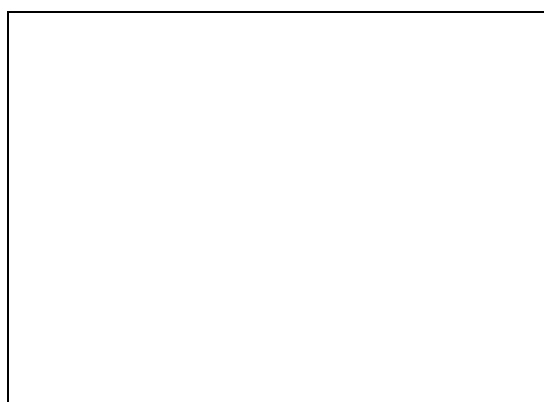


Operating Manual

ELEMENTRAC CS-d



Translation

ELTRA[®]
ELEMENTAL ANALYZERS

Urheberrecht

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1 Information about the Manual

This Manual provides technical guidelines on the safe operation of the machine. Read the Manual through carefully prior to installing, commissioning and operating the machine. Reading and understanding this Manual is a requirement for the safe and correct use of the machine.

This Manual does not contain any repair instructions. Please contact your supplier or Eltra GmbH directly in the event of any queries or questions concerning this Manual or the machine, or in the case of any faults or necessary repairs.


Further information about your machine can be found at <http://www.eltra.com/de> on the pages relating specifically to the machine.

Revision status

Document revision 0002 of the "ELEMENTRAC CS-d" Manual has been prepared in accordance with the Machinery Directive 2006/42/EC.

1.1 Explanation of signs and symbols

The following signs and symbols are used in this Manual:

Sign	Meaning
 <p>Additional or further information is shown here.</p>	Further or additional information.
<ol style="list-style-type: none"> 1. First instruction. 2. Next instruction. <p>Result.</p>	Numbered paragraphs contain a series of instructions. An instruction can end with a result.

Tab 1: Signs and symbols used

1.2 Disclaimer

This Manual has been produced with the greatest care. We reserve the right to make technical modifications. We shall accept no liability for any personal injuries resulting from the failure to comply with the safety information and warnings in this Manual. We shall accept no liability for damage to property resulting from the failure to comply with the instructions in this Manual.

1.3 Copyright

This Manual or parts of it may not be duplicated, distributed, edited or copied in any form without the prior written consent of Eltra GmbH. Damage claims will be asserted in the event of infringement.

2 Safety

Safety officer

The operating company itself must ensure that persons authorised to work on the machine comply with the following points:

- they have noted and understood all regulations regarding the area of safety;
- they are aware before they start work of all instructions and regulations relating to their target group;
- they have easy access to the Manual for this machine at all times;
- they have been familiarised with the safe and correct handling of the machine before starting work on it, either by means of a verbal introduction by a competent person and/or with the help of this Manual.

⚠ Incorrect operation may lead to personal injuries. The operating company itself is responsible for its safety and that of its staff. The operating company itself must ensure that no unauthorised personnel have access to the machine.

Target group

This covers everybody who operates, cleans or works on the machine.

This machine is a modern, efficient, state-of-the-art product from Eltra GmbH. Reliability is guaranteed when it is used correctly and when this Manual is complied with.

⚠ Persons under the influence of intoxicating substances (medications, drugs, alcohol) or who are overtired are not allowed to operate or work on the machine.

2.1 Explanation of the safety instructions

The following **warnings** in this Manual alert to potential hazards and damage:

⚠ DANGER	<small>D1.0000</small>
<p>Risk of fatal injuries Source of the danger</p> <ul style="list-style-type: none"> – Possible consequences of failure to heed the danger. • Instructions and advice on how to avoid the risk. 	

Fatal or serious injuries may ensue if the “Danger” warnings “ are not complied with. There is a **very high risk** of a life-threatening accident or lasting personal injury. The signal word

⚠ DANGER is also used in the running text or instructions

⚠ WARNING	<small>W1.0000</small>
<p>Risk of life-threatening or serious injuries Source of the danger</p> <ul style="list-style-type: none"> – Possible consequences of failure to heed the risk. • Instructions and advice on how to avoid the risk. 	

Life-threatening or serious injuries may ensue if the “Warning“ signs are not complied with.

There is an **increased risk** of a serious accident or potentially fatal injury. The signal word

⚠ WARNING is also used in the running text or instructions.

⚠ CAUTION	<small>C1.0000</small>
<p>Risk of injuries Source of the danger</p> <ul style="list-style-type: none"> – Possible consequences of failure to heed the risk. • Instructions and advice on how to avoid the risk. 	

Moderate or minor injuries may ensue if the “Caution” warnings are not complied with. There

is a moderate or slight risk of an accident or personal injury. The signal word **⚠ CAUTION** is

also used in the running text or instructions.

NOTICE	<small>N1.0000</small>
<p>Nature of the damage to equipment Source of the damage to equipment</p> <ul style="list-style-type: none"> – Possible consequences of failure to comply with the warnings. • Instructions and advice on how to avoid the damage to equipment. 	

Damage to equipment may ensue if the notice is not complied with. The signal word **NOTICE** is also used in the running text or instructions.

2.2 General safety instructions

CAUTION

C2.0002

Risk of injury

Unfamiliarity with the Manual

- The Manual contains all safety-related information. Failure to comply with the Manual can therefore lead to injuries.
- **Read the Manual carefully before using the machine.**



CAUTION

C3.0015

Risk of injury

Improper modifications to the machine

- Improper modifications to the machine can lead to injuries.
- **Do not make any unauthorised changes to the machine.**
- **Only use spare parts and accessories that have been approved by Eltra GmbH.**

NOTICE

N2.0012

Changes to the machine

Improper modification

- As a result of improper modification, the conformity with European directives as specified by Eltra GmbH will no longer be valid. All warranty claims will be invalidated.
- **Do not make any modifications to the machine.**
- **Only use spare parts and accessories that have been approved by Eltra GmbH.**



2.3 Repairs

This Manual does not contain any repair instructions. For reasons of safety, repairs may only be carried out by Eltra GmbH, by an authorised agency, or by qualified service technicians.

Please notify the following in the event of a repair ...

- ...the agent representing Eltra GmbH in your country;
- ...your supplier; or
- ...Eltra GmbH directly.

Service address :

Eltra GmbH
Retsch-Allee 1-5
42781 Haan
Germany



+49 2104 2333-444



service@eltra.com



www.eltra.com

2.4 Intended use

The ELEMENTRAC CS-d has been developed for the analysis of carbon and sulphur in various materials. The induction furnace permits the analysis of typically inorganic materials such as metals, alloys, ceramics and cement. The resistance furnace has been designed for the analysis of carbon and sulphur in organic materials such as coal, coke, alternative fuels or soil.

2.5 Improper use

Use is prohibited in the private domain and for purposes other than those set out in the "[Intended use](#)" chapter. Repairs and modifications may only be carried out by **Eltra GmbH**, by an authorized agency, or by qualified service technicians.

2.6 Safety circuit of the HTFr

NOTICE

N3.0000

Overheating of the HTFr

Using the wrong switch setting for cooling down

- If the switch on the HTFr is set to position 0 before the furnace has cooled down sufficiently, this may result in overheating and the triggering of a safe state. The cooling cannot take place on setting 0 because the HTFr is without power on setting 0, and the fan is therefore also turned off. The HTFr must be set to level 1 to cool down.
- **Set the HTFr to level 1 on the switch to cool down.**
- **Only turn the HTFr to level 0 once it has cooled down sufficiently.**

The safety circuit ensures that the HTFr can only be commissioned under safe conditions.

The safety circuit places the machine in a safe state by interrupting the power supply to the heating elements. The machine is automatically moved to a safe state when the following faults occur:

- Excess current
- Excess temperature on the machine
- Fan is stationary when it should not be
- Triggering of the temperature switch on the top of the furnace



Customer service must be contacted in the first three cases.

2.7 Safety symbols on the machine

Safety symbols on the ELEMENTRAC CS-d provide warnings about risks when using the machine.

The following safety symbols can be found on the analyzer:

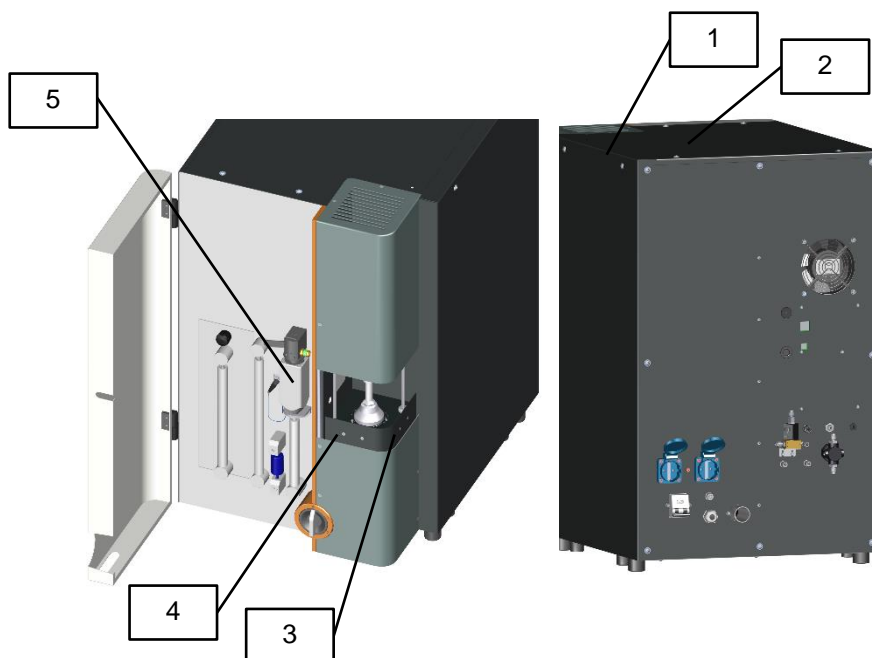


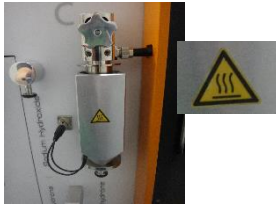


Fig. 1: Safety symbols on the analyzer

Position	Component	Description
1		The warning signs at the top on the back and on the right-hand side warn that the covers may only be opened by qualified personnel.
2		
3		The warning signs on the furnace opening warn of a risk of burns and crushing on fingers or hands.
4		
5		The warning sign on the dust filter housing warns of burns.

2.8 Emergency stop

An emergency stop is initiated using the relevant main switch on the machines.

Turn the analyzer off in an emergency as follows:

1. Turn the main switch on the analyzer to Position 0.

Turn the HTFr off in an emergency as follows:

1. Turn the main switch on the HTFr to Position 0.

2.9 Residual risks

DANGER

D2.0000

Risk to life caused by an electric shock
Exposed power contacts

- Contact with exposed power contacts can cause life-threatening injuries or death.
- **Turn the main switch to Position 0 and pull out the power plug prior to maintenance work on the analyzer.**
- **Turn the main switch to Position 1 prior to maintenance work on the HTFr machine and allow the machine to cool down sufficiently. Only set the main switch to Position 0 and pull out the power plug once you have allowed sufficient time for the machine to cool down.**

WARNING

W2.0015

Risk to life caused by an electric shock
Connection to a socket without protective conductor

- Connecting the machine to sockets without protective conductor can lead to life-threatening injuries caused by an electric shock.
- **Only operate the machine on sockets with a protective conductor (PE).**

WARNING

W3.0002

Risk to life caused by an electric shock
Damaged mains lead

- Operating the machine with a damaged mains lead or plug can result in life-threatening injuries caused by an electric shock.
- **Check the mains lead and plug for damage before operating the machine.**
- **Never operate the machine with a damaged mains lead or plug!**

⚠ WARNING

W4.0000

Risk to life caused by an electric shock

Uninsulated part of the sample insertion tool

- The metal part of the sample insertion tool is not insulated. Contact with the metal part of the sample insertion tool when inserting it into the furnace can result in an electric shock and cause serious or life-threatening injuries.
- **Never grasp the sample insertion tool by the metal part when inserting the tool into the furnace.**
- **Only ever grasp the sample insertion tool by the plastic handle when inserting it into the furnace.**

⚠ WARNING

W5.0017

Risk of injury

Dangerous chemicals

- Dangerous chemicals can cause fatal poisoning or serious chemical burns to the skin when working on the machine.
- **Comply with the safety data sheet for the substances used.**
- **Wear personal protective equipment.**
- **Never eat or drink near chemicals.**

⚠ WARNING

W6.0022

Chemical burns to skin, eyes and mucous membranes

Caustic substances

- Acids can cause chemical burns to skin, eyes and mucous membranes.
- **Comply with the safety data sheet for the acids used.**
- **Always wear suitable work clothing including protective gloves and eyewear.**



⚠ WARNING

W7.0021

Risk of fire / burns

Hot parts (crucibles, reagents etc.) can fall down

- Hot parts may fall onto benches, floors or other surfaces and catch fire.
- Clothing and other materials may catch fire.
- **Erect the analyzer in a fireproof environment. Pay special attention to the bench, the floor and other surfaces close to the analyzer.**
- **Always wear suitable work clothes.**
- **Keep the work environment free from all materials that could catch fire.**

⚠ WARNING

W8.0000

Risk of poisoning

Toxic combustion gases

- Samples are exposed to high temperatures during the analysis. Harmful gaseous fission products can be released or formed from reaction processes here. These gases can escape from the gas outlet and cause serious poisoning.
- **Connect the exhaust air outlet on the machine to a suitable ventilation system.**
- **Wear your personal protective equipment.**
- **Comply with the safety data sheet for the substances used.**
- **Carry out a risk analysis on the potential hazards of your samples and implement protective measures.**

⚠ WARNING

W9.0000

Risk of life-threatening injuries

Falling loads

- The analyzer may only be transported or lifted using suitable lifting gear such as a forklift or crane. Loads can fall down causing life-threatening injuries.
- **Only lift and transport the analyzer with the help of suitable lifting gear such as a forklift or crane.**
- **Secure the analyzer with suitable safety belts (supplied straps) during transport.**
- **Pay attention to the centre of gravity of the analyzer (on the right-hand side of the machine).**
- **Keep a safe distance from the machine while transporting it.**
- **Never step underneath raised loads.**

⚠ CAUTION

C4.0000

Risk of injuries

Moving parts

- The furnace closes automatically. Hands in the area of the opening can get crushed when the furnace closes.
- **Never reach into the closing furnace.**
- **Uses crucible tongs when positioning ceramic crucibles or ceramic dishes.**



⚠ CAUTION

C5.0000

Risk of posture problems

Lifting the HTFr machine unaided

- The weight of the HTFr machine can cause injuries resulting from posture problems due to an unhealthy posture or inattentiveness when lifting.
- **Only lift the machine with the help of a second person.**
- **Ensure you maintain a healthy posture when lifting the machine.**

⚠ CAUTION

C6.0092

Machine falling down

Incorrect installation or insufficient working space

- Due to its weight, the machine can cause injuries if it falls down.
- **Only operate the machine in a sufficiently large, robust, non-slip and stable working area.**
- **Ensure that all machine bases are placed securely on the surface.**

⚠ CAUTION

C7.0000

Risk of cuts

Glass splinters

- Sample vials and reagent tubes are made of glass and can break. Glass splinters can cause cuts.
- **Inspect reagent tubes and sample vials for damage prior to use.**
- **Wear protective gloves and goggles when handling reagent tubes and sample vials.**
- **Replace damaged reagent tubes and sample vials.**
- **Do not touch glass splinters with unprotected hands.**



⚠ CAUTION

C8.0000

Risk of burns

Hot machine parts

- Parts of the machine can get very hot and cause burns during maintenance work if the waiting time to ensure cooling is not complied with.
- **Before maintenance work, wait until the temperature of the furnace is < 40 °C.**
- **Check the furnace temperature in the ELEMENTS software.**

**⚠ CAUTION**

C9.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**

**⚠ CAUTION**

C10.0096

Risk of eye injury

Very bright combustion tube

- The combustion tube shines very brightly when it is hot and can cause eye injuries if you look directly into the furnace due to visible light and invisible infrared light.
- **Wear suitable goggles when working on the furnace.**
- **To protect your eyes, slide the glass guard in front of the furnace entrance.**
- **Never look directly into the furnace.**

⚠ CAUTION

C11.0093a

Risk of burns

Hot sample carriers

- The sample carrier may be very hot after the analysis and can cause fires and therefore injuries if in contact with flammable surfaces.
- **Always use suitable crucible tongs to transport used crucibles and dishes.**
- **Ensure there are no combustible materials beneath the furnace opening.**
- **Only open the furnace once the appropriate waiting time has expired.**
- **Adapt the waiting time in the program where necessary to enable the sample carrier to cool down sufficiently.**

⚠ CAUTION

C12.0090

Risk of eye injury

Chemicals

- When changing the chemicals, minute particles of chemicals may be suspended in the air and cause burns to eyes.
- **Always wear protective goggles when working with chemicals.**
- **Comply with the safety data sheets for the chemicals used.**



⚠ CAUTION

C13.0000

Risk of injury

Pressurised system

- The machine is pressurised during operation. The removal of the reagent tube during operation results in an explosive escape of chemicals or sample material and can cause injuries.
- **Never remove reagent tubes during operation.**

⚠ CAUTION

C14.0094

Risk of burns

Hot catalyst furnace

- The furnace temperature of the catalyst furnace can be up to 800 °C during operation and cause burns.
- **Wear heat-resistant protective gloves when working with the catalyst furnace .**
- **Only replace the catalyst furnace filling after a sufficiently long cooling period.**



3 Description

The ELEMENTRAC CS-d is a combustion analyzer. The machine determines the concentration of carbon and sulphur in inorganic and organic samples through the combustion in the induction furnace or resistance furnace. The gaseous products of combustion CO₂ and SO₂ are measured by infrared measurement cells.

3.1 Front

The following figure shows the front of the machine:

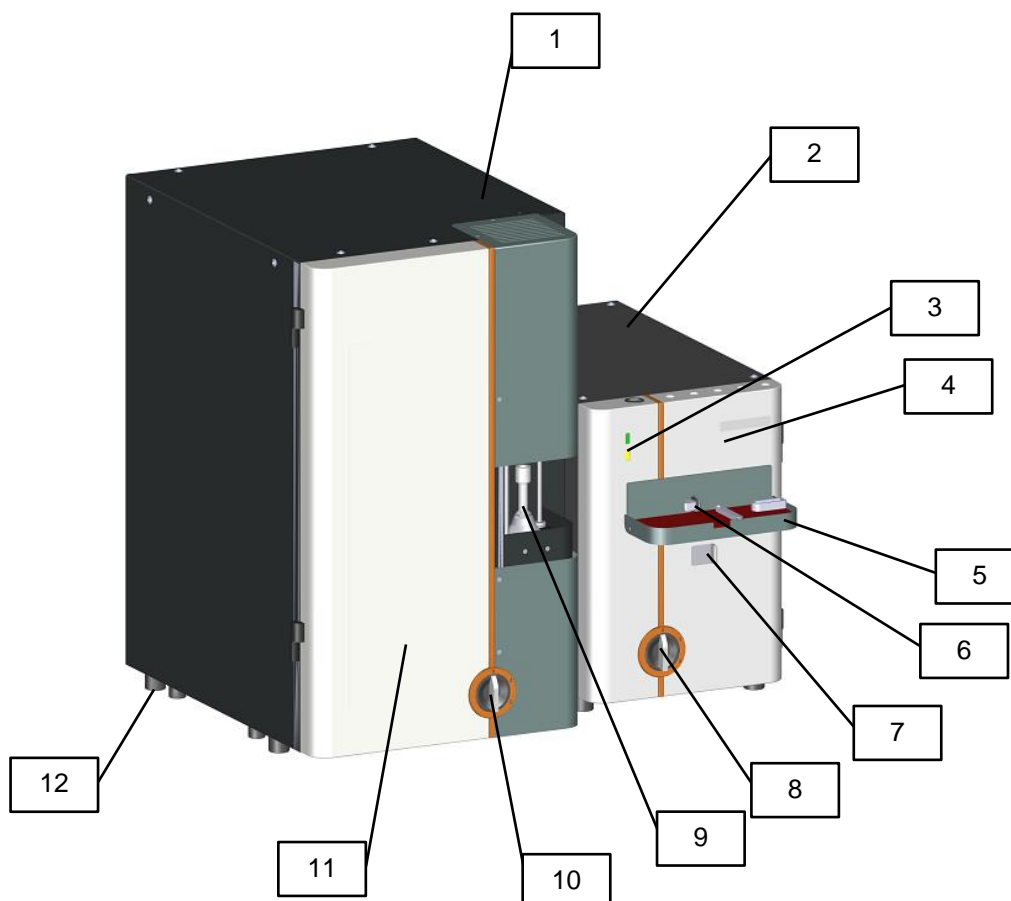


Fig. 2: Front of the ELEMENTRAC CS-d

Position	Component	Description
1	Analyzer	Analyzer with induction furnace
2	HTFr	Resistance furnace
3	LEDs HTFr	LEDs show the operating statuses of the HTFr: <ul style="list-style-type: none"> Green LED The dish can be pushed into the furnace. Yellow LED The measurement is finished. The dish can be taken out of the furnace again.
4	HTFr machine door	Behind the machine door are the paper filter, reagent tube and furnace locking device

Position	Component	Description
5	Platform	Platform for the dishes
6	Entrance to the furnace	Opening for adding dishes
7	Slide for glass guard	The slide moves a glass guard in front of the furnace entrance. The glass guard blocks the IR light in the furnace and prevents air getting in.
8	HTFr main switch	Switches the HTFr on and off
9	Crucible holder	Holder for ceramic crucibles with sample material and furnace opening
10	Main switch on the analyzer	Switches the analyzer on and off
11	Analyzer door	Behind the machine door are the paper filter, dust box, carrier gas preliminary cleaning, particle filter and moisture filter
12	Feet	The inner feet secure the tether (supplied for transport).

3.2 Back of the analyzer

The following figure shows the back of the analyzer:

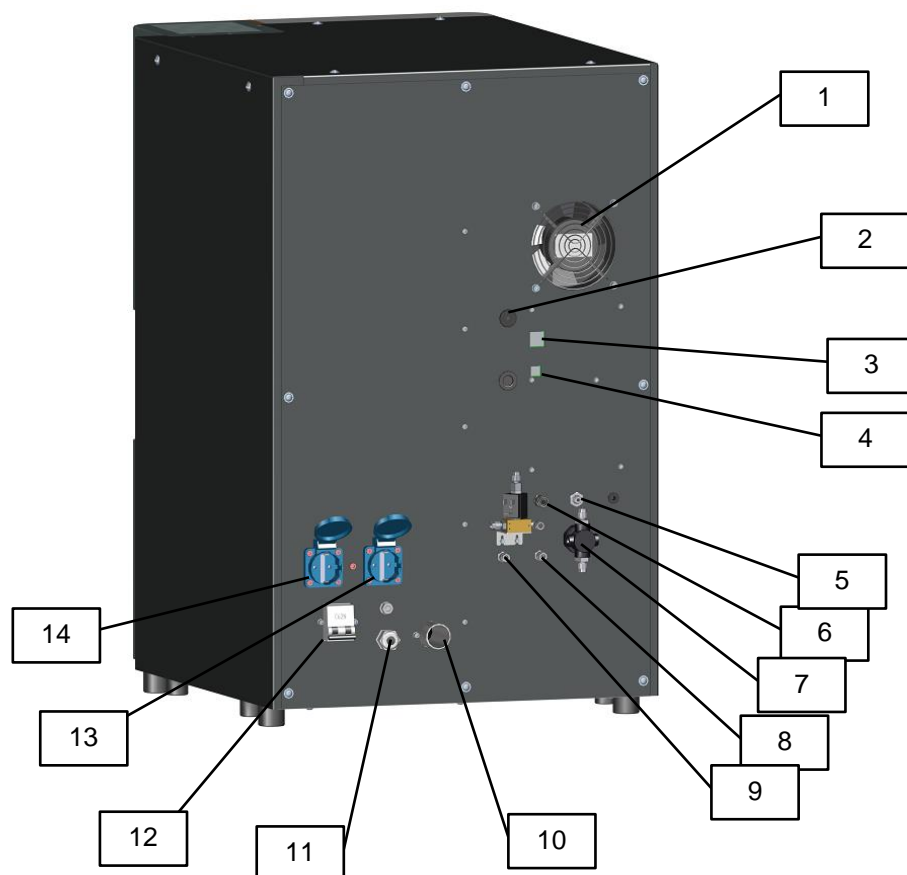


Fig. 3: Back of the analyzer

Position	Component	Description
1	Fan	Fan on the analyzer
2	USB cable (internally already connected)	Cable for connecting to the PC
3	CAN connector	For connecting to the HTFr
4	USB connector	For connecting to the PC
5	Compressed air inlet	Compressed air connector
6	Gas outlet	For discharging the analysis gas
7	Carrier gas connector	Connector with pressure reducer for the carrier gas oxygen
8	Inlet for analysis gas from the HTFr	Return of the analysis gas from the HTFr for analysis
9	Connector for carrier gas supply to the HTFr	Carrier gas supply for the HTFr
10	Connector for vacuum cleaner	Connector for a vacuum cleaner to clean the furnace after every analysis

Position	Component	Description
11	Power connection	Connector for the machine's power supply
12	Circuit breaker	Automatic shutting down of the power circuit in the event of an overload or short circuit
13	Power connection for the vacuum cleaner	Switched power socket to connect a vacuum cleaner The vacuum cleaner can be switched on automatically on opening the furnace after every analysis.
14	Power connection for equipment with low output	Socket for connecting equipment with low output such as a PC and monitor.

