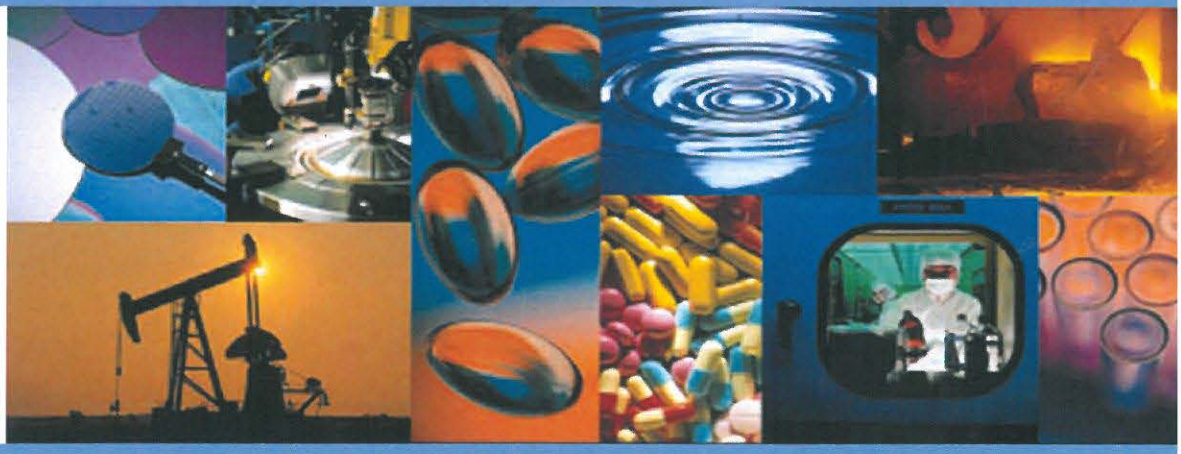
ARL 3460
User Manual

AA83716



USER MANUAL

ARL 3460

Report **MANUAL**

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PAGE DE MODIFICATION

ÄNDERUNGSANGABEN

REVISION CONTROL SHEET

Date Datum Date	Modification Änderung Revision	Description Beschreibung Description
2010 May	00/RTh	Creation. Merging from previous operator AA83322-05 and reference AA83321-06 manuals. Updated according to OM3794, 3911, 3923, 4077 & 4105.

TABLE OF CONTENT

1

INTRODUCTION

1 INTRODUCTION

We congratulate you on the purchase of your ARL spectrometer. This accurate measurement instrument has been produced by Thermo Fisher Scientific to satisfy your analytical needs.

The purpose of this **User Manual** is to introduce you with the ARL 3460 and to assist you in its use and maintenance.

Application Domains

The instrument is designed to analyse the elemental composition of virtually all elements in samples of all metal types, such as low alloyed steels, stainless steels, cast iron, low alloyed aluminium, alloyed aluminium, bronzes, brasses and more. Furthermore, it is suitable for analysis of low carbon, low sulphur, low phosphorus and low nitrogen.

If you are unfamiliar with spectrographic procedures and equipment, please refer to an introduction manual of the optical emission spectroscopy principles.

General comment

This manual, and its pictures, stands for an instrument in the most usual configuration sold. Illustrations and drawings may therefore show noticeable differences with the configuration of your own instrument.

The VUV option is more detailed in a separate manual.

Safety

The instrument conforms to the CEI1010-1 safety standard.

The only two areas where an ill-advised operator could access to hazardous voltage by a simple manual operation are protected by safety contacts ("forced opening") that switches off the power supply of the concerned areas.

The other inside parts of the instrument, around or into which ones hazardous voltage may exist, can be accessed only by the mean of a tool. Although the power supplies are closed or protected, and the wires adequately insulated, a little electrocution risk can remain around these components. The hazardous modules, or the accesses to them, are mentioned with a label.

General Warnings

The instrument uses several components, which can be dangerous to manipulate. The signs shown below are stuck to covers and panels etc. to warn you:

Figure 1.1

Risk of electrocution

Non qualified personnel should never approach these modules when the instrument is powered.

Only our Service Engineers, or your maintenance technicians advised and trained by our care should approach these modules, with the custom precautions when they are under power.

Switch off the power before removing this panel or part.

Figure 1.2

Warning!

This label points out if there is a risk to affect the alignment of the concerned module in case of a wrong handling.

Follow exactly the procedures described in this manual when operating around or inside this module.

Figure 1.3

Warning!

This label points out if there is a risk of fire in case of a wrong handling.

Follow exactly the procedures described in this manual when operating around or inside this module.

The routine maintenance procedures (for example the profile taking) that require the operator to execute an operation around or inside a module are clearly described in the *Routine Maintenance* chapter of this manual. If they are scrupulously followed, the alignment and the calibration of the instrument will not be affected.

Furthermore the handlings indicated in the procedures do not expose the operator to hazardous voltage and electrocution risk.

Conformity to standards

The instrument is developed according to the most common international standards. The ARL 3460 is in conformity with the following standards or other normative documents:

EN292-1,-2 (1991)	Safety of machinery: basic concept
EN60204-1 (1984)	Electrical equipment of industrial machines.
EN60947-1 (1991)	Low voltage switchgear and control gear.
IEC1010-1 (1990)	Safety requirements for electrical equipment for measurement, control and laboratory use.
IEC 950 (1986)	Safety of information technology equipment.
EN50081 (1992)	Electromagnetic compatibility: generic emission standard
EN50082 (1993)	Electromagnetic compatibility: generic immunity standard

Following the provisions of the European directives:

98/37/EC	Machinery.
73/23/EEC	Low voltage material.
89/336/EEC	Electromagnetic compatibility

Disposal / Recycling

RoHS – Weee directives:

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/weeerohs.

Documentation

The documentation of the ARL 3460 is usually delivered on CD-ROM. Only the instrument *User Manual* is delivered on paper.

The documentation is stored in files of the PDF format, and the current version of **Acrobat Reader®** free software in English is supplied with the CD-ROM. If you would like to have the reader in another language, please consult the Adobe web site **www.adobe.com**.

The cover sheet of the CD-ROM gives you directions on how to install the **Acrobat Reader®** and the documentation files on your computer.

> IMPORTANT:
>
> The information in the documentation was true at the time of release, but could include technical inaccuracies or typographical errors.
>
> Furthermore, we do not take any responsibility in the case of the use of this documentation by irresponsible or non qualified people. This is valid for the injury to persons as well as for material damage to the instrument.

Documentation Composition

The instrument documentation is composed by several manuals, lists, catalogue, drawings, schematics, etc.

They are split into two distinct documentation sets:

- ⇨ The documents intended for the operator and the laboratory personnel, as well as for your maintenance technicians. **We call this basic documentation**, supplied as standard with each instrument, "**Customer Documentation**". See there under *Customer Documentation.*

- ⇨ The documents intended for our Service Engineers and of our Distributors and agreed Agents. **This reserved documentation is called "Service Documentation"**; it is not supplied as standard with the instrument. See there under *Service Documentation.*

Customer Documentation

The basic documentation, intended for the operator and the laboratory personnel, as well as for your maintenance technicians, supplied as standard with each instrument is composed of:

SUBJECT	CONTENT / USE
User Manual	This is this manual. It describes the instrument, the start-up, routine analysis and maintenance operations on the instrument.
Catalogue	Lists of available consumables and spare parts, with part numbers.
Vacuum Pump Manual	Operating and maintenance. It is the manual of the pump manufacturer.
The possible **Option Manuals**	Description and use of the concerned option.

The technical file supplied with the instrument contains specific data of your individual equipment. Depending on the options purchased, other manuals can be included into your documentation set.

The OXSAS analytical software documentation is included in the software itself, as a contextual help. Just press the F1 key in order to get contextual help related to the displayed dialogue.

Apart from the OXSAS software, the remaining computer software and hardware is not manufactured by ourselves. For all these modules (software and hardware) you will find the documentation supplied by the manufacturer(s) in their original packing.

Optional hardware accessories (for example: sample preparation machine, voltage stabiliser, etc.) can be delivered with the instrument. In such a case, a documentation is also supplied for those options.

Service Documentation

As said above, this documentation does not belong to the standard documentation supplied with our instruments. These documents are intended to be used by our Service Engineers and those of our Distributors and agreed Agents.

The understanding of the content of these documents requires a strong technical basic knowledge as well as practical experience on our instruments.

These documents are available in English only.

They are:

SUBJECT	CONTENT / USE
The **ARL 3460 Technical Description Manual**	Detailed technical description.
The **Service Preventive Maintenance Manual**	Description, table and checklist of periodical maintenance checks.
The **TICS software**	Troubleshooting and test software.

IMPORTANT:

The information in the documentation was true at the time of printing, but could include technical inaccuracies or typographical errors. Thermo Fisher Scientific assumes no responsibility for any errors that may appear in the Service documentation set described above.

As well the responsibility of Thermo Fisher Scientific cannot be engaged in the case of the use of this documentation by non qualified people and not agreed by Thermo Fisher Scientific. This is valid for the injury to persons as well as for material damage to the instrument that may result in a financial loss to the business user of the instrument.

Summary of the User Manual

The following subjects are contained in this manual:

Introduction	**Chapter 1**	This is this chapter. It contains important information concerning the safety of the ARL 3460 and informs about the instrument documentation.
Layout and Controls	**Chapter 2**	This chapter is a glance on the instrument and its controls. It shortly describes the different parts of the instrument and how they operate.
Routine Operation	**Chapter 3**	This chapter describes how to manipulate the samples, how to get ready for routine analysis, and how to run routine analysis.
Routine Maintenance	**Chapter 4**	This chapter lists and describes the regular basic and ordinary procedures for maintenance operations to be carried out by the operator.
Technical Description	**Chapter 5**	This chapter gives a simplified technical description of the optical emission spectroscopy technique applied to the ARL 3460.
Analytical Principles	**Chapter 6**	This appendix gives some introductory analytical principles used in optical emission spectroscopy.
Sample Preparation	**Appendix A**	This appendix gives basic hints and tips for sample casting and sample surface preparation in order to make them suitable to analyse.
Special Procedures	**Appendix B**	This appendix brings together the particular routine maintenance procedures required for the analysis of some alloys, in relation to the ordinary routine maintenance procedures.

2

LAYOUT AND CONTROLS

2 LAYOUT AND CONTROLS

This section is a purely topographical description of the instrument. It is limited to those items, which the user should be familiar under normal circumstances.

The items are identified by groups of numbers, which are shown in this section. The descriptions are grouped by illustrations.

The text is subdivided into four following categories:

- **D** description
- **U** use (purpose and/or how to use, access)
- **C** comment
- **M** maintenance (not troubleshooting)

If a description is followed by an F!, a further description and figure exist.

Cabinet, General View

The figures 2.1 and 2.2 show two of several alternatives for the arrangement of the complete equipment.

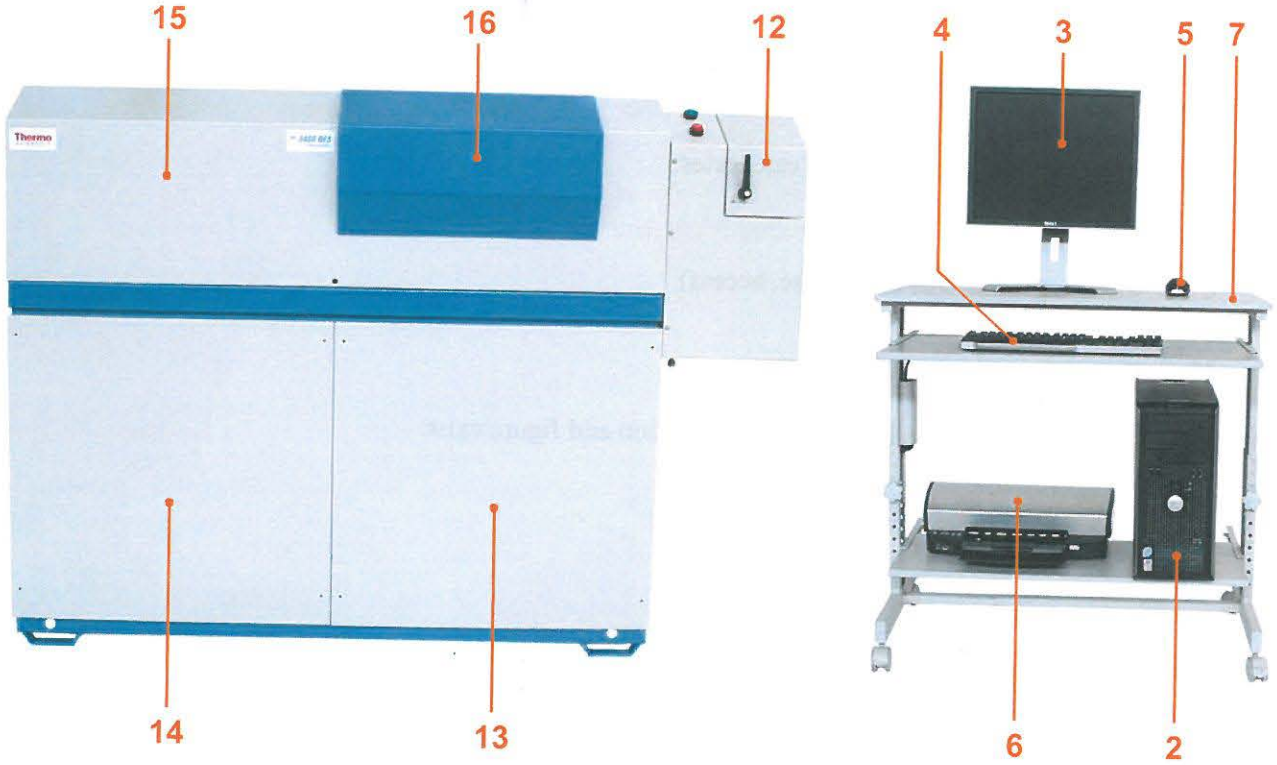


Figure 2.1

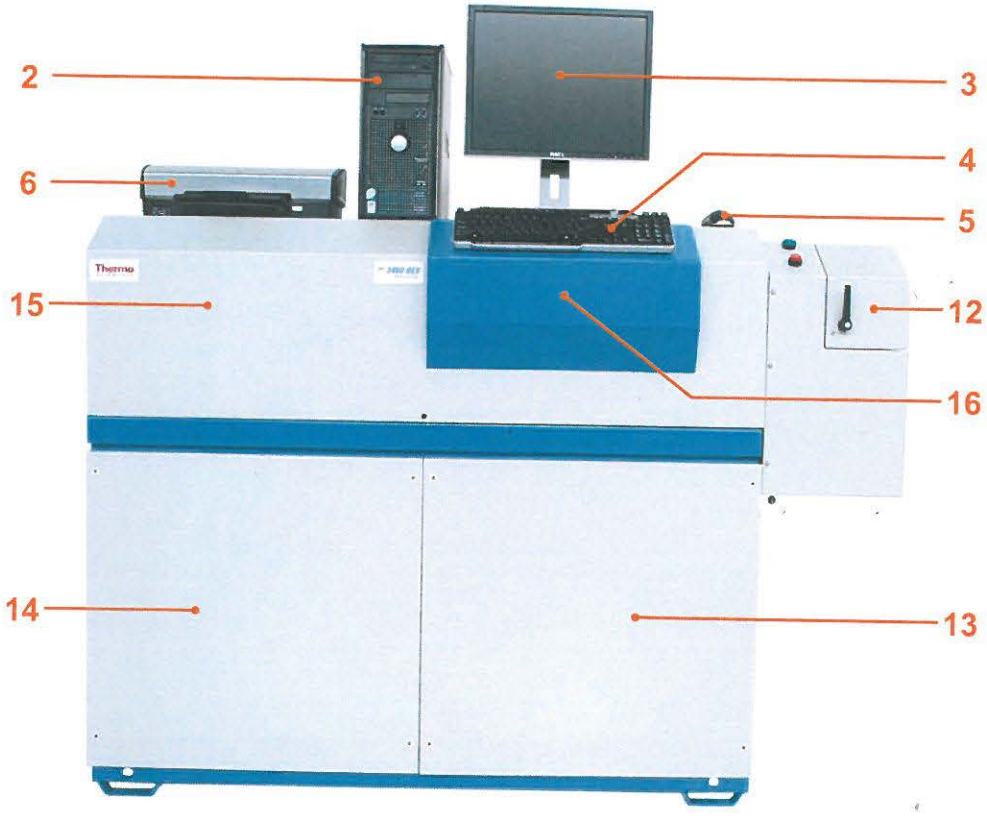


Figure 2.2

Key to figures 2.1 and 2.2:

D : System terminal with keyboard.

