earthed.
Do not use an adapter in the mains cabling.

The novAA 400 P is operated on single-phase alternating current.

The power cable is used to isolate the device from the power supply. Therefore make sure that the power cable is readily accessible.

All other components of the novAA 400 P (e.g., PC, printer etc.) are connected via the 5-way socket strip supplied, which is plugged into the rear of the novAA 400 P, and connected to the same phase as the base device itself. If you use your own PC-printer configuration, and if it is connected via the 5-way multiple adapter, observe the limit of the permitted line current (a total of 5 mA with auxiliary devices). To avoid sudden voltage fluctuations, do not connect the novAA 400 P to the same electrical circuit as other power-intensive devices.

Switching-on conditions

Voltage	110/127/230 V ±10% factory adjustable
Frequency	50/60Hz or different if specified in conditions and terms of supply
Power consumption	700 VA
Power consumption of the hydride system	700 VA while heating the cell 400 VA in continuous operation

Table 1 Switching-on conditions

4.3 Gas supply

CAUTION!

The operator must ensure that the connector type used on the outlet side of the gas pressure controller is adequate for the national requirements that shall apply.

The operator must carry out the necessary safety leakage tests weekly on all gas supplies up as far as the device. For this, possible pressure losses from closed systems and lines under pressure are to be determined. The leak is to be localized and corrected immediately.

If the gas is supplied by pressure cylinders, these must be stored in cylinder cupboards in an upright position or secured to the wall with cylinder mounts outside the laboratory space.

For the flame technique, oxidant (compressed air and N_2O if necessary) and acetylene are required as fuel gas. The purity of the gases is extremely important for the analysis. The piston compressor JUN-AIR 6/S can be used to supply the compressed air. If compressed air is supplied by the operator's own compressed air connection, please consult the service department at Analytik Jena AG. N_2O is supplied by pressure cylinders or by an existing mains line.

The pressure tubes are supplied. The pressure reducing valves are optional.

- ❑ Tubing length cylinder connection 5 m
- ❑ Tubing length for the compressor 5 m

It is also possible to connect other tube lengths. Please consult the service department at Analytik Jena AG.

Fuel gas and oxidant	Inlet pressure	Consumption
Compressed air, oil-free, grease-free, particle-free	4 - 6 bar	Max. 700 NL/h
N2O, oil-free, grease-free, purity 2.5	4 - 6 bar	Max. 600 NL/h
Acetylene Purity 2.5 (for flame photometry): Superior to 99.5 vol% relative to C2H2,, without acetone Additional components: Hydrogen compounds of As, S and P	0.8 – 1.5 bar	Max. 315 NL/h

Table 2 Gases – flame technique

4.4 Exhaust unit

CAUTION!

Switch on the exhaust unit during the use of the device!

Do not operate the novAA 400 P without an exhaust unit!
Direct waste air to atmosphere and avoid blockages!

Correct exhaust is only achieved with an exhaust hood that is installed directly above the sample chamber.

The exhaust unit should remove health-damaging burning residues from the flame as well as any ozone which has resulted. Ozone is caused by the reaction of air and UV radiation from the hollow cathode lamps, from the graphite tube furnace at temperatures above 2000 °C and from the burner flame. Use an exhaust unit made of heat- and corrosion-proof material. The first 6 m of the exhaust unit should be made of metal.

Parameters	Properties
Material	V2A
Exhaust performance for nitrous oxide flame	Approx. 8 to 10 m³/min
Exhaust performance for air flame	Approx. 5 m³/min
Exhaust performance for graphite tube	Approx. 1 m³/min
Hood opening	Approx. 200 × 200 mm
Distance to the upper edge of the device	Approx. 200 to 300 mm
Tube diameter	Approx. 100 to 120 mm

Table 3 Exhaust unit requirements

4.5 Space requirement, weight and device layout

The palce of installation must fulfil the following requirements:

- ❑ Minimum size of work tables:

  For the base device on its own: 800 mm × 700 mm, select the height according to ergonomic requirements

  For the base device, monitor and printer: 1600 mm x 700 mm
- ❑ Carrying capacity of work table: at least 180 kg
- ❑ Additional space on the ground for piston compressor JUN-AIR S6 and, if necessary, the PC
- ❑ Table surfaces: wipe, scrape and corrosion resistant, not allowed to absorb moisture
- ❑ Set up the work table in such a way to allow easy access from all sides.
  For unimpeded cooling air circulation and effective cooling, the surfaces of the casing sides of the mobile cooling unit require a minimum distance of 15 cm from the nearest object.

Components	Width [mm]	Height [mm]	Depth [mm]	Weight [kg]
On the work table				
novAA 400 P	790	650	735	140
AS-F	340	350	460	6.5
AS-FD				
Autosampler	340	350	460	6.5
Fluidik module	360	310	165	3.5
HS 60 modular	360	370	240	14
HS 55 modular	360	370	240	14
HS 50	270	210	190	2
APK	245	265	260	3.2

Components	Width [mm]	Height [mm]	Depth [mm]	Weight [kg]
Under the work table				
Compressor JUN-AIR 6/S	∅ 400	480		28
Mobile cooling unit KM 5	260	660	560	32

Table4 Dimensions and weights of the components of the novAA 400 P

The novAA 400 P is a compact device, conceived for mounting on a table. The space required is a function of all components needed for the measurement.

The PC with the monitor, the printer and the keyboard are arranged beside the base device. The PC and the printer can also be placed on a regular PC table.

The samplers for the flame mode AS-F or AS-FD are hung in the sample chamber of the novAA 400 P. The storage bottle for wash liquid of the AS-F or the Fluidik module of the AS-FD are placed next to the AAS device.

The accessories for the mercury/hydride technique are either placed to the right of the base device or on an additional table to the left of the novAA 400 P (HS 55/60 modular) or they are hung in the sample chamber (HS 50).

The Air Purge Kit APK is placed beside the basic device.

The following are located on the floor near the device:

- The receiving bottle for unnebulized sample liquid, autosampler wash liquid and residue liquid of the mercury/hydride system
- The compressor JUN-AIR 6/S

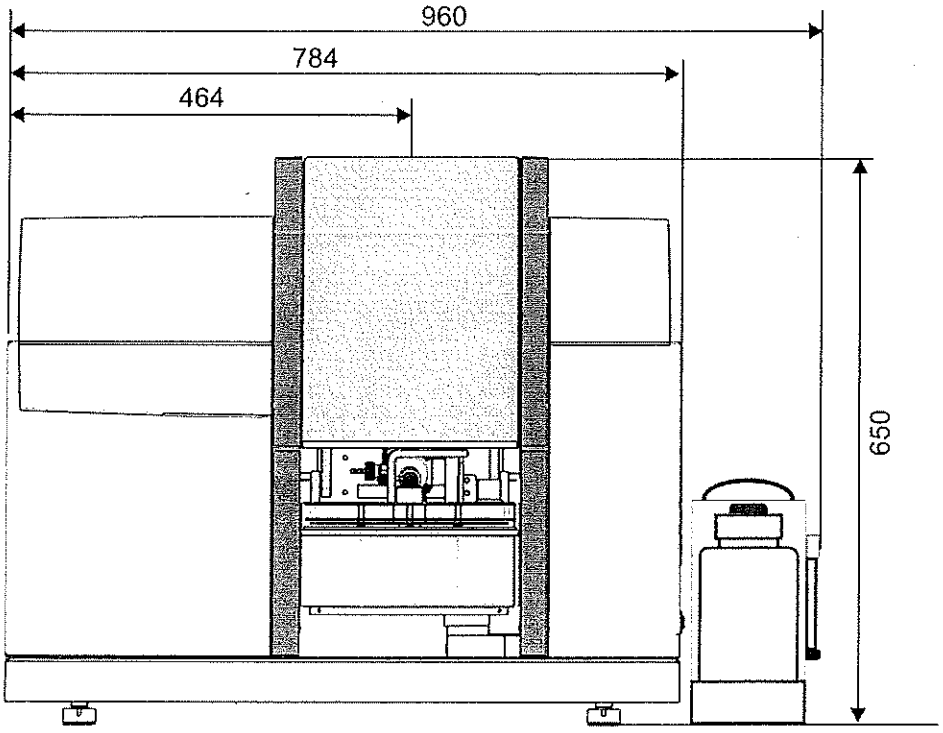


Fig. 2 Dimensions of the novAA 400 P - front view

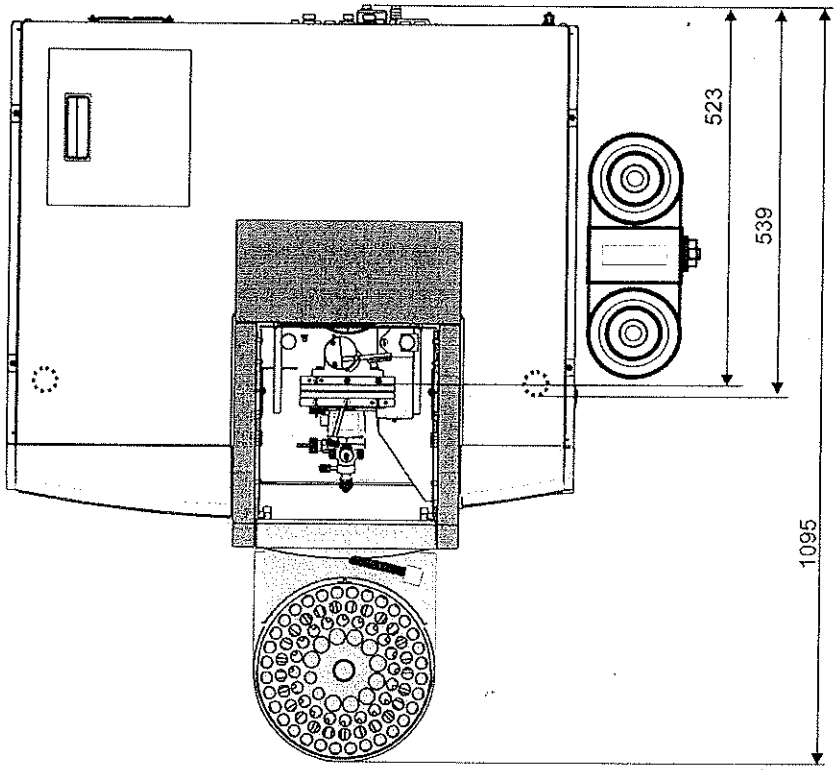


Fig. 3 Dimensions of the novAA 400 P - top view

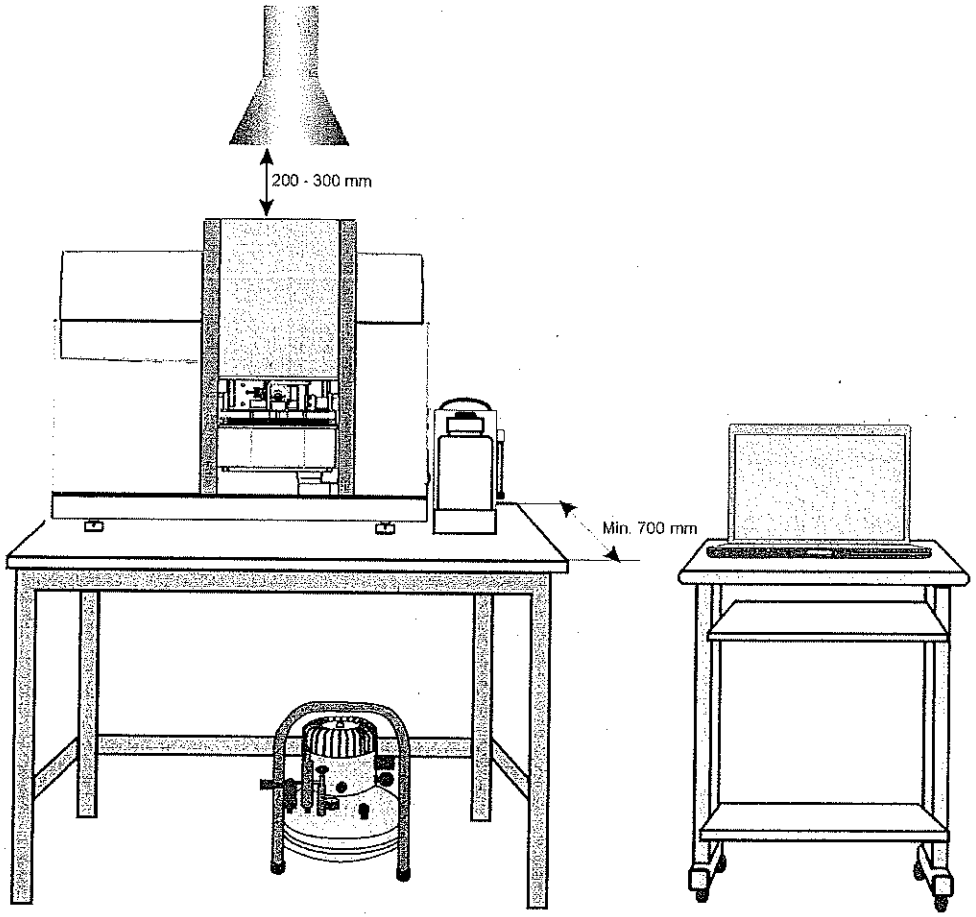


Fig. 4 Installation layout of the novAA 400 P

5 Function and setup of the novAA 400 P

5.1 Function of the novAA 400 P

5.1.1 AAS techniques with the novAA 400 P

The novAA 400 P enables following atomization techniques:

- Flame technique, stationary and as injection technique
- Hydride and mercury cold vapor technique

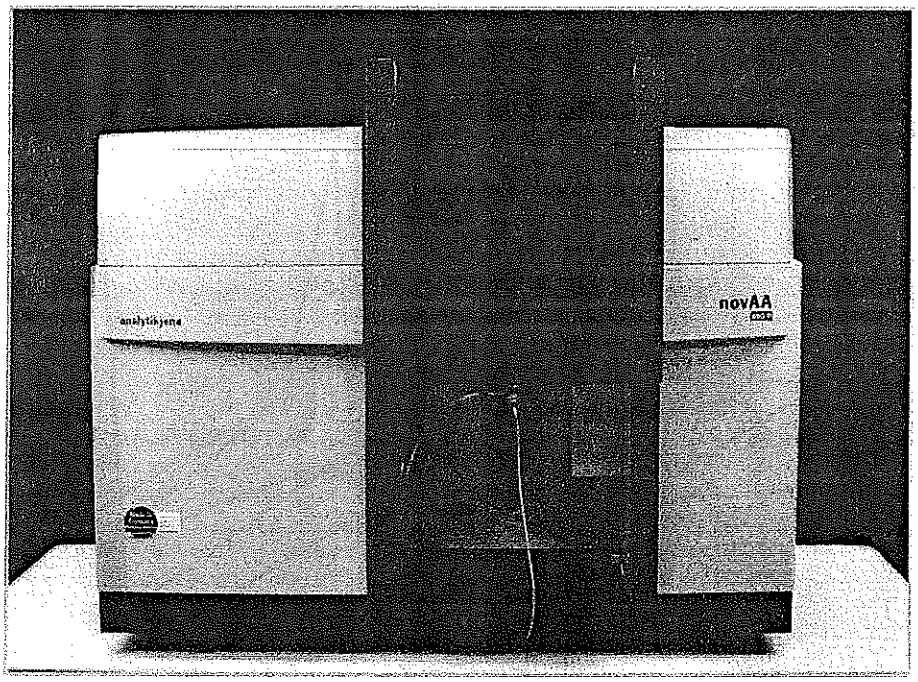


Fig. 5 novAA 400 P

For the flame mode, the novAA 400 P is designed as a double-beam instrument, which can be used in single-beam operation. The core piece for the flame mode is the mixing chamber nebulizer system with direction-independent stable nebulization.

For the flame injection technique, the time-programmed injection switch SFS 6 is available, which couples the sample segments by means of valve switchover into a constant carrier-solution stream.

Hydride technique with the hydride systems of the new generation (HS 50, HS 55 modular, HS 60 modular) are the preferred processes for the detection-sensitive determination of the hydride-forming elements As, Bi, Sb, Se, Sn, Te and of Hg.

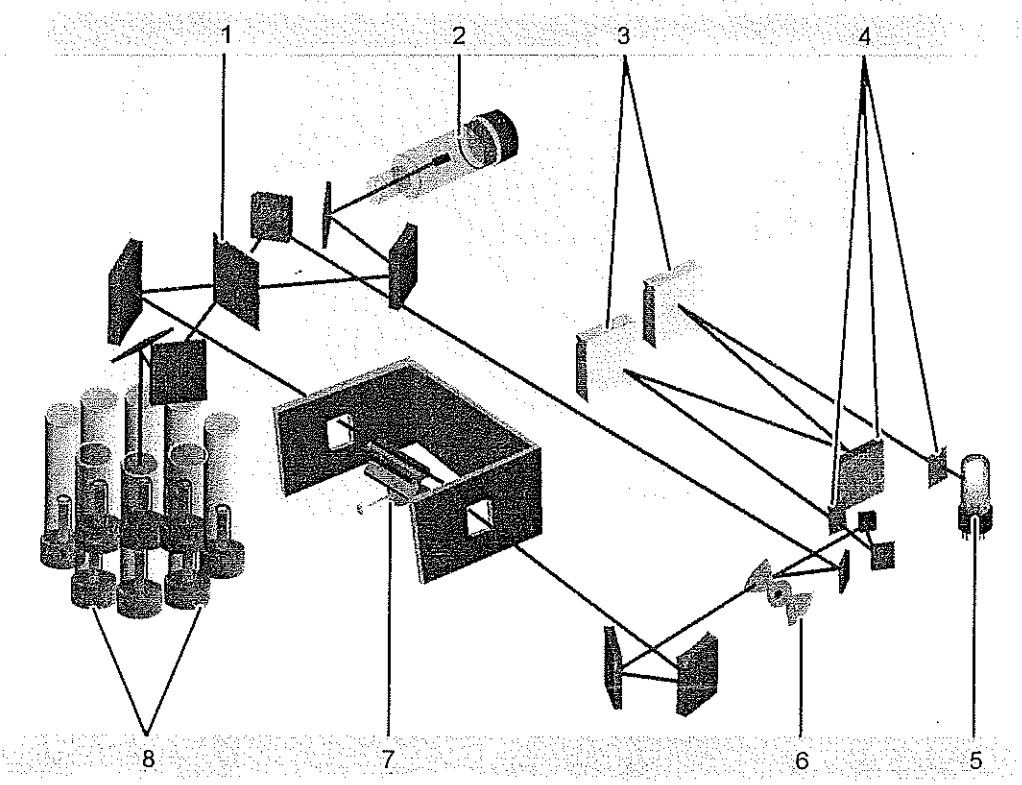
5.1.2 Optical principle

The novAA 400 P is a double-beam instrument, which can be used, according to the technique employed, in single or double beam operation. On the left side the 8-lamp turret (9 in Fig. 6) is vertically arranged. The lamp turret accepts 1.5" hollow cathode lamps (HCL) as the primary radiation source. On the left side there is in addition a deuterium hollow cathode lamp (D_2-HCL) (2 in Fig. 6) for the classical background compensation.