3.3 Back of the HTFr

The following figure shows the back of the HTFr:

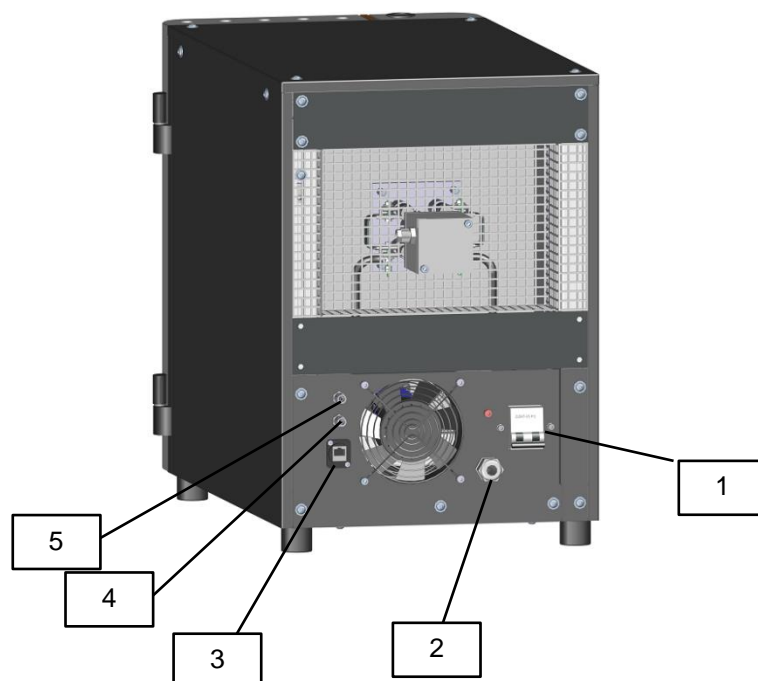


Fig. 4: Back of the HTFr


Position	Component	Description
1	Circuit breaker	Automatic shutting down of the power circuit in the event of an overload or short circuit
2	Power connection	Connector for the machine's power supply
3	CAN connector	For connecting to the analyzer
4	Analysis gas outlet	Analysis gas connector from the HTFr to the analyzer
5	Carrier gas inlet	Supply of oxygen for the HTFr by the analyzer

4 Installation

⚠ WARNING W10.0015

Risk to life caused by an electric shock
Connection to a socket without protective conductor


- Connecting the machine to sockets without protective conductor can lead to life-threatening injuries caused by an electric shock
- **Only operate the machine on sockets with a protective conductor (PE).**



⚠ WARNING W11.0002

Risk to life caused by an electric shock
Damaged mains lead

- Operating the machine with a damaged mains lead or plug can result in life-threatening injuries caused by an electric shock.
- **Check the mains lead and plug for damage before operating the machine.**
- **Never operate the machine with a damaged mains lead or plug!**



⚠ WARNING W12.0000

Risk of life-threatening injuries
Falling loads

- The analyzer may only be transported or lifted using suitable lifting gear such as a forklift or crane. Loads can fall down causing life-threatening injuries.
- **Only lift and transport the analyzer with the help of suitable lifting gear such as a forklift or crane.**
- **Secure the analyzer with suitable safety belts (supplied straps) during transport.**
- **Pay attention to the centre of gravity of the analyzer (on the right-hand side of the machine).**
- **Keep a safe distance from the machine while transporting it.**
- **Never step underneath raised loads.**

4.1 Setting up

CAUTION

C15.0000

Risk of posture problems

Lifting the HTFr machine unaided

- The weight of the HTFr machine can cause injuries resulting from posture problems due to an unhealthy posture or inattentiveness when lifting.
- **Only lift the machine with the help of a second person.**
- **Ensure you maintain a healthy posture when lifting the machine.**

CAUTION

C16.0092

Machine falling down

Incorrect installation or insufficient working space

- Due to its weight, the machine can cause injuries if it falls down.
- **Only operate the machine in a sufficiently large, robust, non-slip and stable working area.**
- **Ensure that all machine bases are placed securely on the surface.**

The space required to set up the ELEMENTRAC CS-d with balance and PC is approx. 190 cm x 75 cm (width x depth), without balance and PC approx. 100 cm x 75 cm.

The machine bench must be able to safely withstand the weight of the machine (see "[Technical data](#)"). The power plugs must be easily accessible at all times. The surface of the machine bench must be non-slip and fire-resistant.

Set the machine up as follows:

1. Set the machine up on the prepared workstation.
2. Make sure that the HTFr is to the right of the analyzer when viewed from the front.
3. Ensure that the power plugs on the analyzer and of the HTFr are freely accessible at all times.
4. Make sure to set up both machines in a way that does not block the fans.
5. Set up the PC, monitor, keyboard and balance in the desired place.
6. Ensure that the machine is secure and stable.
7. Ensure that the surface of the workstation is non-slip and fireproof.
8. Make sure that no crucibles are able to roll down from the surface.
9. Ensure that there are no flammable objects or materials (work papers, files) near the analyzer.

The machine set up is complete.

4.2 Filling the reagent tubes

Proceed as follows to fill the reagent tubes:

1. Fill the reagent tube for the catalyst furnace .
2. Fill the reagent tube for the SO₃ filter.
3. Fill the reagent tube for the gas purification inlet.
4. Fill the reagent tube for the moisture filter on the analyzer and on the HTFr.

Refer to Chapter 10 “Maintenance the analyzer” and 11 “Maintenance the HTFr” for how to correctly fill the individual reagents.

4.3 Establishing the gas supply

NOTICE

N4.0012

Faulty Analysis Results

Unsuitable carrier gas

- Use oxygen with a purity of 99.5% as the carrier gas. Set a pressure of 2 bar.
- **Use only carrier gas with sufficient purity.**
- **Check the set pressure of the carrier gas.**



NOTICE

N5.0012

Damage or malfunction of the device

Incorrect compressed air supply

- Use only oil and grease-free compressed air. Set a pressure of at least 2-4 bar.
- **Use only oil and grease-free compressed air.**
- **Check the set pressure of the carrier gas.**



Establish the gas supply for the machine as follows:

1. Ensure that the gas supply for the carrier gas is switched off.
2. Connect the carrier gas inlet on the analyzer (see Pos. (7) in “[Back of the analyzer](#)”) to the operating company’s carrier gas supply.
Use the supplied hose with corresponding label (Part number 73020).
3. Connect the carrier gas **outlet** on the analyzer (see Pos. (9) in “[Back of the analyzer](#)”) to the carrier gas **inlet** on the HTFr (see Pos. (5) in “[Back of the HTFr](#)”).
Use the supplied hose.
4. Connect the analysis gas **outlet** on the HTFr (see Pos. (4) in “[Back of the HTFr](#)”) to the analysis gas **inlet** on the analyzer (see Pos. (8) in “[Back of the analyzer](#)”).
Use the supplied hose.
5. Connect the exhaust air outlet on the analyzer (see Pos. (6) in “[Back of the analyzer](#)”) to a suitable ventilation system.

- Connect the compressed air connection on the analyzer (see Pos. (5) in "[Back of the analyzer](#)") to the operating company's compressed air supply.
The gas supply has been established.



Make sure the gas and compressed air supply are installed correctly. The hoses should not be laid directly on the laboratory bench because the hot sample carriers present a potential risk of fire.



4.4 Connecting the machine to the PC

Connect the machine to the PC as follows:

- Connect the USB cable on the back of the analyzer (see Pos. (2) in "[Back of the analyzer](#)") to the corresponding USB interface on the PC.
- Connect the USB connector on the analyzer (see Pos. (4) in "[Back of the analyzer](#)") to the interface on the PC with corresponding label.
Use the supplied cable.
- Connect the CAN connector on the analyzer (see Pos. (3) in "[Back of the analyzer](#)") to the CAN connector on the HTFr (see Pos. (2) in "[Back of the HTFr](#)").
Use the supplied cable.

The machine is connected to the PC.

4.5 Establishing the power supply

	WARNING	W13.0015
<p>Risk to life caused by an electric shock Connection to a socket without protective conductor</p> <ul style="list-style-type: none"> – Connecting the machine to sockets without protective conductor can lead to life-threatening injuries caused by an electric shock. • Only operate the machine on sockets with a protective conductor (PE). 		
		

The power supply is provided using the supplied power plug.




The operating company's mains connections must meet the power requirements of the machine (see the table for type plates).

Establish the power supply as follows:

- Ensure that the machine has been set up, see "[Setting up](#)".
- Connect the power plug on the back of the analyzer (see Pos. (11) in "[Back of the analyzer](#)") to the operating company's power supply.
- Connect the power plug on the back of the HTFr (see Pos. (1) in "[Back of the HTFr](#)") to the operating company's power supply.

The machine has been connected to the power supply.

5 Commissioning

⚠ WARNING	W14.0015
<p>Risk to life caused by an electric shock Connection to a socket without protective conductor</p> <ul style="list-style-type: none"> – Connecting the machine to sockets without protective conductor can lead to life-threatening injuries caused by an electric shock. • Only operate the machine on sockets with a protective conductor (PE). 	
	

⚠ CAUTION	C17.0015
<p>Risk of injury Improper modifications to the machine</p> <ul style="list-style-type: none"> – Improper modifications to the machine can lead to injuries. • Do not make any unauthorised changes to the machine. • Only use spare parts and accessories that have been approved by Eltra GmbH! 	


The following conditions must be met before commissioning the machine:

- The machine has been set up, see [“Setting up”](#).
- The reagent tubes have been filled, see [“Filling the reagent tube”](#).
- The machine has been connected to the PC, see [“Connecting the machine to the PC”](#).
- The gas supply has been established, see [“Establishing the gas supply”](#).
- The power supply has been established, see [“Establishing the power supply”](#).

Commission the machine as follows:

1. Switch on the PC and start the ELEMENTS software.
(a current version of the “ELEMENTS software” is supplied on a USB stick or has been preinstalled on your PC)
2. Switch on the carrier gas.
3. Switch on the compressed air supply.
4. Turn the analyzer to Position 1 on the main switch , see Pos. **(10)** in [“Front”](#).
5. Turn the HTFr to Position 2 on the main switch , see Pos. **(8)** in [“Front”](#).
6. Wait until the machine has reached the operating temperature .

The machine has been commissioned.

	<p>The analyzer is ready for the analysis after approx. 30 to 45 minutes when the cell temperature (base lines) has stabilised and the catalyst furnace has reached operating temperature.</p> <p>The HTFr is ready for the analysis after approx. 30 minutes when the resistance furnace has reached its set point temperature (default setting 1350 °C). The current temperature can be found in the status window.</p>
---	---

6 Operation of the machine

WARNING

W15.0000

Risk to life caused by an electric shock

Uninsulated part of the sample insertion tool

- The metal part of the sample insertion tool is not insulated. Contact with the metal part of the sample insertion tool when inserting it into the furnace can result in an electric shock and cause serious or life-threatening injuries.
- **Never grasp the sample insertion tool by the metal part when inserting the tool into the furnace.**
- **Only ever grasp the sample insertion tool by the plastic handle when inserting it into the furnace.**

WARNING

W16.0017

Risk of injury

Dangerous chemicals

- Dangerous chemicals can cause fatal poisoning or serious chemical burns to the skin when working on the machine.
- **Comply with the safety data sheet for the substances used.**
- **Wear personal protective equipment.**
- **Never eat or drink near chemicals.**

WARNING

W17.0000

Risk of poisoning

Toxic combustion gases

- Samples are exposed to high temperatures during the analysis. Harmful gaseous fission products can be released or formed from reaction processes here. These gases can escape from the gas outlet and cause serious poisoning.
- **Connect the exhaust air outlet on the machine to a suitable ventilation system.**
- **Wear your personal protective equipment.**
- **Comply with the safety data sheet for the substances used.**
- **Carry out a risk analysis on the potential hazards of your samples and implement protective measures.**

⚠ CAUTION

C18.0000

Risk of injuries

Moving parts

- The furnace closes automatically. Hands in the area of the opening can get crushed when the furnace closes.
- **Never reach into the closing furnace.**
- **Uses crucible tongs when positioning ceramic crucibles or ceramic dishes.**



⚠ CAUTION

C19.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



⚠ CAUTION

C20.0096

Risk of eye injury

Very bright combustion tube

- The combustion tube shines very brightly when it is hot and can cause eye injuries if you look directly into the furnace due to visible light and invisible infrared light.
- **Wear suitable goggles when working on the furnace.**
- **To protect your eyes, slide the glass guard in front of the furnace entrance.**
- **Never look directly into the furnace.**

⚠ CAUTION

C21.0093a

Risk of burns

Hot sample carriers

- The sample carrier may be very hot after the analysis and can cause fires and therefore injuries if in contact with flammable surfaces.
- **Always use suitable crucible tongs to transport used crucibles and dishes.**
- **Ensure there are no combustible materials beneath the furnace opening.**
- **Only open the furnace once the appropriate waiting time has expired.**

NOTICE

N6.0000

Overheating of the HTFr

Using the wrong switch setting for cooling down

- If the switch on the HTFr is set to position 0 before the furnace has cooled down sufficiently, this may result in overheating and the triggering of a safe state. The cooling cannot take place on setting 0 because the HTFr is without power on setting 0, and the fan is therefore also turned off. The HTFr must be set to level 1 to cool down.
- **Set the HTFr to position 1 to cool down.**
- **Only set the HTFr to position 1 once the machine has cooled down sufficiently.**

The machine is operated using the ELEMENTS software. The program is delivered on a USB stick and is already installed on the PC if this has been ordered.

The following conditions must be met **before** operating the machine to analyse samples:

- The machine has been commissioned, see "[Commissioning the machine](#)".



See the program manual for details of the ELEMENTS software.

Proceed as follows to perform analyses:

1. Ensure that the PC has been switched on and the ELEMENTS software started (see "[Commissioning the machine](#)").
2. Open the "Analyses and results" window.
Create a new analysis and select a suitable application.
(see Elements Software "Application")
3. Prepare a crucible or dish with sample material.
Only use crucibles (Part number 90148 or 90149) and dishes (e.g. Part number 90160) from Eltra GmbH.
4. Use the automatic transfer of the sample weight from the balance to the PC or enter the sample weight manually. Give a name for the sample in the "ID" box.
5. If you wish to analyse the sample using the induction furnace of the analyzer, place the crucible into the crucible holder using crucible tongs (see Pos. (9) in "[Front](#)").
Ensure that the main switch of the analyzer is set to Position 2.
6. If you wish to analyse the sample using the resistance furnace of the HTFr, place the dish in front of the furnace entrance using crucible tongs (see Pos. (6) in "[Front](#)").
Ensure that the main switch of the HTFr is set to Position 2 and that the furnace has reached the set point temperature ("[Commissioning the machine](#)").
7. To start the analysis, ensure that the desired analysis has been marked then press F5 or click on the green arrow in the ELEMENTS software.
When analyzing the sample with the HTFr, slowly push the boat into the oven as soon as the green signal light on the HTFr resistance oven illuminates.
The analysis will be performed.



Analysis with the HTFr resistance furnace:

As soon as the base lines are stable, you will be prompted by the ELEMENTS software and by the illumination of the green LED on the HTFr (see Pos. (3) in "[Front](#)") to slide the boat into the furnace.

Only use the supplied boat slider (Part number 36216-2001) for this and slide the boat until the handle of the boat slider hits the balcony of the furnace.

7 Technical data

7.1 Technical data for the analyzer

The following table lists the technical data for the analyzer:

Definition	Description	Data
Dimensions	Width	52 cm
	Depth	75 cm
	Height	84 cm
	Weight	Approx. 150 kg
Electrical data	Power supply	230 VAC \pm 10 %
	Frequency	50/60 Hz
	Power consumption	16 A
	Mains connection	Safety plug (Type F, CEE 7/4, IEC TR 60083)
Safety	Protection class	I
	Overvoltage category	II
	Degree of contamination	2
	Type of environment	Indoors
	Max. altitude	2000 m
	Ambient temperature	+5 to +35°C
	Ambient humidity	< 80 % at 31 °C non-condensing
	Type of protection	IP20
Carrier gas	Type	Oxygen
	Purity	Min. 99.5 %
	Pressure	2 to 4 bar (30 to 60 psi)
	Connection	Polyamide hose 6/4 mm (Adapter with G $\frac{1}{4}$ " female thread, included with delivery)
Compressed air	Type	Oil-free
	Pressure	5 to 6 bar (75 to 90 psi)
	Connection	Polyamide hose 4/2 mm (Adapter with G $\frac{1}{4}$ " female thread, included with delivery)
Volume	Maximum noise level	55 db(A)

Tab. 1: Technical data for the analyzer

7.2 Technical data for the HTFr

The following table lists the technical data for the HTFr:

Definition	Description	Data
Dimensions	Width	37 cm
	Depth (without balcony)	79 cm (68 cm)
	Height	52 cm
	Weight	53 kg
Electrical data	Power supply	230 VAC ±10 %
	Frequency	50/60 Hz
	Power consumption	≤ 20 A
	Mains connection	CEE-plug, 230 V, 32 A, L+N+PE, EN 60309-1:2018-04
Safety	Protection class	I
	Overvoltage category	II
	Degree of contamination	2
	Type of environment	Indoors
	Max. altitude	2000 m
	Ambient temperature	+5 to +35 °C
	Ambient humidity	< 80 % at 31 °C non-condensing
	Type of protection	IP20
Volume	Maximum noise level	55 db(A)

Tab. 2: Technical data for the HTFr

7.3 Type plate on the analyzer

The following diagram shows an example of the type plate on the analyzer:

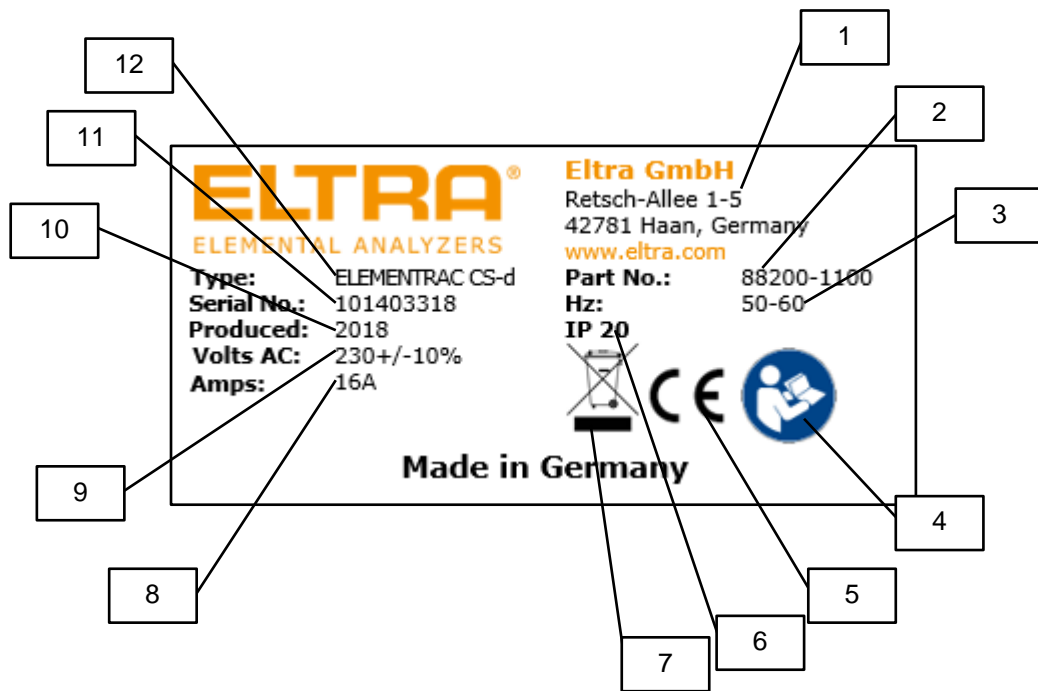


Fig. 5: Type plate on the analyzer

Position	Component
1	Manufacturer's address
2	Part number
3	Mains frequency
4	Read the Manual
5	CE mark
6	Type of protection
7	Disposal label
8	Current
9	Voltage
10	Year of manufacture
11	Serial number
12	Machine designation

7.4 Type plate on the HTFr

The following diagram shows an example of the type plate on the HTFr:

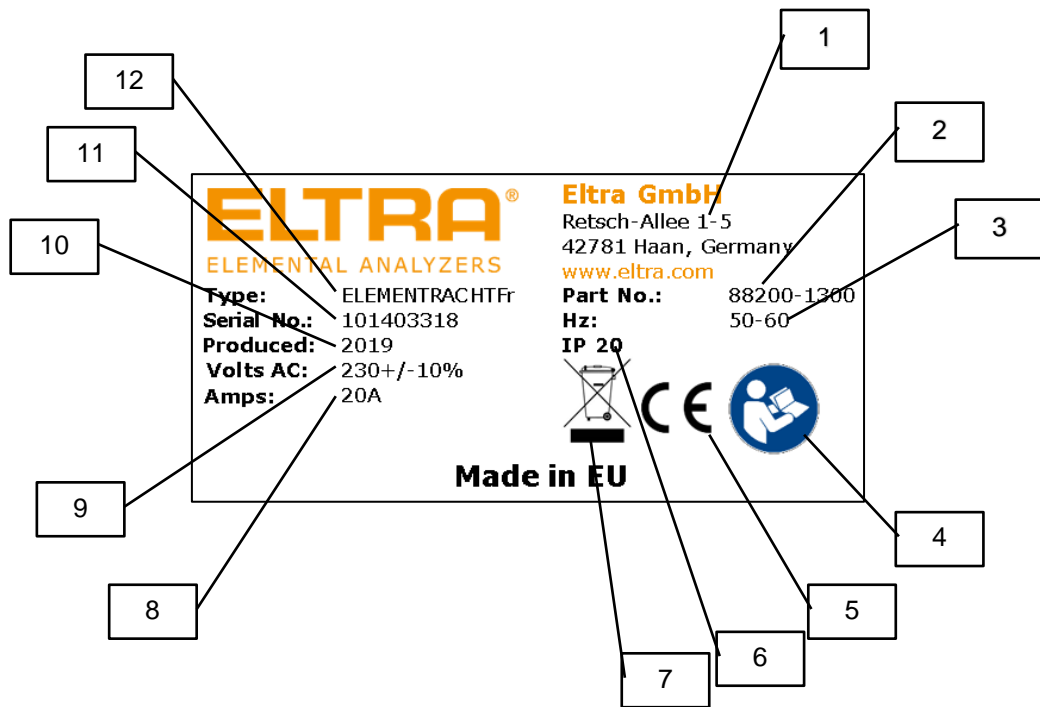


Fig. 6: Type plate on the HTFr

Position	Component
1	Manufacturer's address
2	Part number
3	Mains frequency
4	Read the Manual
5	CE mark
6	Type of protection
7	Disposal label
8	Current
9	Voltage
10	Year of manufacture
11	Serial number
12	Machine designation

7.5 Standards for inorganic materials

The following standards for inorganic materials are met:

Standard	Elements	Materials	Equipment
EN ISO 9556:2002-04	C	Steel and iron	CS-i CS-d
ISO 4935:1989 EN 24935:1992-07	S	Steel and iron	CS-i CS-d
ASTM E1019:2018	C, S	Steel, iron, nickel/cobalt alloys	CS-i CS-d
ASTM E 1587:2010	C, S	Refined nickel	CS-i CS-d
ASTM E1915 - 13	C, S	Metalliferous ores and related materials (i.e. tailings, waste rock)	CS-i CS-d
UOP703 - 09	C	Catalysers	CS-i CS-d
ASTM E 1941:2010	C	Refractory metals	CS-i CS-d
<u>EN ISO 15349-2</u>	C	Steel	CS-i CS-d
<u>ISO 13902</u>	S	Steel and iron	CS-i CS-d
<u>ISO 4689-3</u>	S	Iron ores	CS-i CS-d
<u>ISO 7524</u>	C	Nickel	CS-i CS-d
<u>EN 27526</u>	S	Nickel	CS-i CS-d
<u>EN ISO 15350</u>	C, S	Steel and iron	CS-i CS-d
ISO 10719	C	Steel	CS-i CS-d
EN 1744-1	S	Rocks	CS-i CS-d

7.6 Standards for organic materials

The following standards for organic materials are met:

Standard	Elements	Materials	Equipment
ASTM D 1552:2016	S	Products made of oil and petroleum	CS-d
ASTM D 4239:2018	S	Coal and coke	CS-d
ASTM D 5016:2016	S	Coal and coke ashes	CS-d
ASTM D 1619-16a	S	Soot	CS-d
ISO 15178	S	Soil samples	CS-d
EN 15936	C (TOC)	Sludge, biodegradable waste, soil, waste	CS-d
ISO 19579	S	Mineral oils	CS-d

8 Troubleshooting on the analyzer and on the HTFr

8.1 Troubleshooting on the analyzer.

1. Using the ELEMENTS software, establish which fault has occurred on the analyzer and rectify it in accordance with the error message in the ELEMENTS software.
2. Please contact Service if you are unable to rectify the fault.



To contact Service, see [“Repairs”](#).

8.2 Troubleshooting on the HTFr after a safe state has been triggered

NOTICE

N7.0000

Overheating of the HTFr

Using the wrong switch setting for cooling down

- If the switch on the HTFr is set to position 0 before the furnace has cooled down sufficiently, this may result in overheating and the triggering of a safe state. The cooling cannot take place on setting 0 because the HTFr is without power on setting 0, and the fan is therefore also turned off. The HTFr must be set to level 1 to cool down.
- **Set the HTFr to position 1 to cool down.**
- **Only set the HTFr to position 1 once the machine has cooled down sufficiently.**

After the safety circuit (see [“Safety circuit”](#)) has triggered, heating of the HTFr is not permitted and is interrupted.

If the HTFr has been put into a safe state, both LEDs (1) on the front of the HTFr flash:

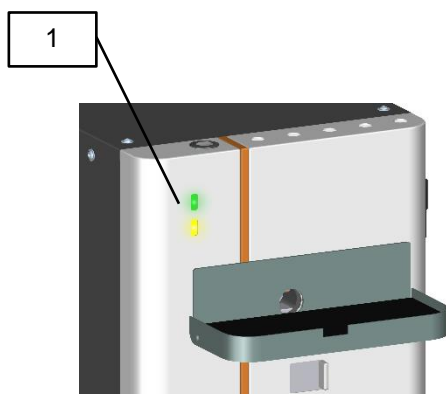



Fig. 7: Front of the HTFr in a safe state with flashing LEDs

Proceed as follows to check the fault after the safety circuit on the HTFr has triggered:

1. In the ELEMENTS software, establish which fault has caused the safety circuit to trigger.
2. If the fault is the triggering of the temperature switch, turn the HTFr switch to Position 1 and allow it to cool down until the LEDs stop flashing.

3. Once the HTFr has cooled down, turn the HTFr switch to Position 2.
The machine heats up again.
4. Contact Service for all other faults.
The fault following the triggering of the safety circuit on the HTFr has been checked.

9 Cleaning

⚠ WARNING	<small>W18.0003</small>
<p>Risk to life caused by an electric shock Using water to clean live parts</p> <ul style="list-style-type: none"> – Using water to clean the machine can lead to life-threatening injuries caused by an electric shock if the machine has not been disconnected from the power supply. • Only clean the machine with water when it has been disconnected from the power supply. 	

NOTICE	<small>N8.0077</small>
<p>Damage to the housing Use of organic solvents</p> <ul style="list-style-type: none"> – Organic solvents can damage the coating. • Organic solvents must not be used to clean the housing. 	

The outside of the ELEMENTRAC CS-d must be cleaned regularly.

Proceed as follows to clean the outside of the machine:

1. Pull out the plugs on the analyzer and on the HTFr.
2. Wait until the analyzer and the HTFr have cooled down sufficiently.
3. Moisten a suitable cloth with water.
4. Clean the outer surfaces of the machine using the damp cloth.
5. Wait until the machine is completely dry.
6. Plug the power plug back in.

The outside of the machine has been cleaned.

10 Maintenance

10.1 Maintenance the analyzer

⚠ CAUTION

C22.0000

Risk of burns

Hot machine parts

- Parts of the machine can get very hot and cause burns during maintenance work if the waiting time to ensure cooling is not complied with.
- **Before maintenance work, wait until the temperature of the furnace is < 40 °C.**
- **Check the furnace temperature in the ELEMENTS software.**



10.1.1 Overview of maintenance work for the analyzer

The following service instructions refer to the usual steel analyses using the analyzer with 10 to 30 samples per day and 99.5 % pure oxygen. Depending on the application, the maintenance cycle may need to be intensified to maintain the precision of analysis results.

