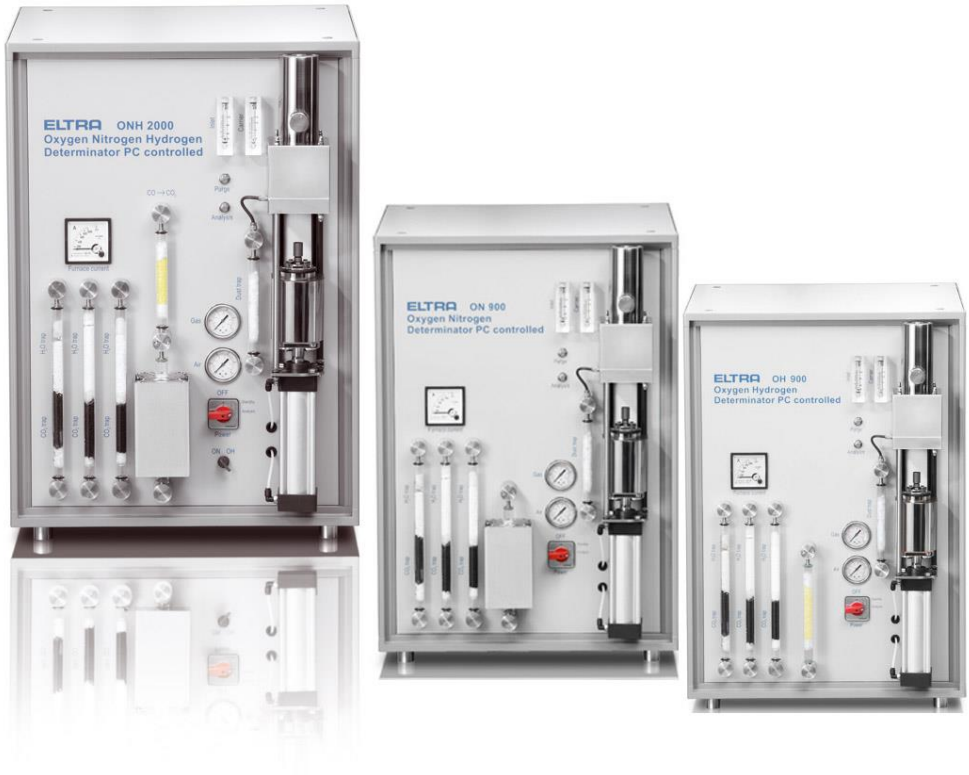
Manual

ONH-2000/ON-900/ OH-900



Translation

ELTRA
ELEMENTAL ANALYSERS

Table of Contents

1 Installation

1.1 Setting check up

Since the analyzer weighs about 130 kg it should be placed on a suitably stable surface. The balance should also be placed on a surface which is free of vibrations. The balance can be placed in any location, although positioning the balance to the right of the analyzer is proven to be best suitable. The balance can of course also be placed on a weighing table next to the analyzer. 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:

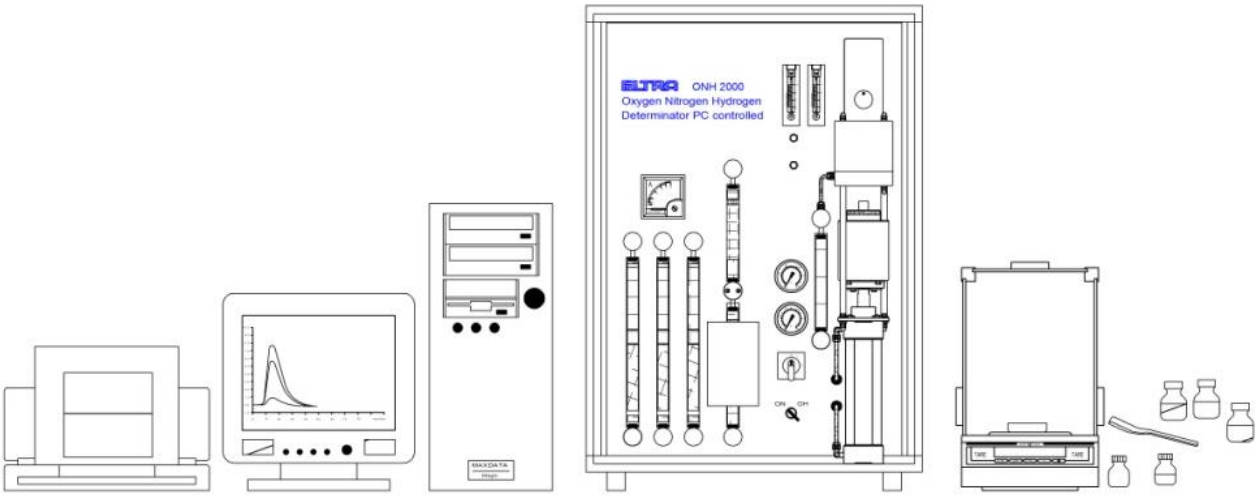


Fig. 1: Installation Example

Although the analyzer'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.

NOTICE

Under no conditions should the device be exposed to direct sunshine!

Avoid places exposed to the wind of air conditioners or to wind blowing through open windows or doors.

NOTICE

Never run the water pump without any water or else it gets damaged.

The pump is activated when mains switch is in pos. 2.

First fill up the cooling system with water, according to chapters ”cooling water” and ”cooling water filling”.

Remark

The analyzers ON900, OH900 and ONH2000 are of similar design. The operation manual is therefore common for all three types. The only difference between them is the tubing and the chemicals.

Fig. 2: ONH-2000

Fig. 3: ON-900

Fig. 4: OH-900

1.2 Front panel illustration

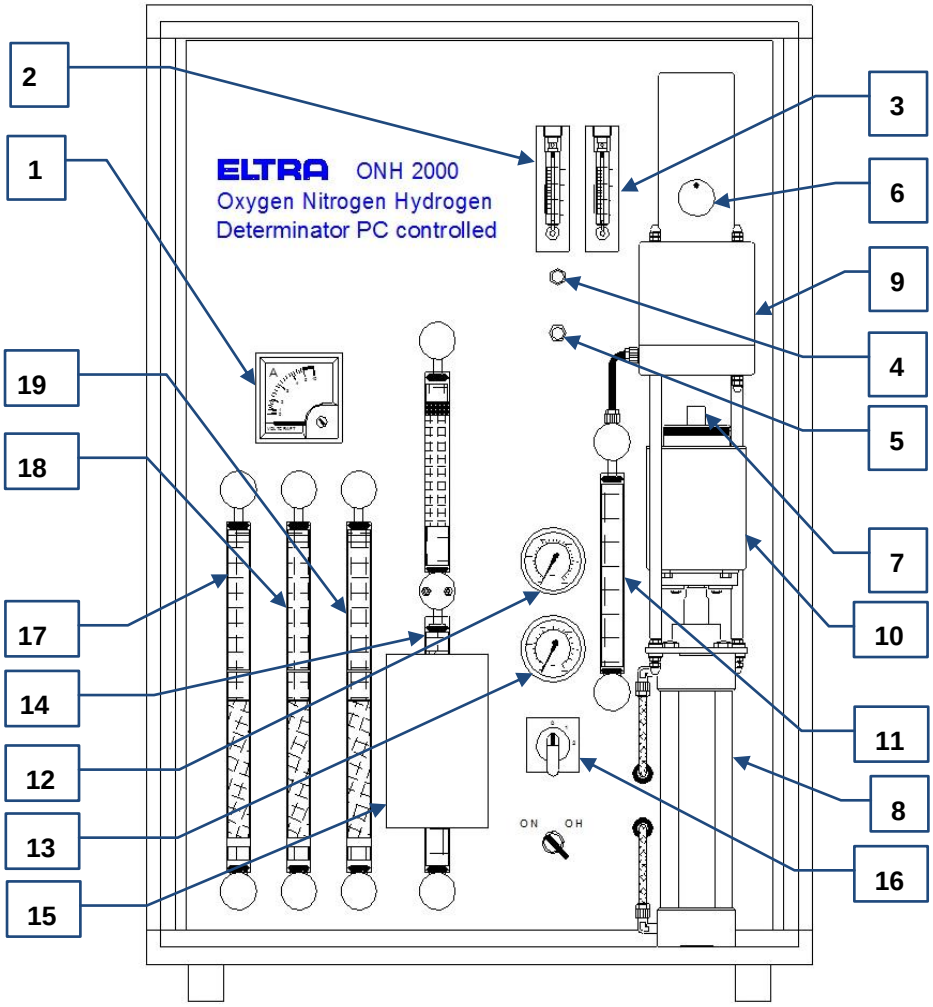


Fig. 5: Front panel

1	Current meter
2	Furnace inlet flowmeter
3	Analytical flowmeter (controlled)
4	Purge flow regulator
5	Analysis flow regulator
6	Sample drop
7	Crucible pedestal
8	Pneumatic lift
9	Upper furnace part
10	Lower furnace part
11	Dust trap
12	Gas gauge
13	Compressed air gauge

14	Copper oxide catalyst
15	Catalyst furnace
16	Main switch
17	Carrier gas pre-cleaning
18	Carrier gas pre-cleaning
19	CO2/H2O-trap

1.3 Mains power connections

Since the infrared cell requires about 1 hour to reach a stable operation temperature, it is advisable to connect the analyzer to the mains power first immediately switch it on before further installation work is carried out.

This waiting time is only necessary when switching on the analyzer from cold condition. It is then normally not switched completely off, in order to always be at constant operation temperature. During long work breaks, the analyzer is on stand-by, which is on position 1 of the mains power switch.

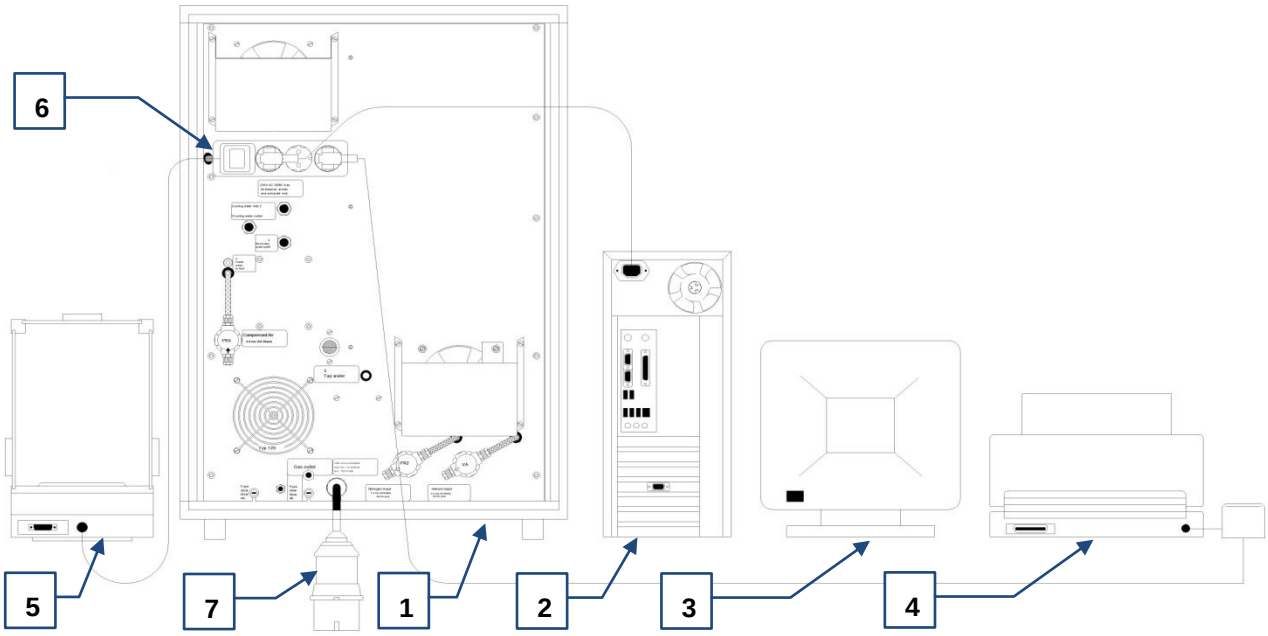


Fig. 6: Mains power connections

1	Analyzer
2	Computer
3	Monitor
4	Printer
5	Balance
6	Quad power socket
7	Analyzer mains power plug

First connect the analyzer to the mains power and switch it on to position 1 in order to win time. The power switch is located on the front panel to the right of the catalyst furnace. Set to position

1. The reason why to first switch on the analyzer is for the detectors to have time to stabilize their temperature while cable connections and software start are made.

1.4 Data Interface

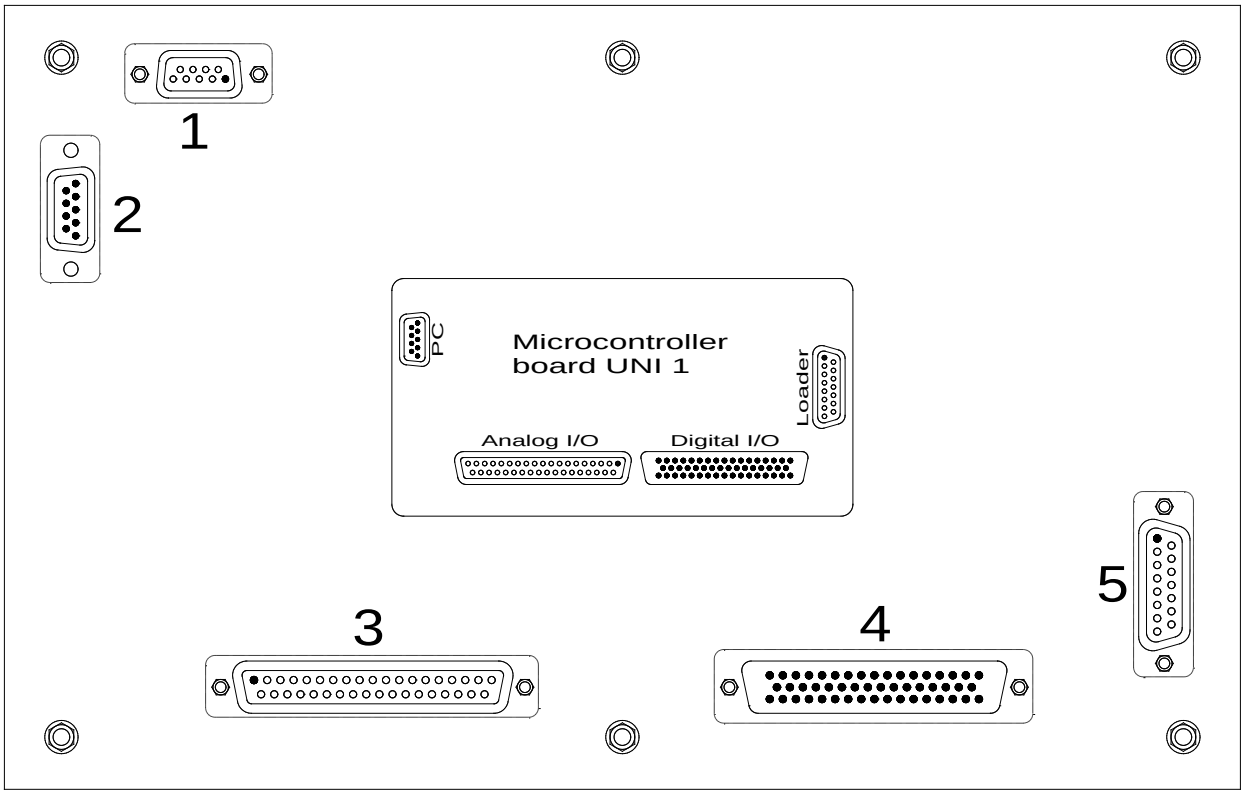


Fig. 7: UNI_1 board

1	Spare serial interface
2	PC connection
3	Analog input/output signals
4	Digital input/output signals
5	Autoloader connection

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

The serial interface of the balance is programmed in order to match the required configuration for weight transfer to the PC.

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

Remark

For information about using the PC for operating the analyzer, refer to the software help manual.

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 in the boxes of peripheral devices supplied with the analyzer. These are adapted to the interfaces when the analyzers are put into operation in our company.

1.5 Tube connections

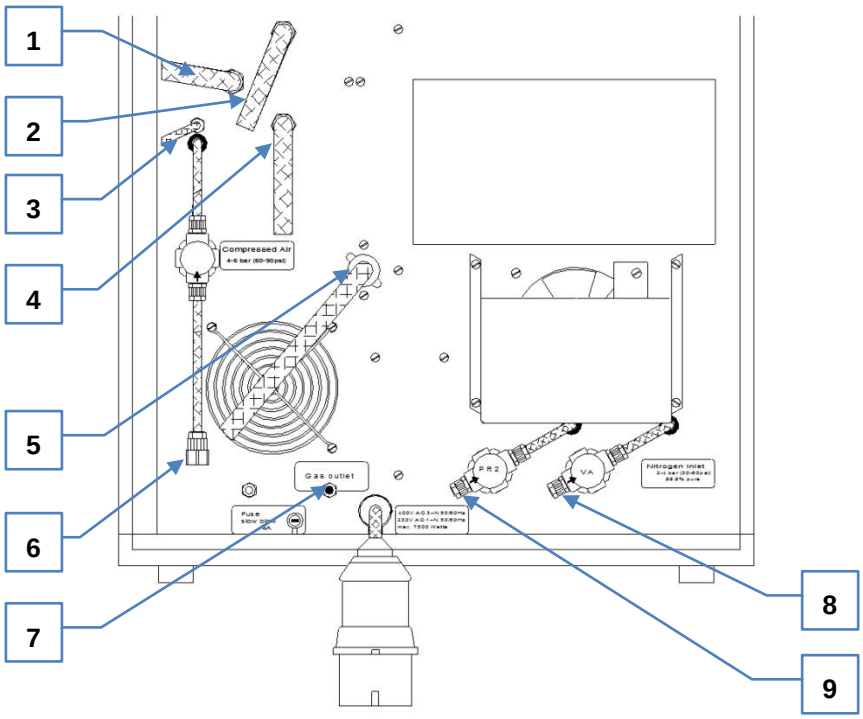


Fig. 8: Tube Connections

1	Cooling water outlet
2	Cooling water inlet
3	Outlet water to tank
4	Secondary cycle outlet
5	Tap water inlet
6	Compressed air 4-6 bar (60 to 90 psi)
7	Gas outlet
8	Helium inlet 2-4 bar (30 to 60 psi)
9	Nitrogen inlet 2-4 bar (30 to 60 psi)

Two gas connections are necessary for the operation of the analyzer. The required tubes are included in the delivery.