An optical beam splitter (1 in Fig. 6) with reflection and transmission fields in chess-board pattern unites the radiation of the active primary HCL with the continuum radiation of the D_2-HCL and splits it simultaneously into the sample and reference beams. Identical beam paths with the same beam distribution and density in the spatial angle used for both radiation sources make a background compensation up to an absorbance of 2.0 possible with the D_2-HCL.

The reference beam is led behind the sample chamber. A rotating sector mirror (6 in Fig. 6) with 90° reflection and transmission sectors brings the sample and reference beams together.

For the hydride technique with D_2 background correction, the novAA 400 P is operated as a single-beam instrument.



1	Beam splitter mirror	5	**Photomultiplier**
2	Deuterium hollow cathode lamp (D_2-HCL)	6	Sector mirror
3	Monochromator mirror	7	Burner-nebulizer system
4	Entrance slit, grid, exit slit	8	Lamp turret with 8 hollow cathode lamps

Fig. 6 Optical schematic of the novAA 400 P

The sample beam or united sample/reference beam is projected onto the entrance slit of a grid monochromator (3 and 4 in Fig. 6), that is fitted with the fixed bandwidth of 0.2 nm / 0.5 nm / 0.8 nm / 1.2 nm. The monochromator selects the resonance wave lengths assigned to the element. The wavelength setting of the monochromator takes place according to the theoretical step number, referred to the Pb-line 405.8 nm as the initialization point and corrected by an amount which results from the device-specific wavelength interpolated function which is available as a polygon curve. 9 interpolation points are distributed equally over the wavelength range from the zero-th order up to 900 nm.

A peak-pick program is used to find the maximum of the particular line. The wavelength setting takes place using a wavelength drive driven by a step motor with a resolution of 0.005 nm per step.

A photomultiplier (5 in Fig. 6) at the exit of the monochromator measures, synchronously with the clocking of the light sources, the intensity of the impinging radiation.

5.1.3 Measurement principle

The element-specific absorption of the radiation of a hollow cathode lamp is measured by atoms in the base state. In this, the absorption signal is a measure for the concentration of the relevant element in the analyzed sample. The HCL delivers a line spectrum from which a suitable resonance line is decoupled by the monochromator.

The continuum radiation of a D_2-HCL is used for compensation of the background - absorption. The radiation of the line radiator (primary HCL) with its extremely narrow base line (resonance line) is element-specific and weakened non-specifically by scattering. In doing this, the total radiation is recorded. The radiation of the D_2-HCL is mainly weakened by the broad band, element-nonspecific absorption, the minimum element-specific part can be neglected. The formation of the difference between the two signals gives the element-specific absorption.

The intensities of both radiation sources are automatically checked and adjusted if necessary.

In the flame mode, the novAA 400 P can be used both as a single-beam and as a double-beam instrument. In the hydride techniques, the novAA 400 P is used as a single-beam – instrument, because an autozero runs immediately before the integration period. In flame technique, double-beam operation is preferred for on-the-spot measurements in the integration modes "Average value" or "Running average" if the running-in time of the lamps cannot be awaited.

5.2 Flame system

Flame atomic absorption spectroscopy is used for the determination of trace elements in the concentration range from mg/L to µg/L and for the determination of main components. It requires a flame with constant properties. The flame composition must be compatible with the element to be analyzed. Motorized vertical adjustment of the nebulizer mixing chamber burner system by 12 mm makes it possible to move the flame zone with the maximum absorption into the direction of the beam. For the measurement of main components, the burner can be rotated by 90° on the mixing chamber tube until it is at a right angle to the beam thus shortening the absorption path of light through the flame.

The sample solution is aspirated by a pneumatic nebulizer and sprayed into the mixing chamber. In the mixing chamber, the sample aerosol is mixed with acetylene and oxidant before it emerges from the burner slot. The flame is either 5 or 10 cm long and a few millimeters wide, depending on the burner used. It is irradiated over its full length.

5.2.1 Gas automatic

The gas automatic ensures that the supply of acetylene and oxidant to the flame is free from pressure fluctuations and within the defined flow quantities. It enables safe and hazard-free ignition and quenching of the flame. The automatic gas control has three gas inlets for acetylene, air and nitrous oxide.

The fuel flow is set in steps of 5-L-between 40 and 315 NL/h acetylene by a proportional valve in the control path. The air flow first fills the store with a capacity of 600 cm^3 and is then released to the nebulizer. Air from the store is responsible for normal flame quenching and

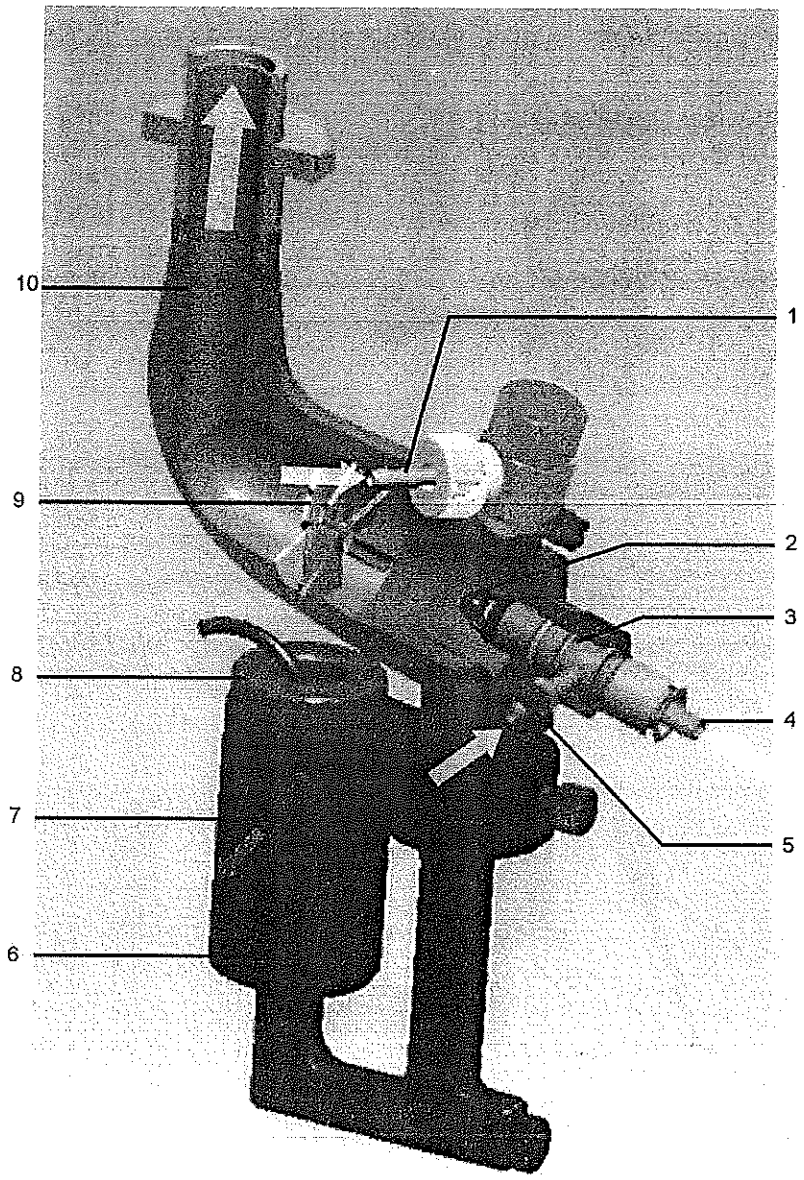
also for flame quenching in the event of an accident. Oxidant flow to the nebulizer is defined by its setting and the inlet pressure. If additional oxidant is used, the additional oxidant flow (air or nitrous oxide) is regulated in three levels.

The flame is ignited using a filament which is rotated out of the back of the sample chamber to the center of the burner. It is possible to switch over from the acetylene-air flame to the acetylene nitrous oxide flame by blocking the air supply, adding nitrous oxide, and increasing the acetylene flow. Quenching the acetylene nitrous oxide flame is carried out in the reverse order.

5.2.2 Burner-nebulizer system

Aerosol required by the sample solution for atomization in the flame is generated by the nebulizer. The oxidant flows into the nebulizer via a side connection and flows through the ring-shaped slit formed by the corrosion-proof platinum-rhodium alloy canula and the PEEK nozzle. The resulting low pressure pulls the sample solution out of the canula and aspirates more sample solution. The positioning of the canula tip relative to the nozzle determines the aspiration rate. It can be set manually with an adjusting screw and lock nut.

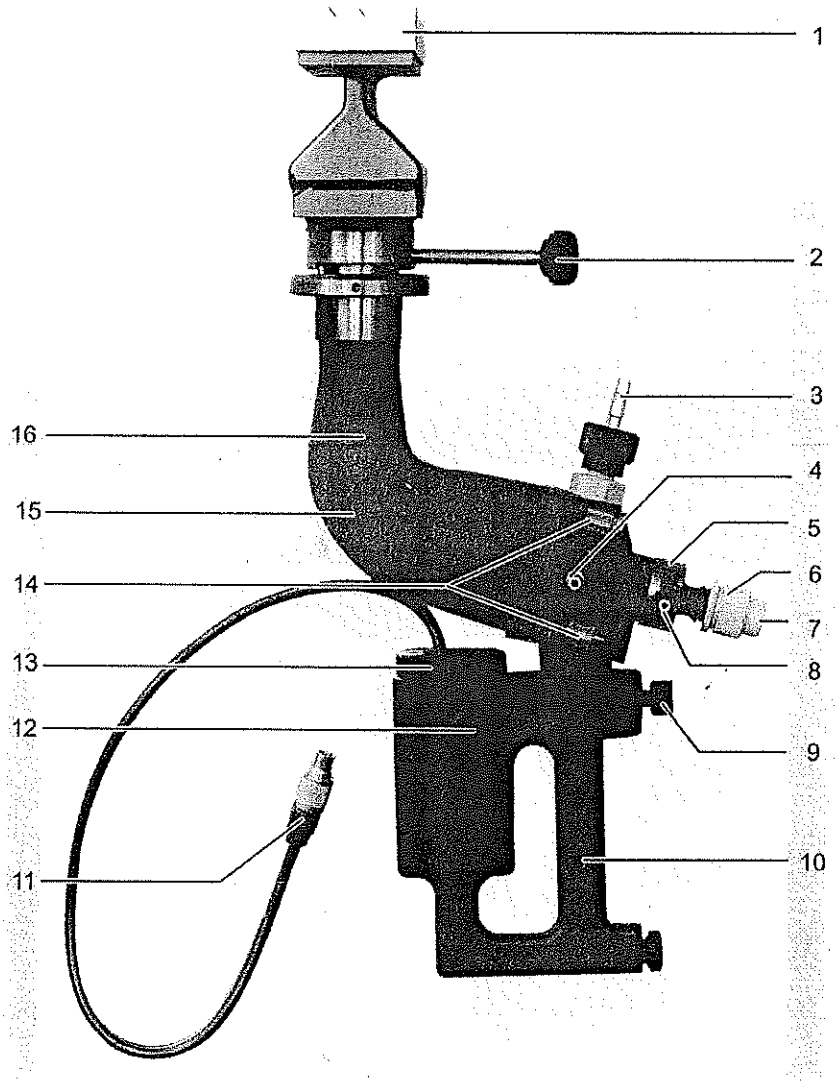
The resulting sample aerosol strikes the impact bead. Larger droplets condense on the impact bead and run off via the siphon. The fuel gas flow strikes the surface of the impact bead at a right angle. The generated aerosol flows through the mixing chamber to the flame at the burner. On the way through the mixing chamber, an equilibrium is reached. Other large droplets are separated by gravity and also run off via the siphon. The aerosol is atomized in the flame. The aerosol of the sample solution must have a small droplet size. Fast evaporation of drops when entering the flame is a precondition for atomizing the sample in the hot zone of the flame. If the sample does not fully evaporate, this has a negative effect on the accuracy of the analysis results. The background absorption is increased through scattering of the radiation by unevaporated droplets.



1	Combustion gas supply	6	Siphon
2	Baffle ball	7	Outflow from siphon
3	Nebulizer	8	Float switch
4	Sample liquid supply	9	Impeller
5	Oxidant supply	10	Mixing chamber tube

Fig. 7 Setup of the burner-nebulizer system

The setup of the mixing chamber nebulizer system optimizes the aerosol formation and ensures that the system is easy to maintain. The outlet into the siphon is located in the immediate vicinity of the nebulizer. Large drops drain off immediately and do not enter the mixing chamber. The impeller retains droplets and stabilizes the aerosol cloud. Potential liquid residues can continuously rise in the mixing chamber tube towards the nebulizer and drain off to the siphon. Furthermore, the baffle ball is permanently centered on the nebulizer so that a readjustment after cleaning the mixing chamber nebulizer system is not required.



1	Burner	9	Fixing screw for siphon
2	Fixing screw for burner	10	Siphon
3	Combustion gas supply	11	Connection of siphon sensor
4	Additional oxidant supply	12	Siphon outlet
5	Locking ring for nebulizer	13	Siphon sensor
6	Nebulizer	14	Screw joints of mixing chamber parts
7	Sample liquid supply	15	Safety plug
8	Oxidant supply	16	Mixing chamber tube

Fig. 8 Nebulizer mixing chamber burner system

5.2.3 Burner and flame type

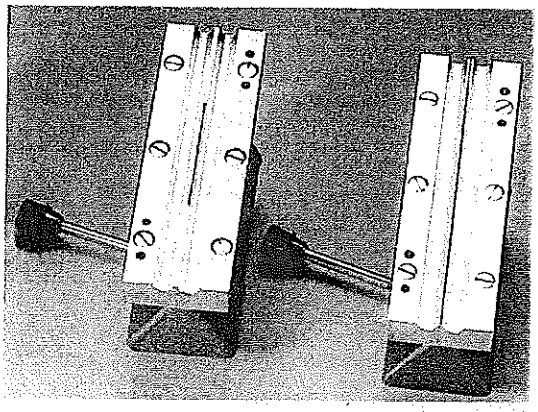
The novAA 400 P can be operated with the following types of flames and their corresponding burners:

- Acetylene-air flame with 50 mm one-slit burner (standard burner) or 100 mm one-slit burner for higher sensitivity
- Acetylene nitrous oxide flame with a 50 mm one-slit burner

If easily atomizable and difficult-to-atomize elements are part of the range of elements to be determined, only the 50 mm one-slit burner (standard) may be used to avoid a burner change between measurements.

Uses of the different flame types:

- Acetylene-air flame can be used for most elements
- Acetylene nitrous oxide flame is required for difficult-to-atomize elements such as boron, aluminum and silicon.



1 2

1 50 mm one-slit burner (standard burner)
2 100 mm one-slit burner

Fig. 9 Burner types

The burners made of titanium are inert with respect to the influences of aggressive sample solutions. The burners can be exchanged easily and can be infinitely variably rotated up to 90° between 2 stops. One stop is positioned in such a way that the burners are aligned to the optical axis. The 90° stop sets the non-sensitive diagonal position of the burners for determining main components.

5.2.4 Sensors

The burner-nebulizer system is checked by various sensors so as to guarantee operational safety.

- A float switch in the siphon indicates the correct level of 80 mm in the water column.
- Two reflex couplers identify the burner type by a code.
- A UV-sensitive sensor monitors the flame.

In addition to the above-mentioned sensors, the mixing chamber is also equipped with a safety plug which will fall out if the flame backfires into the mixing chamber.

The control software evaluates the sensor signals and also monitors the gas pressures and the gas flows as well as the status of the flame.

5.3 Accessories for the flame technique

5.3.1 Automatic samplers AS-F and AS-FD

Manual or automatic sample supply may be employed in the flame technique and the mercury/hydride technique. Automatic operation and multi-element analysis are possible if an autosampler is used. The parameters are set and the function is controlled with the novAA 400 P control software.

The novAA 400 P P can be operated with the following autosamplers:

- ❑ The autosampler AS-F is an automatic autosampler.
- ❑ The autosampler AS-FD also has a dilution function.

