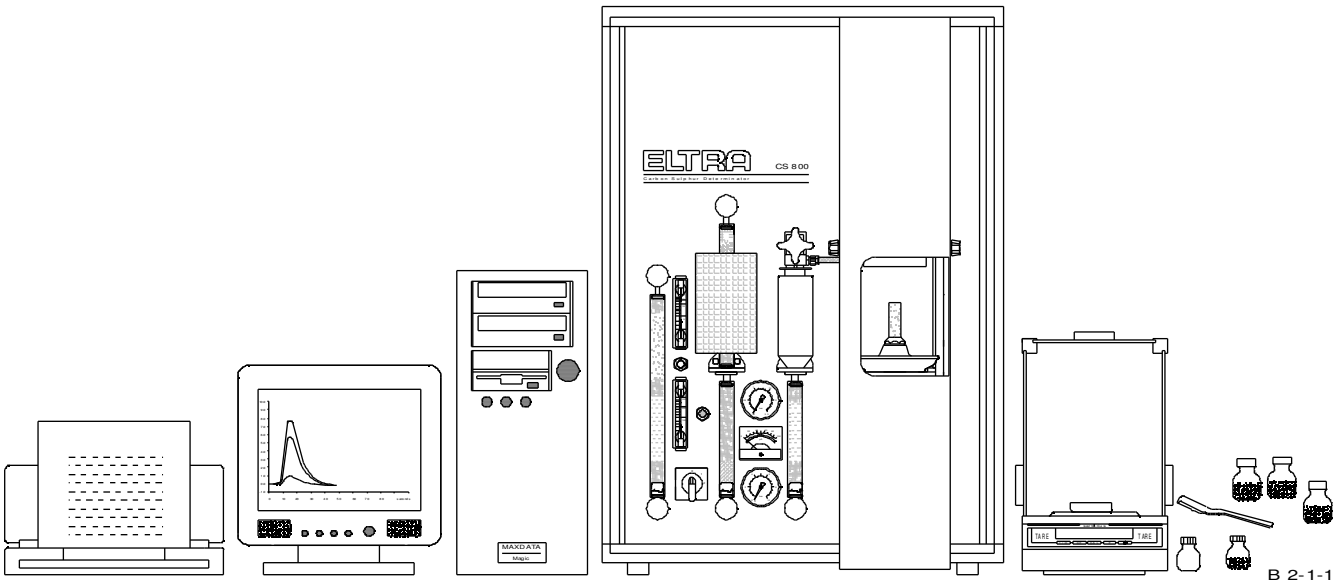
OPERATION MANUAL CS-800
as from serial no. 1557040811

1 INSTALLATION

1.1 Setting up

Since the analyser weighs about **85 kg** it should be placed on a suitably stable surface. The balance should also be placed free of vibration. The balance can be placed in any position, although positioning it to the right of the analyser has proved to be best suited. The balance can of course also be placed on a weighing table next to the analyser. There are no special requirements for setting up the printer and computer; they can be placed on a normal desk.

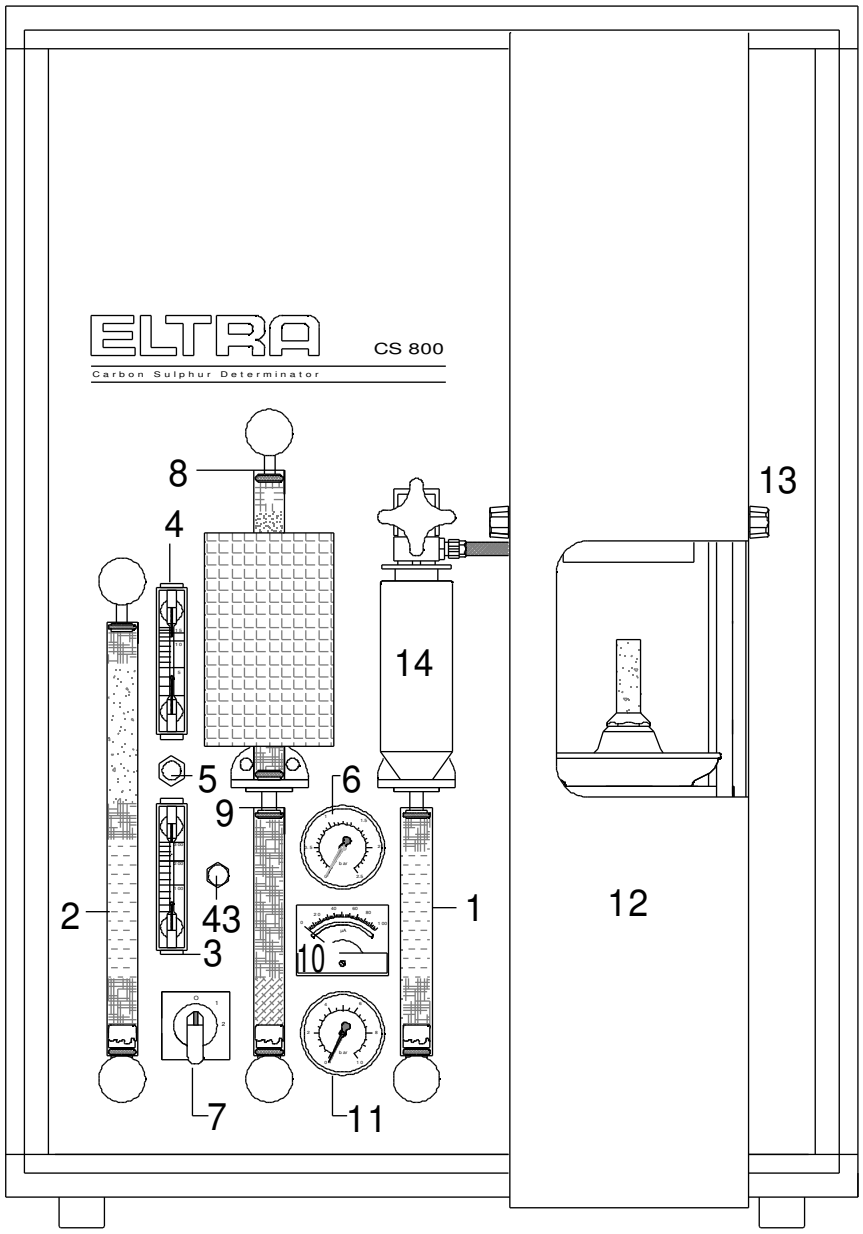
Below is an example of installation:



Although the analyser's operating environment does not necessarily need to be air conditioned, it is advisable to keep the room temperature between **18°C** and **30°C**.

Under no conditions should the device be placed in direct sunlight !
Avoid places exposed to the wind of air conditioners or to the wind blowing through open windows or doors.

1.2 Front panel illustration

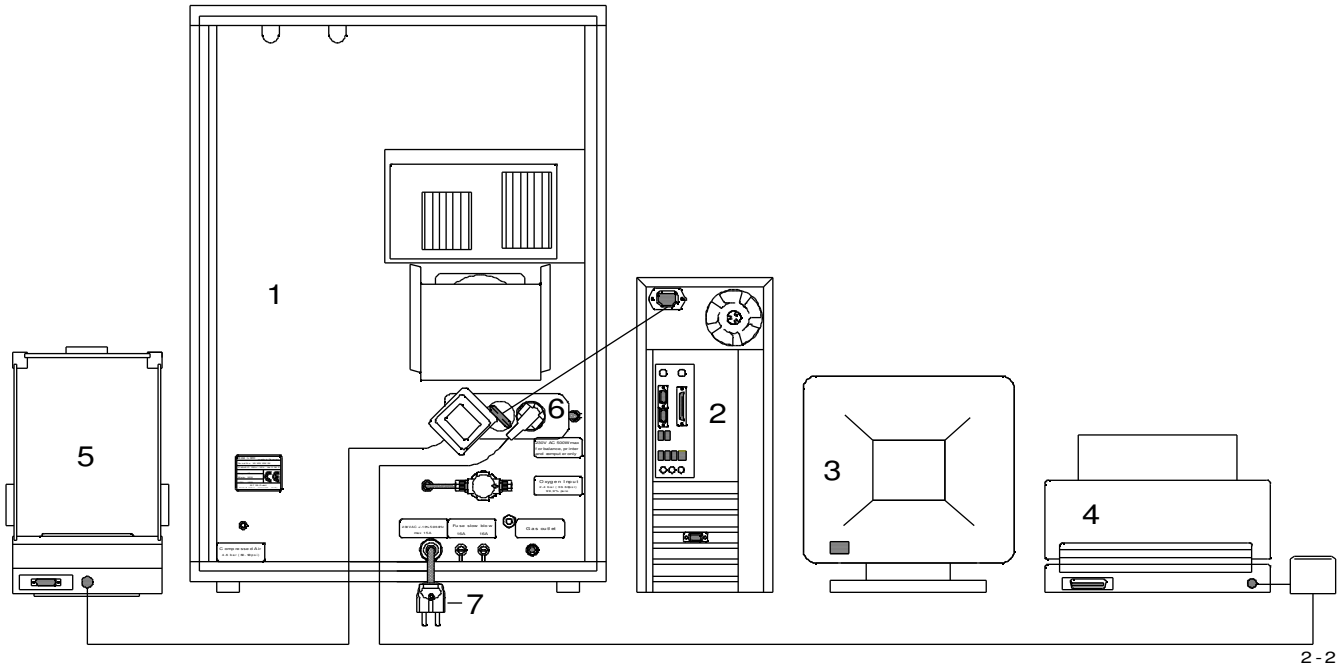


1. H_2O – trap
2. CO_2 / H_2O – trap
3. Carrier gas flow
4. Infrared cell purge 10 l/h
5. Regulator for indicator 4
6. Oxygen pressure gauge (norm. 1,5 bar)
7. Mains power switch
8. Catalyst furnace
9. SO_3 - trap
10. Gas flow valve indicator (norm. 30-70 µA)
11. Compressed air gauge (norm. 5 bar)
12. Furnace cover
13. Cover attachment knobs
14. Dust filter
43. Button for leakage test

1.3 Mains power connection

Since the infrared cell requires about **1 hour** to reach a stable operating temperature, it is advisable to connect the analyser to the **mains power** first and then switch on before further installation work is carried out.

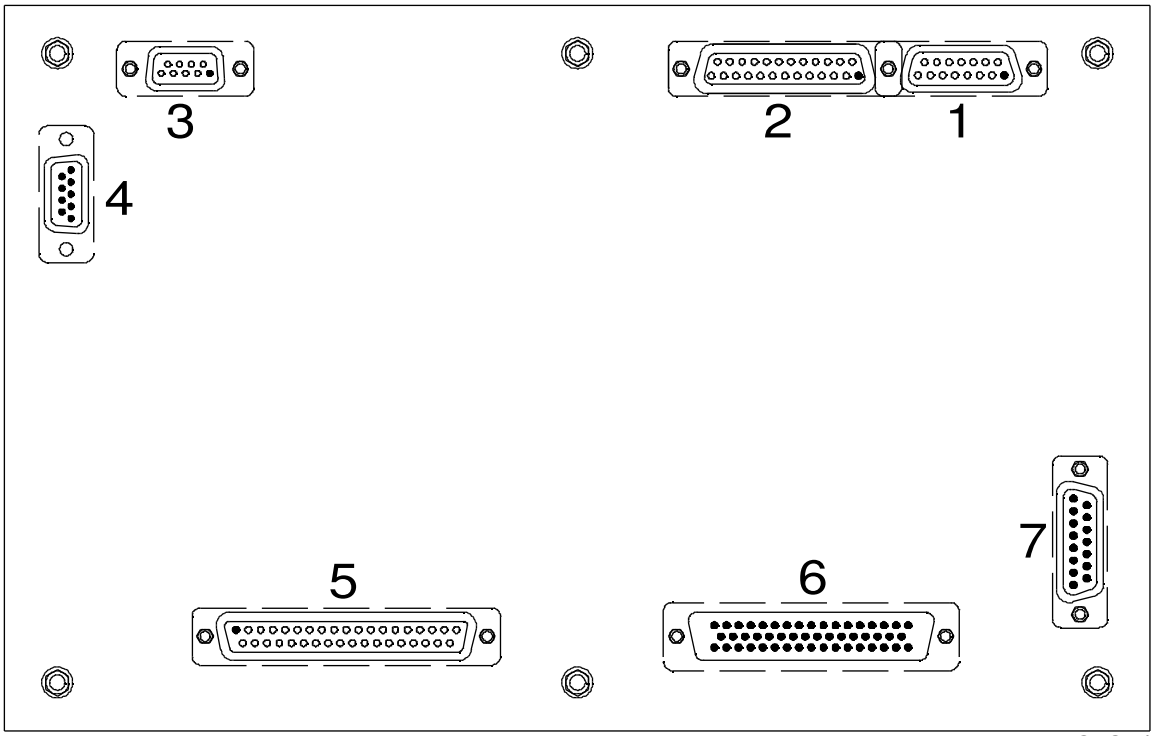
This waiting time is only necessary when **installing** the analyser. Since it is normally not switched off, it will always be in operating temperature.



1 Analyser
2 Computer
3 Monitor
4 Printer
5 Balance
6 Triple plug
7 Analyser mains plug

First connect the analyser to the mains power and switch it on. The switch, located on the fore side of the analyser, is to be set to **position 1.**

1.4 Data interfaces



2-3-1

Rear side of UNI 1.3 board:

1 Micro-controller programming lock (remove for programming)
2 Micro-controller programming connection (LPT-interface)
3 Balance connection (serial)
4 PC connection (serial interface (COM-port))
5 Analog input/output signals
6 Digital input/output signals
7 Autoloader connection

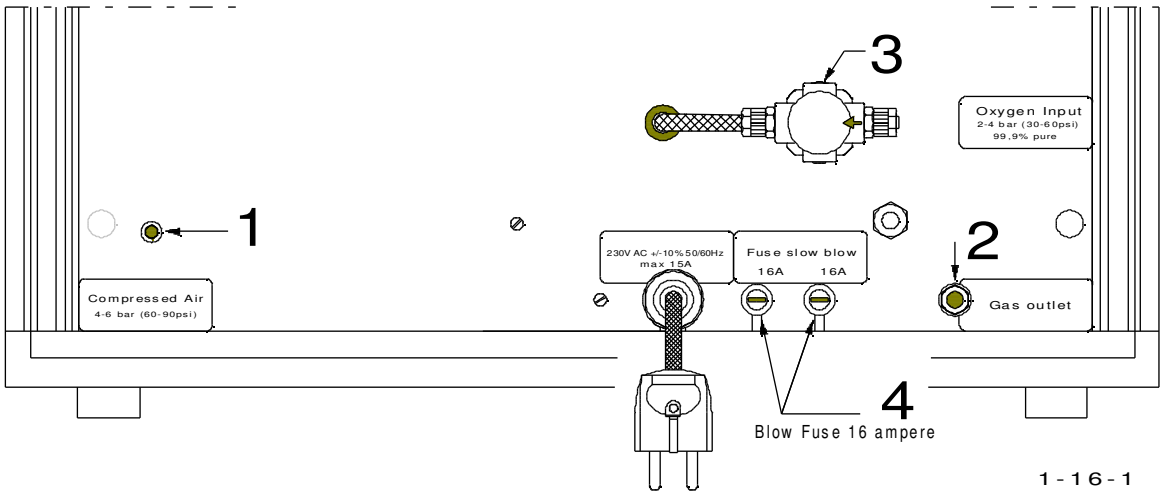
When all the units are connected to the mains power, then data connections can be made. The plugs are all different from each other, so that they cannot be interchanged. The required data cables are included if the additional units are supplied. These are adapted to the interfaces when the analysers are put into operation in our company.

As the **balance** transfers the weight to the analyser, its serial interface must be programmed.

The **computer** is already provided with an operating system and software for controlling the analyser.

NOTE: For all instructions on operating the PC software refer to the Help-function of the software.

1.5 Gas connections



1 Compressed air (4-6 bar)
2 Oxygen outlet
3 Oxygen inlet (2-4 bar)
4 Fuse 20 ampere

Two gas connections are necessary for the operation of analyser. The required tubes are included in delivery. See the diagram above.

Tube **(3)** for the **oxygen** supply is soft and transparent.
Tube **(1)** for the **compressed air** is harder and opaque.

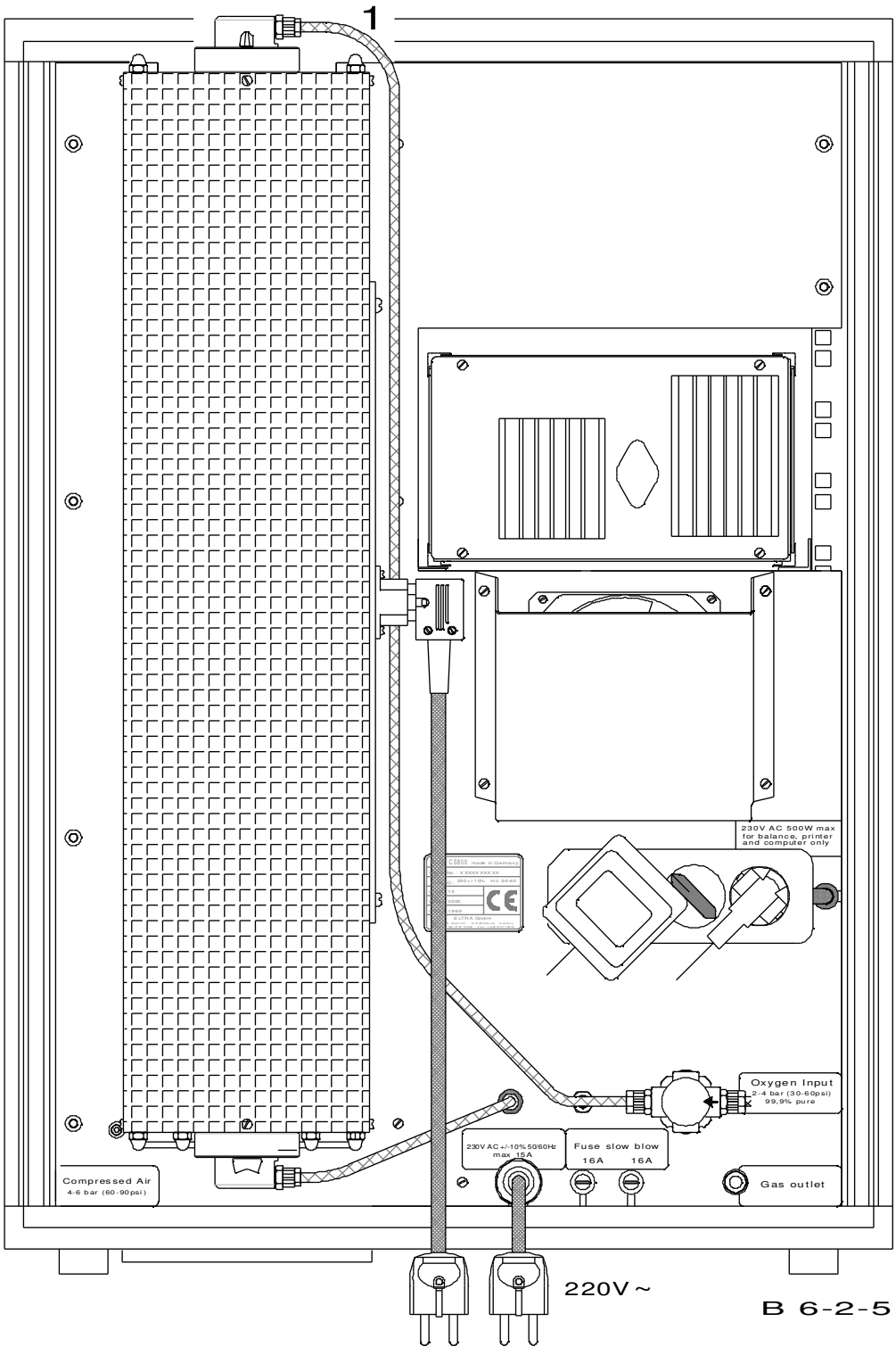
These are delivered already provided with screw fittings for pressure regulators. An inner thread as well as the corresponding **copper seals** are also provided.

Tube fitting **(3)** connects the analyser with an **oxygen bottle** via a pressure regulator. This connection must be very secure, since the operating pressure in the tube is **1.5 bar**. Gas connection **(1)** is for the compressed air supply to the **pneumatic furnace lock** and the internal cooling for the **induction coil**.

Gas connection **(2)** is for drawing off waste gas. It is generally not used, however, since only low quantities of **CO_2** and even lower quantities of **SO_2** result from the sample combustion.

When the analyser's mains switch is set to **position 2** a valve opens, and the oxygen can flow through the gas tubes. The flow rate is stabilised within a few seconds to **180 l/h** and can be read from the lower flow meter.

1.6 Connecting the gas purification furnace



The tube from the pressure regulator is connected to the lower fitting of the gas purification furnace, and the tube **(1)** is connected on its place. See the diagram above.

