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Operating manual

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OE700 series

Hitachi High-Tech Analytical Science

- Before using the instrument, read the safety instructions and precautions carefully.
- Be sure to observe the safety instructions in this manual and the WARNING/CAUTION labels on the instrument.
- Keep this manual in a safe place nearby so it can be referred to whenever needed.

NOTICE:

1. The information contained in this document is subject to change without notice for improvement.
2. This manual is copyrighted by Hitachi High-Tech Analytical Science with all rights reserved. No part of this manual may be reproduced, transmitted or disclosed to a third party in any form or by any means without the express written permission of Hitachi High-Tech Analytical Science.
3. Hitachi High-Tech Analytical Science assumes no liability for any direct, indirect, or consequential damages arising from use not described in this manual.
   Utmost care must be exercised when using the instrument.
4. This document does not provide any warranty or permission for industrial properties or any rights to grant license lawfully and without infringement.

Preface

To ensure smooth operation, we have drawn up this practical operating manual.

We explicitly point out that Hitachi High-Tech Analytical Science does not assume responsibility for damage or losses resulting from the disregard of this operating manual or the misuse of the products described herein.

Our products are subject to continuous further development – technical changes are reserved.

Uedem, February 2019

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1 Notes regarding the use of this operating manual

This chapter contains information regarding this operating manual as well as general safety instructions for handling the instrument.

Information

Due to the customer-specific configuration of all spectrometers, the matrices and/or grades displayed on your screen can deviate from the illustrations and descriptions in this manual and in the software manual.

If not indicated otherwise, we assume that the user has already started the WINDOWS™ operating system. Basic knowledge as to handling software under WINDOWS™ is assumed as given.

1.1 Validity of the operating manual

This operating manual is valid for the stationary optical emission spectrometer OE700 series.
This operating manual is only valid in combination with the "SpArcfire" software manual.

Observe this operating manual for all work. If the instrument is not used according to this operating manual, your safety as well as the instrument function can be affected.
To maintain product reliability, enhance the life cycle and avoid downtimes, do in any case observe the instructions herein.

Furthermore observe the current valid regulations for accident prevention and environmental protection as well as the recognised technical rules for safe working according to good professional practice.

1.2 Pictograms and signal words

Important information in this operating manual is marked with the following pictograms.

⚠ DANGER

DANGER
... indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING
... indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION
... indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

1.2.1 Hazard symbols

Electric voltage!
This sign indicates hazardous electric current.

Hand injuries!
This sign indicates hazardous situations with limb crush hazard.

Hot surface!
This sign indicates hot surfaces of the instrument.

1.2.2 Symbols for personal protective equipment

Wear eye protection!
During the activities marked with this symbol it is absolutely necessary to wear eye protection.

Wear ear protection!
During the activities marked with this symbol it is absolutely necessary to wear ear protection.

Wear hand protection!
During the activities marked with this symbol it is absolutely necessary to wear hand protection.

1.2.3 Notice and information symbol

NOTICE

NOTICE
... indicates important information (e.g. material damage), but does not indicate hazardous situations.

Information

Tips and information are marked with the hand symbol with pointed index finger and the word "Information" in bold print.

2 Intended use and misuse

The stationary optical emission spectrometer (OES) is exclusively intended for qualitative and quantitative element analysis of alloys.

The instrument may only be used in dry rooms.

The instrument may only be operated with the protective covers installed.

The intended use also includes
- the observance of all information and regulations in the operating manual,
- the observance of the software manual,
- the observance of the technical data and
- the adherence to the periods for inspection and maintenance work prescribed or contained in this operating manual.

Misuse

The instrument must not be subjected to heavy shocks or vibrations causing the internal shock indicator to trigger. Damage resulting thereof will void any warranty.

The use in potentially explosive atmospheres is not permitted.

The employment of insufficiently qualified personnel is regarded as misuse.

Measurements without correctly positioned samples is regarded as misuse.

Measurements without a screwed-in spacer are regarded as misuse.

Unauthorised structural modifications, attachments to or conversions of the instrument, modifications of and interference with the instrument program as well as unauthorised updates of the operating system and the software are prohibited. Improper interference with the instrument or the software by the customer will void any warranty.

The manufacturer is not liable for damage resulting from misuse.

3 General safety instructions

Observe the following safety instructions for the operation of the instrument:

- Only operate the instrument if free from defects and under observance of this operating manual.
- Prior to starting work, read this operating manual. This applies particularly to personnel who only occasionally work with the instrument, such as maintenance personnel.
- Observe all safety and information signs on the instrument and maintain legible.
- Check the instrument for external visible damage. Report any visible damage and only put the instrument into service after remedying the damage.
- Protect the instrument from influences which can cause corrosion or affect the function of components.
- **Do not** place any liquids on top of the instrument.
- **Do not** excessively load the hood of the instrument (≤ 3 kg).
- Internal or external safety devices of the instrument shall in no case be made inoperative.
- Maintenance and repair may only be carried out by qualified specialised personnel.
- In the event of malfunctions, remove the instrument from service. Have faults immediately remedied by an electrically skilled person.
- **Never** open the housing! There are no user-relevant elements inside the housing.
- Have defective parts of the instrument immediately replaced.
- Spare parts must comply with the technical requirements specified by Hitachi High-Tech Analytical Science. This is always the case if you use original spare parts.
- For inspection or repair work, attach a warning sign against restart to the external de-energizing device.
- The safety instructions must be supplemented with national accident prevention regulations.
- During measurement, electromagnetic waves may disturb other devices. Please observe the information in chapter 5.3, page 18.
- In the event of an emergency, press the stop switch on the front side to abort the measurement and switch the instrument off at the main switch.
- The measurement can only be started if there is a sample clamped in the hold-down device (sample clamp), or if the hold-down device is swung outwards (90° to spark stand) and engages at the bottom.
- If the hold-down device is at the bottom parallel to the spark stand, no measurement is possible.
- The weight of the sample on the spark stand must be ≤ 5 kg.
- The sample must not protrude from the spark stand.
- The instrument shall not be exposed to the following:
    - extreme temperatures or temperature changes
    - heavy shocks or vibrations
    - moisture and condensing humidity
    - metal dust and large quantities of dust in general

⚠ DANGER

Electric voltage!

During work with the spectrometer, hazards may arise from electric current / voltage. Observe the following safety instructions to avoid the risk of an electric shock:

- If you touch the instrument and electrically conducting parts, such as machines or devices, simultaneously, voltage can be generated from possible potential differences which is perceptible but non-hazardous.
- **Never** spark wet or moist surfaces, since there is a risk of a short circuit!
- **Never** spark without a clamped sample!
- **Never** spark without the spacer screwed into the spark stand!
- When the excitation source is switched on, avoid any contact with the spark electrode!
- When working at the spark stand, e.g. for changing the electrode, do in any case switch off the excitation source.
- **Do not** touch the sample during measurement!
- During sparking, **do not, under any circumstances,** introduce a conducting object into the proximity of the spark stand opening!
- During sparking, **do not, under any circumstances,** remove a conducting object from the spark stand opening!
- With the spark stand opening open during sparking, **do not, under any circumstances,** bring a part of your body into its immediate vicinity!

⚠ WARNING

Hot surface!

Small and/or thin samples can become hot during sparking.

- During measurement of small or thin samples, wear protective gloves!

⚠ WARNING

Risk of injury due to UV radiation!

During the analysis of samples that do not entirely cover the spark stand opening (e.g. wires), spark light can emerge. Your eyes can be blinded by the light and the high-energy UV radiation can damage your eyes.

- Never look into the arc!
- Wear suitable eye protection during work.

⚠ WARNING

Wear ear protection!

During the analysis of samples that do not entirely cover the spark stand opening (e.g. wires), the sound generated upon sparking (measuring) exits through the gap.

- For sparking samples that do not entirely cover the spark stand opening wear ear protection.

⚠ DANGER

Escaping gases!

When measuring hazardous substances, there is a hazard from escaping gases or vapours.

- The operator must know what substances he is working with.
- The operating company must provide for suitable protective measures (e.g. exhaustion). (Metal dusts are primarily released. Those are usually washed in the washing bottle and do not escape.)

3.1 Safety instructions for work on the electrical system

⚠ DANGER

Electric voltage!

Observe the following safety instructions for work on the electrical system:

- Only electrically skilled persons may carry out work on the electrical system.
- Do not carry out any work at live parts of the electrical system.
  Observe the following safety rules when working on the electrical system:

  1. De-energise.
  2. Secure against restart.
  3. Verify de-energised state.
  4. Shield live parts.
  5. Earth and short-circuit.

- In the event of faults of the electrical energy supply, immediately switch off the instrument.
- An interruption in the energy supply of > 20 ms requires restarting the software.
- In the event of a short circuit, there is a risk of spark generation or the break-out of a fire. Only use original fuses with specified amperage and tripping characteristic! When a fuse must be replaced, first identify the corresponding cause and remedy the error before you replace the fuse.
- If work on live parts is required, only use insulated tools.

3.2 Personnel qualification

All persons entrusted with work at the instrument commit themselves to the following before starting work:

- to observing the basic regulations related to occupational safety and accident prevention;
- to reading the safety instructions and warnings in this operating manual and to confirming with their signature that they have understood them;
- to wearing or using personal protective clothing and accessories or workstation-related personal protective clothing and accessories serving occupational safety as required for reasons of safety during work.

Only personnel who have read and understood this operating manual may work with the instrument.
Personnel to be trained or instructed or personnel in training shall only work with the instrument under constant supervision of an experienced person.
Only personnel who are at least 18 years of age may be entrusted with independent work with the instrument.
The individual activities at the instrument require different personnel qualifications listed in table 3-1, page 9.

The various qualifications comprise the following abilities and knowledge:

- Instructed persons must be able to operate the instrument and identify possible damage and hazards related to the instrument.
- Electrically skilled persons must be able to read and understand electric circuit diagrams, to put electrical machines/devices into service, to maintain them, to wire control cabinets, to install control software, to ensure the functionality of electrical components and to identify possible hazards from handling electrical and electronic systems.
- Trained pneumatic specialists must be able to read and understand pneumatic circuit diagrams, to put pneumatic systems into service and to maintain them, to remove and install pneumatic hoses, to ensure the functionality of pneumatic components, to evaluate the work on the pneumatic system they have been entrusted with and to identify possible hazards.

Tab. 3-1 Overview of minimum required personnel qualifications

Activities	**Instructed persons**[a]	**Skilled workers**[b] **with the qualification of an "industrial mechanic" or "mechatronics engineer"**	**Electrically skilled persons**	**Pneumatic specialists**
Transport	X			
Start-up, operation, shutdown	X			
Cleaning	X			
Mechanical work: troubleshooting, repair and maintenance	X	X		
Work on the electrical system: troubleshooting, repair and maintenance			X	
Work on the pneumatic system: troubleshooting, repair and maintenance				X
Disposal	X			

a. *Instructed persons are persons trained in handling the instrument by Hitachi High-Tech Analytical Science. For instruments delivered with a PC user interface, PC knowledge is required.*
b. *A skilled worker is who, due to his professional training, his knowledge and experience as well as due to his knowledge of relevant regulations, is able to judge the work assigned to him as well as to identify possible hazards.*

4 Description of the instrument

4.1 Function

The OE700 series is a laboratory spectrometer for qualitative and quantitative analysis of metal grades.
The metal sample to be analysed is positioned at the spark stand and clamped with a hold-down device. The sample is sparked with an electrically generated arc at the surface. Upon discharging, an area of the sample surface is melted and evaporated by the spark. From the high energy in the spark, a plasma results. This plasma emits light which is spectrally analysed and measured by means of optical sensors. A certain area of the measured spectrum can be assigned to every element.

The instrument is operated via control keys and by use of a supplied software which displays the analysis result on the screen of the connected computer. The analysis result can be stored in the internal database or exported. Through comparison with stored grade data it can be determined immediately whether or with what deviations the analysed grade fulfils the required specifications. Certificates can be easily designed and printed.

4.2 Components and operating controls

The instrument consists of three important assemblies:

Excitation Source

A digitally controlled excitation source generates a strong electric discharge between sample and electrode in the argon-purged spark stand melting a small part of the sample material out of the surface, evaporating it and exciting it to glow in a plasma. The argon atmosphere avoids oxidation on the sample surface and causes practically all discharge energy to be converted at the sample connected as a cathode. The characteristic light (e.g. blue for ferrous metal) contains the spectral information about the elements and their contents in the sample.

Optics

The light generated in the spark stand is directed to a diffraction grating and there dissected into its spectral components. Light with longer wavelengths is deflected ("diffracted") stronger than light with shorter wavelengths. This produces an emission spectrum of the sample which can be measured using light-sensitive detectors. The OE700 series uses optical sensors featuring a high sensitivity and long lifetime. The optical system operates in a medium that ensures transparency even below approx. 200 nm.
The OE700 series has an argon-purged tube as light path ("direct light path").

Readout system

Recording a complete spectrum requires a fast readout system to process large amounts of data fast. Light intensities obtained from the emission spectrum are converted to contents using the calibration curves stored in the instrument.
The contents are displayed on the screen and further processed (quality detection, monitoring of limit values for process control, etc.). The OE700 series uses a special processor which allows the simultaneous evaluation of up to 16 individual sensors. That permits very precise analysis by means of DIA (Dynamic Integration Algorithm).