The following table lists the maintenance work to be carried out. The maintenance work must be conducted regularly at the specified maintenance intervals or upon reaching the number of possible analyses:

Component	No. of analyses	Maintenance interval	Service instructions	See chapter
Cellulose	2000	Every 3 months	Replace when 50 % of the filter is black	“Filling the reagent tube on the SO₃ filter”
Inlet gas purification	1000	Every 3 months	Replace early if clumping is apparent	“Filling the reagent tube on the inlet gas purification”
Magnesium perchlorate	100	Monthly	Replace when clumping is apparent	“Filling the reagent tube on the moisture filter”
Dust filter cartridge	500	Every 6 months	Replace when darkening is apparent	“Replacing the dust filter cartridge on the analyzer”
Catalyser	20000	Yearly	-	“Filling the reagent tube on the catalyst furnace”
Dust filter with metal filter	100	Daily	Empty dust and brush clean	“Cleaning the dust box”
Metal filter	500	Monthly	Replace when rust is apparent	“Thorough cleaning of the dust box”
Furnace cleaning brush	2000	Every 3 months	-	“Replacing the furnace cleaning brush and thermal shield”

Component	No. of analyses	Maintenance interval	Service instructions	See chapter
Brush the thermal shield	100	Monthly	Clean or replace the thermal shield depending on the sample	“Replacing the furnace cleaning brush and thermal shield”
Combustion tube	1000	Monthly	Check, clean and replace where necessary	“Replacing the combustion tube”
O -rings in combustion area	35000	Yearly	Annual maintenance recommended	“Replacing the O-rings”
Connection of combustion tubes / metal filters	5000	Monthly	Clean, replace where necessary	“Cleaning the connecting hose between the furnace and metal filter”

10.1.2 Removing the reagent tubes

⚠ CAUTION

C23.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



⚠ CAUTION

C24.0000

Risk of cuts

Glass splinters

- Sample vials and reagent tubes are made of glass and can break. Glass splinters can cause cuts.
- **Inspect reagent tubes and sample vials for damage prior to use.**
- **Wear protective gloves and goggles when handling reagent tubes and sample vials.**
- **Replace damaged reagent tubes and sample vials.**
- **Do not touch glass splinters with unprotected hands.**



⚠ CAUTION

C25.0090

Risk of eye injury
Chemicals

- When changing the chemicals, minute particles of chemicals may be suspended in the air and cause burns to eyes.
- **Always wear protective goggles when working with chemicals.**
- **Comply with the safety data sheets for the chemicals used.**



The reagent tubes of the analyzer must not be removed during operation.

The following diagram shows the filters on the front of the analyzer with the machine door open:

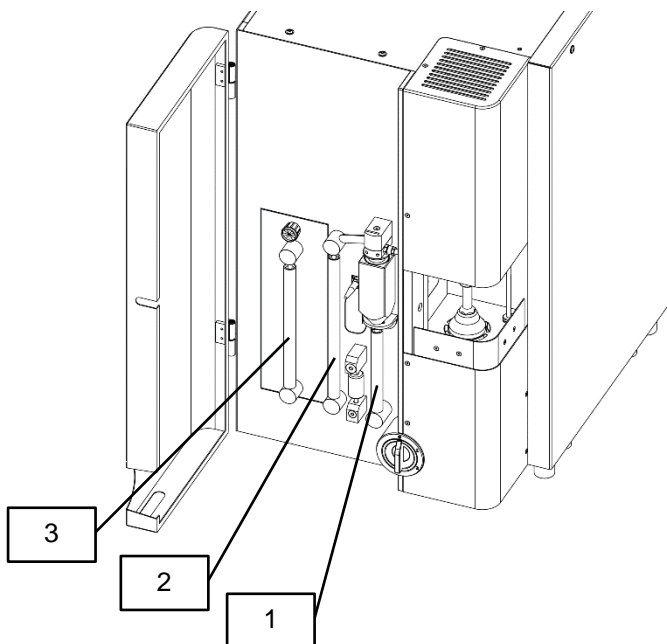


Fig. 8: Front of the analyzer with the door open

Position	Component
1	Moisture filter
2	Inlet gas purification
3	SO ₃ filter

Proceed as follows to remove a reagent tube on the front of the analyzer:

1. Turn the main switch on the analyzer to Position 1.
2. On the “Status analyzer” page of the ELEMENTS software, press the “Change reagents” button to release the pressure.

The following diagram shows an example of removing a reagent tube on the front of the analyzer:

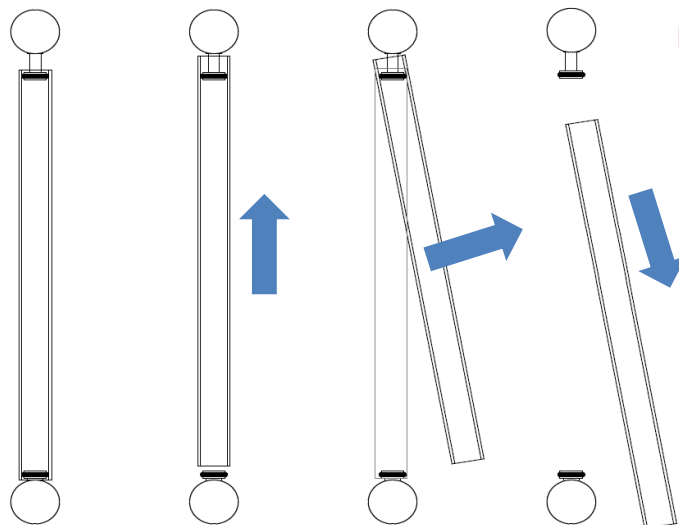


Fig. 9: Removing the reagent tube on the front of the analyzer

3. Slide the reagent tube upwards.
4. Swivel the reagent tube slightly to the side or to the front.
5. Pull the reagent tube out from below. If the reagent tube cannot be moved easily, turn it slightly while pulling it out.

The reagent tube on the front of the analyzer has been removed.

10.1.3 Filling reagent tubes

CAUTION

C26.0000

Risk of injury

Pressurised system

- The machine is pressurised during operation. The removal of the reagent tube during operation results in an explosive escape of chemicals or sample material and can cause injuries.
- **Never remove reagent tubes during operation.**

CAUTION

C27.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



⚠ CAUTION

C28.0090

Risk of eye injury

Chemicals

- When changing the chemicals, minute particles of chemicals may be suspended in the air and cause burns to eyes.
- **Always wear protective goggles when working with chemicals.**
- **Comply with the safety data sheets for the chemicals used.**



⚠ WARNING

W19.0000

Risk of poisoning

Toxic combustion gases

- Samples are exposed to high temperatures during the analysis. Harmful gaseous fission products can be released or formed from reaction processes here. These gases can escape from the gas outlet and cause serious poisoning.
- **Connect the exhaust air outlet on the machine to a suitable ventilation system.**
- **Wear your personal protective equipment.**
- **Comply with the safety data sheet for the substances used.**
- **Carry out a risk analysis on the potential hazards of your samples and implement protective measures.**

⚠ WARNING

W20.0022

Chemical burns to skin, eyes and mucous membranes

Caustic substances

- Acids can cause chemical burns to skin, eyes and mucous membranes.
- **Comply with the safety data sheet for the acids used.**
- **Always wear suitable work clothing including protective gloves and eyewear.**

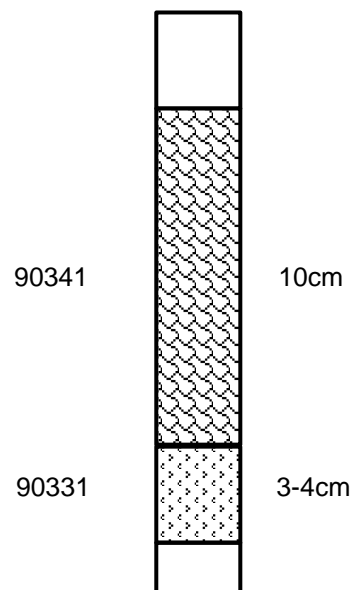


10.1.3.1 Filling the reagent tube on the SO₃ filter

Proceed as follows to replace the filling in the reagent tubes on the SO₃ filter (see Pos. (3) in "[Removing the reagent tubes on filters](#)"):

1. Turn the main switch on the analyzer to Position 1.
2. Remove the reagent tube, see "[Removing the reagent tubes on filters](#)".
3. Remove the used filling from the reagent tube.
4. Dispose of the reagent tube filling in accordance with local regulations and provisions.
5. Ensure that the reagent tube is undamaged.
If it is damaged or too contaminated, use a new reagent tube (Part No. 88400-0422).
6. Fill the reagent tube with 3 to 4 cm of glass wool (Part No. 90331).
7. Fill the reagent tube with 10cm of cellulose (Part No. 90341).
8. Insert the filled reagent tube, see "[Inserting the reagent tubes on filters](#)".

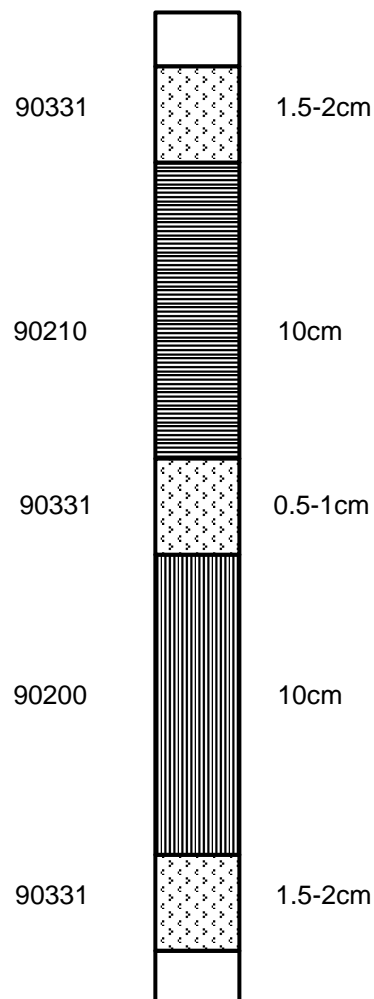
The filling of the reagent tube on the SO₃ filter has been replaced.



10.1.3.2 Filling the reagent tube on the inlet gas purification

Proceed as follows to replace the filling in the inlet gas purification (see Pos. (2) in "[Removing the reagent tubes on filters](#)"):


1. Turn the main switch on the analyzer to Position 1.
2. Remove the reagent tube, see "[Removing the reagent tubes on filters](#)".
3. Remove the used filling from the reagent tube.
4. Dispose of the reagent tube filling in accordance with local regulations and provisions.
5. Ensure that the reagent tube is undamaged.
If it is damaged or too contaminated, use a new reagent tube (Part No. 88400-0006).
6. Fill the reagent tube with 1.5 to 2 cm of glass wool (Part No. 90331).
7. Fill approx. 10 cm of magnesium perchlorate (Part No. 90200) onto the glass wool.
8. Fill 0.5 to 1 cm of glass wool (Part No. 90331) onto the magnesium perchlorate.
9. Fill approx. 10 cm of sodium hydroxide (Part No. 90210) onto the glass wool.
10. Fill 1.5 to 2 cm of glass wool (Part No. 90331) onto the sodium hydroxide.
11. Insert the filled reagent tube, see "[Inserting the reagent tubes on filters](#)".
The inlet gas purification filling has been replaced.



10.1.3.3 Filling the reagent tube on the moisture filter

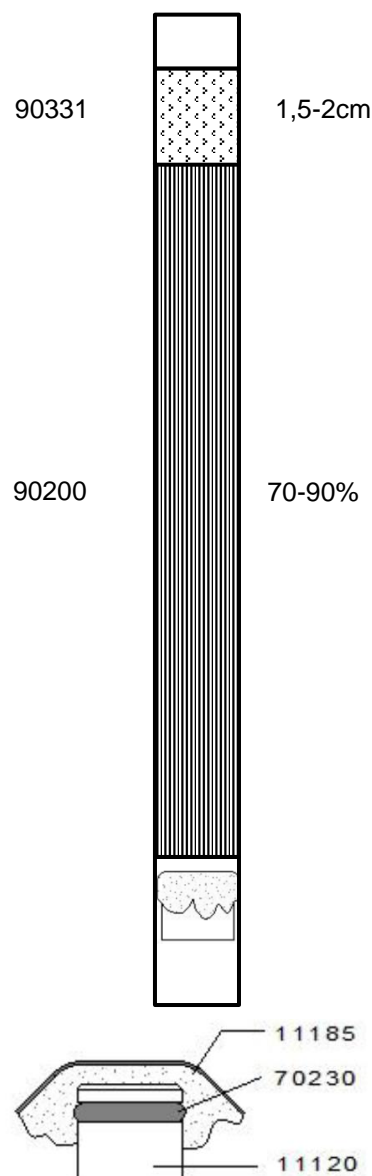
Proceed as follows to replace the moisture filter filling (see Pos. (1) in "[Removing the reagent tubes on filters](#)"):

1. Turn the main switch on the analyzer to Position 1.
2. Remove the reagent tube, see "[Removing the reagent tubes on filters](#)".
3. Turn the threaded rod (Part No. 88400-0332) down into the paper filter holder.
4. Pull the paper filter holder with paper filter on the threaded rod out of the reagent tube.
5. Remove the used filling from the reagent tube.
6. Dispose of the reagent tube filling in accordance with local regulations and provisions.
7. Ensure that the reagent tube is undamaged.
If it is damaged or too contaminated, use a new reagent tube (Part No. 88400-0005).
8. Release the threaded rod from the paper filter holder and remove the paper filter.
If the paper filter holder is damaged, use a new paper filter holder (Part No. 11120).
9. Where necessary replace the O-ring on the paper filter holder (Part No. 70230).
10. Place a new paper filter (Part No. 11185) into the paper filter holder and fold the edge of the paper over.
11. Carefully guide the paper filter holder with the new paper filter 2 cm upwards into the reagent tube
12. Fill the reagent tube approx. 70 to 90 % with magnesium perchlorate (Part No. 90200).
13. Fill 1.5 to 2 cm of glass wool (Part No. 90331) onto the magnesium perchlorate.


	<p>For certain sulphurous samples (e.g., soil samples, ores, sulphides), the use of the glass wool may influence the analytical result.</p>
---	---

14. Insert the filled reagent tube, see "[Inserting the reagent tubes on filters](#)".

The moisture filter filling has been replaced.



10.1.4 Inserting reagent tubes

 The reagent tubes of the analyzer must not be removed during operation.

Proceed as follows to insert a reagent tube on the front of the analyzer:

1. Ensure that the main switch of the analyzer is set to Position 1.
2. Ensure that the “Change reagents” button for releasing the pressure has been pressed in the ELEMENTS software.
Only confirm the message **after** reinserting the respective filter.
3. Ensure that the reagent tube has been filled according to the specifications (see “[Filling reagent tubes](#)”).
4. Clean the connections for the reagent tube on the analyzer.
5. Lightly grease the inner ends of the reagent tube and the O-rings with high vacuum silicon grease (Part No. 92610).

The following diagram shows an example of inserting a reagent tube on the front of the analyzer:

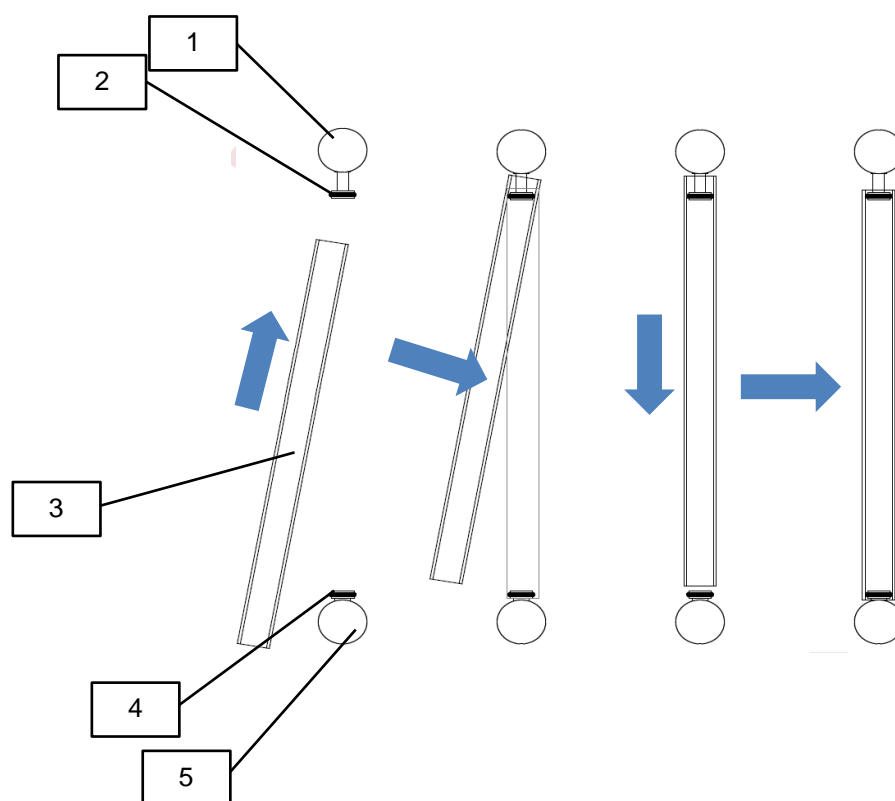


Fig. 10: Inserting a reagent tube on the front of the analyzer

6. Hold the filled reagent tube (3) at a slight angle.
7. Guide the filled reagent tube over the top O-ring (2) onto the top support (1).
8. Align the filled reagent tube vertically above the bottom O-ring (4).
9. Press the reagent tube down slightly until the reagent tube is resting on the bottom of the support (5). Slightly turn the reagent tube if it is difficult to move.

10. Check that the O-rings all round form a uniform impression of approx. 2 mm on the reagent tube and that there is no leak on the O-ring caused by the glass wool.

11. Confirm the message on the ELEMENTS software so that the pressure can be built up again.
The reagent tube on the front of the analyzer has been inserted.

10.1.5 Replacing the dust filter cartridge on the analyzer

The dust filter cartridge on the analyzer must be replaced as soon as the filter material changes colour and after 500 analyses at the latest.

The following diagram shows the dust filter cartridge on the front of the analyzer:

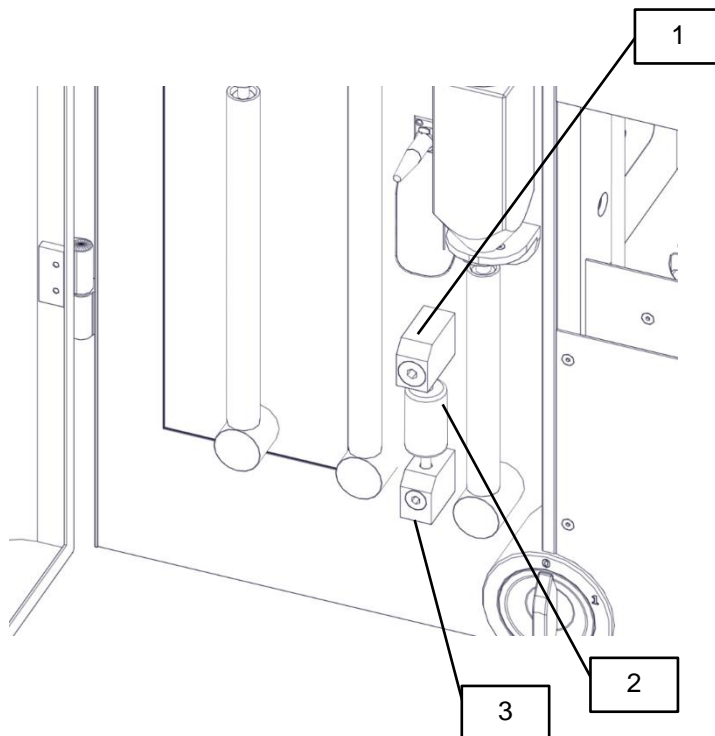



Fig. 11: Dust filter cartridge on the front of the analyzer

Replace the dust filter cartridge on the analyzer as follows:

1. Turn the main switch on the analyzer to Position 1.
2. Press the “Change reagents” button in the ELEMENTS software to release the pressure.
3. Press the dust filter cartridge (2) upwards against the top support (1).
4. Swivel the bottom end of the dust filter cartridge (2) forwards and pull the dust filter cartridge (2) out from below.
5. Press the new dust filter cartridge (2) upwards at an angle into the top support (1).

	The diameter of the cartridge body is smaller at the top than at the bottom.
---	--

6. Place the dust filter cartridge (2) in a vertical position above the bottom support (3) and press it down into the bottom support. The dust filter cartridge has been replaced.

10.1.6 Filling the reagent tube on the catalyst furnace

⚠ CAUTION

C29_0094

Risk of burns

Hot catalyst furnace

- The furnace temperature of the catalyst furnace can be up to 800 °C during operation and cause burns.
- **Wear heat-resistant protective gloves when working with the catalyst furnace .**
- **Only replace the catalyst furnace filling after a sufficiently long cooling period.**



This diagram shows the front of the analyzer with open catalyst furnace and details of the reagent tube:

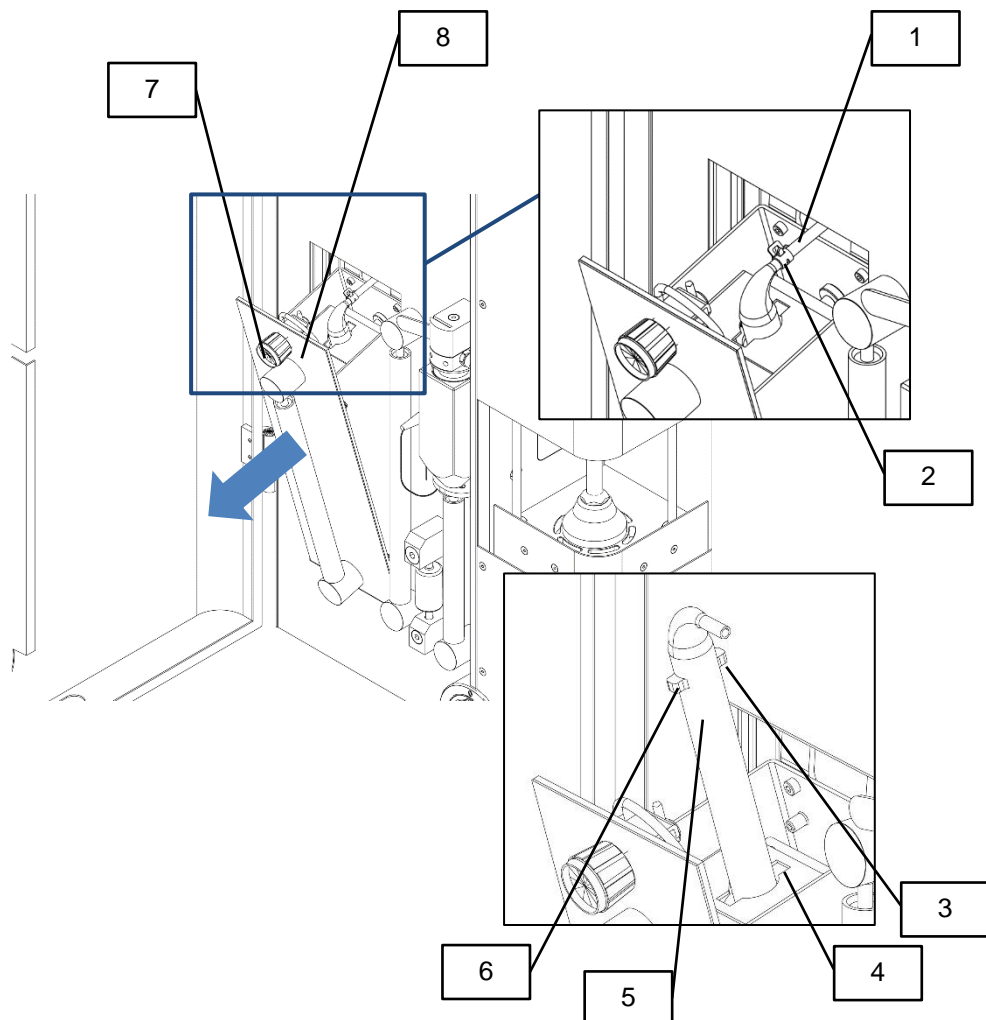


Fig. 12: Open catalyst furnace with details of the reagent tube

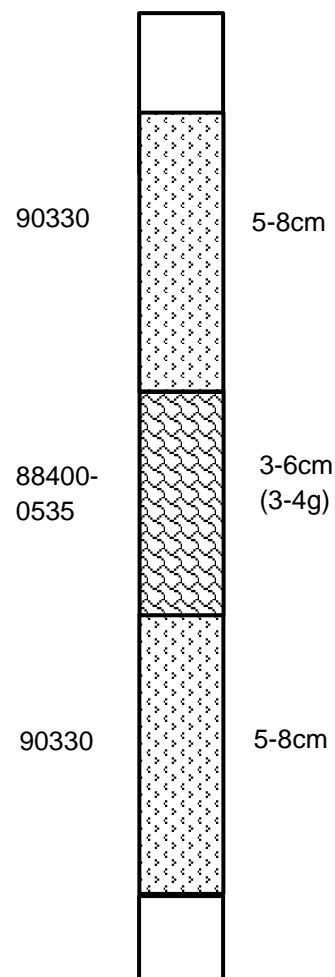


The catalyst furnace is only functional once it has reached its operating temperature.

Position	Component
1	Hose
2	Clamp
3	Locating key
4	Guide
5	Reagent tube
6	Locating key
7	Lock on the catalyst furnace
8	Catalyst furnace

The reagent tube on the catalyst furnace is filled as follows:

1. Ensure that the analyzer is switched off and the catalyst furnace has cooled down.
2. Open the door of the analyzer (see Pos. (11) in “Front”).
3. Turn the lock (7) on the catalyst furnace (8) to the left. The catalyst furnace is unlocked.
4. Open the catalyst furnace .
5. Release the clamp (2) for securing the hose (1) and slide it to the back over the hose
6. Carefully slide the hose (1) from the reagent tube (5) and remove the clamp (2).
7. Turn the reagent tube (5) 90° **clockwise**. The locating keys (3) and (6) on the reagent tube (5) are twisted **into** the guide (4).
8. Turn the reagent tube (5) back and forth slightly within the guide (4) to release the reagent tube.
9. Carefully pull the reagent tube (5) out of the guide (4).
10. Where this is not the first filling, remove the used filling from the reagent tube.
11. Dispose of the reagent tube filling in accordance with local regulations and provisions.
12. Ensure that the reagent tube is undamaged. If it is damaged or too contaminated, use a new reagent tube (Part No. 88400-0452).
13. Turn the reagent tube over for filling.
14. Fill approx. 5 to 8 cm of the length of the reagent tube with quartz wool (Part No. 90330).
15. Onto the quartz wool, fill approx. 3 to 6 cm of the length of the tube (approx. 3 to 4 g) with platinized silica (Part No. 88400-0535).
16. Onto the platinized silica, fill approx. 5 to 8 cm of the length of the tube with quartz wool (Part No. 90330).
17. Carefully slide the filled reagent tube (5) with the connector to the right into the guide (4).
18. Carefully turn the reagent tube (5) 90° **anticlockwise**. The reagent tube locating keys (3) and (6) are twisted **out** of the guide.
19. Slide the clamp back over the hose



20. Carefully slide the hose (1) onto the reagent tube (5).
The hose must be pushed at least 5 mm over the reagent tube connector.
21. Secure the hose (1) using the clamp (2).
The reagent tube on the catalyst furnace has been filled.