1.7 Auto loader

The **CS-800** can be supplied with an automatic sample loading system. This loading system may also be retrofitted at a later date. Unlike many other auto loaders the **ELTRA** system can accommodate 130 samples giving hours of unattended operation. On request, the loader can be delivered for more or less crucibles. The auto loader, which does not occupy any additional bench space, is mounted above the area where the balance, PC, monitor and consumables are normally situated. The crucibles positions in the loader are easily accessible to the operator even from sitting position. The operation of the **CS-800** with an auto loader, requires a PC for easy manipulation of sample weight storage and out of sequence samples.

For instructions on installing and operating the auto loader refer to **"Loader installation, service and operation manual"**.

2 ANALYSIS

2.1 Working procedure

CS-800 was primarily designed for the analysis of **steel** and other metals. However, a wide variety of materials such as **cement**, **coal**, **rubber**, **plastics**, **soil** samples etc. can be analysed. The sample weight, the accelerator and the sensitivity of the analyser are different, depending on how the respective material behaves during combustion.

The **analysis of steel** is described in the following section, as an example.

Ensure that the **compressed air** and **oxygen** supplies are turned on. They should normally not be turned off in any case. By turning the mains switch to **position 2** the heating for the generator tube and air cooling are switched on, as well as a valve which allows the **oxygen** to flow through the analyser. It is advisable to let the **oxygen** flow through the analyser for several minutes before beginning analysis, so that the temperature inside the analyser is stabilised. During brief work breaks, therefore, the **oxygen** is not turned off and the mains switch is left on **position 2**.
The proper chemicals should be used. See **3.3****.**
A crucible is placed on the balance and tared by pressing the **"tare"** key.

CAUTION:
The crucible must only be picked up with clean crucible tongs and **never** be handled with **fingers!**

1.5 g of tungsten are then weighed out and the balance is newly tared. Next, the sample is weighed out. A weight of about **500 mg** steel or cast iron is usual. Then the weight is transferred to the PC and can be seen on the screen.

NOTE: For all instructions on operating the PC software refer to the Help-function of the software.

CAUTION:
Only the sample weight must be read, on no account the weight of the accelerator.

The crucible is placed on the pedestal and the analysis is started. The furnace will close. **"ANALYSIS"** appears in the "status" window of the software, indicating that the analysis cycle is running. The analysis now runs by itself, so that nothing more needs to be done manually. The signals from the **infrared cells** are monitored on the "graphics" window of the software. At the end of analysis the results are shown on the screen.

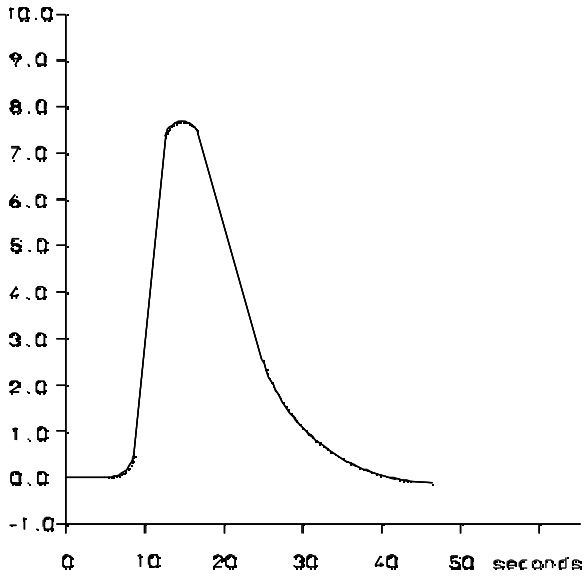
When the **range** is being **overloaded**, it is switched off. If a low range has been built in and it is overloaded, the analyser changes **automatically** over to the **high range**. If high ranges are overloaded, a row of asterisk will appear on the display. When the next analysis is started, the overloaded channel is reactivated automatically.

CAUTION:
The mains switch must not be changed from position **1 to 2** while "**ANALYSIS**" appears in the status window. If, however, the analysis is **mistakenly** started while the mains switch is in **position 1**, the analysis should be interrupted with the **"Abort"** button. The sample weight must be re-entered, then the analysis is restarted.

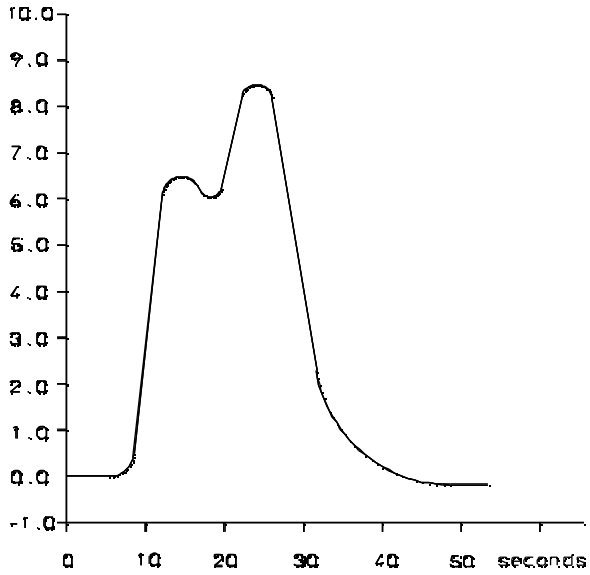
NOTE:
Before pressing **"Abort"**, a note should be made of the sample weight, because it must be re-entered manually before restarting. The first analysis after switching to **position 2** should be carried out after **10-15 minutes**, because the **oxygen** supply and the blower are thereby switched on, causing temperature drift of the **infrared cell**.

Analysis examples.
The analysis of **steel** and **cast iron** is generally carried out with approx. **500mg** of sample (normally grains or pieces) and **1,5g** of **tungsten** accelerator.

The combustion is quite rapid and the peaks on the PC screen look as follows:



Double peaks mean incomplete combustion.



The reason is, that either the sample doesn't contain enough **iron** or the sample is made up of **metal powders**.
In this case take **2 grams** of **tungsten** instead of **1.5 gram**. If the combustion still provides double peaks or there is yellow dust on the surface of the crucible after the analysis, take **1g** of tungsten, **500 mg** pure Iron and **500 mg** of sample.

In case of metal analysis the dust trap has to be cleaned and the moisture trap has to be replaced every **100 analyses** or at least **every two days**. See **3.1**.
The **combustion tube** doesn't need any **cleaning** by the operator, due to the **automatic** cleaning after each analysis.

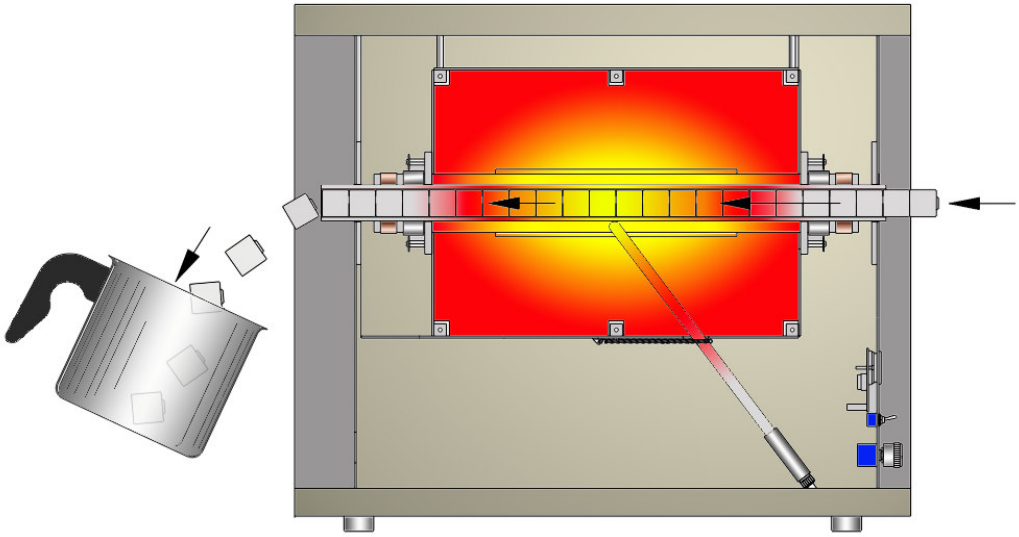
2.2 Work breaks

Work breaks, e.g. during **lunch breaks**, the mains switch remains on **position 2**. During **longer** interruptions, e.g. after finishing work for the day, the mains switch is set to **position 1** (standby). The analyser's thermostatic control is then still working and no long warm-up time is needed, when re-starting the analyser. Energy consumption and wear are negligible on standby.

The mains switch is set to **pos.2** for about **10-15 minutes** before starting the first analysis. Air, and any moisture which has entered the analyser is expelled by the **oxygen flow**. The slight influence which the **oxygen flow** has on the temperature of the **infrared cell** is balanced out The analyser is designed for long term use, so that no **damage** results.

The furnace should always be kept closed during work breaks, so that no moisture can enter. The furnace only remains open when the analyser is completely switched off. The **mains switch is only set to zero for safety reasons**, the crucible lift is then at the bottom.

2.3 Preheating the crucibles

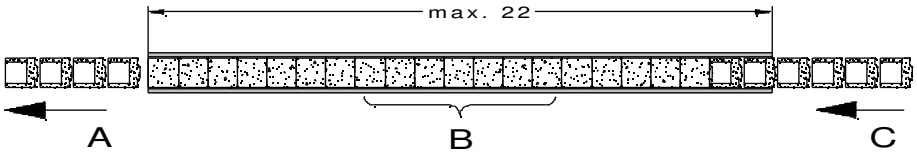


The above furnace is used for preheating the crucibles. It is an **ELTRA** accessory and can be purchased as such.

When analysing samples with a low concentration of **carbon** or **sulphur (<1000 ppm)**, the pre-heating of the crucibles is absolutely necessary.

The crucibles themselves have their own concentration of carbon, which can vary from **20 to several hundred ppm**, depending on their quality. Additionally, the above blank value is not constant; it can vary from crucible to crucible. These problems, of course affect the accuracy of the analyses, therefore by pre-heating the crucibles, the carbon inside them will be largely eliminated. The remaining **blank value** therefore, will be very low and, what is very important, it will remain fairly identical for each crucible.

Operating the pre-heating furnace:



B = hot zone inside furnace

WARNING!
do not move more then 4 crucibles at one time into the furnace, or else the combustion tube may break, due to temperature shock.

After **five minutes** feed-in the next **four** crucibles **(C)**.
Up to **22 crucibles** can fitted inside the furnace. **(B)** is the hot zone inside the furnace.
Eventually, the pre-heated items will drop from the furnace outlet **(A)**.

2.4 Applications

Material/ Analysis time (s)	Sample + Accelerators	Calibration		Typical results
Aluminium 50 s.	1.5 g ± 0.2 g Tungsten 700 mg ± 50 mg Sample 0.7 g ± 0.1 g Nickel	**LC**	0.1 % C Steel	60 ppm C
		HC	2.0% C Steel	3 % C
		LS	0.1 % S Steel	0.2 % S
		HS		
Ash 50 s.	1.6 g ± 0.2 g Tungsten 120 mg ± 50 mg Sample 0.5 g ± 0.1 g Iron	**LC**	0.1 % C Steel	
		HC	2.5 % C Steel	3.5 % C
		LS	0.1 % S Steel	
		HS		
$BaCO_3$ 50 s.	1.7 g ± 0.2 g Tungsten 110 mg ± 30 mg Sample 0.8 g ± 0.2 g Iron	**LC**		
		HC	6.08 %C $BaCO_3$	6.08 % C
		LS		
		HS		
$BaSO_4$ 50 s.	1.0 g ± 0.2 g Tungsten 200 mg ± 100 mg Sample 1.0 g ± 0.2 g Iron	**LC**		
		HC		
		LS		
		HS	13.7 %S $BaSO_4$	13.7 % S
Lead pieces 100 s. Comparator level =1	2.5 g ± 0.2 g Tungsten 2.0 g ± 0.1 g Sample	**LC**	0.1 % Steel	60 ppm C
		HC		
		LS	0.1 % S Steel	100 ppm S
		HS		
Lead powder 100 s. Comparator level =1	2.5 g ± 0.2 g Tungsten 800 mg ± 100 g Sample	**LC**	0.1 % Steel	60 ppm C
		HC		
		LS	0.1 % S Steel	100 ppm S
		HS		
Soil 60 s.	1.8 g ± 0.2 g Tungsten 250 mg ± 50 mg Sample 0.7 g ± 0.1 g Iron	**LC**	0.048 % C Steel	0.03 % C
		HC	1.03 % C Steel	3.0 % C
		LS	0.13 % S Cast iron	1.0 % S
		HS	0.336% S Steel	2.0 % S
$CaCO_3$ 50 s.	1.7 g ± 0.2 g Tungsten 110 mg ± 30 mg Sample 0.8 g ± 0.2 g Iron	**LC**		
		HC	12 % C $CaCO_3$	12 % C
		LS		
		HS		
CaO 60 s.	1.7 g ± 0.1 g Tungsten 370 mg ± 20 mg Sample 0.8 g ± 0.1 g Iron	**LC**	0.048 % C Steel	
		HC	1.33 % C Steel	0.192 % C
		LS	0.13 % S Cast iron	0.017 % S
		HS	0.336% S Steel	
Cast iron 50 s.	1.2 g ± 0.2 g Tungsten 400 mg ± 100 mg Sample 0.3 g ± 0.1 g Iron	**LC**		
		HC	1.33 % C Steel	0.192 % C
		LS	3.0 % S Cast iron	0.017 % S
		HS	0.1% S Cast iron	
Ceramics 60 s.	2.2 g ± 0.2 g Tungsten 150 mg ± 50 mg Sample 0.7 g ± 0.1 g Iron	**LC**		
		HC	12 % C $CaCO_3$	5.98 % C
		LS	0.103 % S	
		HS	0.336 % S Cast iron	2.57 % S
Cement 60 s.	0.8 g ± 0.1 g Tungsten 200 mg ± 50 mg Sample 0.8 g ± 0.1 g iron	**LC**		
		HC	12 % C $CaCO_3$	
		LS		
		HS	13.7 % S $BaSO_4$	

Cement 60 s.	200 mg ± 50 mg Sample 1.1 g ± 0.1 g Iron	**LC**	1 % C Cement	
		HC	2% C Cement	
		LS	1% S Cement	
		HS		
Chrome 70 s.	1.5 g ± 0.2 g Tungsten 200 mg ± 50 mg Sample 0.8 g ± 0.1 g Iron	**LC**	0.048 % C Steel	0.003 % C
		HC	1.33 % C Cast iron	
		LS	0.13 % S Cast iron	0.001 % S
		HS		
Chrome oxide 50 s.	1.5 ± 0.2 g Tungsten 220 mg ± 50 mg Sample 0.6 g ± 0.1 g Iron	**LC**	0.1 % C Steel	0.02 % C
		HC		
		LS	0.1 % S	0.025 % S
		HS		
Limestone 60 s.	1.8 ± 0.1 g Tungsten 250 mg ± 50 mg Sample 0.8 g ± 0.1 g Iron	**LC**	0.048 % C Steel	
		HC	1.3 % C Steel	1.5 % C
		LS	0.13 % S	0.11 % S
		HS		
Cobalt 50 s.	1.8 ± 0.2 g Tungsten 350 mg ± 50 mg Sample 0.3 g ± 0.1 g Iron	**LC**	0.048 % C Steel	
		HC	1.3 % C Steel	1.5 % C
		LS	0.13 % S	0.11 % S
		HS		
Coal and coke 50 s.	1.5 ± 0.2 g Tungsten 50 mg ± 10 mg Sample 0.5 g ± 0.1 g Iron	**LC**		
		HC	3.0 % C Cast ironl	70 % C
		LS	0.1 % S Steel	5 % S
		HS		
Copper 50 s.	5 g Sample	**LC**		
		HC		
		LS	15 ppm S Copper	10 ppm S
		HS		
Copper pin 50 s.	2.0 g ± 0.2 g Tungsten 1.0 g ± 0.1 g Sample 0.1 g ± 0.01 g Iron	**LC**		
		HC		
		LS	0.1 % S Steel	10 ppm S
		HS		
Cu-Ni 50 s.	2.0 g ± 0.2 g Tungsten 0.7 g ± 0.1 g Sample	**LC**	0.048 % C Steel	0.036 % C
		HC	1.03 % C Steel	
		LS	0.1 % S Steel	40 ppm S
		HS		
Nickel 50 s.	2.0 g ± 0.2 g Tungsten 0.8 g ± 0.1 g Sample 0.8 g ± 0.1 g Iron	**LC**	0.048 % C Steel	
		HC	1.03 % C Steel	
		LS	0.1 % S Steel	17 ppm S
		HS		
Fe-Cr 50 s.	2.5 g ± 0.2 g Tungsten 450 mg ± 50 mg Sample 0.2 g ± 0.1 g Iron	**LC**	0.1 % C Steel	0.2 % C
		HC	1.03 % C Steel	6 % C
		LS	0.1 % S Steel	0.3 % S
		HS		
Fe-Mn Fe-Mo 50 s.	1.5 g ± 0.2 g Tungsten 250 mg ± 50 mg Sample 0.4 g ± 0.1 g Iron	**LC**	0.1 % C Steel	0.2 % C
		HC	3.0 % C Cast iron	6 % C
		LS	0.1 % S Steel	0.3 % S
		HS		
Fe-Ni 50 s.	1.7 g ± 0.2 g Tungsten 700 mg ± 100 mg Sample	**LC**	0.1 % C Steel	0.2 % C
		HC	3.0 % C Cast iron	6 % C
		LS	0.1 % S Steel	0.3 % S
		HS		

Fe-Si 50 s.	1.5 g ± 0.2 g Tungsten 250 mg ± 50 mg Sample 0.9 g ± 0.1 g Iron	**LC**	0.1 % C Steel	0.2 % C
		HC	3.0 % C Cast iron	6.0 % C
		LS	0.1 % S Steel	0.3 % S
		HS		
Fly ash 60 s.	2.2 g ± 0.1 g Tungsten 100 mg ± 20 mg Sample 0.3 g ± 0.05 g Iron	**LC**	0.048 % C Steel	
		HC	6.08 % C $BaCO_3$	10 % C
		LS	0.13 % S Cast iron	0.3 % S
		HS		
Gypsum 60 s.	0.8 g ± 0.1 g Tungsten 200 mg ± 50 mg Sample 0.8 g ± 0.1 g Iron	**LC**		
		HC	12 % C $CaCO_3$	
		LS		
		HS	13.7 % S $BaSO_4$	18 % S
Ores 60 s.	1.0 g ± 0.2 g Tungsten 130 mg ± 30 mg Sample 1.0 g ± 0.2 g Iron	**LC**		
		HC	12 % C $CaCO_3$	10 % C
		LS	0.1 % S Steel	≈3 % S
		HS	13.7 % S $BaSO_4$	30 % S
Ores 60 s.	1.0 g ± 0.2 g Tungsten 130 mg ± 30 mg Sample 1.0 g ± 0.2 g Iron	**LC**		
		HC	12 % C $CaCO_3$	10 % C
		LS	0.1 % S Steel	≈3 % S
		HS	13.7 % S $BaSO_4$	30 % S
Iron ores 60 s.	2.0 g ± 0.2 g Tungsten 250 mg ± 50 mg Sample 0.5 g ± 0.1 g Iron	**LC**		
		HC	12 % C $CaCO_3$	10 % C
		LS	0.1 % S Steel	≈3 % S
		HS	13.7 % S $BaSO_4$	30 % S
Rock sample 60 s.	2.2 g ± 0.2 g Tungsten 150 mg ± 50 mg Sample 0.7 g ± 0.1 g Iron	**LC**		
		HC	12 % C $CaCO_3$	5.98 % C
		LS	0.103 % S Steel	
		HS	0.336 % S Steel	2.57 % S
Rubber 60 s.	1.5 g ± 0.2 g Tungsten 40 mg ± 10 mg Sample 0.5 g ± 0.1 g Iron	**LC**		
		HC	3.0 % C Cast iron	60 % C
		LS	0.1 % S Steel	1.9 % S
		HS		
Silicon 60 s.	1.7 g ± 0.2 g Tungsten 80 mg ± 20 mg Sample 0.4 g ± 0.1 g Iron	**LC**		
		HC	12 % C $CaCO_3$	
		LS	0.1 % S Steel	0.02 % S
		HS		
Silicon Carbide 70 s.	2.0 g ± 0.2 g Tungsten 60 mg ± 10 mg Sample 0.7 g ± 0.1 g Iron	**LC**		
		HC	12 % C $CaCO_3$	30 % C
		LS	0.1 % S Steel	0.02 % S
		HS		
Slag 60 s.	1.0 g ± 0.2 g Tungsten 500 mg ± 100 mg Sample 1.0 g ± 0.2 g Iron	**LC**	0.1 % C Steel	
		HC	2.0 % C Cast iron	
		LS	0.1 % S Steel	0.8 % S
		HS		
Steel 50 s.	1.5 g ± 0.2 g Tungsten 500 mg ± 100 mg Sample	**LC**	0.1 % C Steel	0.1 % C
		HC	3.0 % C Cast iron	6 % C
		LS	0.1 % S Steel	0.3 % S
		HS		
Titanium 50 s.	1.4 g ± 0.2 g Tungsten 500 mg ± 100 mg Sample 0.6 g ± 0.1 g Iron	**LC**	0.1 %C Steel	0.016 % C
		HC		
		LS	0.1 % S Steel	10 ppm S
		HS		

Titanium oxide 60 s.	2.2 g ± 0.2 g Tungsten 300 mg ± 50 mg Sample 0.6 g ± 0.1 g Iron	**LC**	0.048 % C Steel	
		HC		
		LS	0.013 % S Cast iron	23 ppm S
		HS		
Titanium oxide 60 s.	2.0 g ± 0.2 g Tungsten 220 mg ± 20 mg Sample	**LC**	0.048 % C Steel	0.230 % C
		HC		
		LS		
		HS		
Tungsten carbide 70 s.	1.7 g ± 0.2 g Tungsten 200 mg ± 50 mg Sample 0.6 g ± 0.1 g Iron	**LC**		
		HC	6.14 % C WC	6.14 % C
		LS		
		HS		
Uranium 50 s.	1.0 g ± 0.1 g Tungsten 800 mg ± 100 mg Sample 0.5 g ± 0.1 g Iron	**LC**	0.1 % C Steel	0.50 % C
		HC		
		LS	0.1% S Steel	0.07 % S
		HS		

LC – low carbon measuring range
HC – high carbon measuring range
LS – low sulphur measuring range
HS – high sulphur measuring range

3 MAINTENANCE

3.1 General information

Every 100 analyses or at least once a month:

- Replace the **magnesium perchlorate** after the metal filter. See 3.3. Brush the metal filter. See 3.6.

