

*Atomic Spectrometry*

# ***AAnalyst 800***

***Atomic Absorption Spectrometer***

***User's Guide***

***PERKIN ELMER***





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Certificate No. FM 22178

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## Customer Service

### Company Name and Addresses

**U.S.A.:**

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Phone: (49-7551) 919-0  
Fax: (49-7551) 919-149

**United Kingdom:**

Perkin Elmer Ltd.  
Post Office Lane  
Beaconsfield, Bucks, HP9 1QA  
England  
Phone: (44-1494) 676161  
Fax: (44-1494) 67-9331 & -9333

**Perkin Elmer on the Internet:**

<http://www.perkin-elmer.com/ai>

### Supplies, replacement parts, and accessories

Supplies, replacement parts, and accessories can be ordered directly from Perkin Elmer, using the part numbers quoted in the guides provided with the instrument.

Perkin Elmer's catalog service offers a full selection of high-quality supplies.

To place an order for supplies and many replacement parts, request a free catalog, or ask for information:

- If you are located *within the U.S.*, call toll free **1-800-762-4002**, 8 a.m. to 8 p.m. EST. Your order will be shipped promptly, usually within 24 hours.
- If you are located *outside of the U.S.*, call your local Perkin Elmer sales or service office.

## **Regulatory information**

This instrument has been designed to comply with a wide variety of international standards governing the safety of laboratory equipment. In routine use, the instrument poses virtually no risk to you. If you take some simple, common-sense precautions, you can maintain the continued safe operation of the instrument.

### **IEC 1010 compliance**

This instrument has been designed and tested in accordance with EN 61010-1:1993 (IEC 1010-1): *Safety requirements for electrical equipment for measurement, control, and laboratory use*, including Amendments 1 and 2 to this standard, and EN 61010-2-061:1996 (IEC 1010-2-061:1995): *Particular requirements for laboratory atomic spectrometers with thermal atomization and ionization*.

### **Electrical protection**

#### **Insulation**

Class I as defined in IEC 1010-1.

#### **Installation Category**

This instrument is able to withstand transient overvoltage according to Installation Category II as defined in IEC 1010-1 and IEC 664.

#### **Pollution Degree**

This equipment will operate safely in environments that contain nonconductive foreign matter and condensation up to Pollution Degree 2 as defined in IEC 1010-1 and IEC 664.

## **Electromagnetic compatibility (EMC)**

### **European Union (EMC Directives)**

This instrument has been designed and tested to meet the requirements of the EU Directives 89/336/EEC and 92/31/EEC. It complies with the generic EMC standard EN 61326-1:1997 *Electrical equipment for measurement, control, and laboratory use – EMC requirements – General requirements*.

This instrument has passed the following EMC tests:

<i>Emission of conducted and radiated noise</i>	<i>Electromagnetic compatibility</i>
EN 55011:96	EN61000-4-2:95
EN 61000-3-2:95	EN61000-4-3:95
EN 61000-3-3:95	EN61000-4-4:95
	EN61000-4-5:95
	EN61000-4-6:96

### **United States (FCC)**

This instrument is classified as a digital device used exclusively as industrial, commercial, or medical equipment. It is exempt from the technical standards specified in Part 15 of FCC Rules and Regulations, based on Section 15.103 (c).

### **Japan (FCC)**

This instrument has been tested and found to comply with the limits of a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

## Safety practices and conventions

The guides provided with the instrument contain information and warnings that must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition. This advice is intended to supplement, not supersede, the normal safety code of behavior prevailing in the country of operation.

The information provided does not cover every safety procedure that should be practiced. Ultimately, maintenance of a safe laboratory environment is the responsibility of the user and the user's organization.

Further safety practices are described in the chapter 'Safety Information'.

Possible hazards that could harm the user or result in damage to the instrument are clearly stated at appropriate places throughout these guides.