4.2.1 Spectrometer components

The OE700 series consists of the following components (see fig. 4-1):

- housing (1)
- hold-down device (2)
- spark stand (3) with removable spark stand plate
- operating elements on the front (4)
- fan and exhaust air outlet filter (5)
- operating elements and connections on the rear (6)
- washing bottle to clean off-gases from the spark stand (not depicted)
- computer with monitor and mouse (not depicted)

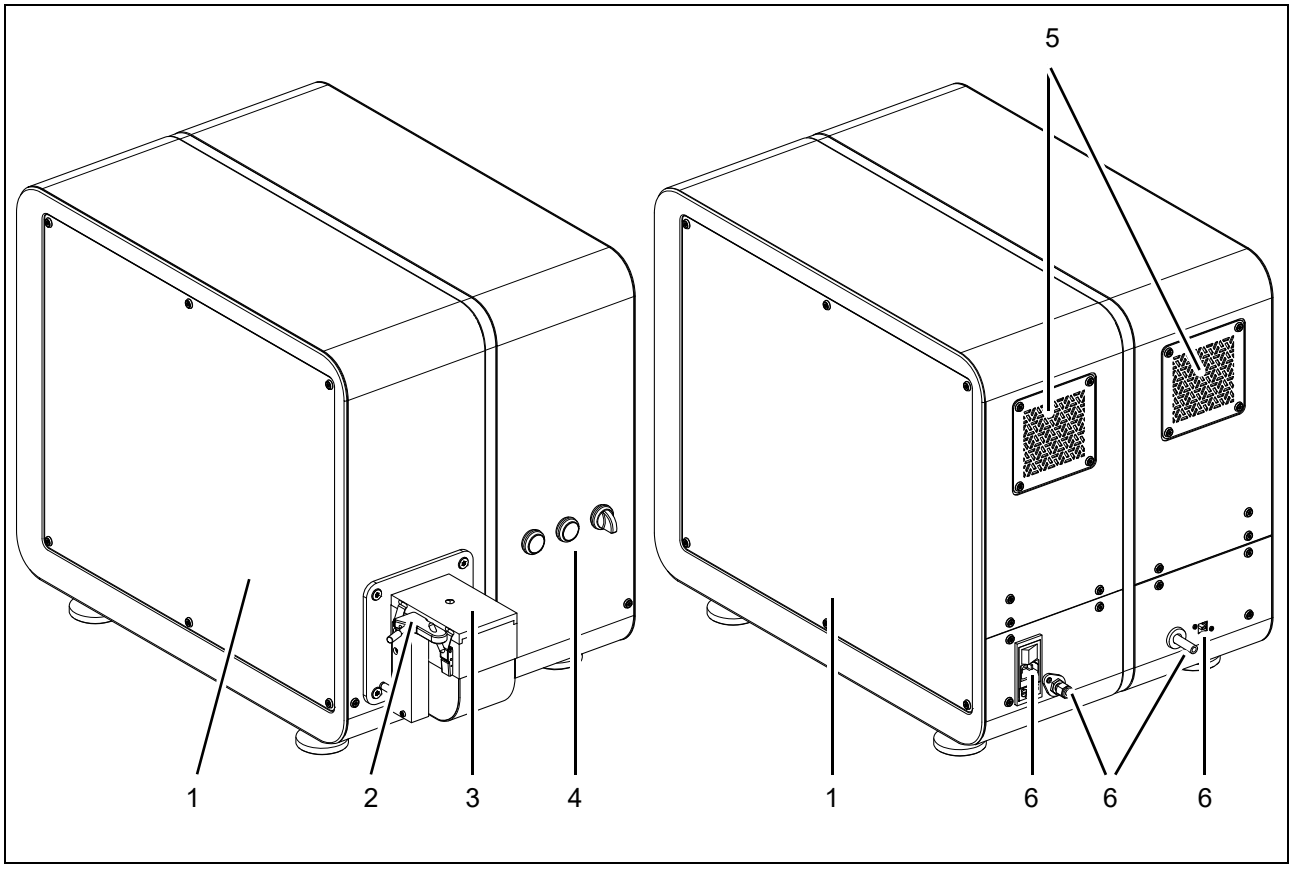


Fig. 4-1 Instrument components

4.2.2 Operating controls, displays and ports of the spectrometer

There are the following operating controls, display elements and ports on OE700 series (see fig. 4-2):

- hold-down device (1) for sample
- green start button (2)
- red stop button (3)
- rotary knob (4) to switch on the excitation source
- on/off switch (5)
- socket (6) for power plug
- fuses (7)
- port (8) for argon
- exhaust hose leading to the washing bottle (9)
- USB port (10) for connecting a computer

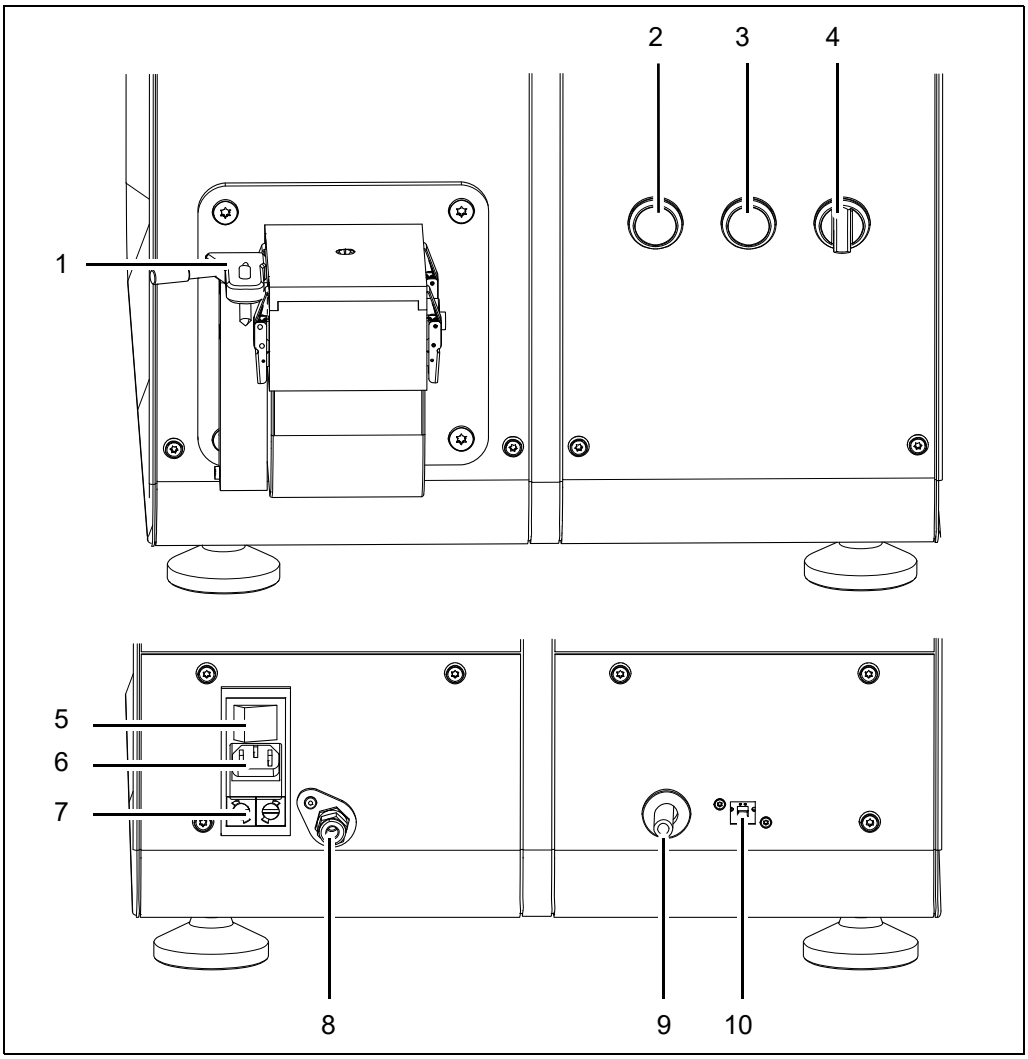


Fig. 4-2 Operating controls and ports of the instrument

4.3 Technical data

Tab. 4-1 Technical data of the OE700 series

Parameter		Value
Designation		OE700 series
Dimensions	width x height x depth	450 mm x 550 mm x 800 mm
Weights	tabletop unit	approx. 100 kg
	max. sample weight	5 kg
Electrical system	supply voltage	100–240 V AC, 50–60 Hz
	fusing	2 x 8 A slow-blowing, 5 x 20 mm
	power consumption, max.	430 W
	power consumption in idle state (without PC)	50 W; source switched on
		45 W; source switched off
	protection class	IP20
	power cable, IEC power connector (for non-heating appliances): length cross-section	 2 m 3 x 1.5 mm^2
Optical system	multi-sensor optics	
	focal length	400 mm
	number of grid lines	2400/mm
	wavelength range	119–766 nm
Excitation source sparking parameters	high-energy pre-spark (HEPS)	
	frequency	80–1000 Hz
	voltage	up to 500 V
Argon	inlet pressure	3 bar
Ambient conditions	temperature	10–40 °C
	air humidity	10–90 %, non-condensing
System requirements for external PC	Operating system: The current Microsoft® Windows™ version at the time of printing or the Microsoft® Windows™ version officially designated by Hitachi High-Tech Analytical Science at the time of ordering/delivery or its successor version. Intel® Pentium® 4, AMD Athlon™ 64 or better 8 GB RAM or more 100 GB available space mouse screen resolution: 1024 x 768 or better 1 x free USB 2.0 port DVD drive	
Options	wire adapter set accessories set consumables set	

5 Scope of delivery, transport, set-up and installation

5.1 Scope of delivery

The following objects are included in the scope of delivery:

- OE700 series – basic instrument incl. optical system
- set of recalibration samples
- tungsten electrode with cleaning brush
- standard accessory case, packed (chapter 12.3, page 65)
- copper tube for argon connection
- twin bottle system
- pressure reducer

optional

- gas purification system
- computer

Unpack the instrument and check the delivered contents for completeness.
Should any parts be missing or damaged, please immediately contact our local Hitachi High-Tech Analytical Science partner.

5.2 Transport

NOTICE

Observe the following for transport:

- Always proceed very carefully during lifting and transporting.
- During transport, make sure the instrument is in horizontal position.

Tabletop unit

For short-distance transport (e.g. within the same room), the instrument can be lifted and transported by four persons.

Indications regarding the instrument weight are given in the technical data in chapter 4.3, page 15.

5.3 Set-up

⚠ WARNING

Crush hazard between the instrument and the surface the instrument is placed on.
When setting the instrument down, there is a crush hazard between the instrument and the surface the instrument is placed on.

- Make sure the surface is horizontal, level and has a sufficient stability. Indications regarding the instrument weight are given in the technical data in chapter 4.3, page 15.
- Wear protective gloves when setting the instrument down.

- Place the instrument on a horizontal, level and sufficiently stable working surface at ergonomically suitable height (workbench or work table).
- Straightly align the instrument. For an improved accessibility for larger samples, the instrument's spark stand should protrude.
- Make sure there is sufficient distance to the wall (> 15 cm) on the rear side so that the power cord, Ar line and exhaust hose to the washing bottle are not kinked.
- Make sure that the mains plug is freely accessible seeing as it serves as mains isolator.
- Set up the instrument so that the operator can operate the instrument on the front (1, fig. 5-1) without restrictions to his freedom of movement. The instrument is operated at the computer screen with the buttons (2) on the front and at the spark stand (3).

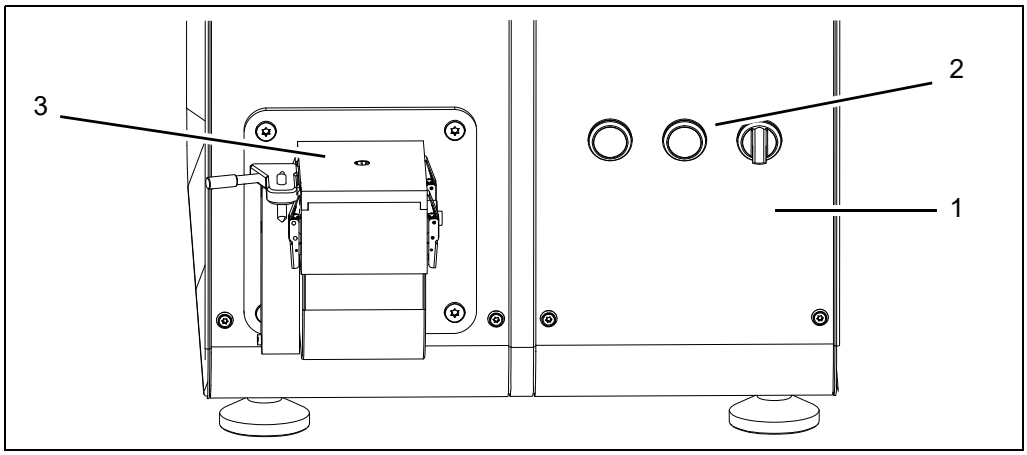


Fig. 5-1 Workstation at the spectrometer

NOTICE

In spark mode, the instrument emits electromagnetic waves. This radiation can cause radio interference. To minimise emitted interference, the instrument must be set up and operated as specified in this manual. In the event of electromagnetic incompatibility, the operating company may have to take additional measures.
The following procedures may contribute to minimising interference:

- enlarging the distance to the "receivers" (power and signal/telecommunications lines as well as radio receivers);
- specific coordination with respect to other systems;
- additional filtering for the power supply;
- low-inductive earthing of the sample to be analysed;
- and in special cases shielding of the entire instrument.

5.4 Installation

Information Initially, the spectrometer is installed by a person authorised by Hitachi High-Tech Analytical Science.

Information A software licence key is required for the operation of the instrument. It must be requested and entered 180 days after delivery or 90 days after initial start-up of the instrument at the latest, whichever comes first. Further information can be obtained from the customer service of Hitachi High-Tech Analytical Science (see chapter 12.1, page 61).

If you put the instrument back into operation after a shutdown, please proceed as follows to connect the mains voltage, the PC and the argon supply:

1. Connect the computer to the instrument (1, fig. 5-2) using the supplied USB cable. Do not use a USB cable longer than 2 m.
   Should the original USB cable be replaced, provide the new cable with a type "Würth 742 727 33" ferrite.
2. Connect the mouse and printer to the computer.
3. Insert the exhaust hose (2) into the washing bottle (please refer to chapter 9.7, page 47 for information on filling and connecting them correctly).
4. Connect the power cable to the instrument (4).
   The instrument may only be operated on mains with protective conductors.
5. Use the supplied copper pipe to connect the instrument's argon connection (3) to the argon container or supply.

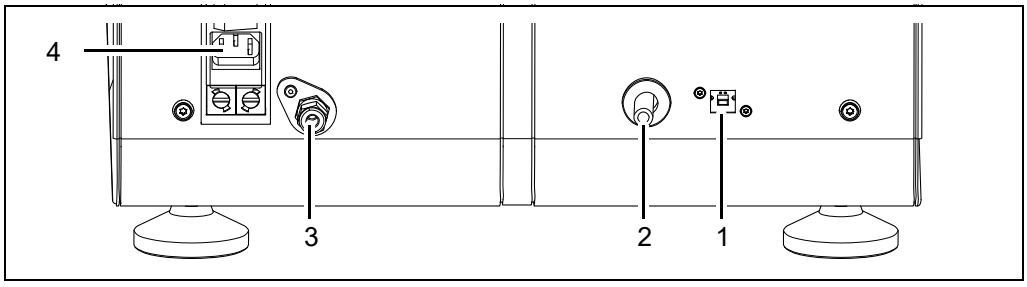


Fig. 5-2 Ports on the instrument

Information Only use 4.8 argon suitable for spectrometry (99.998 % or above). Other gases in the argon (e.g. nitrogen) can affect precision.
If you want to analyse nitrogen, please observe the information regarding argon quality provided in chapter 10.3, page 55.
In case of fluctuations in the argon quality, an optional gas purification system (chapter 5.6, page 24) can be installed between the instrument and the argon supply. Please contact the customer service for further information (chapter 12.1, page 61).

6. Ensure that the supply pressure is always in the range between min. 3.0 bar and max. 5.0 bar.

To avoid condensation inside the instrument, prior to start-up, leave the instrument to acclimatise to the ambient temperature.