Every 500 analyses:

- Clean the metal filter in an ultrasonic cleaner. See 3.4.

Every 1000 analyses or if 1/3 of the material turned grey:

- Replace the paper filters. See 3.3. Replace the **magnesium perchlorate** of both glass tubes.
- Replace the sodium hydroxide. See 3.3.

Every 2000 analyses:

- Replace the **copper oxide** in the catalyst furnace. See 3.3.
- Replace the furnace cleaning brush. See 3.5.
- Replace the cotton wool. It should be replaced earlier when the upper half becomes dark. See 3.3.

Remark:
The above is related to steel analyses and oxygen 99.5% pure.

IMPORTANT:

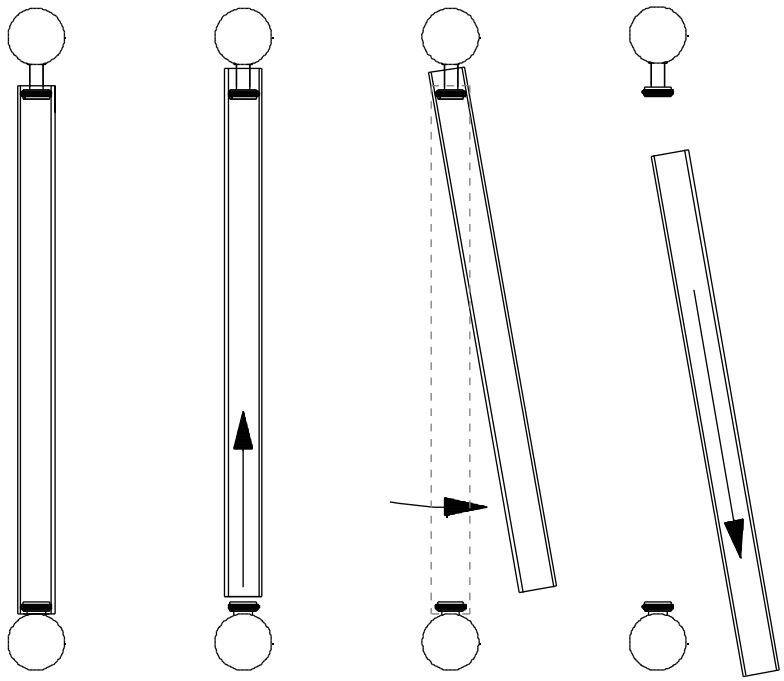
There are qualities of chemicals such as **anhydrone, ascarite, copper oxide, tungsten granules, iron chips, copper chips** etc. which have been specially developed for analysing instruments. The commonly available materials serve their specific purposes either inadequately or not at all.

- The **magnesium perchlorate** which is commonly available, causes memory effect and affects repeatability. Another typical effect is that the analysis takes too long and is often not even completed. This effect also occurs with **magnesium perchlorate** of suitable quality if it is over-saturated.
- The commonly available **sodium hydroxide** binds **CO_2** very inadequately at room temperature, whereas the special quality not only binds extremely well at room temperature but also contains an indicator.
- The **glass tubes** and the **O-rings** should be lubricated with **high vacuum silicon grease** and not with ordinary silicone grease.

The user is free to test commonly available materials; the analyser will **not** be damaged. If problems should arise, however, suitable materials, in proper, unsaturated condition, should be used, **before** calling technical service.

The chemical containers must be closed **very tightly, immediately** after use, so that they do not become contaminated with air moisture or **CO_2**.

3.2 Installing and removing the reagent tubes



6-1-1

To replace the reagent tubes:
The reagent tubes are first lifted, then swung to one side, detached diagonally downwards and emptied.

IMPORTANT:
The dimensions for filling the glass tubes given in the schematic of 3.3 should be respected in all cases.
When, for example, there is a rest of quartz wool in the bottom of the glass tube, it is possible that dust, forming **magnesium perchlorate** can fall through and block the fitting below or this can damage the analyser and the infrared cell.

NOTE:
Before the reagent tubes are fitted, both the O-rings and the inner ends of the tubes are lubricated with **high vacuum silicon grease**.

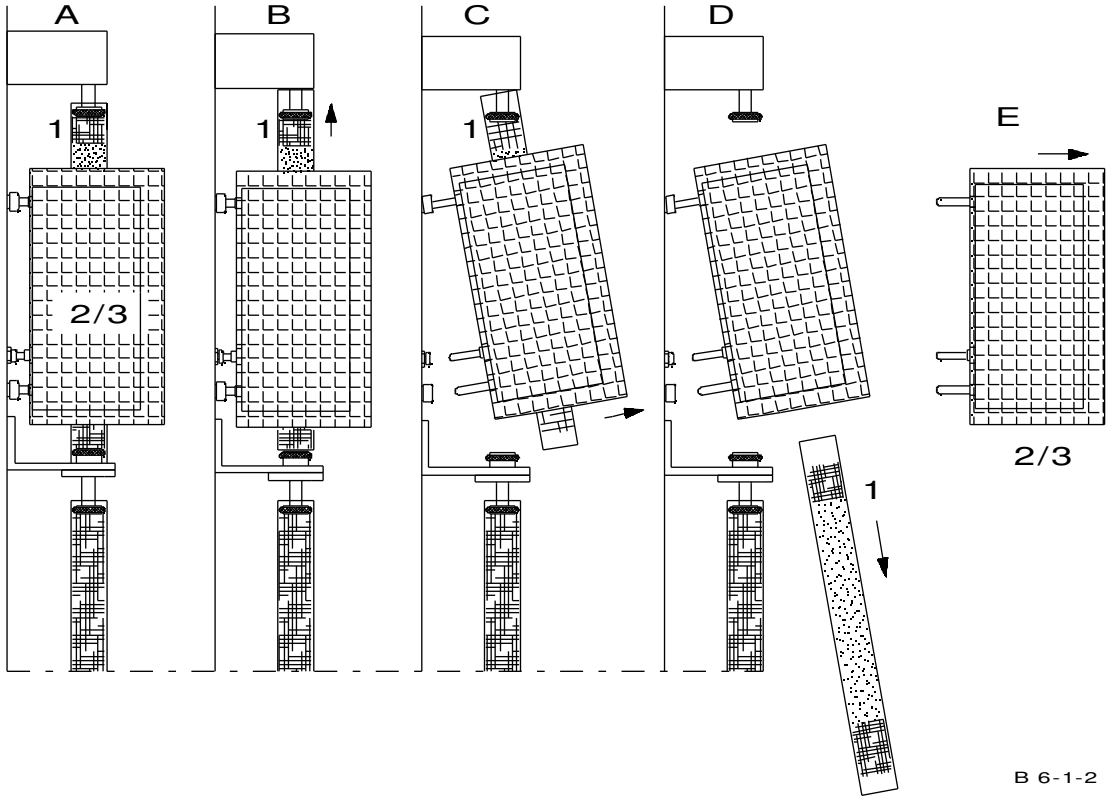
With oxidising furnaces, the copper oxide is replaced after about **2000** analyses. See 3.3. It is safer, but not absolutely essential, to switch the analyser off.

The components are refitted in reverse order.

ATTENTION:

It should be remembered that the furnace temperature is about 450°, and protective gloves must be worn.

Only the outside grid of the furnace is to be handled; the quartz reagent tube must only be held at the ends.



B: The quartz tube **(1)** of the furnace **(2/3)** is raised as far as it will go.
C: It is then swung out together with the furnace **(2/3)**.
D: The quartz tube **(1)** is pulled put diagonally downwards.
E: The furnace **(2)**, together with the grid **(3)** is removed.

The components are refitted in reverse order.

3.3 Filling the reagent tubes

The following chemicals are used:

Magnesium perchlorate (anhydrone)	as moisture absorber
Sodium hydroxide (ascarite)	as CO_2 absorber
Copper oxide on rare soils	as oxidiser ($CO \rightarrow CO_2$)

The reagent tubes are replaced when they are saturated. See **3.1**.
It is not possible to dry the **magnesium perchlorate** and use it again, as it is chemically changed after reacting with the moisture. The saturation of the sodium hydroxide changes it's colour **(it turns to light grey).** If the absorber particles do not move (e.g. tapping on the glass), then this is a sign that the **magnesium perchlorate** is saturated. It is essential to change the absorber before it is completely solid. The moisture absorber should be checked after **100-200 induction analyses** and if necessary replaced **(glass tube underneath the metal filter).**

Please refer to the following schematics to identify the glass tubes on the analyser. In addition to the reagents in the glass tube, fill the bottom end of the tube with **unleaded quartz wool**. One should pay attention that the quartz wool should be only as **thick** as necessary, otherwise the flow of gas can be **choked**. Under no conditions should the amount of quartz wool be less than that given in the following schematics, since fine particles of **magnesium perchlorate** can pass through the wool and collect itself at the bottom of the tube, causing severe damage.

It should be pointed out that **magnesium perchlorate** is a very strong **oxidative material**.
At both ends of the glass tube, you should leave sufficient space for the gas connections to be fitted. The free space at the tube ends serve as sealing space. They must be cleaned after filling. The **O-rings** must be cleaned. Both the **O-rings** as well as the **sealing** areas of the tube must be greased with **high vacuum silicon grease.** This will be easier to assemble or disassemble and further it improves the sealing.

Make sure that the O-rings are completely sealed around the glass tubes.

The reagent tubes are filled as follows:

For the chemicals to be retained in the reagent tubes the lower end is filled with glass wool. Do not stuff the glass wool to tight, otherwise the gas flow will be blocked. The rest of the tube is filled with the appropriate chemicals. The lower half of the reagent tube for the **oxygen** pre-cleaning tube is filled with anhydrone and the upper half with **sodium hydroxide.** The chemicals are separated by a glass wool. The tube at the furnace outlet is filled with **2/3 anhydrone** and the remaining **1/3** with **glass wool**.

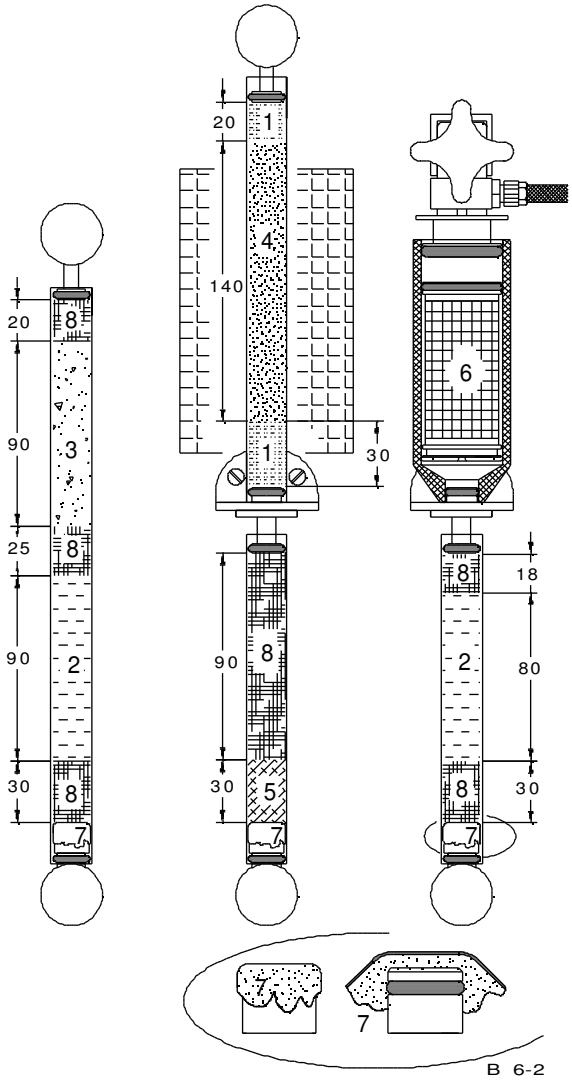
Sufficient **space** must be left at **both ends** of the tube so they can be attached to the glass fittings. The free inner surface at the ends of the tubes serve as sealing surfaces and must be cleaned after filling.

The **O-rings** also have to be clean. Both the **O-rings** and the **sealing surfaces** on the tube should be greased with **silicon grease**. This simplifies the fitting and particularly the removal of the tube, and ensures proper **sealing**.

Make sure that the O-rings are completely sealed around the glass tubes.

Each filling quantity carries a tolerance of ± 20 %

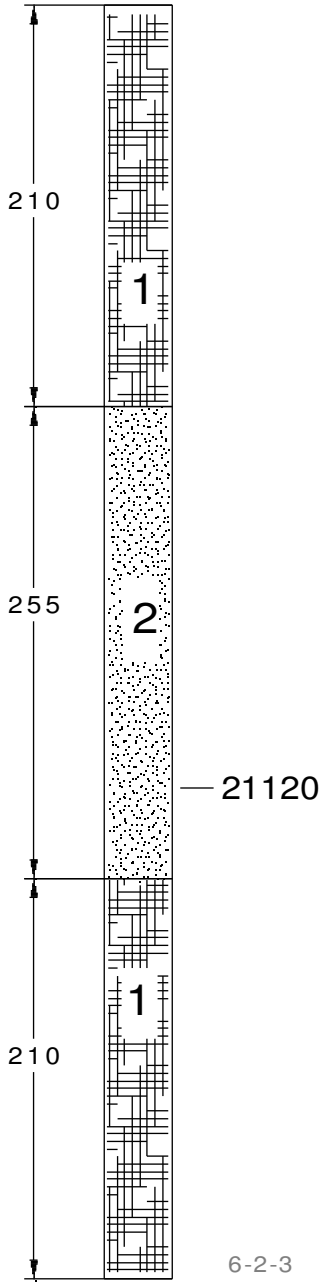
Material	Part No.
1. Quartz wool	90330
2. Anhydrone	90200
3. Sodium hydroxide	90210
4. Copper oxide	90290
5. Cotton wool	90340
6. Metal filter	11105
7. Paper filter	11185
8. Glass wool	90331



Filling the oxygen purifying furnace glass tube:

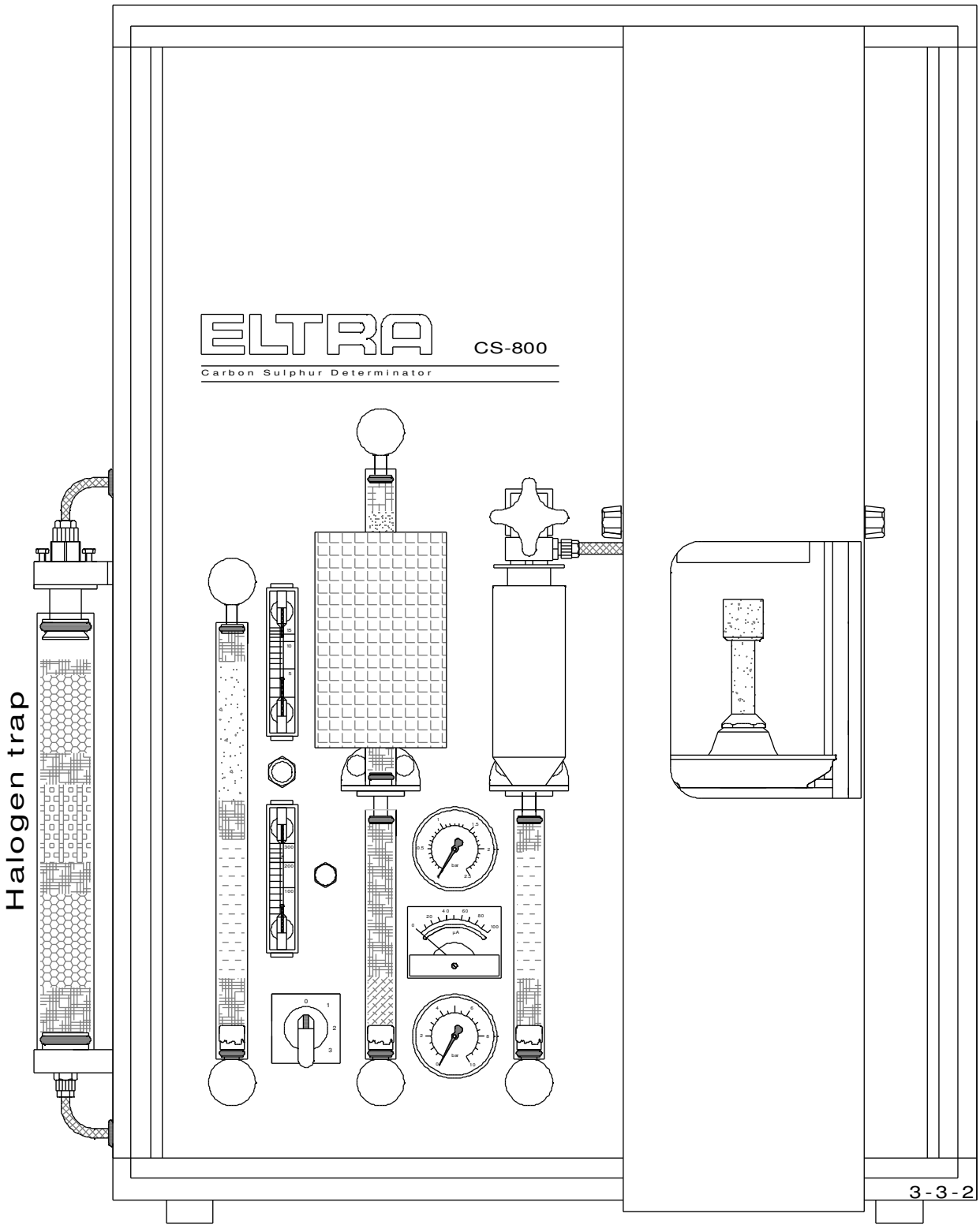
Each filling quantity carries a tolerance of ± 20 %

Material	Part No
1. Quartz wool	90330
2. Copper oxide	90290



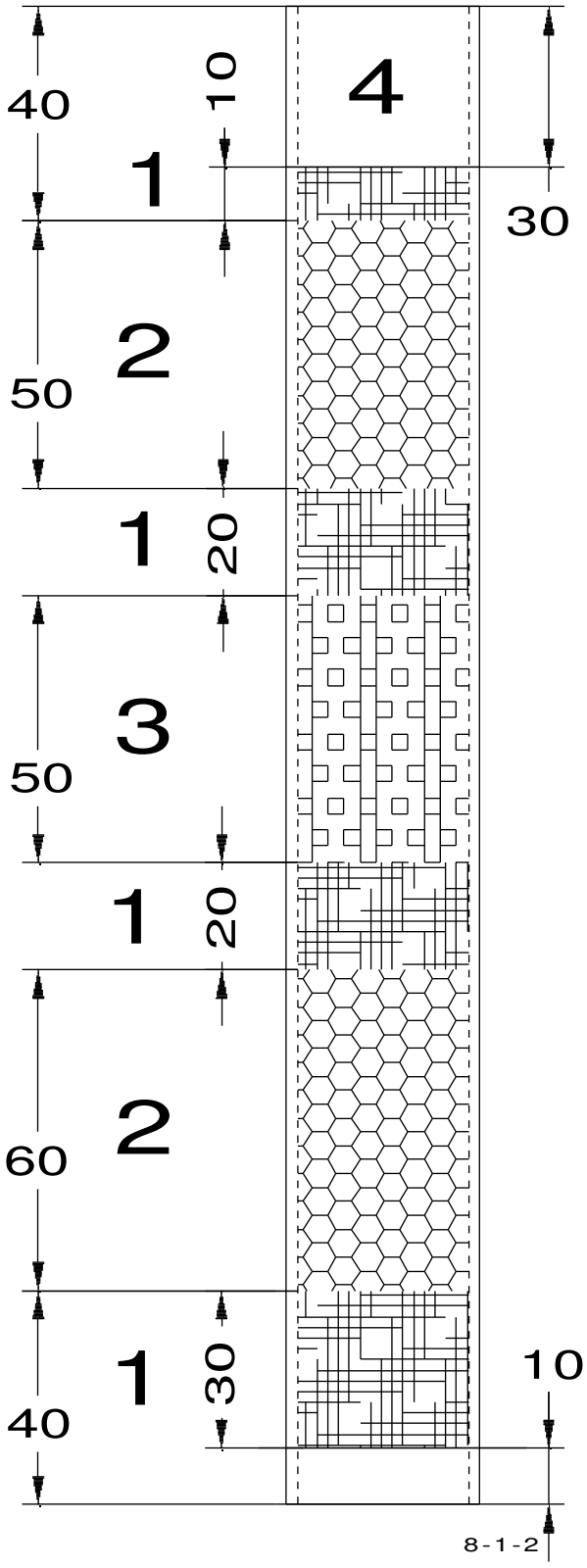
Halogen trap:

On request the **CS-800** can be supplied with a halogen trap. The glass tube must be filled with halogen trap material see **next page**.