Any of the following safety conventions can be used throughout these guides:



This symbol alerts you to situations that could result in **personal injury** to yourself or other persons.  
Details about these circumstances are in a box like this one.



This symbol alerts you to the risk of **electric shock** that could result in **personal injury** to yourself or other persons.  
Details about these circumstances are in a box like this one.



This symbol alerts you to the risk of **hot surfaces** that could cause **personal injury** to yourself or other persons.  
Details about these circumstances are in a box like this one.



This symbol alerts you to the risk of **ultraviolet radiation** that could cause **eye damage** to yourself or other persons.  
Details about these circumstances are in a box like this one.

---

**Caution:**

The term **CAUTION** alerts you to situations that could result in **serious damage to the instrument** or other equipment.

Details about these circumstances are described in a message similar to this one.

---

### **Correct use of the instrument**

Before you install or use your instrument, and in order to get the best results, you should be familiar with all of the instruments in the system and know how to operate them. You should also be aware of the safety procedures in force in your laboratory, especially those concerning atomic spectroscopy instruments. Read the guides supplied with the instruments before you start.

If you use the instrument in a manner not specified in the guides, or if you use it for a purpose other than that intended, you may damage the instrument, or compromise your own, or someone else's, safety.

This instrument should only be operated by persons who are suitably qualified and have received adequate training.

## **Electrical safety**

To ensure satisfactory and safe operation of the instrument, it is essential that the green/yellow lead of the line power cord is connected to true electrical earth (ground).



W2.1

### **Warning: Electrical Hazard**

*Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective conductor (earth/ground) terminal is likely to make the instrument dangerous.*

*Intentional interruption is prohibited.*

### **Lethal voltages are present in the instrument**

- *Even with the power switch off, line power voltages can still be present within the instrument.*
- *When the instrument is connected to line power, terminals may be live, and opening covers or removing parts (except those to which access can be gained without use of a tool) is likely to expose live parts.*
- *Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.*

**Warning: Unauthorized Adjustments and Servicing**

W1.2

Only a Perkin Elmer service engineer or similarly trained and authorized person should be permitted to service the instrument.

- Do not attempt to make adjustments, replacements, repairs, or modifications to this instrument except as described in the documentation supplied with the instrument.

When working with the instrument:

- Connect the instrument to a correctly installed line power outlet that has a protective conductor (earth/ground).
- Do not attempt to make internal adjustments or replacements except as directed in the guides provided with the instrument.
- Do not operate the instrument with any covers or parts removed.
- Disconnect the instrument from all voltage sources before opening it for any adjustment, replacement, maintenance, or repair.  
If, afterwards, the opened instrument must be operated for further adjustment, maintenance, or repair, this must only be done by a skilled person who is aware of the hazard involved.
- Use only fuses with the required current rating and of the specified type for replacement.  
**Do not use makeshift fuses or short-circuit the fuse holders.**
- Whenever it is likely that the instrument is no longer electrically safe for use, make the instrument inoperative and secure it against any unauthorized or unintentional operation.

The instrument is likely to be electrically unsafe when it:

- Shows visible damage.
- Fails to perform the intended measurement.
- Has been subjected to prolonged storage under unfavorable conditions.
- Has been subjected to severe transport stresses.

## **Environment**

### **Operating conditions**



**Warning: Explosive Atmosphere**

*This instrument is not designed for operation in an explosive atmosphere.*

W1.3

***The instrument will operate correctly under the following conditions:***

- Indoors.
- Ambient temperature +15 °C to +35 °C (+59 °F to +95 °F).
- Ambient relative humidity 20% to 80%, without condensation.
- Altitude in the range 0 m to 2000 m.

***You can store the instrument safely under the following conditions:***

- Ambient temperature –20 °C to +60 °C (–4 °F to +140 °F).
- Ambient relative humidity 20% to 80%, without condensation.
- Altitude in the range 0 m to 2000 m.