2 D : Computer (central unit).

3 D : Monitor for computer.
U : Display the dialogue between the operator and the software driving the instrument.

4 D : Keyboard for personal computer.
U : The operator uses the keyboard or the mouse to control the instrument.

5 D : Mouse for personal computer.
U : The operator uses the keyboard or the mouse to control the instrument.

6 D : Printer.
U : Prints analysis results or parameters of the analytical program.

7 D : Table holding the computer, monitor, keyboard and printer.

D : ARL 3460 instrument complete cabinet.

12 D : Stand door (F!). See also key figure 2.7.
C : Access to the analytical table (F!).
U : To open, simply push the handle to the right.

13 D : Right-hand front panel.
C : Access to the source (F!) and to the power supply distribution panel (F!).
U : For removal, either with an Allen key or a screwdriver with an Allen key head, unscrew partly the four "camlock" screws accessible through the holes at the panel corners, lift a little bit the panel and pull it towards you.

14 D : Left-hand front panel.
C : Access to the electronic rack (F!).
U : As above, pos. 13.

15 D : Lid.
C : Access to the thermo-controlled housing (oven) (F!), to the spectrometer (F!) and to the attenuators (F!).
U : To open, either with an Allen key or a screwdriver with an Allen key head, unscrew sufficiently the screw accessible by the hole, then simply lift from the front upwards. If the screw is not enough unscrewed, it is not possible to lift the lid.

16 D : Support for keyboard (pos. 4).
C : Access to the control multimeter (F!) and to the scanning screw (F!).
U : To open, simply lift the support upwards.

Unit and Sub-Assemblies

Figures 2.3 to 2.6 show the different units and sub-assemblies that make up the instrument. Certain of these sub-assemblies are described in further detail in the following paragraphs.

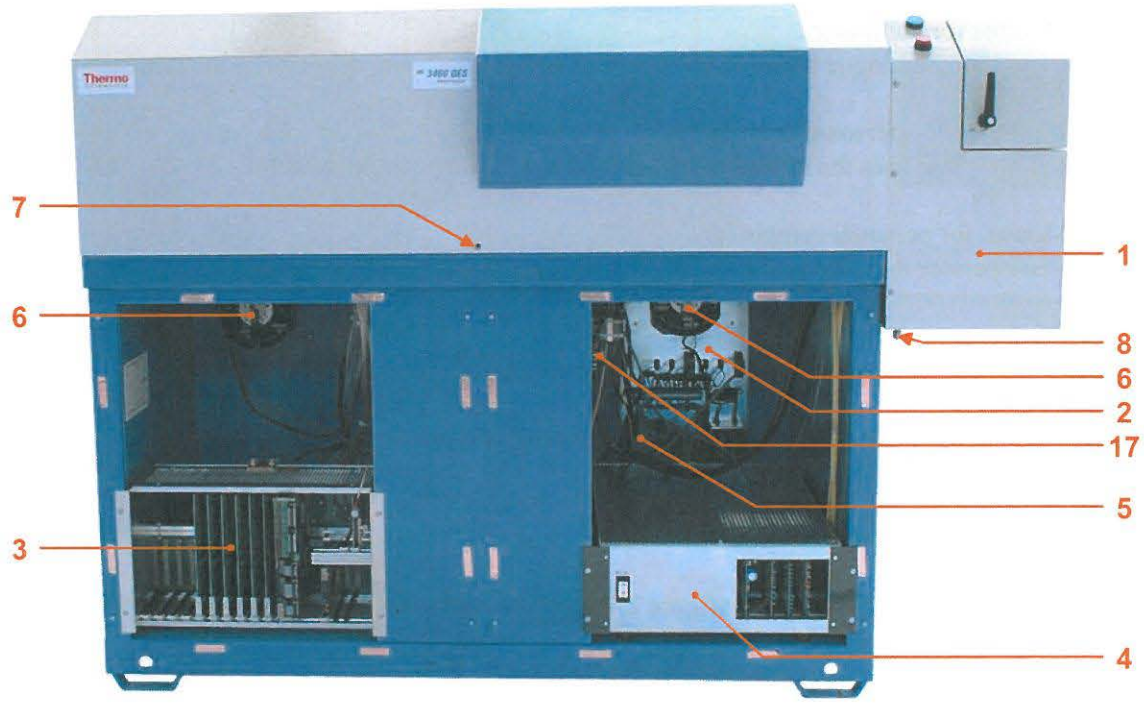


Figure 2.3

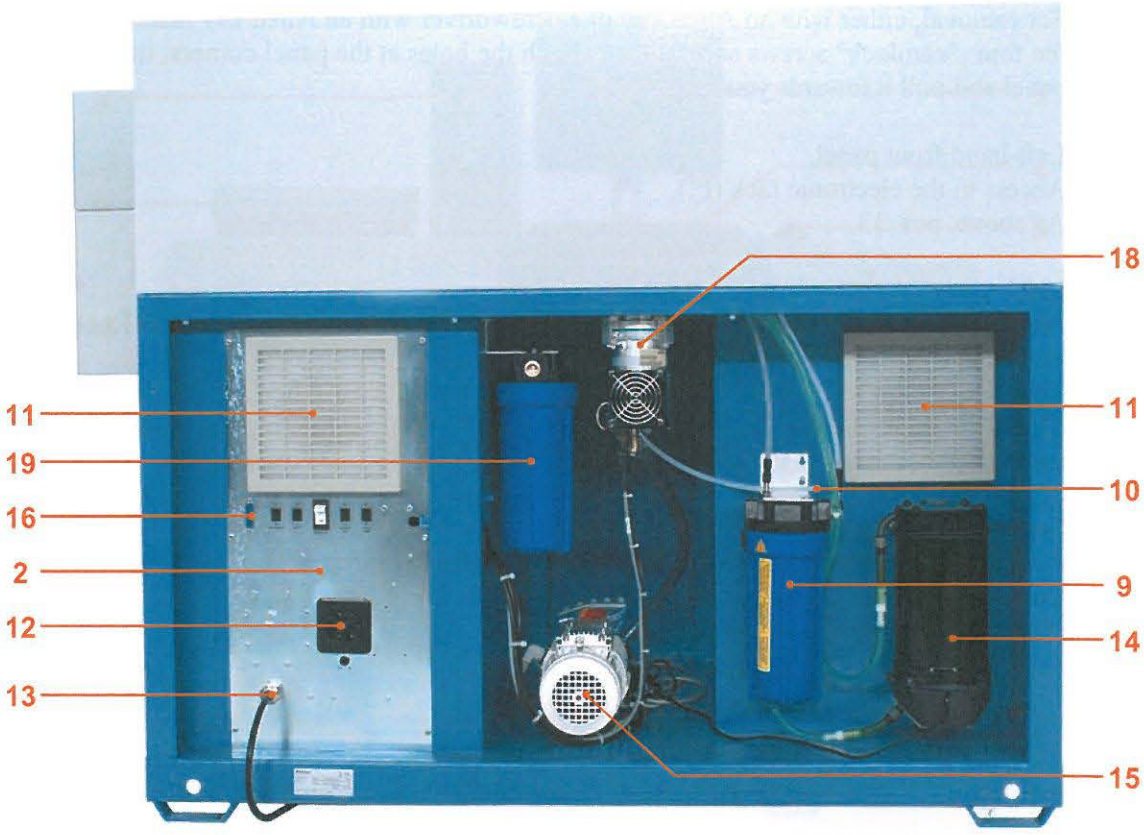


Figure 2.4

Key to figures 2.3 and 2.4:

1 D : Stand. F!

2 D : Power distribution panel. F!
U : For access, remove the right-hand panel (figures 2.1 and 2.2, pos. 13) or open it from the back of the instrument.

3 D : Electronic rack. F!
U : For access, remove the left-hand panel (figures 2.1 and 2.2, pos. 14).

4 D : Source rack.
U : For access, remove the right-hand panel (figures 2.1 and 2.2, pos. 13).

5 D : Air pulser. F!
U : This little compressor is use to send pulsed air into the igniter auxiliary gap.

6 D : Fans.
U : Cooling by air of the lower cabinets of the instrument.
For access, open the front panels (figures 2.1 and 2.2, pos. 13 and 14).
M : Check its operation by observing the fans from the front of the instrument, with the front panels removed (figures 2.1 and 2.2, pos. 13 and 14).

7 D : Lid's blocking screw.
U : Closes the user safety and prevents the lid to be open.
M : If the lid must be open (e.g. for maintenance purpose), that screw must be sufficiently unscrewed. The safety will open and the lid can be lifted. The access to inside components is therefore without danger for the operator.

> **WARNING: Out of alignment risks!**
>
> Handling inside the oven must only be done by qualified personal.

8 D : Argon inlet.

9 D : Argon outlet filter. F!
U : The filter retains the metal dust particles, which are drawn from the sample during the analysis.
M : To be cleaned regularly. Unscrew the container slowly as the dust can catch fire upon contact with the oxygen of the air. Clean the filter cartridge with a vacuum cleaner or change it. See complete procedure, section *Argon Outlet Filter* chapter *Routine Maintenance*.

10 D : Argon outlet.
C : It is recommended to evacuate the argon from the instrument outlet to the outside of the laboratory.

11 D : Dust filters.
U : Prevents dust from entering the instrument's lower cabinets.
M : Should be cleaned regularly. See complete procedure, section *Changing or Cleaning of the Dust Filters* chapter *Routine Maintenance*.
C : Behind the filters (on the inside) is a fan (F!) (figure 2.3, pos. 6).

12 D : 230 VAC output sockets.
U : For connection of the computer and its peripherals.
C : These sockets remain supplied, even if the main switch-breaker (figure 2.12, pos. 2) is off. This permits to switch off the instrument with keeping the computer powered.

13 D : 230 VAC mains power supply cable.

14 D : Water cooler. F!
U : The analytical table is cooled by a closed circuit of circulating water.
M : Check the water level by time to time, see (figure 2.19, pos. 1).

15 D : Vacuum pump. F!
C : Depending if the version is with or without the VUV option the pump models are different, see the later section *Vacuum Pumping Line*. The vacuum pump is switched on by the switch (figure 2.12, pos. 5). However, it can never be powered if the main switch-breaker (figure 2.12, pos. 2) is off.

16 D : RS232 input.
U : Connection between the computer and the instrument.

17 D : High vacuum system control board.
U : This board is present only with the VUV option. It controls the molecular drag pump.

18 D : Molecular drag pump. F!
C : This object is installed only when the VUV option is present. See later section *Special System for High Vacuum*.