Filling the Halogen trap:

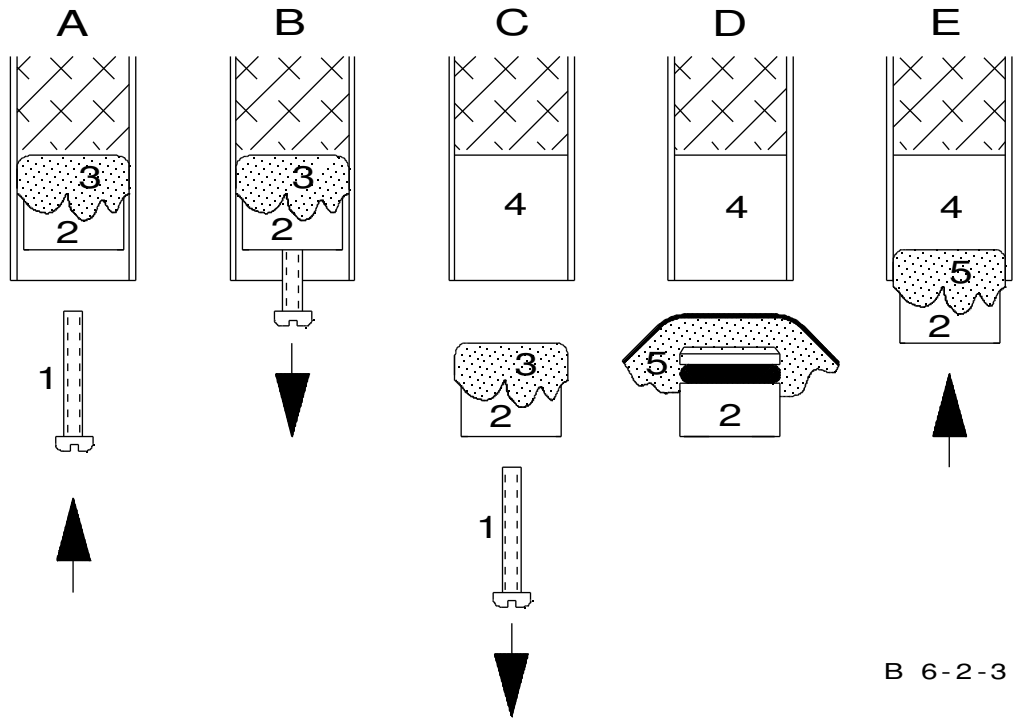
If the **customer** orders an analyser pointing out that he has to analyse materials containing **halogens**, the analyser will be delivered with a **halogen trap tube** attached to the left panel of the analyser.



Each filling quantity carries a tolerance of ± 20 %

Material	Part No
1. Glass wool	90331
2. Halogen trap metal	90235
3. Halogen trap material	90234
4. Glass tube	09090

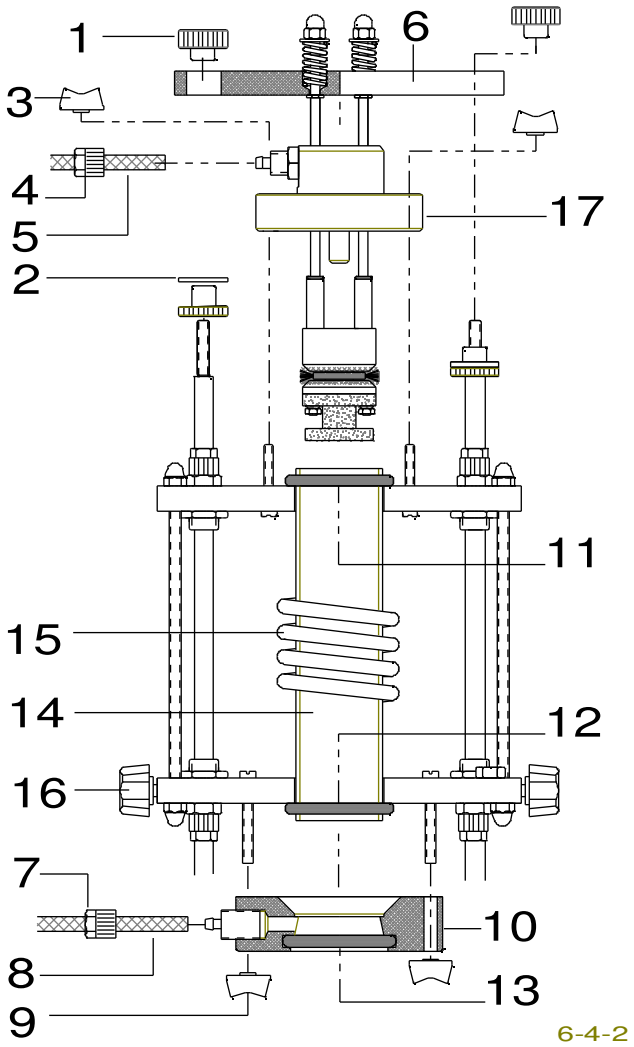
Changing the paper filter:



A. Turn an M4 screw **(1)** into the paper filter holder **(2)**.
B. With this screw, pull the filter holder **(2)** and the filter **(3)** out of the reagent tube **(4)**.
C. Remove the screw **(1)** from the filter holder **(2).** Remove the old filter **(3)**.
D. A new filter **(5)** is placed on the filter holder **(2)** and folded over.
E. The filter holder **(2)**, with the new filter **(5)** is pushed carefully, back into the reagent tube **(4)**.

3.4 Replacing the O-rings

1 Knurled nut
2 Washers
3 Wing nuts
4 Nut for gas inlet tube
5 Gas inlet tube
6 Mounting
7 Nut for gas outlet tube
8 Gas outlet tube
9 Wing nuts
10 Lower furnace lock
11 Upper O-ring for combustion tube
12 Lower O-ring for combustion tube
13 O-ring for lower furnace lock
14 Combustion tube
15 Induction coil
16 Nuts for furnace housing
17 Upper furnace lock



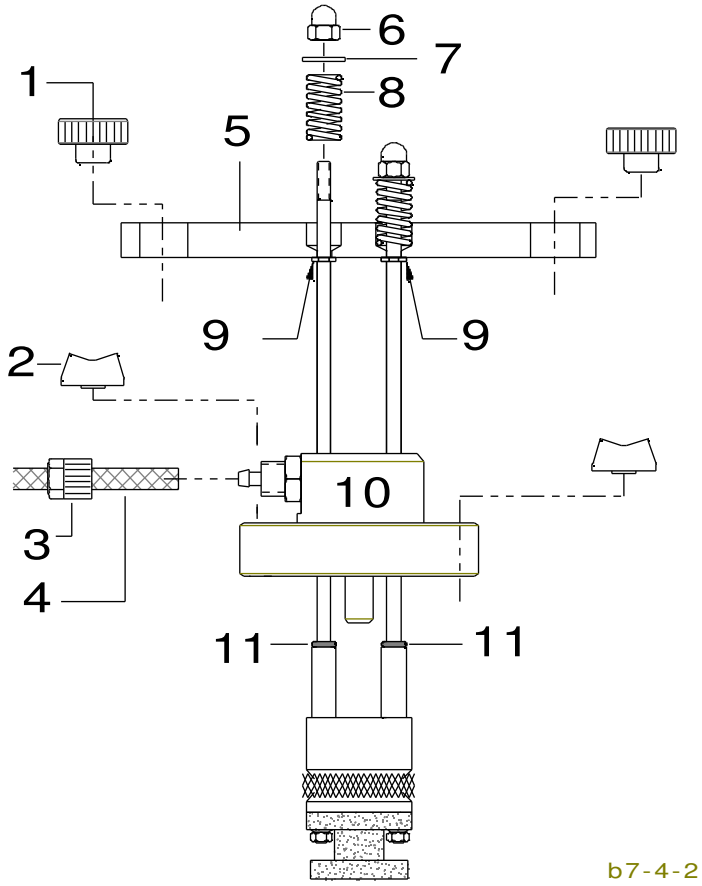
Replacing the O-rings (11 and 12) for combustion tube:

- Remove the furnace housing by just loosening the nuts **(16)**.
- Open the furnace.
- Unscrew the knurled nuts **(1)** and washers **(2)**.
- Unscrew the wing nuts **(3)**.
- Unscrew the nut **(4)** and detach tube **(5)**. If there are two tubes, remove them both.
- Remove the furnace cleaning system, by pulling up the mounting **(6)**.
- Unscrew the nut **(7)** and detach the tube **(8)**.
- Unscrew the wing nuts **(9)** and pull down lower furnace lock **(10)**.
- Now the O-rings **(11)** and/or **(12)** can be removed and replaced. Apply a **thin** layer of grease on the inner surface of the new O-rings, before mounting them. Apply a **thin** layer of grease on the outer surface of the combustion tube, where the new O-rings will be placed.
- Reinstall in reverse order.

Replacing the O-ring (13) for lower furnace lock:

- Remove the furnace housing by just loosening the nuts **(16)**
- Unscrew the nut **(7)** and detach tube **(8)**
- Unscrew the wing nuts **(9)** and pull down lower furnace lock **(10)**
- Remove the O-ring **(13)** with a screwdriver; insert a new one **without greasing it.**
- Reinstall in reverse order.

Replacing the O-rings for furnace seal:



- Unscrew the knurled nuts **(1)**.
- Unscrew the wing nuts **(2)**.
- Unscrew the nut **(3)** and gas inlet tube **(4)**. If there are two tubes, remove them both.
- Remove the furnace cleaning system, by pulling the up the mounting **(5)**.
- Unscrew the nuts **(6)** and remove the washers **(7)** and springs **(8)**.
- Remove the mounting **(5)**.
- Remove the circlips **(9)**.
- Remove the upper furnace lock **(10)**.
- Remove and replace the O-rings **(11) do not grease the O-rings!**
- Reinstall in reverse order.

For the reagent tubes:
The **O-rings** are only replaced when they can no longer adequately seal, due to severe damage or age. When removing the **old** O-rings, be ensure that the sealing area of the fittings are not damaged. The groove in which the old O-rings sat must be cleaned, so that it is completely **free of grease.**

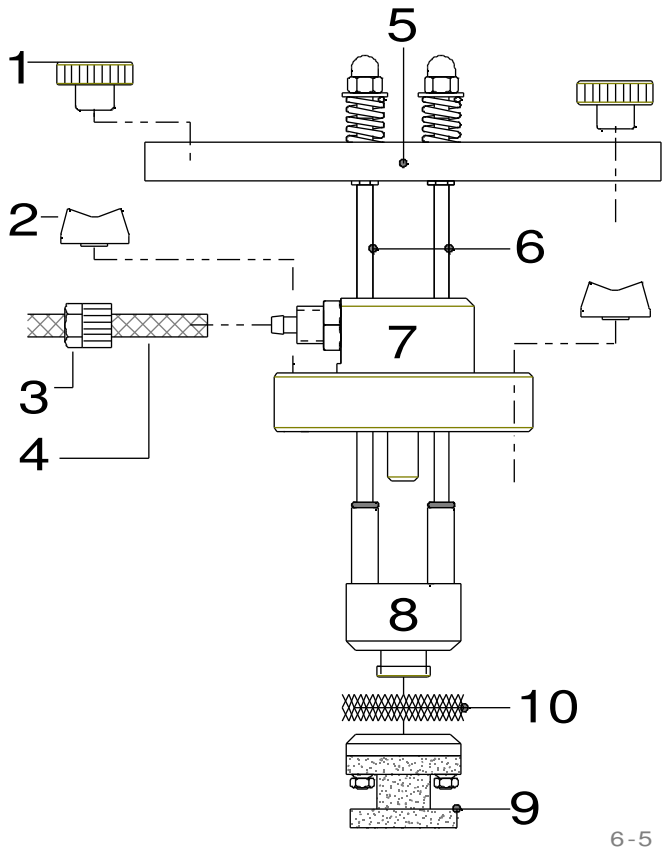
The new O-rings should under **no-circumstances** be greased before installing, **only** after installation. Otherwise, **the O-rings will turn with the glass tubes** when trying to remove it.

3.5 Replacing the furnace cleaning brush

The furnace is equipped with a self-cleaning system. This mechanism contains a brush, which cleans the **quartz tube** (combustion tube).

The position of the main switch **(0, 1, 2 or 3)** is irrelevant. If the brush is replaced during work time, then the main switch of the analyser can be left in position **2,** and merely open the furnace.

1 Knurled nut
2 Wing nuts
3 Nut for gas inlet tube
4 Gas inlet tube
5 Mounting
6 Mounting rods
7 Upper furnace lock
8 Brush holder
9 Heat shield
10 Brush

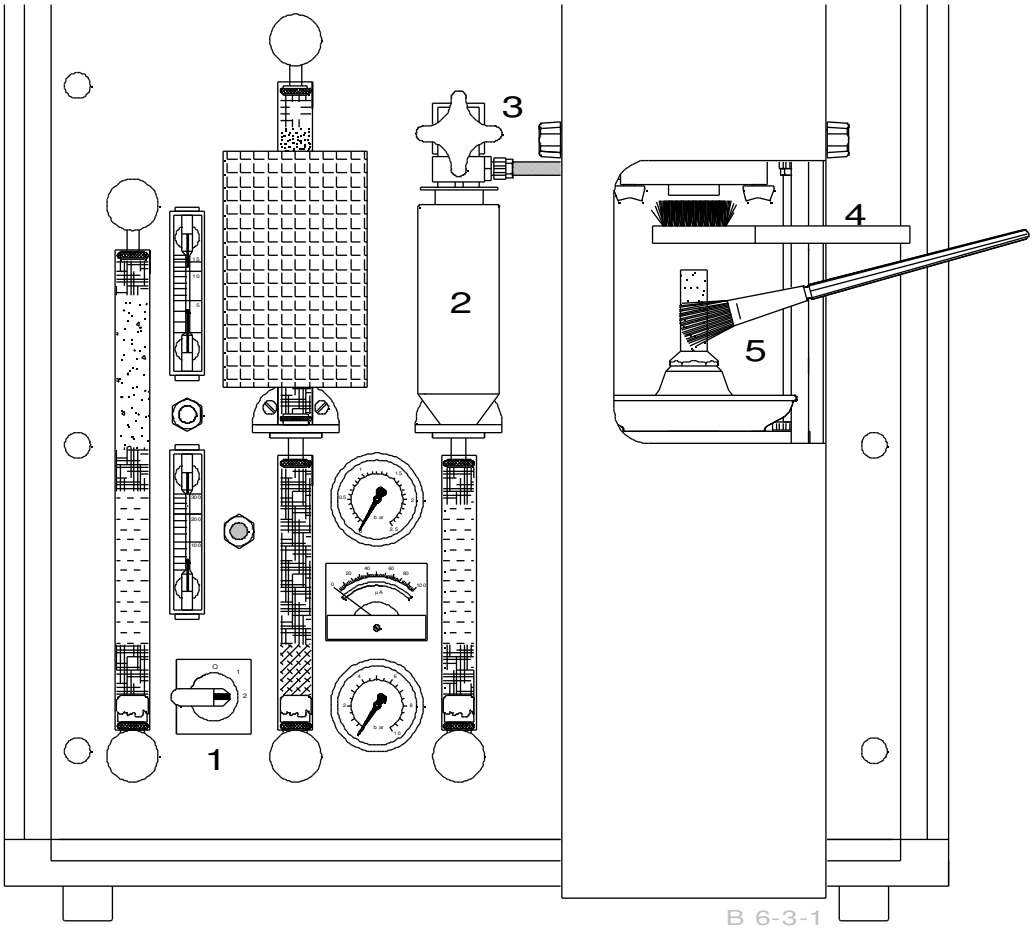


- Loosen the cover attachment knobs and remove the cover.
- Open the furnace.
- Remove the knurled nut **(1)**.
- Unscrew the wing nuts **(2)**.
- Loosen the nut **(3)** and detach the tube **(4)**.
- Remove the furnace cleaning system, by lifting up the mounting **(5)**.
- Hold the brush holder **(8)** tight and unscrew the heat protector **(9),** together with the brass ring.
- Remove and change the brush **(10)**.
- Reassemble in the reverse order

Important:
It is absolutely important to hold the brush holder **(8) and not** the mounting **(5),** when unscrewing the heat shield **(9),** or else the rods **(6)** will bend.

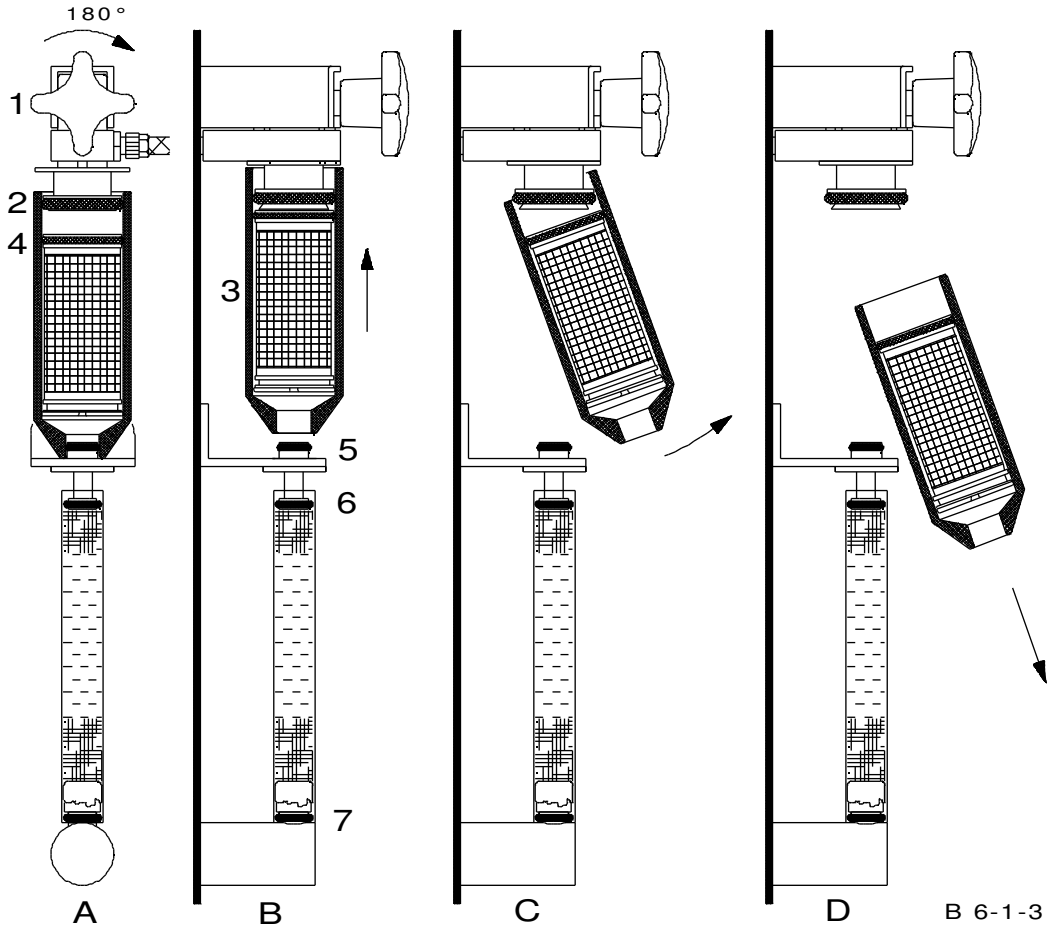
3.6 Cleaning the dust trap

The combustion chamber is automatically cleaned after each combustion; so it is not necessary to clean the chamber manually.
The dust which exits in the furnace, together with the combustion gas, will be retained in the dust filter **(2)**. The dust filter only needs to be changed or cleaned after about 100 analyses. See 3.1**.**
Make sure that the filter is **absolutely dry (!!!)** after cleaning, since the inside of the filter is only **10 microns** and it is impossible to see if the inside of the filter is dry. Therefore it is advisable to have a second filter, while drying the other one. The filter can be dried carefully, e.g. with hot air.
Replacement of the dust filter **(2)** takes only about **5 seconds**.