The autosamplers use sample trays with the same diameter. The following sample tray types are available:

139 positions	Sample tray with 129 sample positions for 15 mL Sarstedt cups on the outer track and 10 sample positions for 50 mL Sarstedt cups on the inner track
54 positions	Sample tray with 54 positions for 50 mL Sarstedt cups

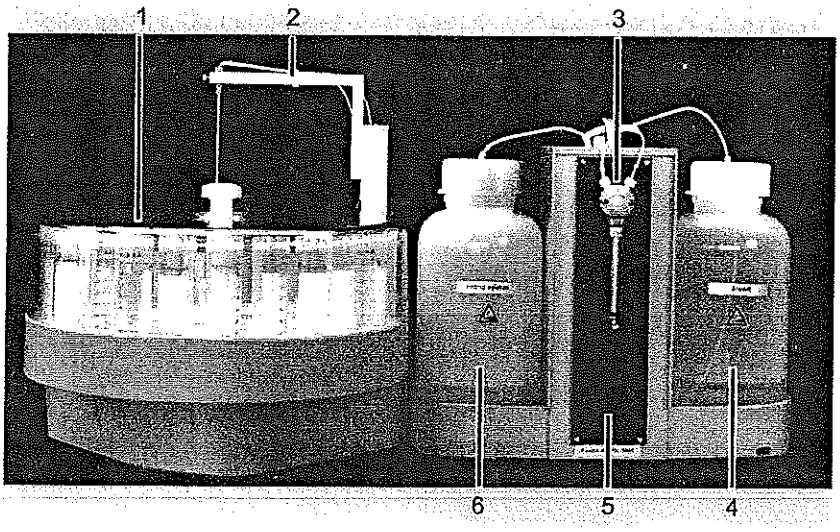
The sample trays should be selected according to the requirements of the sample analysis:

- ❑ Available sample volume
- ❑ Type of signal evaluation

The software controlled autosampler arm reaches all the positions intended for sample-taking. The dipping depth into the sample and the special cups is preset, however, it can be adjusted via the control software.

The novAA 400 P supplies the autosamplers with operational voltage. Tray and autosampler arm are driven by stepping motors. The tray is rotated. The autosampler arm is rotatable and can be lowered by 120 mm.

On the top of the autosampler AS-F there is a wash cup with overflow next to the sample tray. In the autosampler AS-FD the wash cup is located in a plastic block together with a mixing cup. A diaphragm pump delivers the washing liquid from the supply bottle into the wash cup – this action cleans the dipped canula by washing it inside and out. A second diaphragm pump pumps the excess washing liquid flows into the waste receptacle, which is under the table during the wash cycle.



1 Sample tray with cover
2 Autosampler arm
3 Dosing unit (5000 µL)
4 Storage bottle for diluent
5 Fluidik module
6 Storage bottle for washing liquid

Fig. 10 Autosampler AS-FD with separate Fluidik module

The autosampler AS-FD features an extra Fluidik module with a dosing unit (5000 µL). The Fluidik module is electrically connected to the autosampler and is supplied with operating voltage via the novAA 400 P. Standards or samples are diluted in the mixing cup by first placing the concentrate into the mixing cup. Then the diluent is added at a high dosing speed (max. volume: V = 25 mL). A fixed waiting time ensures complete mixing. A second diaphragm pump extracts the residual liquid that has not been taken up by the nebulizer.

The autosampler AS-FD with dilution function features the following advantages:

- Preparation of standards for the calibration by diluting one or several stock standards in the mixing cup
- Dilution of the sample if its concentration is too high, i.e., its element content is higher than 110 % of the calibration standard with the highest concentration
- Dilution of all samples at freely selectable dilution ratios up to a ratio of 1:500

5.3.2 Piston compressor JUN-AIR 6/S

If no in-house compressed air supply is available, it is useful to use a compressor that produces the air required for the acetylene/air flame.

The piston compressor JUN-AIR 6/S is available as an option. The compressed air is free from water, dust and oil. With a maximum operating pressure of 8 bar and a 15 L air container, the compressor meets the demands for compressed air supply. For its operation, observe the instructions given in the operating manual of the piston compressor JUN-AIR 6/S.

5.3.3 Injection module SFS 6

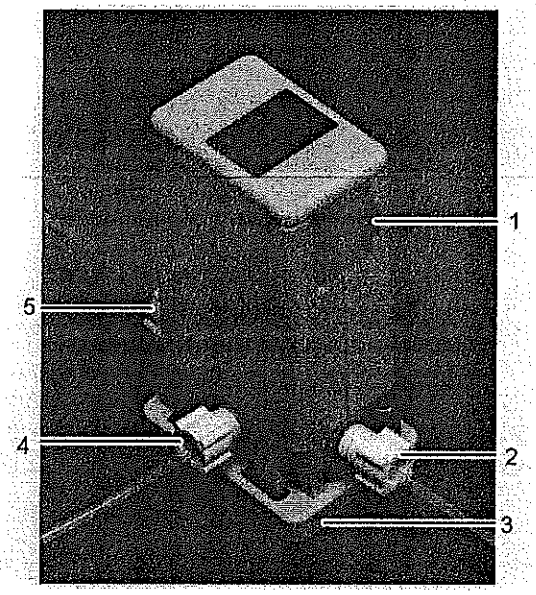
Injection module SFS 6 (Segmented Flow Star) is available as an optional accessory. It may be used in combination with an autosampler or in manual mode.

On the one hand, it allows washing solution to be aspirated continuously thus keeping the burner at a constant temperature by the aerosol, on the other hand it allows for reproducible measurements of small sample volumes relative to the washing solution.

The operating principle of the injection module SFS 6 is based on a magnetic valve with two inlets and one outlet to the nebulizer. The sample aspiration tube is located at the energized inlet. It is dipped directly into the sample or is connected to the autosampler canula. The non-energized inlet is connected to the aspiration tube for the washing solution. The two switching states are:

- Basic state: Sample path is blocked, washing solution path is free
- Active state: Sample path is free, washing solution path is blocked

The parameters for controlling injection module SFS 6 are entered with the control software.



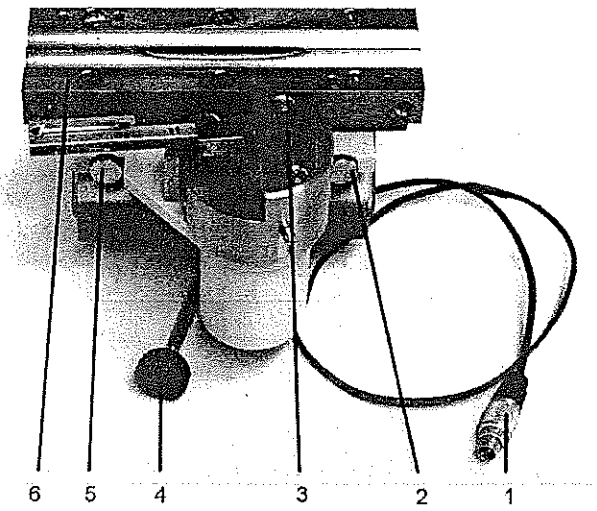
1 Control cable port
2 Tube to washing solution
3 Support
4 Short piece of tube to nebulizer capillary
5 Sample tube

Fig. 11 SFS6 injection module

5.3.4 Scraper - Automatic burner head cleaner for nitrous oxide flame

The automatic burner head cleaner (scraper) is recommended for continuous and fully automated operation with the nitrous oxide flame. When working with the nitrous oxide flame and particularly the fuel-rich C_2H_2/ N_2O flame, as is used for the analysis of such elements as Si, W, Mo and Sn, carbon will deposit on the burner slot over longer periods. If these deposits are not removed completely, this will lead to clogging of the burner slot, which in turn will result in irreproducible measurement results. Using the scraper, the cleaning procedure can be fully automated.

Once activated in the software and stored as a method parameter, the scraper guarantees a continuous and reproducible measuring process without any disturbances and interruptions. You can choose among various cleaning intervals depending on flame composition and need. On the other hand, the scraper can also be used for the automation of the burn-in process of the nitrous-oxide flame. If activated in the window FLAME / CONTROL, a cleaning step is carried out every 30 s. This way, undisturbed burning in of the nitrous oxide flame is possible.



1 Scraper connection cable
2 Knurled head screw
3 Scraper
4 Fixing screw for burner
5 Knurled head screw
6 50 mm burner head

Fig. 12 Scraper mounted to 50 mm burner head

The scraper is fixed to the burner head with two knurled head screws. It can be detached if it is not needed.

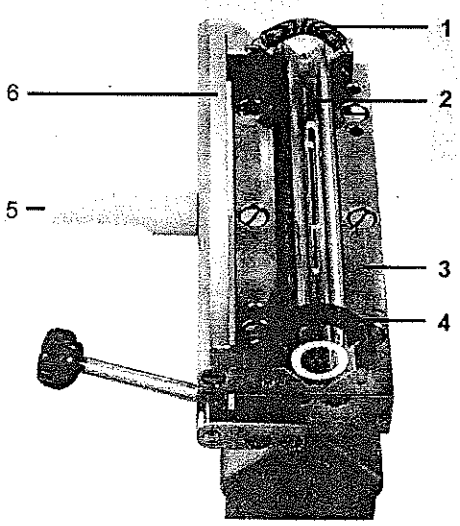
The scraper can be retrofitted on a 50 mm burner.

5.3.5 HPT burner head

The HPT burner head, which consists of a 50 mm burner, hinged holder and slit quartz tube, is available as an option for the air-acetylene flame. The HPT burner head is used to increase the residence time of the atoms in the flame, which helps to achieve higher sensitivity particularly for lightly volatile elements such as Cd, Pb, Zn and Hg.

The quartz glass has a slit with a length of 50 mm on opposite sides to allow the flame to pass through. The holder ensures that the slits are aligned to the burner head.

The HPT burner head is recommended for use up to an acetylene–air ratio of 0.16 to prevent the deposit of soot on the quartz tube.



1, 4 Tension spring
2 Slit quartz glass
3 50 mm burner
5 Handle
6 Hinged holder

Fig. 13 HPT burner head

5.3.6 Air Purge Kit APK

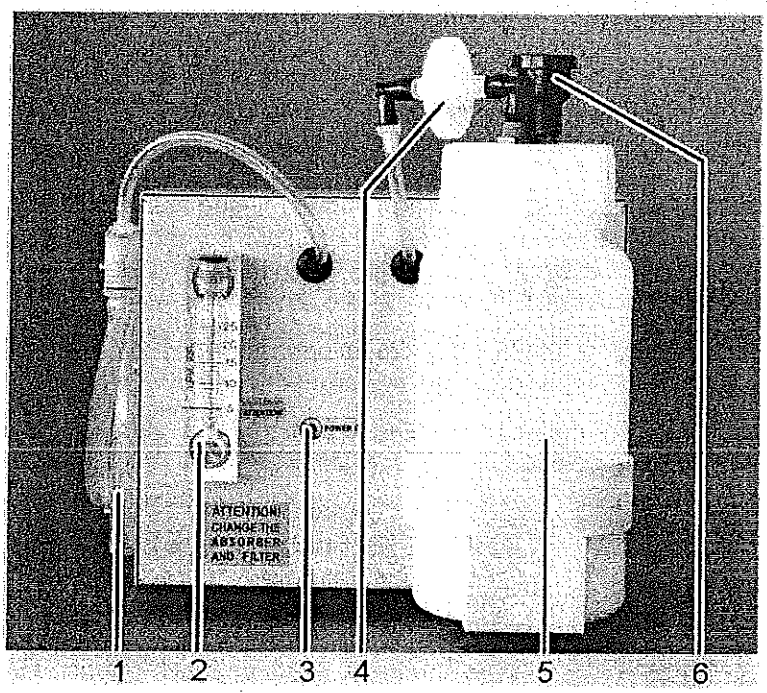
The novAA 400 P can optionally be upgraded with an APK for air-purging the spectrometer. Purging with cleaned and dry air prevents dust and aggressive vapors from entering the optical area.

A connection on the rear side connects the APK to the novAA 400 P. The inflowing air is divided by a T piece in the novAA 400 P and equally flows along the front and rear side into the spectrometer. The closed photometer cover is tightly seated on the photometer plate. The photometer cover has two small cut-outs allowing the inflowing air to escape.

The essential element of the APK is the 24 V mini compressor that aspirates ambient air. The aspiration length is intended for air purification and is divided into:

- ❑ Aspirating filter on the acid separator
- ❑ Acid separator consisting of a 1 liter bottle filled with 600 g $CaCO_3$ serving as marble
- ❑ Filtration unit serving as dust filter
- ❑ Rotameter serving as flow control

A membrane dryer built to the counter-flow principle is located at the compressor outlet. The counterflow is formed by a part of the dried air.



1	Membrane dryer	4	Dust filter
2	Rotameter	5	Bottle with marble granulate
3	"Power on" LED	6	Aspirating filter

Fig. 14 Air Purge Kit APK

5.4 Supplementary accessories - mercury/hydride systems

The mercury/hydride systems available range from the simple batch systems for users with small samples through to fully automated continuous devices with flow injection.

HS 50: Hydride injector.
Simplest batch system with pneumatic working principle.

The quartz cell is heated by the acetylene-air flame.

HS 55 modular: batch system with electrically heated cell unit with or without "Hg Plus" module for Hg detection.
The reduction agent solution is metered by a 1-channel hose pump.

HS 60 modular: Hg/hydride system for flow injection operation with electrically heated cell unit with or without "Hg plus" module for Hg detection.

More information on the mercury/hydride systems can be found in the relevant accessory manuals.

5.5 Lamp turrets and lamps

The novAA 400 P has a 8-lamp turret with a write/read unit (RFID) for coded lamps at the active position. The coded lamps are fitted with transponders. The following is saved: lamp type, element(s), serial number, maximum/recommended lamp current and boost current and operating hours. The use of uncoded lamps is possible. The lamp turret is designed for hollow cathode lamps with a standard bulb diameter of 37.1 mm. The individual lamps are rotated (PC-controlled) into the beam path, switched on and adjusted relative to the pitch circle in steps of 0.1 mm.

A second heat circuit ensures that a second HCL can be preheated at the same time.

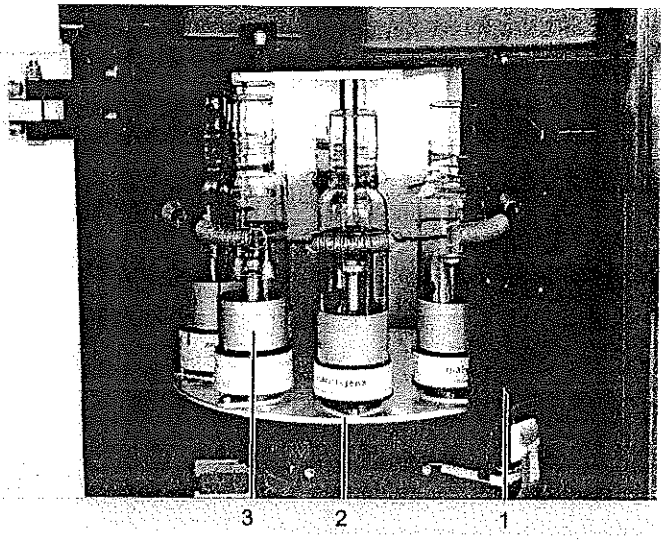
Positions 5 to 8 can also be mounted with super hollow cathode lamps. The required supply for boost current and heating is integrated and can be switched for either one of the positions 5 to 8. If a super HCL is used as an active lamp, a second super HCL cannot be preheated as such, only as a HCL. Therefore, for the multi-element routine it is recommended to have an element method with a super HCL followed by a method with a normal HCL.

Using a super hollow cathode lamp is advantageous for some elements such as As, Se, Te, P, Zn due to the higher intensity of radiation, which enables the signal to noise ratio and the detection limit to be improved.

For mounting the 8-lamp turret, the following combinations can be used:

- 8 coded hollow cathode lamps or multi-element hollow cathode lamps
- 1 to 4 coded super hollow cathode lamps at positions 5 to 8 and the remaining positions with coded hollow cathode lamps or multi-element hollow cathode lamps.

The continuum radiator, a deuterium hollow cathode lamp (D_2-HCL), is installed in a separate holder.



1 Reader for RFID chip
2 Carrier plate for 8 lamps
3 Lamp with RFID chip

Fig. 15 Lamp turret with reader

6 Installation and start-up

CAUTION! Prevent any unauthorized interference!

The device may only be assembled, installed and repaired by service engineers from Analytik Jena AG or by technical personnel authorized by Analytik Jena AG.

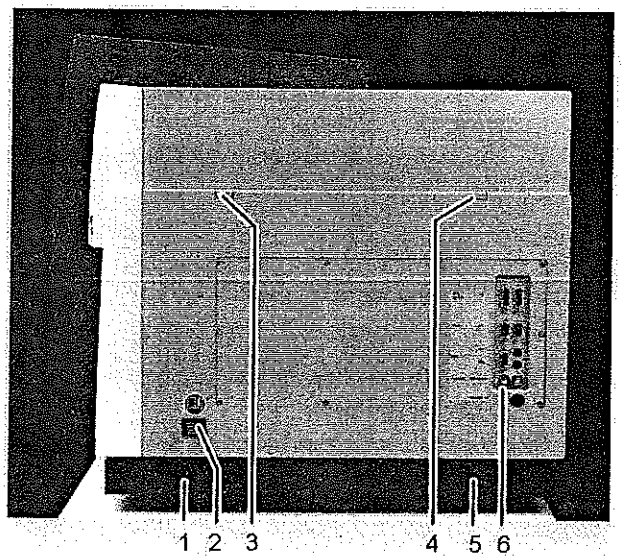
Any unauthorized interference limits warranty entitlements. When installing and starting up your machine, please observe the safety instructions in Section "Basic information" p. 5.

6.1 Supply and control connections

The supply lines are connected during the assembly of the novAA 400 P by service engineers from Analytik Jena AG.

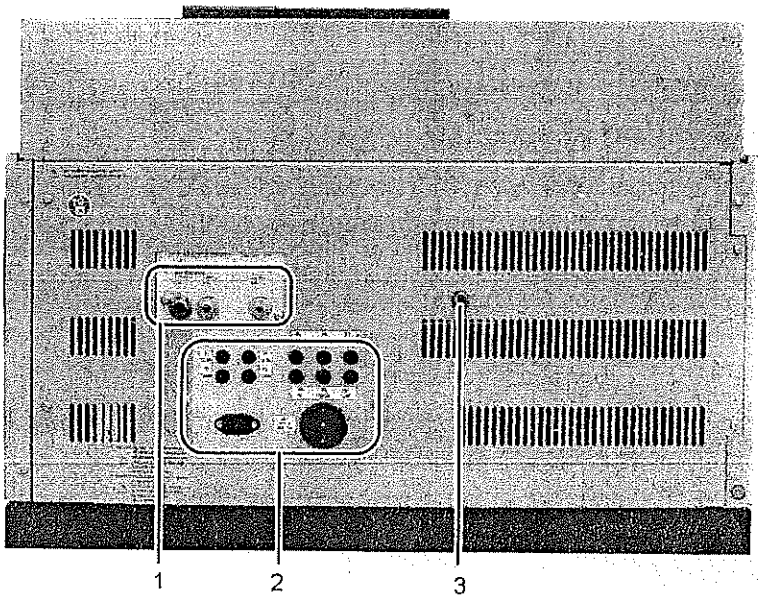
The mains switch is located on the right side of the novAA 400 P. The right side also has easily accessible connections for PC and accessories. The media connections for gas and electricity as well as the fuses are located at the rear.