5.5 Establishing optical transparency

The optical components of the instrument are located inside a vacuum chamber in which a defined negative pressure must be maintained in order to render wavelengths smaller than 200 nm detectable.
Upon initial installation of the instrument or after prolonged periods of non-use, it is therefore absolutely necessary to restore this specific vacuum atmosphere to achieve best measuring results.

Information Please observe the following:

- Disable automatic Windows™ updates (chapter 5.5.1) before starting the pump cycle to establish optical transparency.
- Carry out the pump cycle for establishing optical transparency as soon as the instrument has been switched off or the argon supply has been interrupted.
- During the pump cycle do not close any of the displayed dialogs of the spectrometer software and do not switch off the computer.
- Subsequently perform the UV transparency test (chapter 5.5.3).

5.5.1 Disabling Windows™ updates

In some cases the update function of Windows™ can interrupt the pump cycle. To prevent this, disable automatic updates as follows:

1. Open the Windows™ Computer Management.
2. Select the menu item "Services" (1), then choose "Windows Update" (2) and right-click your mouse to open the "Properties" (3).

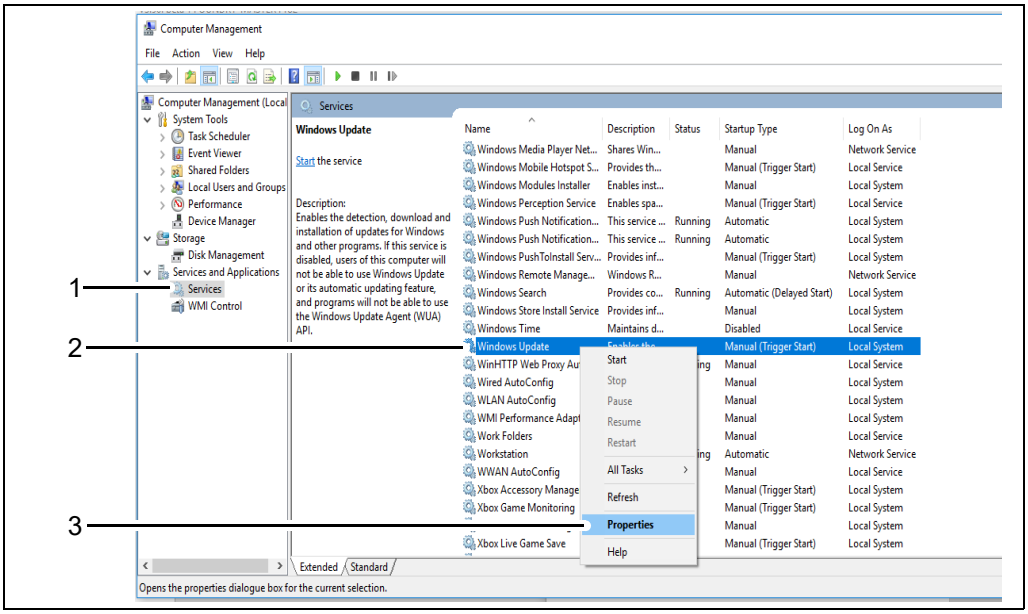


Fig. 5-3 "Computer Management" window

3. Within the "Properties" you can set the "Startup type" to "Disabled" (4) and the "Service status" to "Stopped" (5).

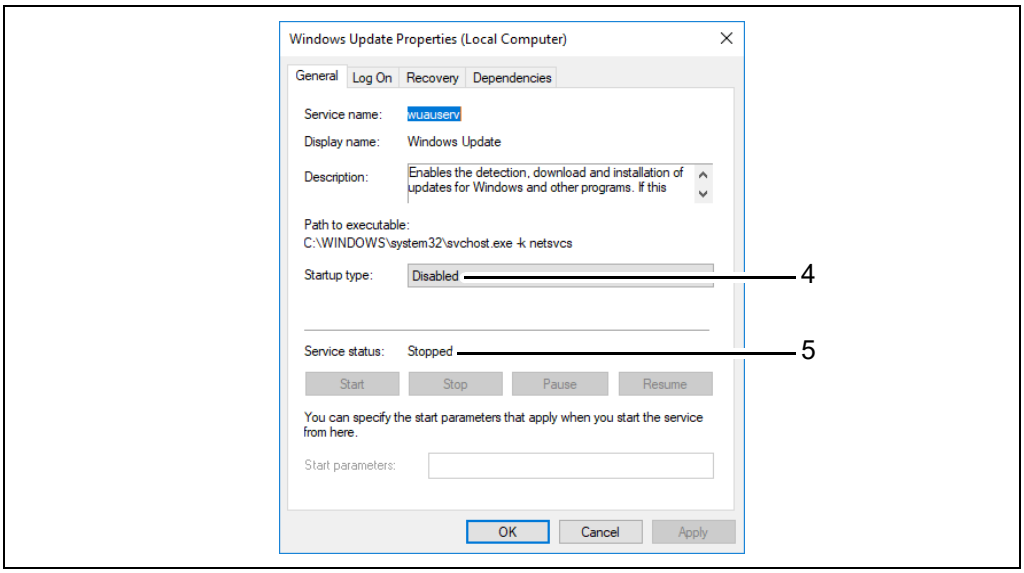


Fig. 5-4 "Windows Update Properties" window

5.5.2 Establishing optical transparency

Perform the following working steps to start the pump cycle for establishing optical transparency:

1. Set up the instrument (chapter 5.3 and chapter 5.4).
2. Open the SpArcfire spectrometer software by double-clicking the SpArcfire symbol on the desktop. The start screen is displayed (see software manual).
3. Open the "System Functions" (1) window. The following screen will be displayed:

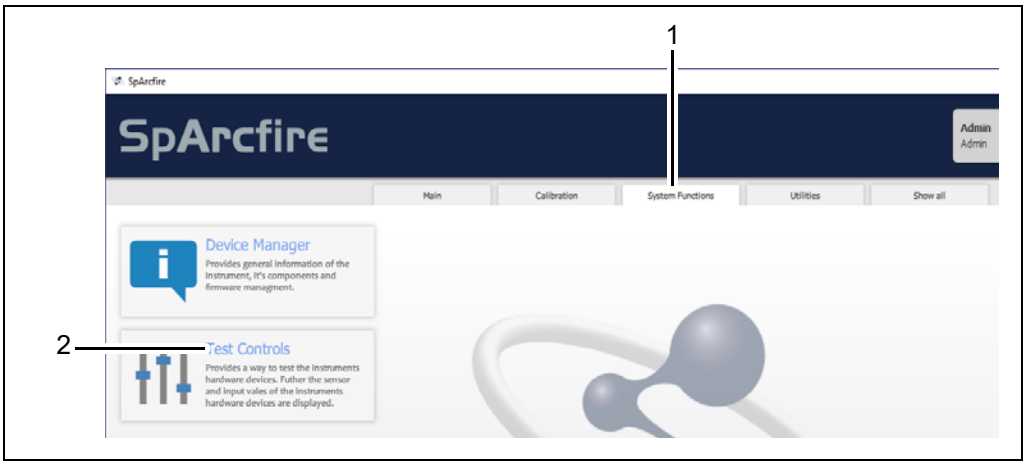


Fig. 5-5 "System Functions" window

4. Now start the application "Test Controls" (2, fig. 5-5, page 5-21).
5. Actuate the "Start pump cycle" button (1, fig. 5-6).
   - The pump cycle starts and runs automatically.
   - Upon completion the message "Vacuum Pump cycle finished... Press OK to continue..." will be displayed on the screen.

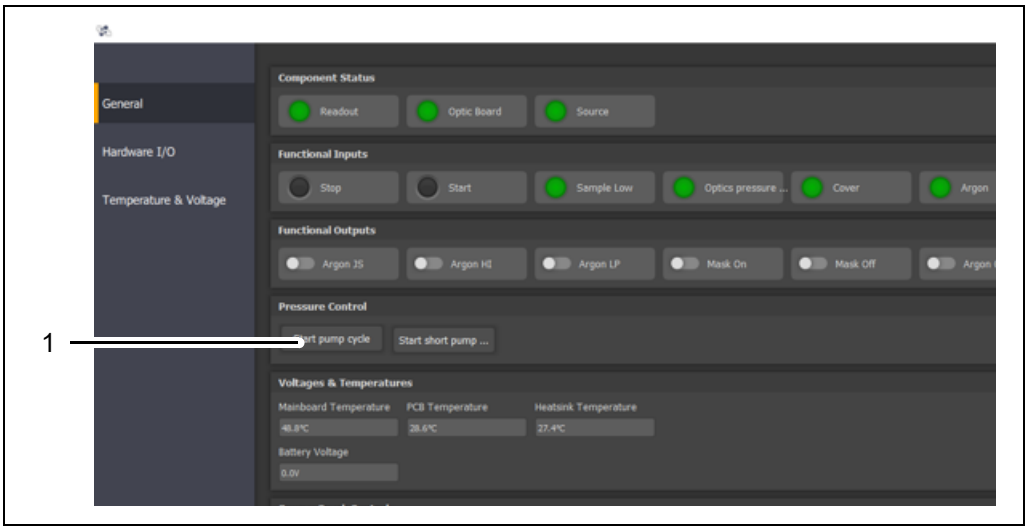


Fig. 5-6 "Test Controls" window

6. Confirm the message with "OK" (1, fig. 5-7).
   - The pump cycle for establishing optical transparency has now been completed.

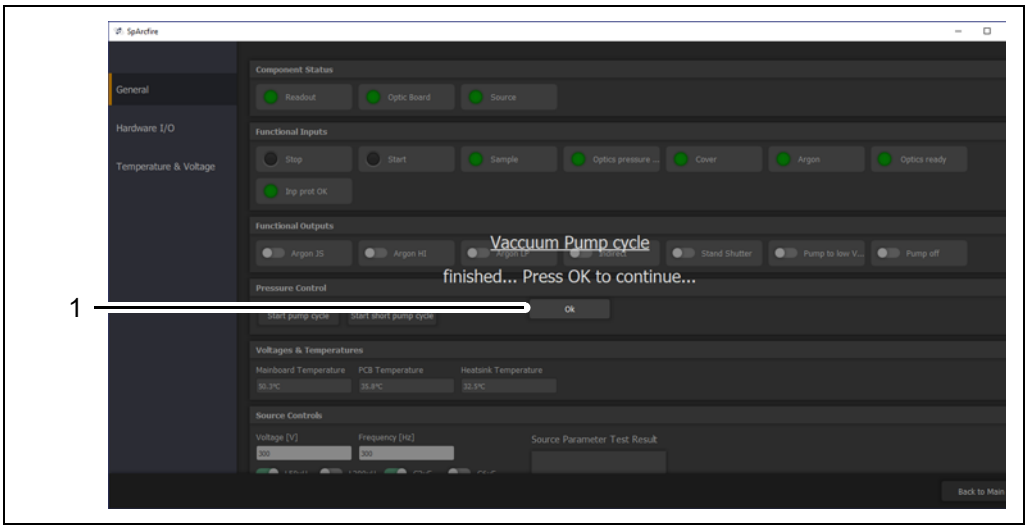


Fig. 5-7 "Vacuum pump cycle finished" window

5.5.3 Testing UV transparency

Once the pump cycle has been completed, check the vacuum chamber's UV transparency as follows:

1. Open the main measuring window in the spectrometer software.
2. Select "Optic UV transparency test" from the menu item "Analysis".

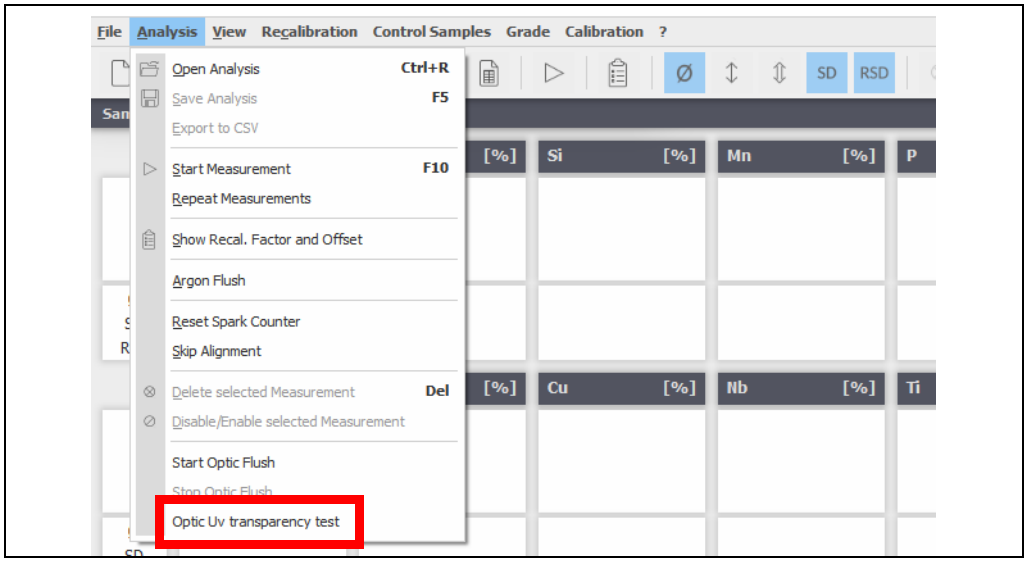


Fig. 5-8 Testing the UV transparency

3. Place the displayed (fig. 5-9) and freshly prepared recalibration sample on the spark stand and fix it in place with the hold-down device.
4. Switch on the excitation source at the rotary knob on the front of the instrument and press "Start".

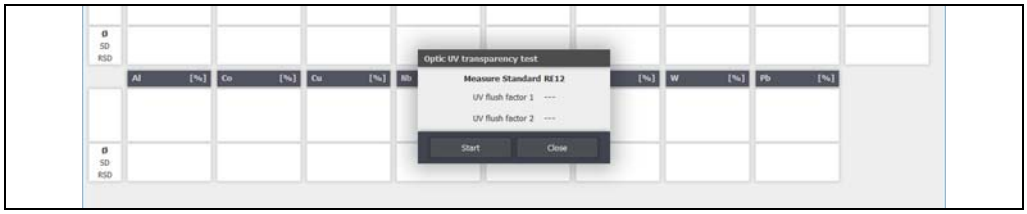


Fig. 5-9 Measuring the recalibration sample

Once the measurement is completed, the instrument will indicate the UV transparency level.
If the message appears in **green** (UV purge factor min. 80 %), the spectrometer is ready for operation.

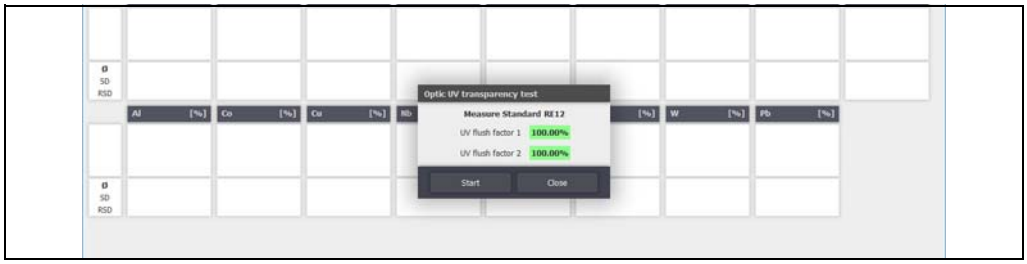


Fig. 5-10 Argon purge completed successfully

If the message appears in **red** (UV purge factor < 80 %), please contact the service of Hitachi High-Tech Analytical Science.