When you remove the instrument from storage and before you put it into operation, allow it to stand for at least a day under the approved operating conditions.



## Symbols used on the instrument

Any of the following symbols can be used on the instrument:



This symbol indicates that there is a potential hazard and that the user must look in the guide for an explanation of the hazard and how to avoid it.



This symbol indicates the risk of electric shock.



This symbol indicates the risk of hot surfaces.



This symbol indicates the off position of the main power switch or circuit breaker. With the switch in this position, the instrument is disconnected entirely from the line power supply.



This symbol indicates the on position of the main power switch or circuit breaker. With the switch in this position, the instrument is connected to the line power supply but is not necessarily switched on and operational.



This symbol indicates the operational on/off switch. This switch turns the instrument on and off, but it does not disconnect the instrument from the line power supply.



This symbol indicates alternating current.



This symbol indicates that there is a potential hazard due to a strong magnetic field and that persons wearing heart pacemakers should remain at least 0.6 m away from the furnace.

## Warning markings on the instrument

### Warning markings at the front of the spectrometer



**A**

*Risk of hot surfaces*

*Risque de surfaces chaudes*

*Gefahr durch heiße*

*Oberflächen*



**B**

**Warning: Moving Parts – Risk of Injury**

*Some moving parts of the instrument are accessible in normal operation.*

*Keep hands, clothing and other objects away from the moving parts of the instrument.*

**Danger: Parties en mouvement – Risque d'accident corporel**

*Certaines parties en mouvement de l'instrument sont accessibles en fonctionnement normal.*

*Tenir les mains, vêtements et autres objets éloignés des parties en mouvement de l'instrument.*

**Warnung: Bewegliche Teile – Verletzungsgefahr**

*Bei normalem Betrieb sind bewegliche Teile des Geräts zugänglich.*

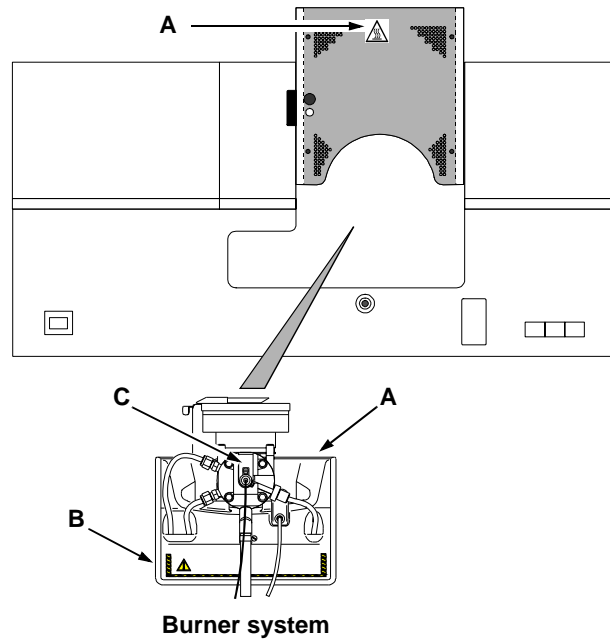
*Hände, Kleidung und andere Gegenstände von den beweglichen Teilen des Geräts fernhalten.*

**C**

*Nebulizer clamp must be lowered and locked over the nebulizer flange.*

*La pince du nébuliseur doit être abaissée et verrouillée audessus de la bride du nébuliseur.*

*Die Zerstäuber-Befestigungsplatte muss nach unten geschoben und über dem Flansch des Zerstäubers befestigt sein.*



**Burner system**

**A**

*Risk of hot surfaces*  
*Risque de surfaces chaudes*  
*Gefahr durch heiße*  
*Oberflächen*

**B**

**Warning: Moving Parts – Risk of Injury**

*Some moving parts of the instrument are accessible in normal operation.*  
*Keep hands, clothing and other objects away from the moving parts of the instrument.*