19 D : Spare filter. F!
C : Leave a clean filter ready to use at this location. See later section *Argon Circuit*.

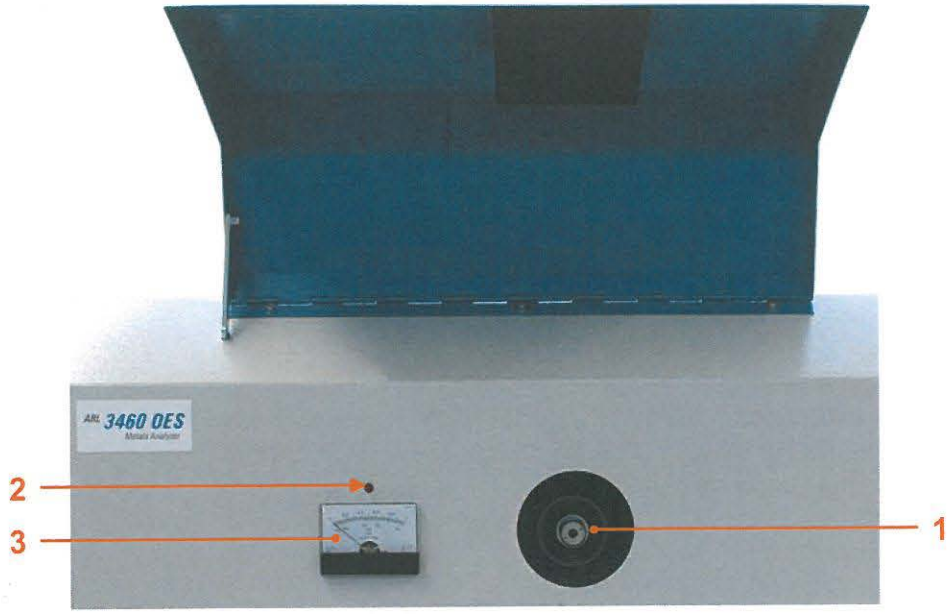


Figure 2.5

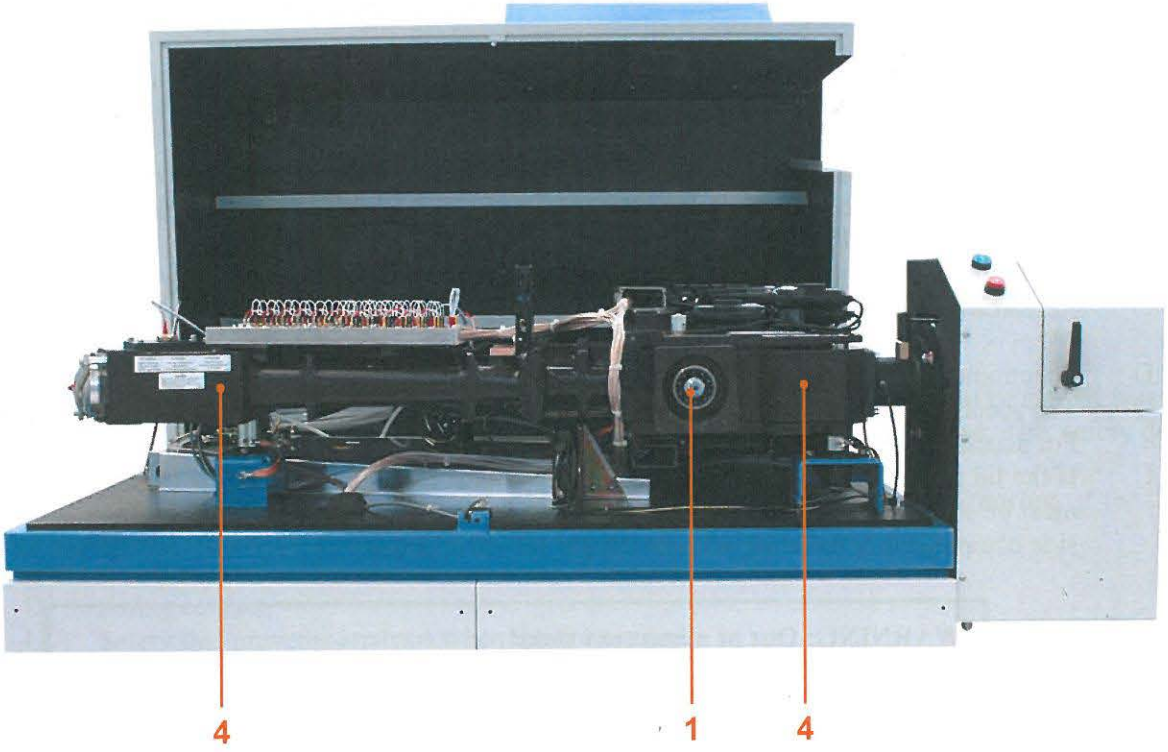


Figure 2.6

Key to figures 2.5 and 2.6:

1 D : Scanning screw. F!
U : This screw is used for finding a spectral line and its intensity peak (in terms of divisions of the scanning screw's scale).
For access, lift the keyboard support (figures 2.1 and 2.2, pos. 16).
M : For the analysis, the scanning screw must be put on the position found during the profile check. See section *Profile Check* chapter *Routine Maintenance*.
C : In order to correct the play on the screw, the final movement of the scanning screw must always be made in the same direction (clockwise).

2 D : Pilot lamp for heating of the oven (F!).
U : Gives an indication on the heating cycle operation. The lamp is lit when the heating is operating and it goes out when it stops. In normal operation, the lamp lights and goes out alternately about one time every three seconds.

3 D : Control multimeter.
U : This multimeter has two purposes:
1. Check the intensity peak of a spectral line, for the direct profile method of profile taking; there are four scales of sensitivity that can be selected on the vacuum and profile card (F!) of the electronic rack (F!). See figure 4.8 for the vacuum and profile card, and the section *Direct (or Manual) Profile* chapter *Routine Maintenance* for the direct profile procedure.
2. Check of the vacuum in the spectrometer; there are two sensitivity scales that can be selected from the vacuum and profile card (F!) of the electronic rack (F!). See figure 4.8 for the vacuum and profile card.
One of these scales gives the absolute value (real) of the vacuum inside the spectrometer; it will be used to check the value of this vacuum and to adjust the air leak by micro-valve (figure 2.8, pos. 15) if necessary.
The other vacuum value indicates a relative value (differential) allowing vacuum leak research during repair.

4 D : Spectrometer. F! See section *Oven and Spectrometer*.
U : The spectrometer contains the optical elements for wavelength dispersion.
For access, lift the lid.
C : If the lid must be open (e.g. for maintenance purpose), the blocking screw (figure 2.3, pos. 7) must be sufficiently unscrewed. The safety will open and the lid can be lifted. The access to inside components is therefore without danger for the operator.

WARNING: Out of alignment risks!

Handling inside the oven must only be done by qualified personal.

Stand

The figure 2.7 shows the stand with a sample in position ready for analysis. The figure 2.8 shows the stand open for cleaning or maintenance purpose. The figure 2.9 shows several separate parts subject to maintenance or cleaning.

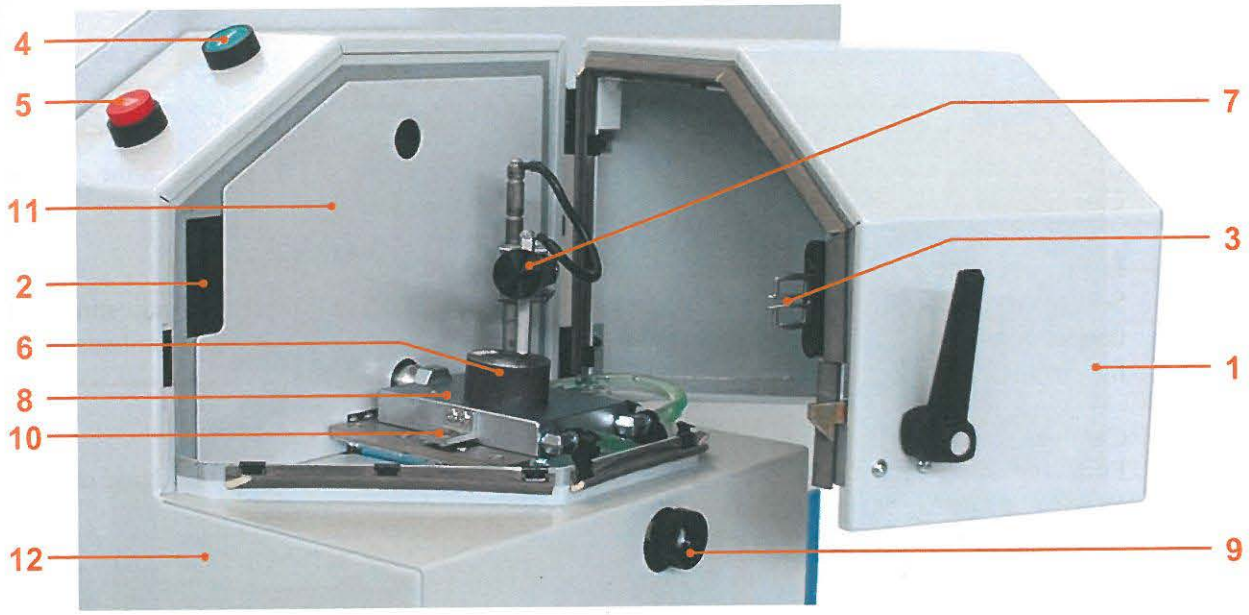


Figure 2.7

Key to figure 2.7:

D : Stand.

1
D : Stand door.
U : The stand door is for closing the sample analysis housing. No analysis can be started when the door is open. Likewise, the analysis is interrupted when the door is opened. This safety device complies with the international standard CEI 1010-1.
M : The door's hinges should be greased from time to time. See section *Greasing of the Stand Door's Hinges* chapter *Routine Maintenance*.

2
D : Safety contact.
U : Safety that prevents analysis when the door is open.

3
D : Safety tab.
U : Frees the safety when the door is closed.

4
D : START button.
U : Analysis start-up.
C : The software can do without the START button if the automatic start is selected. However the analysis will start only if the door is closed.

5
D : STOP button.
U : By pressing this button, the analysis cycle will be stopped at any moment.

6 D : Sample in analysis position.
C : The sample must completely cover the hole in the table. It is necessary that the surface be flat. See also *Sample Preparation* and *Placing the Sample on the Analytical Table* appendixes of this manual.

7 D : Sample clamp.
U : This device maintains the sample firmly in place on the analysis table.

8 D : Analytical table. F!
U : This is a support for the sample and a cover for the sparking chamber.
C : The analytical table is also commonly called "Petrey table".
M : Clean the table and the chamber regularly. The complete procedure is described in the section *Cleaning of the Stand and the Sparking Chamber* chapter *Routine Maintenance.*

9 D : Electrode's (figure 2.9, pos. 11) clamping screw.
U : Secures a reproducible position of the electrode in relation to the sample. The adjustment of the position is to be made with a gauge (figure 2.9, pos. 13). It is useless and even harmful to tighten the electrode excessively.

10 D : Camlocs screws (2x).
U : Fastening of the analytical table. To free the table, see section *Cleaning of the Stand and the Sparking Chamber* chapter *Routine Maintenance.*

11 D : Protection plate.
U : Access to the top inside part of the stand. To remove, pull up. See also section *Lens Cleaning* chapter *Routine Maintenance.*
C : The plate must be removed to proceed to some maintenance operations, for example the lens cleaning.

12 D : Stand housing.
U : To have access to the inside of the stand enclosure, for example for troubleshooting or component exchange, the complete housing must be removed.
C : Routine maintenance operations do not require the operator to remove the stand housing.

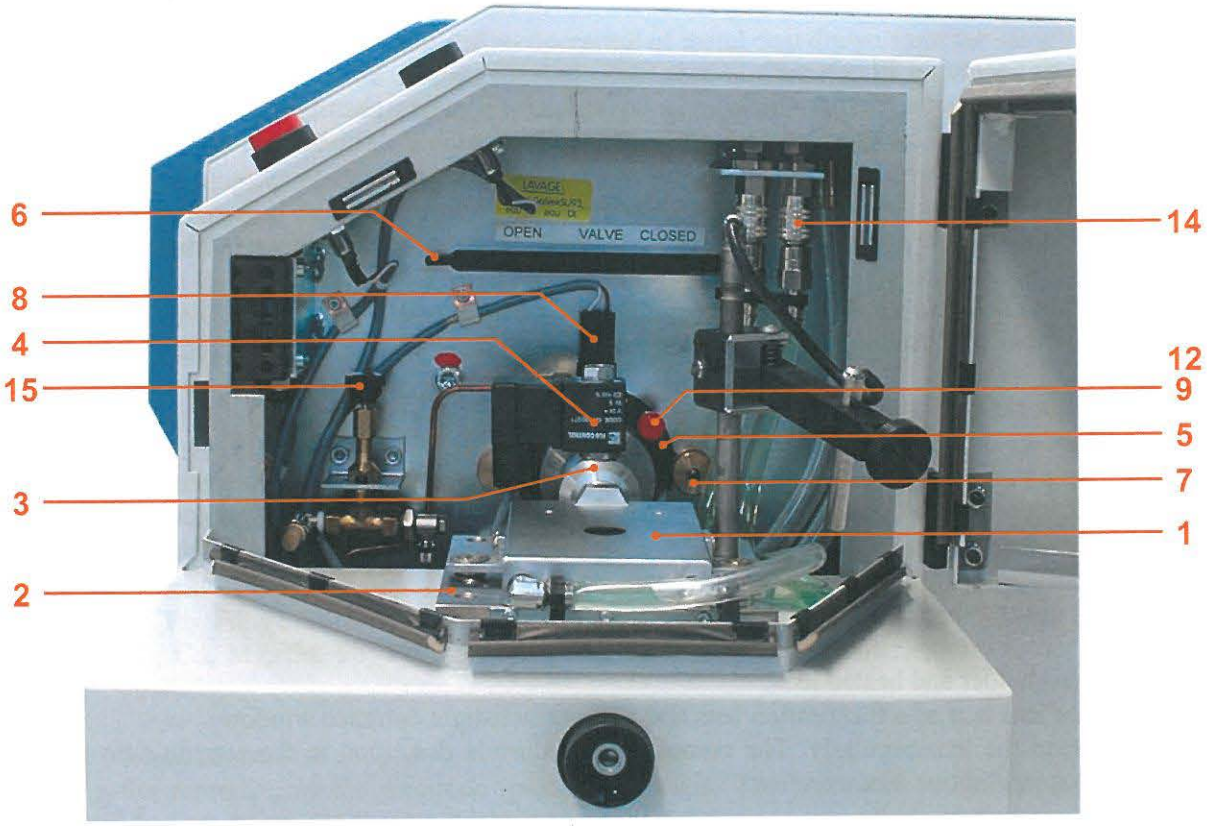


Figure 2.8

Figure 2.9

Key to figures 2.8 and 2.9:

1 D : Analytical table. F!
U : This is a support for the sample and a cover for the sparking chamber.
C : The analytical table is also commonly called "Petrey table". The table is run by a closed water circuit that allows to stabilise the table at a constant temperature.
M : Clean the table and the chamber regularly. The complete procedure is described in the section *Cleaning of the Stand and the Sparking Chamber* chapter *Routine Maintenance.*

2 D : Analytical table's base.
U : Thermal stabilisation support for the table.

3 D : Light channel with shutter controlled by solenoid.
U : Passage of light between sparking chamber and lens.
C : A shutter is in place all the time, except during the integration time of the measurement. It cuts out a part of the light during the pre-spark period so as not to dazzle the photomultipliers.

4 D : Solenoid.
U : Opens the shutter during the integration time of the measurement.

5 D : Lens holder and heated lens.
U : The lens acts as a focalisation lens and as a vacuum-tight entrance window.
M : Clean the lens regularly. The complete procedure is described in the section *Lens Cleaning* chapter *Routine Maintenance.*

6 D : Primary channel manual shutter.
U : The purpose of this shutter is to open and close the primary optic chamber airlock (between the lens and the spectrometer. The analysis position is "open". The "closed" position permits to remove the lens holder (pos. 5) for cleaning purposes, without breaking the vacuum inside the spectrometer. See the complete procedure, section *Lens Cleaning* chapter *Routine Maintenance.*
Positions: open <———> closed.

IMPORTANT:

Do not open the shutter if the lens holder is not correctly in place.

The non-observation of this rule can cause serious damages to your instrument.

7 D : Knurled knobs and clamps (2x).
U : Fastening for lens holder (pos. 5).

8 D : Lens heater connector.

9 D : Knurled knob (1x).
U : Is used for the extraction of the lens holder (pos. 5).
C : The plastic knurled knob is red in colour.

10 D : Glass insulator.
U : Used for electric insulation and recuperation of metal dust drawn from the sample.
M : The insulator must be cleaned regularly, see section *Cleaning of the Stand and the Sparking Chamber* chapter *Routine Maintenance*.

11 D : Large tungsten electrode (6/2 mm Ø).
U : The analytical discharge is made between the sample and the electrode. Ensure that only electrodes delivered by Thermo Fisher Scientific are used.
M : Clean the electrode's tip with a small metal brush (pos. 12), see procedure, section *Analysis Electrode* chapter *Routine Maintenance*.
C : Depending on the application another electrode type may be used.