Tube (8) and (9) for the carrier gases supplies are with 6mm outer diameter.

Tube (6) for the compressed air has an outer diameter of 4mm.

These are delivered, provided with fittings having for G¼" inner thread pressure regulators.

Copper rings for sealing the fittings are included.

Each tube comes with a length of 5 meters.

Tube fitting (8) connects the analyzer with a helium carrier gas bottle, while adapter (9) connects the analyzer with a nitrogen carrier gas cylinder. These connections must be very secure, since the operating pressure in the tube is 2-4 bar (30 to 60 psi).

Gas connection (6) is for the compressed air supply to the furnace pneumatic cylinder.

Gas connection (7) is for connecting the analyzer's exhaust to ventilation. It is normally not used because only low quantities of CO2 and even lower quantities of N2 result from the sample combustion.

When the analyzer's mains switch is set to position 2, a valve opens, and the carrier gas flows through the gas tubes. The flow rate thru the cells is controlled to a constant flow of 15 l/h and it is displayed on the right hand flow meter. At the same time the cooling water pump starts.

1.6 Cooling water

The ELTRA ONH-2000 has two cooling water circulation systems, a primary and a secondary system.

The primary system provides furnace cooling, and consists of:

– External barrel
– Water pump
– Equalizing tank and furnace.

The cooling water circulates from the barrel to the furnace, via the hose (2). It then returns to the barrel, via the hose (1). Inside the barrel, the water temperature is limited by the cooling coil of the secondary system.

The secondary system starts from the drinking water tap, the water is then fed to the water flow valve via the hose (5). The water then flows to the heat exchange cooling coil inside the barrel, via the hose (4). Finally, the water flows to the drain, via the hose (6)

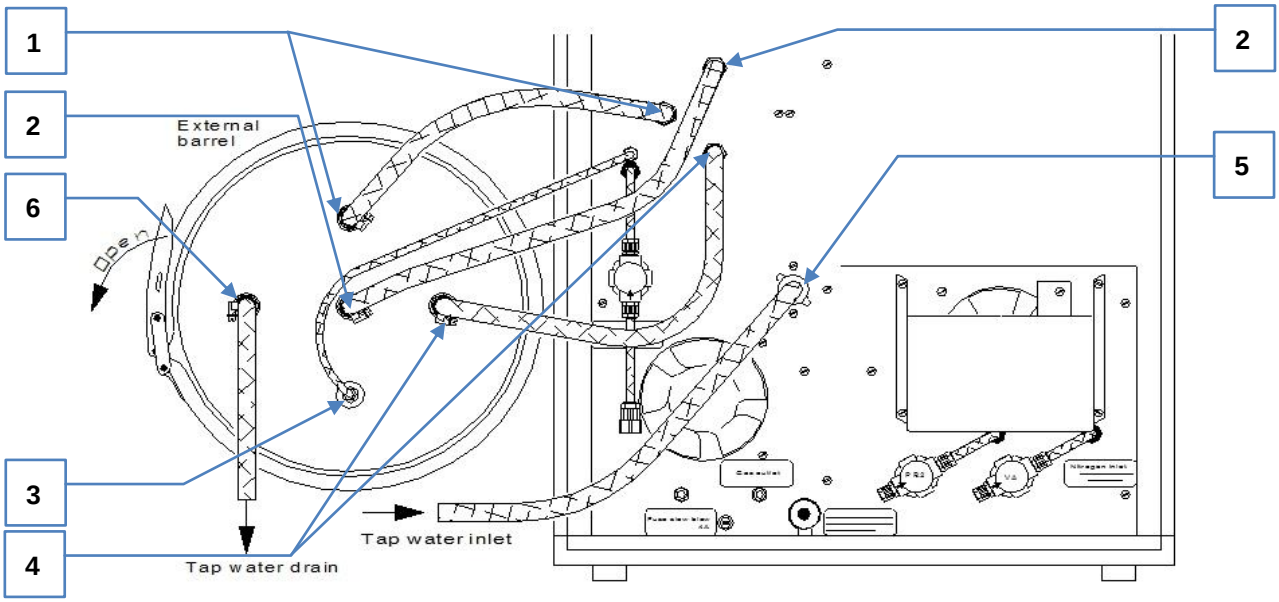


Fig. 9: Cooling water connections I

The analyzer and the barrel are connected as shown in the above drawing.

It is possible to install the barrel at a distance from the analyzer. The barrel should not be installed more than 5m away from the analyzer.

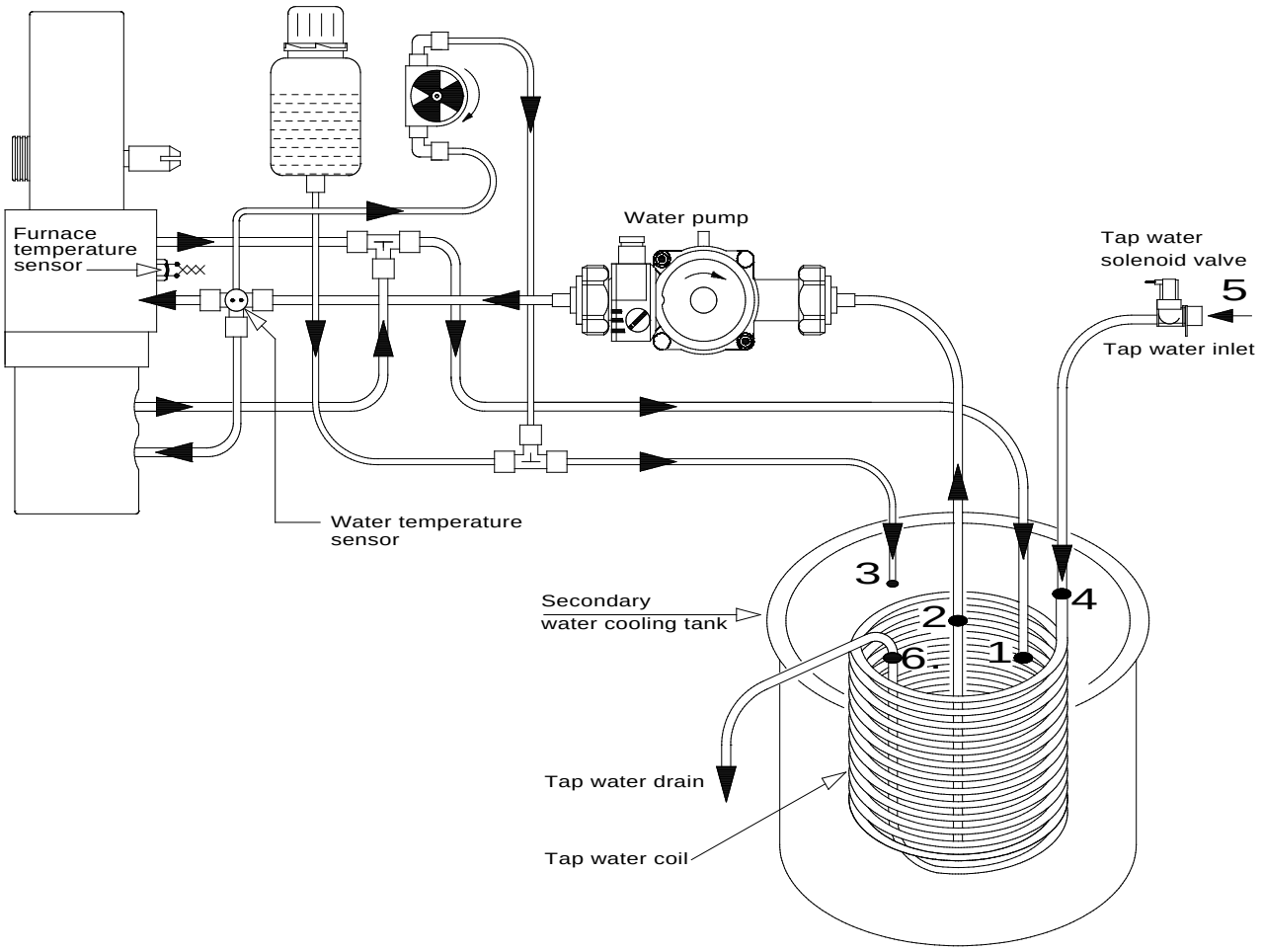


Fig. 10: Cooling water connections II

1.7 Cooling water filling

DANGER

D1.0004

Mortal danger from electric shock

Exposed power contacts - High Voltage

- An electric shock can cause injuries in the form of burns and cardiac arrhythmia, respiratory arrest or cardiac arrest.
- **Don´t touch electric components.**

Before filling the primary cooling system with water, it is necessary to make sure that the analyser is properly connected to the external barrel. See chapter”cooling water”.

It is very important for the inlet of the water pump inside the analyzer to be connected to the central fitting (2) of the external barrel.

Procedures for filling up and bleeding the cooling system:

- Open the barrel by removing the clamp around its lid and taking off the lid.
- Put the additive „Cooling agent„ into the barrel.
- Fill up the barrel almost completely with water.

- Only drinking water quality should be used and not just any tap water which may pollute or corrode the cooling system. Distilled water is also a bad choice.
- Close the barrel.
- Open the air bleeder on the water pump. (Plastic closure on a fitting on the pump's top).
- Pour water into the small plastic water equalizing tank (reservoir) above the pump, until some water starts to exit the open bleeder on top of the pump.
- Close the bleeder.
- Place a graphite crucible onto the graphite tip.
- Make sure that the carrier gas supply is closed, in order to avoid unnecessary gas consumption during the following steps.
- Remove the right side panel of the analyzer.

⚠ DANGER

Exposed power contacts - High Voltage

- **Don´t touch electric components**
- Observe the wheel of the water flow detector on the ON-21 board and switch the mains switch to pos. 2 for a couple of seconds only and check during this short period whether the water wheel is turning.
- Set the mains power switch immediately to position 1 if the water wheel doesn't rotate. Possibly the water pump is not rotating.

The pump can be damaged when power is applied but the pump does not rotate.

When the cooling system is inactive or dry for a long period of time, it could occur that the water pump doesn't start rotating when the mains switch is set to pos. 2

The reason why this may happen is that the pump's bearings (shaft) are not lubricated but the shaft rotates on a thin water layer (water film). When the pump is off and dry, it may not be able to start rotating even if it is filled with water.

- Reopen the air bleeder and add some more water into the equalizing tank. Close the air bleeder, switch back to pos. 2. Repeat this procedure until the system is completely free of air. If this doesn't help, the following instructions will assist you in solving the problem:
- Remove the right side panel of the analyzer.

⚠ DANGER

Exposed power contacts - High Voltage

- **Don´t touch electric components**
- Remove the screw on the pump which is in front of the pump's rotor shaft. A few drops of water may escape from the pump, so place a piece of dry cloth underneath the pump.
- The slot that appears next is pump's shaft. Rotate it by using a screw driver. The jammed shaft is then loosened. Up to 10 rotations may be needed to restore the rotating condition.
- Set the mains power switch to position 2.
- Look at the pump's shaft to see the slot rotating.
- Re-install the removed screw of the pump.
- If the water flow wheel rotates smoothly over a long period of time, the filling-up procedure is complete.
- If the rotation is erratic, then there is still some air in the cooling system.
- Switch the mains switch back to pos. 1, reopen the air bleeder and add some more water into the equalizing tank.

- Close the air bleeder, switch back to pos. 2. Repeat this procedure until the system is completely free of air.
- Reinstall both side panels.

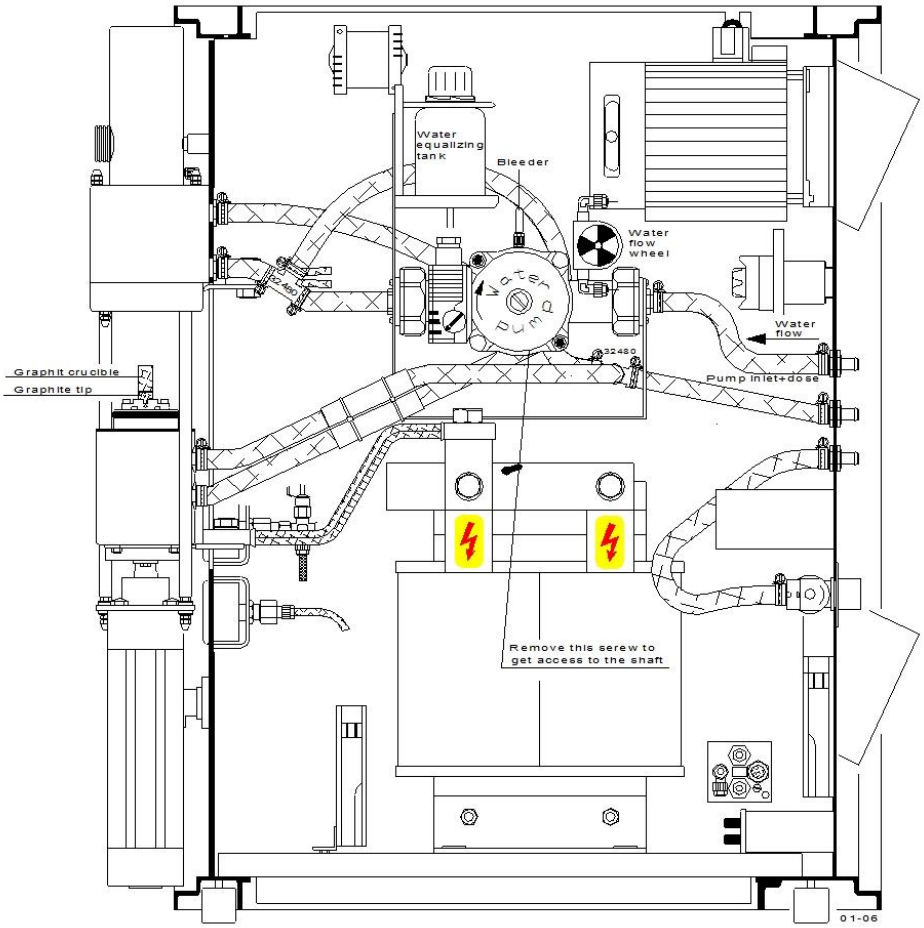


Fig. 11: Analyzer inside view (right)

1.8 Gas flow adjustment

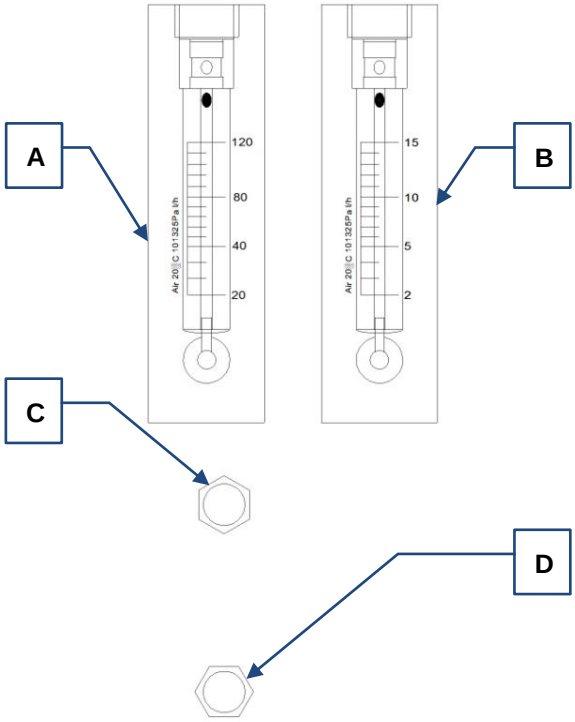


Fig. 12: The gas flow meter

There are two different gas flow systems in the instrument. Flow meter (B) shows the controlled flow thru the system, which cannot be changed from the front panel.

Flow meter (A) shows the total gas flow into the furnace.

There are two different states, which must be adjusted.

1. Only a small flow during the analysis or in normal state with closed furnace (D).
2. But it needs a higher flow for purging during the out-gas phase or with an open furnace (C).

Adjust the gas flow as follows:

- Adjust approx. 2 to 4 bar (30 to 60 psi) on the pressure regulator of the carrier gas/cylinder.
- Enable the carrier gas supply to the analyzer.
- Make sure to have a graphite crucible on the graphite tip.
- Set the mains power switch to pos. 2.
- Close the furnace by pressing the corresponding button in the software and wait about 10 seconds.

Remark

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

- Adjust the lower flow regulator (D) until the left flow meter (A) shows 40 l/h.
- Open the furnace.
- Adjust the upper regulator (C) until the same left flow meter (A) shows 80 l/h.
- Close the furnace again. If the above settings are unstable, increase both flows by about 10 l/h.

- Regarding the flow meter (B), the gas flow is adjusted in our company. This adjustment is normally not changed. If the blank values of O, N and H are higher than 20ppm, then the gas flow could be wrong.

NOTICE

The furnace should be open only as long as absolutely necessary. If the furnace is unnecessarily opened to long, you waste purging gas and additionally the electrodes may oxidize from the air.

2 Analysis

2.1 Working procedure

The ELTRA ONH-2000 analyzer is designed for the analysis of metals. Should other materials be analyzed, take care that the furnace and the gas flow system are not contaminated by dust or by volatile material.

The analysis procedure is described in the following section.

Remark

For all instructions about operating the PC software refer to the Help-function of the software.

1. Ensure that the compressed air and the carrier gas are connected. Turn the mains power switch to position 2. The pump starts working and the gas flow is controlled. It takes a few minutes until the analyzer is ready to work. Put an empty crucible on the lower electrode and close the furnace.
2. A sample of about 1 gram is weighed. Transfer the sample weight to the PC software by transferring the value from the connected balance or enter it manually. The sample ID may be entered as well. Put the sample with clean tongs into the sample drop on top of the furnace.
3. Start the analysis. From now on the analysis is performed automatically. At the end of the analysis the results are displayed and all data are saved on the hard disk of the PC.