**Danger: Parties en mouvement – Risque d'accident corporel**

*Certaines parties en mouvement de l'instrument sont accessibles en fonctionnement normal.*  
*Tenir les mains, vêtements et autres objets éloignés des parties en mouvement de l'instrument.*

**Warnung: Bewegliche Teile – Verletzungsgefahr**

*Bei normalem Betrieb sind bewegliche Teile des Geräts zugänglich.*  
*Hände, Kleidung und andere Gegenstände von den beweglichen Teilen des Geräts fernhalten.*

**D**

**Strong magnetic field**

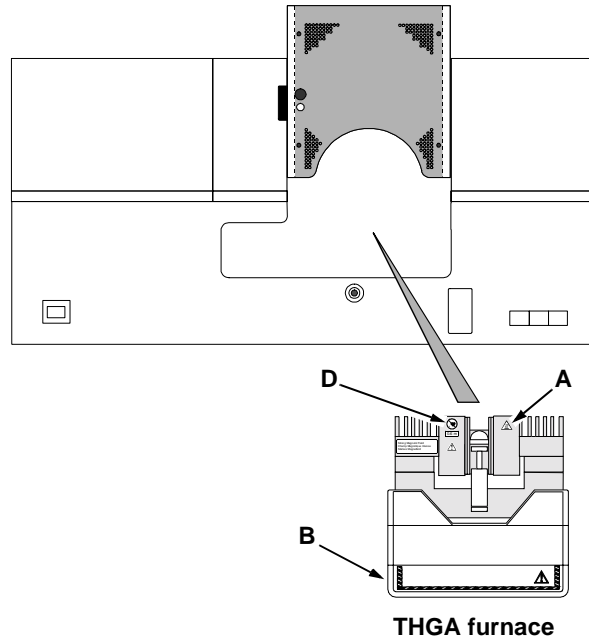
*Anyone wearing a heart pacemaker or having metallic implants should remain at least 0.6 meter away from the furnace – in any direction – while the furnace is operating.*

**Champ magnétique intense**

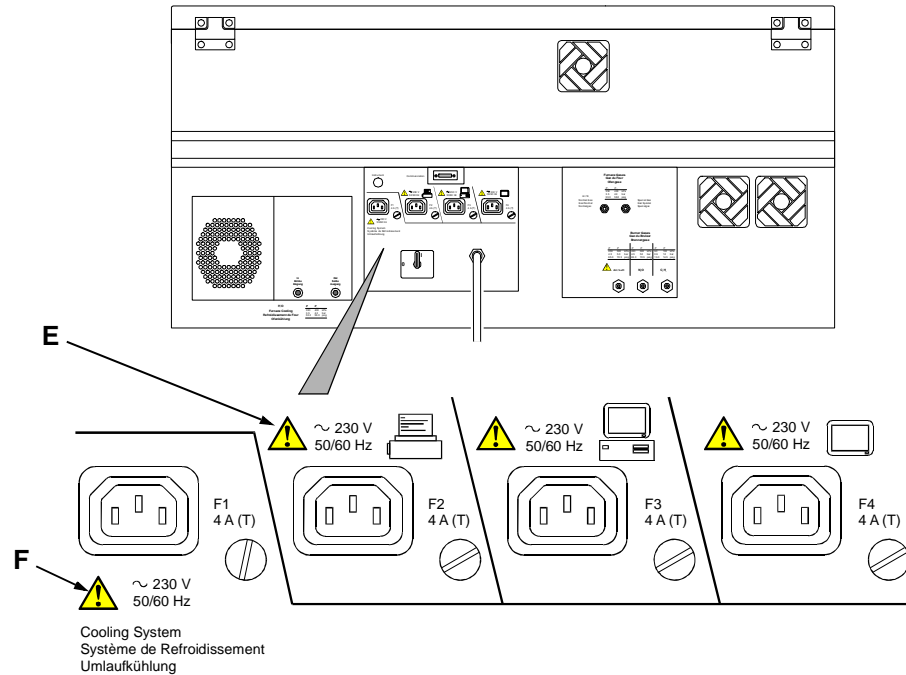
*Tout personne ayant un stimulateur cardiaque ou des implants métalliques doit rester éloignée d'au moins 0,6 m du four pendant le fonctionnement de celui-ci.*