5.6 Gas purification system

Optionally, a gas purification system can be installed between the instrument and the argon bottle to compensate for possible fluctuations in the argon quality or to make sure that the desired argon quality can be achieved. Please contact the customer service for further information (chapter 12.1, page 61).

Observe the following safety instructions when handling the filter cartridges:

⚠ WARNING

Risk of injury due to glass splinters!

- Only use glass cartridges with a splinter protection installed.
- Open glass cartridges carefully and without force.

⚠ WARNING

Irritation of eyes, skin and respiratory tract caused by the powder!

The powder inside the cartridges may irritate the eyes, skin and respiratory tract upon contact.

- Avoid contact with eyes, skin and respiratory tract.
- Wear eye protection and protective gloves.

The gas purification system consists of the following components:

Table 5-1 Gas purification system

Item	Designation
1	connecting nut
2	O-ring 20 x 2
3	O-ring cartridge
4	cartridge A / B
5	union nut
6	O-ring 22.2 x 3
7	base plate
8	copper tube inlet side (argon supply)
9	screw fitting inlet side
10	O-ring 28.24 x 2.62
11	connector
12	copper tube outlet side (instrument)
13	screw fitting outlet side

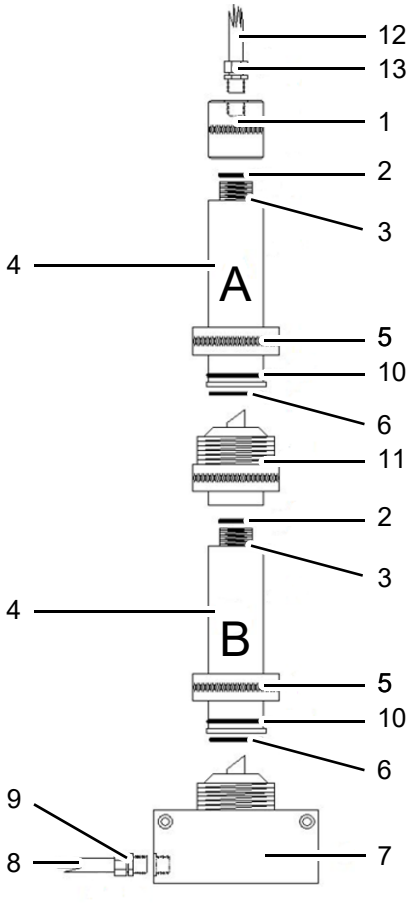


Fig. 5-11 Gas purification system

Information

Observe the cartridges' flow direction from the bottom to the top.
Install the gas purification system as follows:

1. Cover the screw fittings (9, 13, fig. 5-11) with NPT 1/4" external threads with Teflon tape. Wrap 5 to 6 layers of customary Teflon tape (width approx. 10 mm) tightly around the conical thread with a clockwise movement.
2. Screw the screw fitting (9) of the inlet side into the base plate (7) finger-tight.
3. Screw the screw fitting (13) of the outlet side into the connecting nut finger-tight.
4. Fasten both screw fittings with max. 1 to 1.5 rotations.
5. Slide the O-rings (10), dimensions 28.24 mm x 2.62 mm, over cartridges A and B (4).
6. Slide the union nut (5) over cartridges A and B with the threaded side pointing down.
7. Insert the O-rings (6), dimensions 22.2 mm x 3 mm, into the bottoms of cartridges A and B.
8. Insert the O-rings (2), dimensions 20 mm x 2 mm, into the connecting nut (1) and into the connector (11).
9. Screw cartridge A, generally fitted with an O-ring (3), tightly into the connecting nut (1).
10. Screw cartridge B, generally fitted with an O-ring (3), tightly into the connector (11).
11. Connect the inlet line (8) and the outlet line (12) with the screw fittings (9 and 13).
12. Establish a low gas flow through the supply line.
13. Tighten the union nut (5) of cartridge B via the thread of the base plate (7).
14. Tighten the union nut (5) of cartridge A via the thread of the connector (11).

The gas purification system is now ready for operation.

6 Start-up

The initial start-up of the instrument is carried out by customer service employees of Hitachi High-Tech Analytical Science or an authorised representative and includes a complete functional test of the instrument as well as operator training.

If you put the instrument back into operation after a shutdown, please proceed as follows:

Information The following description of putting into service assumes that you are familiar with operating the software and the instrument.

Prerequisite

- The installation of the instrument has been carried out (chapter 5.4, page 19).
- Optical transparency has been established (chapter 5.5, page 20).
- The supplied recalibration samples are available and have been prepared well (i.e. freshly ground, fat-free sample surface).

Recalibration

1. Switch on the computer and wait until WINDOWS™ has been completely started up.
2. Open the SpArcfire spectrometer software double-clicking the SpArcfire icon . The start screen is displayed.
3. Switch on the spectrometer at the on/off switch (1, fig. 6-1).

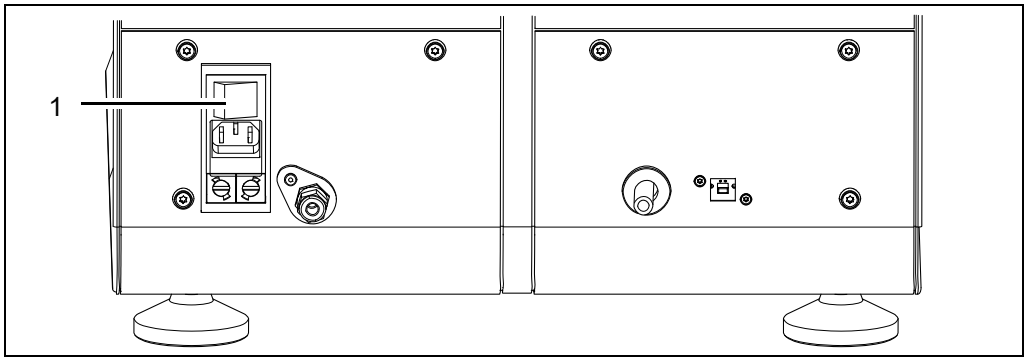


Fig. 6-1 On/off switch

4. Select "Analysis" in the start screen.
5. Select a matrix and analysis program and confirm your selection with "OK". The analysis screen is displayed.
6. Click "Recalibration" to recalibrate the instrument.
7. Select the "Recalibrate Matrix" option. The name of the first recalibration sample (e.g. RE12) is displayed in the centre of the screen.

8. Place the displayed recalibration sample on the spark stand (1, fig. 6-2) and fix it with the hold-down device (2).
9. Switch on the excitation source at the rotary knob (3) on the front of the instrument.

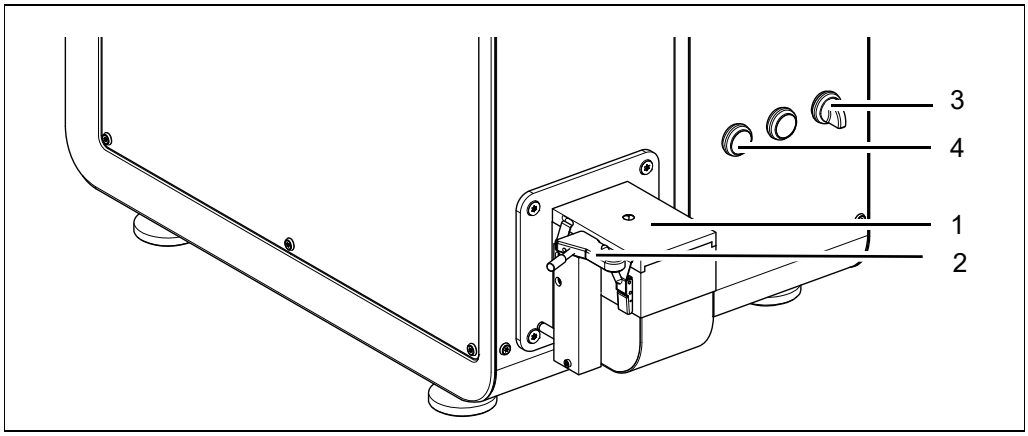


Fig. 6-2 Instrument front

10. Spark this well prepared (freshly ground, fat-free) sample at least 3 times by pressing the start button (4) or clicking the "Start" button in the analysis screen.

Information Avoid sparking the same point of the sample surface twice. The RSD value (RSD: Relative Standard Deviation) is displayed after the third sparking and should be less than or equal to 10 %.

- If that is not the case, carry out further sparkings.
- The results of sparking with the greatest deviations from the average value should be deleted. To delete individual sparkings, highlight the column or line by double-clicking and click the "Delete" button. **Caution:** Deletion cannot be undone!

11. Switch the excitation source **off** at the rotary knob (3) on the front of the instrument.
12. Clean the electrode tip.
13. Switch the excitation source back **on** at the rotary knob on the front of the instrument.
14. In the upper left of the screen click "Next" to spark the next recalibration sample.

Information For the other samples, the RSD value should be less than or equal to 3 %.

Checking the results

After recalibration is completed ("Recalibration successful" note), proceed as follows to check the recalibration factors:

1. Select "Show Recalibration" from the menu bar.
2. All values in the "Factor" column should range between 0.5 and 2.0, ideally near 1.

NOTICE

If factors and/or offset values are outside these ranges, please contact our local Hitachi High-Tech Analytical Science service partner.

After start-up and recalibration, save the analytical data of the instrument as described in the "Backup" chapter of the SpArcfire operating manual to make sure that all relevant data can be recovered if required.
The customer is responsible for regular data backup.
Hitachi High-Tech Analytical Science cannot be called to account in the event of data loss. Data loss can be caused by a failed hard disk, computer viruses, etc.

7 Quick start

7.1 Analysing in spark mode (argon)

Argon quality

If the instrument has not been used during a prolonged period of time, the argon system must be sufficiently purged with argon to remove air from the system. In order to do so, please place a prepared sample on the spark stand and actuate the "Argon Flush" button in the "Analysis" menu item of the main measuring window.
You can switch the purging process off after approx. 5 minutes. Used argon must contain less than 5 ppm of O_2 and H_2O (4.8 argon; 99.998 % or above). Analysis of some elements such as carbon is heavily affected by impurified argon. With an argon quality of 4.6 (99.996 %), analysis may not be possible any more.
During measurement breaks, the spark stand opening should always be covered with a sample.

Sample preparation

The most critical part of spark analysis is the preparation of the sample.
The importance of sample preparation is often underestimated, although quality and reliability of the analysis directly depend on it.
Since the spark discharge only evaporates material on the sample surface and does not penetrate deep into the material, you also measure all impurities on the surface.
Dirt, oils, oxides and even fingerprints can disturb analysis and even prevent the formation of plasma. In that case, you obtain a poor burn spot with very low luminous efficacy ("white focal spot"). The result is a faulty analysis, that means the analysed sample composition does not correspond to the actual composition.

Information

Observe the following information before analysing the sample:

- Freshly ground and clean sample surfaces are a basic requirement for precise analyses!
- Replace the abrasive paper as soon as you change the matrix (e.g. from Cu to Fe) or as soon as the paper does not grind very well any more.
  In general, one set of recalibration samples can be prepared with the same abrasive disk, always starting with the pure sample which is the sample with the smallest number in the stamped designation (e.g. "RA10" for Al matrix).
- Do not use silicon carbide paper (SiC), since the silicon and carbon content adulterates the analysis of those elements. Hitachi High-Tech Analytical Science recommends the use of aluminium oxide paper (corundum) or zirconium oxide paper. Use paper of grain size 60.
- For the preparation of "non-ferrous metals" (alloys with a pure iron content of no more than 50 %, e.g. aluminium or copper) we recommend preparing the sample surface by milling.
- We recommend to clean the spark stand after 1000 sparkings at the latest to ensure preferably precise analyses (chapter 9, page 39).
- The electrode must be cleaned upon every new measurement using the electrode brush (brass handle; chapter 9, page 39).

- When you change the matrix (e.g. from iron to aluminium), replace electrode, brush, ceramic insert and spark stand plate (chapter 9, page 39). Otherwise, analysis can be falsified by a contamination on the components. Therefore, there are a separate tungsten electrode, brush, ceramic insert and spark stand plate for every matrix.
- The spacing between electrode tip and sample surface must be set with the electrode setting gauge (chapter 9, page 39).
- For measuring samples with a diameter of < 11 mm use the measuring adapters and the boron nitride collimator (chapter 9.11, page 50).

Prerequisites for analysis

- The instrument has been successfully put into service (chapter 6, page 27).
- All other required settings have been made (see software manual).

1. To spark a sample (1, fig. 7-1), place it on the spark stand (2) with the prepared side down which is as even as possible so that the spark stand opening (3) is completely covered, if possible.
   To facilitate sample adjustment, you can install an optional prism (5) on the spark stand.

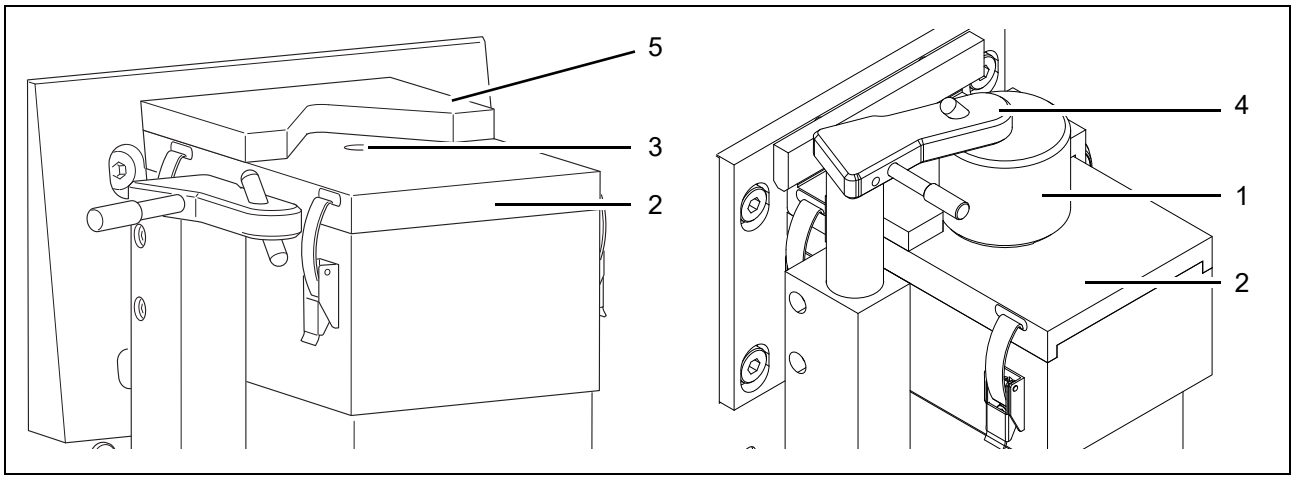


Fig. 7-1 Positioning the sample (example)

2. Press on the sample using the rotatable and height-adjustable hold-down device (4) attached to the left of the spark stand.