- The main switch **(1)** stays at **position 2**.
- The oxygen may not be turned off, but only the furnace has to be opened.
- The radiation shield **(4)** and the pedestal **(5)** can occasionally be cleaned.

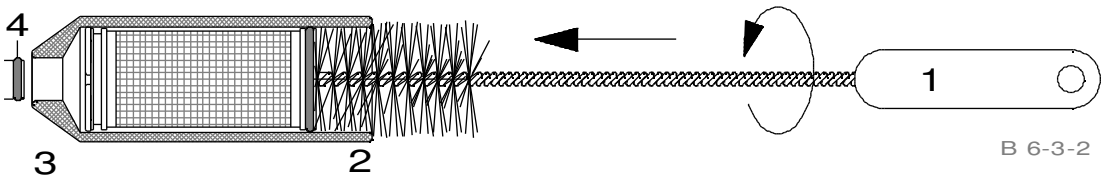
Remove the dust trap **(2)**, as follows:



A: The cock **(1)** is rotated by **180°**, so that the O-ring **(2)** loosens.
B: The dust trap **(3)** is raised as far as it will go.
C: Then it is swung to the side and
D: detached diagonally downwards.

A clean dust trap **(3)**, see **next page** is fitted in the reverse order.

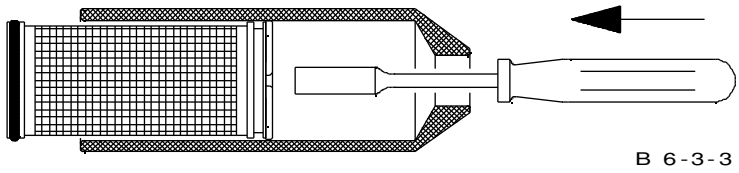
Fast filter cleaning: **once every 200 analyses when using tungsten accelerator**
once every 100 analyses when using tungsten and Iron



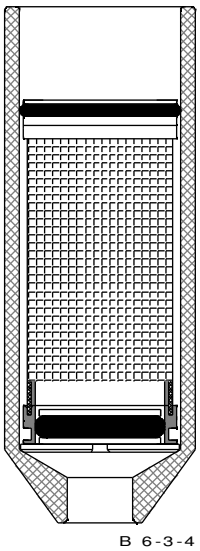
- Clean the dust using the brush **(1)** delivered with the analyser.
- Rotate in only one direction.
- Clean the upper end of the filter housing **(2)**.

CAUTION:
Lubricate only the lower end of the filter housing **(3)** and the lower O-ring **(4)**. The upper end of the filter housing **(2)** and the O-ring of the upper sealing mechanism should remain clean and absolutely **free of grease.**

For better cleaning: **once every 1000 analyses when using tungsten accelerator**
once every 500 analyses when using tungsten and Iron

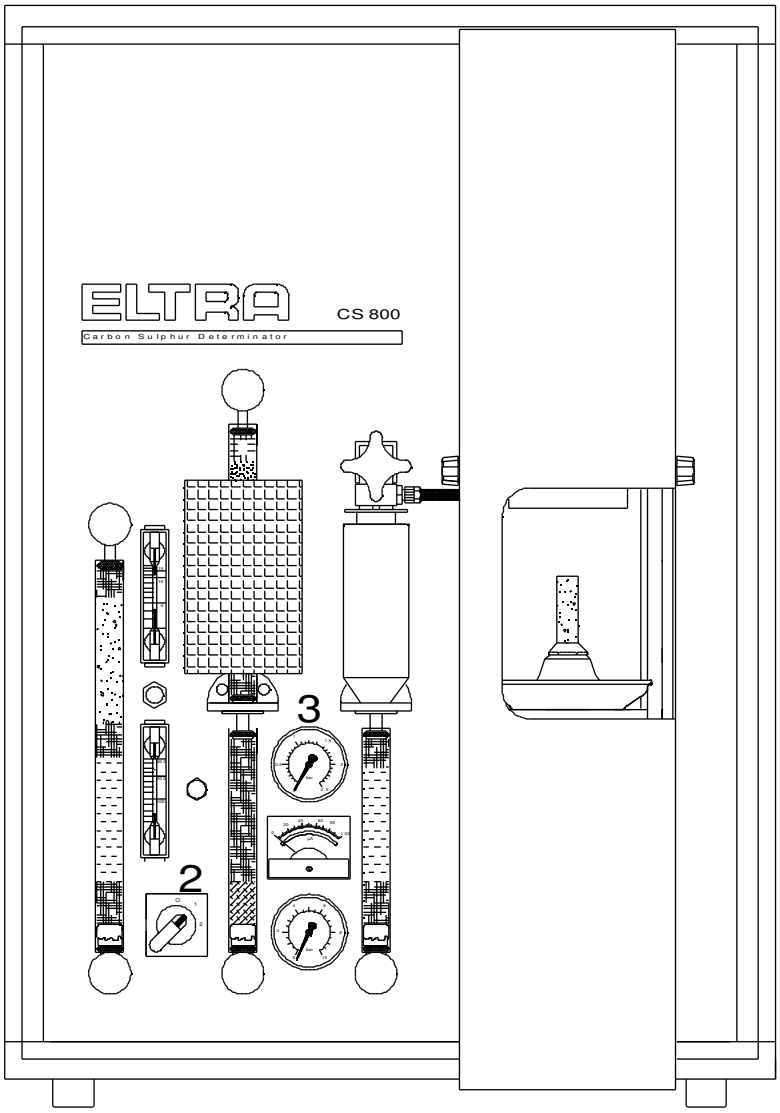


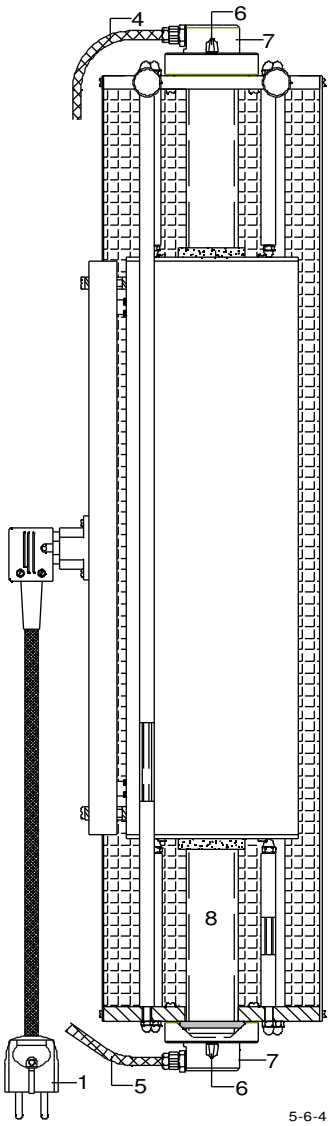
- Remove the metal filter out of the filter housing.
- Perform a preliminary cleaning, by using the brush.
- Clean the metal filter in the ultrasonic cleaner.
- Dry and, if necessary for assembling, lubricate the 0-ring.
- Clean the upper end of the filter housing **(2)** from any grease.



CAUTION:
When reinstalling the filter in the filter housing, the O-rings must be correctly installed otherwise the gas flow will be completely blocked.
Outer O-ring on top, inner O-ring to the bottom!

Oxygen purifying furnace:



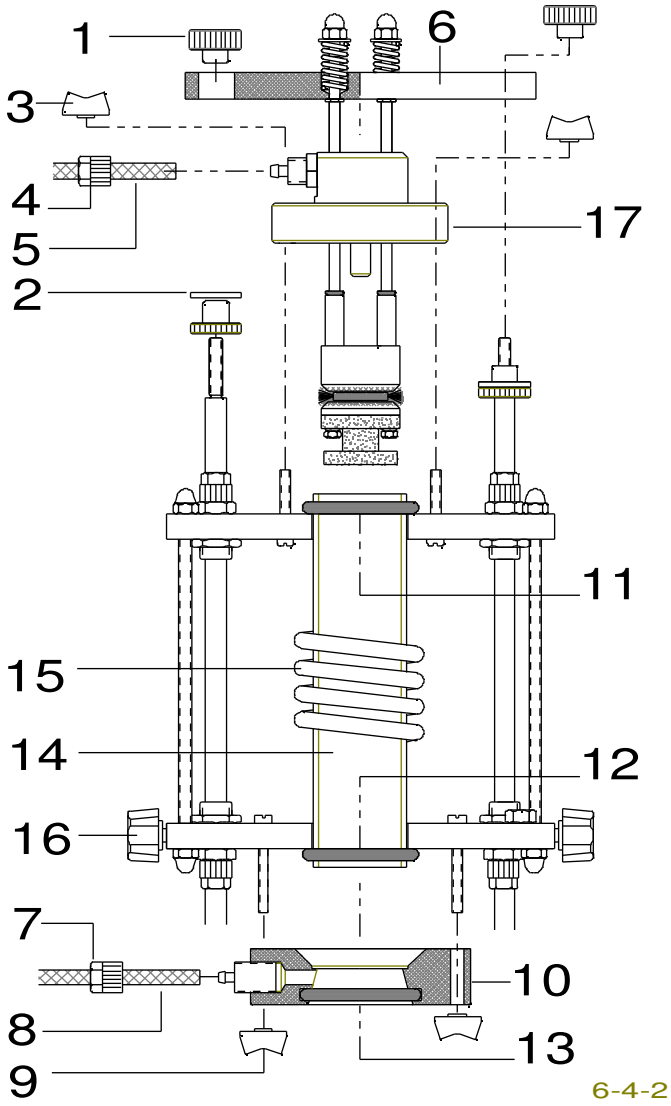


CAUTION: HIGH TEMPERATURE!

- Disconnect the power **(1)**.
- Close the oxygen supply (bottle).
- Keep the power switch **(2)** of the analyser to position 1.
- Wait until the pressure on the oxygen gauge **(3)** drops to zero.
- Disconnect the oxygen tubes **(4)** and **(5)** from the purification furnace.
- Lift the furnace and remove it from the analyser.
- Place the furnace in horizontal position.
- Unscrew all four nuts **(6)**.
- Remove the two parts **(7)**.
- Remove the glass tube **(8)** by pulling it horizontally.
- Empty and refill, see **3.3**.
- Install in reverse order.

3.7 Replacing the combustion tube

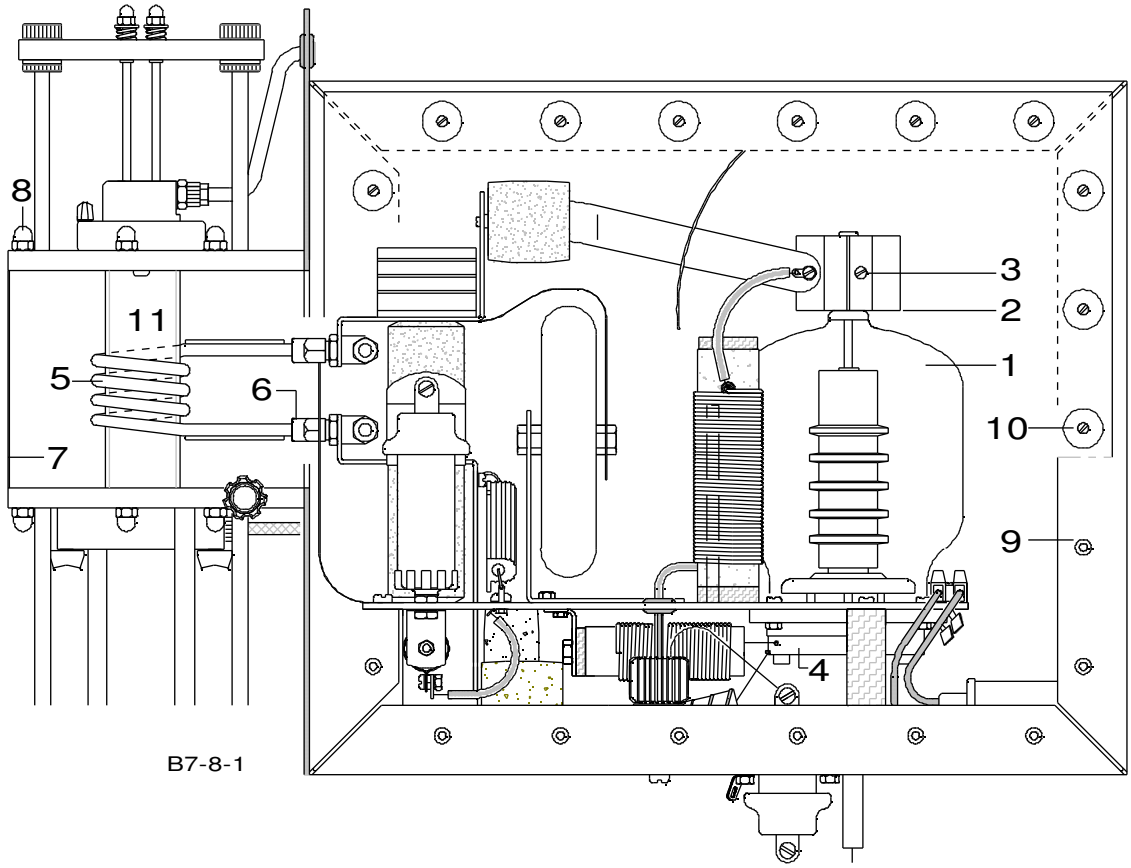
1 Knurled nut
2 Washers
3 Wing nuts
4 Nut for gas inlet tube
5 Gas inlet tube
6 Mounting
7 Nut for gas outlet tube
8 Gas outlet tube
9 Wing nuts
10 Lower furnace lock
11 Upper O-ring for combustion tube
12 Lower O-ring for combustion tube
13 ring for lower furnace lock
14 Combustion tube
15 Induction coil
16 Nuts for furnace housing
17 Upper furnace closing



- Remove the furnace housing by just loosening the nuts **(16)**.
- Unscrew the knurled nuts **(1)** and washers **(2)**.
- Unscrew the wing nuts **(3)**.
- Unscrew the nut **(4)** and the detach tube **(5)**.
- Remove the furnace cleaning system, by pulling the mounting **(6)**.
- Unscrew the nut **(7)** and the detach tube **(8)**.
- Unscrew the wing nuts **(9)** and pull down lower furnace lock **(10)**.
- Pull-off the lower O-ring **(12)** from the combustion tube, remove the combustion tube **(14)** by pulling it up; remove the upper O-ring **(11)**.
- Apply a **thin** layer of grease on the inner surface of the new O-rings **(11)** and **(12),** before mounting them. Apply a **thin** layer of grease on the outer surface of the combustion tube, where the new O-rings will be placed.
- Reinstall in reverse order.

3.8 Replacing the generator tube

CAUTION: HIGH VOLTAGE!
Turn the mains switch to pos. 1 and unplug the mains power plug!



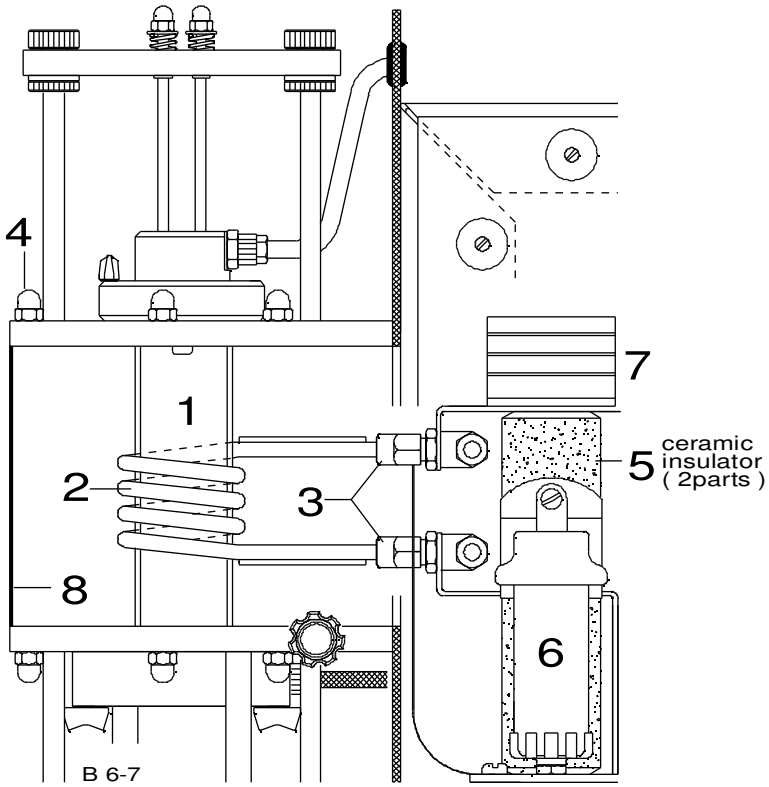
1 Generator tube
2 Anode connection
3 Screw
4 Socket
5 Coil
6 Nut SW12
7 Furnace cover
8 Upper cap nut SW8
9 Oscillator housing
10 Screw
11 Quartz tube

ATTENTION:

In order for the oscillator housing to be properly screened against radio frequencies, all screws **(10)** must be properly tightened ; otherwise there is a risk of radio frequency disturbance.

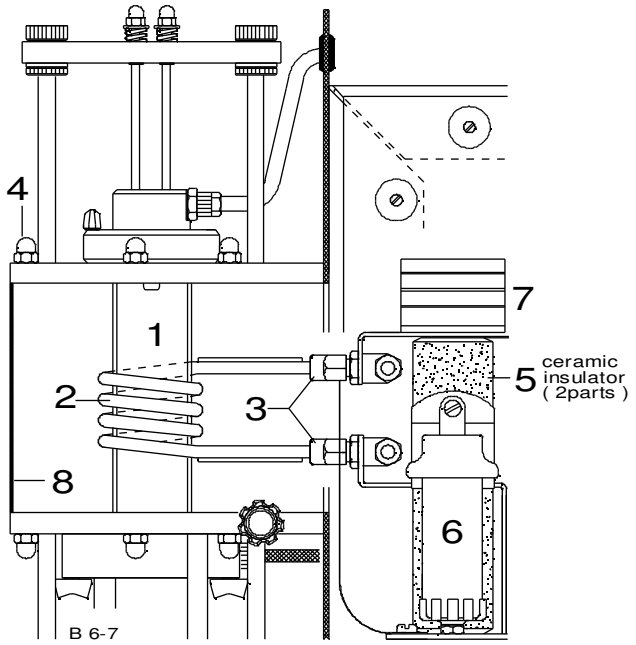
3.9 Changing the combustion coil

1 Combustion tube
2 Coil
3 Nut SW12
4 Cap nut SW 8
5 Ceramic insulator (2 parts)
6 500 pF capacitor
7 Cooling system
8 Furnace cover



- set the mains switch to **position 1**.
- loosen the upper cap nuts **(4)** (SW 8).
- detach the cover **(5)**.
- remove the combustion tube **(1)**, see 3.7.
- remove the nut **(3)**.
- remove the coil **(2)**.
- refit the coil **(2)** in the reverse order.