The analysis procedure consists of a sequence of several phases. Depending on the settings (furnace power mode and sample loading mode) the sequences are different. Here, the sequence in ON-OFF-ON furnace power mode and automatic sample loading mode are described as basic operation modes. Other modes are described by pointing out their differences to the basic mode.

2.1.1 ON-OFF-ON furnace power and automatic sample loading mode

1. Outgazing. During the first phase of this analysis cycle, the graphite crucible (without sample) is heated up in the furnace in order to remove impurities. The carrier gas supply to the furnace is now in the purge mode. The time for outgazing and the furnace power are adjustable.
2. Purging. The furnace purging is continued after the outgasing phase. The furnace is switched off (zero power). The duration is adjustable.
3. Stabilizing. The carrier gas supply to the furnace is switched to the analysis mode. This phase is necessary for stabilizing the base lines of the detectors. The duration is adjustable.
4. Sample drop. The sample drop mechanism rotates and the sample drops into the crucible.
5. Analysis. The furnace is switched on, the sample is melted and the signals from the detectors are processed. The furnace power goes off after the set time expires, but the signals processing continues until the comparator level of all detectors or the maximum analysis time is reached. In order to avoid unnecessary signal integration from the moment when the furnace is powered until the moment when the analytical gas reaches the detectors, an integration delay time can be entered. All settings are available in the software.

2.1.2 CONTINUOUS furnace power and automatic sample loading mode

In this mode, the furnace remains on after the outgazing phase and its power level is set to the analysis power level. The furnace goes off only when the comparator level of all detectors or the maximum analysis time is reached.

2.1.3 ON-OFF-ON furnace power and manual sample loading

In this mode, after the outgassing process expires, the operator is prompted to open the furnace and to put the sample into the outgassed crucible. After closing the furnace, the analysis continues.

Remark

Please, refer to the chapter ”applications” for instructions about the settings for making analyses of different materials.

2.2 Work breaks

NOTICE

Keep the furnace closed to save carrier gas and to avoid oxidation of the electrodes.The furnace is only opened to replace the crucible, otherwise it remains closed.

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 analyzer's thermostatic control is then still working and no long warm-up time is needed, when re-starting the analyzer. 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 analyzer is purged by the oxygen flow. The slight influence which the oxygen flow has on the temperature of the infrared cell is compensated by the thermostatic control. The analyzer may only be switched off (pos. 0) when it is not used for several days or weeks. The analyzer 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 analyzer is completely switched off. The mains switch is only set to zero for safety reasons, the crucible lift is then down.

2.3 Fractional analysis

2.3.1 Introduction

In some cases it is useful not to only know the total content of one element in a specific sample, but also the exact amount of a specific bond or structure.

The ELTRA ONH-2000 can separate different oxygen and nitrogen fractions in the sample.

It is necessary to separate the different oxides in ores and raw materials, to guarantee high quality products and to control the production process more efficiently. Together with the elemental analysis, the engineer obtains information about the iron, silicon, aluminum and magnesium oxides in row materials. It is therefore possible to calculate the alloy elements and elements in the slag more accurately, before it is melted. The exact amount of different oxygen and nitrogen fractions in a high alloy steel is of vital importance, to determine the product quality.

There are several reasons why fractional analysis is so important. Every time when a certain process needs to be optimized or when the quality of a product needs some improvement, there is a demand for more detailed information about the material in use; more than what the simple elemental analysis can offer.

2.3.2 Basics

It is well documented, that the dissociation of various oxides and nitrides, i.e. the iron oxides occurs at approximately 1200°C, of silicon oxides at about 1500°C and of aluminum oxides at 2200°C. It is possible therefore to separate these various oxides, due to their different dissociation temperature.

There is however one problem:

The oxides don't decompose exactly at a certain specific temperature, as it happens for instance when melting a crystal. The velocity of the dissociation increases exponentially with the temperature. This means that below the specific dissociation temperature, an oxide decomposes very slowly.

In practice we need mathematical methods to calculate the contents of each oxide. It is not possible to obtain the oxide value only by temperature analysis.

The first step is to calibrate the temperature in the furnace, in accordance to the power settings of the analyzer. This temperature depends on the kind of carrier gas, on the analytical gas flow rate, the cooling parameter and the furnace geometry. Each furnace must be calibrated individually, because the parameters of the instrument are optimized for each customer individually.

In combination with the power settings, it is possible to plot a calibration curve which shows the temperature in relation to the furnace power.

The value of the temperature inside the crucible can be identified, for instance, by melting different materials, using the analyzer.

Adjust the power of the furnace so that a material of a known melting temperature just melts.

A satisfactory temperature-power correlation of the analyzer can already be established by melting a minimum of three different materials.

2.3.3 Detecting the oxygen fractions

First, we need some information about different oxygen fractions in a material. An elemental analysis with a spectrometer is helpful.

We start by linear ramping of the furnace power, to find out which oxides are present in the sample. A typical pre-selection for furnace power ramp-function, is from 1.0 kW to 5.0 kW in 200s. The oxygen profile of the tested material is shown in figure I

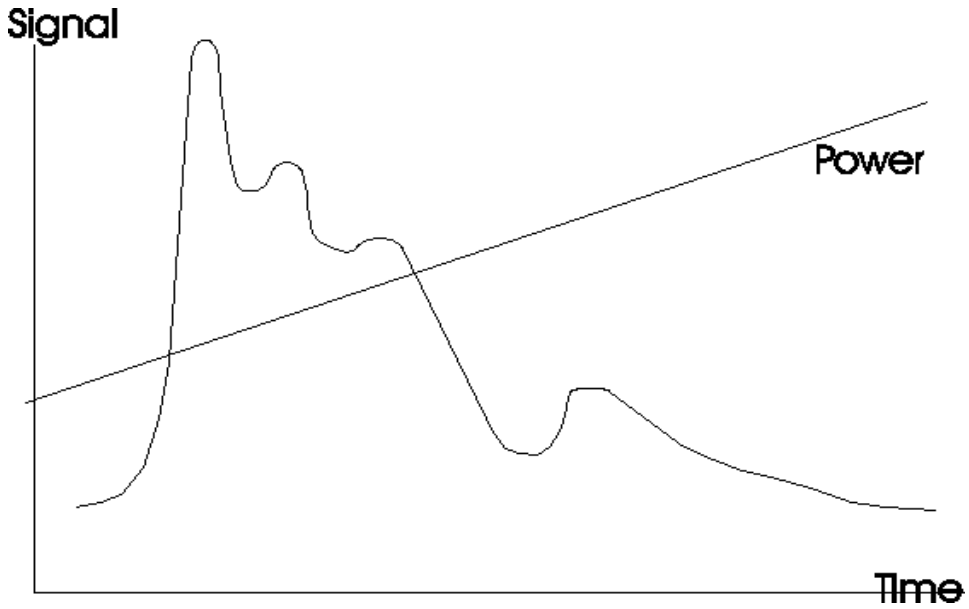


Fig. 13: Figure I

The next step is to separate each oxygen fraction as far as possible. To do this, the temperature program is changed from a ramp function to a step function. The power settings of each level are chosen in a way that the temperature is high enough to decompose just one oxide, but still too low to break the next oxide bond. The duration of each temperature step should be between 30 and 60 seconds, depending on the material. The signal of one oxygen fraction should first fall to its lowest level, before the next step is started. One possible separation is shown in figure II.

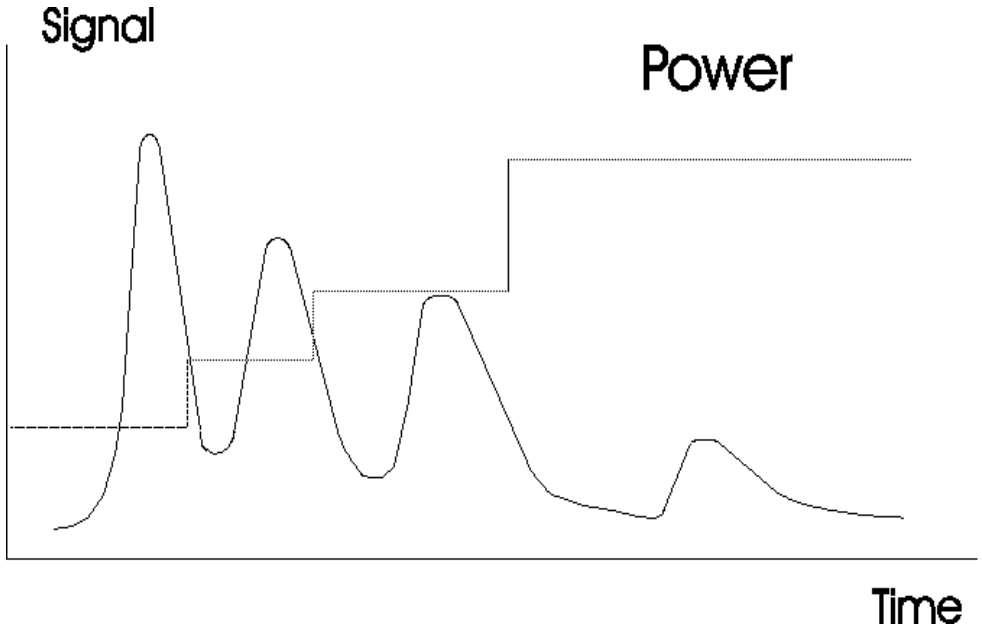


Fig. 14: Figure II

At the end of this analysis we obtain the total oxygen result. This should be in an acceptable range otherwise the temperature program needs to be modified.

2.3.4 Mathematical separation of the peaks

Each peak can be integrated individually, as shown in figure III.

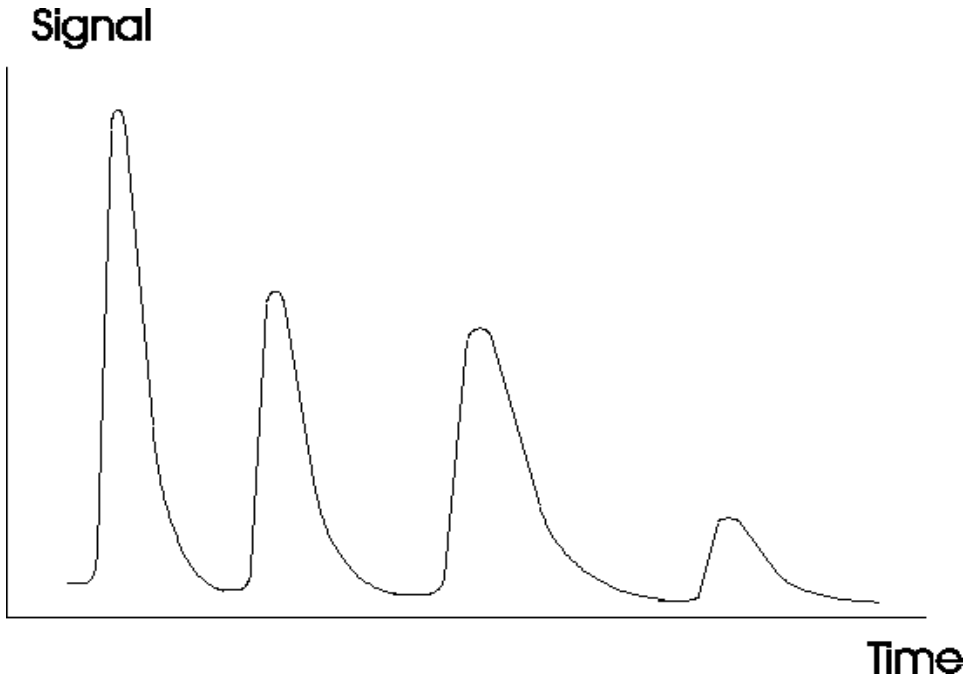


Fig. 15: Figure III

Mostly, before a peak has come down to the base line, the next peak starts to rise, making the reading of the previous peak to look incomplete. For this reason, the peaks need to be calculated as if they actually came down to zero. The peak has to be completed by software. See figure IV.

This way it is possible to individually determine each oxygen fraction.

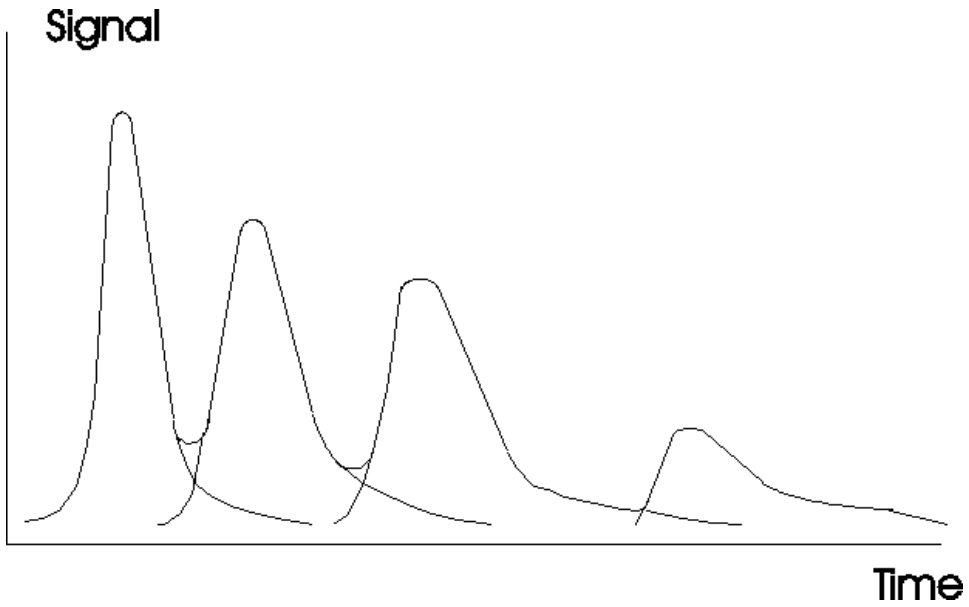


Fig. 16: Figure IV

The typical shape of a peak includes a fast rise, followed by a slow falling slope, because the chemicals and volumes of the gas flow system must be purged.

Figure IV includes two diagrams:

1. Without mathematical correction, as displayed from the analysis, with the peaks not returning to zero.
2. With the mathematical correction. By integrating the whole signal of the first diagram, we obtain the total content of oxygen in the sample.

The individual integration of each peak area, gives the content of each particular oxide. All oxygen fractions together should represent the total oxygen content. The difference between the total oxygen content given by the analyzer and the sum of the single oxides is criteria for the precision of the mathematical procedure. If the difference is too large, then the heating program needs to be optimized. The mathematical treatment cannot compensate physical errors.

2.3.5 Summary

The separation of different oxygen phases of the temperature profile method, is a way to obtain more information about a material than with the simple elemental analysis. It is possible to optimize this method for better temperature programs and better mathematical methods for the peak calculation. But the limits are set by the nature of this analytical method. With the x-ray diffraction analysis, it is possible to analyze the crystal structure directly, without destroying the material. The results are more precise, but more time is needed for sample preparation and analysis.

In most cases it is not necessary to know the exact value of each oxygen phase, it is sufficient to get a “fingerprint” of the material. It is very useful to compare the fingerprints of different materials to control or check a production process.

2.4 Applications

2.4.1 Oxygen nitrogen in boron nitride ceramics

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	5.0 kW for 60s
Purge time	15s
Stabilizing time	30s
Integration delay	2s
Analysis power / time	50 kW for 60s
Min. analysis time	100s
Accelerator / Flux	None
Calibration	Cer (IV)-oxide (Ce O2) pure with 18.59 % O and boron nitride(BN) pure with 56,40 % N.

2.4.2 Oxygen and nitrogen in titanium

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	5,8 kW for 45s
Purge time	15s
Stabilizing time	30s
Integration delay	10s
Analysis power / time	5,0 kW for 45s
Min. analysis time	50s(250mg)
Accelerator / Flux	Sample placed in a 1g Nickel basket. Software for continuous power between the out-gas and the analysis is required. Subsequently a blank analysis, without a sample, is required. A short interval is needed after each analysis, to allow the furnace to cool down.
Calibration	Standard titanium O+N in similar range The furnace needs to be cleaned every 5 analyses.