10.1.7 Cleaning the dust box

⚠ CAUTION

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**

C30.0076



The dust box stops fine dust penetrating the infrared measuring cells of the analyzer. It is necessary to clean the dust box to prevent the absorption of reaction gases and associated lower results:

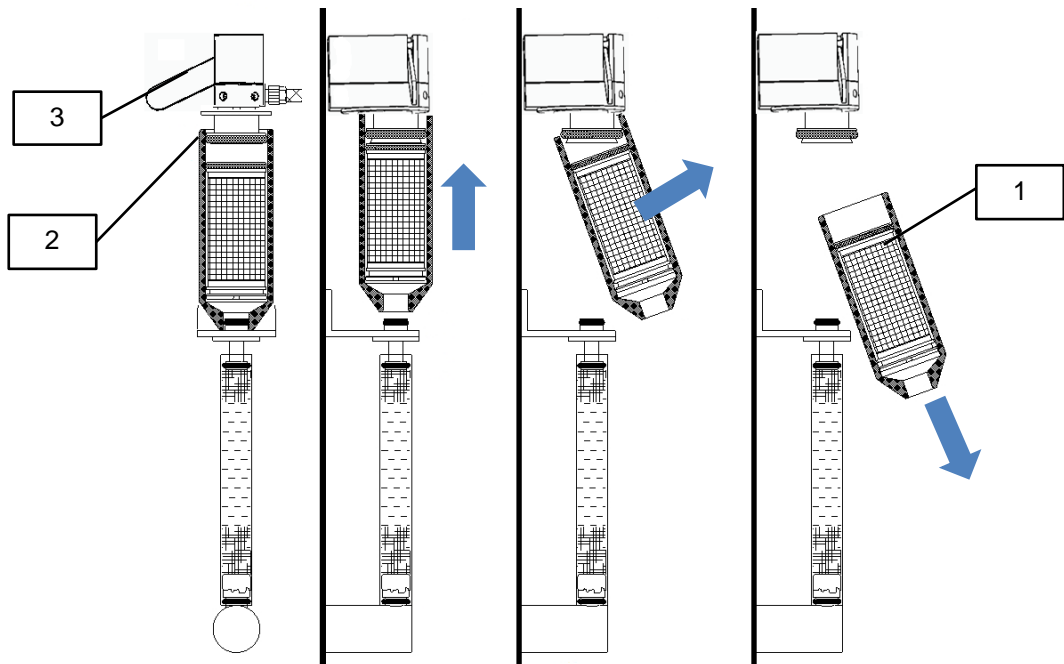


Fig. 13: Removing the dust box

Position	Component
1	Dust box
2	O-ring
3	Lock

For cleaning, the metal filter holder with the dust box must first be removed:

1. Release the plug-in connector on the metal filter heater.
2. Turn the lock (3) 90° to the left to release the O-ring (2).
3. Lift the dust box (1) up as far as possible.
4. Swing the dust box to the side.
5. Remove the dust box downwards.

The metal filter holder with the dust box has been removed.

10.1.7.1 Quick cleaning of the dust box

The dust box should be quickly cleaned daily or every 100 analyses at the latest:

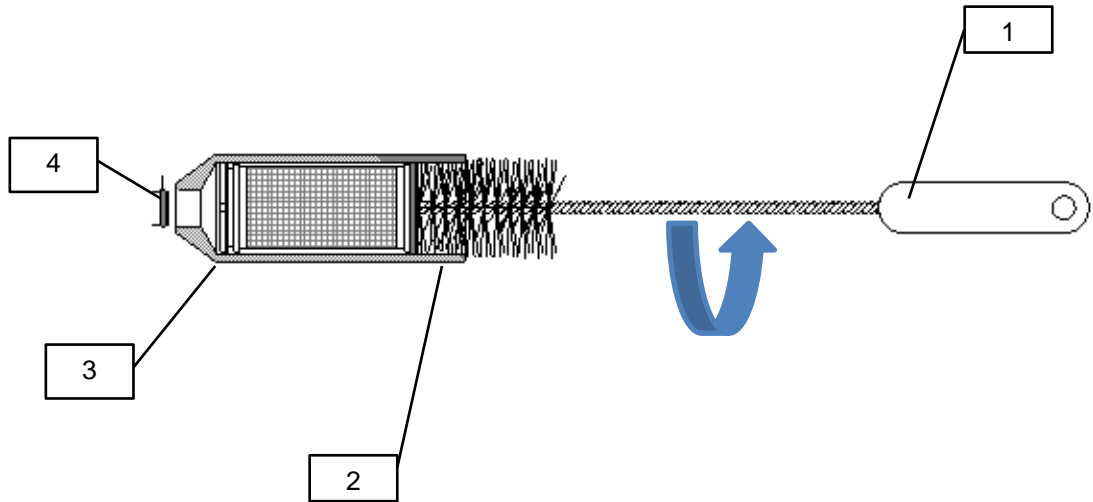



Fig. 14: Quick cleaning of the dust box

Position	Component
1	Supplied brush
2	Top end of the filter housing
3	Bottom of the filter housing
4	Bottom O-ring at support

 Grease is only applied to the bottom end of the filter housing (3) and the bottom O-ring (4). The top end of the filter housing (2) and the O-ring on the top sealing mechanism should be clean and remain absolutely free of grease.

Proceed as follows to quickly clean the dust box:

1. Ensure that the filter housing with the dust filter has been removed (see "[Cleaning the dust box](#)").
 2. Using a suitable paper towel, remove the grease at the top end of the filter cartridge.
 3. Clean the filter from the top end of the filter housing (2).
 3. To do this, turn the supplied brush (1) in only one direction.
 4. Collect the dust **in a suitable waste container**.
 5. Insert the dust box again.
 6. Turn the lock (see Pos. (3) in "[Cleaning the dust box](#)") 90° to the right.
 7. Secure the connector on the metal filter heater.
- The dust box has been cleaned.

10.1.7.2 Thorough cleaning of the dust box

The dust box should be thoroughly cleaned monthly or every 500 analyses at the latest. Proceed as follows to thoroughly clean the dust box:

1. Ensure that the metal filter with the dust box has been removed (see “[Cleaning the dust box](#)”).

Position of the O-rings:

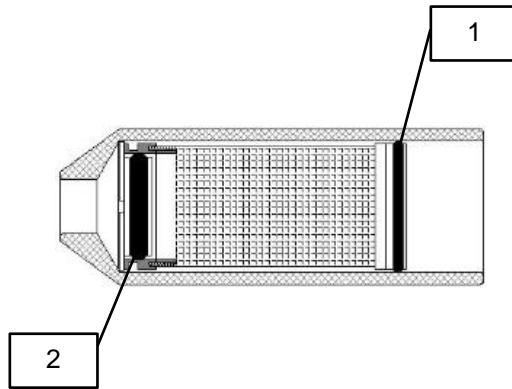


Fig. 15: Assembled metal filter

Position	Component
1	Outer O-ring
2	Inner O-ring

2. Slide the metal filter (5) out of the filter housing (4) with a suitable blunt tool (3).

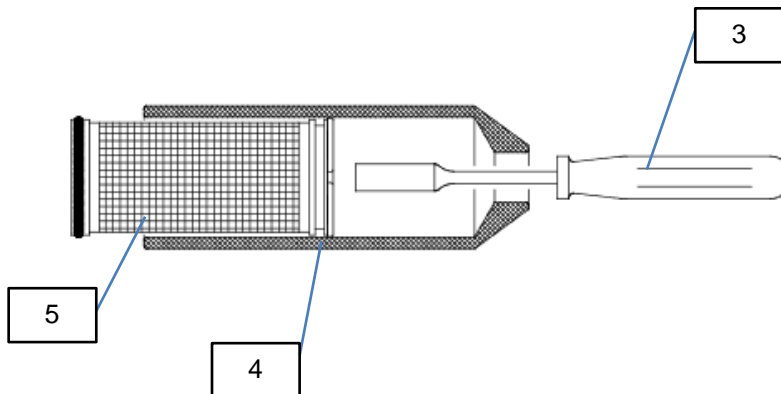



Fig. 16: Thoroughly cleaning the dust box

Position	Component
3	Suitable tool (e.g. screwdriver)
4	Filter housing
5	Metal filter

3. Check the outer O-ring (1) for damages.

4. Clean the filter housing (4) with the supplied brush (also see "[Quick cleaning of the dust box](#)").
5. Clean the metal filter (5) in the ultrasonic bath (Part No. 71007).
6. Dry the O-ring and grease the O-ring (1) where necessary.
7. Clean the top end of the filter housing (also see "[Quick cleaning of the dust box](#)") to remove grease.
8. Install the O-rings correctly (Fig.15) so that the gas flow is not blocked.
9. Insert the cleaned and completely dry metal filter (5) in the filter housing (4).
10. Insert the dust box again.
11. Turn the lock (see Pos. (3) in "[Cleaning the dust box](#)") 90° to the right.
12. Secure the connector on the metal filter heater.
The dust filter has been thoroughly cleaned.

10.1.8 Maintenance in the furnace area


 **DANGER**

D3.0000

Risk to life caused by an electric shock
Exposed power contacts

- Contact with exposed power contacts can cause life-threatening injuries or death.
- **Turn the main switch to Position 0 and pull out the power plug prior to maintenance work on the analyzer.**
- **Turn the main switch to Position 1 prior to maintenance work on the HTFr machine and allow the machine to cool down sufficiently. Only set the main switch to Position 0 and pull out the power plug once you have allowed sufficient time for the machine to cool down.**

10.1.8.1 Replacing the furnace cleaning brush and thermal shield

 **DANGER**

D4.0000

Risk to life caused by an electric shock
Exposed power contacts

- Contact with exposed power contacts can cause life-threatening injuries or death.
- **Turn the main switch to Position 0 and pull out the power plug prior to maintenance work on the analyzer.**
- **Turn the main switch to Position 1 prior to maintenance work on the HTFr machine and allow the machine to cool down sufficiently. Only set the main switch to Position 0 and pull out the power plug once you have allowed sufficient time for the machine to cool down.**

The furnace of the analyzer is fitted with an automatic furnace cleaning system with thermal shield .

Proceed as follows to replace the furnace cleaning brush with thermal shield:

1. Open the furnace.
As a result, the springs at the top of the furnace are released and the knurled nuts can be easily unscrewed.
2. Turn the main switch on the analyzer to Position 0 and pull out the power plug.
3. Wait until the furnace of the analyzer has cooled down sufficiently.

The following diagram shows the mounting bolts for the top furnace lining at the top and at the front of the machine:

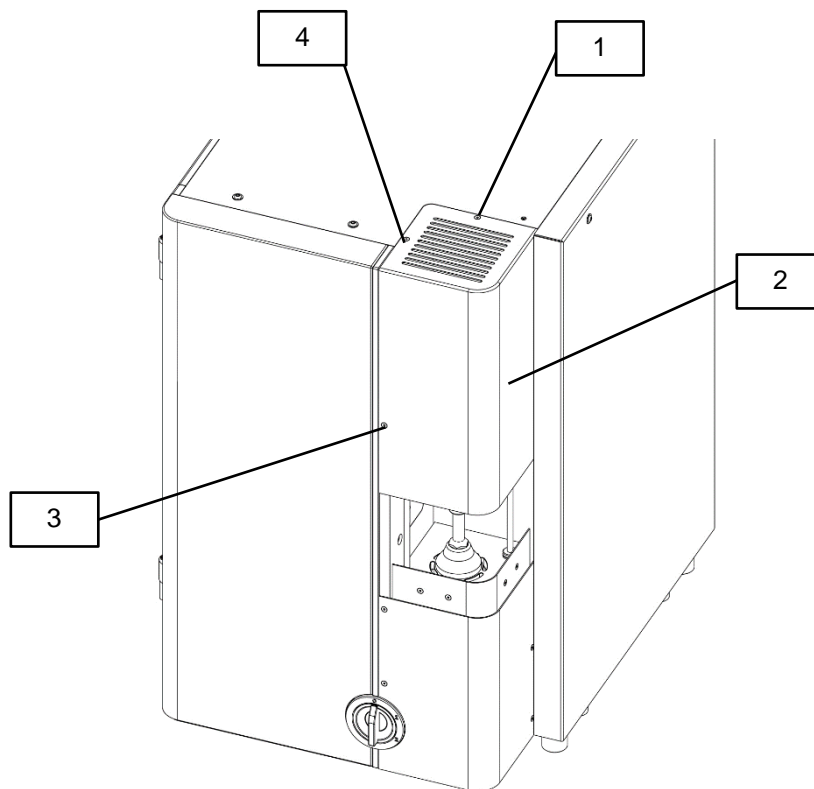


Fig. 17: Removing the top furnace lining

4. Unscrew the Allen screws (1), (3) and (4) at the top and front of the furnace lining.
5. Remove the furnace lining (2).

The following diagram shows the mounting plate of the furnace cleaning system:

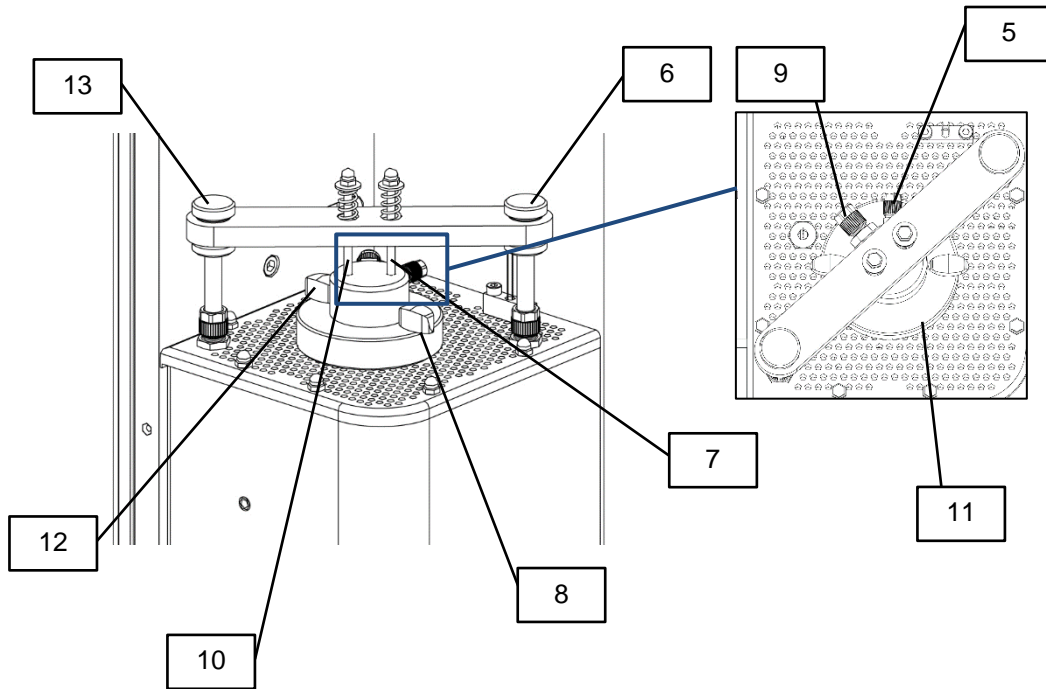


Fig. 18: Furnace cleaning system mounting plate

6. Remove the knurled nuts (6) and (13).
7. Unscrew the wing nuts (8) and (12).
8. Unscrew the gas connectors (5) and (9) (also see detailed image) and remove the gas hoses.

The following image shows the removed furnace cleaning system:

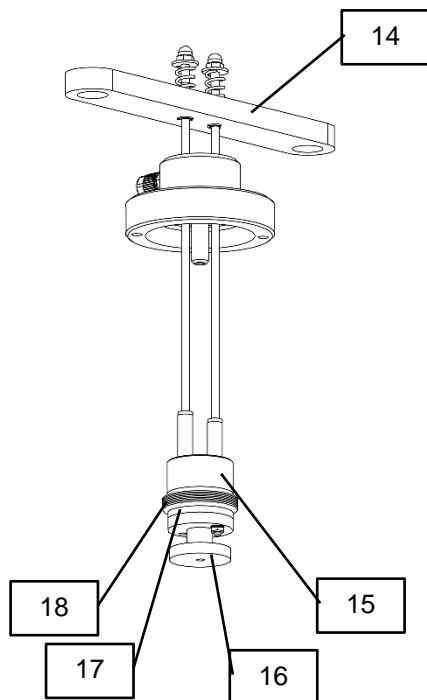


Fig. 19: Removed furnace cleaning system

9. Pull the furnace cleaning system out from the top by the support **(14)**.
Make sure not to bend the rods **(7)** and **(10)** and not to damage the combustion tube.
10. Hold the furnace cleaning brush holder **(15)** firmly and twist the thermal shield **(16)** off.
11. Remove the furnace cleaning brush **(18)**.
Dispose of the furnace cleaning brush (and the thermal shield where necessary) in accordance with local regulations and provisions.
12. Insert a new furnace cleaning brush (Part No. 14045) and a new thermal shield where necessary (Part No. 14072).
The thermal shield must be replaced if it is too contaminated or damaged. Check whether the purge drilled hole is clean and unblocked.
13. Insert the furnace cleaning system again from the top.
14. Check that the top end plate of the furnace **(11)** is resting on the O-ring.
15. Evenly tighten the wing nuts **(8)** and **(12)** on the top end plate of the furnace.
16. Tighten the knurled nuts **(6)** and **(13)**.
17. Connect the gas hoses to the gas connectors **(5)** and **(9)**.
18. Install the furnace lining **(2)** using the Allen screws **(1)**, **(3)** and **(4)**.
19. Plug in the power plug and turn the main switch on the analyzer to Position 1.
The furnace cleaning brush and thermal shield on the machine have been replaced.

10.1.8.2 Replacing the combustion tube

The combustion tube on the analyzer must be serviced or replaced at least once a month, or:

- If the combustion tube is damaged
- If there are greatly fluctuating carbon or sulphur levels
- After approx. 1000 analyses



Never operate the machine without a combustion tube.

Replace the combustion tube on the analyzer as follows:

1. Turn the main switch on the analyzer to Position 0 and pull out the power plug.
2. Wait until the analyzer has cooled down sufficiently.
3. Remove the furnace cleaning system, see "[Replacing the furnace cleaning brush and thermal shield](#)".

The following diagram shows the bottom end plate of the furnace on the analyzer:

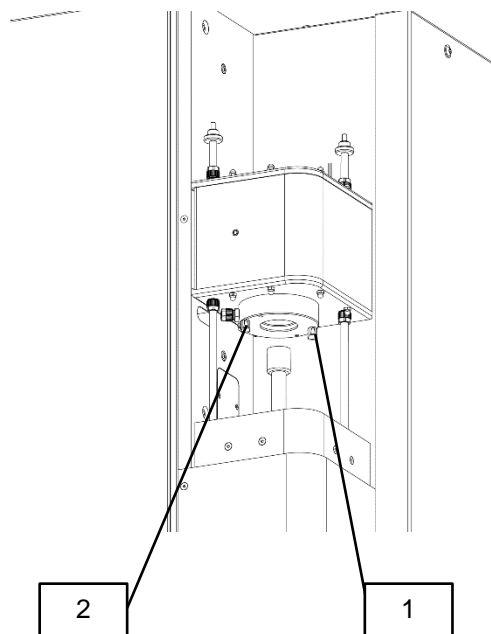


Fig. 20: Bottom end plate of the furnace on the analyzer

4. Unscrew the wing nuts on the bottom end plate of the furnace (1) and (2). Hold the combustion tube tight from above and remove the bottom end plate of the furnace and the O-ring.

The following diagram shows the top of the combustion tube:

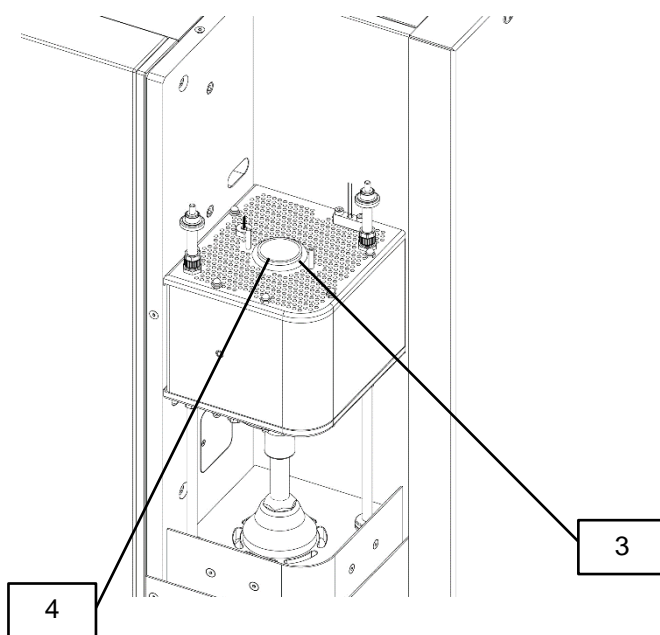


Fig. 21: Top of the combustion tube

5. Carefully pull the combustion tube (4) with the O-ring (3) up and out of the furnace.
6. If necessary, place a new O-ring (Part No. 70380) onto the new combustion tube (Part No. 14130).
7. Insert the new combustion tube with the new O-ring from the top.
8. Hold the combustion tube tight from above and if necessary, insert a new O-ring from below.
9. Secure the bottom end plate of the furnace again. Ensure that the combustion tube is resting cleanly in the guide of the bottom end plate of the furnace.
10. Tighten the wing nuts (1) and (2).
11. Insert the furnace cleaning system, see [“Replacing the furnace cleaning brush and thermal shield”](#).
12. Plug in the power plug and turn the main switch on the analyzer to Position 1.
The combustion tube on the analyzer has been replaced.

10.1.8.3 Removing the crucible tray

The tray must be removed in order to clean the area beneath the tray.

Proceed as follows to remove the tray on the analyzer and to clean the area beneath the tray:

1. Turn the main switch on the analyzer to Position 0
2. Wait until the analyzer has cooled down sufficiently.

The following diagram shows the tray on the analyzer:

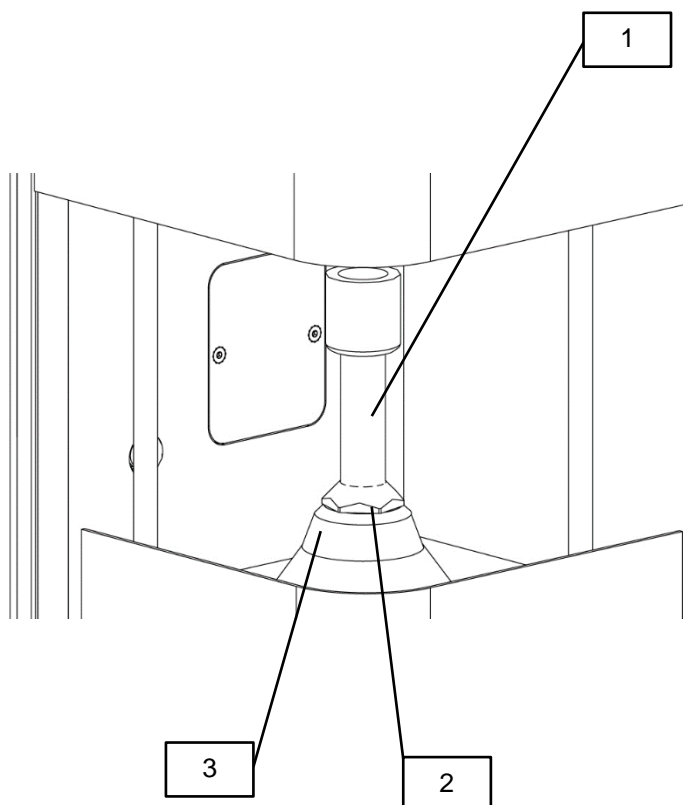


Fig. 22: Removing the tray on the analyzer

3. Lift the tray (1) out of the furnace bell (3). If it is difficult to release this, perform steps 4 to 8, otherwise continue with step 9.
4. If the sample stand is difficult to lift, unscrew the guide (2) from the bell (3) using a 24 mm wrench.
5. Twist the guide out completely.
6. Using a tool, remove the tray from the guide
7. Clean the thread on the furnace bell (3) and on the nut (2). Use a vacuum cleaner to clean the thread.
8. After cleaning, screw the guide (2) into the bell (3).
9. Clean the tray (1) (e.g. with a dry cloth) and inset it again.
10. Turn the main switch on the analyzer to Position 1.
The area beneath the tray on the analyzer has been cleaned.

10.1.9 Replacing the O-rings

⚠ CAUTION

C31.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



⚠ CAUTION

C32.0000

Risk of cuts

Glass splinters

- Sample vials and reagent tubes are made of glass and can break. Glass splinters can cause cuts.
- **Inspect reagent tubes and sample vials for damage prior to use.**
- **Wear protective gloves and goggles when handling reagent tubes and sample vials.**
- **Replace damaged reagent tubes and sample vials.**
- **Do not touch glass splinters with unprotected hands.**



10.1.9.1 Replacing the O-ring at the top of the combustion tube

Replace the top O-ring on the combustion tube of the analyzer as follows:

1. Turn the main switch on the analyzer to Position 0 and pull out the power plug.
2. Wait until the analyzer has cooled down sufficiently.
3. Remove the furnace cleaning system, see "[Replacing the furnace cleaning brush and thermal shield](#)".

The O-ring (1) at the top of the combustion tube is now accessible:

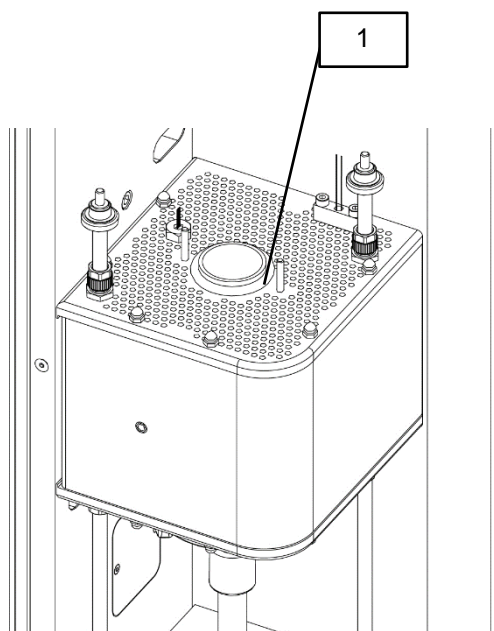


Fig. 23: O-ring at the top of the combustion tube

4. Remove the O-ring (1) at the top of the combustion tube.
5. Apply a thin layer of high vacuum silicon grease (Part No. 92610) to the inside of the new O-ring (Part No. 70380).
6. Apply a thin layer of high vacuum silicon grease (Part No. 92610) to the outer surface of the combustion tube on which the new O-ring will be placed.
7. Insert the greased O-ring at the top of the combustion tube.
8. Insert the furnace cleaning system again, see [“Replacing the furnace cleaning brush and thermal shield”](#).
9. Plug in the power plug and turn the main switch on the analyzer to Position 1.
The O-ring at the top of the combustion tube on the analyzer has been replaced.

10.1.9.2 Replacing the O-rings at the bottom and in the bottom furnace locking device

Replace the O-rings at the bottom of the combustion tube and in the bottom furnace locking device of the analyzer as follows:

1. Turn the main switch on the analyzer to Position 0 and pull out the power plug.
2. Wait until the analyzer has cooled down sufficiently.
3. Remove the furnace cleaning system, see [“Replacing the furnace cleaning brush and thermal shield”](#).

4. Unscrew the wing nuts (2) and (3) on the bottom furnace lock (3):

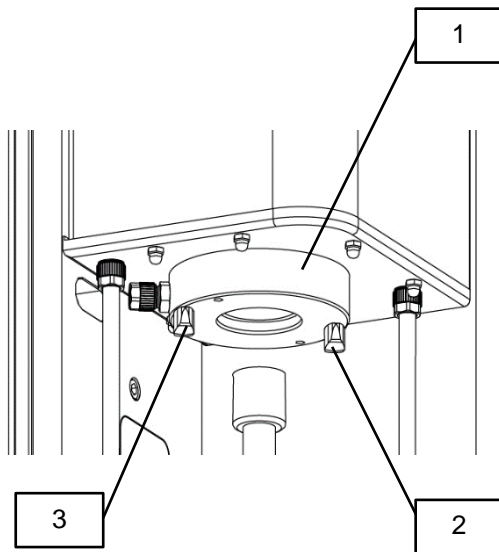


Fig. 24: Wing nuts on the bottom furnace lock

5. Pull the bottom furnace lock (1) down and off.

The O-ring on the underneath of the furnace is now accessible:

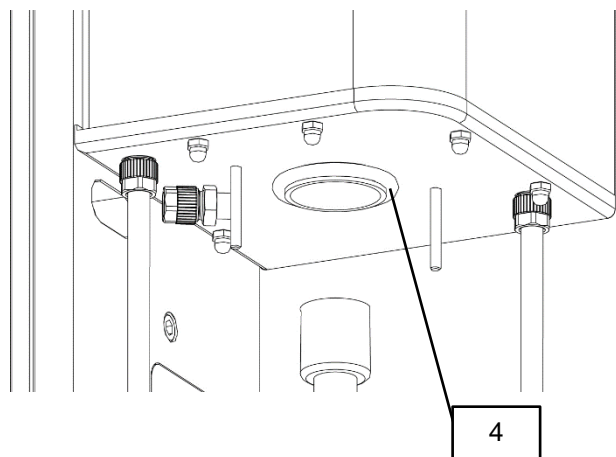


Fig. 25: O-ring on the bottom furnace lock

6. Remove the O-ring (4).
7. Apply a thin layer high vacuum silicon grease (Part No. 92610) to the inside of the new O-ring (Part No. 70380).
8. Insert the new O-ring on the underneath of the furnace on the combustion tube.