Information

Choose the point of support of the hold-down device on the sample so that the sample closes the spark stand opening as tightly as possible. This is mainly the case if the point of support is in the centre above the electrode.
If the sample is not placed correctly, there is a gap between sample and spark stand plate so that air from outside can enter the argon-purged analysis volume (between electrode and sample) and adulterate analysis. At the same time, the sound generated during sparking (measurement) exits through the gap more easily. A sparking noise as low as possible is therefore a good criterion for an optimally placed sample.

⚠ WARNING

Risk of injury due to UV radiation!

During the analysis of samples that do not entirely cover the spark stand opening (e.g. wires), spark light can emerge. Your eyes can be blinded by the light and the high-energy UV radiation can damage your eyes.

- Never look into the arc!
- Wear suitable eye protection during work.

⚠ WARNING

Wear ear protection!

During the analysis of samples that do not entirely cover the spark stand opening (e.g. wires), the sound generated upon sparking (measuring) exits through the gap.

- For sparking samples that do not entirely cover the spark stand opening wear ear protection.

⚠ DANGER

Electric voltage!

Risk of electric shock!

- During sparking, **do not, under any circumstances,** introduce a conducting object into the proximity of the spark stand opening!
- During sparking, **do not, under any circumstances,** remove a conducting object from the spark stand opening!
- With the spark stand opening open during sparking, **do not, under any circumstances,** bring a part of your body into its immediate vicinity!
- **Never** spark without the spacer screwed into the spark stand!

Information

The measurement can only be started if there is a sample clamped in the hold-down device, or if the hold-down device is swung outwards (90° to spark stand) and engages at the bottom.
If the hold-down device is at the bottom parallel to the spark stand, no measurement is possible.
Prior to starting sparking, make sure the hold-down device presses down the sample at the correct position.

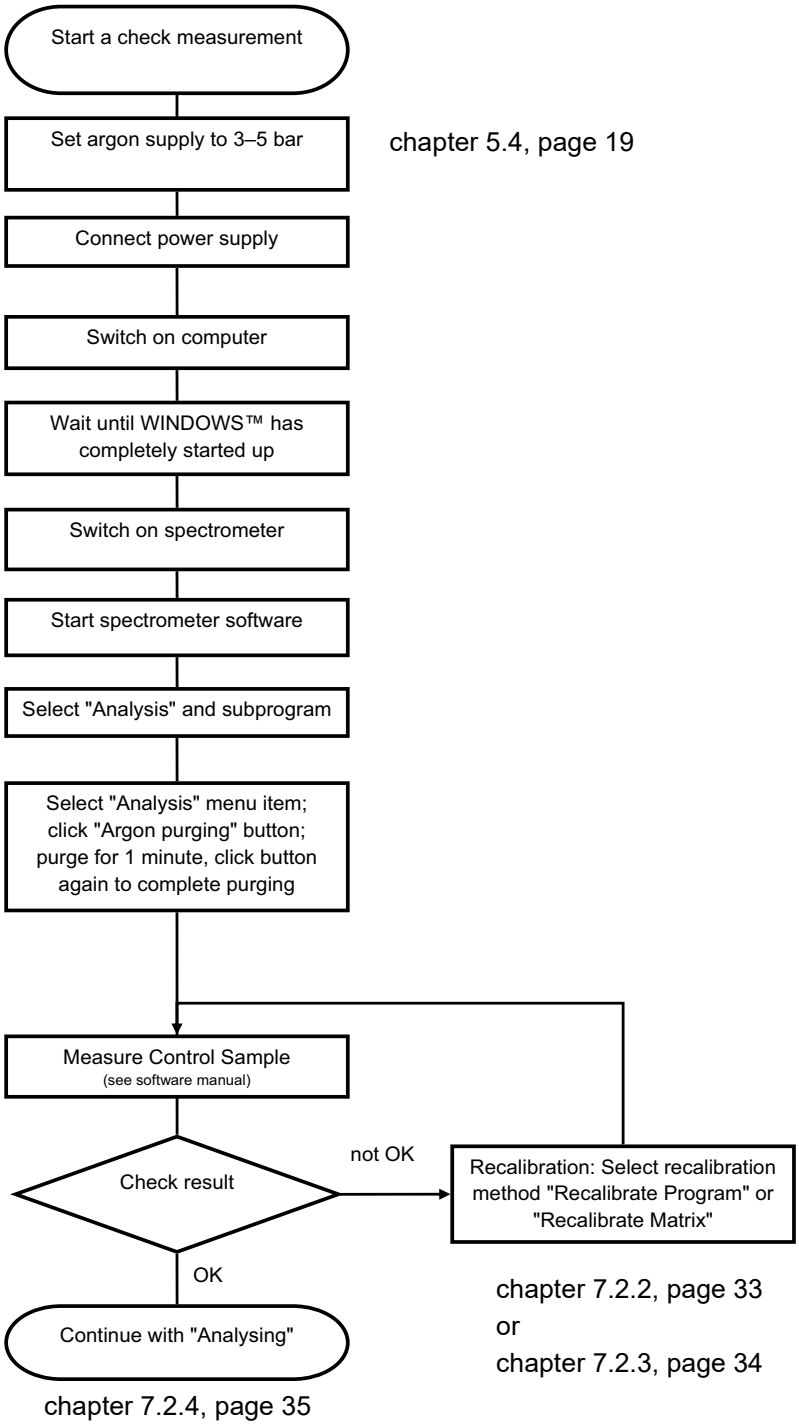
3. Select "Analysis" in the start screen of the SpArcfire program.
4. In the "Select analysis program" window, select a subprogram and confirm your selection with "OK".
5. Switch on the excitation source at the rotary knob on the front of the instrument.
6. Start the analysis of the placed sample by clicking "Start" or pressing the green start button on the front of the instrument.

The flowcharts in the following chapter illustrate the sequence of analysis and recalibration.

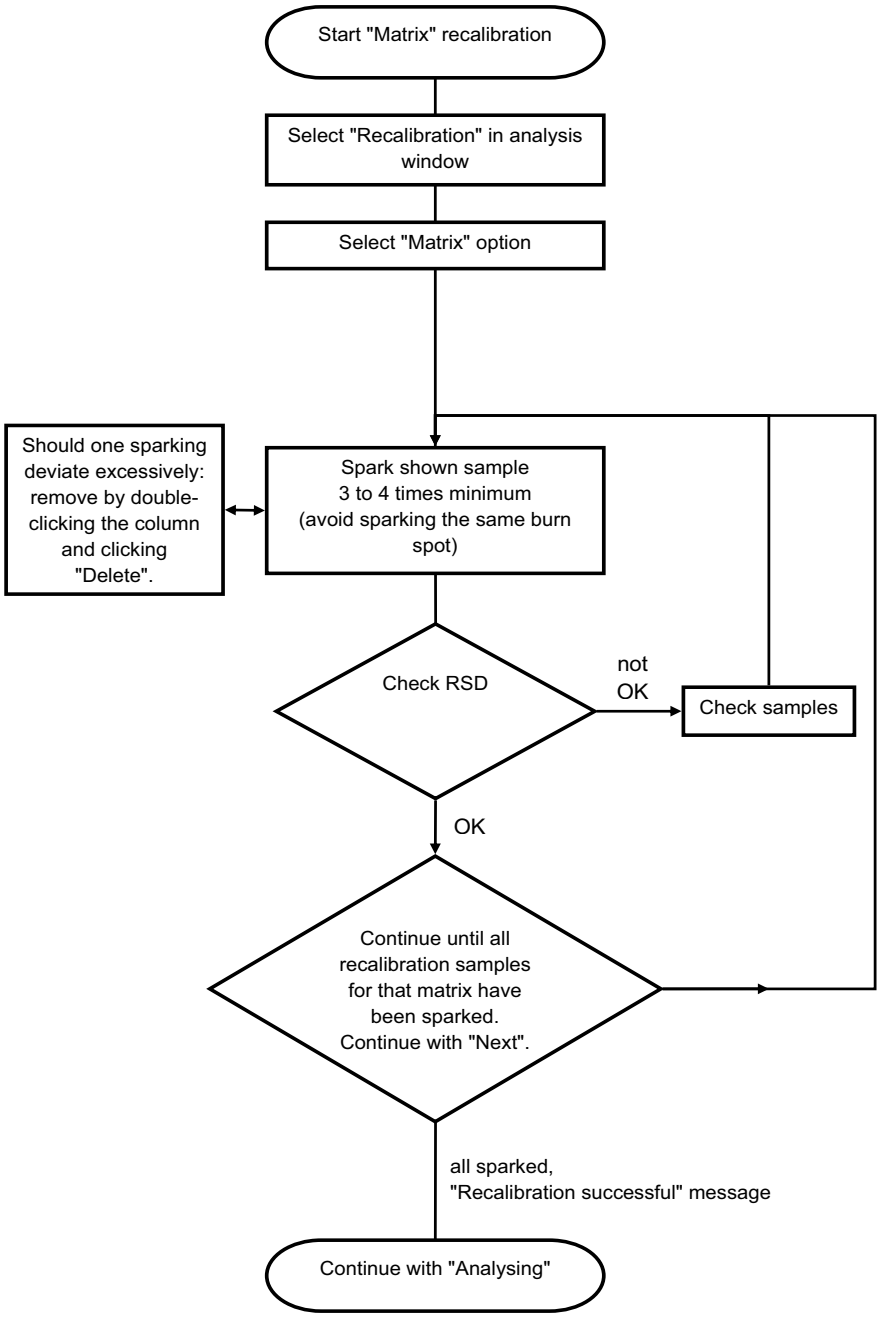
Further information on how to use the software can be found in the software manual.

7.2 Flowcharts for analysis and recalibration

7.2.1 Start and sequence of a check measurement in spark mode

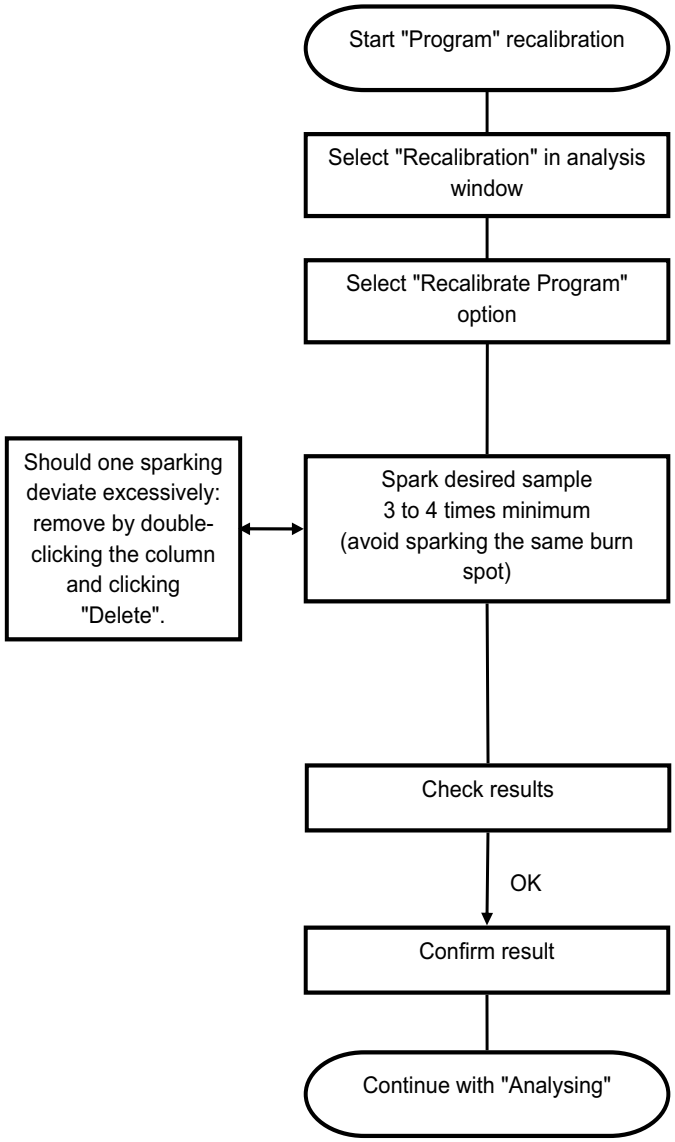


7.2.2 "Matrix" recalibration



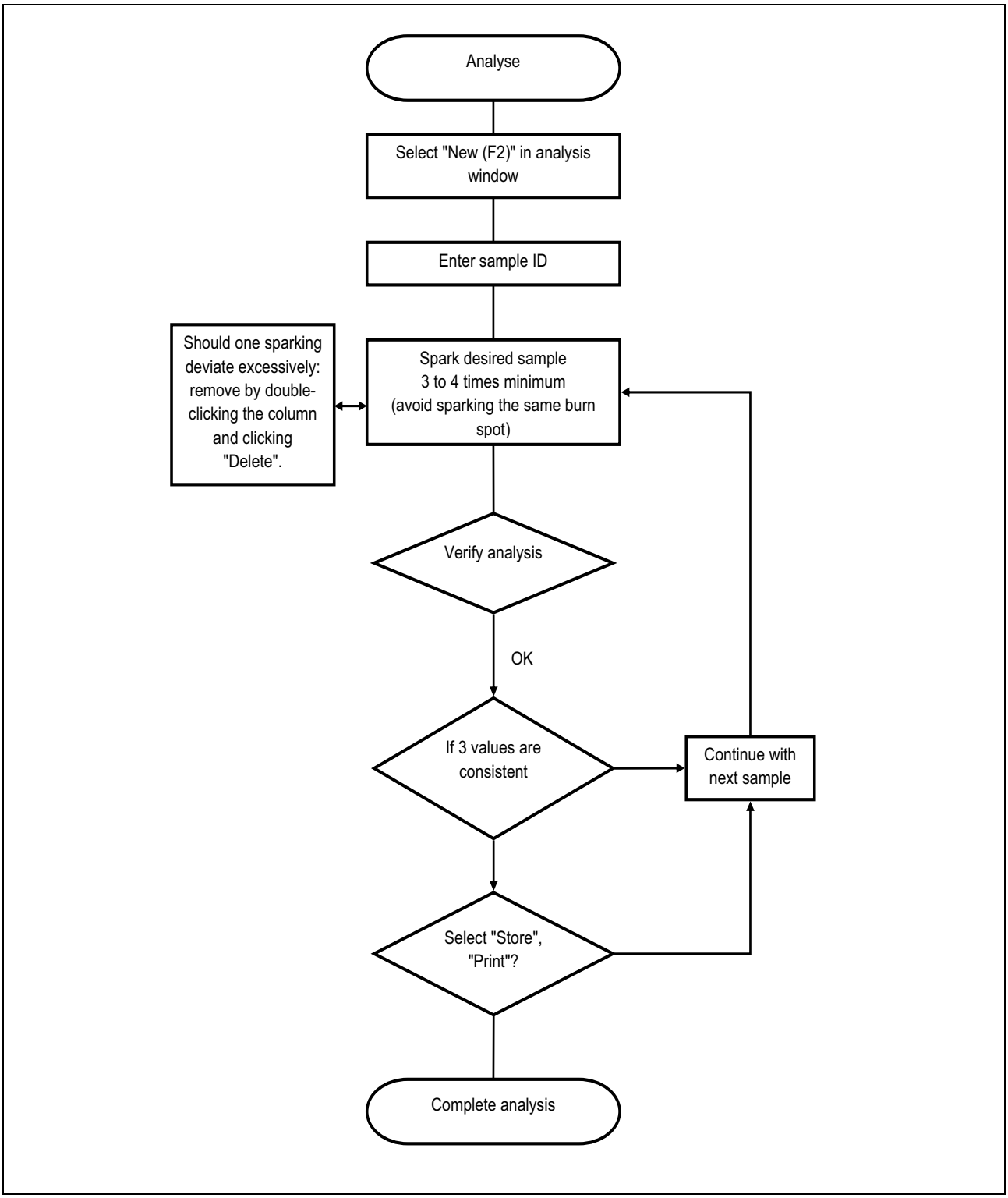
chapter 7.2.4, page 35

7.2.3 "Program" recalibration



chapter 7.2.4, page 35

7.2.4 Performing an analysis



8 Shutdown

Proceed as follows to remove the instrument from service:

1. Switch off the excitation source at the rotary knob on the front.
2. Terminate the SpArcfire software (Alt+Q), shut down the operating system and switch off the PC.
3. Switch off the instrument at the on/off switch on the rear.
4. Shut off argon supply at the pressure regulating valve of the bottle.