1 Combustion tube
2 Coil
3 Nut
4 Fastening for the coil arms
5 Ceramic insulator (2 parts)
6 500 pF capacitor
7 Cooling system
8 Furnace cover



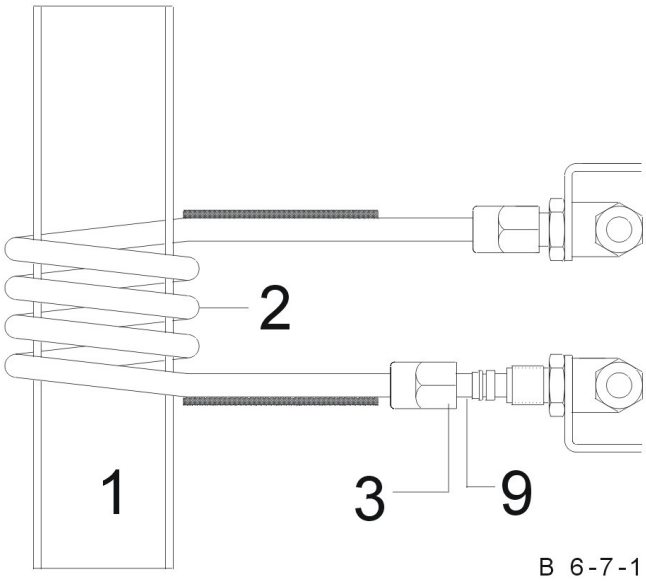
IMPORTANT:

The fastening for the coil arms **(4)** are adjusted to ceramic and metal material. Therefore it is necessary to use minimum force to change the coil **(2)**. While tightening or loosening the nuts **(3)** it is advisable to counterbalance the upper and the lower ceramic insulator **(5)** to avoid damage. **(they are sensitive and might crack or break).**

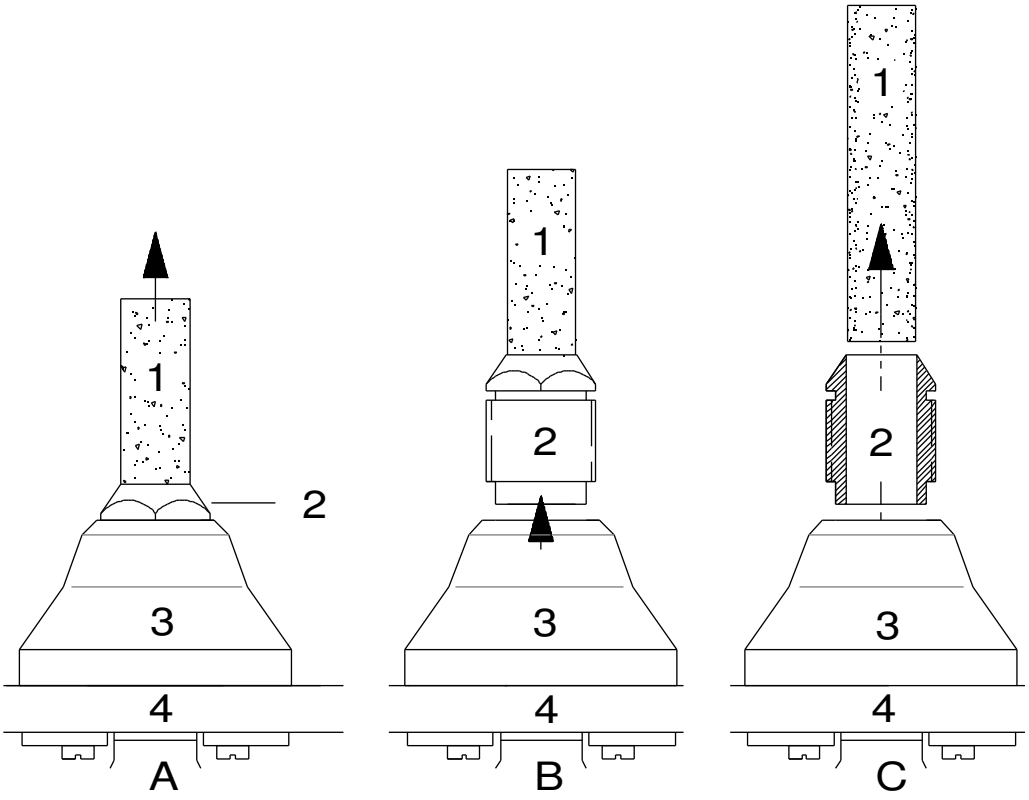
The contact of the coil arms is of great importance. A poor contact causes heating and oxidisation, so that the contact progressively deteriorates. It is advisable to clean the contact surface **(9)** and the screw fitting (threads) **(3)** with a thin wire brush to obtain the proper connection. See **drawing below**.

The coil **(2)** should be positioned so that it does **not touch** the combustion tube. For this reason, the nuts should not be pulled tight until the combustion tube **(1)** has been fitted. The nuts **(3)** should be tightened far enough, for the coil to be properly clamped at the ends.

1 combustion tube
2 coil
3 nut
9 contact surface

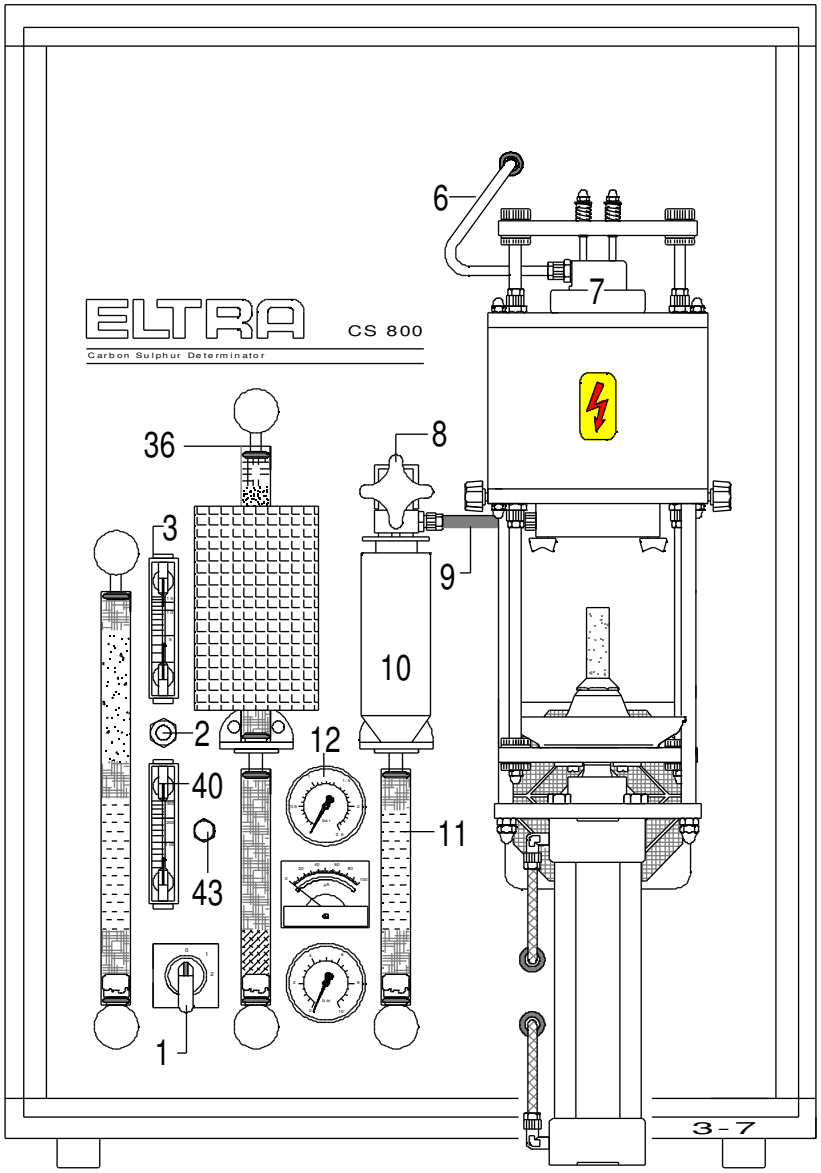


3.10 Removing the pedestal



A: Remove the pedestal **(1)** from the furnace closing mechanism by lifting.
B: If the pedestal can not be easily extracted unscrew with a **24 mm** spanner the nut **(2)** from the cone **(3)**.
C: This will give access to the bottom off the pedestal allowing its extraction. When fitting nut **(2)** to cone **(3)** ensure there is no dust in the threads of the components. A vacuum cleaner can be used to clean the threads prior to assembly.

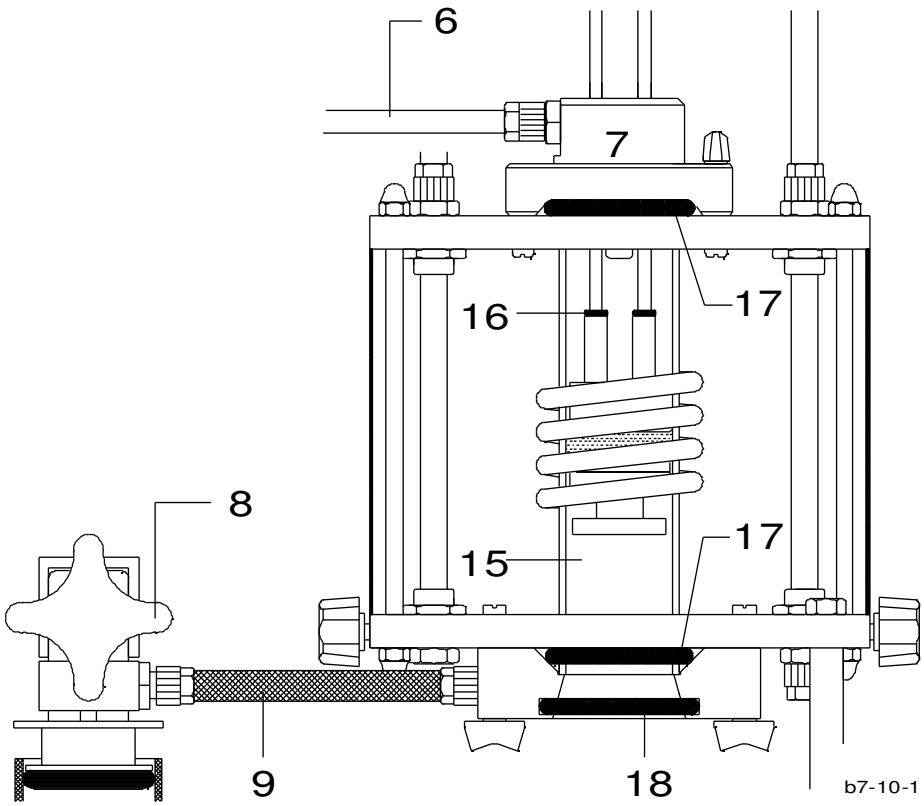
3.11 Checking for gas leaks



- Set the power switch **(1)** to **pos. 2**.
- Close the furnace.
- Press and hold the button **(43)**. The entire system will be checked for leaks.

  After about 5 seconds of initial pressure drop, the pressure on gauge (12) remains constant, then the leakage test is completed. The gas system is ok.

- Should there be a continuous pressure drop, then release the button **(43),** open the furnace, and press and hold the button **(43)** again. If the pressure still decreases, then the leakage is situated inside the analyser. Contact a local **Eltra** agent or **Eltra GmbH** directly.
- If the pressure remains constant after an initial drop, then the fault can either be found inside the furnace or in its proximity.



- Release the button **(43),** close the furnace, squeeze the tube **(6) tightly** and press and hold the button **(43).**
- If the pressure on gauge **(12)** remains constant, then the furnace has to be checked for leaks.
- If the pressure shown on gauge **(12)** drops, then the leakage has to be found somewhere along the furnace inlet system.

Leaks in the furnace inlet system:

- After following the above instructions, check the inlet tubes **(6)** for leakage.

Leaks in the furnace:

- After following above instructions, close the furnace, squeeze tube **(9) tightly**, press and hold the button **(43),** observe the pressure gauge **(12)**.
- If the pressure drops, then the furnace is leaking. Check whether the O-rings **(16), (17)** and **(18)** are dirty or defective. See **3.4**. Check whether the combustion tube **(15)** is broken or cracked.
- If the pressure remains constant, then the leakage has to be found in the furnace outlet system.

Leaks in the furnace outlet system:

After following the instructions in the section **„Leaks in the furnace“**, **check if the handle (8) is properly shut**, or else there will be a major gas leakage from the dust filter. Check the dust trap **(10)** and the glass tube **(11)** for leakage.

4 DESCRIPTION OF FUNCTIONS

System overview.

The CS-800 automatic analyser incorporates the latest in combustion technology. It is designed for the rapid simultaneous determination of carbon and sulphur in **steel, cast iron, copper, alloys, ores, cement, ceramics, carbides, minerals, coal, coke, oil, ashes, catalysts, lime, gypsum, soils, rubber, leaves, soot, tobacco, waste, sand, glass** and other solid materials.
The CS-800 can be supplied with up to four independent infrared cells. The basic configuration of the instrument is two IR-cells for carbon and two IR-cells for sulphur. This configuration offers optimum precision for the analysis of high and low levels of the chosen element. The change over from the low to the high range is done automatically during the analysis and doesn't require any pre-setting by the operator.

4.1 Measuring principle

The measuring procedure is based on sample combustion and measurement of the combustion gases on a method of infrared absorption.

During combustion, the sulphur and carbon components present in the sample are oxidised to form **CO_2** and **SO_2**.

Combustion is obtained by supplying **oxygen**, which at the same time acts as carrier gas. An electronic flow regulator keeps the flow quantity at a constant level of **180 l/h** (unless the analyser is a special model).

Dust traps and a moisture absorber ensure that a dry, dust free gas mixture is supplied to the infrared cells.

The signals emitted from the infrared cells are selective and correspond to the **CO_2** and **SO_2** concentrations in the gas mixture. They are electronically linearised and integrated, divided by the sample weight and digitally displayed as **%C** and **%S**.

Since the sample weight is taken into account, the results are not dependent on the weight. For this purpose, the sample is weighed before being analysed and entered into the PC. If necessary, blank values can also be entered; the software takes them into account when determining the results.

The analyser is operating connected to PC, with the software **"UNI"** for controlling the analyser. **For the instructions on software, please, refer to the Help-function of the software.**

The graphical representation of the detectors' signals (peaks) is shown on the PC's screen during and after analyses. At the end of analysis the results are displayed as well. All analysis data for every finished analysis are saved in the PC and remain available for review, results recalculation, calibration, etc. and can be printed out on a printer or exported to other software, if necessary.

4.2 Gas flow system

The **oxygen** supply is connected to the inlet of the **oxygen** system. Pure **oxygen** is available in steel bottles. The **99.5%** purity is fully sufficient. Any **CO_2** or **H_2O** which may be contained in the **oxygen** is retained in the **H_2O** trap. The upper half of the trap is filled with a **CO_2** absorber and the lower half with a **H_2O** absorber.

Magnesium perchlorate (anhydrone) acts as a **H_2O** absorber. **Sodium hydroxide** acts as a **CO_2** absorber, preferably with an indicator, so that the degree of saturation can be seen from the coloration.

The **oxygen** inlet pressure should be **2 to 4 bar**, which is then regulated inside the analyser to **1.5 bar**, as shown on the pressure gauge. Any pressure fluctuation of the external **oxygen** supply has no influence on the accuracy of the measurements.

The **oxygen** combustion then enters the furnace through the **oxygen** valve. A pressure switch informs the **electronic module** as to whether there is sufficient pressure in the furnace to begin the analysis. And it can also detect whether the furnace is open or shut.

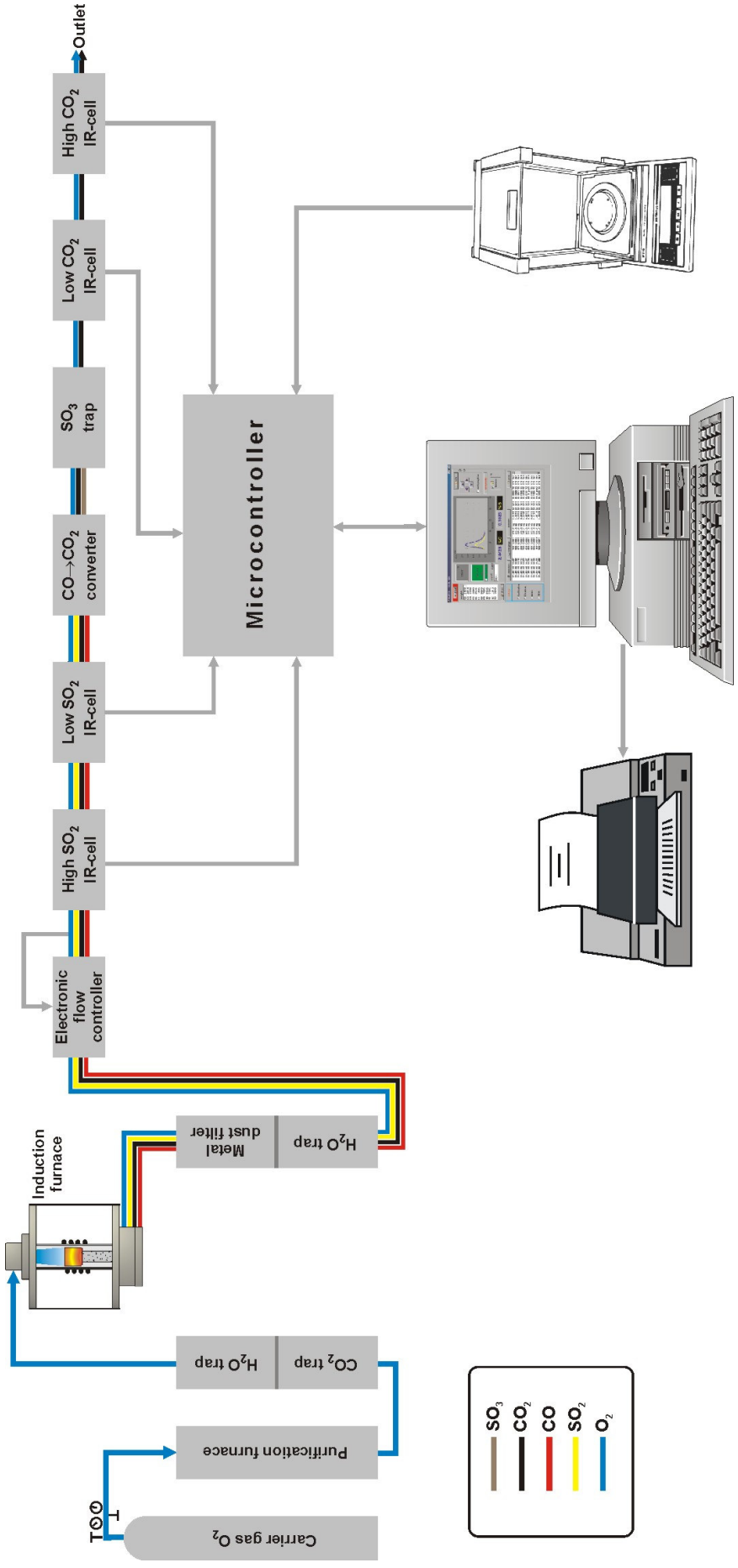
The **combusted gases** from the furnace flow first through a dust trap and then through a **H_2O** absorber. Via the bypass valve, they reach the **electronic controlled** regulating valve, which is the adjusting element of the **electronic flow** regulation. Before reaching the **flow regulating** valve **V6**, the gas pressure is **0.35 bar**; therefore it is virtually an **atmospheric pressure** and flows constant, at a precisely controlled rate.

Then, the gas flows through the **SO_2-selective channels** of the **infrared cell**. Any **CO**, that may be present, is **oxidised** to **CO_2** in the catalyst furnace filled with the copper oxide. Unwanted **SO_3**, which results thereby from **SO_2**, is retained in the cotton wool-filled **SO_3** trap.

A flow indicator allows the gas flow to be **visually** monitored. The flow rate is set internally to **180 l/h**. The exact level of the flow is not important, since the calibration of the analyser takes this into account.

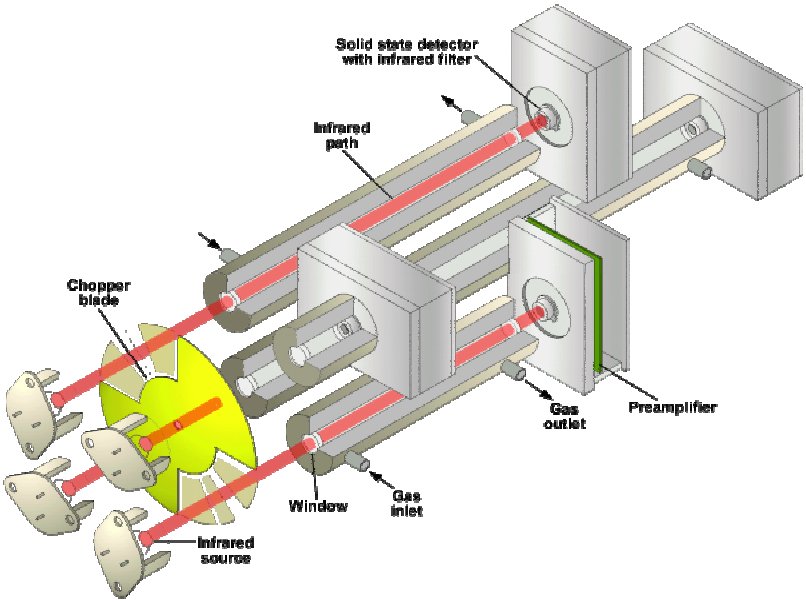
It is extremely important that the flow rate is constant. The **electronic board** ensures this. A slight **deviation** from the standard value or a **conflict**, as with mechanical regulators, cannot arise. The regulation either functions **precisely**, in which case the flow rate is correct or, in the event of a **defect**, the flow rate is completely **blocked** or extremely **high**.
See **next page**.

Gas flow diagram



4.3 Infrared cell

The measuring principle is based on the infrared radiation absorbing property of many gases. Each of these gases absorbs specific characteristic spectral wavelengths of infrared radiation. The absorption spectrum is determined by the number, configuration and type of the atoms in the gas molecules.