**Starkes Magnetfeld**

*Herzschrittmacherträger und Personen mit Metall-Implanten müssen zum Magneten einen Sicherheitsabstand von mindestens 0,6 m in jeder Richtung um den Magneten einhalten.*



## Warning markings on the rear panel



**E**

### **Power outlets**

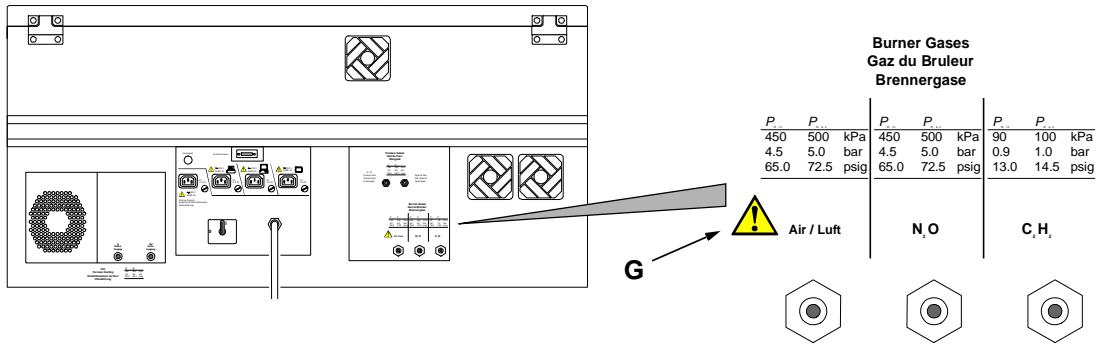
Power outlets for a printer, computer, or monitor.

Use these outlets only when the equipment requires 230 V, 50/60 Hz.

**F**

### **Cooling system outlet**

Connect the cooling system to this power outlet only. Do not connect the cooling system to any other supply. Do not connect other equipment to this power outlet.



G

### Burner Gases

**Never** set the outlet pressure to a value exceeding the maximum pressure ( $P_{max}$ ).

#### Warning: Acetylene – Explosion Hazard

Acetylene can decompose explosively at pressures higher than 103 kPa / 1.03 bar / 15 psig. Always make sure that the acetylene outlet gauge pressure is below this value.

#### Danger: Acétylène – Risque d'explosion

L'acétylène peut se décomposer de manière explosive à des pressions supérieures à 103 kPa / 1.03 bar / 15 psig.

Toujours vérifier que la pression de l'acétylène sur le manomètre de sortie est inférieure à cette valeur.

#### Warning: Acetylen – Explosionsgefahr

Stellen Sie für Acetylen keinen höheren Ausgangsdruck als 103 kPa (1,03 bar) ein.

Bei höheren Drücken kann Acetylen spontan zerfallen und explodieren

#### Warning: Flashback Hazard

Perkin Elmer burner systems are designed for use with compressed air. The use of oxygen can cause an explosion in the burner system, and oxygen-enriched air can cause a flashback of the flame.

Never use oxygen or oxygen-enriched air with Perkin Elmer burner systems. Use only compressed air.

#### Danger: Risque de retour de flamme

Les systèmes de brûleurs Perkin Elmer sont conçus pour être utilisés avec de l'air comprimé.

L'utilisation d'oxygène peut provoquer une explosion dans le système de brûleur, et l'air suroxygéné peut provoquer un retour de flamme.