9 Maintenance

9.1 Safety instructions for maintenance and repair

Maintenance and repair may only be carried out by qualified specialised personnel.

Switching off the instrument

Prior to beginning maintenance or repair work, switch off the instrument:

- Switch off the excitation source at the rotary knob.
- Exit the SpArcfire software and shut down the operating system.
- Switch off the instrument at the on/off switch on the rear.
- Secure the instrument against restart and attach a warning "Caution – Maintenance!".

⚠ CAUTION

There is a crush hazard when opening or closing the holding clamps on the flap of the spark stand!

- If necessary, use a tool to open the holding clamps.
- Close the holding clamps from above.

9.2 Maintenance table

In the following table,

the abbreviation means that the maintenance activity must be performed

OH .....after x operating hours
m .....after x months
y.....after x years
.

Tab. 9-1 Maintenance intervals OE700 series

Assembly	Maintenance activity	Maintenance interval			Further information
		m	y	OH	
entire instrument	replacement of all loaded parts and analytical check of the instrument		1		to be performed by customer service
	check of filters and replacement, if required	3			chapter 9.6, page 47
	cleaning the instrument	1			chapter 9.8, page 48
	cleaning and filling the washing bottle	when dirty or filled to a low level			chapter 9.7, page 47
	replacing the argon bottle	as necessary			chapter 9.9, page 48
spark stand	cleaning the spark stand	• after 1000 sparkings (to ensure preferably precise analyses) • upon notification • at every change of matrix			chapter 9.3.1, page 41
	replacing the spark stand plate	at every change of matrix			chapter 9.3.2, page 42
	cleaning of electrode with brush	after every measurement			chapter 9.4.1, page 43
	replacing the electrode	at every change of matrix			chapter 9.4.2, page 44
	adjustment of the electrode	after every change of electrode			chapter 9.4.2, page 44
	changing the ceramic insert	at every change of matrix			chapter 9.5, page 46

9.3 Maintenance of the spark stand

9.3.1 Disassembling and cleaning the spark stand

When the spark stand must be cleaned, an according message is displayed on the screen.

Information

We recommend the immediate cleaning of the spark stand when this message is displayed.
You could skip the message clicking "Remind later", however, that is not recommended.
The cleaning interval can be set in the "Options" window (see software manual).

Proceed as follows:

Opening the spark stand

1. Switch the instrument off (chapter 9.1, page 39).
2. Loosen the 4 holding clamps (1, fig. 9-1) on the spark stand plate (2).
3. Lift the spark stand plate vertically to the top.

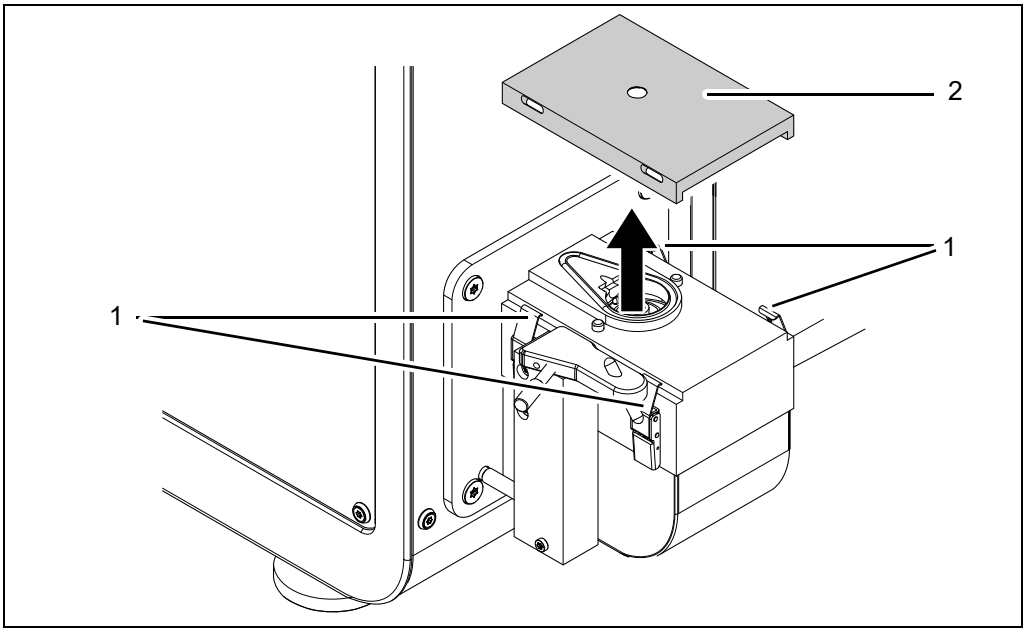


Fig. 9-1 Opening the spark stand plate

Cleaning the spark stand

4. Brush the condensate off the surface below the spark stand plate and around the electrode using the brush from the accessory case.

⚠ CAUTION

There is a crush hazard when closing the holding clamps on the spark stand plate!

- Close the holding clamps from above.

5. Replace the spark stand plate on the spark stand and close the holding clamps.

9.3.2 Replacing the spark stand plate

Information

There are a separate tungsten electrode, brush, ceramic insert and spark stand plate for every matrix.

Replace the spark stand plate whenever you change the matrix.

Opening the spark stand

1. Switch the instrument off (chapter 9.1, page 39).
2. Loosen the 4 holding clamps (1, fig. 9-1) on the spark stand plate (2).
3. Lift the spark stand plate vertically to the top.

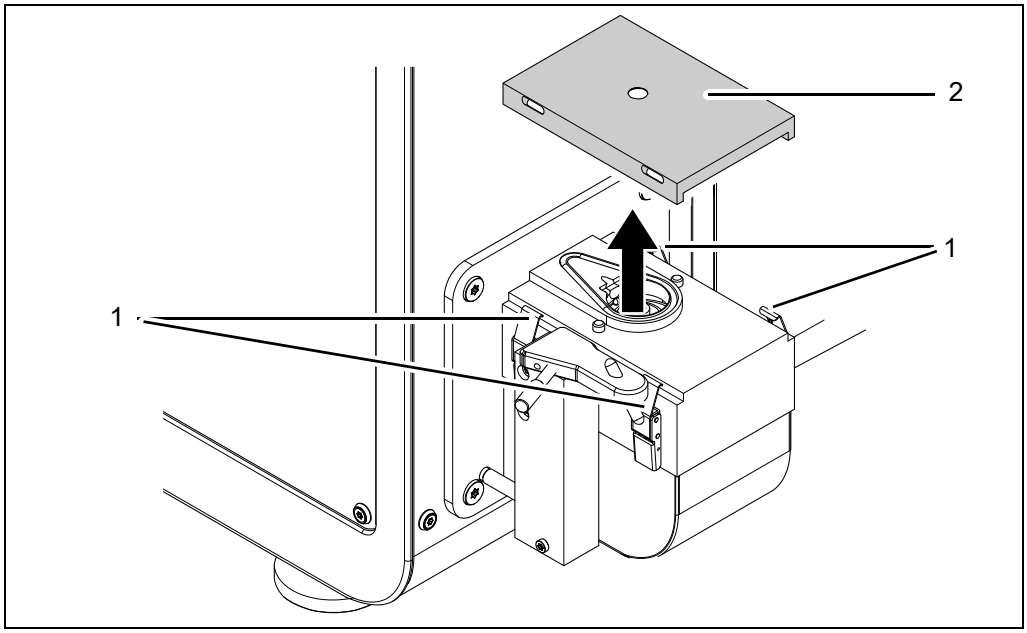


Fig. 9-2 Opening the spark stand plate

Cleaning the spark stand

4. Brush the condensate off the surface below the spark stand plate and around the electrode using the brush from the accessory case.

⚠ CAUTION

There is a crush hazard when closing the holding clamps on the spark stand plate!

- Close the holding clamps from above.

5. Place the **spark stand plate of the new matrix** on the spark stand and close the holding clamps.

9.4 Maintenance of the electrode

9.4.1 Cleaning the electrode

The electrode must be cleaned with the electrode brush after every measurement because residue on the electrode could affect the measurements. This is evident from fluctuating measuring results. When changing the sample there can also be falsified values due to contamination. In the worst-case scenario excessive residue on the electrode can lead to short circuits.

Use the electrode brush (brass handle) to clean the electrode as follows:

1. Switch off the excitation source at the rotary knob on the front of the instrument.
2. Brush the tungsten electrode through the spark stand opening (1, fig. 9-3) using the electrode brush from the accessory case.
3. Switch the excitation source back on.

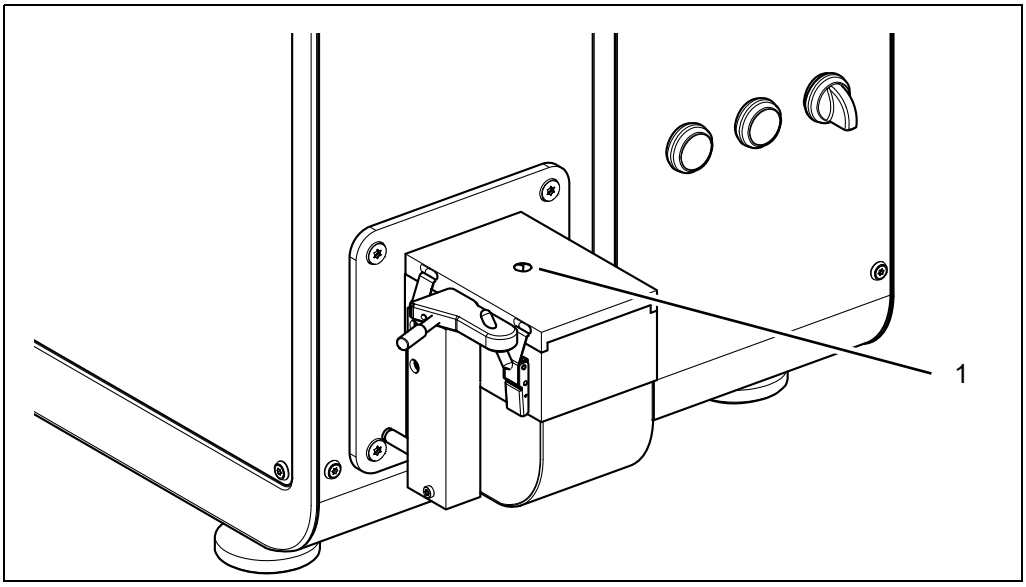


Fig. 9-3 Spark stand

9.4.2 Replacing and adjusting the electrode

Information There are a separate tungsten electrode, brush, ceramic insert and spark stand plate for every matrix.

Replace the electrode whenever you change the matrix.

1. Switch the instrument off (chapter 9.1, page 39).
2. Screw out the spacer (1, fig. 9-4) on the right.
3. Loosen the inner grub screw (2) on the electrode clamp using a 2 mm Allen key (3).
   - The electrode (4) is pushed out of the spark stand toward the top by a spring.

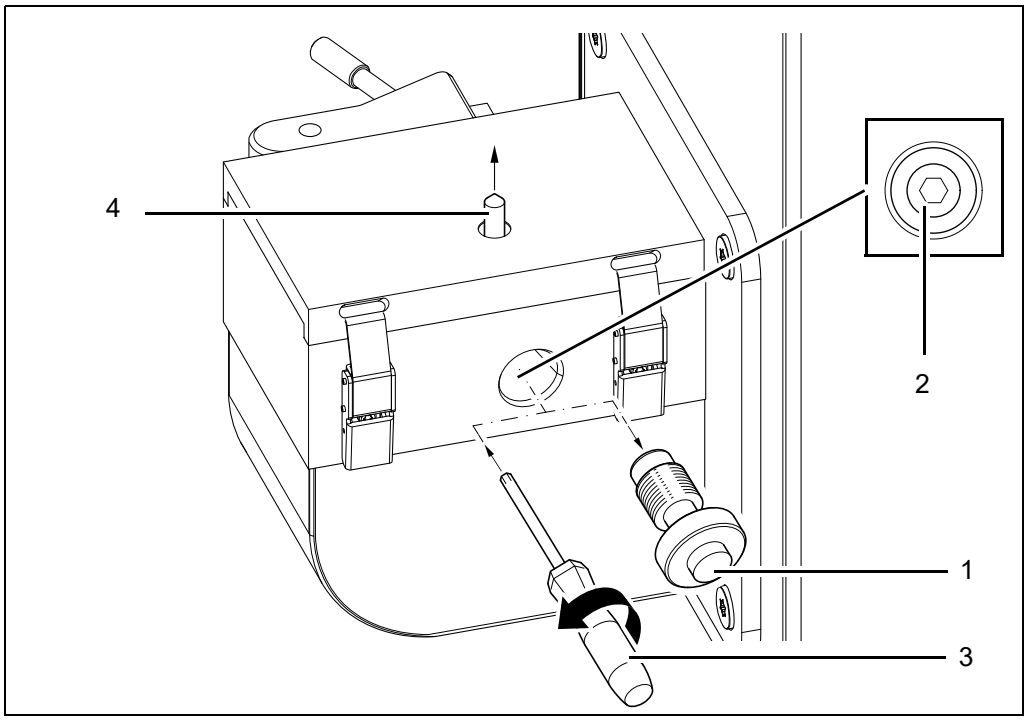


Fig. 9-4 Replacing the electrode

4. Completely remove the electrode and replace it with a new one.
5. Insert the new electrode from above.

Adjusting the electrode

6. Completely press down the new electrode with the head (1, fig. 9-5) of the spacer to adjust the correct distance to the sample. Simultaneously fasten the grub screw to the electrode clamp.