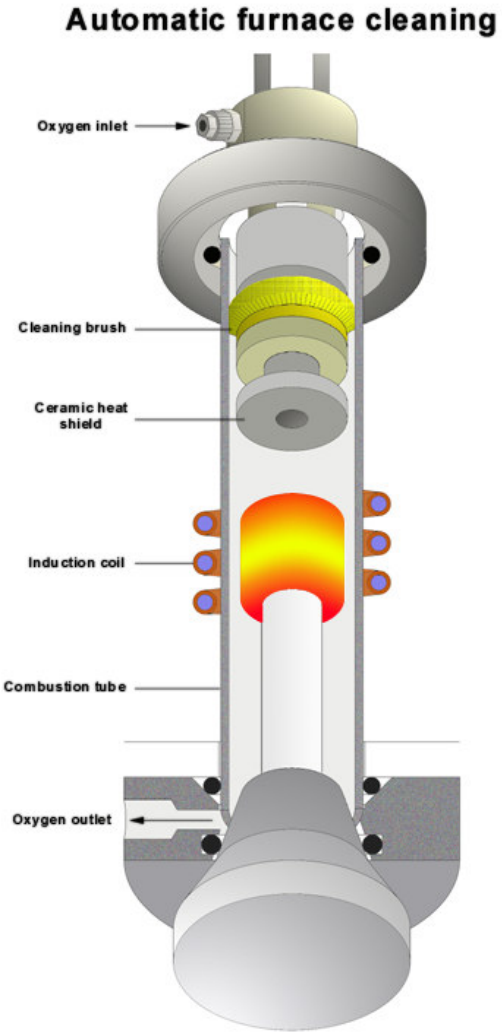
An infrared source is electrically heated and radiates broad-band infrared radiation. The light is interrupted by a rotating chopper blade, resulting in an alternating light. The chopper is crystal controlled, so that the chopper frequency is highly stable. The infrared radiation then passes through the measuring IR-paths, through which a mixture of combustion gases and carrier gas flows.
Depending on the composition of the gas mixture, certain frequencies of the infrared spectrum are absorbed. The rate of absorption depends on the concentration of the gases.
As the infrared beam leaves the IR-path, it passes through an infrared filter, which only allows a narrow band of infrared radiation to pass. This narrow band must correspond to the IR wavelength for which the sample gas shows its maximum absorption capacity. The intensity of the radiation after the filter thus corresponds to the concentration of a specific gas in the path. The beam finally strikes a solid state infrared detector, which emits an electrical signal, in proportion to the intensity of the beam. Since the beam is interrupted by the rotating chopper, as mentioned above, the detector receives an alternating signal. Temperature and aging influences of the detector, as well as noise, are thereby suppressed. The signal thus obtained is amplified and rectified, so that it leaves the infrared cell as a d.c. value.
The infrared cells of the CS-800 do not require any manual zero adjustments. The zero and sensitivity adjustments of the infrared cells are permanently and automatically controlled by the electronics. The detectors utilize solid state sensors combined with infrared filters. The sensors are not gas filled, thus eliminating long term problems due to gas leakage. The CS-800 can be equipped with up to four independent infrared cells.
The lengths of all four cells can be individually optimised to obtain maximum precision for the target analysis levels of each customer. Each of the cells can be installed with infrared absorption lengths ranging between 1 mm and 320 mm.
The infrared cell rack is temperature controlled, so that the sample gas which flows through it, is kept at a constant temperature.

4.4 Furnace

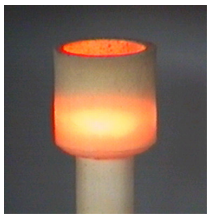
The combustion is carried out in a **high frequency induction furnace**. The sample is inserted into the induction coil of the oscillating circuit of the pedestal, then heated by high frequency induction and combusted by supplying **oxygen**.
By starting the analysis, the **HF generator's** high voltage supply is switched on. Inside the coil, a quartz tube is fitted to an **upper** and a **lower** holder. The gas flows **downwards**. The furnace inlet leads through a lance, which blows the **oxygen** for combustion **directly** into the crucible and onto the burning sample. When the sample is inserted into the furnace by the pedestal, the lower opening of the quartz tube is closed with the sealing cone.

Automatic induction furnace cleaning.
The users of **carbon** and **sulphur** analysers with the induction furnaces knows that dust accumulates during the combustion (mainly of **iron** and **tungsten oxides)** in the combustion chamber.
The **CS-800** furnace is cleaned **automatically** after each analysis, thus ensuring repeatable and accurate results. The **standard** cleaning apparatus is mechanically attached to the furnace **open/close system**, to ensure that the cleaning brush will not collide wit the hot crucible.

The cleaning brush will never burn !
The **efficient** design of the cleaning mechanism rules out any possibility of the cleaning brush to catch fire.
To confirm this fact, **ELTRA** offers **free** replacement of each burned cleaning brush, during the entire working life of the analyser.



- After each **analysis start**, a **thyristor** switches the high voltage transformer **"smoothly"** on, to prevent any current surge in the main power supply and therefore eliminating the risk of blowing any **fuses**.
- The **induction coil** is cooled internally with **compressed air**. The **outside** is cooled by the blower, which also ventilates the generator.
- The induction furnace uses standard ceramic crucibles, which are **1"** or **25 mm** in diameter.

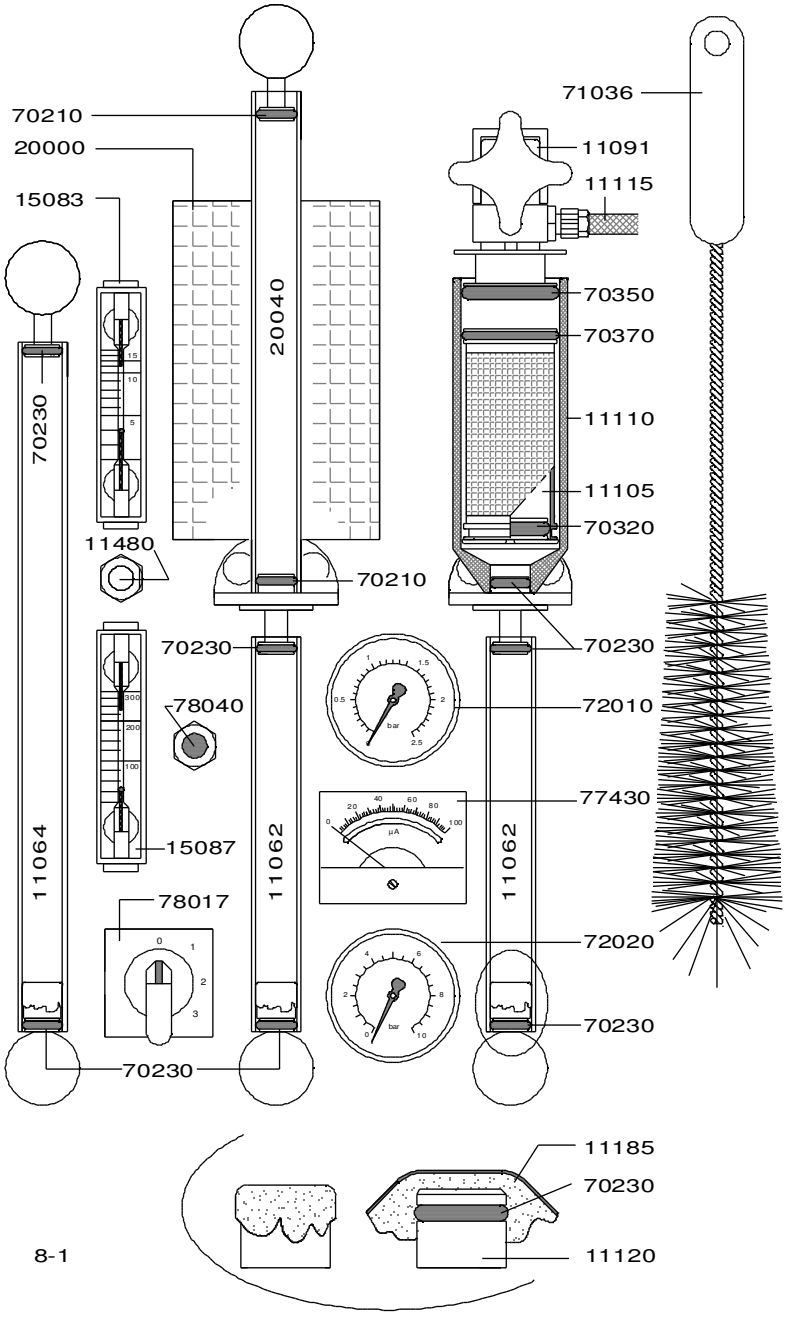


5 MISCELLANEOUS

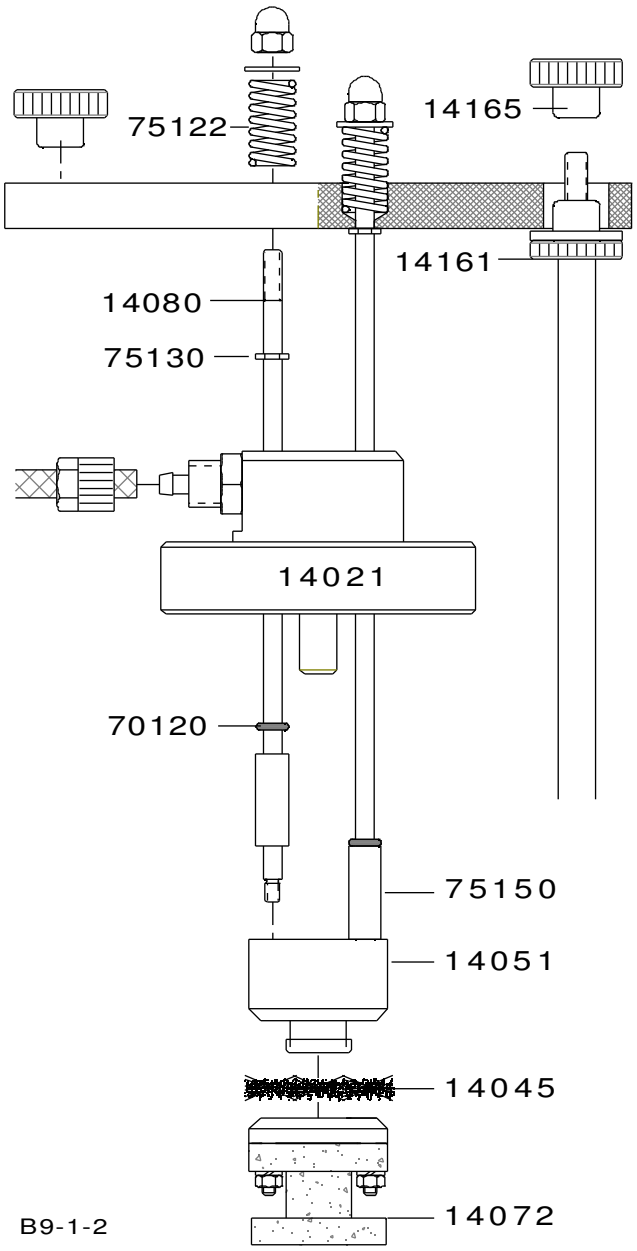
5.1 Ordering numbers

Front side

11062	Reagent tube
11064	Reagent tube
11091	Dust trap mechanism
11105	Metal dust filter
11110	Filter housing
11115	Furnace outlet tube
11120	Paper filter holder
11185	Paper filters
11480	Adjustable restrictor
15083	Gas flow indicator 15 l/h
15087	Gas flow indicator 300 l/h
20000	Catalyst furnace
20040	Catalyst tube
70210	O-ring
70230	O-ring
70320	O-ring
70350	O-ring
70370	O-ring
71036	Cleaning brush for filter
72010	Pressure gauge
72020	Pressure gauge
77430	Panel meter 100 µA
78010	Main power switch
78040	Button for leakage test



Furnace cleaning

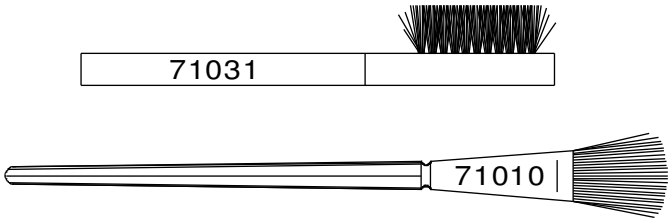


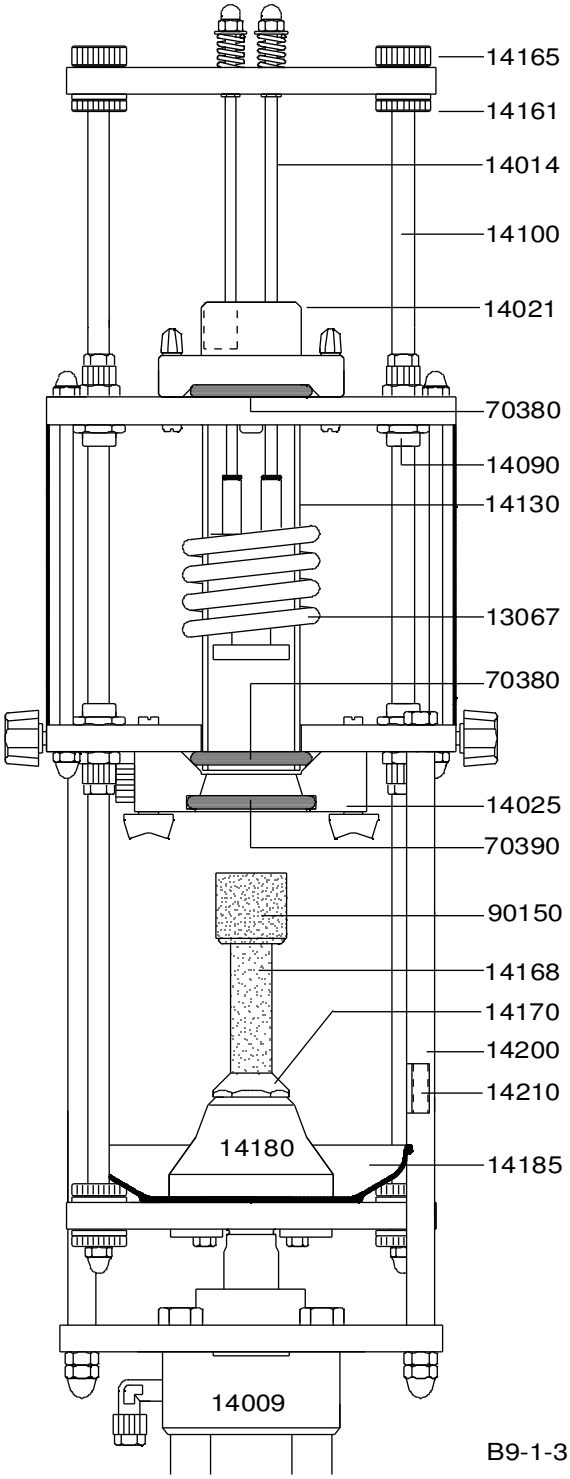
14014 Complete furnace cleaning assembly unit

14021	Upper furnace lock
14045	Cleaning brush for combustion tube
14051	Brush holder
14072	Ceramic heat shield for brush
14080	Cleaning mechanism rod
70120	O-ring
75122	Spring
75130	Safety spring
75150	Metal tube

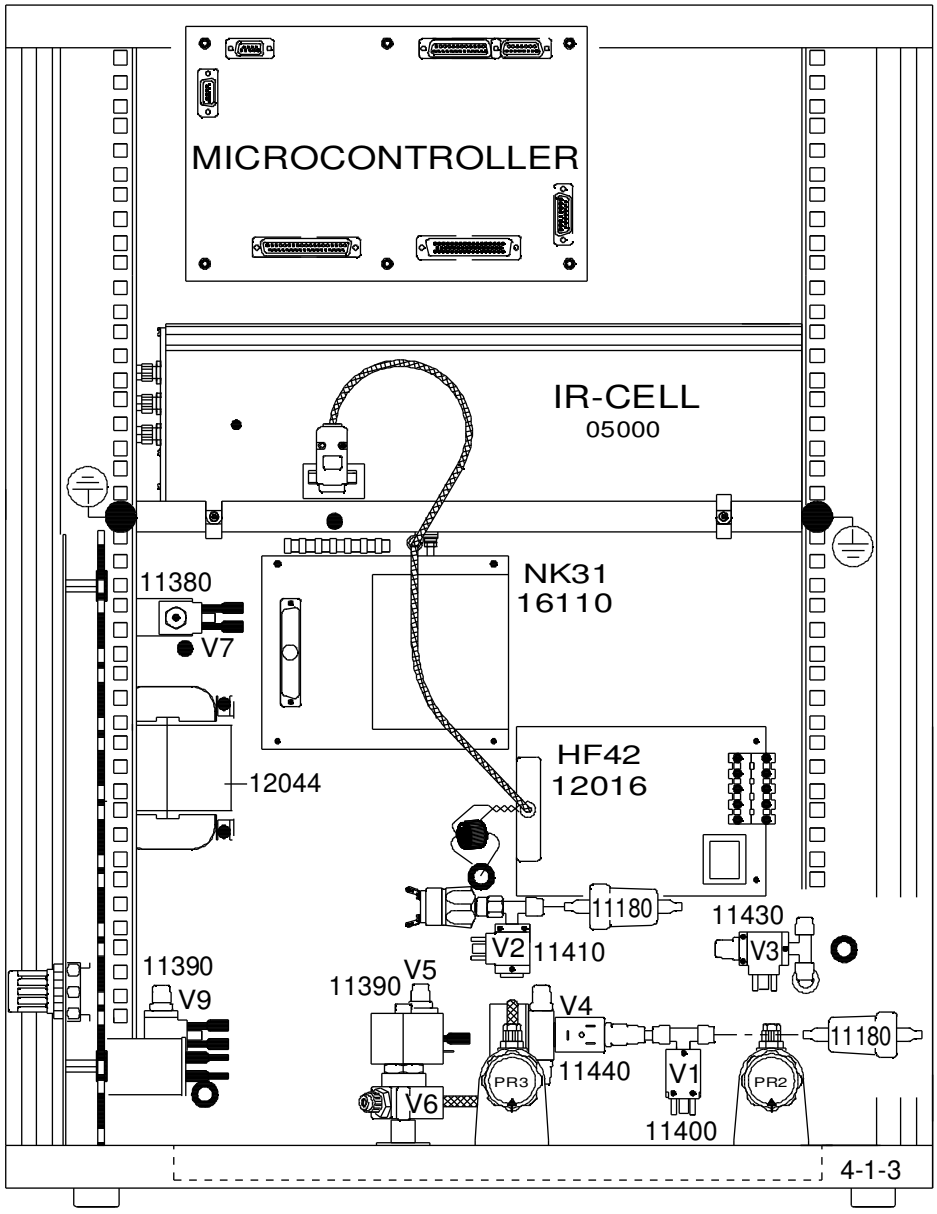
Furnace

13067	Combustion coil
14009	Pneumatic cylinder for furnace lift
14021	Upper furnace lock
14025	Lower furnace lock
14090	Bearing
14100	Mounting rod
14130	Combustion tube
14168	Pedestal
14170	Pedestal mount
14180	Furnace closure
14185	Tray
14200	Metal tube
14210	Threaded rod
70380	O-ring
70390	O-ring
71010	Cleaning brush for pedestal
71031	Cleaning brush for radiation shield
90150	Crucibles