12 D : Small metal brush.
U : Cleaning the electrode tip (for large electrodes only).
M : Brush the electrode vigorously (pos. 11). Take care to not damage the table's hole border. A worn brush must be thrown away and replaced by a new one.
C : There are three types of brushes: the ones with a yellow handle (steel strands) are for Fe, Ni, Co and Ti bases; the ones with a black handle (Mo strands) are for Ag, Al, Au, Cu, Cd, Mg, Sn, Pb, Pd, Pt, Sb, Bi and In bases; the ones with a red handle (W strands) are for Ag, Al, Au, Cu, Cd, Mg, Sn, Pb, Pd, Pt, Sb, Bi and In bases when the black brush is not suitable (Mo analysis).

13 D : 3 mm adjustment gauge.
U : Set reproducibly the electrode (pos. 11) position. The procedure is described in the section *Analysis Electrode* chapter *Routine Maintenance*.

14 D : Fittings for water pipes (2x).
U : The water cools the analysis table and the sample. See also section *Water Cooler*.

15 D : Micro-valve for inlet of spectrometer air leak.
U : To be adjusted to obtain a vacuum of 30 milliTorr, reading on the multimeter (figure 2.5, pos. 3).
C : When the VUV lines option (nitrogen, oxygen, etc.) with a high vacuum pumping line is installed, the air leak is useless. In such a case the micro-valve must remain completely closed.

Hi-Rep Source

The figure 2.10 shows the front side and the figure 2.11 the back side of the Hi-Rep 2+ source. Its ignition module is inside a Faraday cage into the stand enclosure.

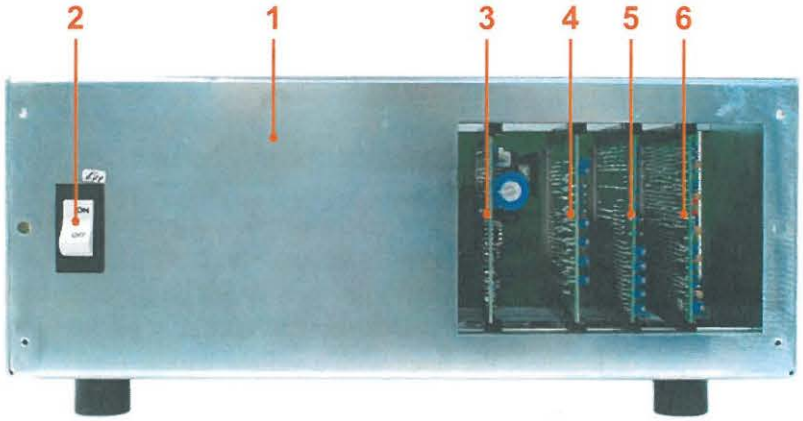


Figure 2.10

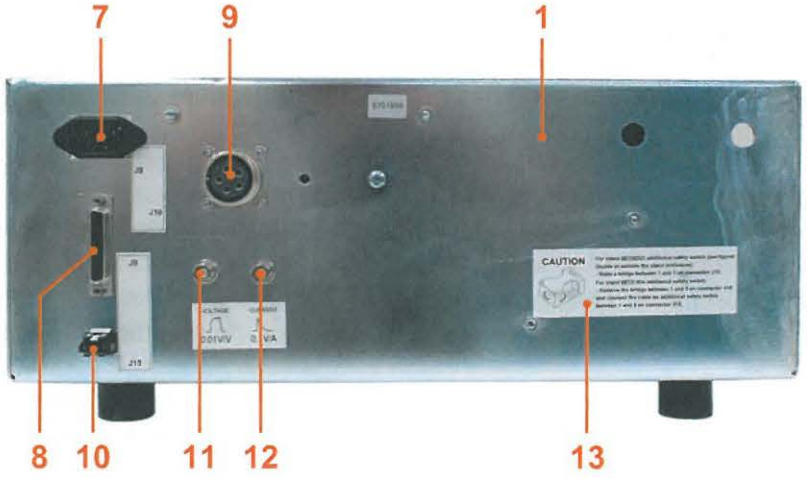


Figure 2.11

Key to figures 2.10 and 2.11:

1 D : Hi-Rep 2+ source rack.
U : The source generates sparks between the electrode and the sample to be analysed. The energy brought by the sparks extracts atoms from the sample that emits light to be analysed.

2 D : Switch-breaker (6 A) for the source.
U : Switching on the source.
C : The switch breaker is not powered if the main switch breaker (figure 2.12, pos. 2) of the instrument is off.

3 D : Power supply board.

4 D : Pulse generator board.

5 D : Condition selection board.

6 D : Logic control board.

7 D : 230 VAC power supply connector.

8 D : Control signal connector.

9 D : High voltage signal connector cable.

10 D : Safety connector.

11 D : Voltage output connector.
U : Discharge voltage check.

12 D : Current output connector.
U : Discharge current check.

13 D : Label.
U : Safety wiring directions.

Power Distribution Rack

The figure 2.12 shows the external side of the power distribution panel, seen from the back side of the instrument.

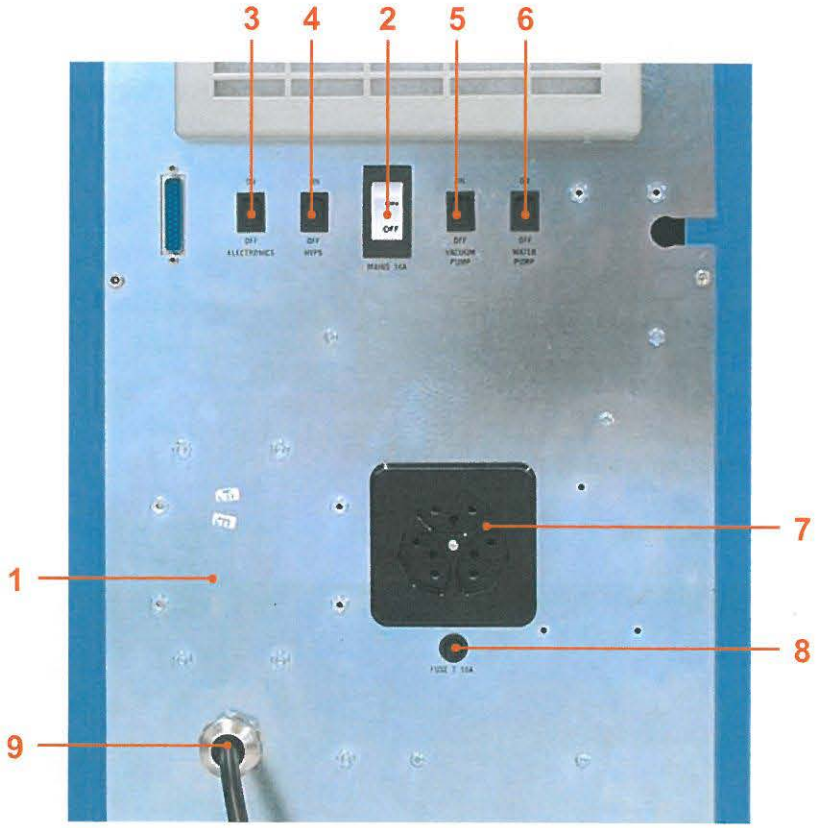


Figure 2.12

Key to figure 2.12:

1 D : Power distribution panel (seen from back).

2 D : Main switch-breaker 16 A.
U : Switching on the instrument.
C : In the off position, the whole instrument is switched off, but the external output sockets (pos. 7) remain powered.

3 D : Electronics' switch.
U : Switching on the low voltages for the electronics.

4 D : High voltage switch.
U : Switching on the high voltage for the photomultipliers.

5 D : Vacuum pumping line switch.
U : Starting the vacuum pumping line.

6 D : Water cooling circuit switch.
U : Switching on the water cooling pump.

7 D : 230 VAC output sockets.
U : For connection of the computer and its peripherals.
C : These sockets remain supplied, even if the main switch-breaker (pos. 2) is off. This permits to switch off the instrument with keeping the computer powered.

8 D : Fuse 10 A.
U : Output sockets (pos. 7) safety.
M : To check or change the fuse, unscrew the cap.
C : Only replace a fuse by an identical one (value and size).

9 D : Mains power cord input (230 VAC).

Electronic Rack

The figure 2.13 shows the front of the rack including the electronic boards, and the figure 2.14 shows an overall view (modules and connections).

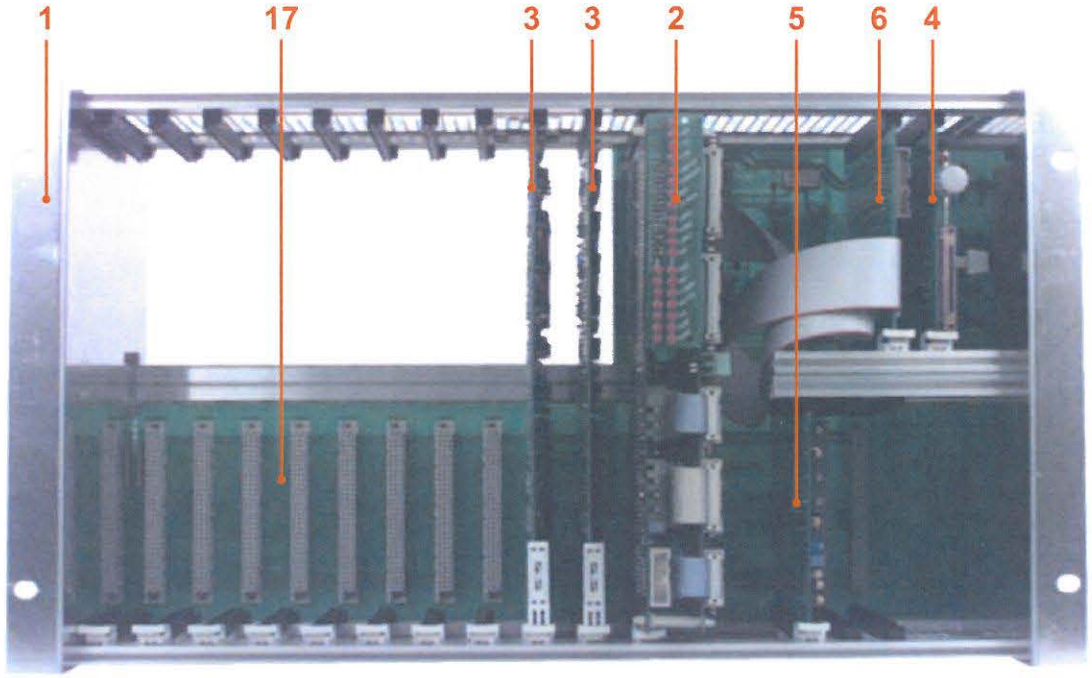


Figure 2.13

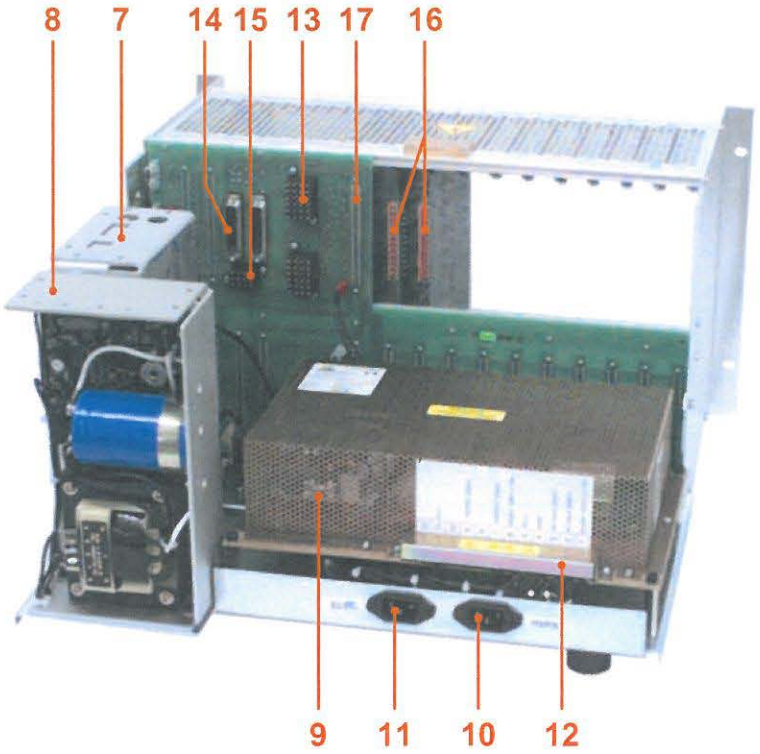


Figure 2.14

Key to figures 2.13 and 2.14:

1 D : Electronic rack.
C : Boards other than those shown in the figures and described below may be installed in the electronic rack; in principle these will be optional boards or ones covering specialities. They will be described in documents other than this manual.

2 D : ICS34 assembly (ICS = Instrument Controller System).
U : Instrument management centre.
C : The sandwich assembly consists in two boards. One is called MMB88 and it contains the microprocessor, the firmware dedicated to the instrument, the signals management and the communication ports. The other one is called the adaptation board; it serves as an interface between the microprocessor and the instrument, and is specific to the applications of the ARL 3460 instrument.
On the top right-hand side of the ICS34 is a square red button: this is the microprocessor reset button. It may be that you will have to press this button, e.g. during a telephone assisted troubleshooting. It is important to note that when the button is pressed, the microprocessor looses its previous information and it will thus be necessary after a reset to reload the parameter into the microprocessor using the appropriate software command.
M : In case of replacement, always change the entire ICS34 assembly; do not separate the two boards.

3 D : IVFC board. Current-voltage-frequency converter board.
U : Acquisition of signals coming from the photomultipliers and conversion to frequency for counting.
C : One board can control 6 channels. The rack can admit a maximum of 10 boards (60 channels).

4 D : Vacuum and profile board.
U : Control and measurement of "vacuum" and "profile" functions.
C : Two wires are directly connected onto the board; these wires supply the control multimeter (figure 2.5, pos. 3).
M : A 6 positions switch is situated on the front of the board, its purpose is to select different scales of the multimeter (see also section *Direct (or Manual) Profile* chapter *Routine Maintenance*). The positions are:

Top	1 :	Differential vacuum
	2 :	Absolute value of vacuum
	3 :	Profile, low sensitivity
	4 :	Profile, medium sensitivity
	5 :	Profile, high sensitivity
Bottom	6 :	Profile, very high sensitivity

5 D : Status board.
U : Monitoring of the instrument's general operation. The following 10 parameters are automatically checked at each analysis or by request from the operator through the software: the 4 LVPS (+24 V, +12 V, -12 V, +5 V), the HVPS and its polarisation (-1000 V, -100 V), the spectrometer temperature, the electronic cabinet's temperature, the value of the vacuum inside the spectrometer, and the voltage of the mains power supply (230 VAC).