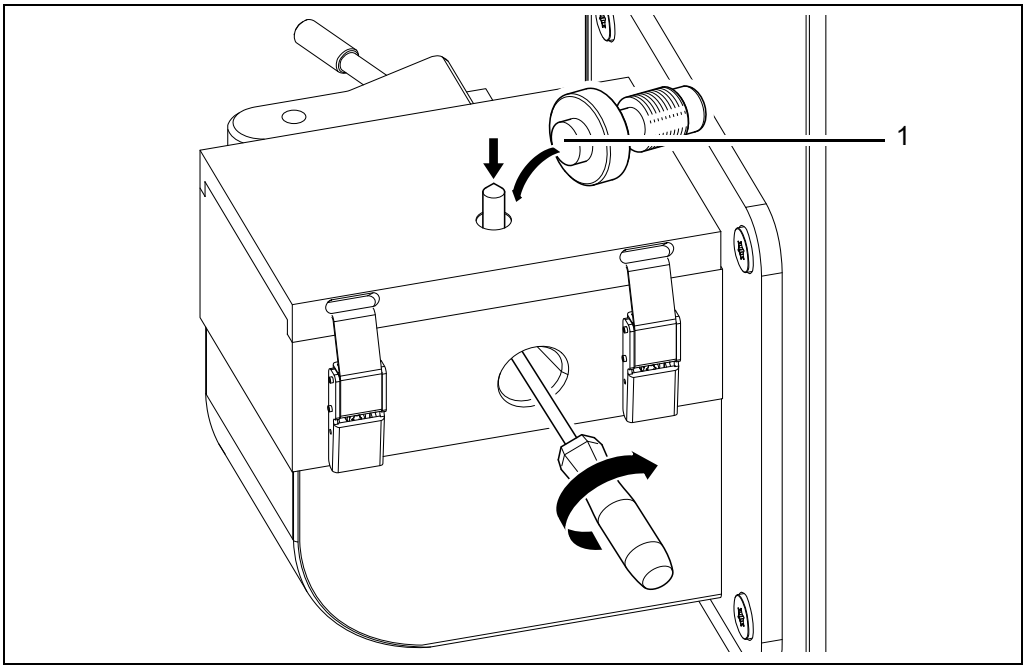


Fig. 9-5 Installing the electrode

DANGER

Spark-over!
If the spacer is not screwed in, this may cause a spark-over between the electrode and the spark stand during sparking.

- **Never** spark without the spacer screwed into the spark stand!

7. Screw the spacer back into the side of the spark stand finger-tightly.

9.5 Replacing the ceramic insert in the spark stand

Information There are a separate tungsten electrode, brush, ceramic insert and spark stand plate for every matrix.

Replace the ceramic insert whenever you change the matrix.

1. Switch the instrument off (chapter 9.1, page 39).
2. Disassemble the spark stand plate (chapter 9.3.2, page 42).
3. Disassemble the electrode (chapter 9.4.2, page 44).
4. Place the screw head pin from the accessory case into the ceramic insert (1, fig. 9-6) from the top and expand the pin with the screw head.
5. Use the pin to remove the ceramic insert from the spark stand in an upward movement.

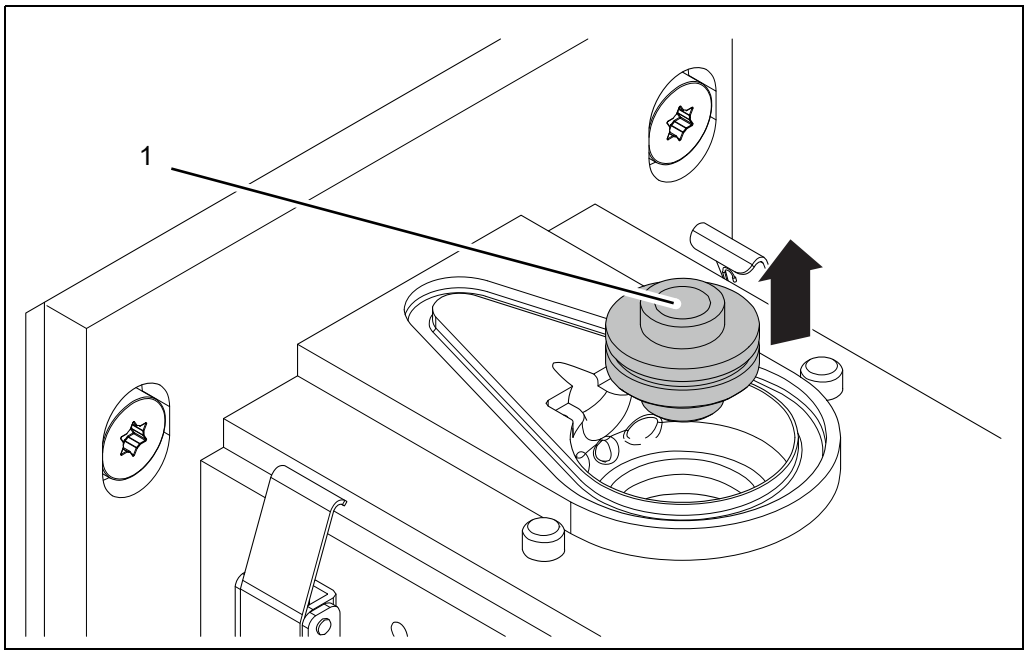


Fig. 9-6 Ceramic insert (example)

Information Observe the safety regulations for handling acetone!

6. Clean the pulled out ceramic insert with a soft, acetone-soaked cloth.
   - If the ceramic insert cannot be cleaned, replace it.
7. Reinsert the ceramic insert of the new matrix into the spark stand.
   - Make sure that the seal is mounted.
8. Assemble the spark stand plate of the new matrix on the spark stand (chapter 9.3.2, page 42).
9. Assemble the electrode of the new matrix (chapter 9.4.2, page 44).

9.6 Replacing filters

Check the filter mats in the fan and in the outlet filter on the rear of the housing for contamination. Replace the filter mats if required.

9.7 Cleaning and filling washing bottles

The washing bottle (2) filled with tap water serves to collect the off-gases from sparking so that they are not released into the air.
From time to time, check the washing bottle is correctly filled. Clean and fill it if the fill level is not correct or cannot be easily seen.

Twin bottle system

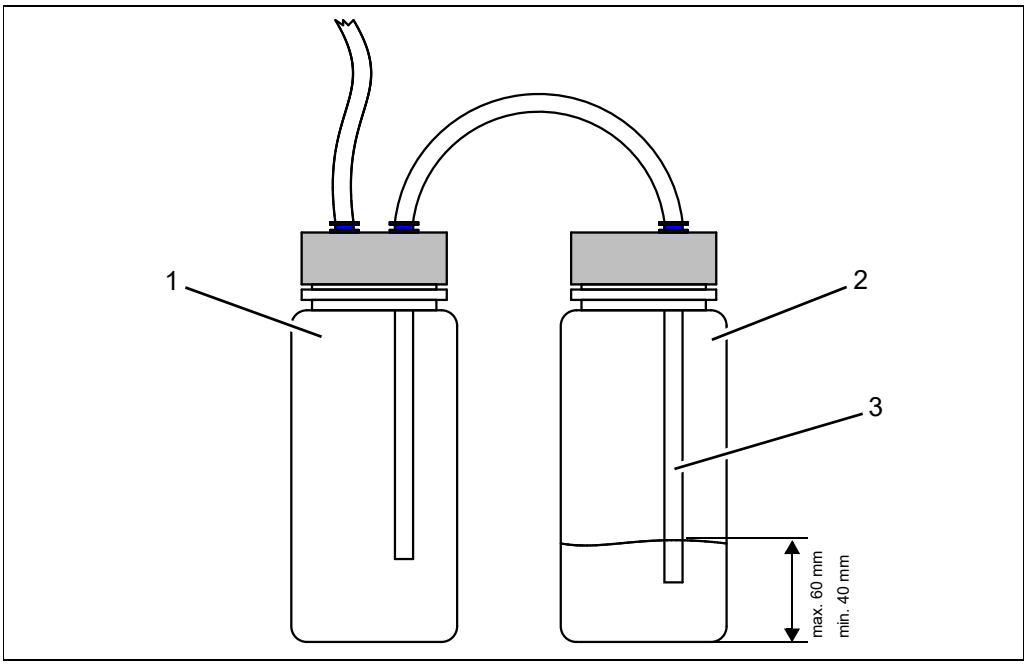


Fig. 9-7 Washing bottles

NOTICE

Potential damage caused by water!
The empty bottle (1, fig. 9-7) prevents water being sucked into the exhaust hose.
- **Do not** fill water into the empty bottle!

To clean and fill the washing bottle (2), proceed as follows:
- Unscrew the lid of the washing bottle.
- Empty the washing bottle.
- Rinse any dirt out with tap water.
- Fill up the washing bottle with tap water.
  - The washing bottle's tube (3) must be below the water level.
  - The fill level in the washing bottle must not exceed 60 mm high and should be at least 40 mm high.
- Screw the lid back onto the washing bottle. Make sure that the lid is well positioned.

9.8 Cleaning the instrument

Use a soft, dry or slightly damp cloth to clean the spectrometer on the outside. DO NOT use any solvents!
No water may penetrate into the instrument!

9.9 Replacing the argon bottle(s)

When replacing the argon bottle(s), air might enter part of the argon supply segment. There are two possible ways to then remove it from the system again:

- One possibility is to purge the argon system after replacement. For that, activate purging via "Analysis", "Argon Flush". That method is quite time-consuming, since it may take several hours until the supply lines have been purged sufficiently so as to ensure the analysis is not affected any more.
- A more effective possibility is the use of purchasable fittings, with a purging device on the delivery side. That is the safest method.

9.10 Renewing the argon connection

After a prolonged period of use of the instrument or frequent loosening of the argon connection, the union nut at the copper tube may be worn.
This causes a leakage in the argon system and results in an incorrect analysis.
Check the argon connection for damage and leaks on a regular basis.
If the argon connection is damaged, it must be renewed as follows:

NOTICE

Potential damage caused by chips!
When using a metal saw, the argon system may be soiled with chips!
- Use a pipe cutter for outer pipe diameters of 3–16 mm.

1. Unscrew the screwing (1, fig. 9-8) of the copper tube (2) from the instrument.
2. Sever the copper tube approx. 3–4 cm behind the old screwing using a pipe cutter.

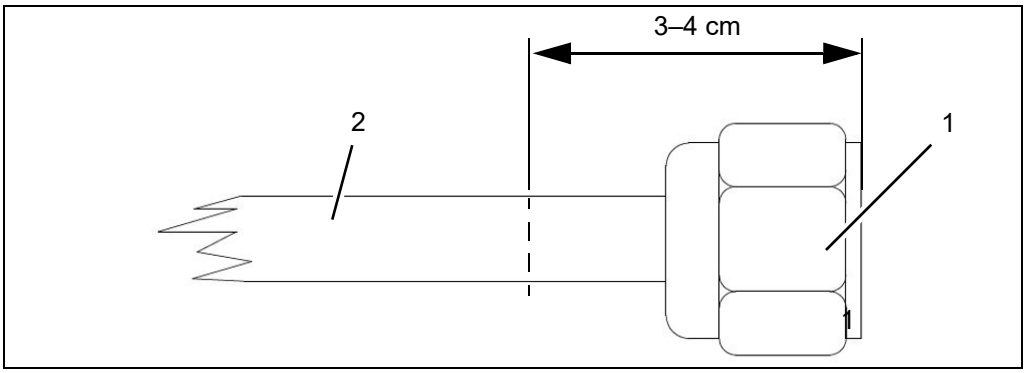


Fig. 9-8 Severing the copper tube

NOTICE

Pay attention to the sequence and direction of the fitted parts; otherwise the instrument connection can be damaged.

3. Mount the individual components of the new screwing (see accessory case) to the end of the copper tube as shown in fig. 9-9.

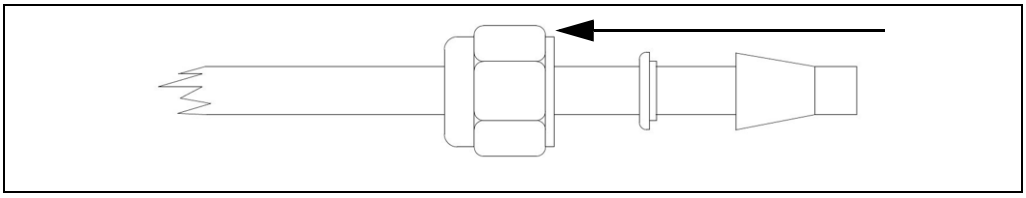


Fig. 9-9 Mounting the new screwing

4. Insert the copper tube into the instrument connection up to the stop.
5. Slide the screwing onto the thread of the instrument connection.

NOTICE

Do not overwind the thread.

6. Fasten the screwing using an SW14 open-end wrench.

9.11 Measuring adapters

For measuring wire samples and tubes with a diameter of < 11 mm, the diameter of the spark stand opening in the spark stand plate must be reduced in order to increase measuring accuracy.
For this purpose, a boron nitride collimator and two different wire adapters are available.

- The boron nitride collimator reduces the diameter of the spark stand opening from 10 mm to 5 mm.
- The wire adapters retain the wire on the spark stand plate.
- Using the adapters, you can measure samples with a diameter of < 3 mm with sufficient precision.
- Generally, it is preferable to use the "face-on" adapter in order to achieve more consistent measuring results and avoid surface effects.

Information

Even if the constant argon flow reduces the negative effects of an open spark stand opening, it is indispensable to shield the measuring spot from ambient air for the precise determination of carbon (C) and phosphorus (P).
A disadvantage of boron nitride is that the boron contained therein is also contained in steel. During sparking, a contamination with boron can therefore not be excluded, and a recognition of boron concentrations in steel of < 30 ppm cannot be guaranteed.

DANGER

Risk of electric shock!
The boron nitride collimator is non-conductive. Small parts measured using the collimator do not have earthing contact with the instrument, thus there is a risk of electric shock!

- **Do not** touch the sample during measurement!
- Should the hold-down device shift or any other inadvertent event occur during a measurement, always switch off the excitation source before remedying the error.

NOTICE

Touch the boron nitride collimator carefully so that it does not break.

1. Place the adjustment aid (1, fig. 9-10) for the wire adapter onto the spark stand plate and fix the adjustment aid using the knurled screw (2).
2. Insert the boron nitride collimator (3) into the spark stand opening.