The following diagram shows the O-ring (5) in the bottom furnace lock:

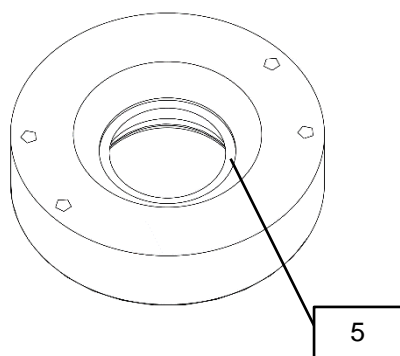


Fig. 26: O-ring in the bottom furnace lock

9. Remove the O-ring (5) from the bottom furnace lock.
10. Apply a thin layer high vacuum silicon grease (Part No. 92610) to the outside of the new O-ring (Part No. 70380).
11. Insert the greased O-ring in the bottom furnace lock.
12. Insert the furnace lock (1) and screw the wing nuts (2) and (3) on the bottom furnace lock tight.
13. Insert the furnace cleaning system again, see [“Replacing the furnace cleaning brush and thermal shield”](#).
14. Plug in the power plug and turn the main switch on the analyzer to Position 1.
The O-rings at the bottom of the combustion tube and in the bottom furnace lock of the analyzer have been replaced.

10.1.9.3 Replacing the O-rings on the furnace seal

The O-rings must be replaced when they no longer provide an adequate seal due to damage or age.

Replace the O-rings on the furnace seal of the analyzer as follows:

1. Turn the main switch on the analyzer to Position 0 and pull out the power plug.
2. Wait until the analyzer has cooled down sufficiently.
3. Remove the furnace cleaning system, see [“Replacing the furnace cleaning brush and thermal shield”](#).

4. Remove nuts (1) and (12):

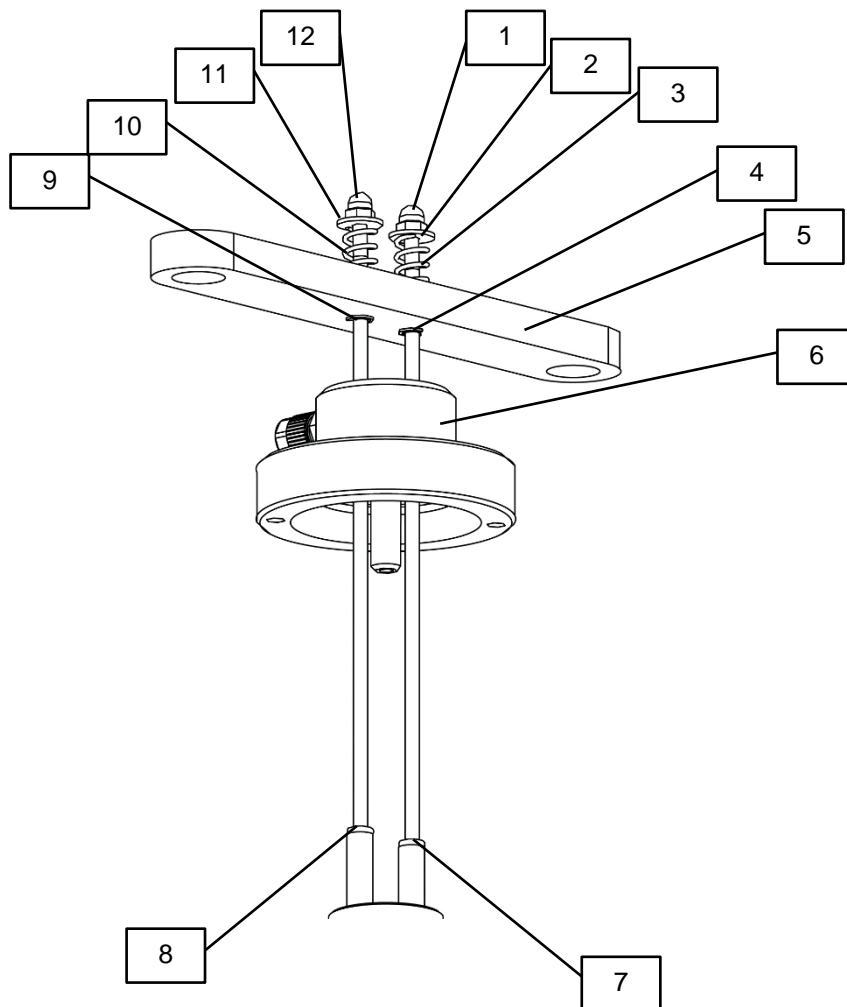


Fig. 27: O-rings on the furnace cleaning system

5. Remove the washers (2) and (11) and the springs (3) and (10).
6. Pull the support (5) up and off.
7. Remove the retaining rings (4) and (9).
8. Pull the top furnace lock (6) up and off.
9. Remove the O-rings (7) and (8).
Make sure not to damage the sealing surfaces of the connectors when removing the O-rings.
10. Clean the O-ring sealing surfaces on the rods and the inside of the furnace lock to remove grease and dust.
11. Insert the new O-rings.
12. Slide the top furnace lock (6) back on.
13. Insert the retaining rings (4) and (9).
14. Slide on the support (5) from above.
15. Insert the washers (2) and (11) and the springs (3) and (10).
16. Screw on the nuts (1) and (12).
17. Insert the furnace cleaning system again, see [“Replacing the furnace cleaning brush and thermal shield”](#).
18. Plug in the power plug and turn the main switch on the analyzer to Position 1.
The O-rings on the furnace seal of the analyzer have been replaced.

10.1.10 Cleaning the connecting hose between the furnace and metal filter

Clean the hose connection from the dust filter to the furnace on the analyzer as follows:

1. Open the machine door (see Pos. 11 in "[Front](#)").

The following figure shows the hose connection from the dust filter to the furnace of the analyzer:

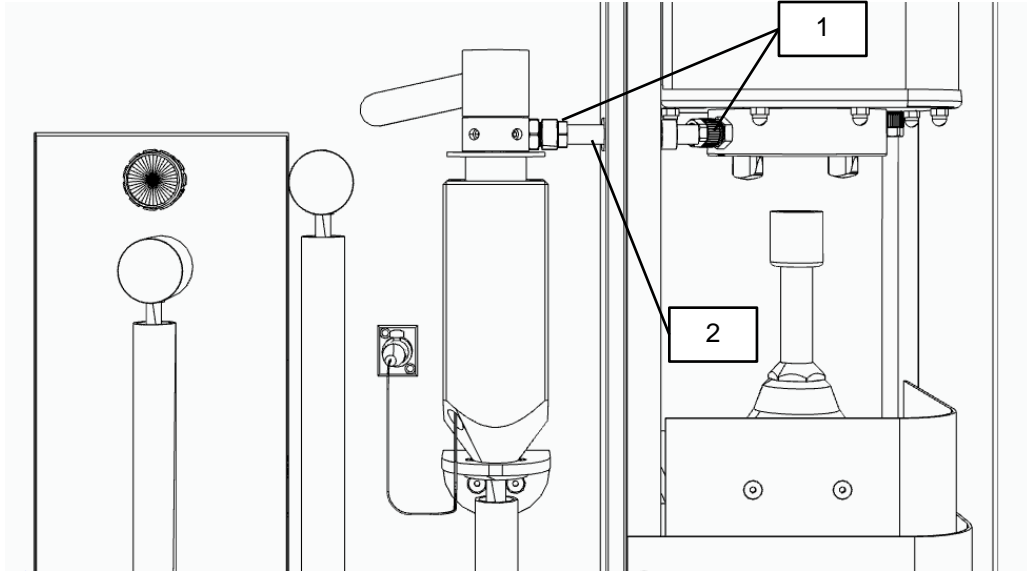


Fig. 28: Hose connection from the dust filter to the furnace

2. Unscrew the hose nuts on the filter connector and on the bottom furnace locking device (1).
3. Pull the hose (2) off.
4. In der ELEMENTS software, start the vacuum ("Analyzer status" window under "User service") or use an external vacuum cleaner to remove falling particles while cleaning.
5. Clean the hose with a pipe cleaner (Part No. 70002) or with a micro-brush (Part No. 88400-0501).
6. Replace the hose (Part No. 51100-2040) if it can no longer be cleaned or leaks.
7. Insert the hose (2) and secure the hose nuts (1).
8. Close the machine door.

The hose connection from the dust filter to the furnace has been cleaned.

10.2 Maintenance the HTFr

⚠ CAUTION

C33.0000

Risk of burns

Hot machine parts

- Parts of the machine can get very hot and cause burns during maintenance work if the waiting time to ensure cooling is not complied with.
- **Before maintenance work, wait until the temperature of the furnace is < 40 °C.**
- **Check the furnace temperature in the ELEMENTS software.**



10.2.1 Overview of maintenance work for the HTFr

The following service instructions refer to the analysis of dried coal and coke using the HTFr with 15 to 20 samples per day. Depending on the application, the maintenance cycle may need to be intensified to maintain the precision of analysis results.

The following table lists the maintenance work to be carried out. The maintenance work must be conducted regularly at the specified maintenance intervals or upon reaching the number of possible analyses:

Component	No. of analyses	Maintenance interval	Service instructions	See chapter
Anhydrone (magnesium perchlorate) trap	150	Monthly	Dispose of glass wool and magnesium perchlorate, clean glass and filling new chemicals	“Replacing the anhydrone”
Replace the dust filter cartridge	500	Quarterly	Replace	“Replacing the dust filter cartridge”
Replace the combustion tube	15000	Yearly	Replace	“Replacing the combustion tube”
Check or replace the O-rings on the combustion tube, anhydrone	15000	Yearly	Replace	“Replacing the O-rings on the HTFr”

10.2.2 Cleaning the combustion tube and the dust box

DANGER

D5.0000

Risk to life caused by an electric shock

Exposed power contacts

- Contact with exposed power contacts can cause life-threatening injuries or death.
- **Turn the main switch to Position 0 and pull out the power plug prior to maintenance work on the analyzer.**
- **Turn the main switch to Position 1 prior to maintenance work on the HTFr machine and allow the machine to cool down sufficiently. Only set the main switch to Position 0 and pull out the power plug once you have allowed sufficient time for the machine to cool down.**

CAUTION

C34.0000

Risk of burns

Hot machine parts

- Parts of the machine can get very hot and cause burns during maintenance work if the waiting time to ensure cooling is not complied with.
- **Before maintenance work, wait until the temperature of the furnace is < 40 °C.**
- **Check the furnace temperature in the ELEMENTS software.**



CAUTION

C35.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



The dust box on the HTFr should be cleaned regularly. The dust box must be opened to clean the combustion tube and the dust box.

10.2.2.1 Opening the dust box

The following diagram shows the dust box at the back of the HTFr:

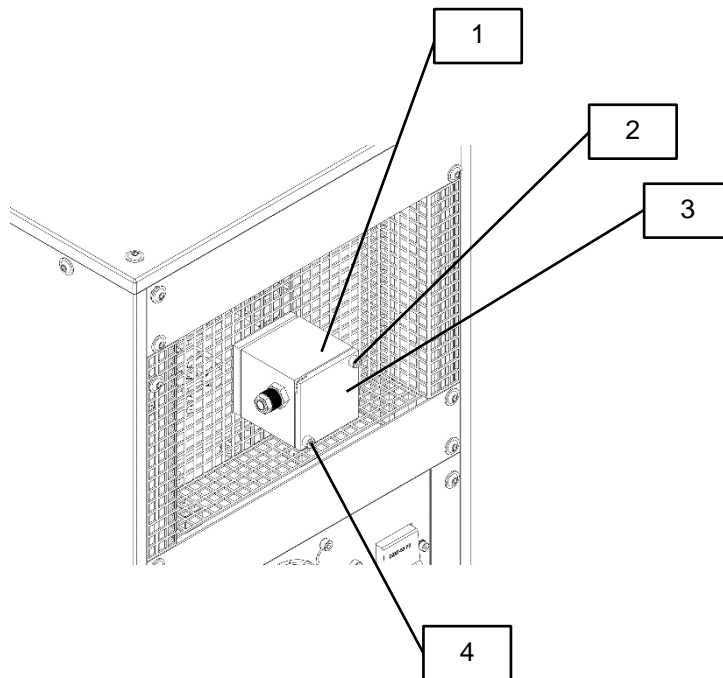


Fig. 29: Dust box on the back of the HTFr

Open the dust box as follows:

1. Turn the analyzer to Position 0 on the main switch or switch to induction furnace mode in the ELEMENTS software.
The analyzer must not generate any vacuum in the HTFr.
2. Turn the HTFr to Position 1 on the main switch.
3. Wait until the machine has cooled down sufficiently.
3. Turn the HTFr to Position 0 on the main switch.
4. Remove the screws (2) and (4) from the dust box (1).
5. Remove the cover (3).
The dust box has been opened.

10.2.2.2 Cleaning the dust box

The following diagram shows the back of the HTFr with open dust box:

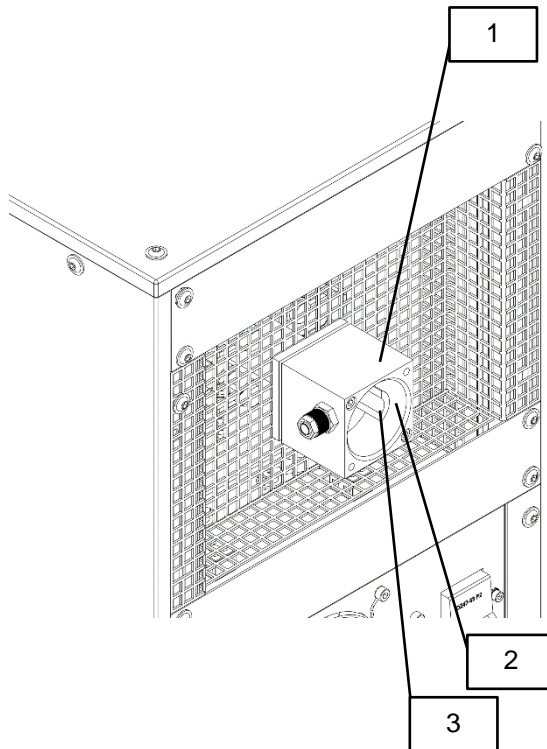


Fig. 30: Back of the HTFr with open dust box

Clean the combustion tube and the dust box as follows:

1. Open the dust box, see "[Opening the dust box](#)".
2. Clean the dust box (1) using a brush and a vacuum cleaner.
3. The dust box has been cleaned.

10.2.2.3 Closing the dust box

The following diagram shows the dust box at the back of the HTFr:

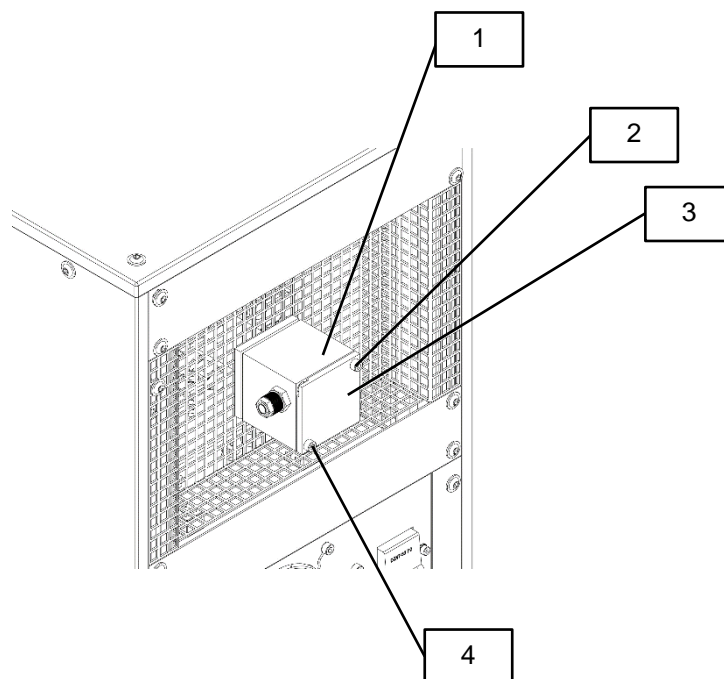


Fig. 31: Dust box on the back of the HTFr

Close the dust box as follows:

1. Place the cover (3) onto the housing of the dust box (1).
2. Evenly tighten the screws (2) and (4) to secure the cover.
The dust box is closed.

10.2.3 Replacing the combustion tube

DANGER

D6.0000

Risk to life caused by an electric shock

Exposed power contacts

- Contact with exposed power contacts can cause life-threatening injuries or death.
- **Turn the main switch to Position 0 and pull out the power plug prior to maintenance work on the analyzer.**
- **Turn the main switch to Position 1 prior to maintenance work on the HTFr machine and allow the machine to cool down sufficiently. Only set the main switch to Position 0 and pull out the power plug once you have allowed sufficient time for the machine to cool down.**

CAUTION

C36.0000

Risk of burns

Hot machine parts

- Parts of the machine can get very hot and cause burns during maintenance work if the waiting time to ensure cooling is not complied with.
- **Before maintenance work, wait until the temperature of the furnace is < 40 °C.**
- **Check the furnace temperature in the ELEMENTS software.**



CAUTION

C37.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



The combustion tube must be replaced at least once a year, or:

- If the combustion tube is damaged
- If there are greatly fluctuating carbon or sulphur levels
- After approx. 15000 analyses



Never operate the machine without a combustion tube.

10.2.3.1 Removing the dust box

The following diagram shows the back of the HTFr with open dust box:

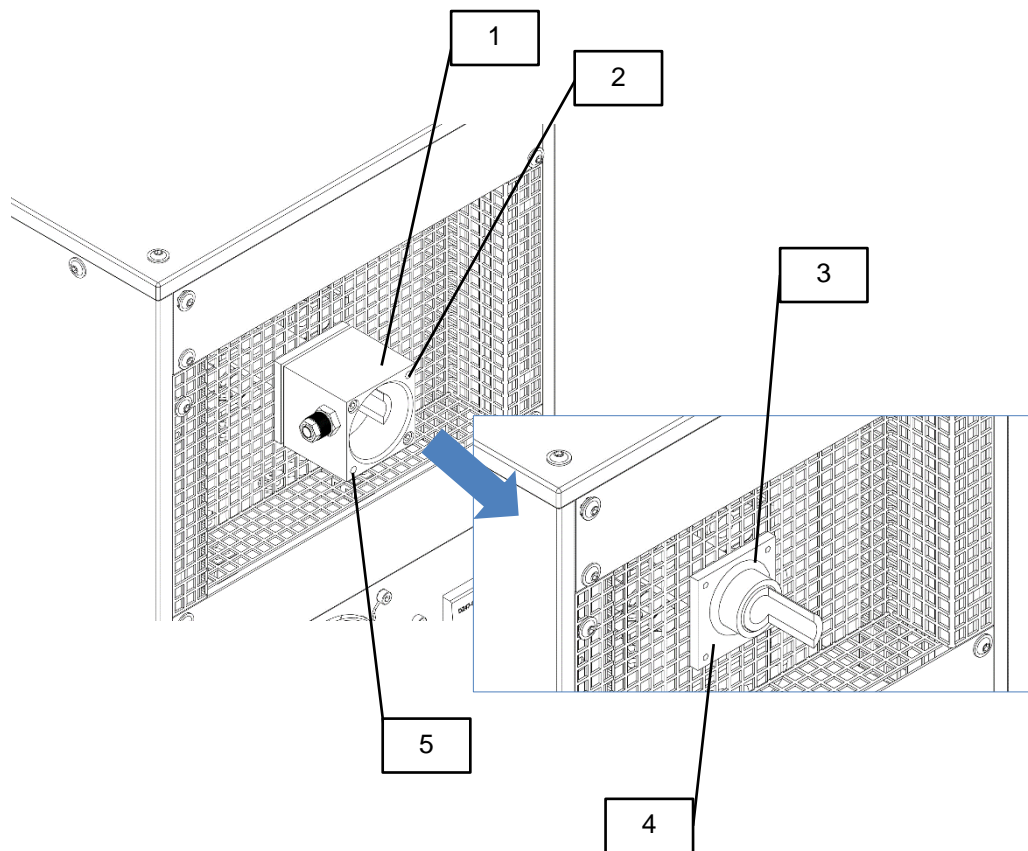


Fig. 32: Back of the HTFr with open dust box

Remove the dust box as follows:

1. Ensure that the dust box is open, see [“Opening the dust box”](#).
2. Remove the screws (2) and (5) and remove the housing of the dust box (1).
3. Pull off the O-ring (3).
If the O-ring is stuck to the combustion tube, slide the rear cover plate (4) back a little so that you can carefully release the O-ring all round.
4. Pull off the cover plate (4).
The dust box has been removed.

10.2.3.2 Removing the combustion tube

The following diagram shows the front of the HTFr with the machine door open:

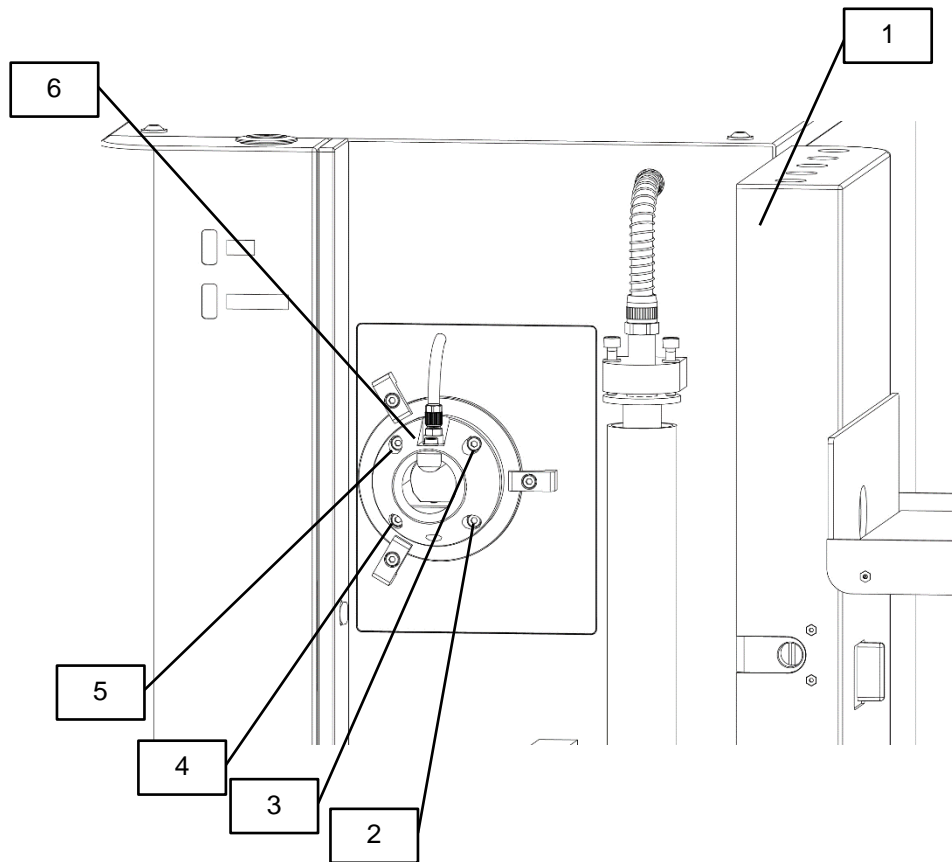


Fig. 33: Front of the HTFr with the machine door open

Remove the combustion tube as follows:

1. Ensure that the dust box on the back has been removed, see "[Removing the dust box](#)".
2. Open the machine door (1) on the front of the HTFr.
3. Loosen the screws (2) to (5) one by one to ease the pressure on the O-ring behind them.
4. Remove screws (2) to (5).
5. Remove the front furnace locking device (6).

The O-ring is visible:

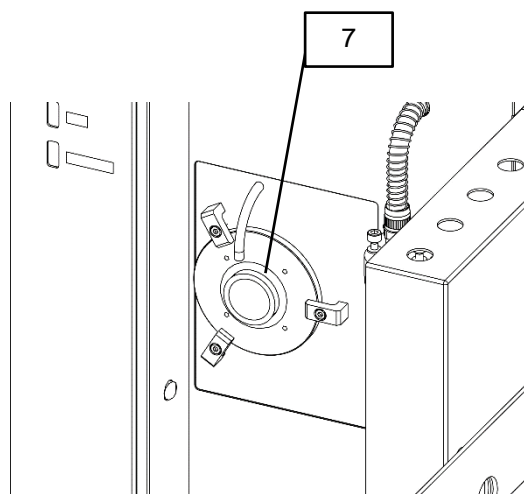


Fig. 34: O-ring behind the furnace locking device

6. Pull off the O-ring (7).

The mechanical stop on the dish and the combustion tube on the back:

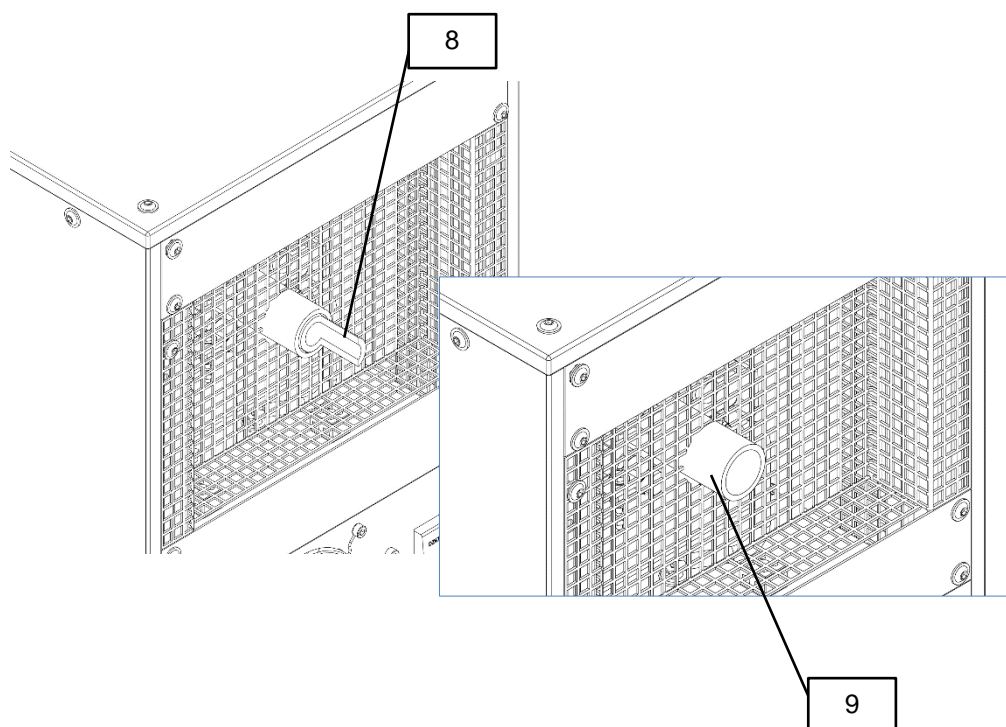


Fig. 35: Removing the mechanical stop on the dish and combustion tube on the back

7. Pull the mechanical stop on the dish (8) at the back out of the machine from behind.

8. Carefully pull the combustion tube (9) out of the machine from behind.

Make sure that the combustion is not twisted.