6 D : Dual attenuator board. Option.
U : Driving the dual attenuators.
C : A maximum of 12 out of all the instrument channels can be switched on 2 attenuator selections of a phototube. This allows to have two sensitivity ranges for 12 phototubes of the instrument.

7 D : LVPS module ±12 VDC and +5 VDC.

8 D : LVPS module +24 VDC.

9 D : HVPS module (High Voltage Power Supply).
U : Power supply of photomultipliers' attenuators to around -1000 VDC and polarisation of the photomultipliers to -100 VDC.

10 D : 230 VAC power supply connector for HVPS module (pos. 9).

11 D : 230 VAC power supply connector for LVPS modules (pos. 7 and 8).

12 D : Connection strip high voltage output.

13 D : Connector, electronic signals source/stand.

14 D : Connector serial link ACS-ICS
U : Links the instrument's microprocessor to the computer central unit.
C : An intermediary connector is to be found on the back side of the instrument (figure 2.4, pos. 16).

15 D : Connector, electronic signals oven/spectrometer.

16 D : Connector, channels' signals.
C : Signals coming from the photomultipliers.

17 D : Motherboard.
U : Receptacle for electronic boards and interconnections with other modules.

Vacuum Pumping Line

Standard System for Intermediary Vacuum

The figure 2.15 shows the standard pumping line that permits to obtain an intermediary vacuum. Such a system is sufficient if the analysis in the VUV range is not required. The figure 2.16 shows the vacuum gauge and the spectrometer's aeration valve.

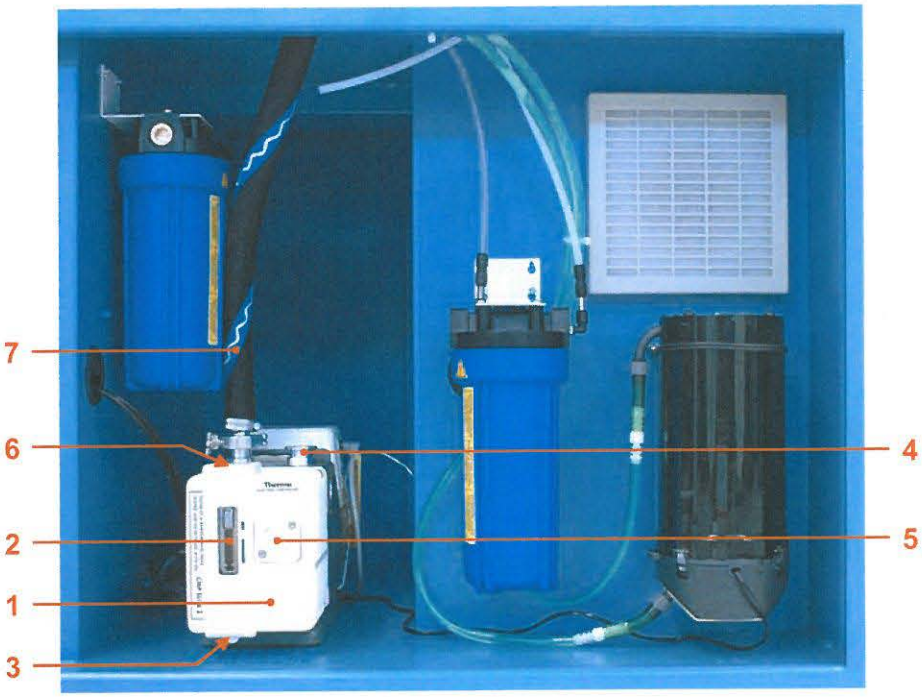


Figure 2.15

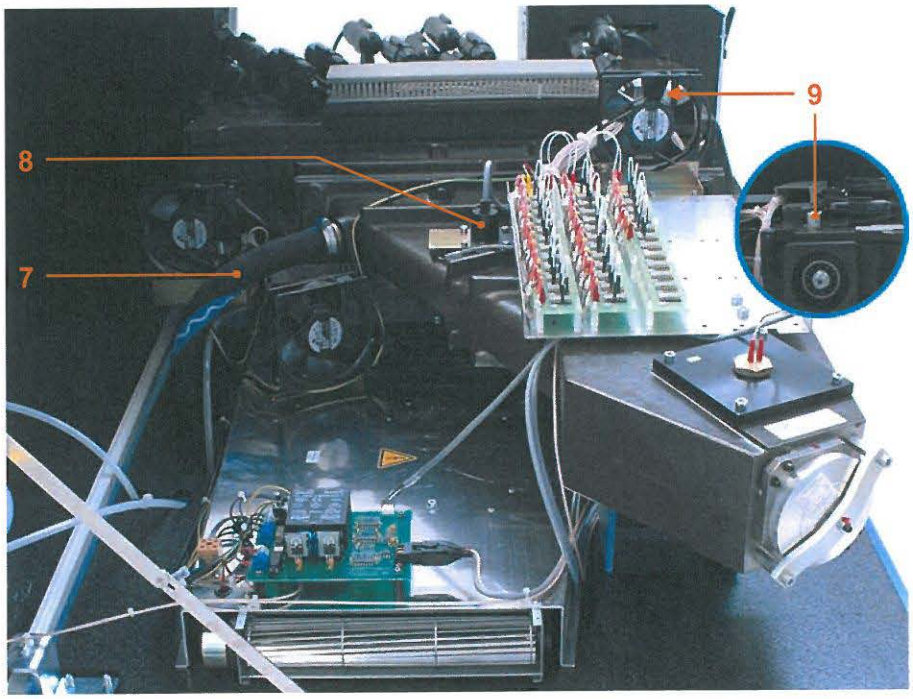


Figure 2.16

Key to figures 2.15 and 2.16:

1 D : Alcatel mechanical vacuum pump model 2005ARL-LS.
M : Change oil every six months; use only oil prescribed by Thermo Fisher Scientific. See section *Vacuum Pumping Line* chapter *Routine Maintenance*.

2 D : Oil level indicator.
U : The level must be visible; it can be easier to check this when the pump is stopped.

3 D : Oil drain plug.
C : The black plastic protection must be removed.

4 D : Outlet of air and possible oil vapours.

5 D : Air ballast valve.
U : After having changed the oil, run the pump for around 30 minutes with the valve open, then close it.

6 D : Oil inlet cap.
C : The black plastic protection must be removed. One of the ends of the plastic protection can be used as a tool for opening or closing the caps.

7 D : Pumping pipe.
U : Connects the vacuum pump's air inlet to the spectrometer.

8 D : Vacuum gauge.
U : This thermocouple returns a proportional voltage of the pressure into the spectrometer to the vacuum and profile board (figure 2.13 pos. 4)
C : The pressure can be read on the control multimeter (figure 2.5 pos. 3), as long as the 6 positions switch of the vacuum and profile board (figure 2.13 pos. 4) is set on the position 2.
The reading is however approximate and the circuit is designed to read intermediary vacuum pressure. Under a pressure of 5 µmHg the reading is not anymore valid.

9 D : Spectrometer's manual aeration valve.
U : The atmospheric pressure can be restored into the spectrometer with this valve.

Special System for High Vacuum

The figures 2.17 and 2.18 show the special pumping line that permits to reach a high vacuum. This system is necessary if elements in the VUV range require to be analysed, in particular nitrogen and oxygen. When the VUV option is purchased, this system is therefore automatically supplied with the instrument. In addition an electronic board controls the system; it can be seen on the figure 2.3 and is described with the corresponding legend.

Figure 2.17

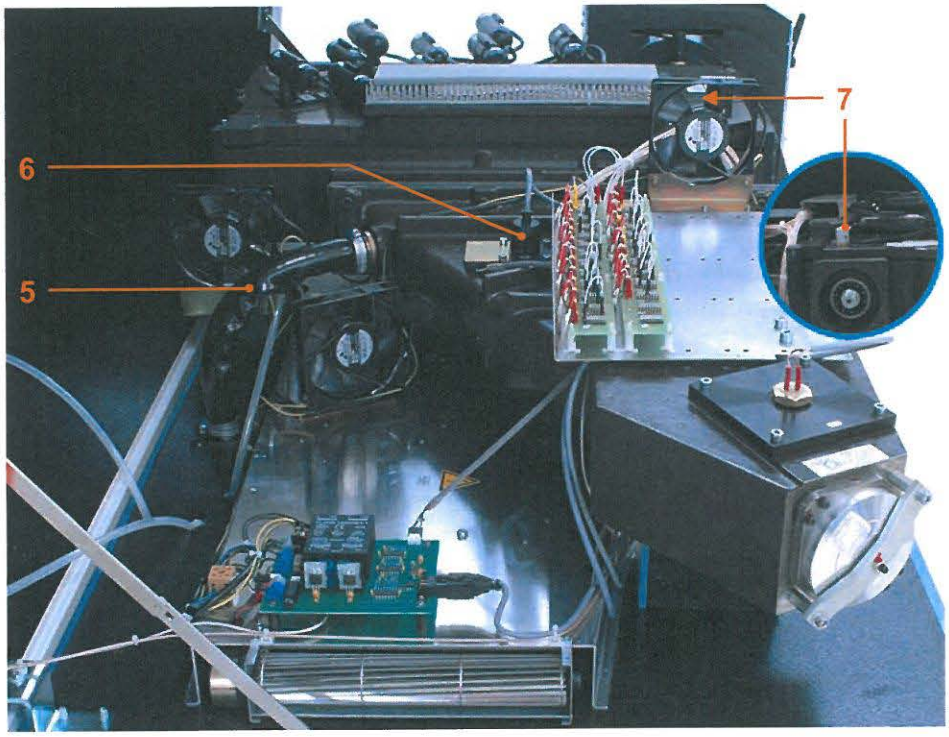


Figure 2.18

Key to figures 2.17 and 2.18:

1 D : Diaphragm pump
U : This pump produces a dry primary vacuum.
M : The diaphragm and the valves wear down and must be replaced at least once a year. The procedure is described in the section *Vacuum Pumping Line* chapter *Routine Maintenance*.
C : This pump has a calibrated air ballast with a silencer, which must remain installed for routine operation. The ballast can be replaced by a cork only for leakage test purpose.

2 D : Pumping pipe between pumps.
U : Connects mechanically the diaphragm pump to the molecular drag pump (pos. 4).
C : The volume of the pipe is a buffer, therefore the length and diameter should not be changed. **Do not use another pipe or do not shorten the supplied pipe.**

3 D : Molecular drag pump.
U : This pump achieves the high vacuum into the spectrometer.
M : Bearings must be greased at least once a year. This subject is described in the section *Vacuum Pumping Line* chapter *Routine Maintenance*.
C : This pump has a motor rotating at 27'000 turns per minutes and is therefore fragile. The motor requires about 5 minutes to stop rotating once the circuit is switched off.

During operation, and even 5 minutes after switching off, shocks against the molecular drag pump body must absolutely be avoided.

4 D : Air cooler
U : Cooling of the molecular pump.

5 D : Intermediary pumping pipe.
U : Connects the molecular pump to the spectrometer.

6 D : Vacuum gauge.
U : This thermocouple returns a proportional voltage of the pressure into the spectrometer to the vacuum and profile board (figure 2.13 pos. 4)
C : The pressure can be read on the control multimeter (figure 2.5 pos. 3), as long as the 6 positions switch of the vacuum and profile board (figure 2.13 pos. 4) is set on the position 2.
The reading is however approximate and the circuit is designed to read intermediary vacuum pressure. Under a pressure of 5 µmHg the reading is not anymore valid.

7 D : Spectrometer's manual aeration valve.
U : The atmospheric pressure can be restored into the spectrometer with this valve.

WARNING - VERY IMPORTANT

Wait at least 5 minutes after the high vacuum system switch off before opening manually this valve.

C : This waiting time is necessary to let the molecular drag pump to stop completely.

Water Cooler

The figure 2.19 shows the water cooling system (closed circuit).

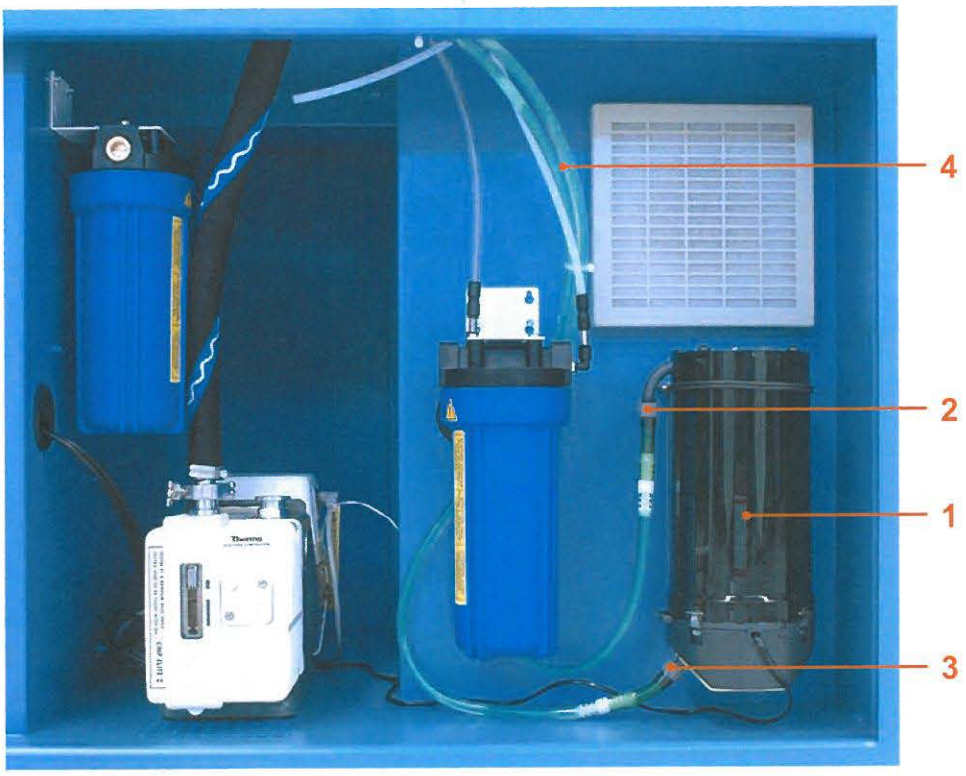


Figure 2.19

Key to figure 2.19:

1 D : Water pump and container.
M : The purge of the system is part of the preventive maintenance (revision) and is therefore done in principle by a Thermo Fisher Scientific – or by our local agent – service engineer.
The level must be between the half and the three quarters of the container. Use deionised water in case of addition.
C : The liquid is a water-antifreeze mixture. In case of complete purge, only the Thermo Fisher Scientific mixture should be used.