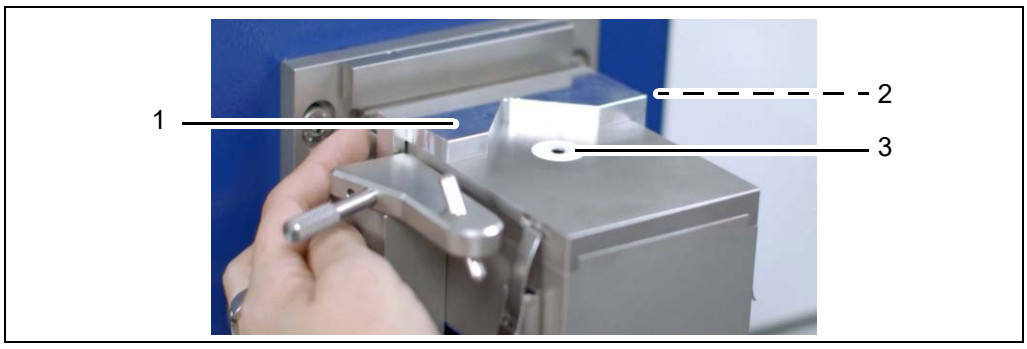


Fig. 9-10 Adjustment air and boron nitride collimator (example)

Wire adapters

For analysing wire samples, please use the optional wire adapters.
There is an adapter for analysing the lateral wire surface ("side-on") and an adapter for analysing the front wire surface ("face-on").

3. Fix the wire to be measured with the wire adapter.

The following illustrations show the two adapters and their positions on the spark stand plate.

Fig. 9-11 "side-on" wire adapter on spark stand plate (example)

Fig. 9-12 "face-on" wire adapter on spark stand plate (example)

10 Faults

10.1 General faults

NOTICE

Faults caused by anti-virus software!
An anti-virus software or other software installed on the computer which is not specified by Hitachi High-Tech Analytical Science may cause system faults.

Disturbances from electrical signals

Disturbances caused by the electrical signals of the external keyboard and mouse can be prevented by fitting the two ferrites (item no. 3510000047) to the connection cables of the keyboard and mouse as shown below.

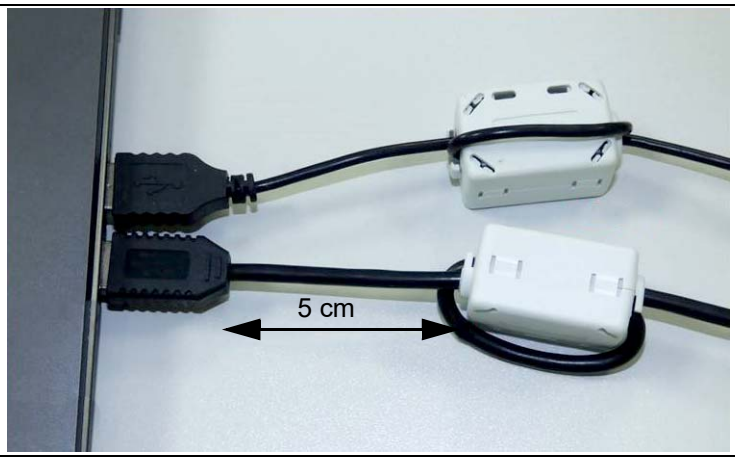


Fig. 10-1 Ferrites

- Mount the ferrites at a distance of approx. 5 cm from the USB connectors.
- Wrap the cable around the ferrite one time (1x).

Information

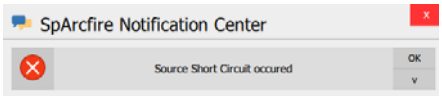
The ferrites are supplied in the accessory case. If you have obtained the external keyboard and mouse from Hitachi High-Tech Analytical Science, the ferrites are already mounted.

Instrument faults

You can recognise any instrument faults e.g. from error messages displayed on the screen. Try to remedy the error using table 10-1.
Should you have any problems remedying the error, feel free to contact our customer service for support.
Our contact data are provided under "Service" (chapter 12.1, page 61).

10.2 Faults of the OE700 series

Table 10-1 Possible faults and remedies (OE700 series)

Fault	Information	Remedy/explanation
No communication between PC and instrument	Error message: No spectrometer connected! Possible reasons: ...	Follow the instructions in the error message.
Measurement cannot be started.	Red bar at the bottom of the analysis window of the instrument: 1. Source 2. Sample 3. Argon	1. Switch on the excitation source on the instrument. 2. Place the hold-down device prior to measurement. 3. Is the argon pressure correct?
Instrument cannot be switched on.	No visible reaction at the instrument	1. Is there a mains voltage? 2. Check fuses at the power input.
measurements extremely loud	Loud measurement	1. Position the sample correctly. 2. Connect the off-gas hose to the washing bottle. 3. Check the water level in the washing bottle.
Intensity in the direct light path decreases or has completely ceased.	Error message: Reference beyond tolerance	1. Incorrect analysis program selected? 2. Check of argon system? 3. Optics sufficiently purged?
Measuring results deviate from usual values, precision decreases, spark-overs in the spark stand.	(See fault)	1. Check the electrode spacing and readjust, if required. 2. Clean the spark stand.
Message: e.g. Cr > 6 %	Message: Admissible calibration range exceeded.	Wrong analysis program selected – start in orientation program.
Message: e.g. C < 0.001	Message: Detection limits fallen below of.	The concentration of the corresponding element in the measured sample is too low.
Short circuit	1. Flashing rotary knob (source) 2. Error message SpArcfire: 	1. Switch off the rotary knob for the excitation source on the front of the instrument. 2. Confirm the error message with OK. 3. Clean the spark stand (chapter Maintenance). Please note that there might be other reasons for the short circuit (e.g. a foreign object). 4. Switch the rotary knob for the excitation source back on and repeat the measurement. 5. Should the error reoccur directly, please contact the service.

Information If none of the above named faults can be identified or the fault cannot be remedied applying the methods indicated under "Remedy", please contact the service (see chapter 12.1, page 61).

10.3 Information regarding nitrogen analysis

Nitrogen (N) analysis, particularly in steel, does not fundamentally differ from analysis of other non-metals such as phosphorus or sulphur. The challenge consists in the presence of N_2 in the atmosphere. Even the smallest leak in the area of the valves and fittings, the argon supply or the spark stand immediately leads to fluctuating and/or incorrect analysis values, although the burn spot – as the general evaluation criterion for "good sparking" – is still in order. The same applies for a too high N_2 content in the used argon. Careful work and repeated checks of the instrument condition are prerequisites for precise and correct N analysis.

Argon quality

Since nitrogen can also be present as contamination in the used argon, argon must be very pure. The N_2 content should be below 1 ppm. That is only ensured from a purity of at least 99.9999 %, corresponding to quality[1] 6.0 (also referred to as 6N0). However, that quality is relatively expensive.

A less expensive solution is so-called spectrometer argon (argon for spectrometry). It has at least 99.999 % (Ar 5.0) and can therefore contain a maximum of 10 ppm of contaminations. From experience we can assume that with respect to the N_2 content the qualities 6.0 and 5.0 barely differ in Europe and the States so that usually spectrometer argon can be used for analysing nitrogen. However, there is no guarantee as to the high degree of purity. The difference in price results from the guarantee and the special bottling procedure.

Spectrometers of Hitachi High-Tech Analytical Science allow to easily check the used argon by means of a pure aluminium sample.
As far as the Al matrix is part of the spectrometer analysis programs, recalibration sample RA10 is used. A pure aluminium sample is also included in the scope of delivery of instruments without Al matrix. A small bottle of Ar 6.0, however, is useful for cases of doubt.

1. *The quality indicates the minimum percentage of gas in abbreviated form. The number of nines in the percentage is indicated in front of the dot. The digit following the dot is equal to the first of nine deviating digits in the percentage. Ar 4.6, for example, indicates an Ar degree of purity of at least 99.996 %. Ar 5.0 accordingly contains at least 99.999 % of argon.*

11 Reshipment and disposal

11.1 Declaration of Decontamination

Due to legal regulations and to ensure safety of our employees, Hitachi High-Tech Analytical Science requires a signed Declaration of Decontamination prior to processing your reshipment.
Enclose this form signed with the shipping documents and attach it on the outside of the packaging. Reshipments that have been exposed to hazardous substances and which have not been decontaminated according to good professional practice, are not processed and returned at your expense.

NOTICE

The instrument must not be shipped without the transport lock installed. Previous to that, contact our customer service.

The Declaration of Decontamination as well as the contact information are provided in the Annex.

11.2 Disposal

The PC includes a battery containing contaminants. That must not be disposed of with the domestic waste.
After the life has expired, disposal may only be executed through the customer service of Hitachi High-Tech Analytical Science or a suitable collection point.

The operating company is obliged to dispose of the instrument after the completion of its use at his/her own expense according to the legal requirements and to exempt us from the take-back obligation and related claims of third parties.

Disassemble the instrument for disposal into the individual material groups:

- plastics
- non-ferrous metals (e.g. copper scrap)
- aluminium
- electronic scrap
- steel

Dispose of the materials according to national legislation!

12 Annex

This chapter contains

- service address
- glossary
- list of components in the standard accessory case
- Declaration of Decontamination

12.1 Service

If you need any help handling this product, please contact your service partner of Hitachi High-Tech Analytical Science or call us at the Service Centre:

Hitachi High-Tech Analytical Science
Service
Wellesweg 31
47589 Uedem
Germany

EMEA
Phone: +49 (0)2825 9383-421
E-mail: support.de@hitachi-hightech-as.com

Americas
Phone: +1 978-369-9933
E-mail: support.us@hitachi-hightech-as.com

India
Phone: +91 (0)22 4253 5100
E-mail: support.in@hitachi-hightech-as.com

Asia/China
Phone: +86 400 622 5191
E-mail: support.cn@hitachi-hightech-as.com

12.2 Glossary

AES	Short for Atomic Emission Spectrometry
OES	Short for Optical Emission Spectrometry
arc mode	here: Using an arc probe or a combined probe with the arc adapter. The sparking takes place in an air atmosphere without argon. Thus, the measurement is less precise but can be carried out faster and is less complicated.
CMOS sensors	are light-sensitive semiconductor chips used to measure the intensity of a radiation source. In a spectrometer, the source is the plasma generated during sparking.
CRM	Short for Certified Reference Material: designation for samples whose precise composition is known. Used for spectrometer recalibration.
spark mode	In spark mode, the sparking takes place in argon atmospheres in the spark stand for stationary instruments and in the spark adapter of the combined probe or in the head of the UVPro probe and the spark probe for mobile instruments.
ICP	Short for Inductively Coupled Plasma
PMI	Short for Positive Material Identification
plasma	Plasma is a material state in which atoms or molecules are split into charged fragments (ions and electrons) at very high temperatures. Excited atoms and ions emit light of discrete wavelengths the intensity of which is measured in the spectrometer.
recalibration	Periodic remeasuring of a measuring/test device (here spectrometer and recalibration sample) to monitor and adjust its accuracy.
standard deviation	The standard deviation is a measure for the deviation of measured values around their average value. A distinction is made between relative standard deviation (RSD) and absolute standard deviation (SD).
white burn spot	Poor burn spot with very low luminous efficacy. It results from contamination on the sparked surface.
XRF	Short for X-ray fluorescence

12.3 Standard accessory case, packed

Table 12-1 Standard accessory case, packed

Item number	Designation	Quan-tity
10016319	Al sample for N test only	1
10013929	O-ring 9 x 2 mm	2
10013877	O-ring 16 x 2 mm	2
10017211	Instruction leaflet: ferrites for keyboard and mouse	1
10017603	TORX screw driver T20, L = 100 mm	1
10017675	Tool box	1
10000060	2 m power cable, IEC power connector (for non-heating appliances)	1
10016089	USB cable A-B, 1.8 m, with ferrite	1
10013928	O-ring 51 x 3 mm	4
10000171	Extraction tool ceramic insert	1
10000182	Spark stand cleaning brush	1
10000156	Hexagon screwdriver SW 2	1
10000134	Fusing 6.3 A, 5 x 20 mm, slow-blowing	10
10000004	Tungsten electrode	1
10000046	Brush for electrode	2
10000160	Union nut	2
10000161	Locking ring set	3
10000129	Allen set screw M4 x 4 mm	5
10000005	Compression spring for electrode	2
10000253	Fan filter	2
10014308	Snap ferrite	2

Declaration of Decontamination
Dekontaminationserklärung

Because of legal regulations and for the safety of our employees Hitachi High-Tech Analytical Science needs a signed "declaration of decontamination" before your return can be handled.
This signed declaration must be included with the shipping documents on the outside of the packaging. Any returns which were exposed to hazardous substances and were not professionally decontaminated are not accepted and will be sent back on your cost.
Aufgrund gesetzlicher Bestimmungen und um die Sicherheit unserer Mitarbeiter zu gewährleisten, benötigt Hitachi High-Tech Analytical Science eine unterschriebene Dekontaminationserklärung, bevor Ihre Rücksendung bearbeitet werden kann. Legen Sie dieses unterschriebene Formular den Versandpapieren bei und bringen Sie es außen an der Verpackung an. Rücksendungen, welche gefährlichen Stoffen ausgesetzt waren und nicht fachgerecht dekontaminiert wurden, werden nicht bearbeitet und auf Ihre Kosten zurückgeschickt.

Name / *Name*	Address / *Adresse*	
Serial number / *Seriennummer*		
Order number / *Auftragsnummer*	Phone / *Telefon*	E-mail / E-Mail
Notes / Bemerkungen		

1. Equipment has been in contact with hazardous substances.
Das Gerät ist mit gefährlichen Stoffen in Berührung gekommen.

☐ No / *Nein* ☐ Yes / *Ja* = Please list the hazardous substances. / *Bitte benennen Sie die gefährlichen Stoffe.*

	Substance / *Stoff*	**Danger Class / *Gefahrenklasse***	**Safety precautions / *Sicherheitsvorkehrungen***
1			
2			
3			

2. Equipment has been decontaminated professionally. / *Das Gerät wurde fachgerecht dekontaminiert.*

☐ No / *Nein* ☐ Yes / *Ja* = Cleaning agent / *Reinigungsmittel:* ----------

3. Legally binding declaration / *Rechtsverbindliche Erklärung*

Herewith I confirm that the returned instruments were cleaned and decontaminated according to the industry standards and all appropriate regulations. The instruments are free of hazardous substances.
Hiermit bestätige ich, dass die zurückgesendeten Geräte nach industriellen und gesetzlichen Bestimmungen gereinigt und dekontaminiert sind. Die Geräte sind frei von gefährlichen Stoffen.

Location / Ort

Company stamp and legally binding signature
Firmenstempel und rechtsverbindliche Unterschrift

Date / Datum

Name of signatory in block letters
Name des Unterzeichnenden in Druckbuchstaben