A pair of carrying rods is fastened to the left and right for transport and assembly. After assembly the bars are unscrewed and the openings sealed with the stoppers supplied.



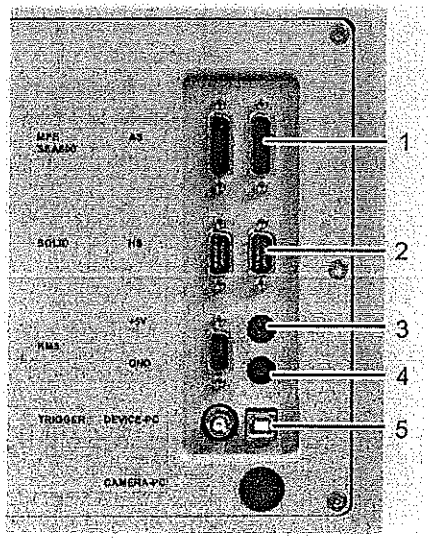
1; 5 Openings for carrying bars
2 Mains switch
3; 4 Clamp for fastening the device cover
6 Connections for PC and accessories

Fig. 16 Mains switch and bar for supply and control connections on the right side of the novAA 400 P



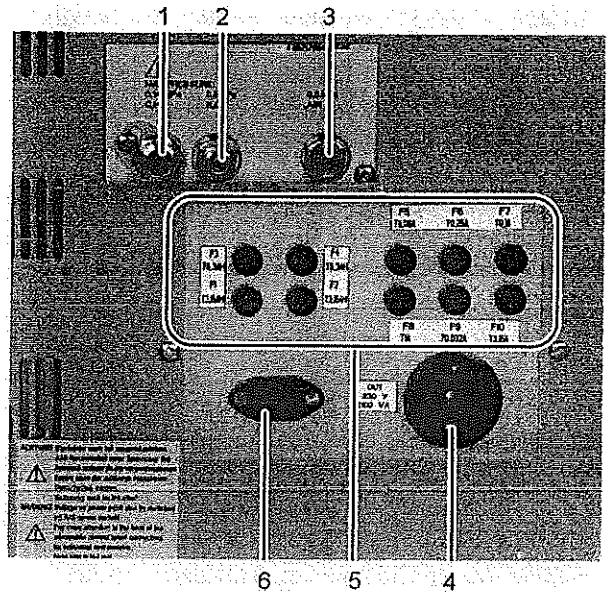
1 Gas supplies
2 Fuses and electrical connections
3 Connection for Air Purge Kit APK

Fig. 17 Connections on the rear side of 400 P



1 Connection autosampler (AS)
2 Connection hydride system (HS)
3 (+5V)
4 (GND)
5 Connection novAA 400 P – PC (DEVICE PC)

Fig. 18 Bar for supply and control connections



1	Connection fuel gas (C_2H_2)	4	Mains connection for accessories (5-way multiple adapter)
2	Connection nitrous oxide (N_2O)	5	Fuses
3	Connection air		

Fig. 19 Rear view of the novAA 400 P with connections for the supply of gas, electricity and water, as well as the fuse holders

6.2 Removing the transport locks

ATTENTION!

Removing the transport locks!

The transport locks must be removed by service engineers from Analytik Jena or technical personnel authorized by Analytik Jena AG.

During the transport on the monochromator, the novAA 400 P and the novAA 400 P Graphite are protected by a transport lock. An additional transport lock is fitted on the insertable graphite tube furnace of the novAA 400 P.

The transport locks must be removed prior to the start-up of the AAS.

Transport lock on the monochromator

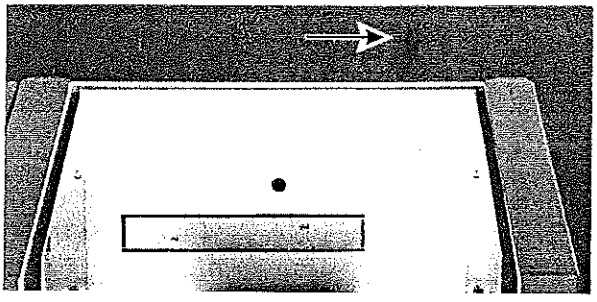


Fig. 20 Transport lock on the novAA 400 P

1. Unscrew and remove the clamps for the device cover on the left and right side walls (3 and 4 in Fig. 16).
2. Remove the device cover.
3. Unscrew the red-marked transport lock (arrow in Fig. 20) from the grid lever.
4. Fit on the cover of the device and fasten the clamps on the left and right side walls.

6.3 Installing the novAA 400 P

CAUTION!

Only service engineers are allowed to install the device!

The device may only be installed by service engineers from Analytik Jena AG or by technical personnel authorized by Analytik Jena AG.

ATTENTION!

Ensure that installation conditions are guaranteed in the new installation area!

See Chapter "Installation conditions" p. 23.

Observe the instructions in Chapter "Safety instructions" p. 8.
Observe work protection regulations. Warnings regarding potential dangers do not replace valid work protection regulations!

Tools

- 4 stoppers, plastic
- 19 mm open-end wrench (included in scope of supply)

1. Unscrew and remove the four handles and keep in a safe place.
2. Seal the openings with stoppers.
3. Install the gas supply:
   - Tighten the acetylene gas connector with a 19 mm open-end wrench. Left hand thread!
   - Fix the argon tube to the screwed tube connection.
   - Fasten the air tube to the screwed tube connection.
   - Fix the nitrous oxide tube to the screwed tube connection.
4. Check the gas connections for leaks.
5. Establish the electrical connection for the novAA 400 P (→ Section "Energy supply" p. 24).
6. Connect the PC and the novAA 400 P with USB cable (5 in Fig. 18).
7. Further work steps:
   - Install ASpect LS software
   - Complete novAA 400 P according to the desired atomization technique

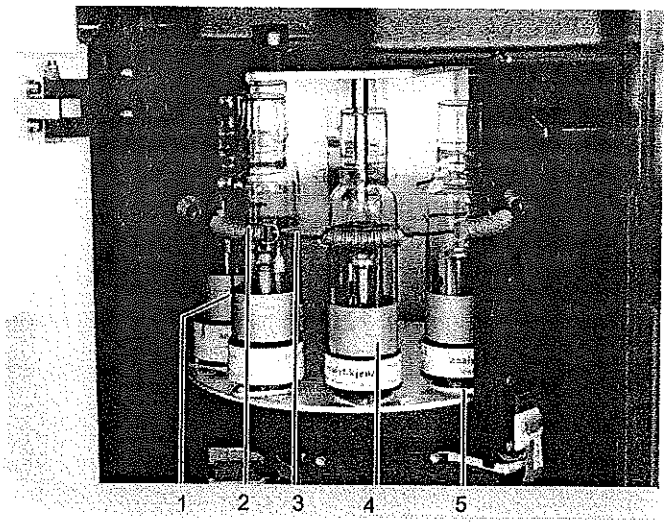
6.4 Installation and start of the ASpect LS program

For the installation and start of the ASpect LS program, which is required for controlling the spectrometer, refer to the Manual "ASpect LS."

6.5 Mounting the 8-lamp turret and lamp adjustment

A 8-lamp turret can be mounted as follows:

- The 8-lamp turret should preferably be mounted with coded hollow cathode lamps.
- The use of uncoded lamps is also possible.
- The positions 5 to 8 can also be mounted with super hollow cathode lamps.



1	Hollow cathode lamp	4	Position of the lamp turret for removal and installation of the HCLs
2	Tension spring		
3	Prism holders for HCL	5	Base plate with lamp sockets

Fig. 21 Setup of the lamp turret

6.5.1 Removing and installing the hollow cathode lamp

CAUTION!

Risk of burning!

Before changing the lamp, switch off the lamp current and allow the lamps to cool down.

VORSICHT

Risk of damage to lamp!

Do not touch the lamp window.
Remove and install lamps only when no current is flowing.

Only use your hand when opening and closing the door to the lamp turret chamber.

1. Open the door to the lamp chamber.
2. Unhook the tension spring.
3. Remove the lamp from the lamp socket. Do not touch the lamp window!
4. Plug the new lamp into the lamp socket, hook the tension spring in again.

6.5.2 Removing and installing the deuterium hollow cathode lamp

CAUTION!

Risk of burning!

Before changing the lamp, switch off the lamp current and allow the lamps to cool down.

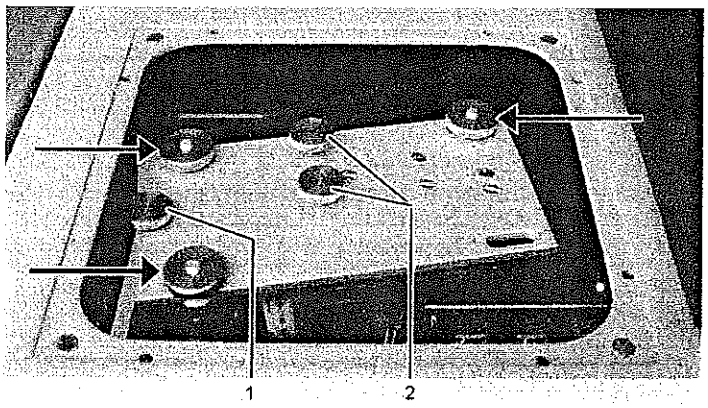
ATTENTION!

Risk of damage to lamp!

Do not touch the lamp window.
Remove and install the lamp only when no current is flowing.

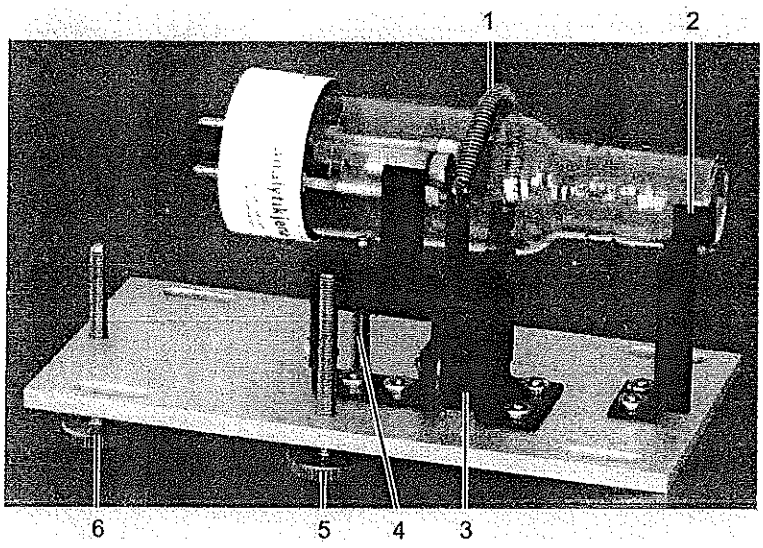
1. Remove the cover plate of the D2HCL holder from the device cover.
2. Unscrew the three fixing nuts (arrows in Fig. 22) and remove the lamp holder.
3. Unscrew the retaining screw (6 in Fig. 23). Pull the lamp socket from the lamp.
4. Carefully pull out the lamp under the tension spring (1 in Fig. 23).
5. Place the new lamp carefully under the tension spring and push it to the stop (2 in Fig. 23).

   Note: Do not touch the lamp window!
6. Put the socket on the lamp. Screw in the retaining screw.
7. Adjust the lamp axis parallel to the mount of the holder (by eye): Change the position of the lamp (4 and 5 in Fig. 23) with the long fine adjusting screws.
8. Fit on the holder and screw on the fixing nuts loosely. They are tightened by hand only after the adjustment.



Arrow Fixing nuts of the lamp holder
1 Retaining screw for the lamp socket
2 Adjusting screws

Fig. 22 D_2-HCL holder installed in the lamp chamber



1	Tension spring	4; 5	Fine adjusting screws
2	Stop	6	Retaining screw for the lamp socket
3	Support		

Fig. 23 D2HCL with the holder removed from the lamp chamber and positioned for lamp change

6.5.3 Setting up the lamp turret in ASpect LS

Coded lamps

If coded lamps are available, the data which is important for the method of analysis and which is saved on the transponder, such as the lamp type, elements, maximum and recommended lamp current as well as maximum and recommended boost current, is read out in the active position during initialization and entered in the table with the assignment to the lamp turret position.

Uncoded lamps

ATTENTION!

Observe the lamp position!

If the hollow cathode lamps are not coded, the lamps must only be mounted according to their entered positions in the turret.

1. Click the  icon to call up the SPECTROMETER window and then go to the CONTROL tab.
2. Use the [LAMP TURRET] button to open the corresponding window.
3. In the table, highlight the lamp turret position that is to be mounted with a lamp or which is to be changed.
4. Use [CHANGE] to open the SELECT LAMP/ELEMENT window.

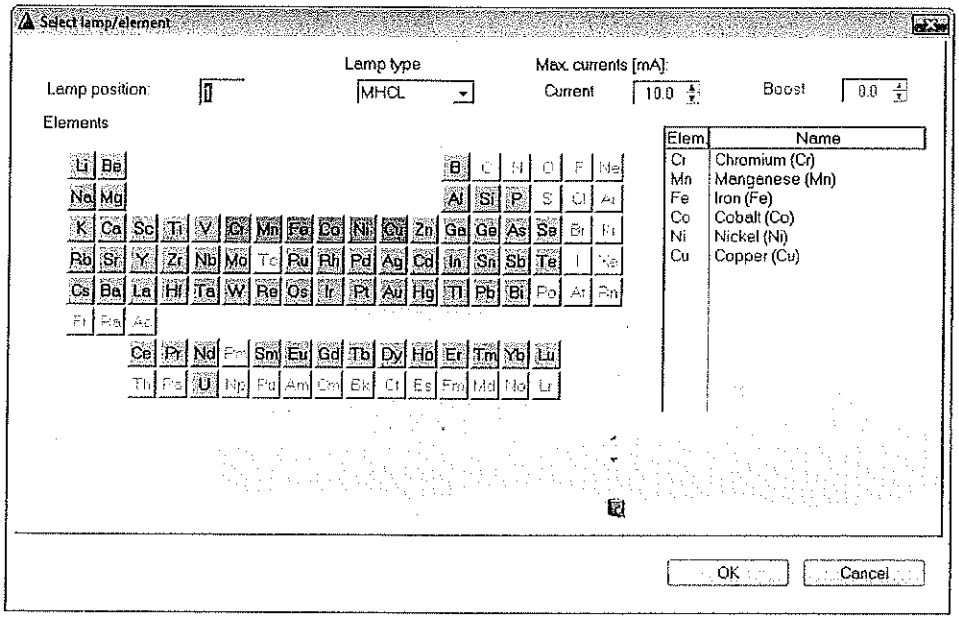


Fig. 24 Select lamp/element window

5. Enter the following values:

LAMP POSITION Shows the position in the lamp turret.
Cannot be edited in this window.

LAMP TYPE For selecting the lamp type. The selection is based on the lamp position and the lamp types available at the position.

S-HCL and S-MHCL are only available at the positions 5 to 8.

NONE The position does not contain a lamp.

HCL Single-element hollow cathode lamp

M-HCL Multi-element hollow cathode lamp

S-HCL Single-element super hollow cathode lamp

S-MHCL Multi-element super hollow cathode lamp

CURRENT For setting the maximum lamp current.

BOOST *Only for S-HCL and S-MHCL*

For setting the maximum boost current.

PERIODIC TABLE Click with the cursor on the element symbol in the periodic table to select the lamp element:

Blue buttons indicate selectable elements. Gray (inactive) buttons indicate elements that cannot be analyzed with the AAS technique. Green buttons indicate selected elements.

For M-HCL and S-MHCL several elements can be selected. Click on the element symbol again to cancel the selection. Selected elements are displayed in the table on the right.

6. Click [OK] to exit the SELECT LAMP/ELEMENT window and return to the LAMP TURRET window.

The lamp specification is entered into the table of the LAMP TURRET window.

6.5.4 Adjusting the lamps

Fine adjusting the lamps is generally required only once after new installation of the lamp.

Maximizing the lifetime of the lamp

The lifetime of the lamp is strongly dependent on the current setting for the lamp. The recommended operating current varies from lamp type to lamp type. For the following adjustment, observe the instructions in the cookbook of the ASpect LS software, the Analytik Jena operating instructions for the various lamps and the information supplied with the lamp.

Adjust line radiator

1. Click the  icon to call up the SPECTROMETER window and then go to the **Control** tab.
2. Use the [LAMP TURRET] button to open the corresponding window.