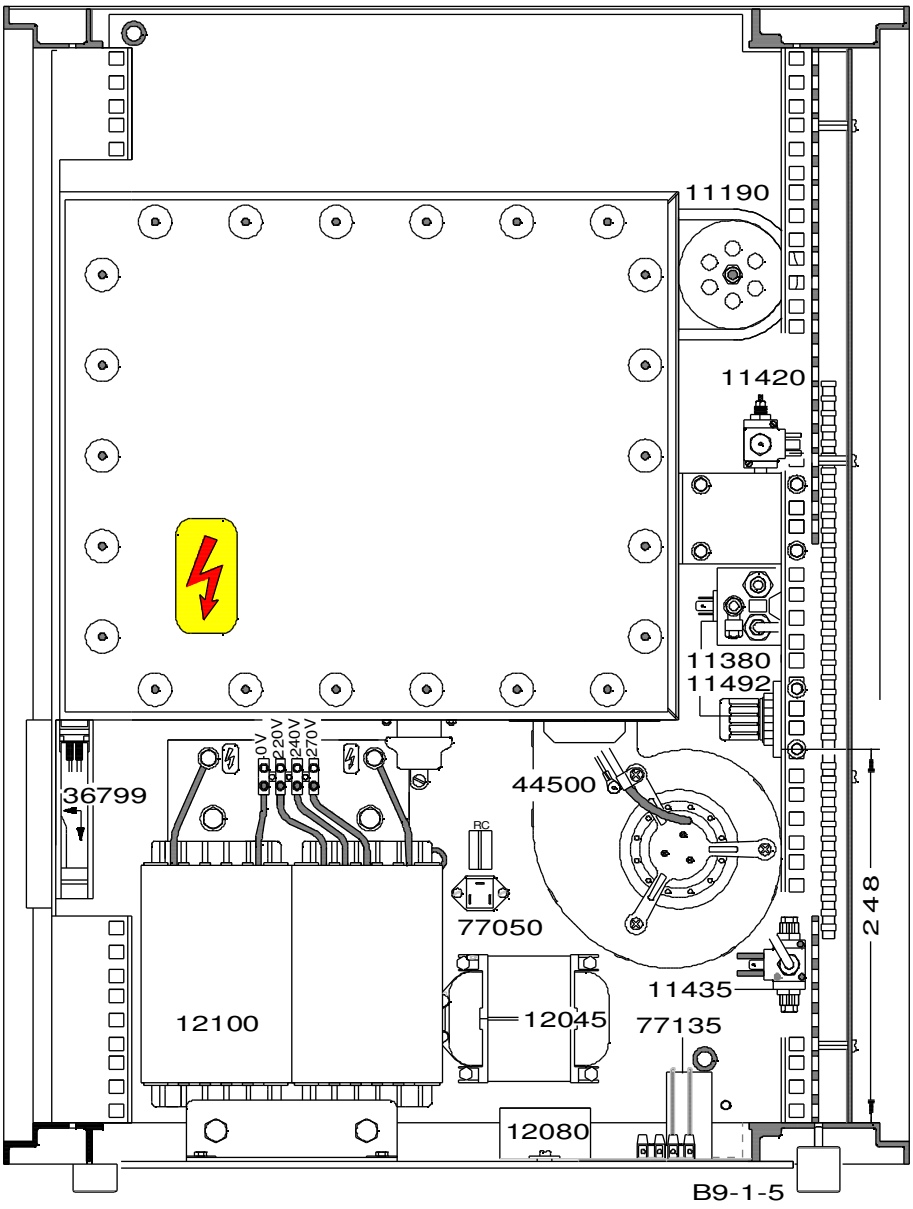


Left side
Separator plate side



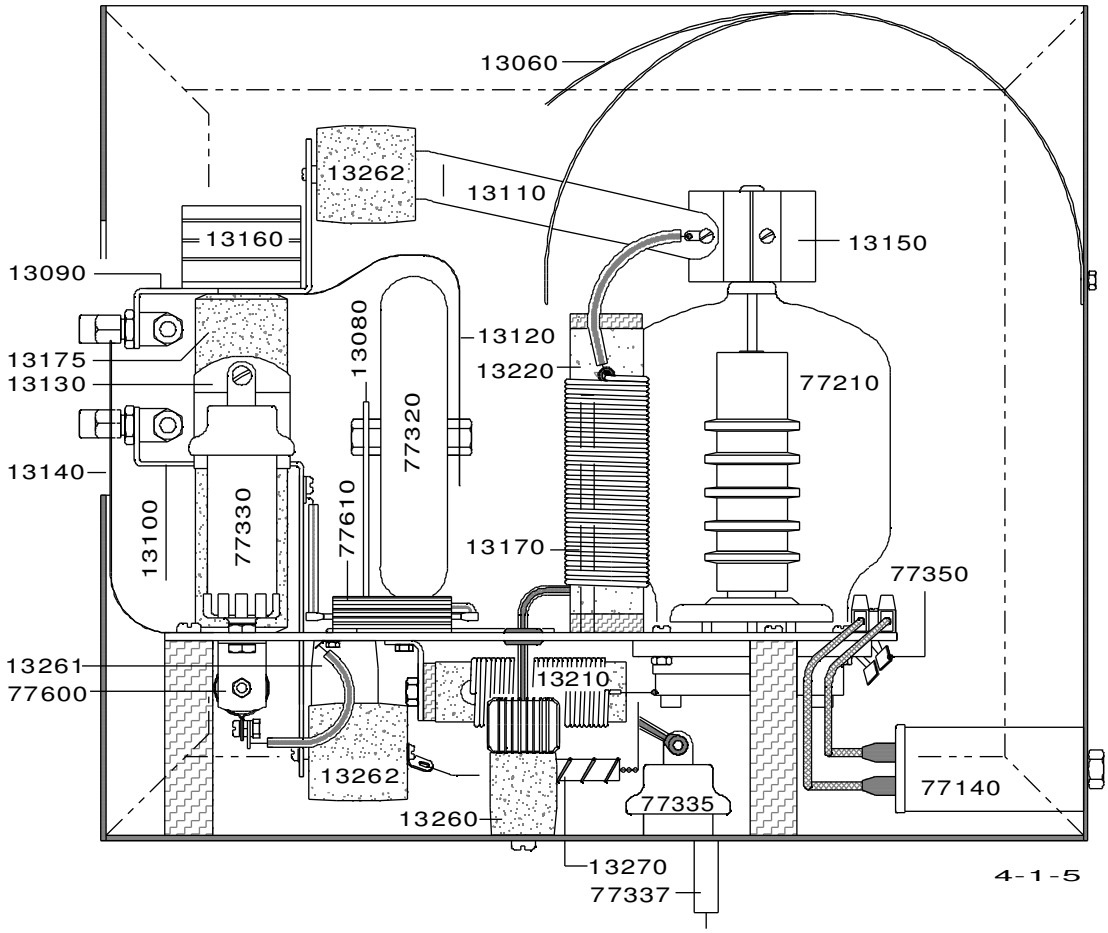
05000	IR-cell
11180	Dust cartridge
11390	Oxygen solenoid valve
11400	Pressure outlet solenoid valve
11415	Oxygen stop solenoid valve
11430	Purge solenoid valve
11440	Bypass solenoid valve
12016	Gas flow and furnace control board HF 42
12044	Transformer
16100	Power supply board NK 31

Right side
Ventilation



11190	Exhaust muffler
11380	Pneumatic valve
11420	Coil cooling solenoid valve
11440	Pressure switch-over solenoid valve
11492	Pressure regulator
12045	Transformer
12080	Rectifier
12100	Transformer
44500	Centrifugal blower
77050	TRIAC
77135	Capacitor

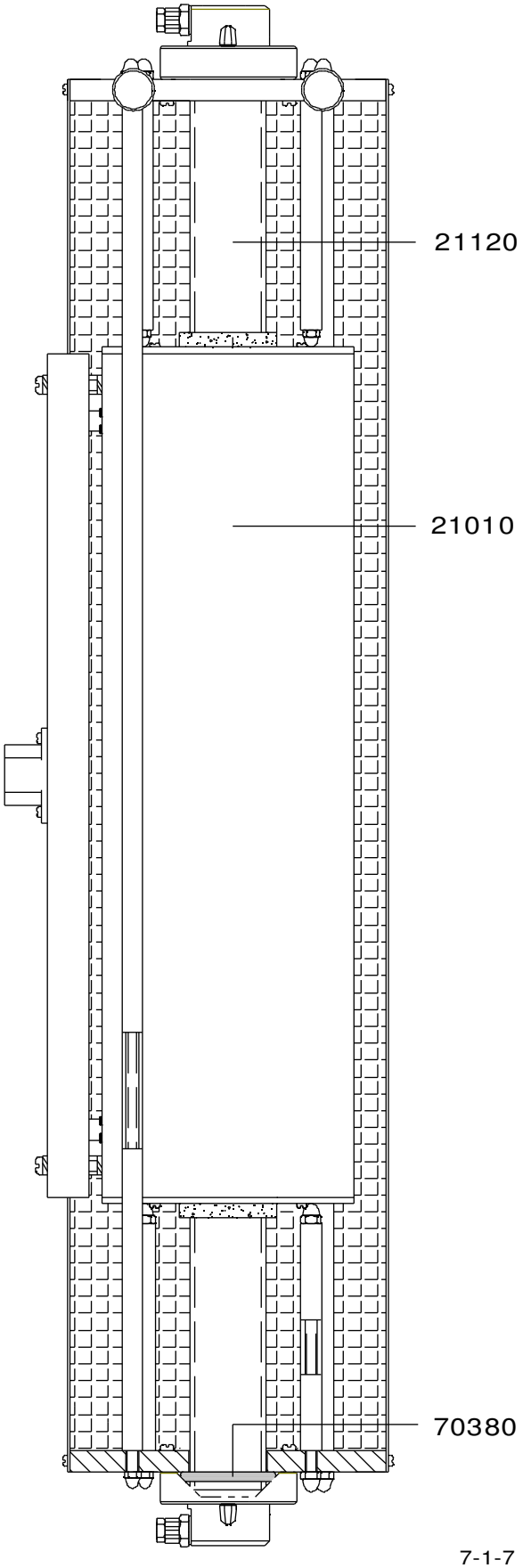
Oscillating circuit



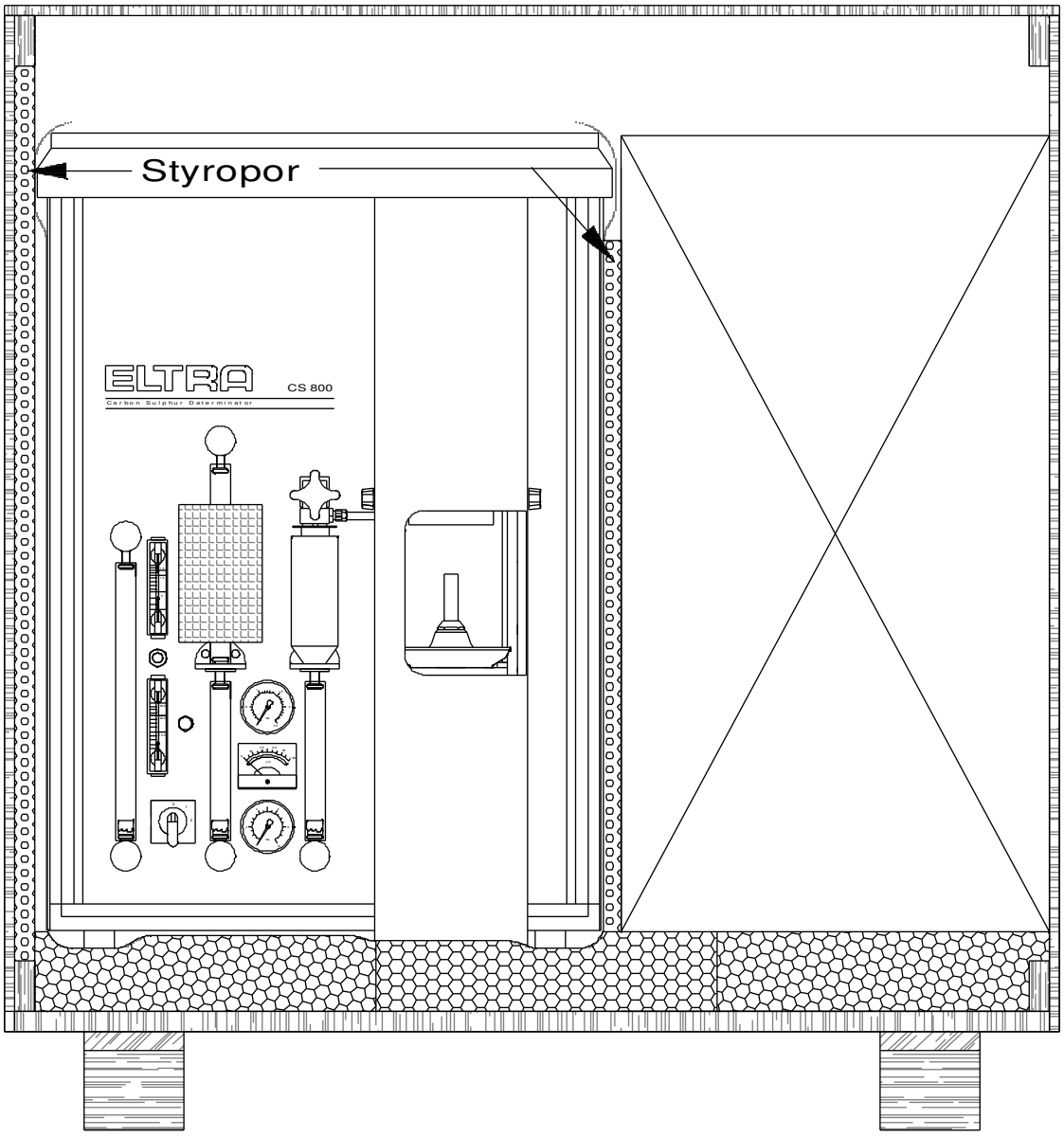
13080	Capacitor support	77140	HF - filter 250V
13090	Upper coil connector	77210	Oscillator tube
13100	Lower coil connector	77320	Capacitor
13110	Anode connector	77330	Capacitor
13120	Capacitor connector	77335	Capacitor
13130	Capacitor connector	77350	Capacitor
13140	Ground connector	77600	Resistor
13150	Anode heat sink	77610	Resistor
13160	Coil heat sink		
13170	Radiation shield		
13175	Insulator		
13210	Grid choke		
13220	Anode choke		
13250	Chassis support		
13260	High voltage filter		
13261	Capacitor		
13262	Capacitor		
13270	Resistor		

Oxygen purifying furnace

21010	Heather section
21120	Quartz tube
70380	O-Ring



5.2 Packing



Before packing, the analyser and furnace must be wrapped in plastic foil, to protect it from moisture and dust, and then to be placed in a wooden case. The wrapped analyser, should be surrounded by a layer of **foam (chips)** of at least **10cm**, in order to avoid any **damage** due through transportation.

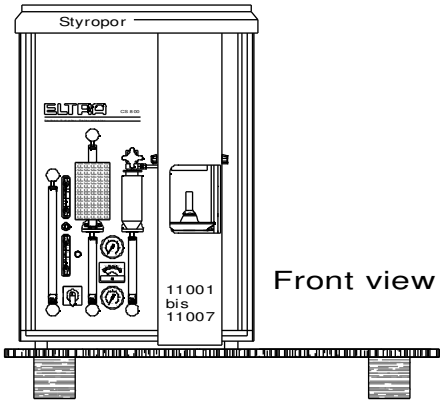
Especially the foam where the analyser is placed on, is very important. It should neither be too hard nor too soft. When the foam is too soft, the analyser will practically touch the wood. Fix the foam on the bottom of the wooden case by gluing.

The analyser and the furnace should be wrapped in plastic foil, especially when you use chips or any other kind of material in small pieces. **The glass tubes must be empty.**
In case of transportation by vessel, use a seaworthy crate.

Packing is done as follows

Front view

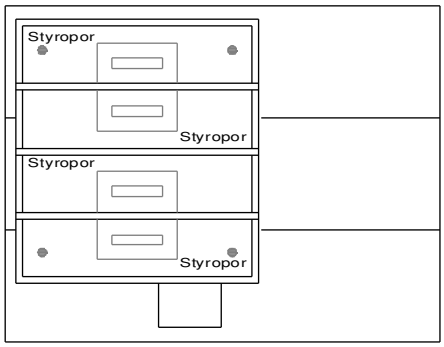
a. Place the analyser directly on the pallet with the right side towards the middle of the pallet, because the furnace and the transformer are the heaviest parts of the analyser.



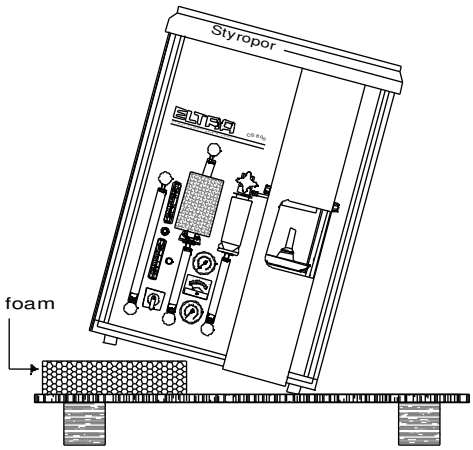
Front view

Top view

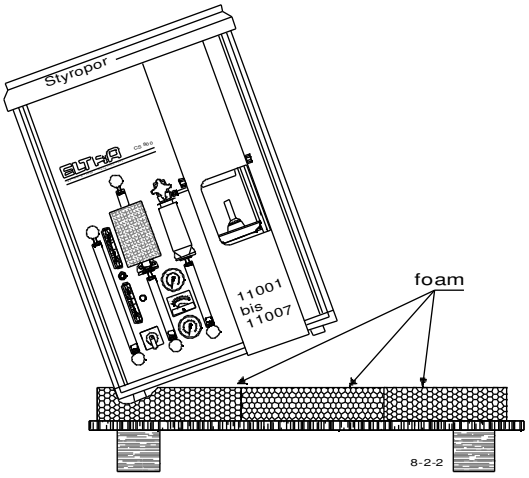
b. Shift the analyser to the exactly required position.



c. **Foam**
Tilt the analyser to the furnace side and place a piece of foam at the right position.



d. **Foam**
Tilt the analyser to the other side and place the second piece of foam at the right place. If necessary, a third piece of foam can be placed on to the pallet.



5.3 CS-800 pre-installation guide

Following requirements apply, when installing the Analyser Eltra CS-800.

Carrier gas	Oxygen 99.99% pure; 2 - 4 bar (30 - 60 psi)
Compressed air	4 – 6 bar (60-90 psi)
Mains power supply	230 VAC ±10%, 50/60 Hz; 16 A fuse
Analyser dimension	55 x 80 x 60 cm
Analyser weight	ca. 95 kg.It is important to install the instrument on a stable place.

The balance should rest on a vibration free support.

Connections for oxygen and compressed air; outer diameter = R¼". The tubes supplied together with the analyser, carry a connector with G¼" inner diameter.

ELTRA

CONFORMITY CERTIFICATE

We,

ELTRA GmbH
Mainstr. 85, Block 20
D - 41469 Neuss
Germany
☎ : +49 02137 - 12822
Fax: +49 02137 - 12513

herewith declare, that the instrument CS-800 produced and sold by us, has been manufactured in accordance to the following CE standards:

	73/23/EEC	(Low voltage standard)
amendet to:	93/68/EEC	
	89/336/EEC	(Electromagnetic compatibility)

The instruments have been tasted in accordance to the following norms:
EN 61010 part 1 (VDE 0411 part 1)
EN 61010-2-010 (VDE 0411 part 2-010)
EN 55011 Group 2. Class A: 1991+A1: 1997+A2:1966
EN 50082-2: 1995 Parts: EN 61000-4-2, EN 61000-4-3, ENV 50204, EN 61000-4-4, EN 61000-4-6

The Eltra products can only be used in an industrial environment.

This declaration is based on:
Test report(s) of the independent and accredited EMC-Test-Laboratory

ELEKLUFT GmbH
Justus-v.Liebig-Straße 18
D - 53121 Bonn
Germany
☎ : +49 0288 - 6681 - 558
Fax: +49 0288 - 6681 - 792

Any alteration on the instruments without prior authorisation from Eltra GmbH, will cause this declaration to become null and void.

Signed in Neuss on this day of February 18, 1998

Managing Director
(J.Polemitis)

ELTRA

TÜV CERT
DIN EN ISO 9001
Zertifikat: 01 100 0020005

Inspection and Quality Certificate

We herewith confirm that the Eltra products manufactured according to the quality and quantity you require.

Thanks to a thorough inspection before shipment, the instrument, together with its accessories, the consumption materials and spare parts, are free of manufacturing defects and will provide excellent performance.
When treated in a proper way for the required application, according to the specifications from our offer, our order acknowledgement and in accordance with our catalogue specifications, the above products will show good results, and therefore will be used to your entire satisfaction.

Y. Polemitis	2005-01-25	
Name	Date	Signature

Approved Methodologies to Which ELTRA Instruments Conform

ASTM (ANALYTICAL SOCIETY FOR TESTING MATERIALS)

Metals

Instruments	Method	Elements	Materials
CS-2000 CS-800	ISO-9556	C	Steel & Iron
CS-2000 CS-800	ISO-4935	S	Steel & Iron
CS-2000 CS-800 ON-900 ONH-2000	ASTM E-1019	C, S, N, O	Steel, Iron, Nickel/Cobalt Alloys
CS-2000 CS-800 ON-900 ONH-2000	E-1587	C, S, N, O	Refined Nickel
ON-900 ONH-2000	E-1409	O	Titanium and Titanium Alloys
ON-900 ONH-2000	E-1569	O	Titanium
ON-900 ONH-2000	E-1937	N	Titanium and Titanium Alloys
OH-900 ONH-2000	E-1447	H	Titanium and Titanium Alloys
CS-2000 CS-800 CS-500	E1915-97	C, S	Metal Bearing Ores and Related Materials (f.e. tailings, waste rock)
CS-800 CS-2000	UOP-703-98	C,S	Catalysts

Organics

Instruments	Method	Elements	Materials
CS-2000 CS-500	ASTM D-1552	S	Oils & Petroleum Products
CS-2000 CS-500	D-4239	S	Coal & Coke
	D-5016	S	Coal & Coke Ash
CS-2000 CS-500	D-1619	S	Carbon Black
CS-2000 CS-500	PN-93 G-04514/17	S	Coal & Coke
CS-2000 CS-500	DIN EN 13137	TOC	Waste
CS-2000 CS-800 CS-500	ISO-10694	TC/TOC	Soil samples

CERTIFICATE

The TÜV CERT Certification Body of TÜV Anlagentechnik GmbH

Unternehmensgruppe TÜV Rheinland Berlin Brandenburg

certifies in accordance with TÜV CERT procedures that

ELTRA

Entwicklungs- und Vertriebsgesellschaft von elektronischen und physikalischen Geräten mbH
Mainstraße 85
D – 41469 Neuss

has established and applies a quality management system for

Development, Production and Distribution of Analytical Instruments.

An audit was performed, Report No. **002005**.
Proof has been furnished that the requirements according to

DIN EN ISO 9001:2000

are fulfilled.
The certificate is valid until **2006-05-31**.
Certificate Registration No. **01 100 002005**

Deutscher Akkreditierungs Rat DAR TGA-ZM-28-96-00

Düsseldorf, 2003-06-03

First certification 2000

TÜV

TÜV Rheinland Berlin Brandenburg

TÜV CERT Certification Body of TÜV Anlagentechnik GmbH

10/093 BB 03.02_TGA 00