2.4.3 Oxygen in lead and lead alloys

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	3.3 kW for 45s - 60s
Purge time	10s

Stabilizing time	20s
Integration delay	10s
Analysis power / time	2.7 kW for 30s
Min. analysis time	50s
Accelerator / Flux	1000 mg of copper (oxygen free copper)1000 mg of OF copper needs to be melted inside the crucible during the out-gas phase, before the sample drop unit automatically drops 1000 mg of lead into the crucible.
Calibration	Copper 10 ppm O. Furnace needs to cleaned after 25 analysis

2.4.4 Oxygen in steel

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	5.0 kW for 30s - 45s
Purge time	10s
Stabilizing time	20s
Integration delay	10s
Analysis power / time	4,0 kW for 30s
Min. analysis time	50s
Accelerator / Flux	None
Calibration	Standard steel O+N in similar range

2.4.5 Oxygen in aluminum

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	5,0 kW for 45s
Purge time	15s
Stabilizing time	30s
Integration delay	10s
Analysis power / time	3,2 kW for 30s
Min. analysis time	50s
Accelerator / Flux	1g Sn together with sample 1000 mg of tin need to be melted inside the crucible during the out-gas phase, before the sample drop unit automatically drops 1000 mg of aluminium into the crucible.
Calibration	Standard copper 300 ppm 250 mg sample size

2.4.6 Oxygen in magnesium

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	4,5 kW for 45s
Purge time	10s
Stabilizing time	20s
Integration delay	10s
Analysis power / time	2,8 kW for 30s
Min. analysis time	50s
Accelerator / Flux	1g Sn
Calibration	Standard copper. Furnace cleaning after each analysis

2.4.7 Oxygen in copper

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	4,0 kW for 30 - 45s
Purge time	10s
Stabilizing time	20s
Integration delay	10s
Analysis power / time	2,8 kW for 30s
Min. analysis time	50s
Accelerator / Flux	None
Calibration	Standard copper 300 ppm O

2.4.8 Oxygen in oxygen free copper (OF)

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	3,8 kW for 45s - 60s
Purge time	15s
Stabilizing time	30s
Integration delay	5s
Analysis power / time	2,4 kW for 20s
Min. analysis time	40s
Accelerator / Flux	None
Calibration	Standard copper 100 pmm O

	Standard steel 1 ppm H

2.4.9 Hydrogen in titanium

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	3,3 kW for 60s
Purge time	15s
Stabilizing time	30s
Integration delay	10s
Analysis power / time	2,8 kW for 45s
Min. analysis time	50s
Accelerator / Flux	1g Sn for out-gassing in crucible
Calibration	Standard titanium 100 ppm. Inner and outer crucible required 100 – 250 mg sample size

2.4.10 Hydrogen in zirconium

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	3,2 kW for 45s
Purge time	15s
Stabilizing time	30s
Integration delay	5s
Analysis power / time	2,8 kW for 45s
Min. analysis time	60s
Accelerator / Flux	1g Sn for out-gassing in crucible
Calibration	Standard titanium or zirconium. Inner and outer crucible required

2.4.11 Hydrogen in steel

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	4,5 kW for 30 - 45s
Purge time	10s
Stabilizing time	30s
Integration delay	10s
Analysis power / time	3,3 kW for 30s

Min. analysis time	50s
Accelerator / Flux	None
Calibration	Standard steel 5 ppm H

2.4.12 Free hydrogen in aluminum

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	4,0 kw for 45s
Purge time	15s
Stabilizing time	30s
Integration delay	2s
Analysis power / time	0,6 kW for 100s
Min. analysis time	100s
Accelerator / Flux	None
Calibration	Standard steel 1 ppm H gas dose calibrate. Outer crucible for max. sample weight 1g

2.4.13 Total hydrogen in aluminium

Power mode	On-Off-On Mode
Sample drop	Manually
Out-gassing (Power / time)	3,5 kW for 45s
Purge time	15s
Stabilizing time	30s
Integration delay	5s
Analysis power / time	1,7 kW for 40s
Min. analysis time	50s
Accelerator / Flux	None
Calibration	Standard steel 5 ppm H 1g sample size / 20s extra purge for manual loading

2.4.14 Hydrogen and oxygen in oxygen free copper (OF)

Power mode	Continuously
Sample drop	Automatic
Out-gassing (Power / time)	3,8 kW for 45s - 60s
Purge time	15s
Stabilizing time	30s

Integration delay	5s
Analysis power / time	2,4 kW for 20s
Min. analysis time	40s
Accelerator / Flux	None
Calibration	Standard copper 100 ppm O Standard steel 1 ppm H

2.5 Gas saving mode

When the ONH-2000 is in analysis mode, but it has not been used for a while, the gas consumption will automatically be reduced to a very low level. This low flow keeps the gas flow system flooded with carrier gas, preventing the air from penetrating the system. As soon as the operator starts using the analyzer again, for example by moving the mouse or by entering the weight of the next sample, the normal flow will be automatically restored. The analyzer will be ready again for operation in a very short time, due to the purging with the low flow during the break.

This function can be activated in the software.

3 Maintenance

3.1 General information

3.1.1 Every 50 analyses or at least 2 times per day

- Clean the furnace and the electrodes. See chapter “Furnace cleaning“

3.1.2 Every 500 analyses

- Replace all chemicals (except copper oxide). See chapters”Reagent tubes – removing and installing” and”Reagent tubes filling”.

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

- Change the graphite tip. See chapter”Electrodes replacing”

3.1.4 Every 3000 analyses

- Replace the copper oxide in the catalyst furnace. ”Reagent tubes – removing and installing” and”Reagent tubes filling”.
- Take the electrodes out of the furnace and clean them with a brush. See chapter “Electrodes replacing“.

Remark

The above is related to steel analyses and helium 99.995% pure.

3.2 Reagent tubes – removing and installing

CAUTION

C1.0076

Scalding/burns

Hot furnace / combustion tube / analyzer parts

– Parts of the analyzer can be very hot.

- **Use heat protecting gloves.**

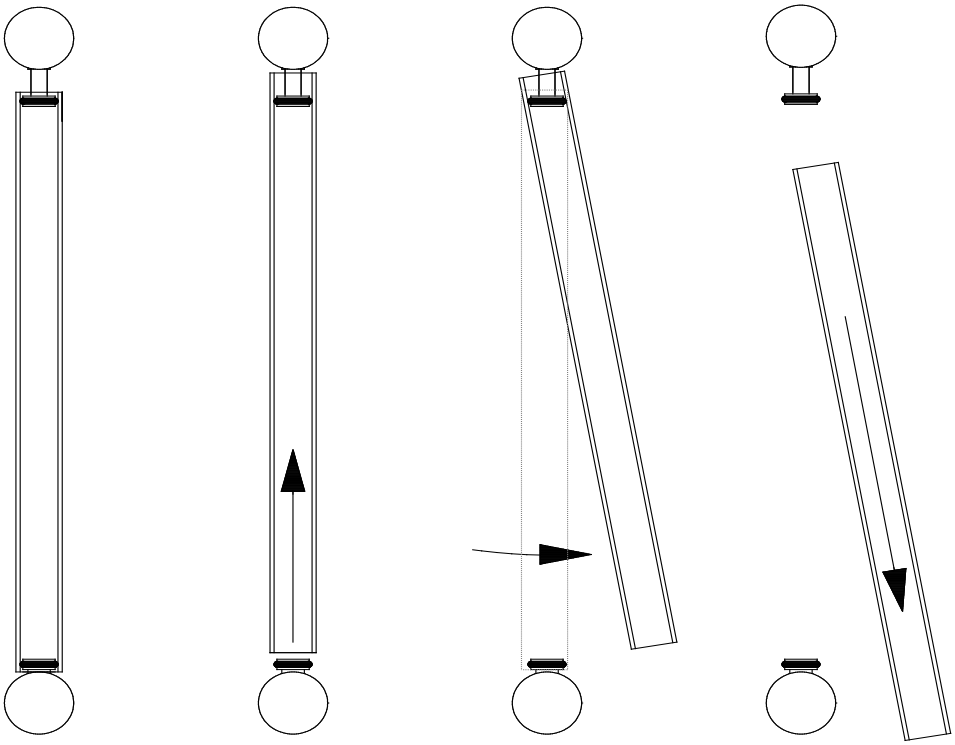


Fig. 17: The reagent tubes installing and removing

To replace the reagent tubes:

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

NOTICE

The dimensions for filling the glass tubes given in the schematic of the chapter “Reagent tubes filling” should be respected in all cases.

When, for example, there is not enough quartz wool in the bottom of the glass tube, it is possible that dust from magnesium perchlorate can fall through blocking the fitting below causing corrosion along the gas flow system.

NOTICE

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

The copper oxide of the catalyst furnace is replaced after about 2000 analyses. See chapter “Reagent tubes filling“

It is safer, but not absolutely essential, to switch off the analyzer.

The components are refitted in reverse order.

⚠ CAUTION

Scalding/burns

Hot furnace / combustion tube / analyzer parts

– The furnace temperature is about 450°C.

- **Use heat protecting gloves.**
- **Only the outside grid of the furnace is to be handled; held the quartz reagent tube only at the ends.**

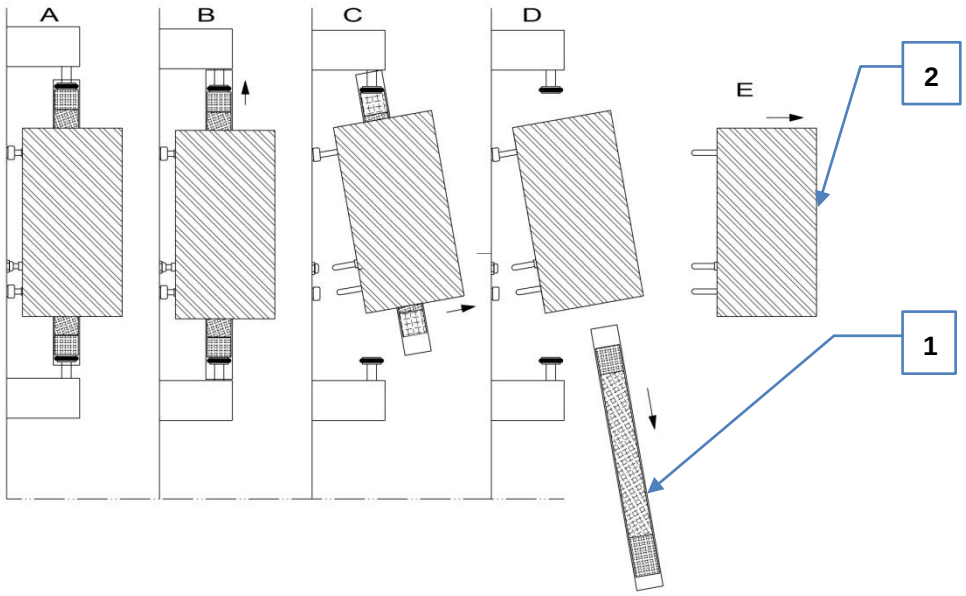


Fig. 18: Catalyst furnace removing

A: Normal position during operation.

B: The quartz tube (1) of the furnace (2) is raised as far as possible.

C: It is then swung out together with the furnace (2).

D: The quartz tube (1) is pulled downwards at an angle.

E: The furnace (2) is removed.

After replacing the copper oxide, the removed components are refitted in reverse order.

3.3 Reagent tubes filling

The following chemicals are used:

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

The reagent tubes are replaced when they are saturated. See chapter “General information“

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 color (it turns to light grey).

The magnesium perchlorate is saturated if its particles do not move when tapping on the glass tube. It is essential to change the absorber before it becomes cloggy. The moisture absorber should be checked every 100-200 induction analyses and if necessary, it should be replaced (glass tube underneath the metal filter).

Please refer to the following schematics to identify the glass tubes on the analyzer. In addition to the reagents in the glass tube, fill the bottom end of the tube with glass wool. One should pay attention that the glass wool should be only as thick as necessary, otherwise the gas flow can be choked. Under no conditions should the amount of glass wool be less than that shown in the following schematics, otherwise fine particles of magnesium perchlorate can pass through the glass wool layer blocking the hole of the fitting underneath.

It should be pointed out that magnesium perchlorate and schutzes reagent are very strong oxidizing materials.

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 of the glass tubes.

Make sure that the o-rings are completely sealed around the glass tubes, by looking at the imprint of the o-ring on the inner surface of the glass tube. Check whether there are fibers of glass wool trapped between o-ring and glass tube. This causes leakages.

The o-rings are only replaced when they can no longer adequately seal, due to a damage or age. When removing the old o-rings, be ensure that the sealing areas of the fittings are not damaged.

Remark

When replacing o-rings, never grease the new o-rings before installation. Otherwise, the o-rings will turn with the glass tube when trying to remove it.

NOTICE

There are qualities of chemicals such as anhydrone, ascarite, copper oxide, schutzes reagent, tungsten granules, iron chips, copper chips etc. which have been specially developed for combustion analyzers and other analytical instruments. The commonly available materials fulfill 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 it is often not even completed. This effect also occurs with magnesium perchlorate of suitable quality when it is saturated.
– The commonly available sodium hydroxide binds CO2 very inadequately at room temperature, whereas the special quality, not only perfectly binds CO2 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 analyzer will not be damaged. If problems should arise, however, suitable materials, in proper, unsaturated condition, should be used, before calling technical service.

The bottles with chemicals must be closed very tight, immediately after use, so that they do not become saturated with air moisture or CO2.

The reagent tubes are filled as follows:

The lower end of each glass tube is filled with glass wool, for the chemicals to be retained in the reagent tubes. Do not stuff the glass wool to tight, otherwise the gas flow will be blocked. The rest of the tube is filled with reagents as shown in the schematic below. The lower half of the reagent tube for the oxygen pre-cleaning tube is filled with magnesium perchlorate (anhydrone) and the upper half with sodium hydroxide. The chemicals are separated by a glass wool layer.

Provide sufficient space at both ends of the tube so they can be attached to the glass fittings without blocking the fitting holes. Free inner surfaces at the ends of the tubes serve as sealing surfaces and must be cleaned after filling.

Remark

Use quartz wool for the catalyst furnace.

The o-rings also have to be clean. Both the o-rings and the sealing surfaces of the tubes 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.

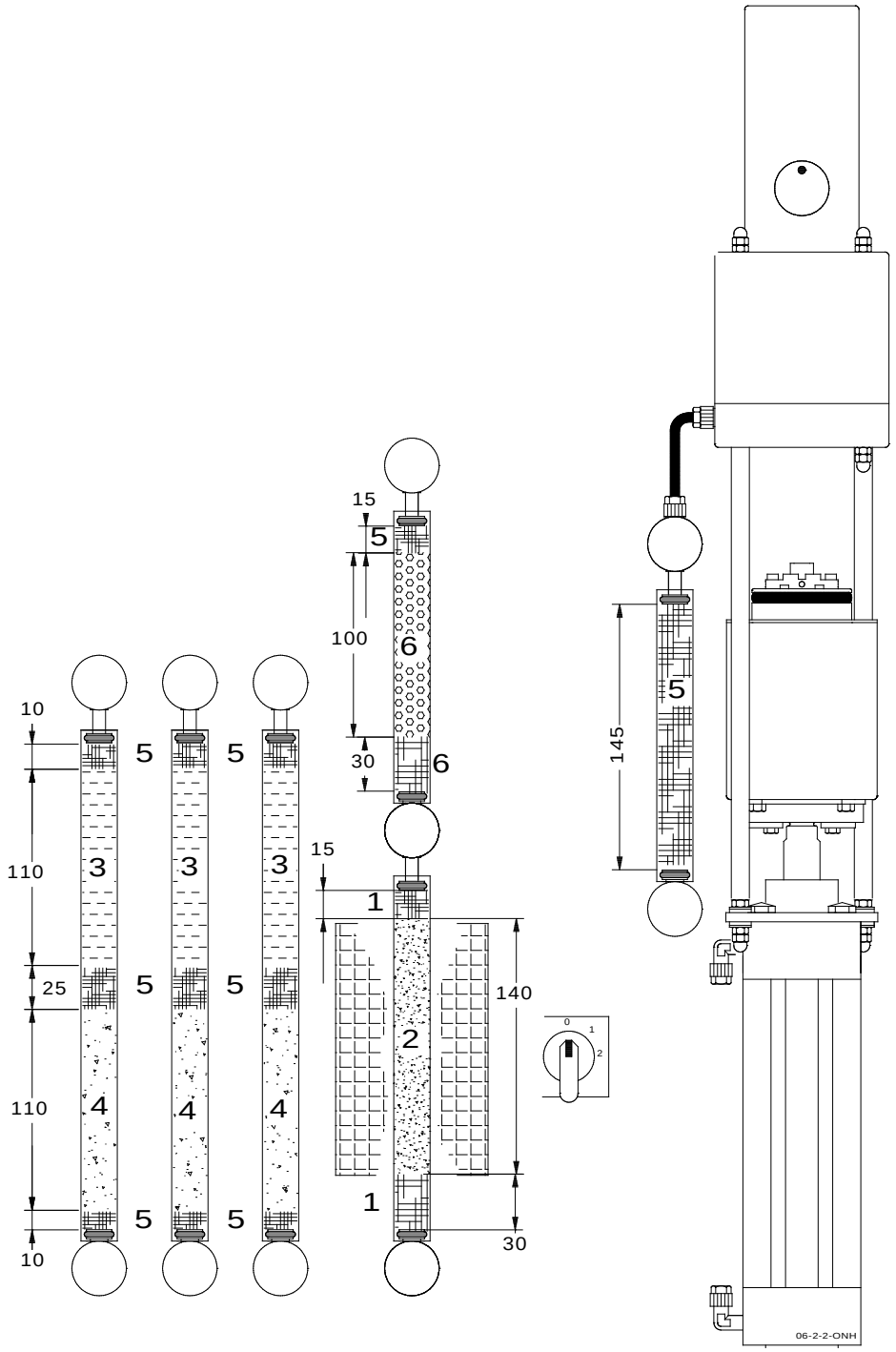


Fig. 19: The reagent tubes

Each filling quantity carries a tolerance of ± 20 %

1	Quartz wool	90330
2	Copper oxide	90289
3	Anhydrone	90200
4	Sodium hydroxide	90210
5	Glass wool	90331
6	Schutzes reagent	90270

3.3.1 Gas purification furnace

Sometimes there is a certain oxygen concentration in the carrier gas as impurity. This oxygen causes a high blank value in case of oxygen determination in a sample. At the same time the blank value in the nitrogen range (detector) is low.

In this case it is helpful to use a gas purification furnace. In this furnace are copper turnings which trap the oxygen of the carrier gas by oxidation of their surface.

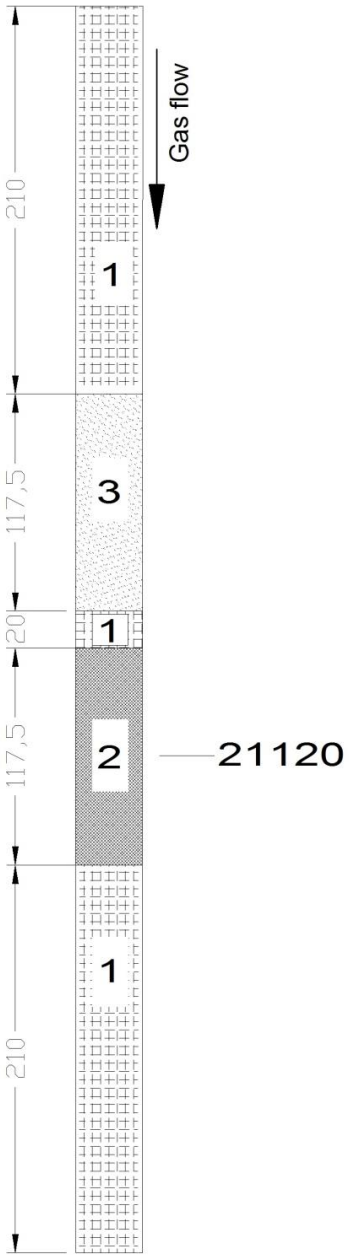


Fig. 20: Gas purification furnace - quarz tube

Keep a tolerance of about ± 20 % of the filling lengths of the drawing.

1	Quartz wool	90330
2	Copper turnings	88400-0311
3	Copper oxide	88400-0122

3.4 O-rings replacement

The O-rings are only replaced when they can no longer adequately seal, due to a damage or age. When removing the old O-rings, be sure that the sealing areas of the fittings are not damaged.