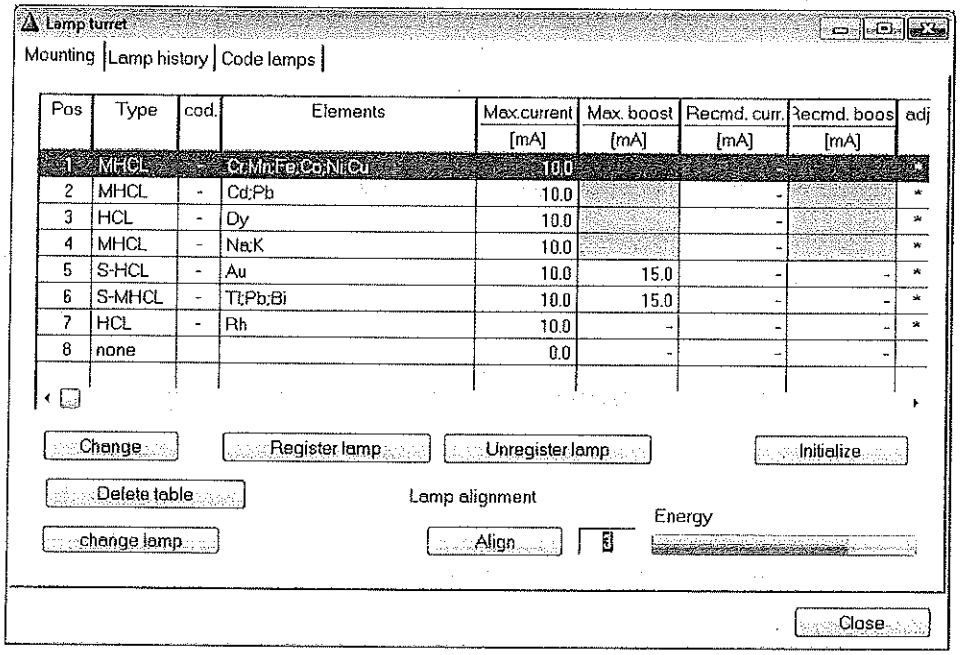


Fig. 25 Lamp turret window

3. Highlight the lamp to be adjusted in the table.
4. Click the [ALIGN] button.

   The lamp is then automatically adjusted relative to a pitch circle. In the Lamp alignment area, the energy is displayed as a **blue** bar during the adjustment.

Adjust deuterium hollow cathode lamp

1. Click on the  icon to call up the SPECTROMETER window and then go to the Control tab.
2. In the BACKGROUND CORRECTION list, select the D2 BACKGROUND ONLY option.
3. Approach the spectrometer parameters using [SET].
4. Go to the ENERGY tab.

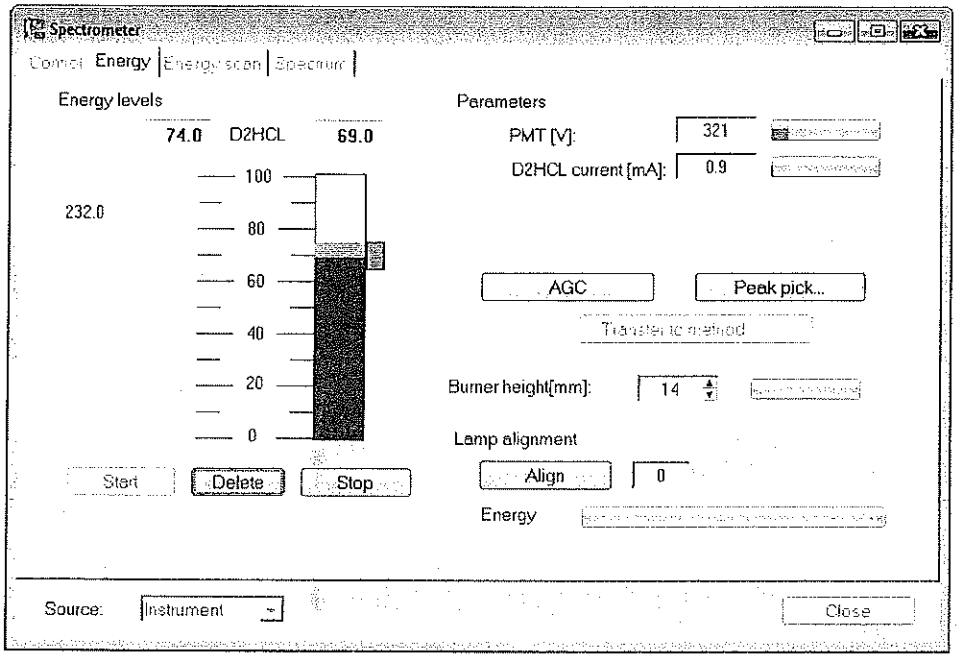
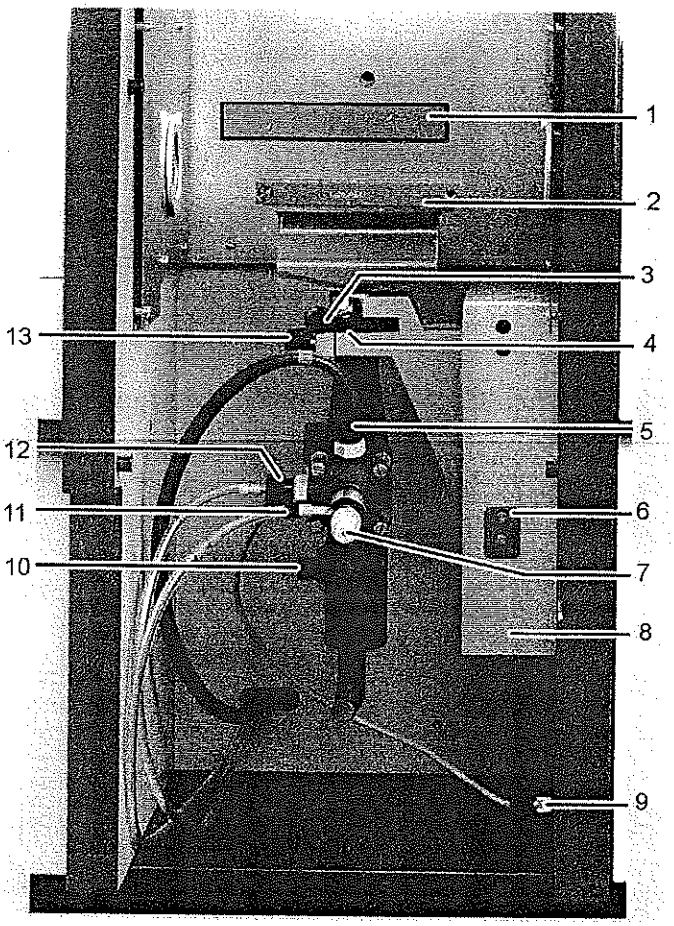


Fig. 26 SPECTROMETER window - ENERGY

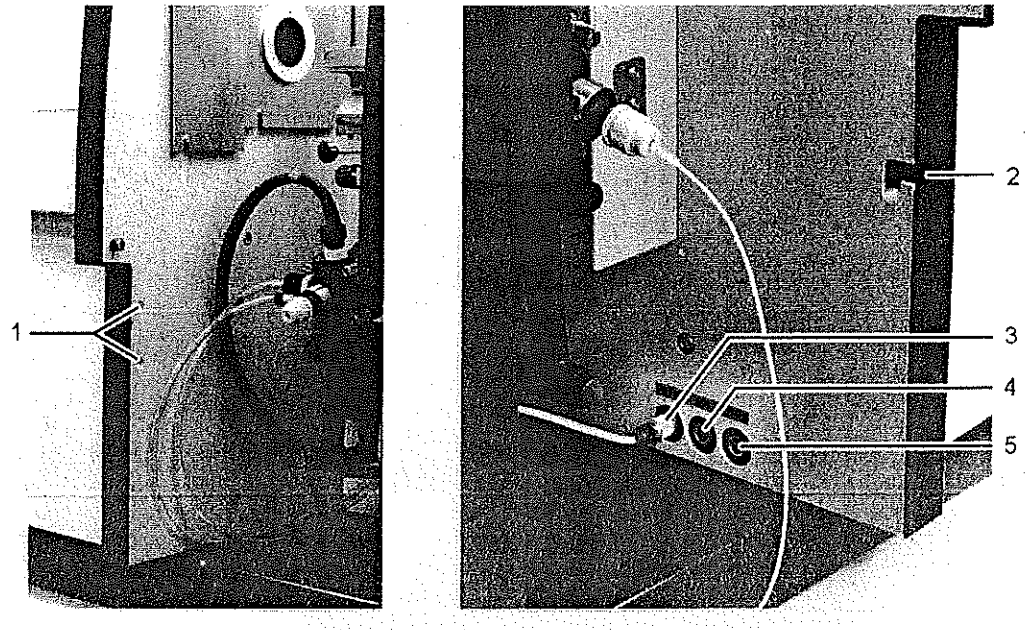
5. With the [AGC] button, equalize the voltage for the photomultiplier PMT and the D2HCL current with the aim of setting the energy level to 65 to 75%.
6. With the [START] button, begin the energy measurement.
7. Set the energy level (red bar) to a maximum value:
   Note: The gray highlighted bars indicate the last maximum to have been reached and can be deleted with the [Delete] button.
   - With focus adjusting: Move the lamp holder slightly by hand in the axial direction, then tighten the locking screws.
   - With axis adjusting: Adjust the fine adjusting screws (2 in Fig. 22 p. 48).
8. Proceed, depending on possible error messages or the D2 current:
   - If an error message indicates too little energy for the D_2-HCL, first check the D2 current. If it is not at 35 mA after the control, enter the value 35 mA and repeat the control using the [AGC] button.
   - If the D2 current is already at 35 mA, increase the BC amplification by one step (steps from 0 to 4) and repeat the control using the [AGC] button.
   - If an error message indicates too much energy for the D_2-HCL (too little energy for the HCL), increase the HC amplification by one step (steps from 0 to 4) and repeat the control using the [AGC] button.

6.6 Connections for flame technique



1	Automatic ignition unit	9	Connecting sockets for siphon sensor, injection switch SFS 6 and scraper
2	Burner	10	Outlet tube from the siphon
3	Stud bolt for fastening the burner	11	Connection for oxidant (tube with two blue markings)
4	Markings for alignment on the mixing chamber tube and the holding fixture	12	Connection for additional oxidant (tube with a blue marking)
5	Connection for fuel gas (tube with red marking)	13	Fixing screw for the holding bow
6	Suspension for SFS 6		
7	Sample liquid supply		
8	Height adjustment		

Fig. 27 Connections to the burner-nebulizer system (BNS) in the sample chamber for the flame technique



1	Suspension AS-F/AS-FD, left	3	Connection for siphon monitoring (SIPH)
2	Suspension AS-F/AS-FD, right	4	Connection for injection switch (SFS)
		5	Connection for scraper (SCRA)6

Fig. 28 Connections on the rotatable height adjusting unit

6.6.1 Software presettings for the flame technique

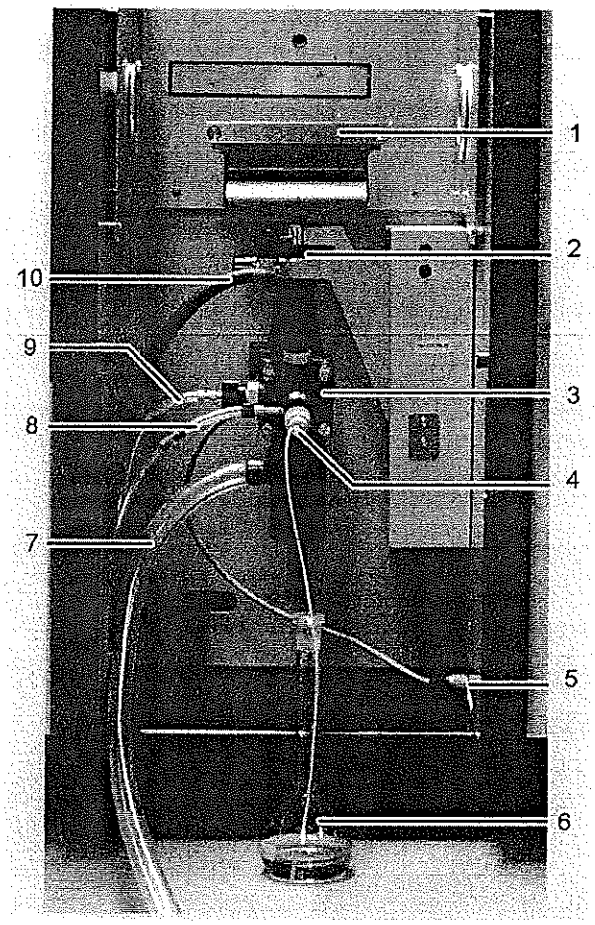
In the start menu of the Aspect LS in the TECHNIQUE group set the FLAME option.

The software interface with the method and device parameters is adjusted accordingly.

6.6.2 Installation for manual sample supply

With manual sample supply the sample is loaded directly to the burner-nebulizer system.

The injection switch SFS 6 can be used.



1	Burner	7	Outlet tube from the siphon
2	Holding fixture for the height adjustment	8	Connection for oxidant (tube with two blue markings)
3	Mixing chamber nebulizer system	9	Connection for additional oxidant (tube with a blue marking)
4	Sample aspiration tube on the nebulizer	10	Connection for fuel gas (tube with a red marking)
5	Siphon sensor connecting cable		
6	Sample cup		

Fig. 29 Flame technique, manual sample supply

CAUTION!

Switch off the novAA 400 P prior to any installation!

The connection or disconnection of electrical plug-in contacts can cause a short circuit, which destroys the device.

1. Attach the mixing chamber nebulizer system without burner to the holding fixture for the height adjustment.
   The marking on the mixing chamber tube must be positioned above the edge of the holding fixture (2 Fig. 29 p. 55).
2. Put the collection tray under the burner-nebulizer system.

3. Lead the outlet tube from the connector of the siphon through the opening in the tray and attach it on the connector or the corresponding opening in the lid of the receiving bottle.

   Note: Position the outlet tube at a constant incline. If necessary shorten the tube. Tube must not dip in the liquid.

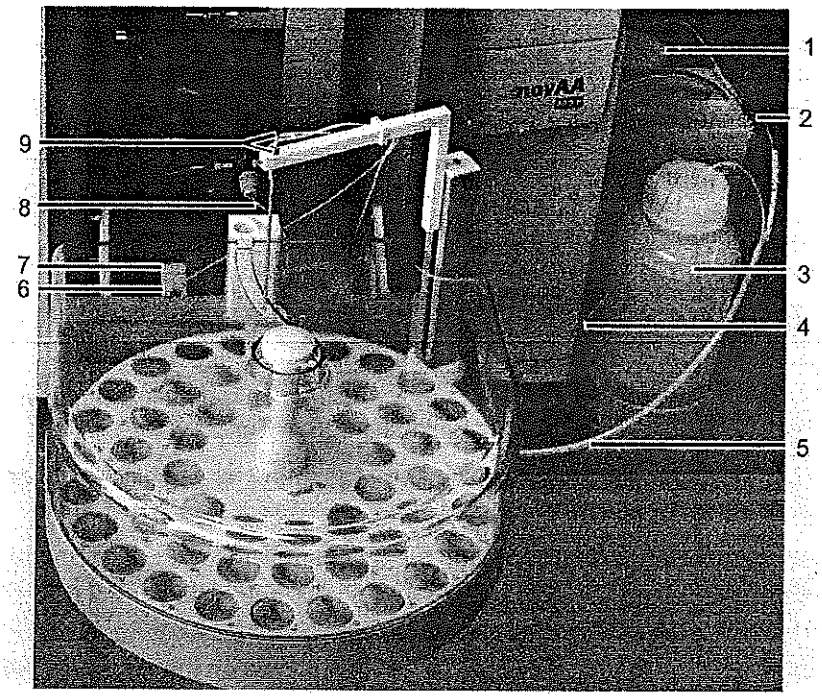
4. Fill the siphon with water via the mixing chamber tube until water flows out via the outlet tube.
5. Connect the the siphon sensor plug with the connector on the right side of the sample compartment (3 in Fig. 28 p. 53).
6. Connecting the gas supply:
   - Connect fuel gas (tube with red marking) (10 in Fig. 29 p. 55)
   - Connect oxidant (tube with 2 blue markings) (8 in Fig. 29 p. 55)
   - Connect additional oxidant (tube with 1 blue marking) (9 in Fig. 29 p. 55)
7. Attach the required burner (50 mm or 100 mm depending on the measurement task) on the mixing chamber tube, turn to the stop position and clamp. Ensure that the burner is positioned correctly.
8. Injection module SFS 6
   If you are working with injection module SFS 6, install injection module SFS 6 (see section "Installing the injection module SFS 6" p. 60).
9. Place the sample and wash cups in front of the device.
10. Attach the aspiration tube to the nebulizer canula.
11. Hang the safety glass in and slide it in front of the burner.
12. Switch on the novAA 400 P and start the software.

Work steps: Uninstall

1. Switch off the novAA 400 P.
2. If you worked with injection module SFS 6, put injection module SFS 6 out of operation (see section "Installing the injection module SFS 6" p. 60).
3. Remove the sample and wash cups from the tray.

6.6.3 Installation for continuous working mode / sample supply by autosampler

In continuous working mode, the samples are loaded via the autosampler AS-F or AS-FD.



1	Storage bottle for diluent	6	Tube from autosampler arm to the SFS 6
2	Fluidik module with dosing unit	7	Injection module SFS 6 (where applicable)
3	Storage bottle for washing liquid	8	Sample intake tube
4	Tube for washing liquid to the SFS 6	9	Tube for diluent (thick canula) and sample intake tube (thin canula)
5	Encased tubes for washing liquid and diluent		

Fig. 30 Flame mode, continuous with autosamplers AS-FD and SFS 6

Installing the burner/nebulizer system

1. Switch off the novAA 400 P.
2. Attach the mixing chamber nebulizer system without burner to the holding fixture for the height adjustment.
   The mixing chamber must be aligned to the height adjustment, the marking on the connector must be above the edge of the holding fixture (2 Fig. 29 p. 55).
3. Slide the collection tray under the burner/nebulizer system in the sample chamber.
4. Plug the outlet tube from the connector of the siphon to the connector or the corresponding opening in the lid of the collection bottle.

   Note:
   Position the outlet tube at a constant incline. If necessary shorten the tube. Tube must not dip in the liquid.
5. Fill the siphon with water via the mixing chamber tube until water flows out via the outlet tube.
6. Plug the connector of the siphon sensor to the connection on the right sample chamber wall (3 in Fig. 28 p. 53).
7. Connecting the gas supply:

- Connect fuel gas (tube with red marking) (10 in Fig. 29 p. 55)
- Connect oxidant (tube with 2 blue markings) (8 in Fig. 29 p. 55)
- Connect additional oxidant (tube with 1 blue marking) (9 in Fig. 29 p. 55)

8. Attach the required burner (50 mm or 100 mm depending on the measurement task) on the connector, turn to the stop position and clamp. Ensure that the burner is positioned correctly.