The combustion tube has been removed.

10.2.3.3 Inserting the combustion tube

The following diagram shows the front of the HTFr with furnace locking device removed and O-ring removed:

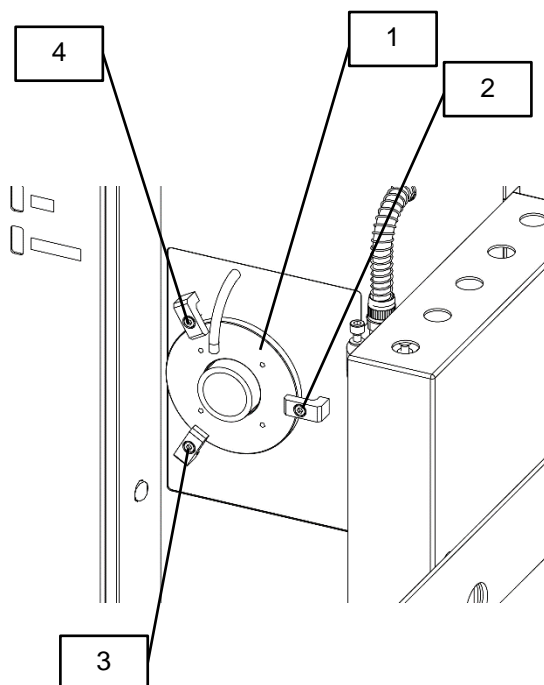


Fig. 36: Front of the HTFr with furnace locking device removed and O-ring removed

Insert the combustion tube as follows:

1. Ensure that the combustion tube has been removed, see "[Removing the combustion tube](#)".
2. Loosen the screws (2) to (4) as much as is needed for the adapter ring (1) to be moved.

The following diagram shows the back of the HTFr with combustion tube:

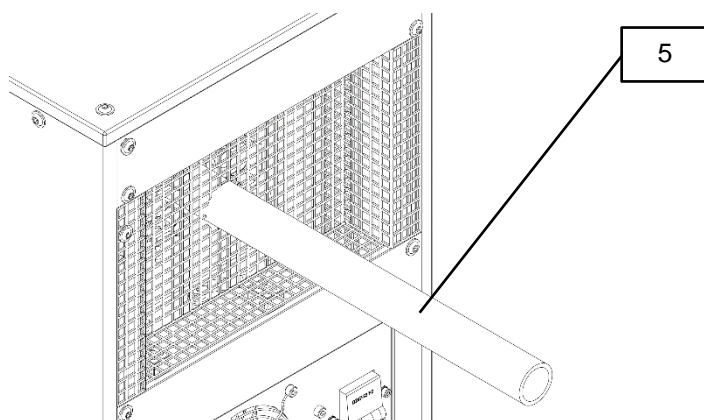


Fig. 37: Back of the HTFr with combustion tube

3. Carefully insert the new combustion tube (5) (Part No. 90162) onto the back of the HTFr. Move or twist the combustion tube gently to ensure that the path is not blocked. Do not use great force.
4. Slide the adapter ring (1) onto the front when the combustion tube abuts so that the combustion tube is positioned in the middle. The combustion tube should protrude a few centimetres from the adapter ring.

The following diagram shows the front of the HTFr with combustion tube inserted and O-ring in place:

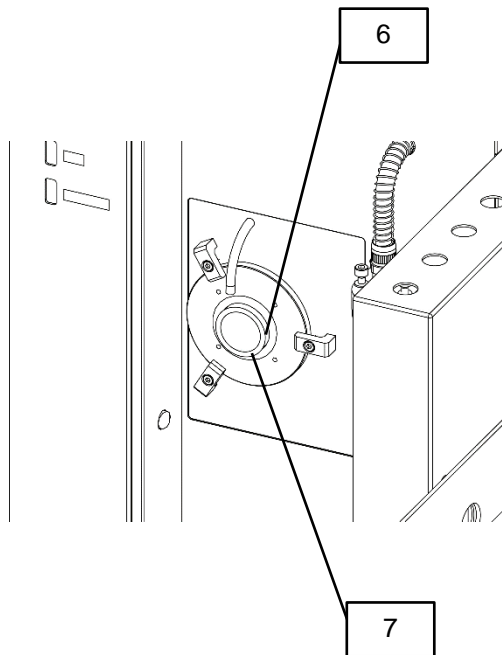


Fig. 38: Front of the HTFr with inserted combustion tube and O-ring

5. Slide the O-ring (6) onto the combustion tube (7).
The O-ring (6) should be positioned at a distance of approx. 2 cm from the edge of the combustion tube (7).

The following diagram shows the front of the HTFr with fitted furnace locking device:

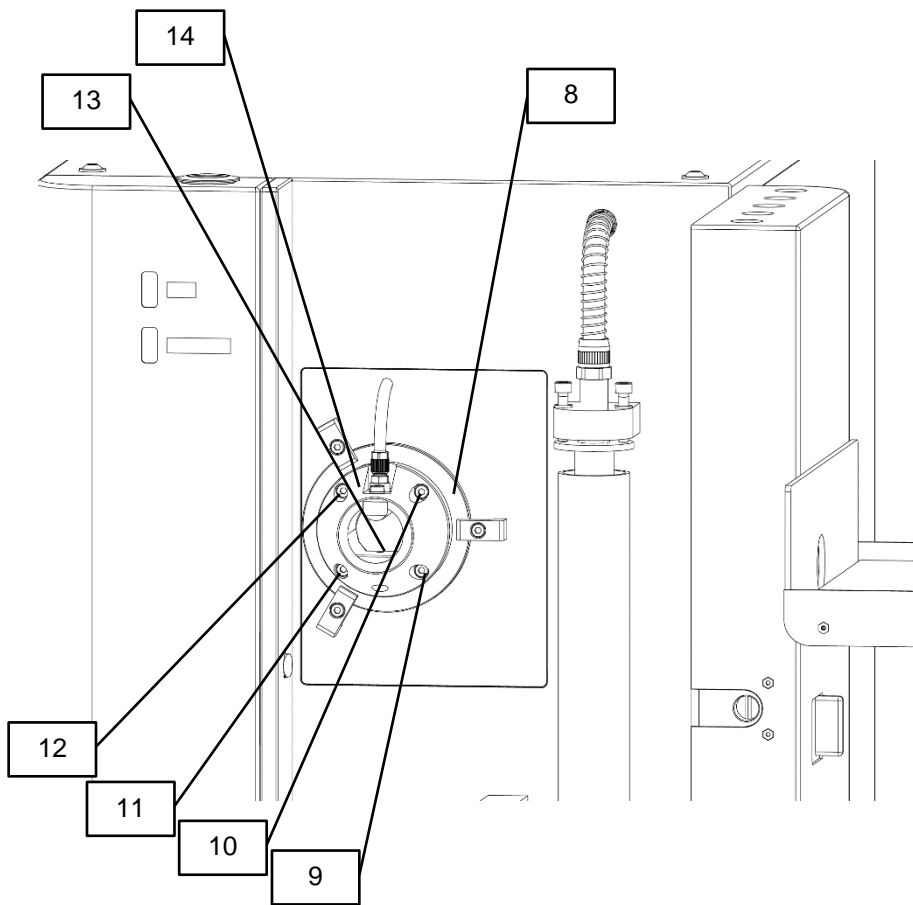


Fig. 39: Front of the HTFr with fitted furnace locking device

6. Using screws (9) to (12), secure the front furnace locking device (14) on the adapter ring (8).
7. Turn the furnace locking device (14) and adapter ring (8) so that the support plate (13) is aligned horizontally.
8. Gradually tighten each of the screws (9) to (12) in turn to ensure that the furnace locking device does not get twisted. When tightening the screws, the O-ring is squeezed and the tube pushed slightly backwards. The furnace locking device (14) and adapter ring (8) should be aligned parallel to each other at all times.
9. Tighten the screws (2) to (4) so that the adapter ring (8) can no longer be moved. The combustion tube has been inserted.

10.2.3.4 Installing the dust box

The following diagram shows the back of the HTFr with combustion tube inserted:

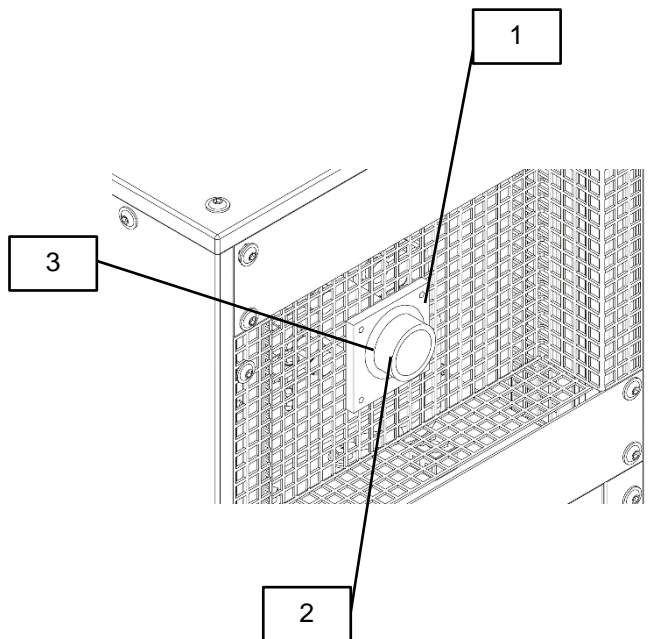


Fig. 40: Back of the HTFr with combustion tube inserted

Install the dust box as follows:

1. Ensure that the combustion tube has been inserted, see "[Inserting the combustion tube](#)".
2. Slide the rear cover plate (1) of the dust box on the back of the HTFr onto the back end of the combustion tube (2).
3. Slide the O-ring (3) onto the back end of the combustion tube (2).
The O-ring should be at a distance of approx. 2 cm from the end of the tube.

The following diagram shows the back of the HTFr with fitted dust box housing:

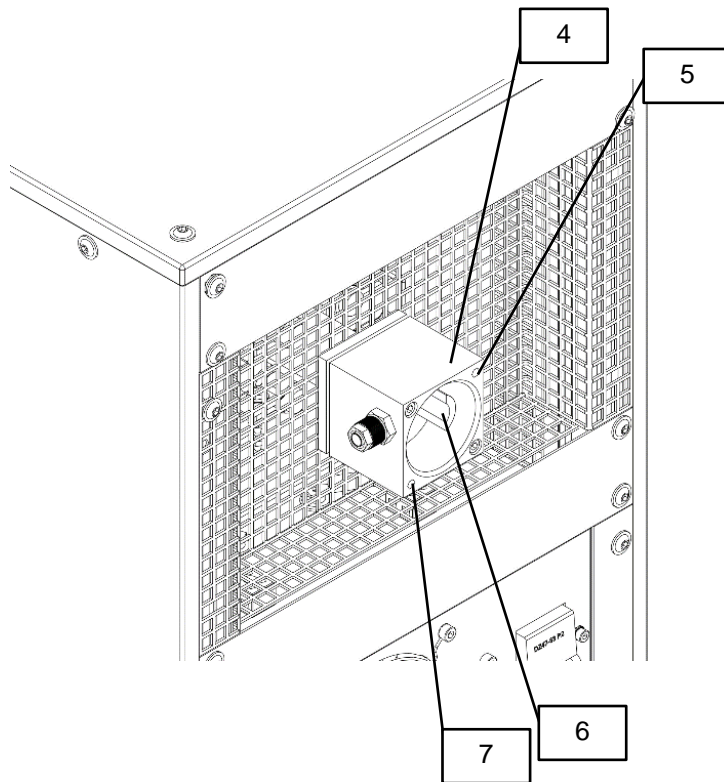


Fig. 41: Back of the HTFr with fitted dust box housing

4. Slide the dust box housing (4) as far as possible onto the combustion tube.
5. Secure the housing to the rear cover using the screws (5) and (7).
6. Gradually tighten the screws alternately.
Make sure that the housing and cover are aligned parallel to each other.
7. Tighten the screws.
8. Insert the mechanical stop on the dish (6) into the combustion tube (2) so that it protrudes slightly from the housing. Make sure that the rounded lug on the mechanical stop on the dish is pointing to the front of the machine and aligned parallel to the dish.
9. Close the dust box with the cover and screws, see "[Closing the dust box](#)".
The cover then pushes the mechanical stop on the dish forwards.
The dust box has been installed.

10.2.4 Replacing the moisture filter on the HTFr

The following diagram shows the front of the HTFr with the machine door open:

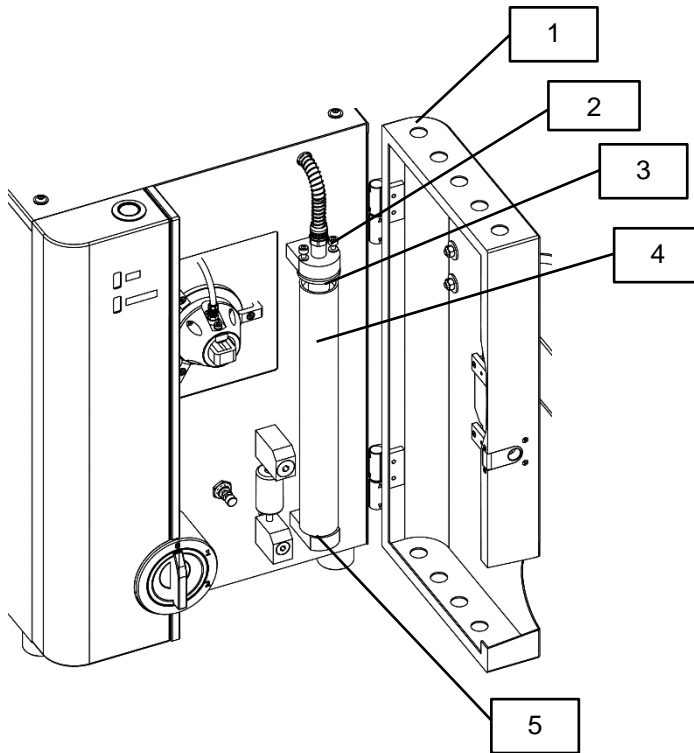
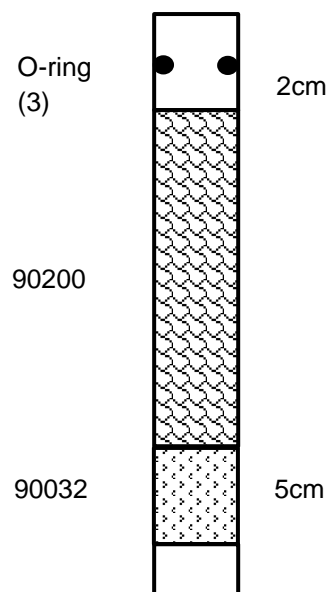



Fig. 42: Front of the HTFr with the machine door open


Replace the anhydroner as follows:

1. Turn the analyzer to Position 0 on the main switch or switch to the induction furnace mode in the ELEMENTS software.
The analyzer must not generate any vacuum in the HTFr.
2. Open the machine door (1) on the front of the HTFr.
3. Loosen the two screws on the clamping device (2) so that the reagent tube (4) can be moved easily.
Turn the reagent tube (4) when the O-ring is firmly in place.
4. Slide the reagent tube (4) carefully upwards and tilt the bottom end of the reagent tube forwards.
5. Pull the reagent tube (4) out from below.
6. Remove the used filling from the reagent tube.
7. Dispose of the reagent tube filling in accordance with local regulations and provisions.
8. Fill the bottom section of the tube to a length of approx. 5 cm with glass wool (Part No. 90032).
9. Apply as much magnesium perchlorate (Part No. 90200) to the glass wool as is needed for the distance between the magnesium perchlorate filling and the top O-ring (3) to be approx. 2 cm.



	<p>Do not apply any glass or quartz wool to the upper end of the reagent tube, because this can distort the sulphur readings due to condensation.</p>
---	---

10. Grease the bottom O-ring (5) with high vacuum silicon grease (Part No. 92610).

	<p>The top O-ring (3) must remain free from grease because it may otherwise become stuck to the holding mechanism or the glass.</p>
---	---

11. Hold the filled reagent tube at a slight angle and guide it over the top O-ring (3) onto the support.
12. Align the reagent tube vertically above the bottom O-ring (5) and slide it down until the reagent tube is resting on the bottom of the support.
13. Tighten the screws on the clamping device (2) again.
14. Close the machine door.
15. Turn the analyzer to the desired setting.
16. Wait until the HTFr is operational.
The anhydroner has been replaced.

10.2.5 Replacing the dust filter cartridge

The following diagram shows the dust filter cartridge on the front of the HTFr:

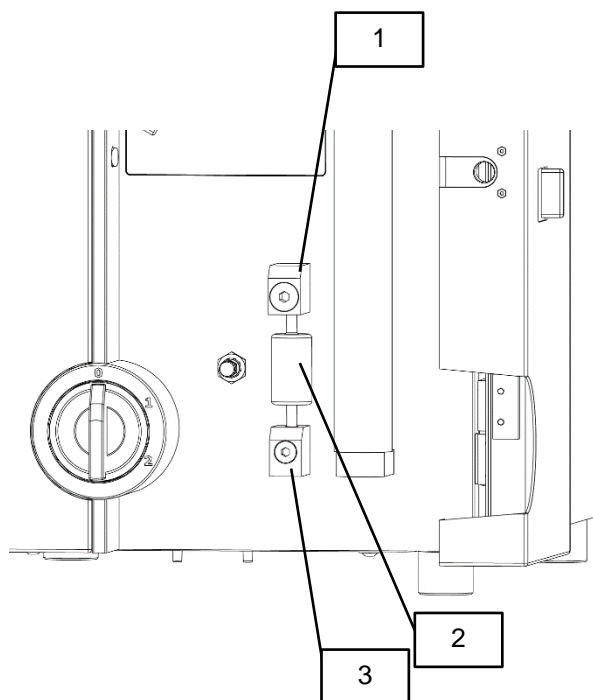



Fig. 43: Dust filter cartridge on the front of the HTFr

Replace the dust filter cartridge as follows:

1. Turn the analyzer to Position 0 on the main switch or switch to induction furnace mode in the ELEMENTS software.
The analyzer in the analyzer must not generate any vacuum in the HTFr.
2. Open the machine door at the front of the HTFr (see Pos. 11 in "[Front](#)").
3. Press the dust filter cartridge (2) upwards against the top support (1).
4. Swivel the bottom end of the dust filter cartridge (2) forwards and pull the dust filter cartridge (2) out from below.
5. Press the new filter cartridge (2) upwards at an angle into the top support (1).

	The diameter of the cartridge body is smaller at the top than at the bottom.
---	--

6. Place the dust filter cartridge (2) in a vertical position above the bottom support (3) and press it down into the bottom support. The dust filter cartridge has been replaced.
7. Close the machine door.
8. Turn the analyzer to the desired setting.
9. Wait until the HTFr is operational.
The dust filter cartridge has been replaced.

10.2.6 Replacing the O-rings on the HTFr

The O-rings on the HTFr are on the anhydron and on the combustion tube. Each have two O-rings which must always be replaced together.

10.2.6.1 Replacing the O-rings on the moisture filter

The O-rings on the anhydron are at the top and bottom end of the reagent tube. The condition of the O-rings should always be checked when changing the filling. The O-rings should be replaced if they have taken on a greyish colour or are brittle.

Replace the O-rings on the anhydron as follows:

1. Turn the analyzer to Position 0 on the main switch or switch to the induction furnace mode in the ELEMENTS software.

The analyzer in the analyzer must not generate any vacuum in the HTFr.

2. Open the machine door (1) at the front of the HTFr.

The anhydron (3) is accessible:

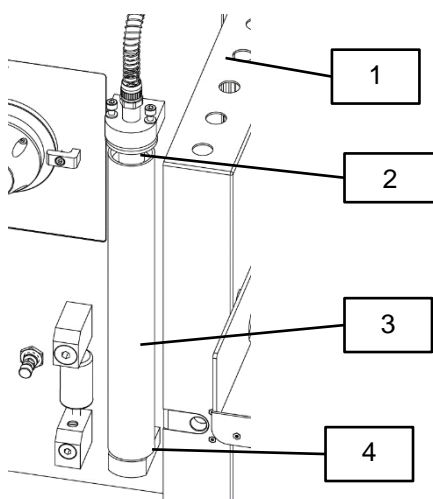


Fig. 44: O-rings on the anhydron on the front of the HTFr with the machine door open

3. Remove the anhydron, see "[Replacing the anhydron](#)".
The O-rings are now accessible.
4. Remove the top O-ring (2) and insert a new O-ring (Part No. 70320).
5. Remove the bottom O-ring (4) and insert a new O-ring (Part No. 70320).
6. Grease the bottom O-ring (4) with high vacuum silicon grease (Part No. 92610).



The top O-ring (2) must remain free from grease because it may otherwise become stuck to the holding mechanism or the glass.

7. Insert the anhydron again, see "[Replacing the anhydron](#)".
8. Close the machine door.
9. Turn the analyzer to the desired setting.
10. Wait until the HTFr is operational.
The O-rings on the anhydron have been replaced.

10.2.6.2 Replacing the O-rings on the combustion tube

⚠ CAUTION

C38.0076

Risk of burns

Hot machine parts

- Some parts of the machine can get very hot and cause burns when touched without wearing protective gloves.
- **Wear heat-resistant protective gloves when working with hot machine parts.**
- **Never touch hot parts of the machine without suitable protective gloves.**



The O-rings are at the front and back end of the combustion tube. The O-rings should always be replaced with the combustion tube.



The O-rings on the combustion tube of the HTFr must not be greased.

Replace the O-rings on the combustion tube as follows:

1. Turn the analyzer to Position 0 on the main switch or switch to the induction furnace mode in the ELEMENTS software
The analyzer in the analyzer must not generate any vacuum in the HTFr.
2. Turn the HTFr to Position 0 on the main switch and pull out the power plug.
3. Wait until the machine has cooled down sufficiently.
4. Open the machine door (1) at the front of the HTFr.
5. Remove the furnace locking device, see "[Removing the combustion tube](#)".

The O-ring at the front is now accessible:

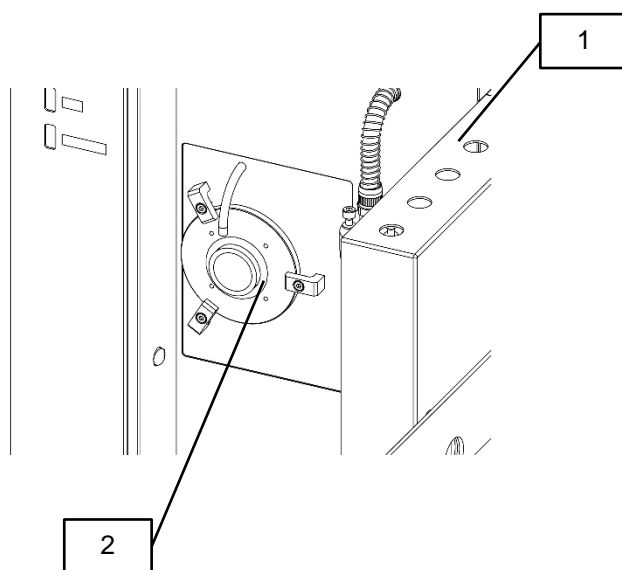


Fig. 45: O-ring behind the furnace locking device

6. Pull off the O-ring (2) and put a new one on (Part No. 70380).
The O-ring should be at a distance of approx. 2 cm from the end of the tube.
7. Remove the dust box at the back of the HTFr, see "[Removing the dust box](#)".

The O-ring at the back is now accessible:

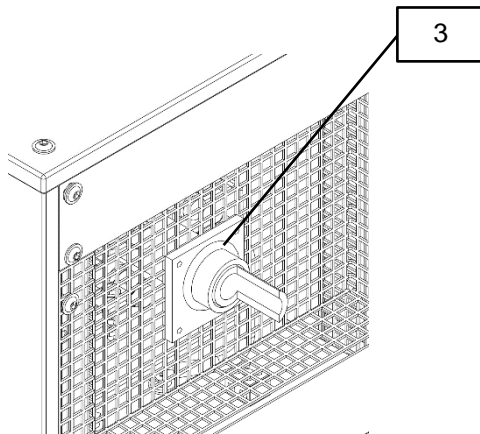


Fig. 46: O-ring at the back of the combustion tube

8. Pull off the O-ring (3) and put a new one on (Part No. 70380).
The O-ring should be at a distance of approx. 2 cm from the end of the tube.
9. Install the dust box again, see "[Installing the dust box](#)".
10. Put the furnace locking device back on, see "[Inserting the combustion tube](#)".
The O-rings have been replaced.