Remark

When replacing O-rings, never grease the new O-rings before installation. Otherwise, the O-rings will turn with the glass tube when trying to remove it.

For easier assembling, slightly grease the O-rings of the furnace. See figure II below.

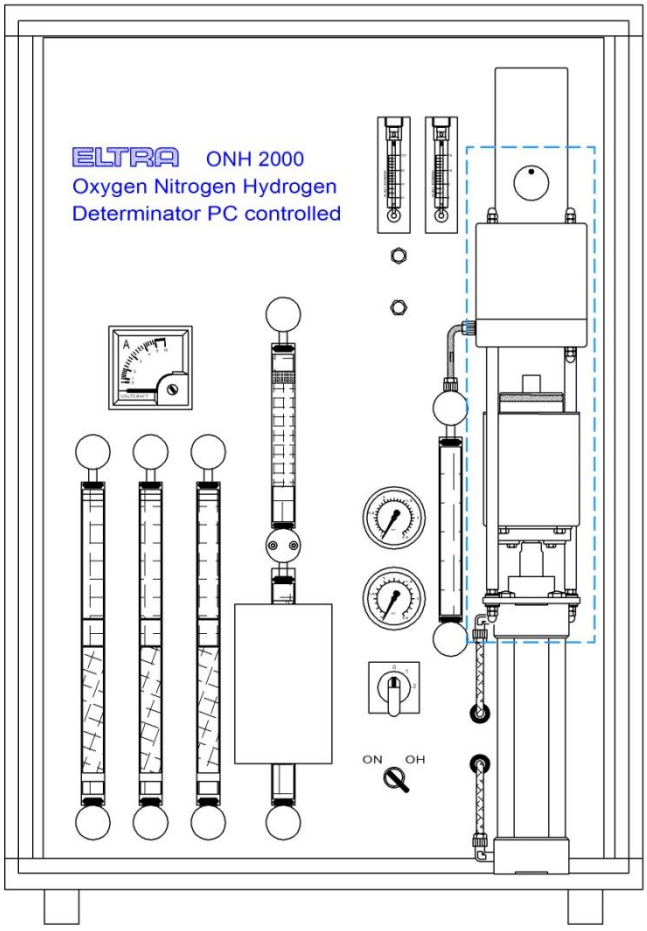


Fig. 21: Figure I

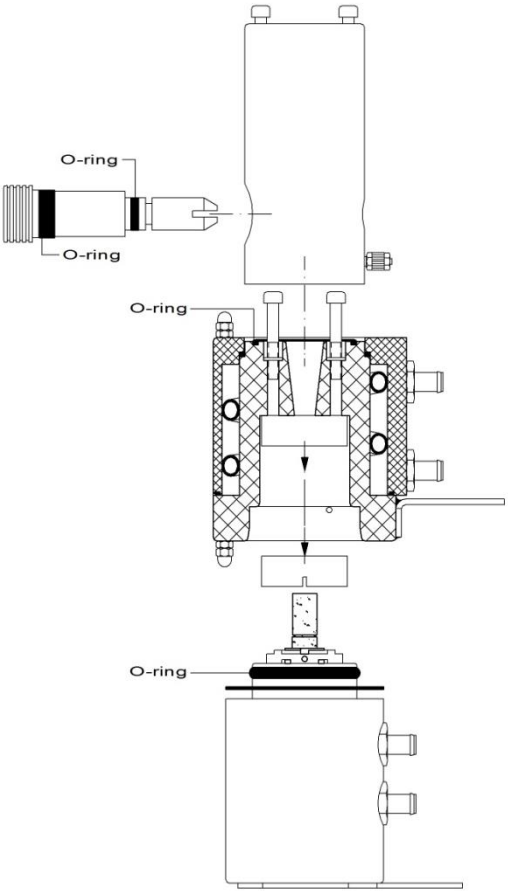


Fig. 22: Figure II

3.5 Dust trap cleaning

The dust trap is a glass tube, filled with glass wool. If this glass wool is dirty, it has to be replaced. See chapters ”Reagent tubes removing and installing”, and ”Reagent tubes filling”.

3.6 Furnace cleaning

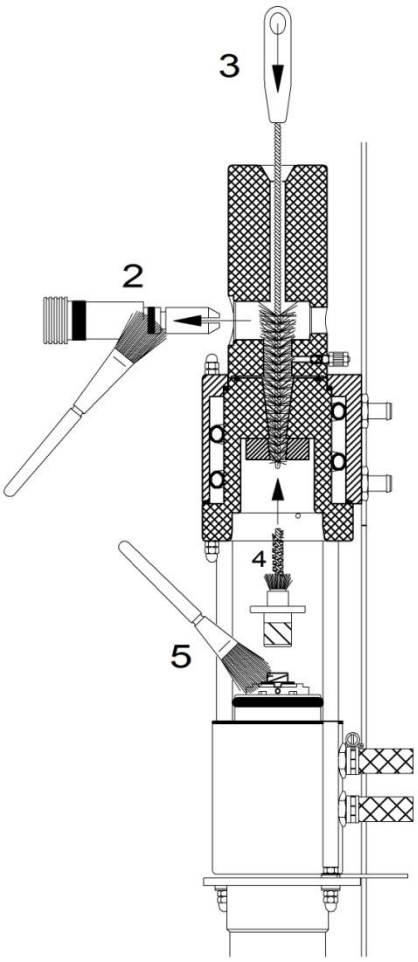


Fig. 23: Furnace cleaning

The quantity of dust in the furnace depends on the power setting.

The furnace should be cleaned every 50 analyses.

If there is more dust than usual, then the furnace should be cleaned in shorter intervals.

- Open the furnace with the pneumatic lift.
- Pull the sample drop (2) out of the furnace.
- Clean the sample inlet hole with the big brush (3).
- Clean the inside of the furnace and the upper electrode with a soft cloth or a paper tissue. If this is not enough to clean the upper electrode, then use the metal brush (4).
- Clean the lower electrode with the small brush (5) or a soft cloth.
- Insert the sample drop back into the furnace.
- Close the furnace.

3.7 Electrodes replacing

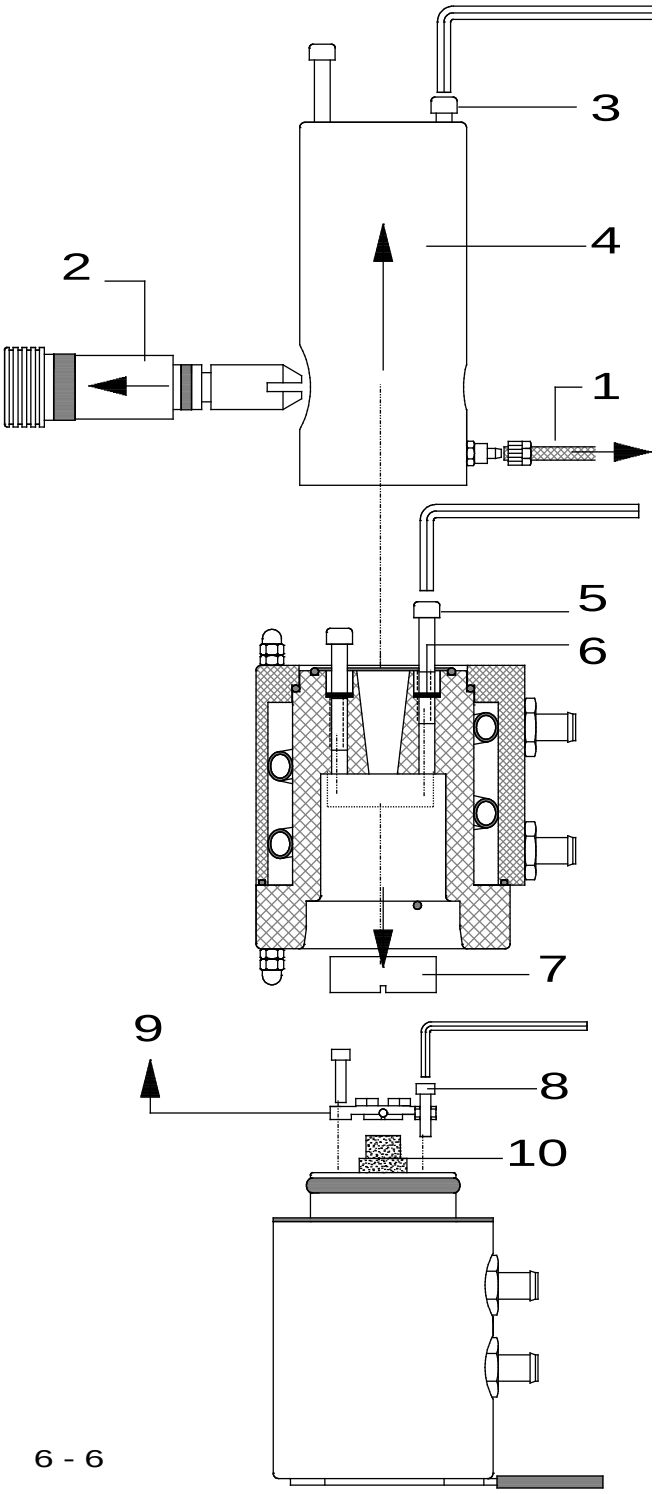


Fig. 24: Furnace details

Due to the high temperature in the furnace, the graphite tip and the upper electrode will have limited service life, so they need to be changed from time to time. If there is no contact between the crucible and upper electrode, the current flow fails and the analysis starts without any current.

The graphite tip and eventually the upper electrode need to be replaced.

3.7.1 Replacing the upper electrode insert

- Remove the sample drop unit (2).
- Remove the two screws on top of the upper furnace unit (3) with a 5 mm allen key.
- Remove the gas inlet tube (1).
- Remove the upper furnace unit (4).
- While holding a hand below the combustion chamber, loosen the four screws (5), with a 5 mm allen key, until the electrode insert (7) falls into the hand.

  There is no need to pull out the screws, make sure that the coil spring washers (6) don't get lost.
- Replace the electrode insert (7) by reassembling in reverse order. Drive properly the screws (5).

3.7.2 Replacing the graphite tip

- Remove the four screws (8) with a 3 mm allen key, remove the tip holder (9), clean the area under the tip holder and finally replace the graphite tip (10).
- Reassemble in reverse order.

4 Function description

4.1 Measuring principle

The sample falls from the sample drop into the graphite crucible where it melts due to high temperature created by power consumption in the graphite crucible, liberating oxygen, nitrogen and hydrogen out of the sample. The oxygen is converted to CO at the surface of the hot graphite crucible. The carrier gas purges these gases out of the crucible.

A pump sucks the gases through the catalyst furnace, where CO is oxidized to CO2. After that, CO2 is detected in the IR-cell and then trapped in sodium hydroxide. Nitrogen resp. hydrogen are detected by a thermal-conductivity-cell.

4.2 Gas flow system

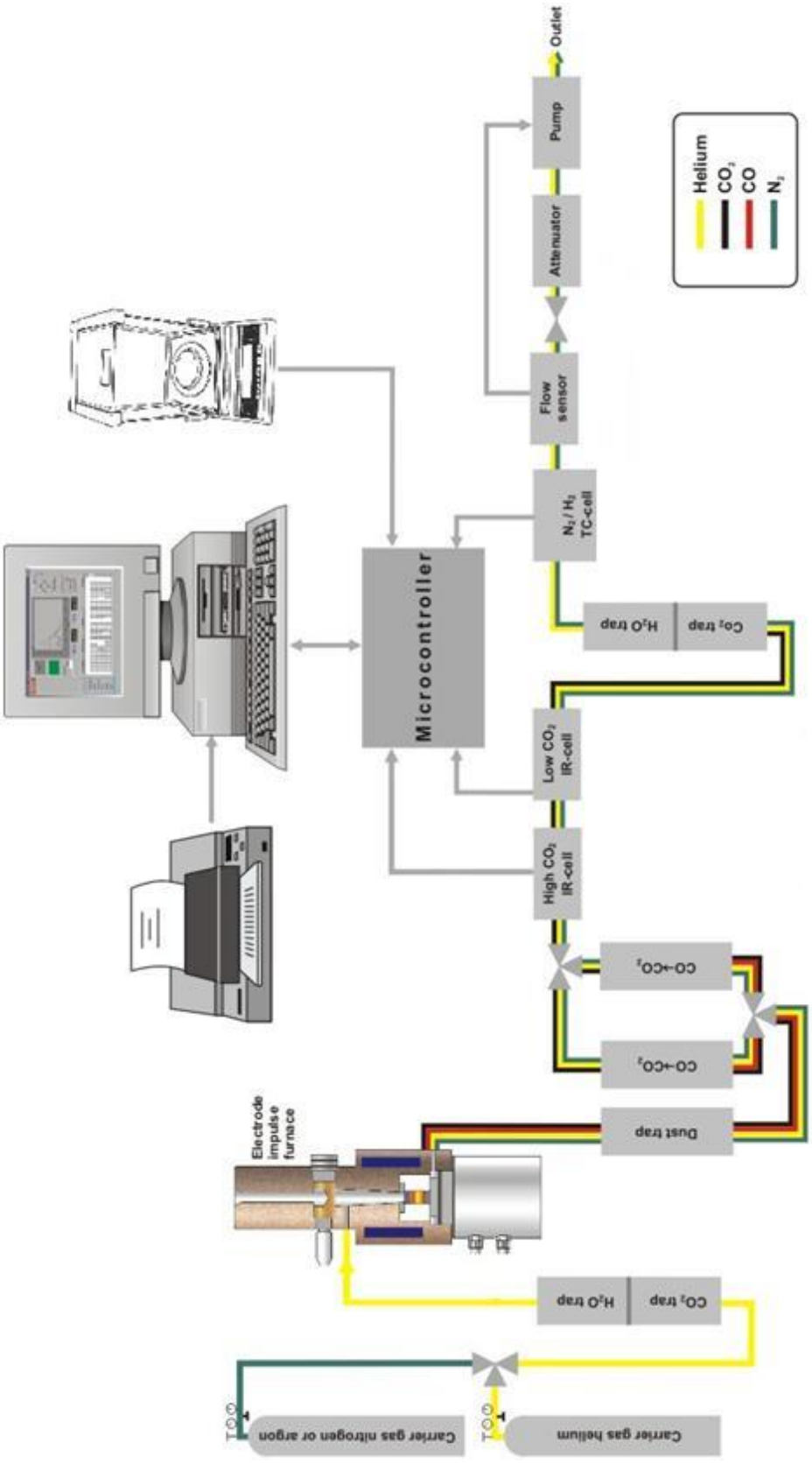


Fig. 25: Gas flow diagram

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.

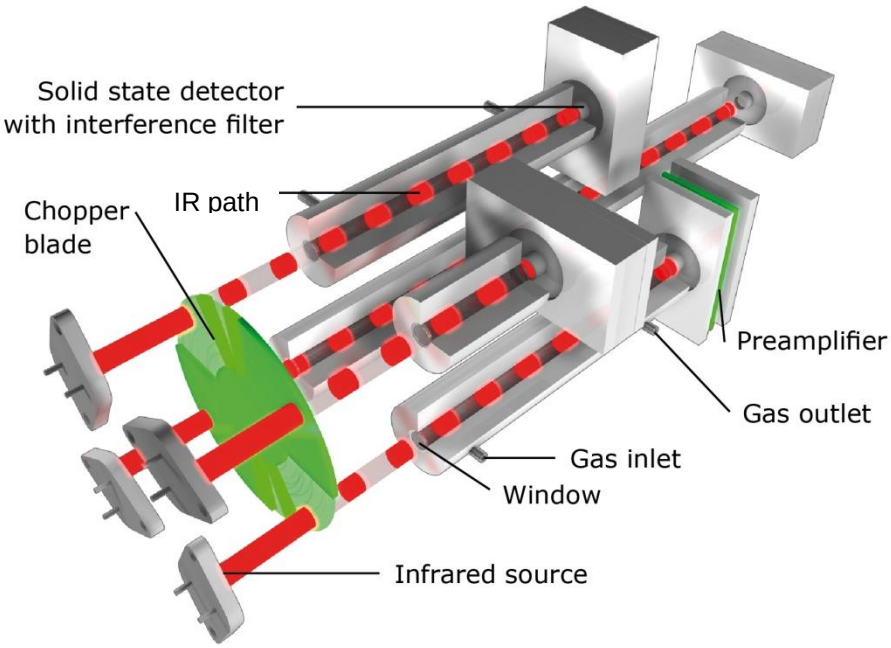


Fig. 26: Infrared cell

An infrared source is electrically heated emitting wide band infrared radiation. The radiation beam is interrupted by a rotating chopper blade, resulting in alternating light. The rotary speed of the chopper is crystal controlled, so that the chopper frequency is very 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 allows only a certain narrow band infrared radiation to pass. This narrow band must correspond to the IR wavelength for which the gas to be detected has its maximum absorption capability.

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 sensor, giving an electrical signal corresponding to the intensity of the beam.

As the beam is interrupted by the rotating chopper, the detector receives an alternating radiation creating an AC electrical signal. Temperature and aging influences of the detector, as well as noise are thereby strongly reduced.

The signal obtained is amplified, rectified and passed thru a low pass filter so that it leaves the infrared cell as a DC voltage.

The infrared cells utilize solid state sensors combined with infrared filters. The infrared cell module 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 from 1 mm to 320 mm. The infrared cell rack is temperature controlled so that the sample gas flowing through it is kept at a constant temperature.

The infrared cell rack is temperature controlled, so that the sample gas which flows through it, is kept at a constant temperature.

4.4 Thermal conductivity cell

The thermal conductivity sensor is based on a micro-mechanical silicon chip with a thin membrane. Two thin film resistors are integrated into the membrane and they are used, one for heating and the other one for sensing the membrane temperature. Both resistors are protected by an inert coating in order to prevent chemical reactions with the gas molecules.