2 D : Water inlet.

3 D : Water outlet.

4 D : Water pipes towards stand.
C : The water of the circuit is driven into the analytical table (figure 2.9, pos. 1).

Argon Circuit

The argon inlet is under the stand and can be located on the figure 2.3 pos. 8. The figure 2.20 shows the standard version of the outlet argon circuit, after the stand.

Important:	The analysis of magnesium alloys requires a special argon circuit and a special argon filtering, different to the circuit illustrated here below. In case of multiple bases analysis (Mg bases and one or more other bases), a dual filtering system with a commutation valve is installed. In that case a particular manual *Mg Filter Kit* describing this speciality is supplied. For safety reasons tied to the presence of magnesium powders (highly flammable) it is essential to understand and to follow the safety instructions of this manual.

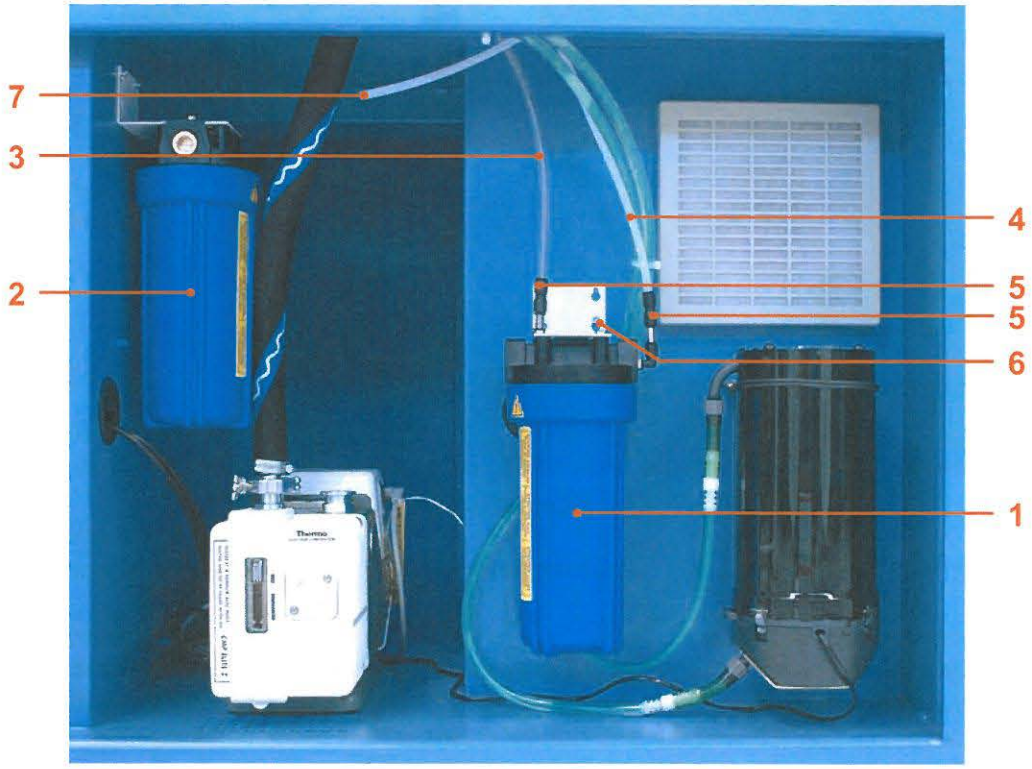


Figure 2.20

Key to figure 2.20:

1 D : Argon outlet filter.
U : The filter retains the metal dust particles, which are drawn from the sample during the analysis.
M : To be cleaned regularly. **Unscrew the container slowly** as the dust can catch fire upon contact with the oxygen of the air. Clean the filter cartridge with a vacuum cleaner or change it. See complete procedure, section *Argon Outlet Filter* chapter *Routine Maintenance*.
C : When an used filter is dirty disconnect it at the fittings level (pos. 5) remove the assembly from the fixation screws (pos. 6), and replace it with the spare filter.

2 D : Spare filter.
C : Leave a clean filter ready to use at this location.

3 D : Argon pipe.
U : This pipe carries the argon evacuated from the stand to the outlet filtering device.

4 D : Argon outlet pipe.
U : The pipe does a 7.5 meters loops in the oven (above the argon outlet) in order to avoid air

coming back into the filter.

C : Do not move or shorten the pipe.

5 D : Argon fittings.

U : Fittings on small metallic pipes allow multiple fast dismounting without damaging the plastic pipes.

6 D : Fastening screws of the outlet argon filter assembly.

U : If the complete assembly must be removed for maintenance, just unscrew partially these four screws so as to free the supporting square. The assembly can the be lifted and removed.

7 D : Argon outlet.

C : It is recommended to evacuate the argon from the instrument outlet to the outside of the laboratory.

Oven and Spectrometer

The oven is the thermostatic controlled enclosure containing the spectrometer. The volume of the enclosure is delimited by the interior of the instrument's lid.

A dual purpose safety switch (operator safety and safety for component function life span) automatically cuts the high voltage power supply (of attenuators and photomultipliers) as well as the heating power supply for the oven during lid opening.

Some objects, written in *italics* in the keys to figures, are indicated for information purpose only. These are objects that should only be handled by duly qualified people. In case of false manipulation of these objects, the replacement or repair of some of them would lead to very delicate and expensive operations that can only be done with great difficulty outside our factories. These objects are indicated so as to warn you of the care to be taken near to them. **In any case, shocks must be avoided to the outside and inside of the spectrometer**. Do not forget that the mechanical and optic components of the spectrometer have been manufactured with the greatest care and adjusted with highest precision to attain the analytical performances that you expect from your instrument. Consequently, the spectrometer and its components are the most fragile and delicate to handle in the instrument.

Common items

The figures 2.21 and 2.22 show two general views of the oven and the spectrometer. The figures 2.23 and 2.24 show close-ups that will help you to locate some objects in greater details. For these four figures, the description is grouped just after them.

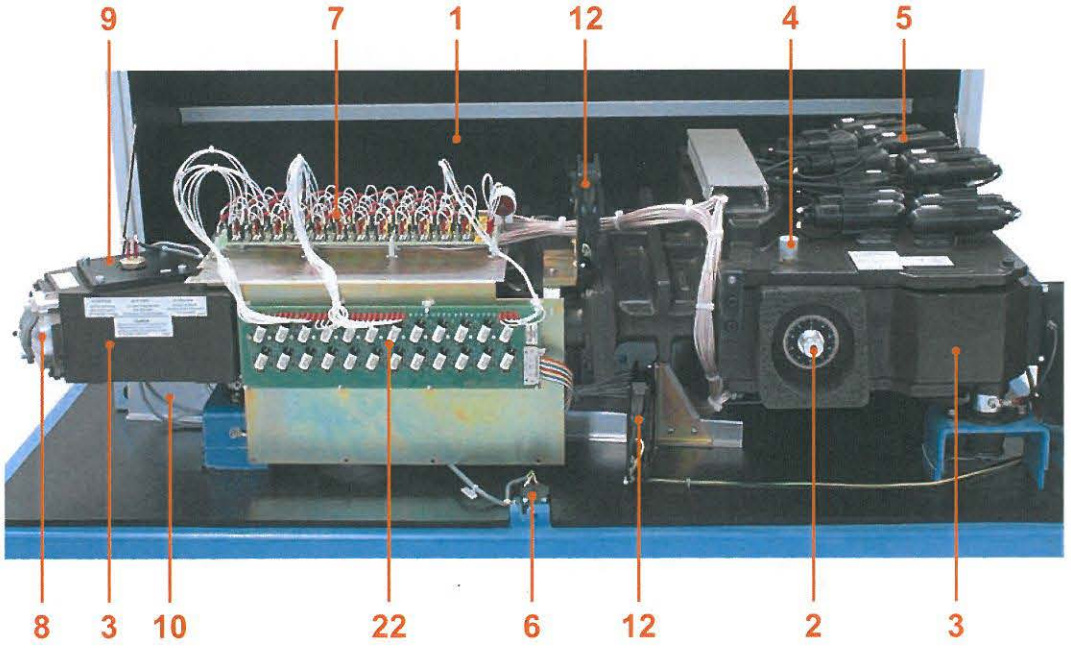


Figure 2.21

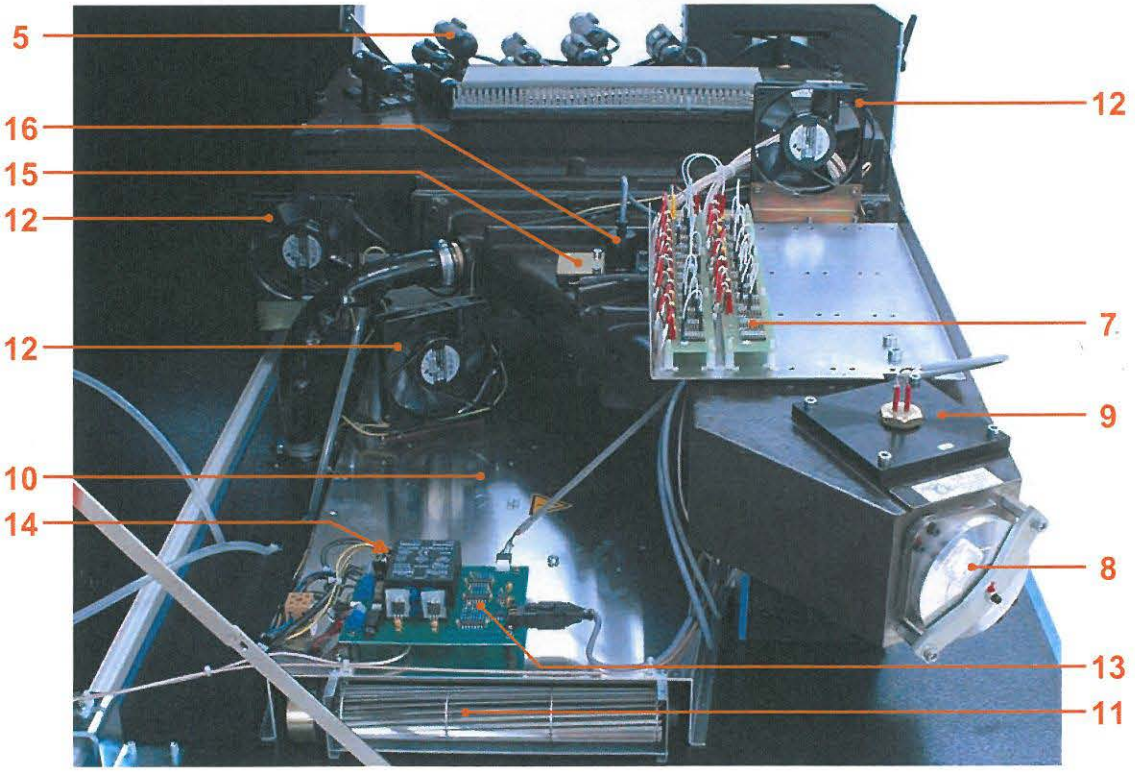


Figure 2.22

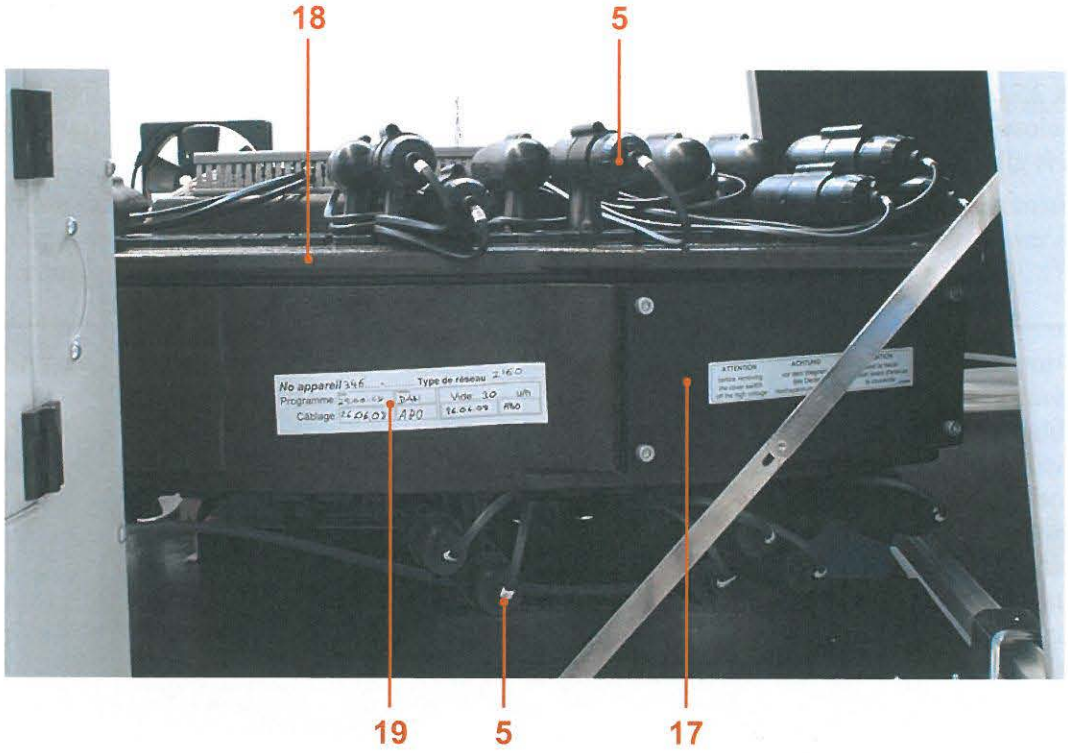


Figure 2.23

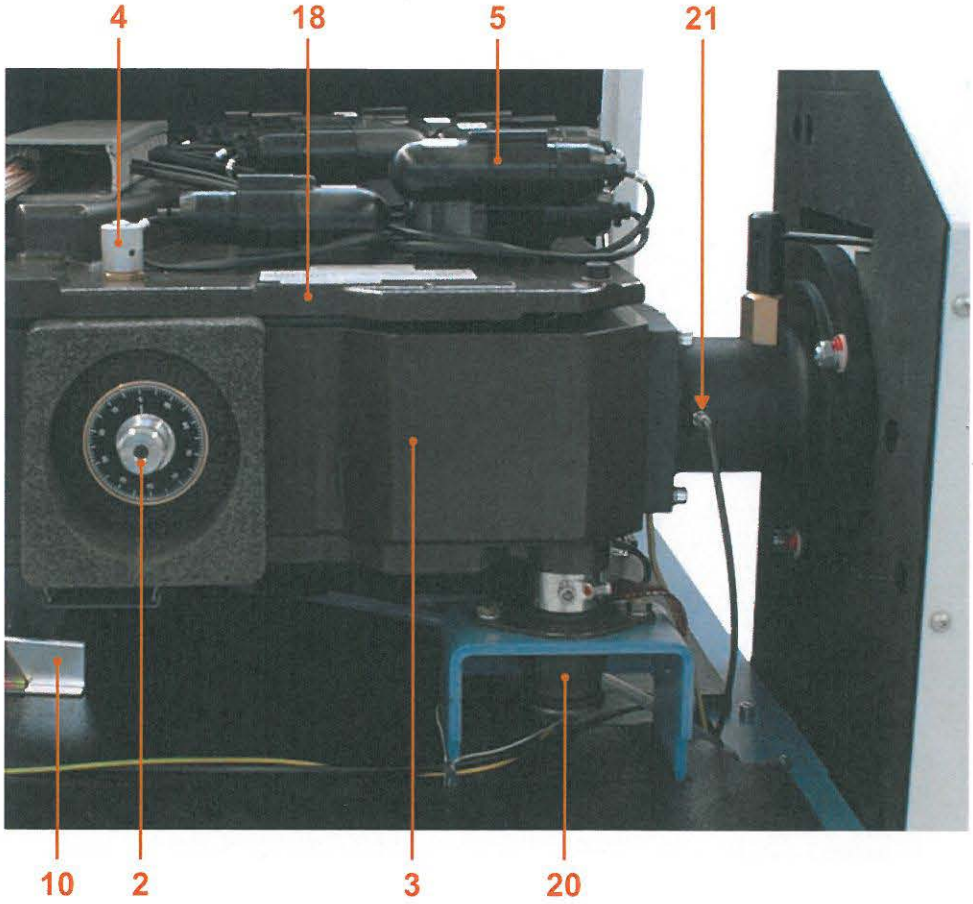


Figure 2.24

Key to figures 2.21, 2.22, 2.23 and 2.24:

1 D : Lid.
C : See key (figures 2.1 and 2.2, pos. 15).

2 D : Scanning screw.
C : See key (figure 2.5, pos. 1).

3 D : Spectrometer body.
U : The spectrometer serves as a support and as a box for the optic dispersive system.
C : Avoid all shocks against spectrometer body.