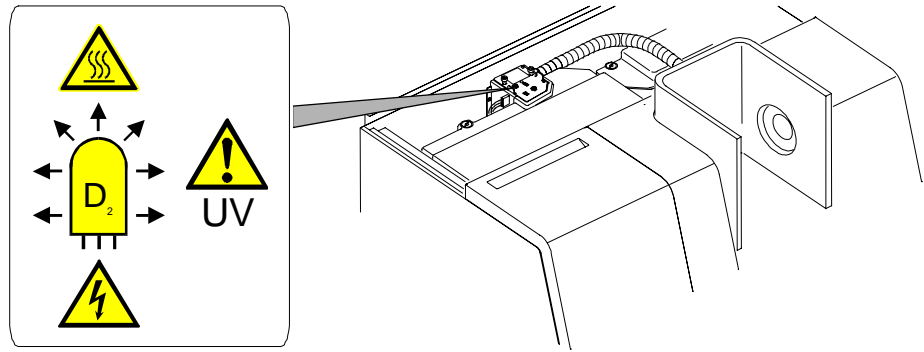
Ne jamais utiliser d'oxygène ou d'air suroxygéné avec les systèmes de brûleurs Perkin Elmer. N'utiliser que l'air comprimé.

#### Warning: Sauerstoff und mit Sauerstoff angereicherte Luft

Verwenden Sie für Perkin Elmer Brenner nur Druckluft. Sauerstoff oder sogenannte 'Atemluft' sind nicht zulässig. Bei Verwendung von Sauerstoff besteht Explosionsgefahr. Mit Sauerstoff angereicherte Luft kann einen Flammenrückschlag verursachen.

## Warning markings on the deuterium lamp cover

The warning markings below are visible when you open the top cover of the spectrometer.



### **High Temperatures – Risk of Burns**

*The lamp is hot.*

**Températures élevées**

*La lampe est chaude.*

**Verbrennungsgefahr**

*Die Lampe ist heiß.*



### **UV Radiation – Risk of Eye Damage**

*The lamp emits intense UV radiation which can damage your eyes.*

*Do not gaze into a lighted lamp.*

**Rayonnement UV**

*La lampe émet un rayonnement UV intense susceptible de provoquer des lésions oculaires.*

*Ne pas regarder fixement une lampe allumée.*

**UV-Strahlung – Gefährdung der Augen**

*Die Lampe emittiert starke UV-Strahlung und kann dadurch Augenschäden verursachen.*

*Nicht mit ungeschützten Augen direkt in die leuchtende Lampe schauen.*



### **Electrical Hazard**

*The deuterium lamp operates at high voltage.*

*To avoid electrical shock, disconnect the line power cord before opening the cover.*

**Risque d'électrocution**

*Pour éviter les chocs électriques, débrancher le cordon d'alimentation avant d'ouvrir le couvercle.*

**Gefährdung durch elektrischen Strom**

*Die Deuteriumlampe benötigt zum Betrieb gefährlich hohe Spannung.*

*Um elektrischen Stromschlag zu vermeiden, ziehen Sie die Netzanschlußleitung bevor Sie die Abdeckung öffnen.*

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## ***Introduction***

The guides provided with your analytical instrument contain information and warnings that you must follow to ensure safe operation and to maintain the instrument in a safe condition. This advice is intended to supplement, not supersede, the normal safety code of behavior prevailing in the country of operation.

This chapter describes general safety practices for atomic spectroscopy and potential hazards with various atomic absorption techniques. The information provided does not cover every safety procedure that should be practiced. Ultimately, maintenance of a safe laboratory environment is the responsibility of the user and the user's organization.

## ***Correct use of analytical instruments***

Before you install or use your instrument, and in order to get the best results, you should be familiar with all of the instruments in the system and know how to operate them. You should also be aware of the safety procedures in force in your laboratory, especially those concerning atomic spectroscopy instruments. Read the guides supplied with the instruments before you start.