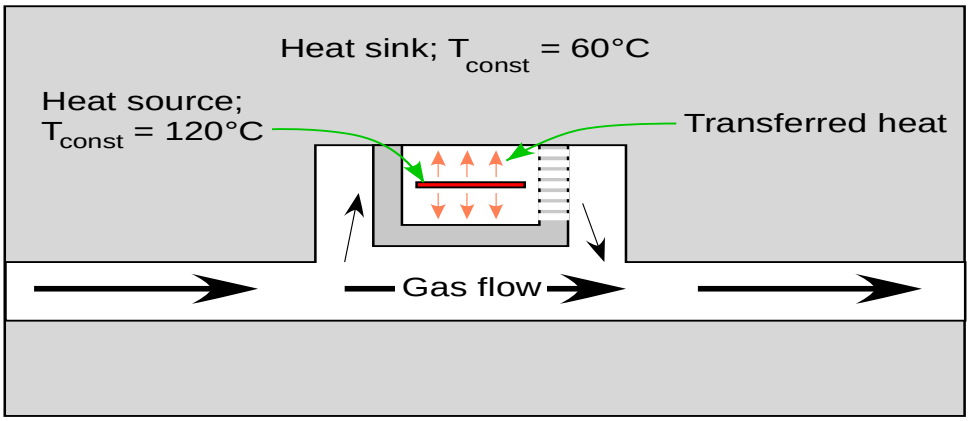


Fig. 27: TC cell operation principle

Above and underneath the membrane, two cavities are etched into the silicon chip. The measuring gas diffuses into the cavities and depending on its thermal conductivity, more or less energy is required to keep the membrane at constant temperature level. The voltage needed to keep the temperature of the membrane constant, is a value corresponding to the thermal conductivity of the gas. This value is used to obtain the output signal of the thermal conductivity cell.

The micro-mechanical chip is fitted in a stainless steel housing where the measuring gas flows through. In order to allow a temperature controlled operation mode of the sensor, the temperature of the stainless steel housing of the chip is controlled at constant level using two heating elements and a temperature sensor attached to the housing.

The boards containing the analog and digital signal processing electronics are installed on the stainless housing. The temperature can be set with a digital potentiometer. The default value is 60°C.

5 Miscellaneous

5.1 Ordering numbers

5.1.1 Front panel

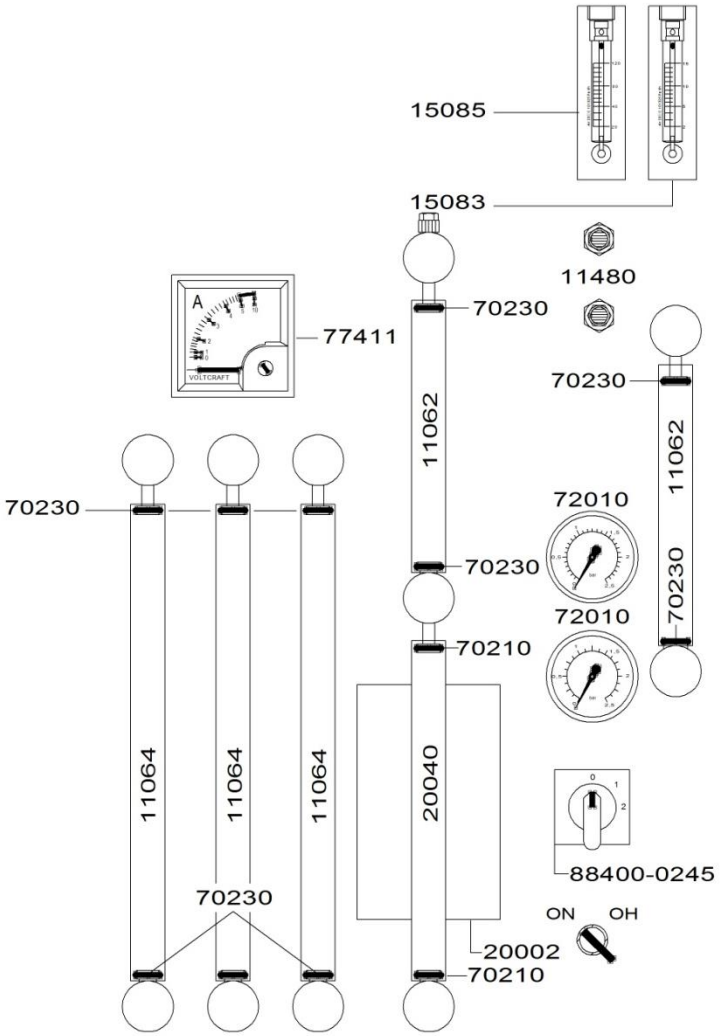


Fig. 28: Front view

Part No.	Description
11062	Reagent tube
11064	Reagent tube
11480	Adjustable restrictor
15083	Gas flow meter 15 l/h
20002	Gas flow meter 130 l/h
15085	Catalyst furnace
20040	Catalyst tube
70210	O-ring

70230	O-ring
72010	Pressure gauge
77411	Panel meter 1000A

5.1.2 Chopper asssembly

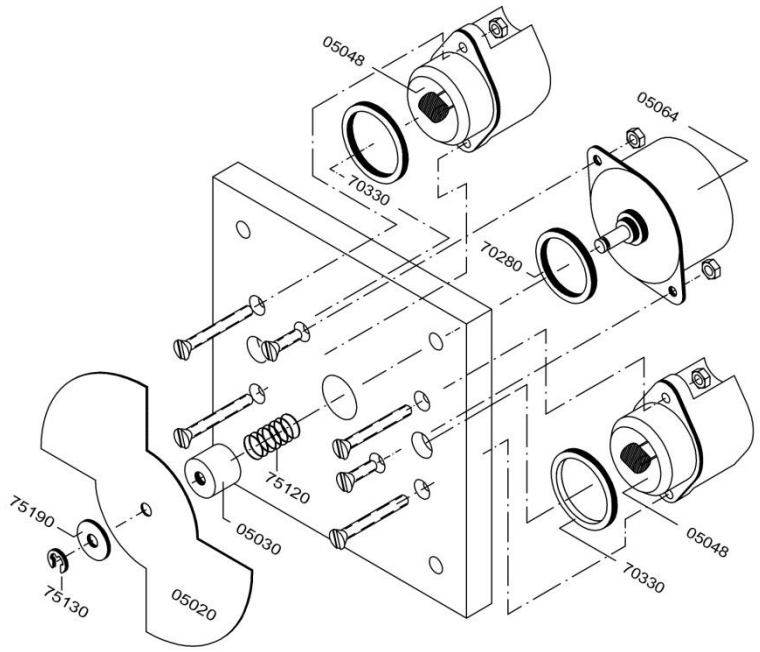


Fig. 29: Chopper assembly

Part No.	Description
05020	Chopper blade
05030	Chopper blade holder
05064	Chopper motor
05048	Infrared source (emitter)
70280	O-ring
75120	Spring
70330	O-ring
75130	Retaining washer

5.1.3 IR/TC - Cell

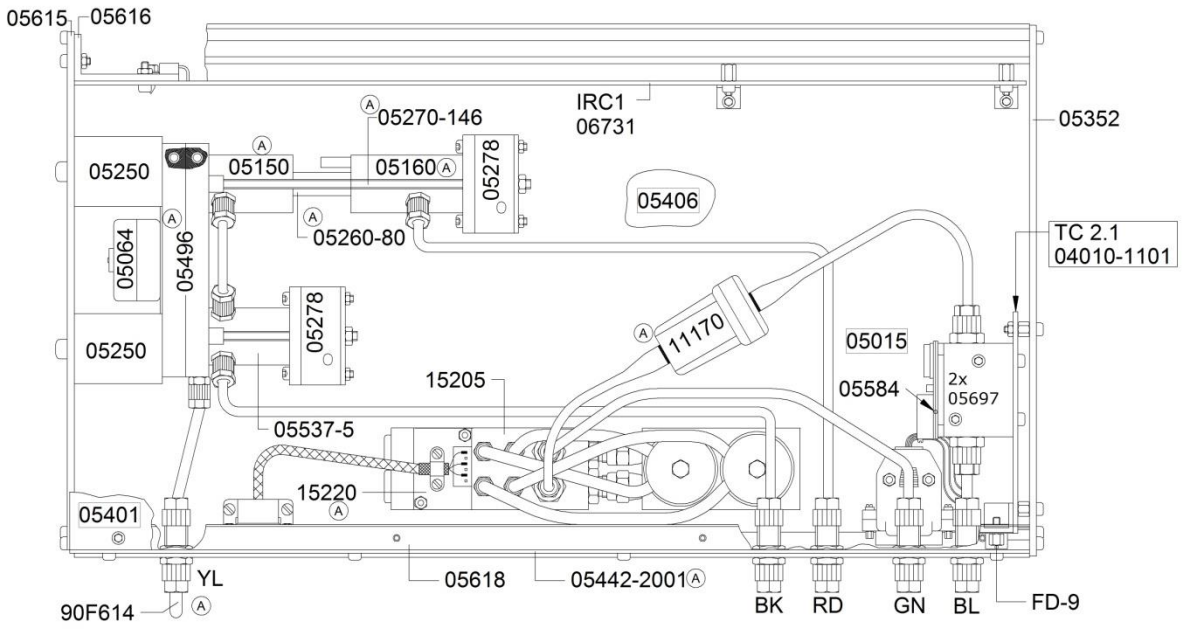


Fig. 30: IR/TC - Cell

Remark

The items marked with * in the following list, are specified for standard version analyzers. They can vary in their specs so that they can have different part numbers for non-standard versions.

All available versions of the marked items can be found in the service manual.

Part No.	Description
11170	Dust filter cartridge
04010-1101	Board TC2.1
05064	Chopper motor
05150	Path-end Source side
05160	Path-end sensor side
*05260-80	Path tube 80mm (for 100mm path length)
*05270-146	Threaded rod (for 100mm path length)
05278	Preamplifier for 3-pin sensor
*05496	Thermal conductivity cell (without board 04010-1101
*05537-5	IR path for high oxygen (5mm for standard version)
05584	Copper assembly with IR sources and motor
*06731	IR board IRC1 two range version
15205	Gas flow sensor assembly (complete assembly including sensor)
15220	Flow sensor (Sensor element only, with cable and plug)

5.1.4 Right hand side

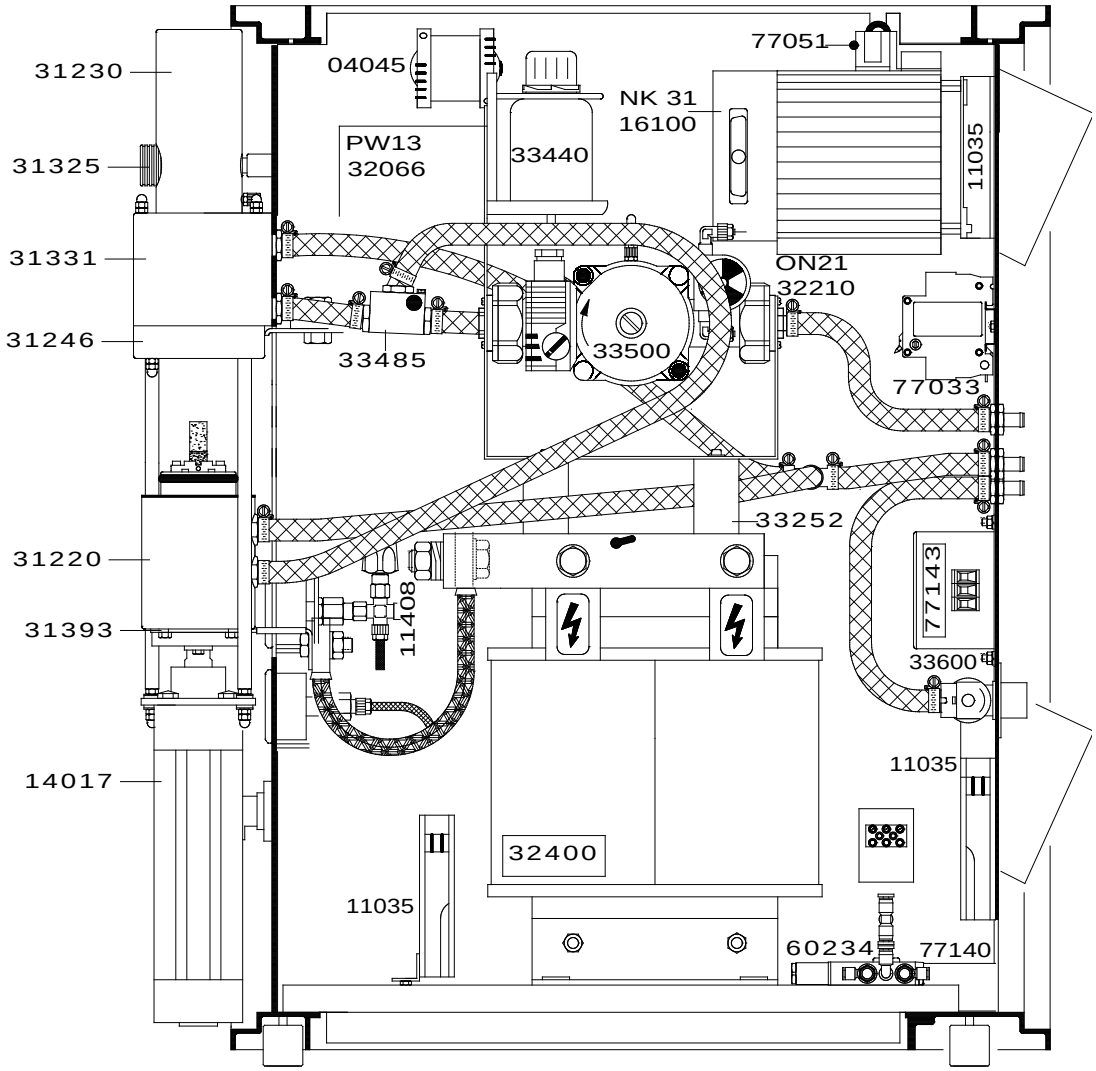


Fig. 31: Right hand side view I

Part No.	Description
04045	Transformer
11035	Cooling fan
11408	Pressure switch
14017	Pneumatic cylinder
31220	Power supply board NK32
16100	Lower furnace assembly
31230	Sample inlet block
31246	Upper furnace block
31325	Sample drop mechanism
31331	Water cooling cup
32066	Power control board PW 13

32210	Water temperature control board ON 21
32400	Transformer
33440	Water level tank
33485	Water temperature sensor
60234	Water pump
33500	Pneumatic valve
77033	Breaker 32A for 3-phase analyzers
77034	Breaker 40A for single phase analyzers
77051	Thyristor block
77140	HF-filter 250 V

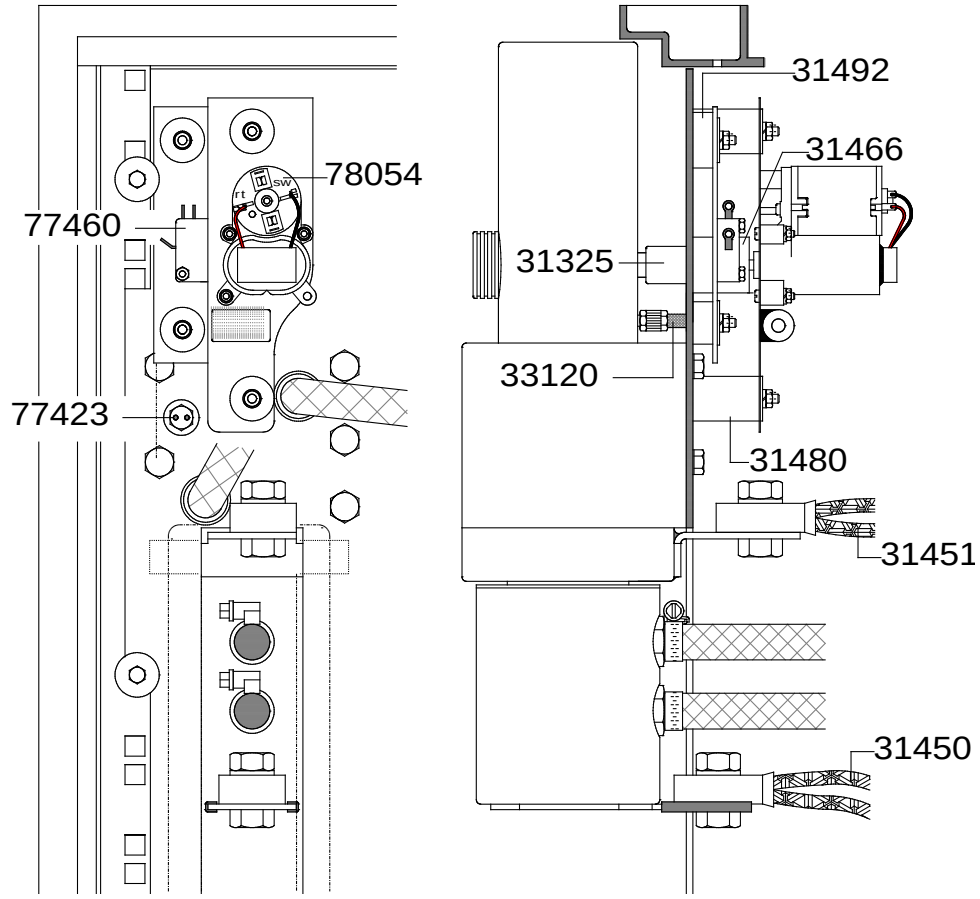


Fig. 32: Right hand side view II

Part No.	Description
31325	Sample drop mechanism
31450	Lower bride
31450	Upper bride
31466	Eccentric wheel
31480	Support for motor bracket