Installing the injection module

If you are working with injection module SFS 6, install injection module SFS 6 (see section "Installing the injection module SFS 6" p. 60).

Installing the autosampler

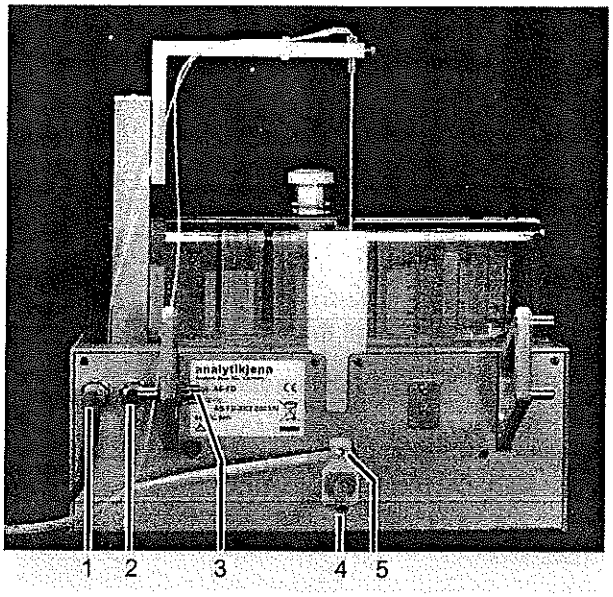
1. Hang the autosampler in the corresponding supports of the sample chamber (Fig. 28 p. 54). Adjust the adjusting screw at the right suspension mount in such a way that the autosampler cannot slip out of the mounting hole (3 in Fig. 31 p. 59).
2. Place the Fluidik module (for AS-FD) or storage bottle for washing liquid (for AS-F) next to the AAS device.
3. Plug the control cables for connecting the autosampler to the Fluidik module and the AAS device into the connections on the rear of the autosampler and lock them in place (1 and 2 in Fig. 31 p. 59).
4. Plug the control cable into "Sampler flame" connection on the right-hand wall of the novAA 400 P (1 in Fig. 18 p. 44) and lock it in place.
5. Attach the outlet tube to the outlet connector of the autosampler (backplate, 4 in Fig. 31 p. 59). Attach the outlet tube to the connector or the corresponding opening in the lid of the collection bottle.

   Note: Position the outlet tube at a constant incline. If necessary shorten the tube. Tube must not dip in the liquid.
6. Screw the tube for the washing liquid to the rear of the autosampler (5 in Fig. 31 p. 59).

   Note: In the AS-FD the tubes for connecting the autosampler and the Fluidik module are attached to each other by encasing and are numbered. The tubes are attached to the rear of the autosampler using the attachment lug. Marking Wash tube "2".
7. In the AS-FD feed the dosing tube for the diluent (marking "1") through the tube guide at the autosampler arm and plug it onto the thicker canula of the autosampler arm.

   Note: The autosampler arm can be moved manually when switched off.
8. Attach the sample intake tube to the nebulizer.
9. Plug the sample intake tube through the tube guide at the autosampler arm onto the thin canula of the autosampler arm.
10. Place the sample tray onto the autosampler housing, make sure it latches.

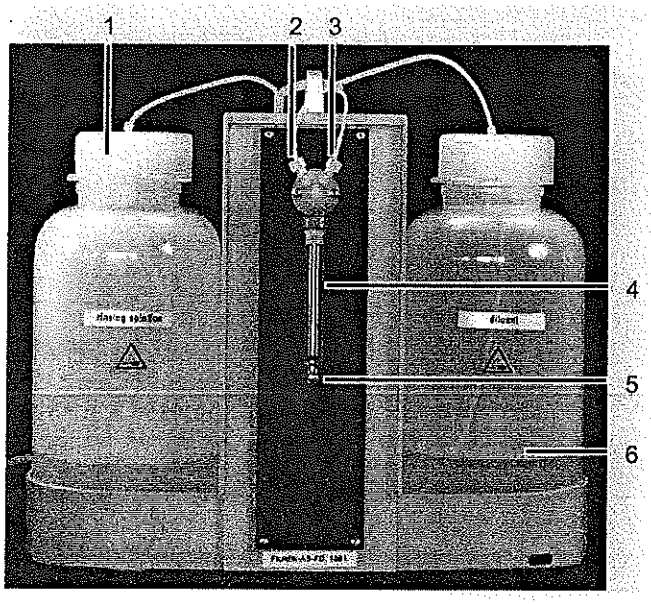
    Note: The controller does not start the autosampler or stops automatically if no sample tray has been placed.
11. Place the sample cover until it sits in the guide rail.



1 Fluidik module connection
2 AAS connection
3 Suspension mount with adjusting screw
4 Connector for outlet tube
5 Screw for wash tube

Fig. 31 Rear of the autosampler AS-FD

Preparing the Fluidik module (for AS-FD)



1 Storage bottle for washing liquid
2 Diluent connection
3 Dosing tube connection (to AS-FD)
4 Dosing syringe, consisting of piston and glass cylinder
5 Dosing syringe with attachment screw
6 Storage bottle for diluent

Fig. 32 Dosing unit at the Fluidik module of the AS-FD

12. If necessary, fit the dosing syringe to the dosing unit (see section "Replacing the dosing device" p. 78).
13. Place the storage bottles for the wash liquid (left) and diluent (right) into the bottle holders of the Fluidik module.
14. Immerse the short tube (marking at the tube "3") into the storage bottle for the diluent. Screw the second tube end to the valve (2 in Fig. 32 p. 59).
15. Screw the dosing tube for the diluent (encased, marking "1") to the second connection of the valve (3 in Fig. 32 p. 59).
16. Immerse the hose for the wash liquid (marking "2") into the storage bottle.

Work steps for Uninstalling

1. Switch off the novAA 400 P.

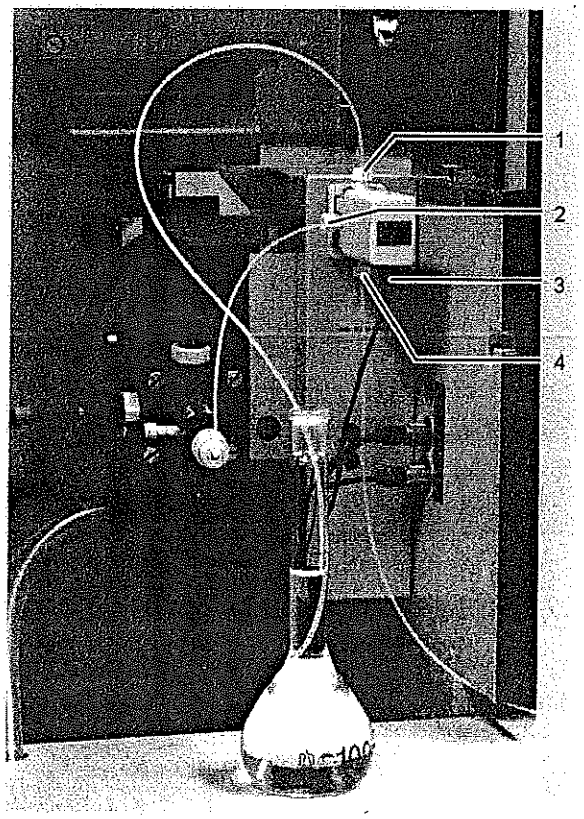
Uninstalling the autosampler

2. Detach the sample intake tube from the thin canula of the autosampler arm.
3. Detach the tube for the wash liquid at the rear of the autosampler.
4. For the AS-FD detach the dosing tube for the diluent from the thicker canula. Pull the two encased tubes out of the attachment lug at the rear of the autosampler.
5. Pull the outlet tube from the connector of the autosampler (backplate).
6. Detach both control cables at the rear of the autosampler.
7. Take the autosampler out of the sample chamber.

Uninstalling the injection module

If the injection module SFS 6 was used during operation, decommission the injection module SFS 6 (→Section "Installing the injection module SFS 6" p. 60).

6.6.4 Installing the injection module SFS 6



1	Tube connecting to sample/autosampler	3	Communication cable to controller
2	Tube connecting to nebulizer	4	Tube connecting to rinsing solution

Fig. 33 SFS 6 installed at the AAS for manual sample delivery

1. Screw aspiration tubes into free ports of the injection module as follows:

- medium-long tube into upper port – to sample or autosampler
- short tube into sidewayse port – to nebulizer
- long tube into lower port – to rinsing solution

2. *Manual operation mode:* Hinge injection module into its designated suspension points at the front of the vertical adjustment mechanism.
   Working with an autosampler: Hang injection module into position at the right holder of the autosampler.
3. Plug control cable into the lower two-pole jack terminal at the height adjustment and screw it firmly on.
4. Mount short tube piece onto the nebulizer needle.
5. Dip tube for rinsing solution (long tube) into the storage bottle for rinsing solution.
6. Dip sample tube (tube of medium length) into the sample container or connect with the aspiration needle of the autosampler.

Shutting the SF 6 injection module down

1. Remove the intake tubes out from the washing liquid bottle and the sample cup (for manual operation), or pull them off the intake canula of the autosampler, allowing the system to drain.
2. Pull off the short piece of tube from the nebulizer canula.
3. Detach the control cable of the SFS 6 from the AAS, remove the injection module.

6.6.5 Installing the scraper at a later stage

When working with the nitrous oxide flame it is recommended to use a scraper. Alternatively, carbon deposits can be manually removed from the burner slot with the scraper. The scraper is delivered ready installed on the 50 mm burner upon request. It can also be retrofitted to a 50 mm burner.

ATTENTION!

For combustion gas flows > 250 NL/h pay attention to stubborn deposits. Remove these where necessary to ensure the functionality of the scraper.

The scraper is delivered ready installed on the 50 mm burner by the manufacturer upon request. It can also be retrofitted on a 50 mm burner.

1. Unscrew the screws from the front burner jaw (arrow in Fig. 34) (the screw for fastening the burner on the mixing chamber tube is also located on the side of the front burner jaw).
2. Unscrew the fastening rail (1 in Fig. 35) with knurled head screws (2 in Fig. 35) from the scraper.
   The captive knurled head screws remain attached in their holder in the scraper.
3. Mount the fastening rail on the burner body. Use the long titan screws and nuts. Place the screws through the front burner jaw and screw down the fastening rail with nuts.
4. Attach the scraper to the guide pins of the fastening rail (2 in Fig. 35) and tighten with knurled head screws (3 in Fig. 35).

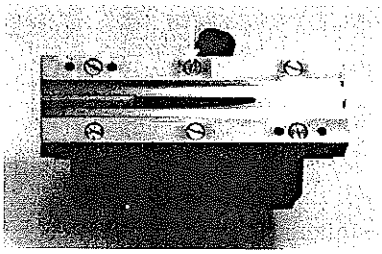
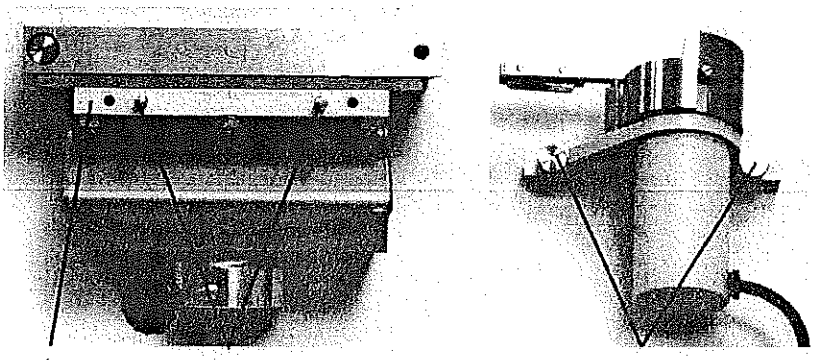


Fig. 34 Screws on the front burner jaw



1 Fastening rail for the scraper
2 Guide pins
3 Knurled head screws

Fig. 35 Fastening rail mounted on burner / knurled head screws on the scraper

6.6.6 Replacing the burner

CAUTION!

Risk of burning!

To remove the hot burner, use the burner bracket (optional accessory). Otherwise wait until the burner has cooled down.

1. Push the sample chamber door upwards.
2. Loosen the fixing screw of the burner and take the burner off. Use the burner bracket if available.
3. Place the new burner on the the mixing chamber tube, turn against the 0° stop and fasten with the fixing screw.

6.6.7 Operation of the HPT burner head

CAUTION!

The HPT burner head can only be used for the air-acetylene flame up to a fuel gas – air ratio of 0.16.

1. Insert the quartz tube in the holder.
   Make sure that the pin in the left V bearing is positioned in the existing groove on the

face side of the quartz tube. This ensures that the quartz tube slits are aligned to the burner slit.

2. Set the HPT burner head on the mixing chamber tube and clamp.
3. Set a burner height of 12 mm or more for flame ignition and operation.
4. To ignite the flame, tilt the holder with quartz tube forwards. As soon as the flame has ignited, already fold back the holder during the active ignition process.

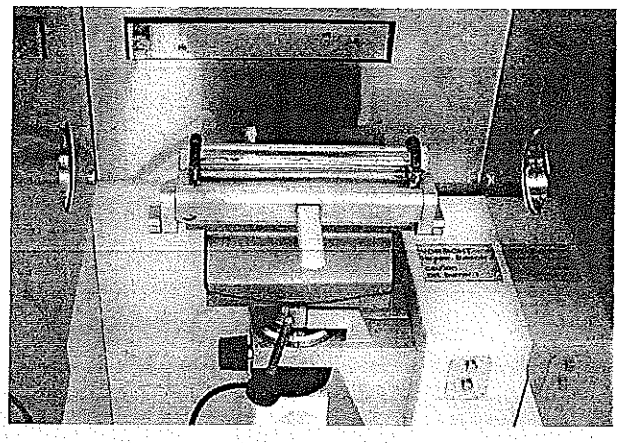


Fig. 36 HPT burner head mounted on the mixing chamber

6.7 Operating the Air Purge Kit APK

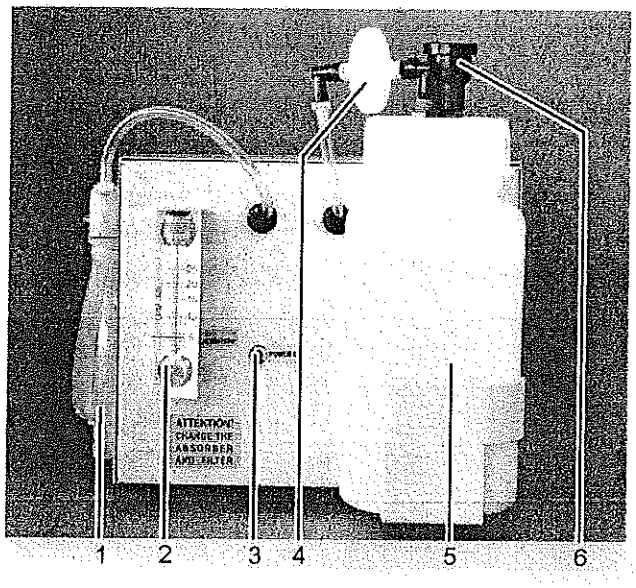
Only the air connection connects the APK to the rear side of the novAA 400 P. Purging with cleaned and dry air shall prevent dust and aggressive vapors in the laboratory atmosphere from entering the spectrometer and damaging the optical components.

1. Connect the air tube to the blue gas inlet (3 in Fig. 17 p. 44) in the middle of the rear side of the novAA 400 P.
2. Connect the other end of the air tube to the "Air outlet" connection of the APK.
3. Switch on the APK at the power switch.

ATTENTION!

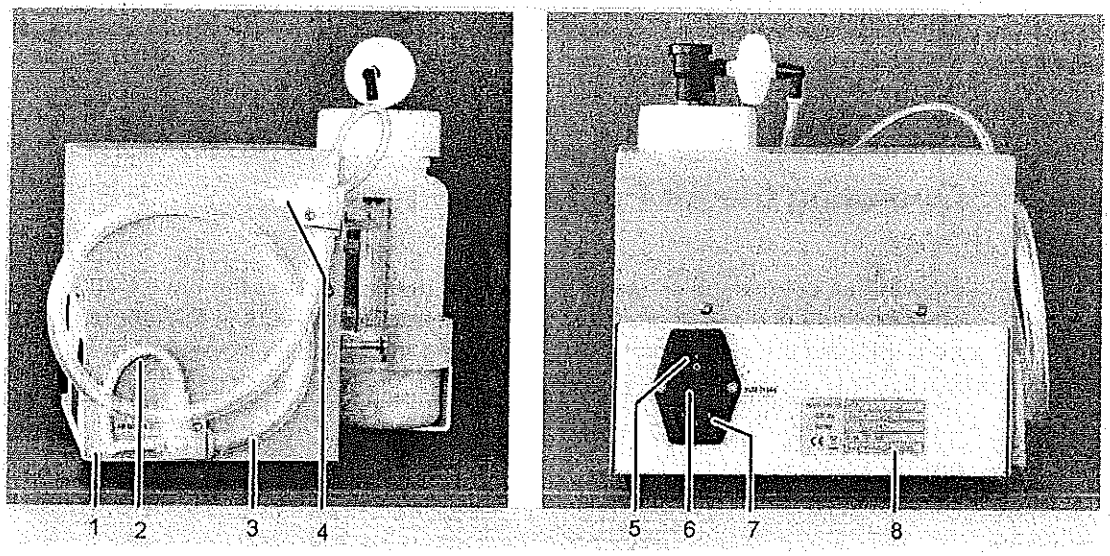
It is recommended to operate the APK without interruptions to ensure the protection of the spectrometer when purging it with cleaned air.

The filter system must be exchanged regularly to ensure the filter function during air-purges (see "Servicing the Air Purge Kit APK" p. 80).