If you use the instrument in a manner not specified in the guides, or if you use it for a purpose other than that intended, you may damage the instrument, or compromise your own, or someone else's, safety.

Analytical instruments should only be operated by persons who are suitably qualified and have received adequate training.

## ***Laboratory hygiene***

- Keep the work area scrupulously clean to avoid contaminating your samples and to maintain a safe working environment. Clean up spilled chemicals immediately and dispose of them properly.
- Do not allow smoking in the work area. Smoking is a source of significant contamination and also a potential route for ingesting harmful chemicals.
- Do not store, handle, or consume food in the work area.

## ***Laboratory ventilation***

Toxic combustion products, metal vapor, ozone, etc., can be generated by the system, depending on the type of analyses being performed.

- You must provide an efficient laboratory ventilation system to remove toxic products generated during instrument operation.

## Safe handling of chemicals

Some chemicals used with the instrument may be hazardous or may become hazardous after completion of an analysis.

The responsible body<sup>1</sup> must take the necessary precautions to ensure that the surrounding workplace is safe and that instrument operators are not exposed to hazardous levels of toxic substances (chemical or biological) as defined in the applicable national, state, and local health and safety regulations and laws. Venting for fumes and disposal of wastes must be in accordance with all national, state, and local health and safety regulations and laws.

- Use, store, and dispose of chemicals in accordance with the manufacturer's recommendations and the applicable national, state, and/or local regulations.
- Wear appropriate eye protection at all times while handling chemicals. Depending on the types of chemicals you are handling, wear safety glasses with side shields, or goggles, or a full-face shield.
- Wear suitable protective clothing, including gloves if necessary, resistant to the chemicals you are handling.
- When preparing chemical solutions, always work in a fume hood that is suitable for the chemicals you are using.
- Perform sample preparation away from the instrument to minimize corrosion and contamination.
- Clean up spills immediately using the appropriate equipment and supplies, such as spill cleanup kits.
- Do not put open containers of solvent near the instrument.
- Store solvents in an approved cabinet (with the appropriate ventilation) away from the instrument.

---

1. Definitions from IEC 1010-1:

**Responsible body:** 'individual or group responsible for the use and maintenance of equipment, and for ensuring that operators are adequately trained.'

**Operator:** 'person operating equipment for its intended purpose.'

**Sodium tetrahydroborate**

Sodium tetrahydroborate is used as a reductant in the mercury cold vapor technique and the hydride-generation technique. Sodium tetrahydroborate solutions are unstable and decompose, releasing hydrogen. Sodium tetrahydroborate also releases hydrogen when it comes into contact with acids.

- Make sure that the work area has an adequate ventilation system to prevent the build-up of explosive hydrogen/air mixtures.
- Use and store sodium tetrahydroborate according to the manufacturer's recommendations.
- Keep sodium tetrahydroborate solutions:
  - Out of direct sunlight.
  - Away from open flames.
  - In an area with an efficient ventilation system.
- Protect sodium tetrahydroborate solutions from temperature variations.
- Handle sodium tetrahydroborate solutions with care since they are corrosive.
- Do not allow smoking in areas where sodium tetrahydroborate is used.
- When you are using sodium tetrahydroborate as the reductant with flow-injection systems, hydrogen is formed when it comes into contact with the acidic carrier solution.
  - Do not loosen or remove any connections when the system is operating.
  - The maximum concentration of sodium tetrahydroborate that you should use with Perkin Elmer flow-injection systems is 0.5% w/v.
  - At the end of the work session, pump deionized water through the sodium tetrahydroborate tubing system to remove all traces of the reductant.

## Waste disposal

### Contents of waste containers

The materials that you collect in waste containers may include small amounts of the substances that were analyzed and other chemicals used in the analyses.

If these materials are toxic, corrosive, or contain organics you may have to treat the collected effluent as hazardous waste. Refer to your local safety regulations for proper disposal procedures.