4 D : Spectrometer's manual aeration valve.

ATTENTION:

Before disassembling the vacuum circuit (pump oil change), this valve must be used to restore atmospheric pressure in the spectrometer.

With a high vacuum pumping system you must wait at least 5 minutes after the pumping line system is switched off before to open this aeration valve.

5 *D : Photomultipliers.*
U : Transforms the light photons into electric signals.
C : There are as many photomultipliers as there are element-channels installed in your instrument; they can be situated indifferently above or below the spectrometer body.
Even though the damage which could occur through incorrect handling of the photomultipliers is less important than that affecting the diffraction grating, access to them remains reserved to qualified personnel.

6 D : Safety contact.
U : Cuts the high voltage power supply and heating when the lid is opened.

7 D : Attenuator board.
U : Adaptation of the high voltage individually on each photomultiplier.
C : Each photomultiplier has its attenuator, which has been pre-set in the factory according to different parameters (photomultiplier sensitivity, spectral line sensitivity, dynamic range to be measured, etc.). The change of position of the attenuator directly affects the photomultiplier's response, and because of this affects the previous analytical calibrations using the appropriate channel. Only to be changed with full knowledge of the facts.

8 *D : Diffraction grating holder.*
U : The grating is the main optic part of the spectrometer; it separates the spark's light into all the wavelength that composes it.
C : If it is handled with care, the grating should never need to be replaced during the life of the instrument. Therefore in principle, it can only be damaged by accident or by a handling error; its repair is almost impossible and its replacement is an operation that can only be carried out by a few rare specialists outside our factories. There is no routine maintenance operation requiring that you handle it or even approach it.

9 *D : Lid and connection of fatigue lamps.*
U : The fatigue lamps light up automatically in the absence of a spark in the stand. They are a light source, which softly lights the photomultipliers so as to improve their stability (to avoid dazzling). The fatigue lamps are also used for electronic function checks without sparking analysis.
C : Owing to their proximity to the diffraction grating, only qualified personnel must have access to the fatigue lamps. The checking operations with the fatigue lamps require no physical access to the lamps themselves by the operator.

10 D : Oven's ventilation nozzle. F!
U : The nozzle carries the heating resistors (located inside the nozzle) and is used to run the warm air propelled by the transverse fan (pos. 11).

11 D : Transverse fan.
U : To propel the warm air through the nozzle.

12 D : Radial fans.
U : Mixing the warm air inside the oven enclosure.

13 D : Heating regulation board.
U : Regulation of the spectrometer temperature.
C : The regulation operation can be observed by watching the heating pilot lamp (figure 2.5, pos. 2).

14 D : Thermostat.
U : Safety against fire risk, if the nozzle becomes overheated. The thermostat cuts the power of the heating circuit if the temperature of the nozzle's plate exceeds 60 °C.
C : If the thermostat starts to operate, there will be no further heating and the temperature of the nozzle's plate will go down to about 54 °C; at this temperature the thermostat rearms automatically and lets the heating resistors be powered again.

15 D : Small board with temperature sensor.
U : This temperature sensitive circuit returns an instruction (under the form of an electrical signal proportional to the temperature) to the regulation board.

16 D : Vacuum gauge.
U : This thermocouple returns a proportional voltage of the pressure into the spectrometer to the vacuum and profile board (figure 2.13 pos. 4)
C : The pressure can be read on the control multimeter (figure 2.5 pos. 3), as long as the 6 positions switch of the vacuum and profile board (figure 2.13 pos. 4) is set on the position 2.
The reading is however approximate and the circuit is designed to read intermediary vacuum pressure. Under a pressure of 5 µmHg the reading is not anymore valid.

17 *D : Side plate for access to the secondary optics.*
U : For adjustment of spectrometer's secondary optic parts.
C : Qualified personnel only.

18 *D : Spectrometer lid.*
U : When opening the lid, access is gained to the primary and secondary optics of the spectrometer.
C : The mechanical and optical components inside the spectrometer have been set with great precision. Only qualified personnel should have access to these parts. No routine maintenance procedure requires the spectrometer to be opened by the operator.

19 D : Label.
U : Indicates several mechanical characteristics of the spectrometer's body (figure 2.21, pos. 3).

20 D : Silent-bloc (3x)
U : Vibration absorption.

21 *D : Air leak inlet in the spectrometer.*
C : The air leak is adjusted by the micro valve (figure 2.8, pos. 15). The micro valve must remain closed with the high vacuum system (VUV option).

22 D : Dual attenuator relay board. Option.
U : Selects one of the attenuators for a given phototube (channel). The relays are controlled by the dual attenuator board (figure 2.13, pos. 6) of the electronic rack.
C : A maximum of 12 channels can have this option.

Particular items

Reflected beam

The Reflected Beam (RB) can be used to install an external line that could not be easily installed inside the spectrometer. This may be the case, for example, when an element such as the Li, Na or K must be installed.

The reflected beam is the total reflection of the grating, and it is necessary to install a narrow bandwidth interference filter in order to measure only the desired light of the element to be analysed.

Note:	Only one element can be installed on the reflected beam. If two particular elements are needed, the direct beam (DB) will used. If three particular elements are needed, both the RB and DB are used. For the Direct Beam, see the next section.

The figure 2.25 shows the spectrometer body with a reflected beam device installed.

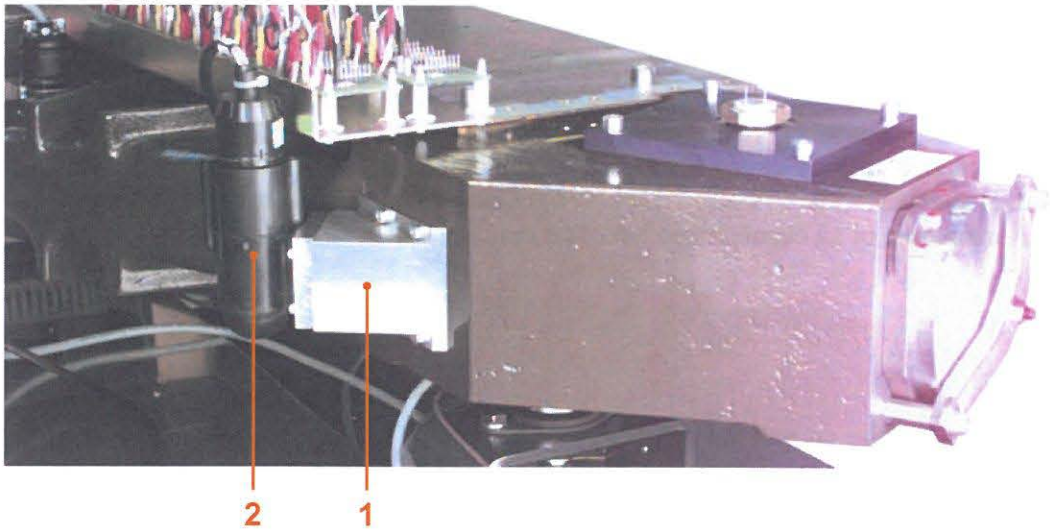


Figure 2.25

Key to figure 2.25:

1 *D : Support device for Reflected Beam.*
C : Holds the RB photomultiplier and contains the interference filter corresponding to the mounted external line.

2 *D : RB Photomultiplier.*
C : See legend of pos. 5 section Common items.

Direct beam

The Direct Beam (DB) can be used to install an external line that could not be easily installed inside the spectrometer. This may be the case, for example, when an element such as the Li, Na or K must be installed.

The direct beam is a part of the primary light, reflected by two mirrors outside the spectrometer. This light is then directed by optical fibres to photomultipliers. It is necessary to install a narrow bandwidth interference filter in order to measure only the desired light of the element to be analysed.

Note:	One or two elements can be installed on the direct beam. If only one element is needed, the reflected beam (RB) will be preferred. If three particular elements are needed, both the RB and DB are used. For the Reflected Beam, see the previous section.

The figure 2.26 shows the spectrometer body with a direct beam device installed.

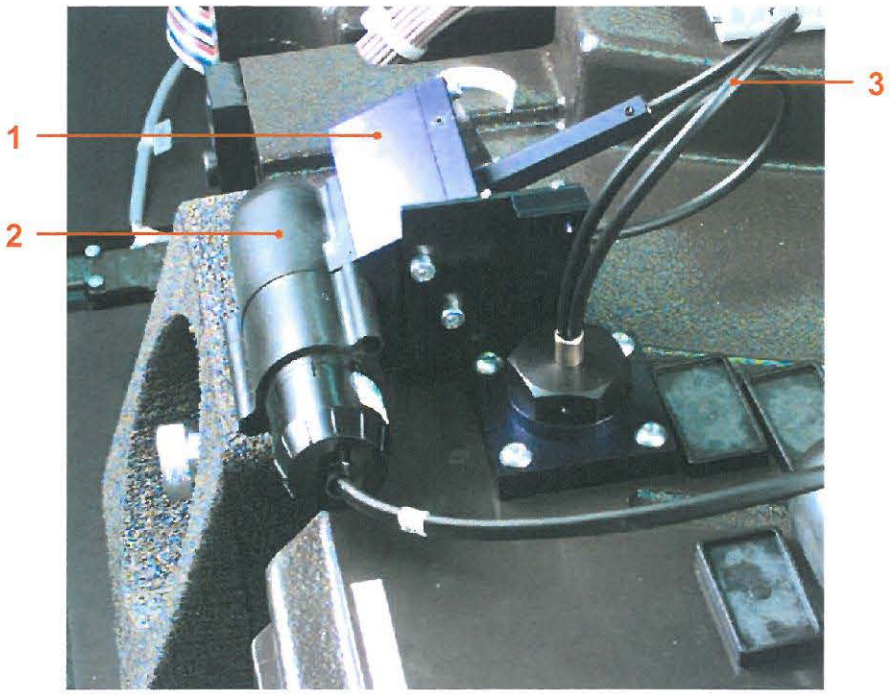


Figure 2.26

Key to figure 2.26:

1 *D : Support device for direct Beam.*
U : Holds the DB photomultiplier and contains the interference filter corresponding to the mounted external line.
C One or two PMT's can be mounted.

2 *D : DB Photomultiplier.*
C : See legend of pos. 5 section Common items.

3 *D : Optical fibre.*
U : Brings the light to the PMT.

3

ROUTINE OPERATION

3 ROUTINE OPERATION

The routine operation consists of running (e.g. analysing) unknown samples on the instrument in order to get the elemental composition the sample.

The spectroscopy by optical emission is a comparison technique, which means the instrument must be prepared and calibrated for the types of samples to be analysed. Furthermore the samples must be prepared in a proper way so as to be suitable for being excited by the generator. Other external factors influence the measurement environment and require to be controlled. All these preliminary requirements must be under control before performing the analysis.

In order to run quantitative routine analysis with the ARL 3460 you need:

- the sample to be analysed, prepared, positioned on the analytical table
- the instrument switched on, operating and in a stable state
- the computer with the analytical software running
- a calibrated method or analytical program suitable for the sample nature

Sample Preparation and Positioning

Preparation

A suitable sample taking and a careful surface preparation are absolutely essential. Indeed, it is necessary to have a sample as homogeneous as possible without inclusions on one hand, and on the other hand a clean and flat surface is needed in order to insure reliable and reproducible measurements.

The sample preparation consist in two distinct operations:

- the sample fabrication or casting
- the sample surfacing

Both operations depend on the nature of the material to be analysed. The preparation principles are as old as the spectroscopy technique, but the methods used are permanently refined. Various methods, hints and tips are regularly issued in spectroscopy application books written by spectroscopist or metallurgic researchers.

The appendix *Sample Preparation* of this manual gives some ways on how to prepare samples.

Once the sample are prepared and surfaced, they must be stored in a clean place, for example over a clean tissue or paper. They should not been touch again with fingers on the analysis surface. Some samples (Pb base or even Al base) require to be surfaced just before being analysed, because of their high capability of oxidation!

We recommend to manipulate the samples with clean gloves.

Positioning

Putting the Sample

The surface to be analysed should no longer be touched with the fingers after the sample's surface preparation. This is also valid for the analysis table.

One must avoid doing the analysis on the centre of the sample. It is a known fact the homogeneity is better in the area near to the edge of the sample. The sample will therefore be placed so that it hides the hole by about 3 mm on the table's area.