1 Membrane dryer
2 Rotameter
3 "Power on" LED
4 Dust filter
5 Wide mouth bottle with marble granulate
6 Air inlet filter

Fig. 37 Air Purge Kit APK, connections and filter system to the front



1 "Air outlet"
2 Hose bridge for supplying the membrane dryer with dried air
3 Membrane dryer
4 Air outlet of the membrane dryer
5 Mains switch
6 Fuse holder
7 Mains connection
8 Type plate

Fig. 38 APK, membrane dryer and mains connection to the side and on the back

6.8 Starting up the novAA 400 P with accessories

6.8.1 Switching on sequence, daily work commencement

1. Switch on the PC and wait for the computer program to initialize: The application icons appear on the screen, including the ASpect LS program icon.
2. Switch on the novAA 400 P: Press the green ON/OFF switch on the right side wall.
3. Start the ASpect LS program: Double-click with the mouse cursor on the ASpect LS icon.

4. Connect the printer and the compressor if they are needed.

The AAS system is now switched on, work (analysis preparation and measurement) may begin.

IMPORTANT

The mobile cooling unit KM5 is controlled by the novAA 400 P and is therefore not switched on manually.

6.8.2 Switching off sequence

1. On the PC close the application program Aspect LS: Click the FILE / CLOSE menu options.
2. For unsaved values decide whether unsaved data/information should be saved before exiting the program.
3. Shut down the PC.
4. Use the respective mains switches to switch off (in this order):
   - PC
   - AAS
   - Printer
   - Compressor

The AAS system is now switched off.

7 Care and maintenance

CAUTION!

Observe the safety instructions!

The operator may not undertake any service or maintenance work to this device and its components other than those specified and described in this chapter.

Only service engineers from Analytik Jena AG or other technical personnel authorized by Analytik Jena AG may carry out repairs to the novAA 400 P.

Please observe all guidelines, norms and safety instructions when undertaking any maintenance work as specified in Section "Safety instructions" p. 8. To guarantee perfect and safe functioning, the novAA 400 P should be inspected on an annual basis by service engineers from Analytik Jena AG.

Only use replacement parts from Analytik Jena AG. Parts required for routine operation can be ordered from Analytik Jena AG.

CAUTION!

The novAA 400 P must be switched off before carrying out any service work and the mains plug must be disconnected. The safe disconnection of the novAA 400 P from the mains can only be achieved by pulling out the mains plug. Power is still supplied to both certain areas of the spectrometer, as well as the output socket, after the device has been switched off at the main switch.

7.1 Maintenance overview

Maintenance item	Action	Frequency
Base device		
Fuse	Change the fuse	When required
Sample chamber	Clean sublimated substances (residues)	Regularly
	Remove residual liquid from the tray	If there are residues in the tray
	Clean the windows for beam entry and -exit in the sample chamber	On visual inspection: Streaks, burnt-in residues When energy losses arise
Autosampler AS-F and AS-FD		
Dosing tube/ canulas	Check for freedom from deposits, kinks and cracks.	Check regularly since sediments can falsify the measurement results
Wash cup, mixing cup	Clean	Regularly

Maintenance item	Action	Frequency
Gas connectors		
	Check for leaks	When connections are newly connected and when a clear pressure loss is detected by the manometer
Burner-nebulizer system		
	Dismantle and clean	Depending on the analyzed sample material (medical samples or samples with a high salt content)
Piston compressor JUN-AIR 6/S		
Air container	Drain off the conden-sation water under pressure	Monthly
Pressure reducer filter	Drain off the conden-sation water	Monthly
Air Purge Kit APK		
Filter system	Change	When the gas flow wenn der Gasfluss unter 5 L/min sinkt
Drying hose	Change	When the surface has been contaminated with particles or condensate
Fuses	Change fuses	When required

Table 5 Maintenance overview

7.2 Base device

7.2.1 Replacing the fuses

CAUTION!

Switch off the novAA 400 P before replacing fuses!

The fuses of the novAA 400 P are to be found on the rear side of the device. They are marked.

Fuses on the rear (see Fig. 19)

Fuse number	Type	Protected circuit
F1	T 3.15 A/H	Transformer, primary side, SNT
F2	T 3.15 A/H	Transformer, primary side, SNT
F3	T 6.3 A/H	Socket for external accessories
F4	T 6.3 A/H	Socket for external accessories
F5	T 0.08 A	D2-HCL
F6	T 0.25 A	HCLs
F7	T 0.08 A	Boost current
F8	T 1 A	Heating for boost current

Fuse number	Type	Protected circuit
F9	T 0.032 A	Analog
F10	T 3.15 A	Filament

Table 6 Fuses on the rear side of novAA 400 P

7.2.2 Cleaning the sample chamber

1. Clean the sample chamber regularly using a lint-free cloth moistened with alcohol.
2. If there are liquid residues in the tray under the mixing chamber nebulizer system, e.g., from the siphon outlet, remove, empty and then wipe out the sample chamber tray with a dry cloth.
3. Check the radiation entrance and exit windows of the sample chambers, if energy losses are detected.
   Wipe the windows free of streaks with a lint-free cloth soaked in alcohol (optical cloth).

7.3 Burner-nebulizer system

The burner-nebulizer system must be cleaned at regular intervals, which can be seen from the following indications:

- ❑ Irregularities in the flame hem of the burner flame. Washing with diluted acid in the active program and blowing the burner out does not bring about any improvement.
- ❑ The sensitivity given in the cookbook for an individual element is not achieved despite changing the composition of the gas.
- ❑ Build-up on the burner slit, which occurs during analysis of solutions with a high salt content, cannot be removed with the cleaning stick.

CAUTION!

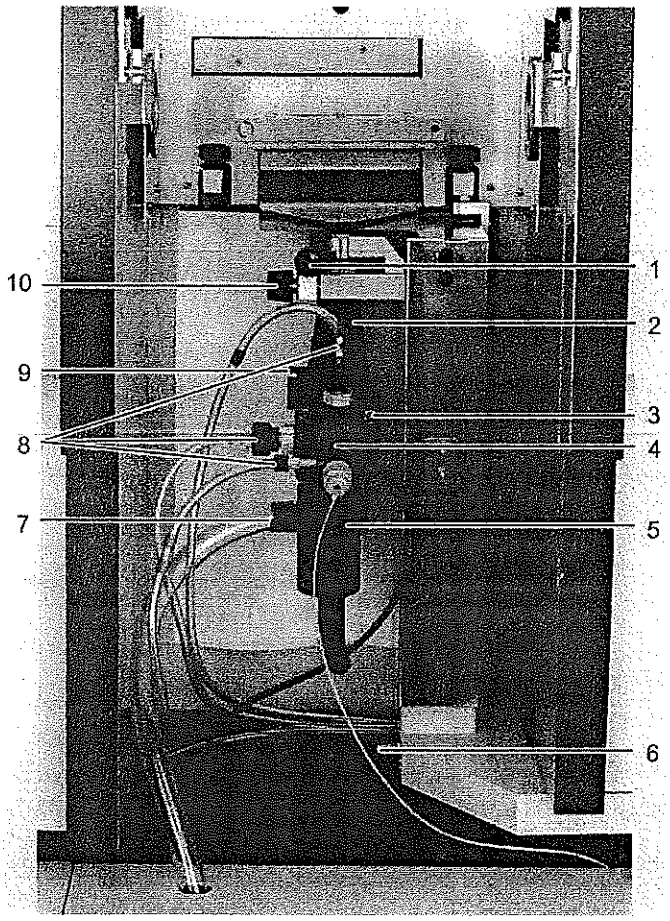
Risk of burning!

Allow the burner to cool down before attempting any service or maintenance work.

Undertake the following maintenance work to the burner-nebulizer system:

1. Take the burner-nebulizer system apart.
2. Clean the burner.
3. Clean the nebulizer.
4. Clean the siphon.
5. Clean the mixing chamber.
6. Assemble the burner-nebulizer system.
7. Adjust the sensitivity of the burner-nebulizer system (optimize flame).

7.3.1 Taking the burner-nebulizer system apart



1	Stud bolt on the burner	7	Connector for outlet tube from the siphon
2	Mixing chamber tube	8	Screwed tube connections on the mixing chamber head and the nebulizer
3	Mixing chamber screw joints (4 x)	9	Safety plug
4	Locking ring for nebulizer	10	Knurled head screw on the holding bow
5	Fixing screw for siphon		
6	Connection of siphon sensor		

Fig. 39 Removing and taking apart the burner-nebulizer system

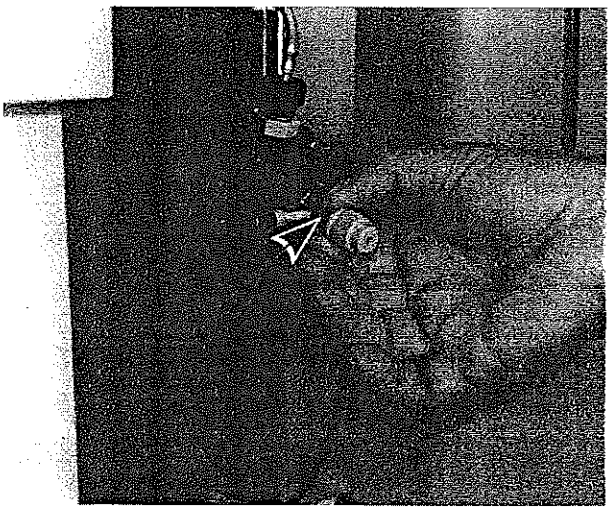
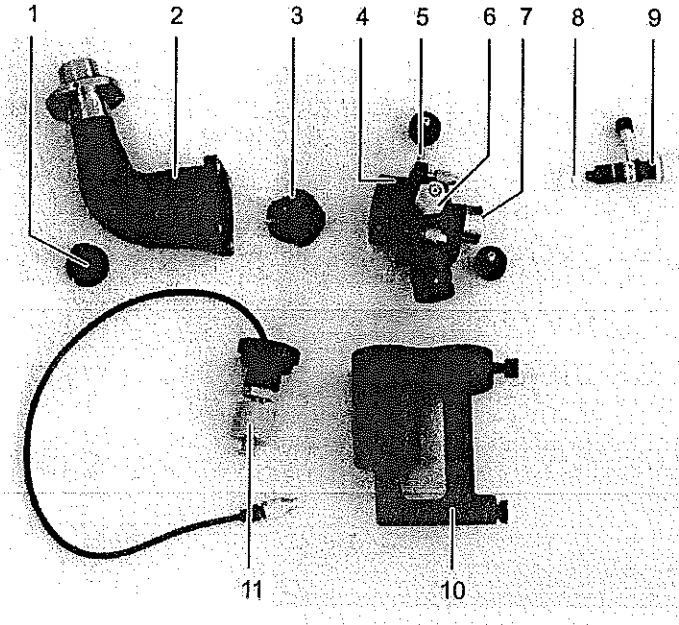


Fig. 40 Withdrawing the nebulizer from the mixing chamber



1	Safety plug	7	Nebulizer connection with locking ring
2	Mixing chamber tube	8	Impact bead
3	Impeller	9	Nebulizer with connection for oxidant and connection for sample tube
4	Mixing chamber head with connections for gases, nebulizer and siphon	10	Siphon
5	Connection for fuel gas	11	Siphon sensor
6	Connection for additional oxidant		

Fig. 41 Mixing chamber and nebulizer disassembled

1. Loosen the stud bolt (1 in Fig. 39 p. 69) on the burner and remove the burner from the connector.
2. Unscrew the screwed tube connections on the mixing chamber head and the nebulizer (8 in Fig. 39) and pull off the tube from the nebulizer connector.
3. Turn the locking ring of the nebulizer (4 in Fig. 39) to open the locking. Withdraw the nebulizer from the mixing chamber head, holding the nebulizer in the groove (Fig. 40).
   Attention:
   Connector for gas connection may break when being pulled.
4. Unscrew the connection of the siphon sensor (6 in Fig. 39) on the rotating arm and pull it off.
5. Pull off the outlet tube from the outlet connector of the siphon (7 in Fig. 39).
6. Loosen the knurled head screw of the siphon (5 in Fig. 39) and pull the siphon down.
7. Empty the siphon.
   Caution! The solution in the siphon is acidic.
8. Unscrew the insert of the siphon sensor, remove the sensor from the siphon (11 in Fig. 41 p. 70).
9. Hold the system tightly, loosen the knurled head screw on the holding bow of the mixing chamber tube (10 in Fig. 39), rotate the holding bow backwards and remove the system.
10. Withdraw the safety plug (1 in Fig. 41) from the mixing chamber.
11. Loosen the four screw joints of the mixing chamber (3 in Fig. 39) and disassemble the mixing chamber into the chamber head and the chamber tube.
12. Remove the impeller (3 in Fig. 41) from the chamber tube.

13. Unscrew the gas connections for fuel gas and additional oxidant.

7.3.2 Cleaning the burner

1. Clean the burner under running water.
2. Clean the burner with burner jaws downwards in an ultrasonic bath for 5 to 10 min with 0.1% HNO3.

Work steps for particularly stubborn residue build-up

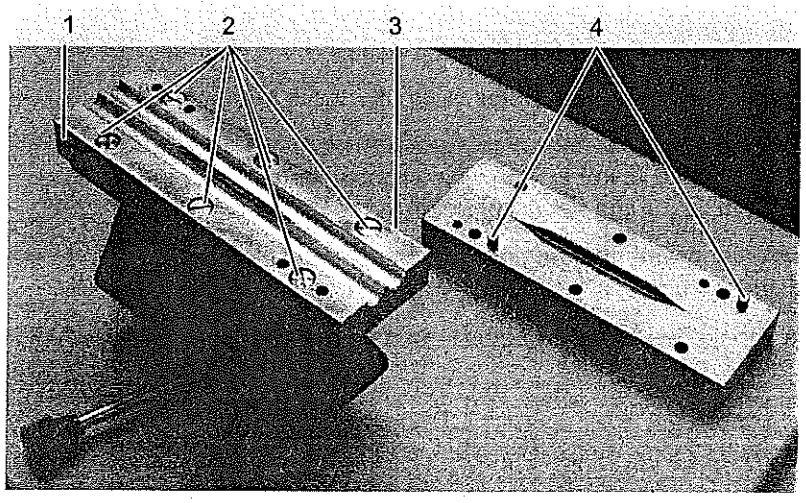
1. Undo the fittings (2 in Fig.42) of the burner jaws on the burner body and remove the burner jaws.
2. Undo the fittings of the burner jaws against each other (1 and 3 in Fig.42).
3. Remove the burnt residue build-up with the burner cleaner (timber wedge).
4. Clean the burner jaws in 0.1 N HNO_3, and then wash with distilled water.
5. Screw the burner jaws together, making sure that the ends of the spacers on the burner slit extension and the end faces are flush.

   Caution: The spacers must not protrude over the upper side of the burner jaws (arrow in Fig.44)! When using a scraper, it remains attached.
6. Screw the burner jaws onto the burner body, the dowel pins (4 in Fig.42) on the burner ensure correct positioning.

ATTENTION!

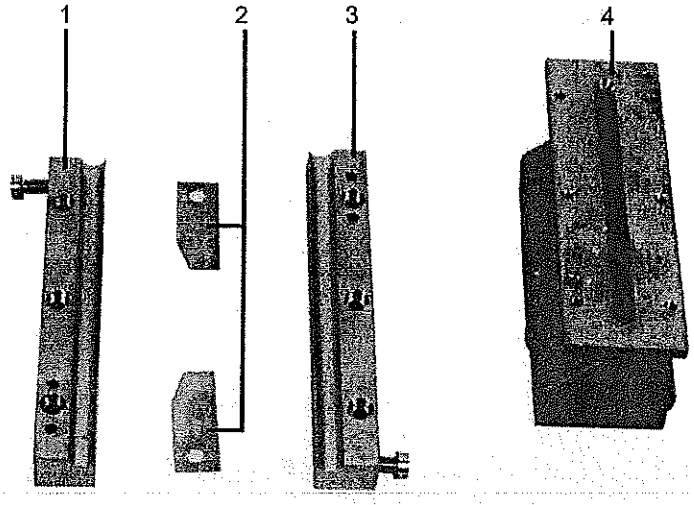
Using the scraper!

When the spacers protrude over the upper side of the burner jaws, the scraper can get caught and burn!



1;3 Burner jaw fittings against each other
2 Fittings of the burner jaws with the burner body
4 Dowel pins on the underside of the burner jaws

Fig.42 Fittings of the burner



1 Burner jaw
2 Spacers
3 Burner jaw
4 Burner body

Fig. 43 Burner, disassembled

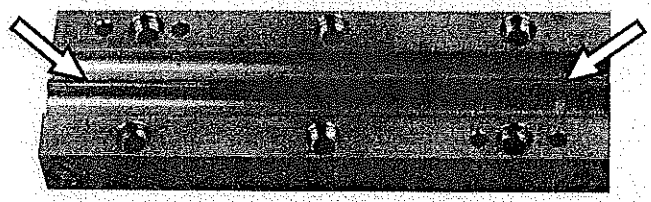


Fig.44 Spacers inserted in burner jaws

7.3.3 Cleaning the nebulizer

1. Put the nebulizer for several minutes in an ultrasonic bath with approx. 1% nitric acid or organic solvent (isopropanol).
2. Turn the impact bead (8 in Fig. 41 p. 70) slightly and pull it off the nebulizer. Should the impact bead stuck; put the nebulizer again in the ultrasonic bath.
3. Insert the cleaning wire into the nebulizer canula and clean the canula by moving it up and down several times.
4. Attach the impact bead on the nebulizer and lock it by turning slightly.

7.3.4 Cleaning the mixing chamber

Mixing chamber – chamber tube and chamber head:

1. Clean with saltpeter, diluted mineral acid, or the appropriate solvent according to the substances analyzed.

2. If the mixing chamber is cleaned with a diluted mineral acid, wash thoroughly with distilled water after cleaning.

7.3.5 Cleaning the siphon

Work steps

1. Clean with saltpeter, diluted mineral acid, or the appropriate solvent according to the substances analyzed. Clean the channels with a round brush.
2. If the siphon is cleaned with a diluted mineral acid, wash thoroughly with distilled water after cleaning.
3. Wash the float holder.

7.3.6 Assembling the burner-nebulizer system

CAUTION! Check connections for leakage!