11 Spare parts

11.1 Spare parts for the analyzer

11.1.1 Front of the machine

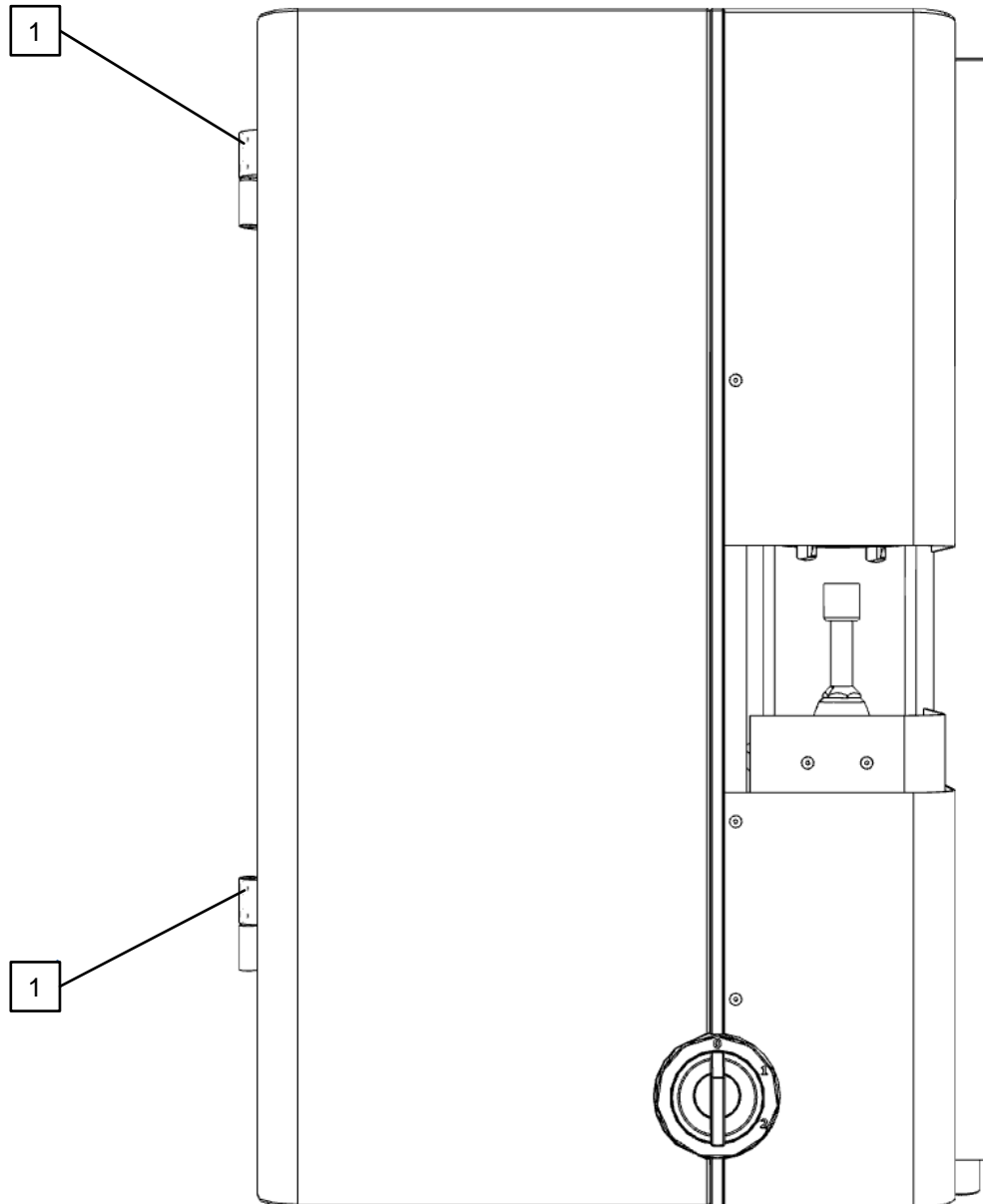


Fig. 47: Diagram of the front when closed

Position	Designation	Part No.	Quantity
1	Hinge with eccentric pin	88400-0288	2

11.1.2 Front (interior view)

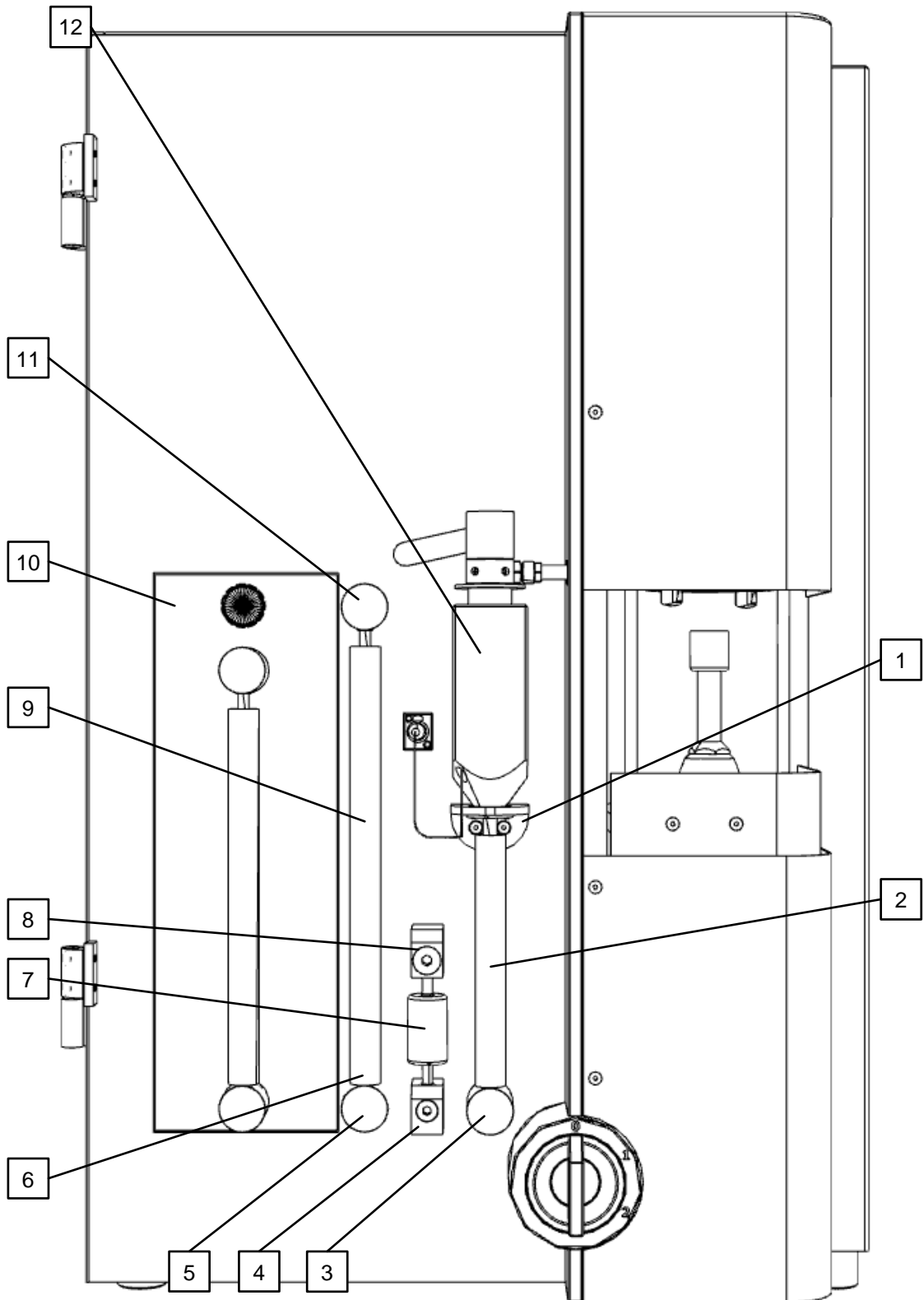


Fig. 48: Diagram of the front inside

Position	Designation	Part No.	Quantity
1	Filter connection holder, assembled	51100-2013	1
2	Reagent tube	88400-0005	1
3	Reagent tube holder 28.5 mm	51100-2017	1
4	Bottom filter holder	35361	1
5	Bottom reagent tube holder, moisture trap	11045	1
6	O-ring 9x3	70230	6
7	Dust filter cartridge	11170	1
8	Top filter holder	35363	1
9	Reagent tube	88400-0006	2
10	Complete catalyst furnace	20100-2003	1
11	Top reagent tube holder, moisture trap	11042	1
12	Complete dust filter housing with heating element	51100-2035	1

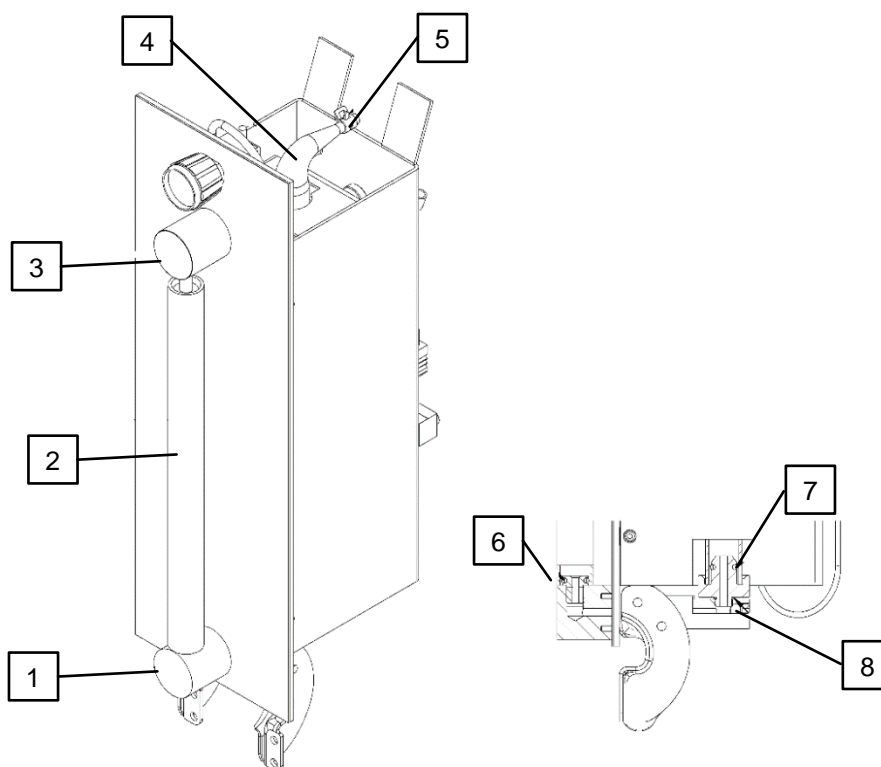
11.1.2.1 Catalyst furnace

Fig. 49: Catalyst furnace 20100-2003

Position	Designation	Part No.	Quantity
1	Bottom reagent tube holder, catalyst furnace	20100-2004	1
2	Quartz tube	88400-0422	1
3	Top reagent tube holder, catalyst furnace	20100-2005	1
4	Reagent tube 240x20/16.4	88400-0452	1
5	Hose clip/clamp	66500-0084	1
6, 7	O-ring 9x3	70230	2
8	O-ring 8x1.5 for 20100-2003, catalyst furnace	70180	1

11.1.2.2 Complete dust filter housing with heating element

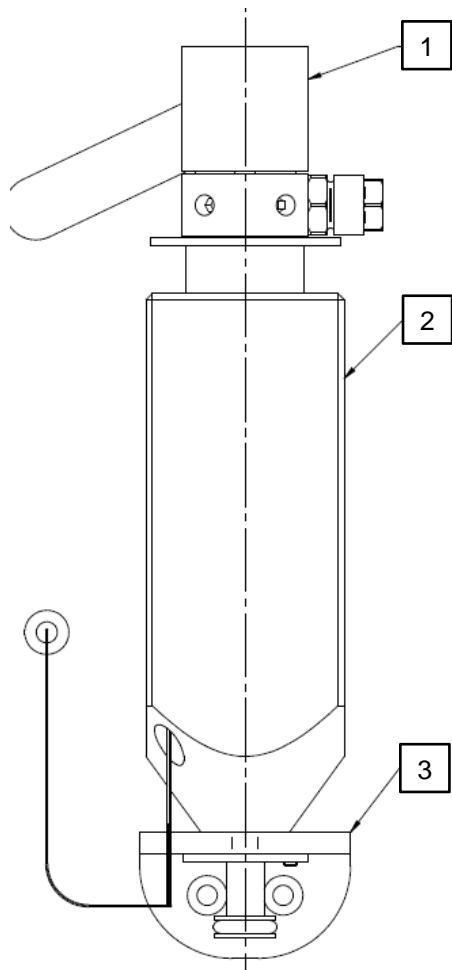
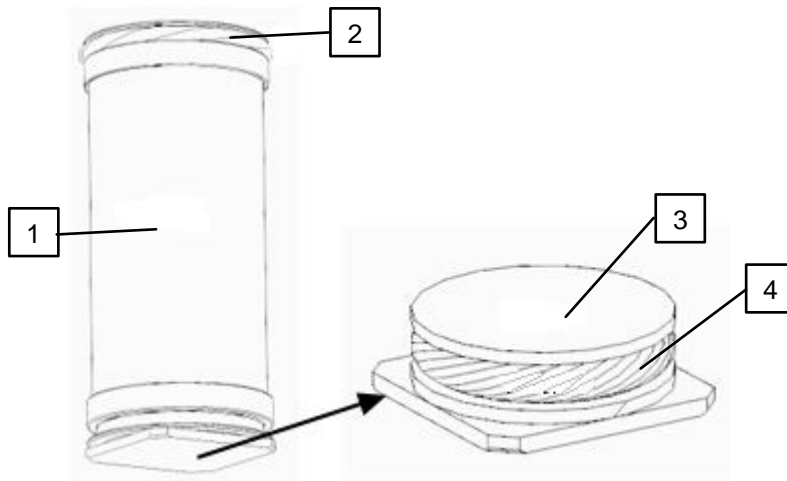


Fig. 50: Complete dust filter housing 51100-2035

Position	Designation	Part No.	Quantity
1	Dust box mechanism	51100-2019	1
2	Complete dust filter housing with heating element	51100-2035	1
3	Filter connection holder	51100-2013	1

11.1.2.3 Complete dust filter**Fig. 51:** Dust filter 11107

Position	Designation	Part No.	Quantity
-	Complete dust filter	11107	1
1	Metal filter	11105	1
2	O-ring 34x3	70370	1
3	Filter lock	11093	1
4	O-ring 20x5	70320	1

11.1.3 Furnace

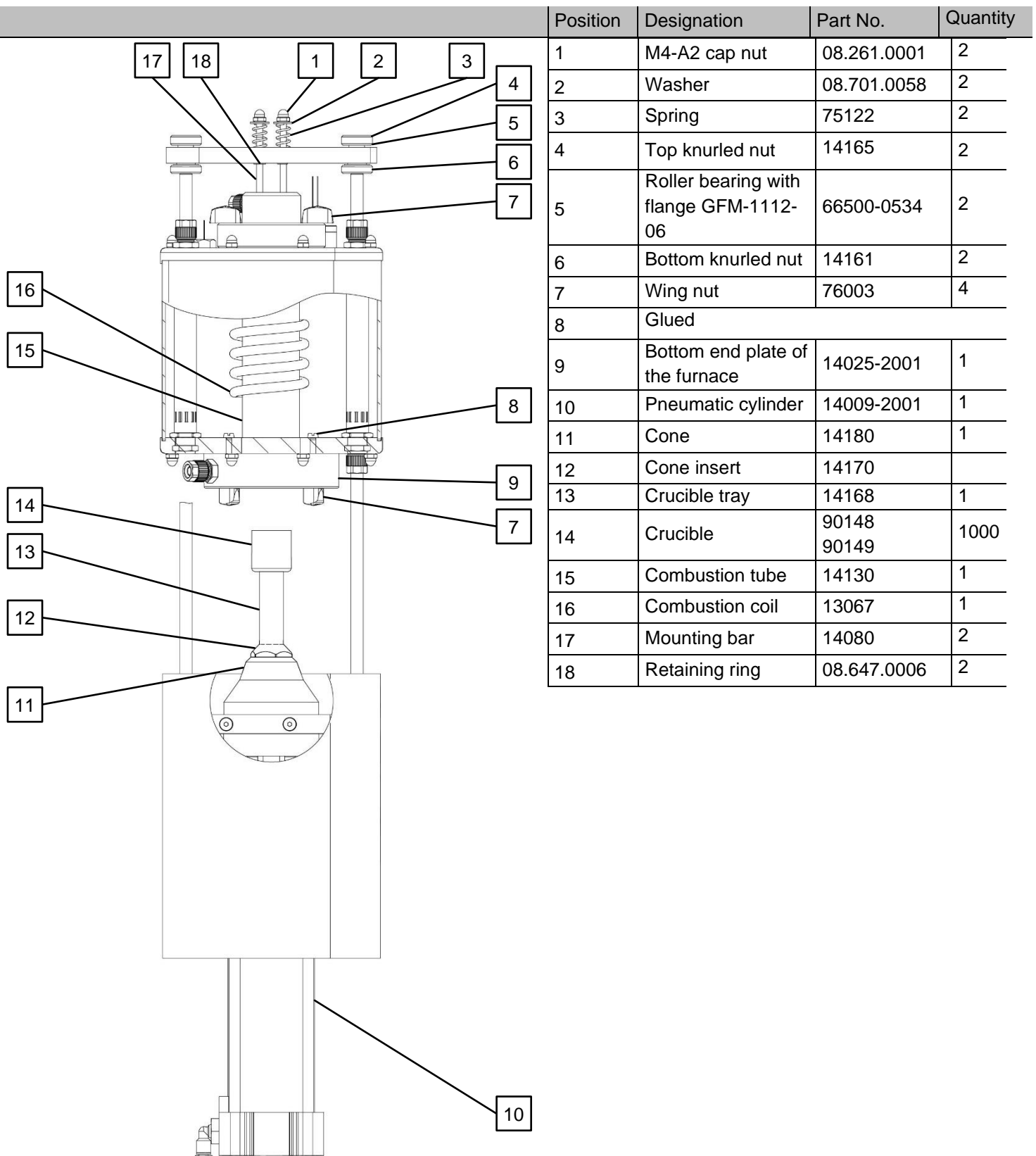
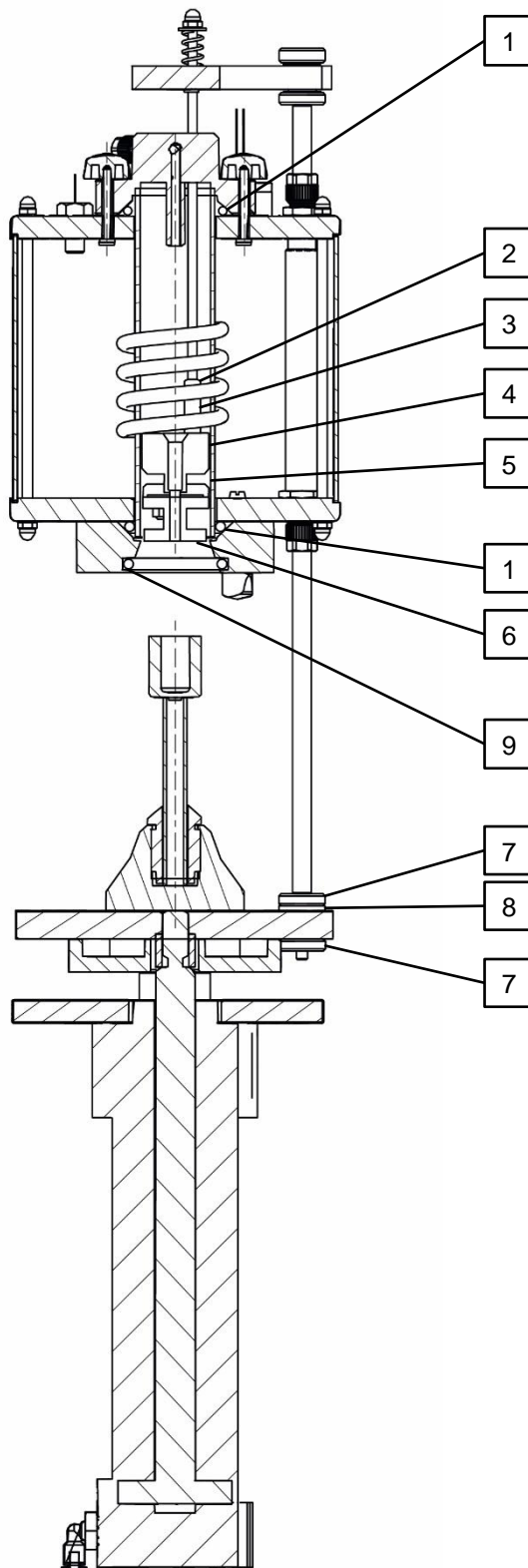


Fig. 52: Furnace, front view 1



Pos.	Designation	Part No.	Quantity
1	O-ring 35x5	70380	2
2	O-ring 3.4x1.9	70120	2
3	M4 spacer sleeve	75150	2
4	Brush holder	14051	1
5	Cleaning brush	14045	1
6	Heat protection, ceramic	14072	1
7	Bottom knurled nut	14161	4
8	Disc	08.701.0076	4
9	O-ring 35x5	70390	1

Fig. 53: Furnace, front view 2

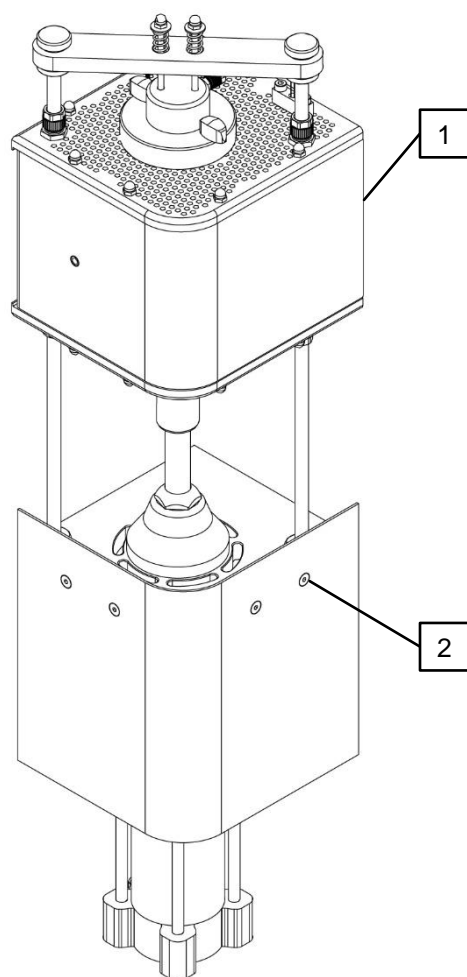
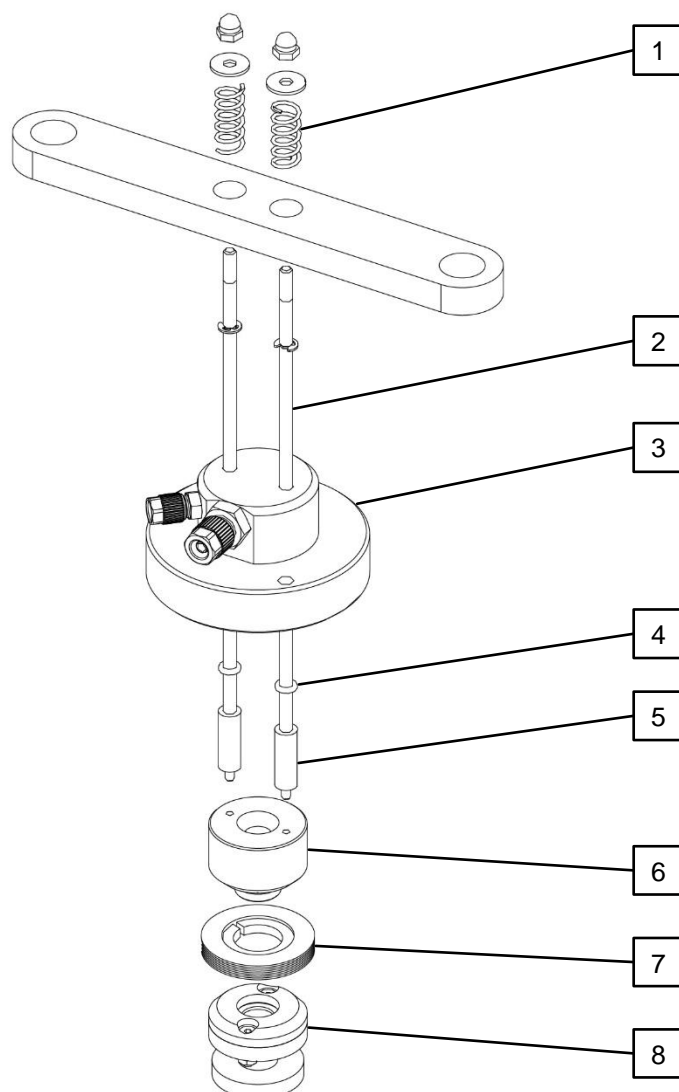


Fig. 54: Furnace, front view 3

Position	Designation	Part No.	Quantity
1	Furnace cover	51100-2045	1
2	M4x10 countersunk screw	08.643.0055	4

11.1.4 Furnace cleaning mechanism

Fig. 55: Furnace cleaning mechanism

Position	Designation	Part No.	Quantity
1	Spring	75122	2
2	Mounting bar	14080	2
3	Complete top furnace locking device	14021	1
4	O-ring 3.4x1.9	70120	2
5	Spacer sleeve	75150	2
6	Brush holder	14051	1
7	Combustion tube cleaning brush	14045	1
8	Complete ceramic thermal shield for the brush	14072	1
	Complete furnace cleaning mechanism	51100-2004	1

11.1.5 Back of the machine

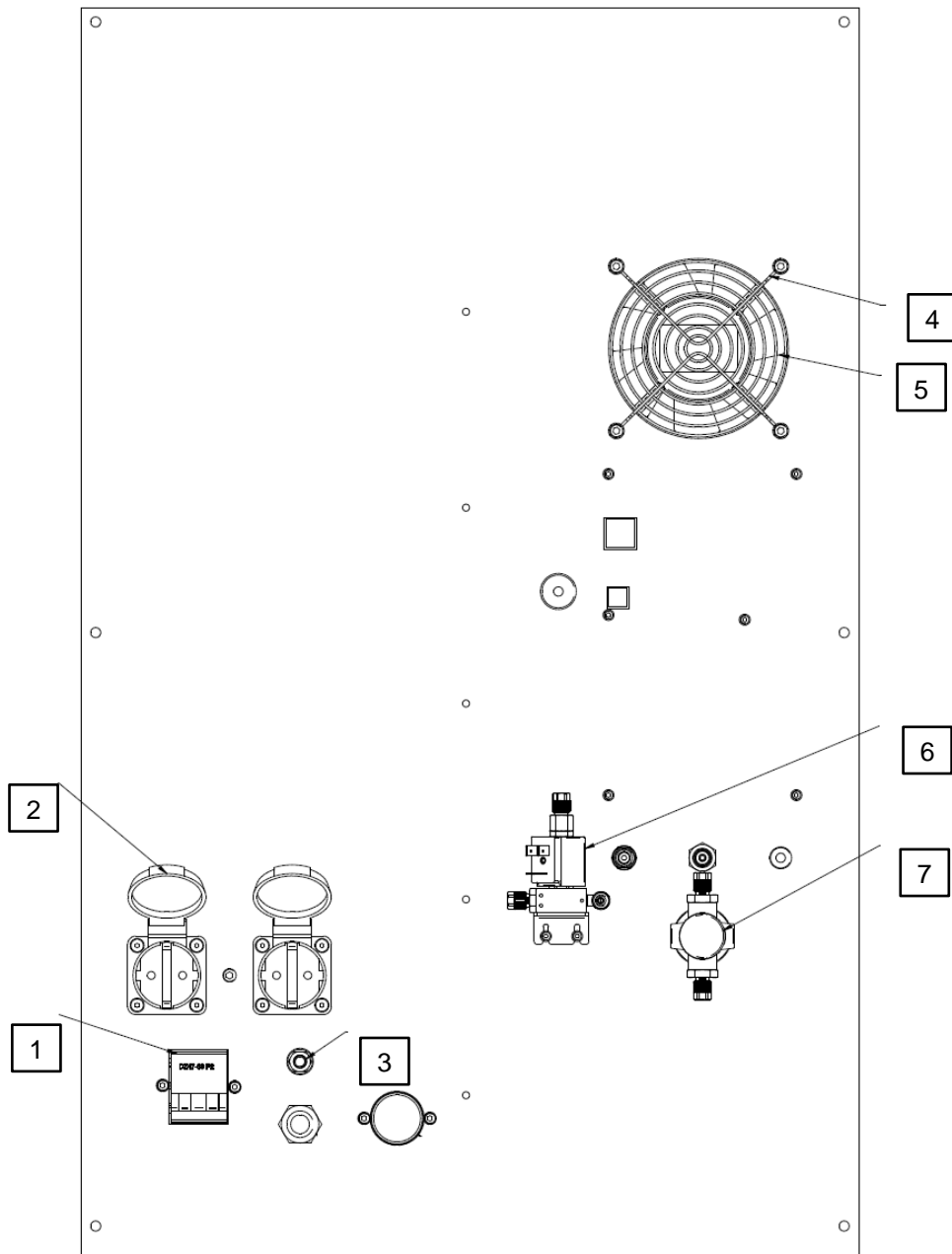


Fig. 56: Back

Position	Designation	Part No.	Quantity
1	2P 16 AC circuit breaker	66400-0385	1
2	SCHUKO socket	88400-0413	2
3	250V / 16A mains filter	77140	1
4	Fan guard 120x120	88400-0155	1
5	24V fan	66400-0304	1
6	Gas valve	51100-2031	1
7	O ₂ pressure regulator	11492	1