33120	Tube for dust trap
77423	Temperature sensor
77460	Micro switch
78054	Motor for sample drop

5.1.5 Left hand side

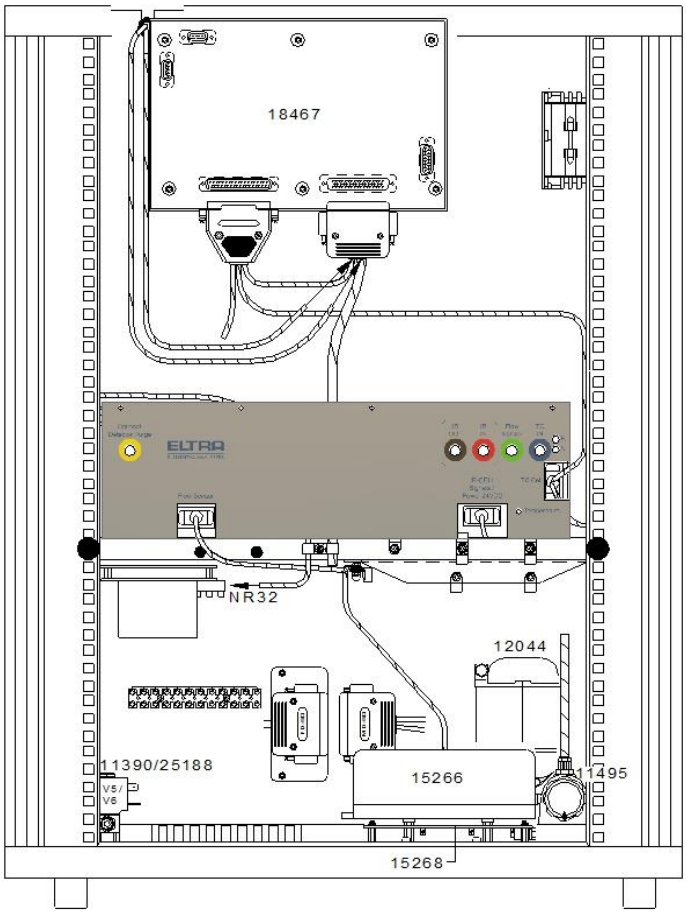


Fig. 33: Left hand side view

Part No.	description
05569	IR/TC cell for ONH
11390	Gas valve (ON900&OH900)
25188	Gas valve (ONH2000)
12044	Transformer
15037	Voltage stabilizer board NR32/IR version
15266	Gas pump
15268	Pump control board PC1
18467	Microcontroller board UNI

5.1.6 Valves plate

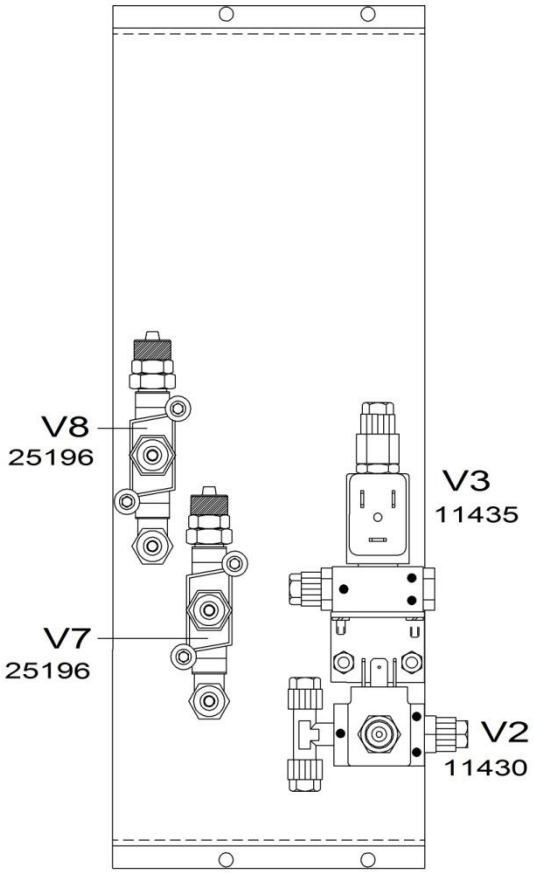


Fig. 34: Valves plate

Part No.	Description
11430	Valve V2 (Gas saving valve)
11435	Valve V3 (Gas saving valve)
25196	Valves V7 and V8 (catalyst valves for ONH analyzers only)

5.1.7 Furnace

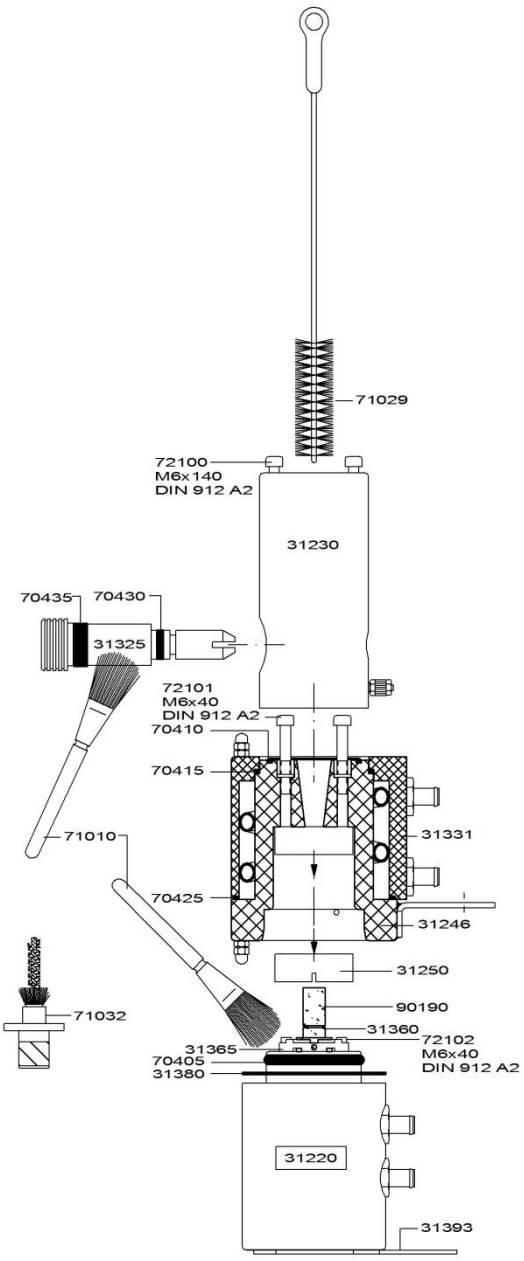


Fig. 35: Furnace

Part No.	Description
31220	Lower furnace assembly
31230	Upper furnace part
31246	Combustion chamber
31250	Upper electrode insert
31325	Sample drop mechanism
31331	Cooling cover

31360	Graphite tip
31380	Graphite tip holder
31365	Isolating ring
31393	Lower power connector
70405	O-ring
70410	O-ring
70415	O-ring
70430	O-ring
70435	O-ring
71010	Cleaning brush
71029	Furnace cleaning brush
71032	Upper electrode cleaning brush
72100	Screw
72101	Screw
72102	Screw
90180	Inner crucible
90185	Outer crucible
90190	Single crucible