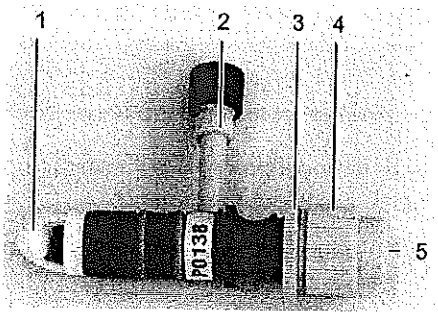
When connecting the supply tubes, ensure correct connection. Insert the seals and check for leakage.
Tighten all screws by hand only.

1. Check all sealing rings of the chamber head, connections and the nebulizer, replace worn out sealing rings, pull on seals and ensure correct positioning.
2. Hold the impeller at the handle and insert it into the mixing chamber tube. Lock by pressing slightly.
3. Stick the mixing chamber parts (chamber tube and chamber head) together, align the sides so that they are flush and screw (3 in Fig. 39, p. 69).
4. Screw the siphon sensor (11 in Fig. 41 p. 70) in the siphon. Stick the siphon on the chamber head, align the sides so that they are flush and fasten with knurled head screw (5 in Fig. 39).
5. Attach the safety plug (1 in Fig. 41) on the chamber tube.
6. Screw the connections for fuel gas and additional oxidant (5 and 6 in Fig. 41) with the sealing rings into the mixing chamber head.
7. Stick the nebulizer (9 in Fig. 41) into the chamber head and fasten using the locking ring.
   Note: If the nebulizer cannot be stuck easily into the chamber head, slightly grease the sealing rings with the lubricant supplied (Apiezon grease).
8. Fasten the mixing chamber nebulizer system at the height adjustment using the holding bow (10 in Fig. 39). The marking must be above the edge of the holding fixture. Screw the knurled head screw at the holding bow tightly.
9. Plug the cable of the siphon sensor (6 in Fig. 39) into the connection on the rotating arm (take care with the lug) and screw tight.
10. Set the burner on the mixing chamber tube and turn against the 0° stop. Clamp with stud bolt.
11. Screw the tube for fuel gas (red marking) on the connector.
12. Screw the tube for oxidant (1 blue mark) on the connector.

13. Connect the tube for oxidant (2 blue marks) to the nebulizer connector.

Sensitivity control / adjustment

1. In the ASpect LS software, use the  button to call up the FLAME / CONTROL window.
2. Set the ratio of fuel gas to oxidant.
3. Align the burner head to the height of and parallel to the optical axis.
4. Use the [IGNITE FLAME] button to ignite the flame.
5. Open the MANUAL OPTIMIZATION tab.
6. Aspirate a test solution, e.g., Cu / 2 mg/L, via the nebulizer, start the continuous measurement value display. Evaluate the signal.
7. If the sensitivity is not reached, readjust the nebulizer:
   Loosen the lock nut (3 in Fig. 45).
   Adjust the depth of the canula (4 in Fig. 45) with the adjustment nut.
8. After completing the adjustment, secure the adjustment with lock nut (3 in Fig. 45).



1	Impact bead
2	Connection for oxidant
3	Lock nut
4	Adjustment nut for canula
5	Inner canula

Fig. 45 Components of the nebulizer

7.3.7 Cleaning the sensor of the burner

The sensor monitors if the burner is mounted correctly before igniting the flame. Clean the sensor of the burner if

- there are deposits (for example salt incrustations) on the openings of the sensor
- the inserted burner cannot be detected (shown by an error message in the software).

1. Remove the burner-nebulizer-system by loosening the knurled head screw on the holding bow (10 in Fig. 39).
2. Clean the sensor cautiously with the help of a little brush, for example a toothbrush, using alcohol, for example Isopropanol.
3. Reinstall the burner-nebulizer-system on the holding bow.

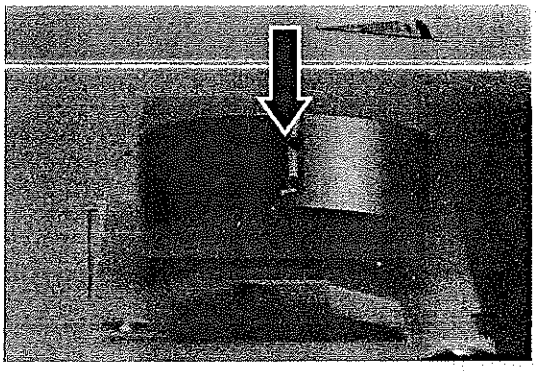


Fig. 46 Sensor of the burner

7.4 Autosamplers AS-F, AS-FD

Contamination on the tray and the casing can be removed with a dry cloth on a daily basis as required. In addition according to conditions:

- Washing the sample paths
- Wash the mixing cup
- Replace the canula(s) at the autosampler arm
- Replace the aspiration tube and dosing tube
- Replace the dosage syringe
- Clean, after a wash or mixing cup has overflowed

7.4.1 Washing the sample paths

1. In the software ASpect LS use  to open the FLAME window and ignite the flame.
2. Use  to open the AUTOSAMPLER window.
3. In the tab TECHN. PARAMETERS set approx. 60 s in the input field WASH TINE WASH CUP.
4. Use the [WASH] button to start the wash cycle.

The canula of the autosampler dips into the wash cup. The wash liquid is aspirated through the system.

7.4.2 Washing the mixing cup of the AS-FD

The mixing cup must be washed before and after the operation to prevent adhesion and scaling. Before preparing the first standard / first sample the mixing cup is washed automatically. Further washing processes might be useful during continuous operation.

Washing the mixing cup prior to and after the measurement

1. In ASpect LS open the window Autosampler with  .
2. In the tab TECHN. PARAMETERS enter a volume of 25 mL in the group WASH MIX CUP.

3. Use the [START] button to start the wash cycle.
4. The wash cycle can be repeated several times if required.

25 mL of washing liquid is dispensed from the storage bottle into the mixing cup and automatically drained off afterwards.

Washing the system prior to an extended period of decommissioning

If salts were added to the diluent (bidistilled or acidic bidistilled water), the dosing unit and valve must be washed with methanol or ethanol prior to extended periods of decommissioning. Otherwise scaling and blocking may also occur.

1. Fill the storage bottle for the diluent with methanol or ethanol.
2. Perform the wash cycle as described in Section "Washing the system prior to and after the measurement". Repeat the washing process several times.

7.4.3 Replacing the canulas on the autosampler arm of the AS-FD

The canulas and guide must be replaced if there is a significant contamination or mechanical damage (detectable by large standard deviations in the measurements).

1. Pull off the hoses from the canulas.
2. Loosen the fixing screw on the autosampler arm.
3. Pull the canula guide with canulas upwards and out.
4. Fit the guide with the new canulas into the autosampler arm and fix in place with the locking screw.

ATTENTION!

Caution! Risk of fracture!

Set the canula height for them to terminate 1-2 mm above the block with the wash and mixing cup.

5. Plug the sample intake tube onto the thinner canula. Plug the dosing tube for the diluent onto the thicker canula.

7.4.4 Replacing the canula on the autosampler arm of the AS-F

The canula for picking up the sample (thin canula) must be replaced if there is a significant contamination or mechanical damage (detectable by large standard deviations in the measurements).

1. Pull the intake tube off the canula.
2. Loosen the lock screw at the autosampler arm and pull out the canula.
3. Insert the new canula and fix with the clamp nut.

ATTENTION!

Caution! Risk of fracture!

Set the canula height for them to terminate 1-2 mm above the block with the wash and mixing cup.

4. Plug the intake tube onto the new canula.

7.4.5 Replacing the intake tube

If the intake tube is contaminated, it must be replaced.

1. Pull off the intake tube from the thinner canula at the autosampler arm and then from the nebulizer canula.
2. Cut a new tube to the required size and attach it on both canulas.

7.4.6 Replacing the tube set at the AS-FD

1. Pull the dosing tube for diluent off the thicker canula at the autosampler arm and feed it through the tube guide (9 in Fig. 30 p. 57).
2. Detach the tube for the washing liquid at the rear of the autosampler (5 in Fig. 31 p. 59).
3. Pull the encased tubes out of the attachment lug at the rear of the autosampler.
4. Pull the tube for the washing liquid off the storage bottle.
5. Unscrew the dosing tube from the change-over valve (3 in Fig. 32 p. 59).
6. Screw the new tube set with dosing tube (marking "1") to the change-over valve and attach the encased tubes with the attachment lug to the rear of the autosampler.
7. Insert the tube with the marking "2" into the storage bottle for the washing liquid.
8. Screw the tube for the washing liquid to the rear of the autosampler.
9. Slide the other end of the dosing tube through the tube guide onto the thicker canula of the autosampler arm.

7.4.7 Clean-up after cup overflow

If during the process the washing cup or mixing cup (with AS-FD) has overflowed, immediately interrupt the process and clean the device.

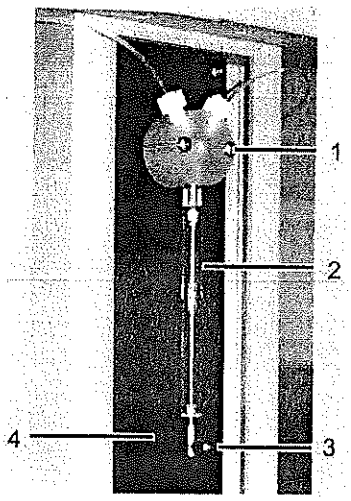
1. Stop the measuring process immediately.
2. Take up the liquid with cellulose wadding or cloth. Wipe the surface dry.
3. *Washing cup:* Ensure that the outlet can be drained, i.e., remove any sharp bends in the draining tube or make sure that the draining tube does not dip into the liquid in the waste bottle.

   Mixing cup (only for AS-FD):

   Use  to open the AUTOSAMPLER window. Change to the tab FUNCTION TESTS.
   In the area Pumps enable the checkbox MIX CUP PUMP to start the pump.

Run the pump until the liquid has been drained off.
Disable the checkbox MIX CUP PUMP, to stop the pump

7.4.8 Replacing the dosing device



1 Valve
2 Dosing syringe, consisting of piston and glass cylinder
3 Fixing screw
4 Drive rod

Fig. 47 Dosing unit at AS-FD

1. Switch on the novAA 400 P and start the ASpect LS software. In the window MAIN SETTINGS select technique FLAME (AS-FD).
2. Use  to open the AUTOSAMPLER window. Change to the tab FUNCTION TESTS.
3. In the PIPETTER area, in the list field VOLUME [µL], use the arrow keys to set the volume to be picked up (AS-FD 5000 µL). Increase the speed to 6-7.
4. Press the button [TAKE UP].
   The piston of the dosing syringe moves down.
5. Unscrew the fixing screw (3 in Fig. 47).
6. Unscrew and remove the dosing syringe (2 in Fig. 47).
7. Screw the new dosing syringe to the valve.
8. Carefully pull the piston down until the eyelet at the piston end is aligned with the hole in the drive rod.
9. Screw the piston with the attachment screw finger-tight to the drive rod.
   Attention: Excessive force can lead to material damage! Do not tighten the screw too much.
10. In the window AUTOSAMPLER click on the [Initialize] button.
    The piston of the dosing unit moves back to the original position.

7.5 Compressor JUN-AIR 6/S

IMPORTANT

Observe the maintenance and care instructions in the separate instruction manual "Compressor JUN-AIR 6/S".

1. Drain the pressure cylinder and the water separator at the filter:

   Attention:
   Condensation water sprays out when released under pressure. Open the drainage tap carefully.

   - Drain off the oily condensation water once in 3 months by opening the drainage tap.
   - Drain off the oily condensation water into a narrow necked bottle with a tube.

2. Clean the aspirating filter:
   A dirty aspirating filter impairs compressor performance.

   - Clean or replace the filter at least every six months.

3. Refill/change oil:

   Note:
   Only use the special oil SJ 27!

   Check the oil level in the gauge regularly. Refill the oil at the oil screw if necessary. Change the oil every 12 months.

   - Unscrew the gauge glass and tilt the compressor enough so that the used oil can drain off completely.
   - Screw the gauge back on and refill with approx. 0.75 liter of oil at the oil screw.
   - Check the oil level.

4. Check the safety valve:

   Allow air to escape from time to time by turning the knurled nut. The valve position is thus prevented from sticking and the functioning is guaranteed.

   Note:
   Do not damage the seal and do not alter the setting of the safety valve!

7.6 Injection module SFS 6

Replace the injection module tubes,

- when they are clearly contaminated
- with decreased sensitivity caused by a reduced aspiration rate.

1. Unscrew the PTFE tubes from the valve.
2. Screw in the new PTFE tubes to the assigned positions.

7.7 Servicing the Air Purge Kit APK

Replacing the filter system

In normal state, the delivery rate of the compressor is 7 L/min. The filter system consisting of aspirating filter, marble granulate and dust filter (4, 5 and 6 in Fig. 37, p. 64) must be replaced entirely if the delivery rate indicated on the rotameter is below the threshold value of 5 L/min.

1. Remove the aspirating filter (6 in Fig. 37, p. 64) from the cover of the wide mouth bottle.
2. Unplug the dust filter (4 Fig. 37, p. 64) from the connections.
3. Remove the marble granulate (5 in Fig. 37, p. 64) from the bottle and dispose of properly.
4. Fill the bottle with 600 g fresh marble granulate and close.
5. Connect the new dust filter to the connections.
6. Screw the new aspirating filter onto the cover.

Replace the membrane dryer

The membrane dryer (3 in Fig. 38 p. 64) must be replaced if membrane condensate or particles deposit on the surface.

1. Disconnect the hoses of the compressor and novAA 400 P from the membrane dryer.
2. Unscrew the membrane dryer from the housing side of the APK.
3. Screw the new membrane dryer onto the housing and connect the hoses.

Changing fuses

The fuses are located in the fuse holder (6 in Fig. 38 p. 64) on the rear side of the device. Defective fuses must be replaced.

1. Switch off the APK and disconnect the mains plug from the APK connection.
2. Pull on the fuse holder cover and open. If necessary, carefully lift the cover by pressing a screwdriver against it.
3. Replace the fuses and close the fuse holder again.
4. Connect the mains plug to the APK mains connection.
5. Switch on the APK.

7.8 Checking the gas connections for leaks

See Section "Supply and control connections" p. 43.

The gas connections must be checked for leaks:

- Weekly as a safety check.
- If during a recommissioning a gas connection is opened.

To carry out a leakage test, close the stopcock of the gas supply system and observe the pressure indication on the downstream manometer. If pressure drops significantly, localize and correct gas leak as follows:

1. Brush connections with a heavily foaming liquid (e.g., soap solution). If bubbles form at the gas connections during commissioning, switch off the novAA 400 P and disconnect the gas supply.
2. Unscrew the leaking gas connections and check for correct fitting. Replace worn out sealing rings.
3. Tighten the gas connections, check for correct positioning and once again for gas leaks.

8 Transporting the novAA 400 P

Tools

- 4 handles
- 19 mm open-end wrench (included in scope of supply)

CAUTION!

Risk of injury if the device falls!

Handles which are screwed in too loosely may cause damage during transport. Screw in the handles up to the end stop.

The device must be transported by at least 4 persons using the fixed screw-in carrying handles (included in scope of supply).
The novAA 400 P is too heavy for two persons (see Section "Safety instructions" p. 8). In addition, it is not possible to get an adequate grip for transport without the screw-in handles. There is a risk of injury if transport is attempted without using the handles or by too few people.

1. Uninstall all components, see Chapter "Installation and start-up" p. 43. Ensure that the outlet tube has been removed from the sample chamber.
2. Remove the safety glass.
3. Close the gas supply upstream of the device connections.
4. Loosen the gas connectors on the rear of the novAA 400 P:
   - Undo the air and nitrous oxide tubes from the tube couplings.
   - For the acetylene gas connector, use a 19 mm open-end wrench. Left hand thread!
5. Undo the electrical connections.
6. Remove the four stoppers from the holes for the handles on both sides of the device and keep in a safe place.
7. Screw the four handles securely into the holes as far as the end stops.

9 Waste disposal

Atom absorption spectrometry usually creates only liquid waste. The liquid waste contains metal ions or heavy metal ions, but mostly different mineral acids which were used during sample preparation. For safe removal of this waste, all solutions must be neutralized, for example with a diluted sodium hydroxide solution.

The neutralized waste must be brought to the appropriate waste disposal center for correct disposal according to the appropriate legal guidelines.

At the end of its service life, the novAA 400 P and all its electronic components must be disposed of as electronic scrap in accordance with valid regulations.

Please dispose of the hollow cathode lamps (HCL) in accordance with the local requirements or contact Analytik Jena AG service personnel.

analytikjena

EG-Konformitätserklärung EC Declaration of Conformity

Analytik Jena AG Konrad-Zuse-Straße 1 07745 Jena

Wir erklären hiermit die Übereinstimmung des genannten Gerätes mit der EG-Richtlinie 2004/108/EG über die elektromagnetische Verträglichkeit und der Niederspannungs-richtlinie 2006/95/EG für die Gerätesicherheit.

We declare the compliance of that device with the requirements of the Electromagnetic Compatibility Council Directive 2004/108/EC and the Low Voltage Council Directive 2006/95/EC for device security.

Bei Änderungen am Produkt, die nicht von uns autorisiert wurden, verliert diese Erklärung ihre Gültigkeit.

Any modification to the product, not authorized by us, will invalidate this declaration.

Gerätebezeichnung / Device name

novAA 400P

Normen / Standards

DIN EN 61326-1 :1998
DIN EN 61010-1:2002

Konformitätsbewertungsverfahren
assessment procedure

novAA 400P/07-2013

Das Gerät ist gekennzeichnet mit / The device is marked with: CE

Jens Adomat
Vorstand
COO

Jena, den 29.07.2013

Dr. Jürgen Otte
Qualitätsmanager
Quality Manager

Die Erklärung bescheinigt die Übereinstimmung mit der Richtlinie und dem Gesetz Gewährleistung und Haftung sind in unseren Allgemeinen Lieferbedingungen geregelt.
The declaration certifies the compliance with the Directive and the Law. Conditions of guarentee and liability are dealt within our General conditions of Sale.