11.1.6 Left-hand side of the machine

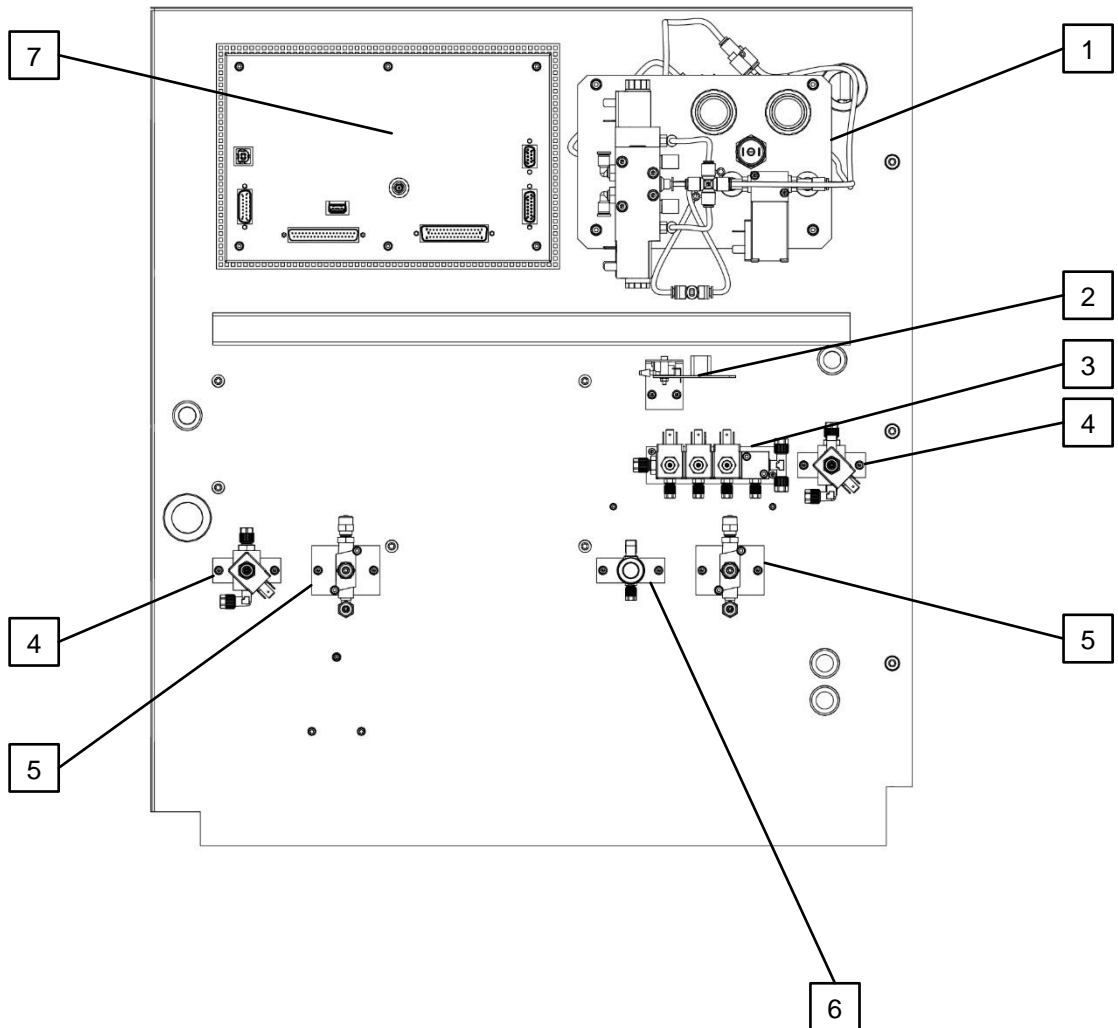


Fig. 57: Left-hand side

Position	Designation	Part No.	Quantity
1	Complete compressed air control system	27000-2024	1
2	PCB pressure sensor	27000-5004	
3	Valve block	51100-2030	1
4	Complete gas valve	51100-2029	4
5	CS-i/d gas valve	51100-2041	2
6	Complete control valve	51100-2032	1
7	Uni 2.x with housing	11001-3003	1

11.1.6.1 Left side, Dev Gate

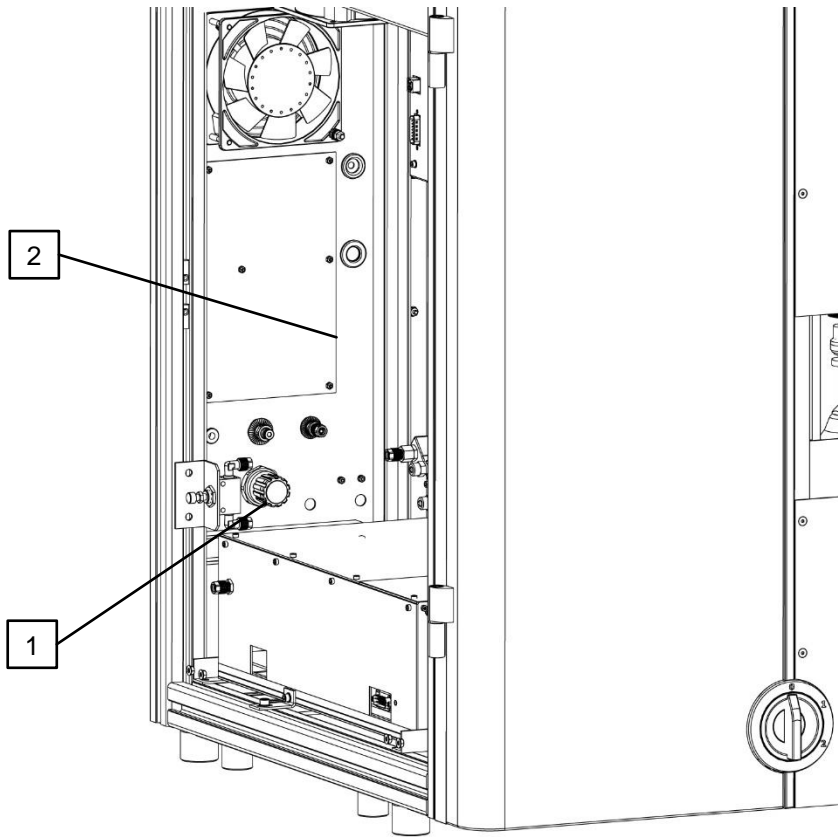
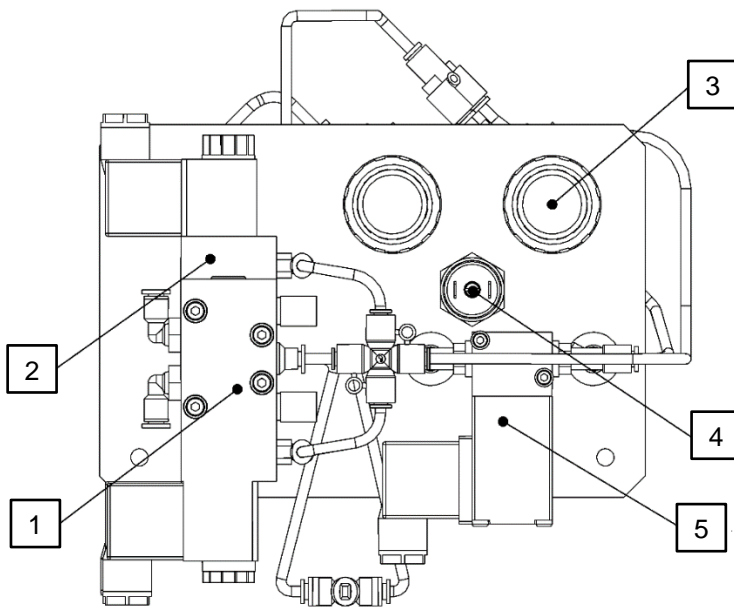


Fig. 58: DevGate

Position	Designation	Part No.	Quantity
1	Inlet pressure regulator	11492	1
2	PCB DevGate	88600-5000	1

11.1.6.2 Valve block, compressed air control system

**Fig. 59:** Valve block compressed air control system 27000-2024

	Designation	Part No.	Quantity
1	5/2 way valve	66200-0140	1
2	5/3 way valve	66200-0139	1
3	Pressure regulator	60236	2
4	Pushbutton switch	66300-0158	1
5	2/2 way valve	66200-0141	1


Attention!
Important information!

The information in the following section is purely informative and is not a call to action.

All work on the components described must be performed by appropriately qualified service personnel. The voltage range is 10 kV.

A special tool (Part No.: 1101-2005) is required to discharge the oscillating circuit.


ELTRA Service must be contacted before opening the right-hand side of the machine to work on this side.

 **DANGER**

D7.0005

Risk to life caused by an electric shock
Exposed power contacts – high voltage

- An electric shock can cause serious injuries in the form of burns, cardiac arrhythmia, respiratory failure or cardiac arrest.
- **Set the mains switch on the analyzer to position 0 and unplug the mains plug from the socket.**




11.1.7 Top mounting plate

⚠
DANGER

D8.0005

Risk to life caused by an electric shock
Exposed power contacts – high voltage

- An electric shock can cause serious injuries in the form of burns, cardiac arrhythmia, respiratory failure or cardiac arrest.
- Set the mains switch on the analyzer to position 0 and unplug the mains plug from the socket.**



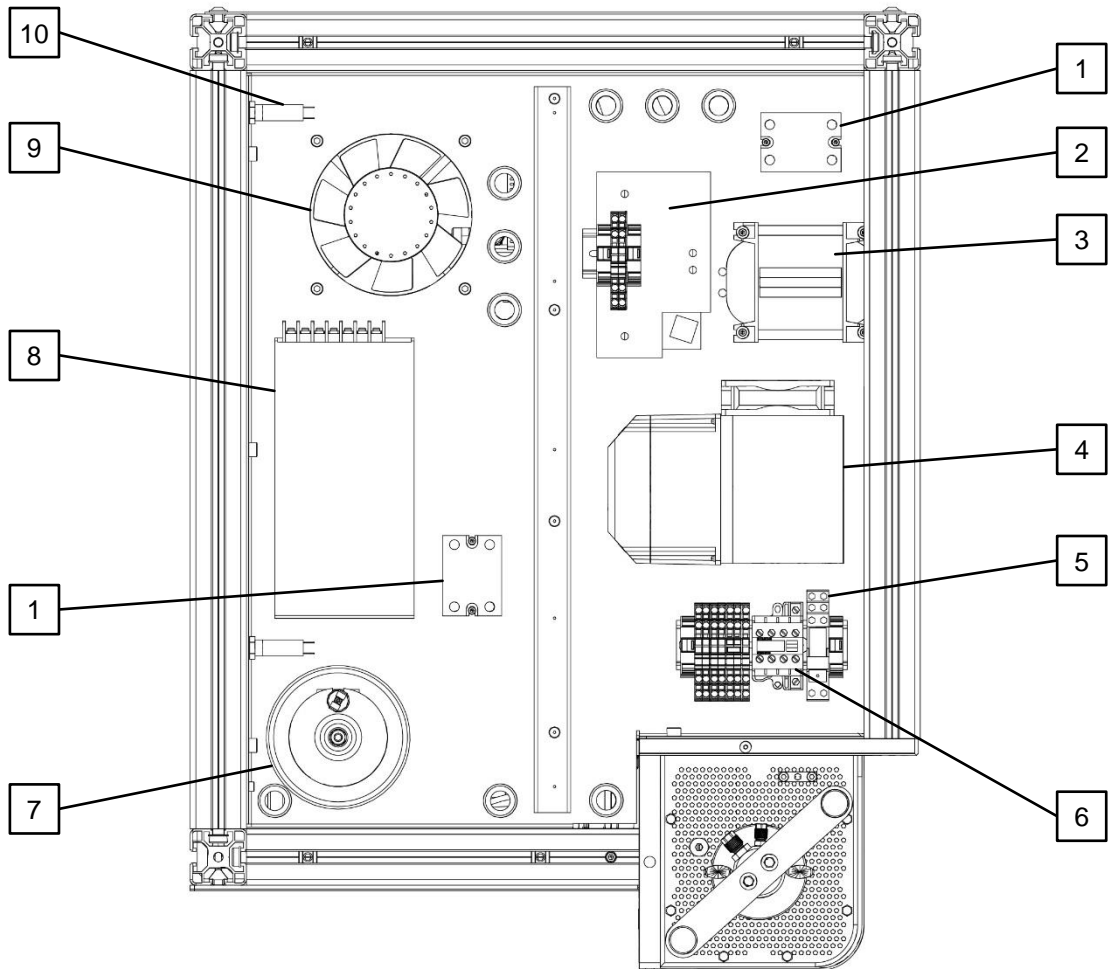


Fig. 60: Top mounting plate

Position	Designation	Part No.	Quantity
1	40A solid state relay	77052	2
2	PCB guard plate	27000-3103	1
3	Transformer	12045	1
4	Maxthermo Power Controller	88400-0394	1
5	Coupling relay 2 changeover 8A. 24VDC	66400-0450	1
6	24VDC 4 NO mini contactor	66300-0428	1
7	Toroidal transformer catalyst furnace	66400-0061	1
8	Power supply unit	88400-0395	1
9	Fan, furnace cooling, 24V	66400-0304	1
10	Fuse holder	88400-0268	2

11.2 Spare parts for the HTFr

11.2.1 Front of the machine

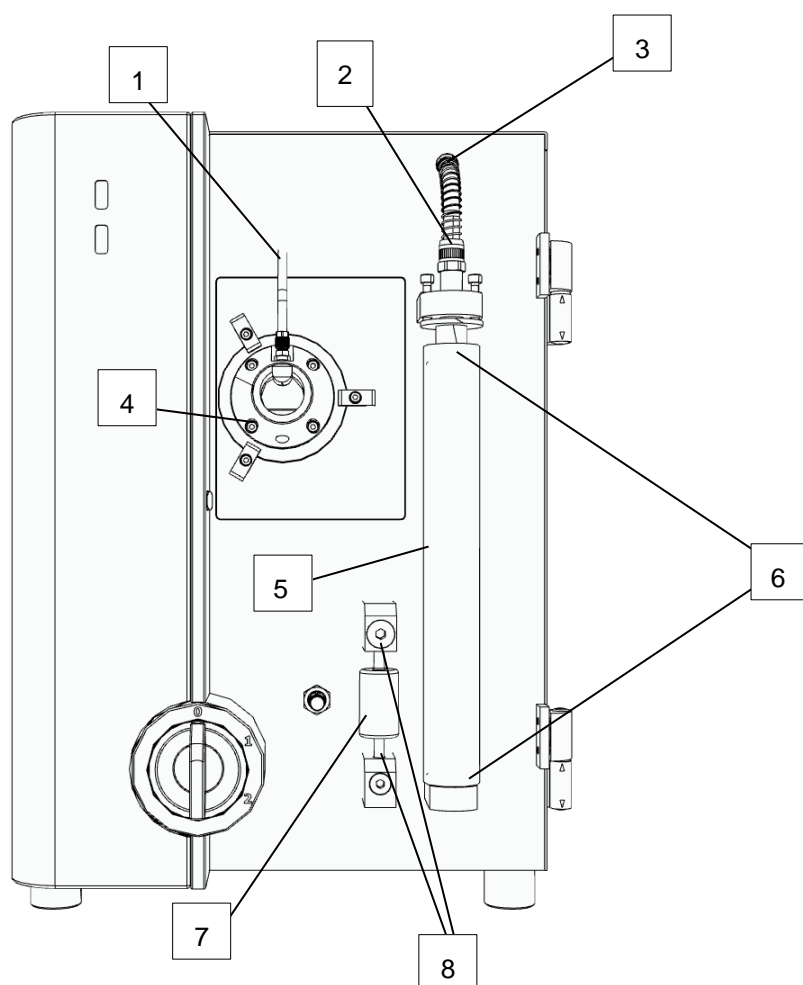


Fig. 61: Front of the machine

Position	Designation	Part No.	Quantity
1	Viton hose 4x1	73030	0,5m
2	Cap nut with coil	66200-0048	1
3	PTFE hose furnace	36720-2001	1
4	M4x20 cylinder head screw	089330034	4
5	Reagent tube	09090	1
6	O-ring	70320	2
7	Filter cartridge	11170	1
8	O-ring	70150	2

11.2.2 Right-hand side of the machine

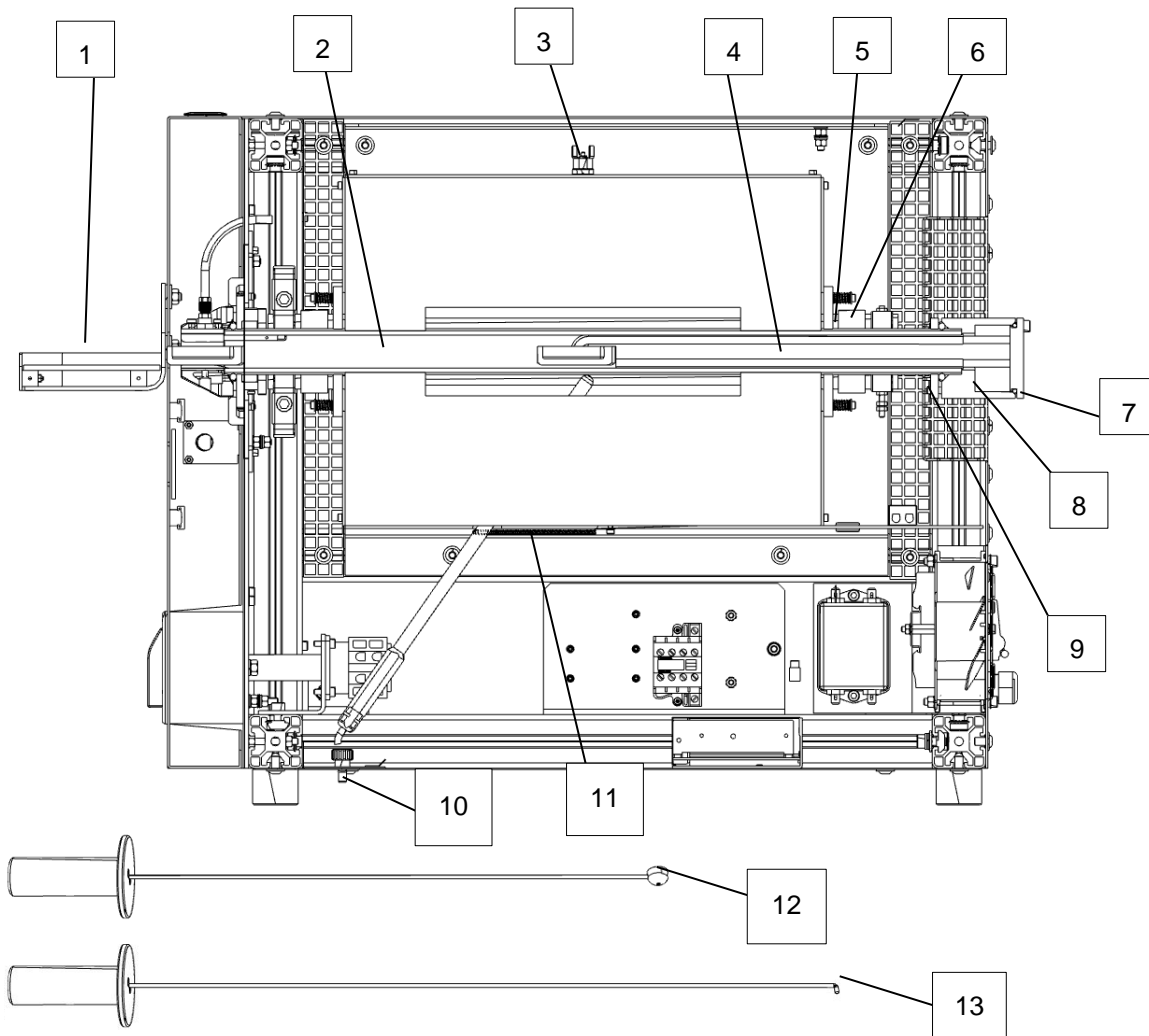
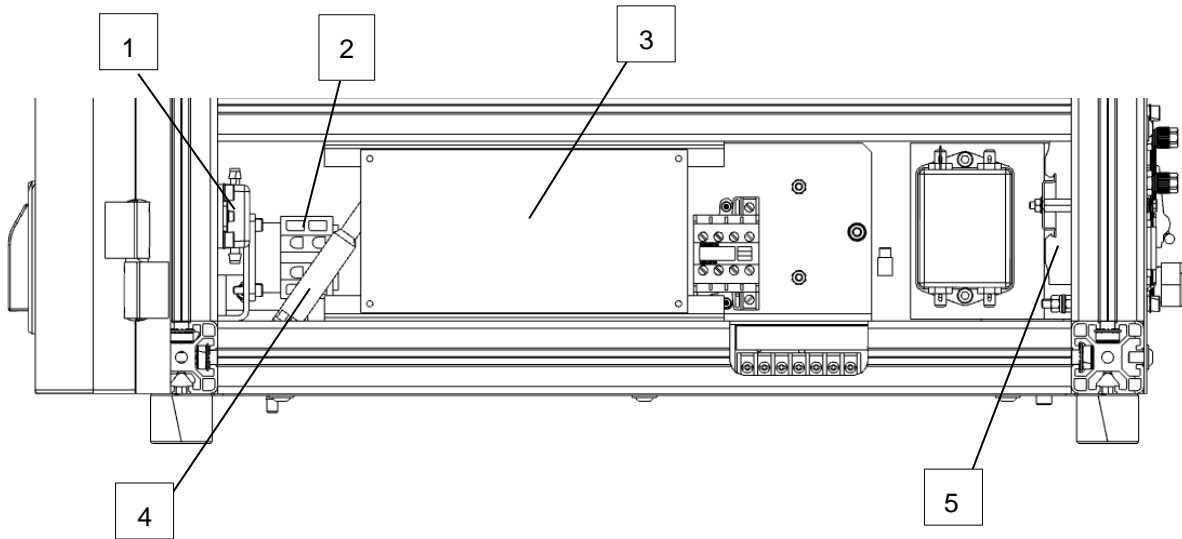


Fig. 62: Right-hand side of the machine

Position	Designation	Part No.	Quantity
1	Ceramic plate	36000-3014	1
2	Combustion tube	90162	1
3	Temperature switch	66300-0465	1
4	Mechanical stop on the dish	36101	1
5	Heating element set (4 units with bonding)	36000-8000	1
6	Ceramic spacer	77505	4
7	Complete dust box	36620-2001	1
8	O-ring	70380	2
9	O-ring	70410	1
10	Knurled screw	66100-0329	2
11	Spring	36665	1
12	Rod for inserting the combustion dishes	36216-2001	1
13	Rod for pulling out the combustion dishes	36218-2001	1

**Fig. 63:** Right-hand side of the machine, bottom section

Position	Designation	Part No.	Quantity
1	Gas flow sensor	66036-2010	1
2	Main switch	66400-0479	1
3	HTFChild motherboard	36000-5000	1
4	Thermocouple	36914-3001	1
5	Fan	66036-2011	1

11.3 Gas purification furnace, optional

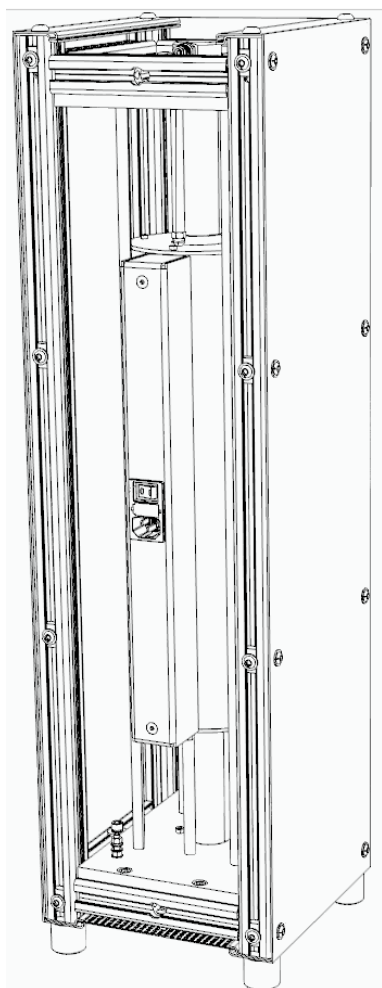


Fig. 64: Complete gas purification furnace

Part No.	Designation	Quantity
21000-1001	Complete gas purification furnace	1
21120	Quartz tube	1
70380	O-ring 35x5	2
88400-0122	Filling for the gas purification furnace (CS)	1

11.4 Fuses

Part No.	Designation	Quantity
66300-0369	Safety fuse 6.3A for 27000-5000 DevGate board and 27000-5001 PCB furnace power control	2
66300-0410	Safety fuse 3.15A for the top mounting plate	1

11.5 Consumables

Part No.	Designation	Quantity
90148 90149	Crucible	1000 Stk.
90200	Anhydron	454g
90210	Sodium hydroxide	500g
88400-0535	Pt/Si	15g
90330	Quartz wool	50g
90332	Glass wool	50g

12 Decommissioning

The machine is decommissioned as follows:

1. If necessary, remove crucibles and boats from the analyzer and HTFr.
2. Ensure that the machine has been switched off and has cooled down.
3. Unplug the analyzer and the HTFr.
4. Ensure that the gas supply for the carrier gas has been turned off.
5. Dismantle the gas hoses from the analyzer to the operating company's gas connection and from the analyzer to the HTFr.
6. Dismantle the exhaust hose from the analyzer to the ventilation system.
7. Dismantle the gas hoses from the HTFr to the analyzer.
8. Remove the reagent tube and the tube from the catalyst furnace on the analyzer, see ["Filling the reagent tube"](#).
9. Mechanically remove the consumed chemicals and dispose of them in accordance with local regulations.
10. Check the reagent tube for damage.
In the event of damage such as cracks or recrystallisation, dispose of the reagent tube in accordance with local regulations because proper use is no longer possible.
11. Insert the empty reagent tube.
This ensures that the reagent tube is not damaged when not in use.
2. Empty the anhydron in the HTFr and insert the empty reagent tube (see ["Replacing the anhydron"](#)).
This ensures that the reagent tube is not damaged when not in use.
The machine has been decommissioned.

13 Storage

The following storage conditions apply to storage of the ELEMENTRAC CS-d:

- Indoor area
- Ambient temperature between +5 and +35 °C
- Ambient humidity <80 % at +31 °C, non-condensing

Store the machine as follows:

1. Decommission the machine, see ["Decommissioning"](#).
2. Store the machine under the specified storage conditions.
The machine has been stored.

14 Disposal

Applicable statutory regulations must be heeded during disposal. Information about the disposal of electrical and electronic machinery in the European Community is set out below.

The disposal of electrically operated equipment is governed within the European Community by national regulations based on EU directive 2012/19/EU for waste electrical and electronic equipment (the WEEE Directive).

According to this, no machinery delivered after 13th August 2005 in the B2B area (which applies to this product) may be disposed of with the municipal or domestic waste. The machines have a disposal label to indicate this.

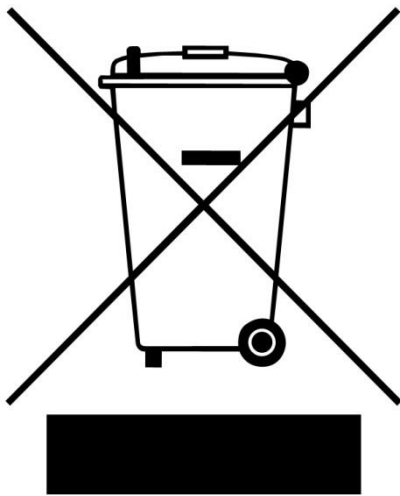


Fig. 65: Disposal label

Since the disposal regulations may differ from country to country throughout the world and within the EU, you should contact the supplier of the machine directly where necessary.

In Germany this labelling duty has applied since 23rd March 2006. As from this date, the manufacturer is required to provide a suitable option for returning any machines delivered as from 13th August 2005. The end user is responsible for correctly disposing of machines delivered before 13th August 2005.

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