5.2 Diagrams

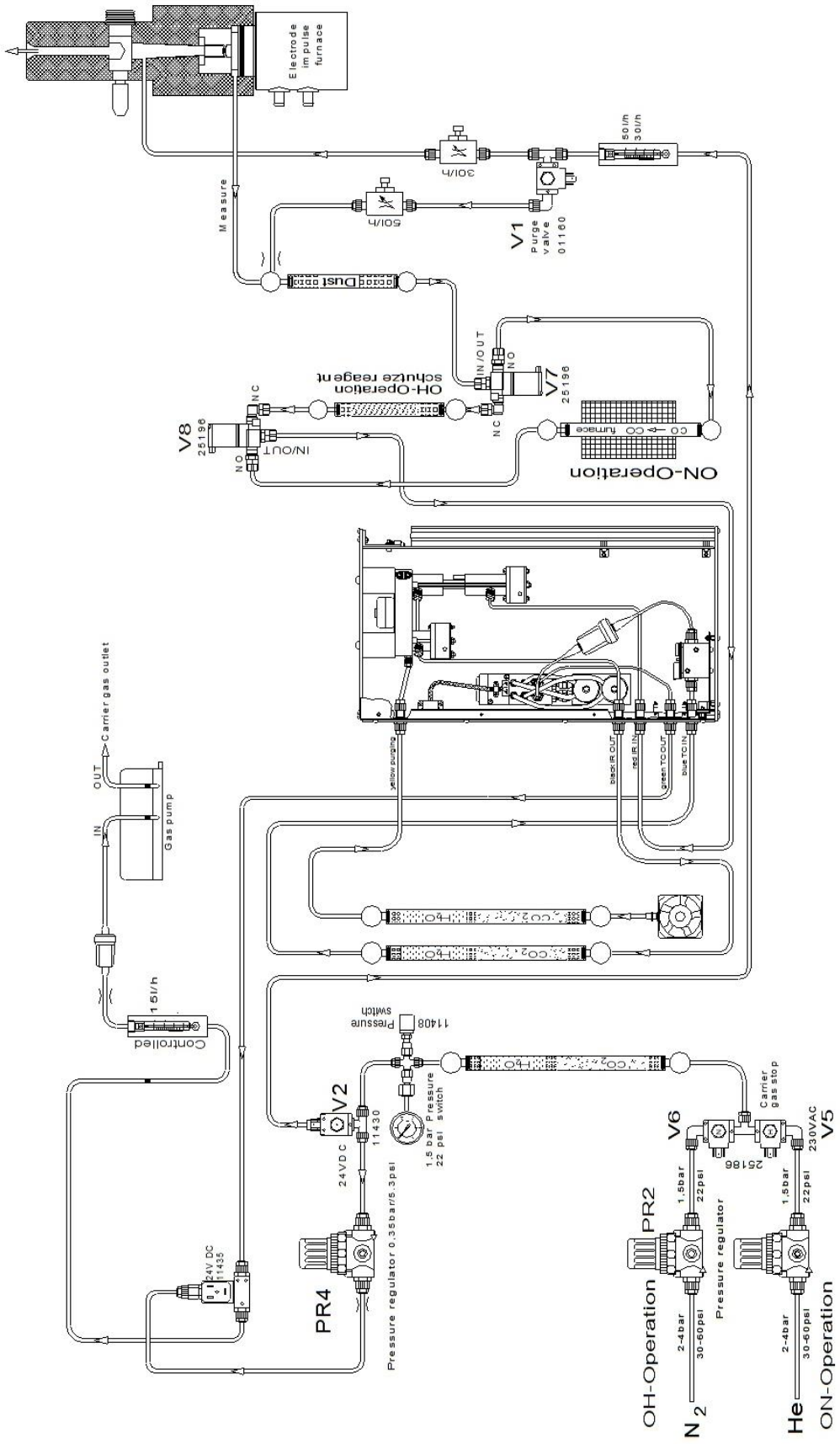


Fig. 36: Gas flow diagram-ONH2000

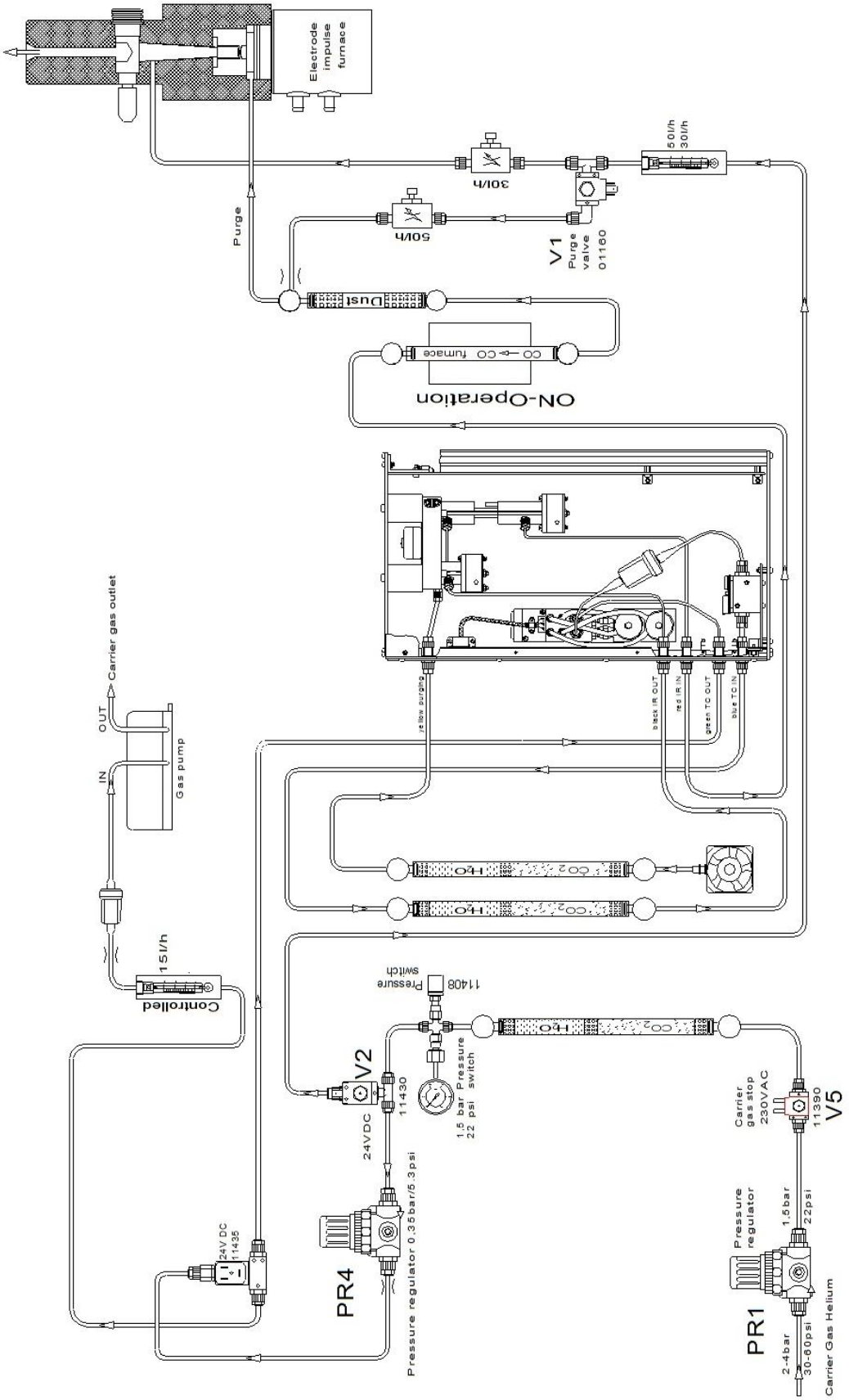


Fig. 37: Gas flow digram-ON900

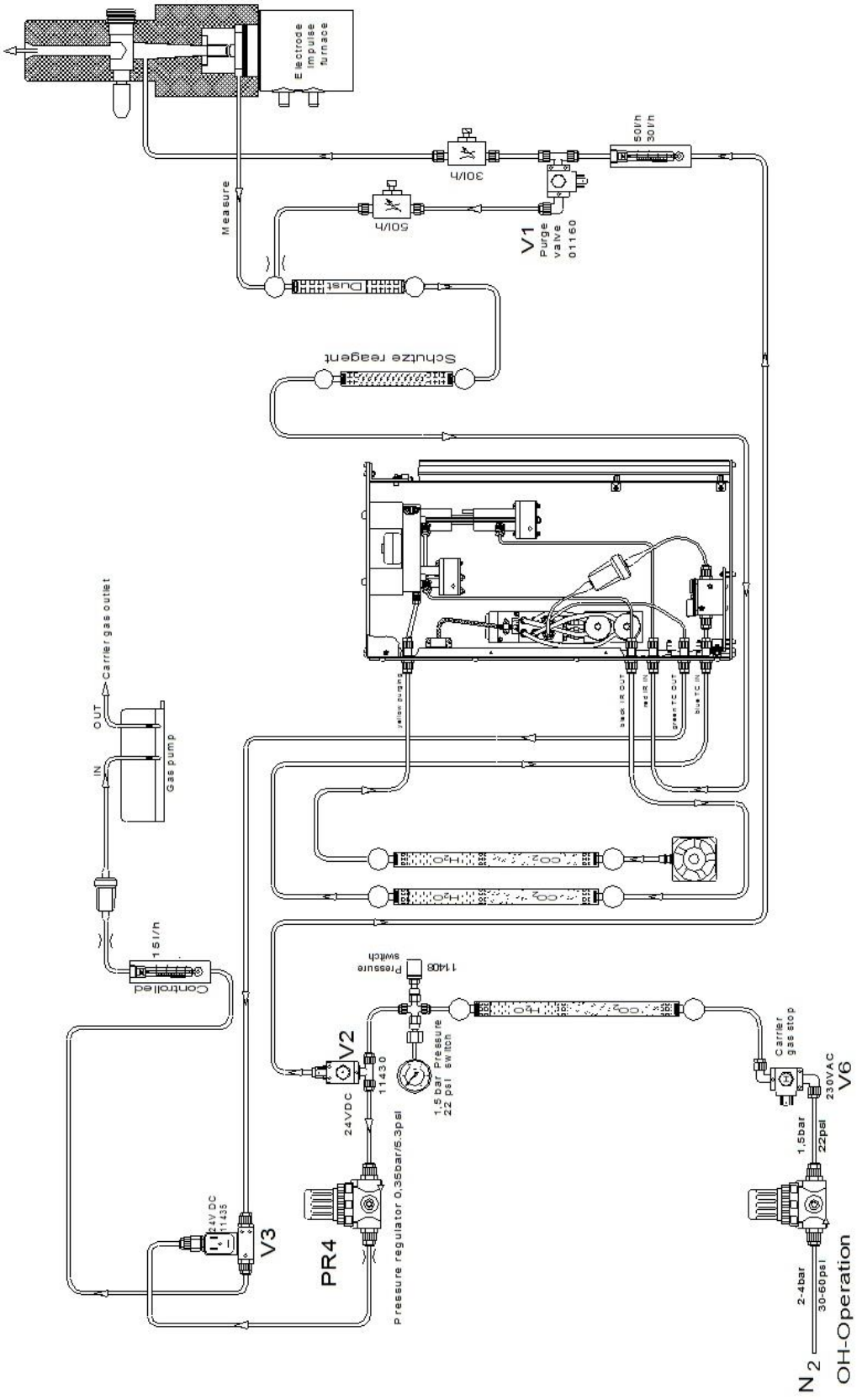


Fig. 38: Gas flow digram-OH900

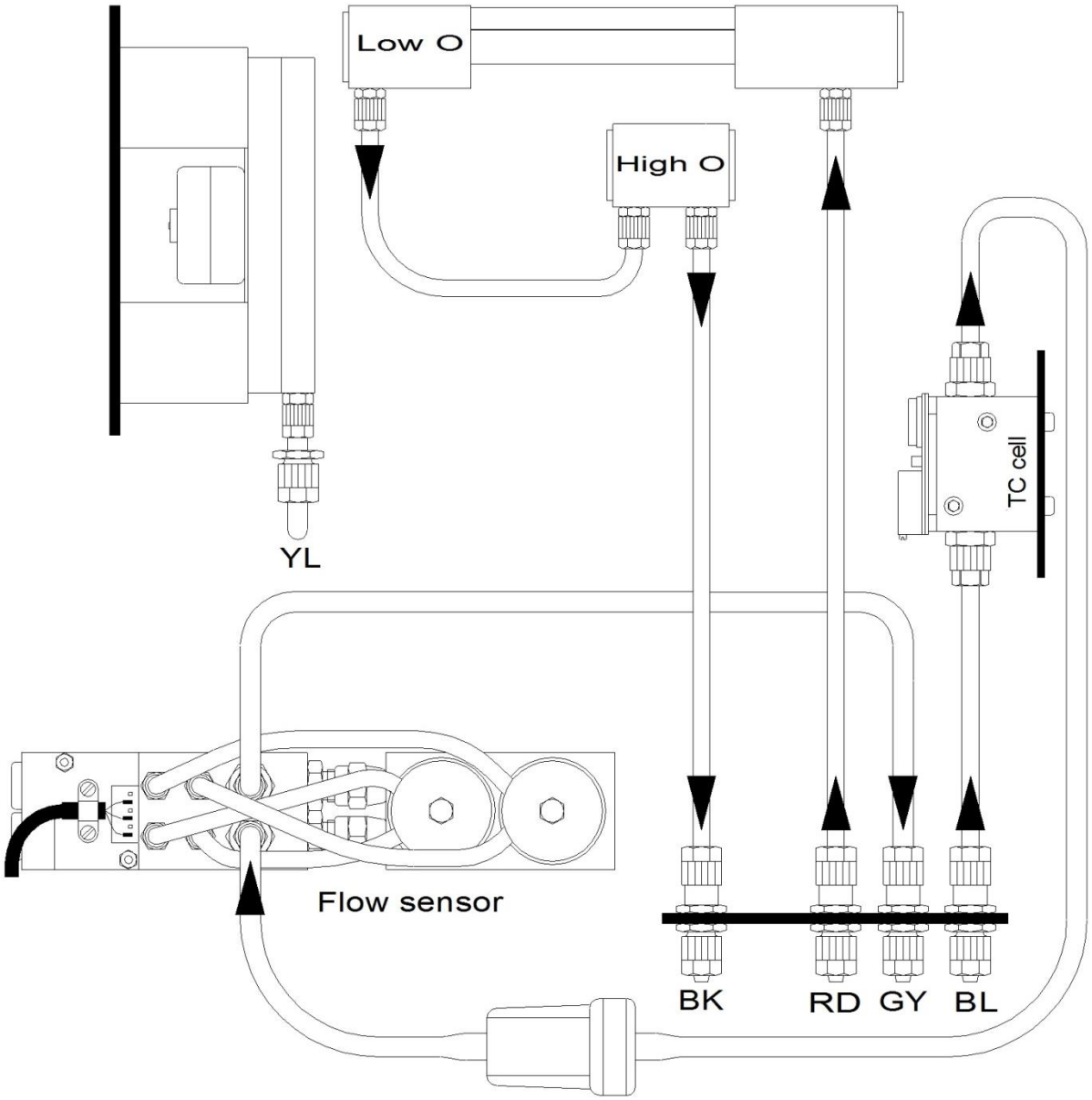


Fig. 39: IR/TC gas flow

5.3 Trouble shooting

5.3.1 High blank value in O and N

in some cases the gas flow is not high enough to prevent the air from entering the furnace. See chapter “Gas flow adjustment“ .

Remark

Check if the o-rings at the catalyst furnace are not damaged.

5.3.2 The analysis does not start

The start of analysis depends on many conditions. If there is no water flow, or the temperature is too high, a message appears on the display. A wrong adjustment of the flow rate prevents the analysis form starting as well.

If a base line is not stable, then this problem will occur. Maybe the gas bottle is empty, or some air got into the analyzer. Check and change the chemicals if necessary.

5.3.3 No current during analysis

If there is no current during an analysis, then there is a problem with the electric contact of the crucible in the furnace. There must be a gap between the upper furnace and the plastic ring of the lower furnace. If there is no gap, change the lower electrode. If this is not the problem, change the upper electrode.

Remark

Make sure that the dimensions of the crucible are correct especially the length.

5.3.4 "No water flow" or furnace overheat message

If there is no water flow in the beginning of the analysis, then the following message will appear: No water flow. The system will then shut down the furnace power. The analysis will be stopped.

Behind the right door of the analyzer is a flow sensor on a board consisting of water wheel and an optical element. If this wheel doesn't turn, there are most probably air bubbles in the wheel housing due to low water level of the cooling system. If the wheel is turning but even though no water flow is reported, change the cooling water, it may be muddy. Otherwise call a service engineer.

If the furnace becomes too hot during the analysis, the following message will appear: TEMPERATURE TOO HIGH

Make sure that the temperature does not exceed 70°C. Test the secondary cooling system. If the temperature is not above 70°C. an electric fault is the problem. Call a service engineer.

5.4 Pre-installation guide ONH 2000

Following requirements apply, when installing the Analyzer:

Compressed air	4 - 6bar (60 - 90psi)
Carrier gas	Helium 99.995% pure; 2 - 4bar (30 - 60psi)
	Nitrogen 99.995% pure, 2 - 4bar (30 – 60psi)

Mains power supply 3-phase version analyzer:

400VAC ± 10%, 50/60Hz, 32A fuse, 3 phase, earth and neutral.

Use DIN 49462/63 mains power socket, if locally applicable (CEE-481 T)

Mains power supply single phase version analyzer:

220 VAC ± 10%; 50/60 Hz, Breaker 40 A. (CEE, IEC60309)

Analyser dimension 560 x 780 x 600mm

Analyser weight approx. 135kg.

– It is important to install the instrument on a stable place
– The balance should rest on a vibration free support.

Gas connections:

The supplied tubes carry a connector with G¼" inner diameter ".

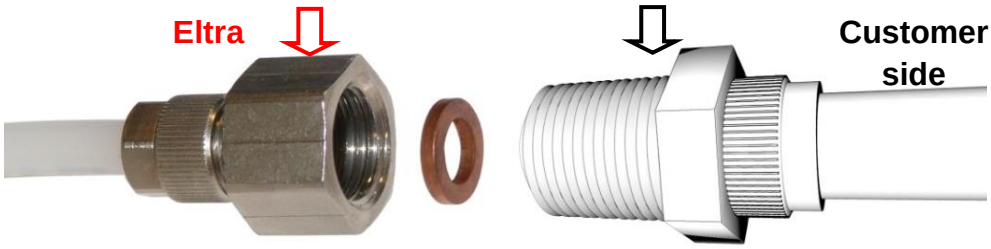


Fig. 40: Carrier gas tube

Connections for compressed air:

The tubes supplied together with the analyzer, carry a connector with G¼" inner diameter.

Fig. 41: Compressed air tube

Water connection:

Use tap water for cooling, with 4bar (60psi) pressure,

The tubes supplied together with the analyzer, carry a connector with G¾" inner diameter.

Fig. 42: Water connection

5.5 Packing

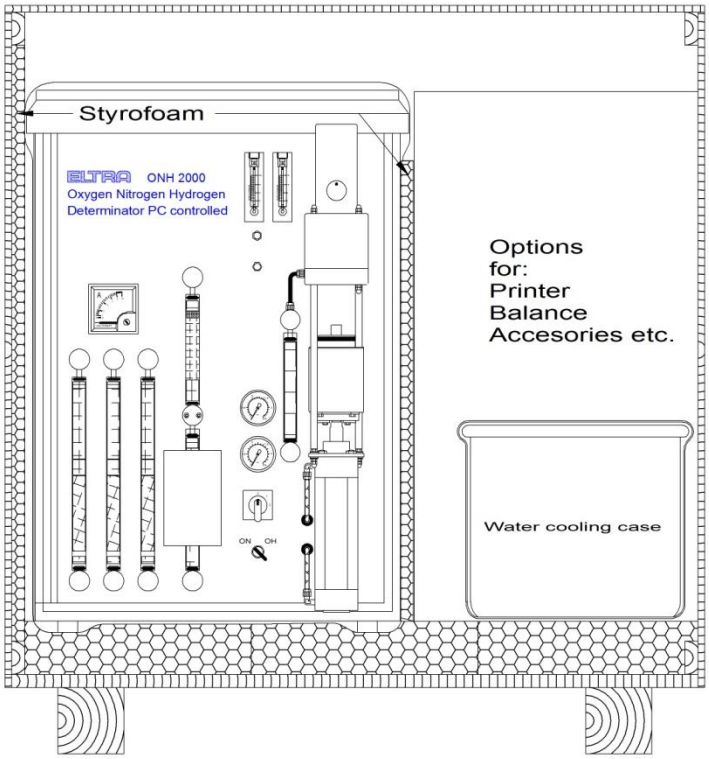


Fig. 43: Packing

The glass tubes on the front panel must be empty.

Before packing, the analyzer must be wrapped in plastic foil, in order to be protected from moisture and dust and to prevent packing chips from entering the analyzer. The analyzer is then placed into a wooden case having a thick layer of plastic foam on the bottom of at least 10 cm. The analyzer should be surrounded by a layer of plastic foam as well, in order to avoid damages during transportation.

Especially the foam where the analyzer is put on, is very important. It should be neither too hard nor too soft. When the foam is too soft, the analyzer's feet will practically touch the wood. Fix the foam on the bottom of the wooden case by gluing, to prevent it from shifting.

Place any other items to the right of the analyzer and fill up the rest of the space with soft packing material. Packing is done as follows:

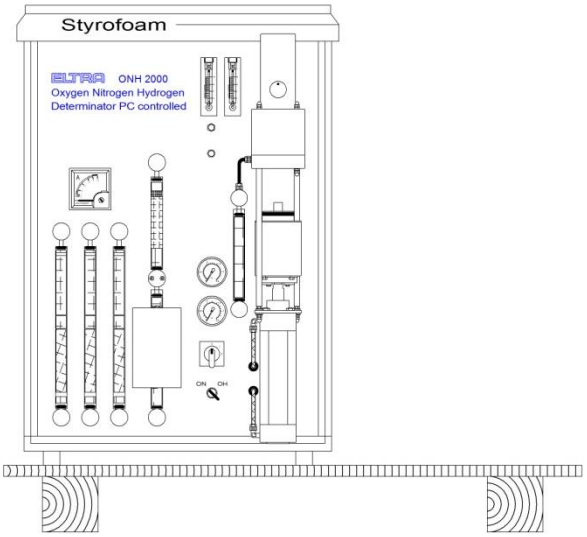


Fig. 44: Packing-Front view

- Place the analyzer 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 analyzer.

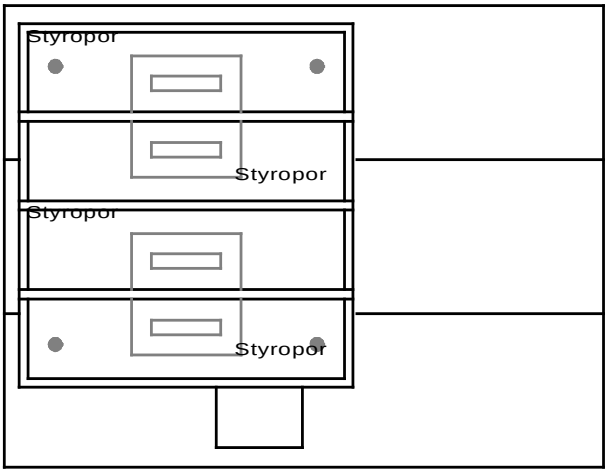


Fig. 45: Packing-Top view

- Shift the analyzer to the exactly required position.

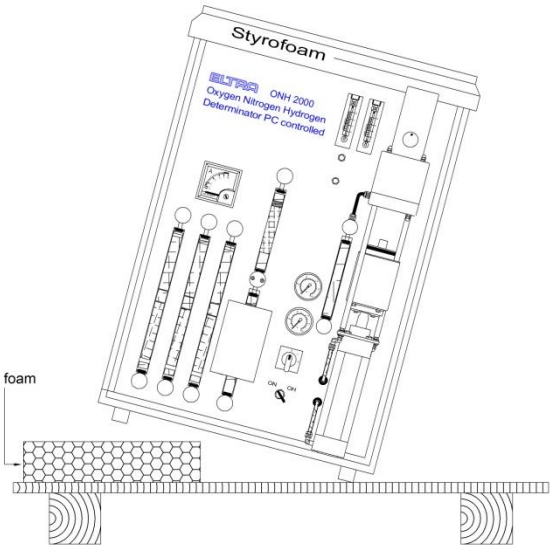


Fig. 46: Packing-Foam I

- Tilt the analyzer to the furnace side and place a piece of foam at the right position.

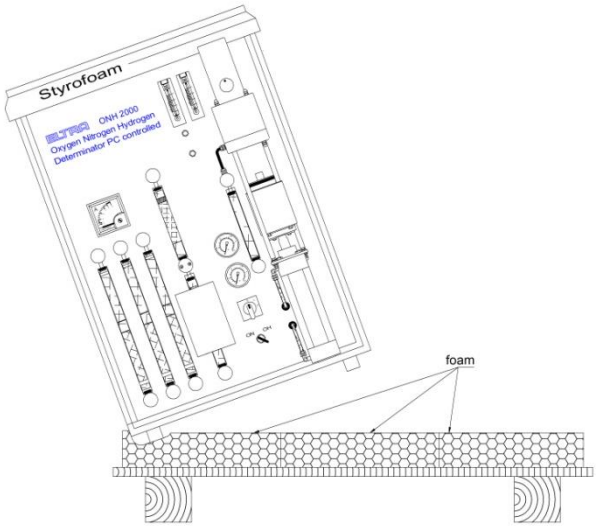


Fig. 47: Packing-Foam II

- Tilt the analyzer to the other side and place the second piece of foam at the right place. If necessary, a third piece of plastic foam can be placed on to the pallet.

6 Approved methodologies to which Eltra instruments conform

6.1 Inorganic materials (Metals)

Norm	Elements	Materials	Instruments
DIN EN ISO 9556:2002-04	C	Steel and Iron	CS-800 CS-2000
ISO 4935:1989 DIN EN 24935:1992-07	S	Steel and Iron	CS-800 CS-2000
ASTM E 1019:2011	C,N,O,S	Steel, Iron, Nickel / Cobalt Alloys	CS-800 CS-2000 ON-900 OH-900 ONH-2000
ASTM E 1587:2010	C,N,O,S	Refined Nickel	CS-800 CS-2000 ON-900 OH-900 ONH-2000
ASTM E 1409:2013	N,O	Titanium and Titanium Alloys	ON-900 OH-900 ONH-2000
ASTM E 1569:2009	O	Tantalum	ON-900 OH-900 ONH-2000
ASTM E 1447:2009	H	Titanium and Titanium Alloys	OH-900 ONH-2000
ASTM E1915 - 13	C,S	Metal Bearing Ores and Related Materials (i.e. tailings, waste rock)	CS-580 CS-800 CS-2000
UOP703 - 09	C	Catalysts	CS-800 CS-2000
ASTM E 1941:2010	C	Refractory and Reactive Metals	CS-800 CS-2000
ASTM E2575 - 08	O	Copper	ONH
DIN EN ISO 15351	N	Steel	ONH 2000 ON900
ISO 22963	O	Titan	ONH serie
ISO 17053	O	Steel/Iron	ONH serie
DIN EN ISO 15349-2	C	Steel	CS 800 CS 2000

ISO 13902	S	Steel/Iron	CS 800 CS 2000
ISO 4689-3	S	Iron ore	CS 800 CS 2000
ISO 7524	C	Nickel	CS 800 CS 2000
DIN EN 27526	S	Nickel	CS 800 CS 2000
DIN EN ISO 15350	C,S	Steel / Iron	CS 800 CS 2000
DIN EN ISO 3690	H	Steel	H 500
DIN EN ISO 10720	N	Steel	ON 900 ONH 2000
ISO 10719	C	Steel	CS 800 CS 2000

6.2 Organic materials (Oil, Coal, foodstuffs)

Norm	Elements	Materials	Instruments
ASTM D 1552:2008	S	Oil and Petrolium Products	CS-580 CS-2000
ASTM D 4239:2013;	S	Coal and Coke	CS-580 CS-2000
ASTM D 5016:2008	S	Coal and Coke Ash	CS-580 CS-2000
ASTM D 1619:2011	S	Carbon Black	CS-580 CS-2000
DIN EN 13137:2001-12	C	Waste	CS-580 CS-2000
DIN ISO 10694:1996-08	C	Soil samples	CS-580 CS-2000
ASTM D 7348:2013	Loss On Ignition (LOI)	Combustion Residues	TGA Auto TGA Thermo Chain
ISO 15178	S	Soil	CS 580 CS 800 CS 2000

7 Disposal

Please observe the respective statutory requirements with respect to disposal.

Information on disposal of electrical and electronic machines in the European Community.

Within the European Community the disposal of electrically operated devices is regulated by national provisions that are based on the EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

Accordingly, all machines supplied after 13.08.2005 in the business-to-business area to which this product is classified, may no longer be disposed of with municipal or household waste. To document this they have the following label:

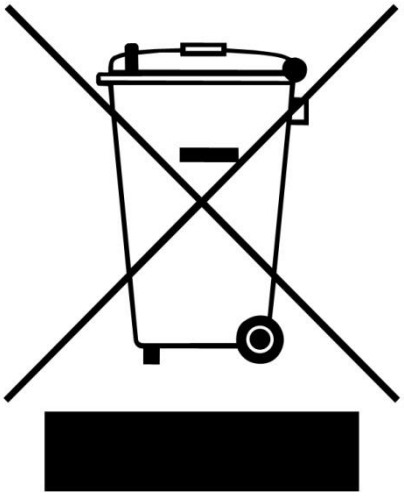


Fig. 1: Disposal label

Since the disposal regulations within the EU may differ from country to country we would request you to consult your supplier.

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ELTRA
ELEMENTAL ANALYSERS