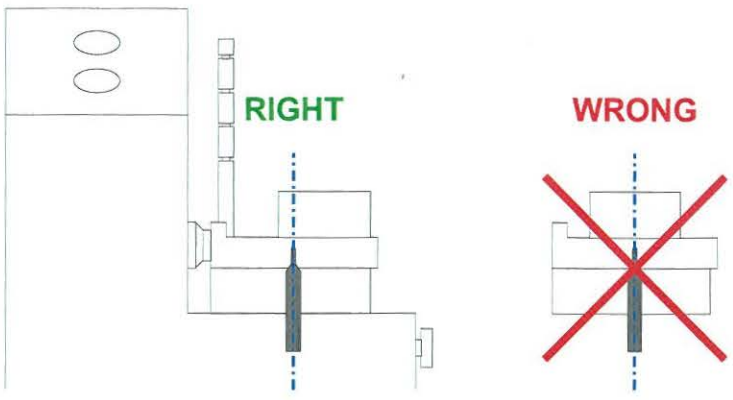


Figure 3.1

Multiple Measurements

Usually in routine analysis, 2 or 3 measurements are carried out on each sample. Sparking spot's overlap must be avoided. Black halos around the sparking area can however be superposed, except in the case of oxygen analysis, where the spots must absolutely not crossover.

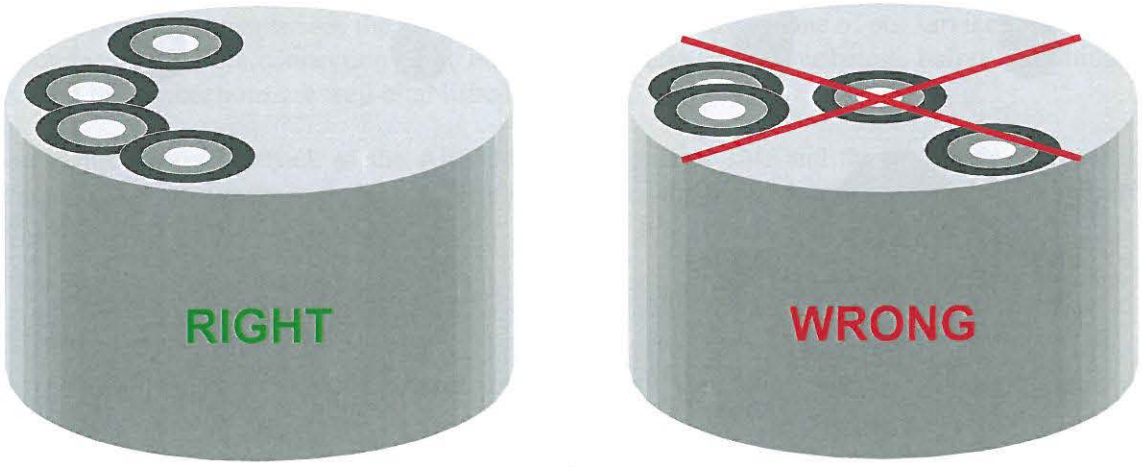


Figure 3.2

Remark: The analytical table can be damaged, or the hard metal disk can be broken, if the sample edge is too abruptly set down before covering the hole. If the disk is broken, or not well in its position, usually the next analysis will be recognised by a characteristic whistle from the sparking. If the table is slightly damaged, it is sometimes possible to "repair" such a damaged table with an oilstone. However a cracked or broken disk must be exchanged.

Sample Stop

The use of the sample stop is optional. It has however two functions:

- clamping the hard metal disk,
- stop guide jig for positioning the sample.

The sample stop can be used on its two faces. When you put the sample stop on the table you must be sure the two little rubbers down the stop lay on the hard metal disk.

The next figure shows one sample positioning example using the sample clamp on each both faces.

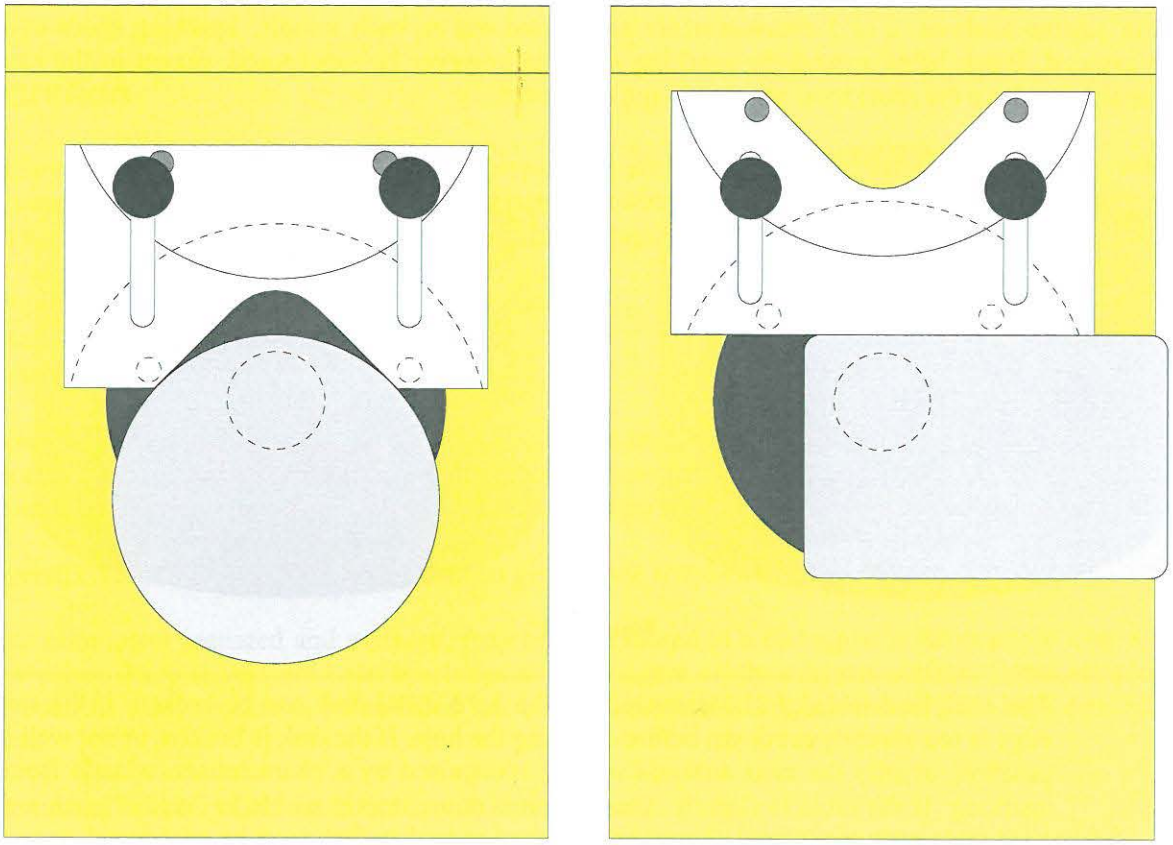


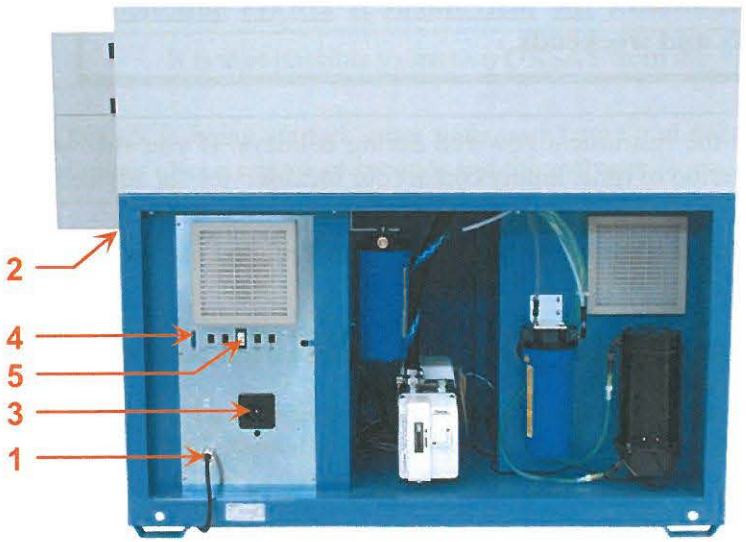
Figure 3.3

Instrument Hardware Ready to Operate

Connections

According to our recommendations the instrument has been installed by one of our service engineer, and you should not need to move a connection made during the installation. Nevertheless, before switching on, you may check if the connections are well established.

The next figure shows the back of the ARL 3460. It is on that side and the right side you will find all connections of the instrument with outside. You can also see the main switch-breaker, that we will tell more about in the next section.



① 230 VAC mains input

② Argon supply inlet

③ External 230 VAC plugs for computer and peripherals

④ RS232 I/O computer serial link

⑤ Main switch-breaker

Figure 3.4

Check that:

- the power cable ① is connected to the 230 VAC supply; ensure that supply is functional,
- the argon pipe ② is connected to the argon supply or the argon battery – otherwise directly on an argon bottle; if there is a manual valve on the pipe, be sure it is open and there is enough argon to proceed to analyses,
- the computer (central unit and peripherals) are supplied by the external plugs ③ (or by the same supply as the instrument is),
- the serial link cable is well connected on the connector ④ of the instrument, and also at the rear of the computer central unit (on the serial link port).

Switch On

The instrument is switch on by the mains switch breaker (see figure 3.4). Normally, the four auxiliary switches located on both sides of the main switch-breaker, should be left on.

Remark: If one of these switches is off some instrument functions will be unavailable, and therefore the instrument will not operate correctly; that means the liability on measurements will not be guaranteed anymore.

Normally the computer and peripherals (printer, screen) are supplied by the external sockets (see figure 3.4). Switch on the computer by its own switch.

Important! Under normal conditions, the instrument is always supplied, even during nights and weekends.

Remark: We even recommend to keep the instrument powered during holidays. If you still want to switch it off during a certain period of time, kindly contact our local service for advice.

In order that strangers do not proceed to a wrong command by hitting the keyboard, you can switch off the computer system during the night.

In case of power off and as far as possible, we recommend to switch off all the circuit breakers and then, once the power has returned, to switch them on again.

Argon Supply

The argon should not be stopped, even for the weekends.

One can reduce the argon consumption if the instrument is not used for several hours by closing completely the second stage pressure regulation valve. When the pressure reaches zero, the valve has to be open a little bit, in order to unstuck the needle. However one should not forget to re-open the valve, and to adjust it to the correct pressure, at least one quarter of an hour before to proceed to analyses.

Analytical Software Ready to Operate

The different installation and initial start-up procedures of the OXSAS software are explained inside the OXSAS CD jacket.

Routine Start-Up

The instrument itself must be powered up before (or at the same time as) the computer system.

Windows starts up automatically when the main unit of the computer is powered.

To start-up OXSAS, just double click on the OXSAS icon which is located on the Windows desktop.

Note: It is also possible to start-up OXSAS from the Windows **Start** menu.

After OXSAS is being started, enter your user name and password and click on **OK**. The OXSAS main window opens after a couple of seconds and the software is ready for use.

If you need help, use the F1 key.

Interruption - Restart

When the OXSAS software starts-up, it will provide a certain number of information to the instrument's microprocessor. This information will be lost if, for any reason, the instrument's power supply has been cut (or at least the electronics switch is switched off).

In case of a power cut or also if the software is stuck, quit OXSAS and restart it as described above.

Saving and Restoring of Files and Working Parameters

For many different reasons, it is highly recommended to save the working files regularly ("Backup") on a CD-ROM or another data media.

The procedures and further information are indicated in the OXSAS contextual help.

After restoring the files, you should carry out a standardisation (recalibration) of the instrument before starting with routine analyses. The standardisation is explained in section *Standardisation (or Recalibration)* of the *Analytical Principle* chapter of this manual.

Stopping the System

As mentioned previously, it is not recommended to stop the instrument, even for weekends. However, it is possible to stop one or several parts of the computer system for the night, or even for shorter periods.

If the screen has its own switch, you can switch it off at any time; this will not affect the correct operation of the software.

However, although an unwanted power cut can occur it is not recommended to stop the computer's main unit without having left the software correctly.

You can quit OXSAS by clicking on the **Exit** icon of the **File** menu.

Once the **Exit** command is acknowledged, a confirmation window is displayed.

Click on the **Yes** button, the OXSAS session is closed and the WINDOWS desktop should relay.

You can now quit Windows and then switch off the computer system's different units using their individual switches.

Analytical Prerequisite

Before performing routine analysis of unknown samples, some analytical tasks must be done:

- the instrument must be stable.
- the instrument must be calibrated.
- the necessary routine maintenance must have been performed.
- the instrument must be standardised.

Instrument Stability

If the instrument has been switched off (despite it is not recommended), you should wait about 2 to 4 hours after having switched it on before starting routine operation.

Calibrating the Instrument

In order to run quantitative routine analyses, the instrument must have been calibrated for the qualities or alloys to be checked. Usually the calibration is made by us according to the contract and supplied with the analytical software.

Further calibration purposes are developed in the chapter *Analytical Principle* of this manual.

Routine Maintenance

The routine maintenance is necessary to keep the instrument in a suitable analytical state. However some operations are rarely required and some other more frequently.

The *Routine Maintenance* chapter of this manual gives a complete description with frequency rates of routine maintenance operations; look at the *Summary Table* section it in order to decide what is required.

Standardisation of the Instrument

The purpose of the standardisation is to correct the instrumental drift at the medium and long term.

The ARL 3460 is very stable and does not requires frequent standardisation. However it is essential and guarantees reliable accurate results all along the instrument's life.

The necessity to standardise depends on your experience and your expectations with the instrument, but it is also possible to take the standardisation under control by the use of control sample(s).

A description of the standardisation principle is given in the *Analytical Principle* chapter of this manual.

Running Routine Analysis

A routine analysis is usually done by performing two measurements on a given sample. The analysis time is about one minute (for two measurements).

When all the above subject listed in the previous sections:
- *Sample Preparation and Positioning*
- *Instrument Hardware Ready to Operate*
- *Analytical Software Ready to Operate*
- *Analytical Prerequisite*

are completed or under control, you can perform routine analysis of unknown samples.

An unknown sample analysis can be separated in three main steps:

- **Starting the analysis process.** This is a preparation step, where you should enter sample identifiers and you may change the analytical task, as well as the associated method, type standard or quality. This step terminates with the physical "start" analysis order.

- **Measurements runs.** This is properly the step where the sample is burned, its emitted light analysed by the spectrometer and the results returned from the instrument control (ICS) to the computer software (OXSAS). This step terminates after the manual or automatic averaging.

- **Ending the analysis process.** After the average, the system (automatically) or you (manually) may take several actions with the results, such as printing, storing, transmitting, modifying, etc. This step terminates with a "continue" order that returns you to the starting analysis process for the analysis of another sample.

From the OXSAS analytical software and according to its configuration, there are many ways to start the analysis process.

On a general way, you can start one analysis by using the **Quantitative Analysis** command of the **Analysis and Data** menu, or simply by pressing on the F10 key, or even by using a predefined shortcut.

More about this can be found in the software contextual help.

Routine Analysis Steps

Several procedures and examples are given in the contextual help, please consult the *About Quantitative Analysis* of the *Quantitative Analysis* book.