### Disposing of defective lamps

Hollow cathode lamps and electrodeless discharge lamps contain small quantities of the lamp element in a very pure form. If a lamp containing toxic elements becomes defective or otherwise unusable, you must treat it as hazardous waste and dispose of it accordingly. A licensed company in the chemical waste disposal business can provide lamp disposal in accordance with environmental regulatory requirements. Please note that Perkin Elmer does not take back defective lamps for disposal.

In addition, hollow cathode lamps and deuterium lamps are maintained under reduced pressure. Handle and dispose of them correctly to minimize the implosion risk.

For information, the quantities of analyte material contained in the cathodes of hollow cathode lamps are listed in the table below:

Quantity of material in the cathode	Single-element hollow cathode lamps	Multi-element hollow cathode lamps
less than 5 g	As, Au, B, Ba, Be, Ca, Dy, Er, Eu, Ga, Gd, Ge, Hf, Ho, In, Ir, K, La, Li, Mg, Na, Nd, Pd, Pr, Pt, Re, Rh, Ru, Sc, Se, Sm, Sn, Ta, Tb, Tm, Yb, Y	Na-K, Pt-Ru
5–10 g	Ag, Al, Bi, Cd, Co, Cr, Mn, Mo, Ni, Sb, Si, Sr, Te, V, W, Zn, Zr	Ca-Mg, Ca-Zn, Ag-Au, Sn-Te, Ca-Mg-Zn, Ca-Mg-Al
10–15 g	Cu, Fe, Hg, Nb, P, Pb, Ti, Tl	all other multi-element HCLs

For EDLs, the quantity of analyte material used is much less than the quantities used in HCLs. Typically, only several milligrams of material are placed in the EDL bulb. No Perkin Elmer EDLs (System 1 or 2) contain more than 0.05 g of analyte material.

## ***UV radiation***

You should be aware of the health hazard presented by UV radiation.

- When the instrument is on, do not remove any covers unless specifically instructed to do so in the guide since otherwise you may be exposed to potentially hazardous UV radiation.
- Always wear UV-absorbing eye protection when viewing any of these sources:
  - The flame, especially the nitrous oxide/acetylene flame.
  - The graphite furnace when it is heated to incandescence.
  - Hollow cathode or electrodeless discharge lamps.
  - The deuterium background correction lamp.

## ***Magnetic field***

### ***Zeeman graphite furnace systems***

The electromagnet generates a strong magnetic field inside the furnace during measurement cycles.

There is a weak, accessible, stray magnetic field around the graphite furnace. This stray magnetic field can affect heart pacemakers and metallic implants up to 0.6 meter from the furnace in all directions. This stray field can also affect other instruments, watches, and magnetic storage devices.

- Do not operate the furnace when persons wearing electronic heart pacemakers, or having other metallic implants, are present.
- Anyone wearing a heart pacemaker or having metallic implants should remain at least 0.6 meter away from the furnace – in any direction – while the furnace is operating.

## High temperatures

### **Burner system**

The flame can generate temperatures of up to 2800 °C.

- Do not touch the burner head until it has cooled to room temperature.

### **Graphite furnace**

The THGA graphite furnace can generate temperatures of up to 2600 °C.

- Do not touch any part of the graphite furnace until it has cooled to room temperature.
- Do not attempt to inject a sample into the graphite tube when the furnace is hot. You may be subjected to fumes from the sudden vaporization of the sample, and may damage the pipet.

### **Quartz tube atomizer cell**

The quartz tube atomizer cell (QTA-cell) used for the hydride-generation technique can reach temperatures of up to 1000 °C.

- Do not touch any part of the heating mantle (electrically heated systems), or the cell holder (flame-heated systems), or the QTA-cell until they have cooled to room temperature.

## Handling compressed gases

*Note: The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building regulations.*

### Summary of gas hazards

Hazards associated with the different gases used in atomic absorption spectrometry are presented in the table below:

Gas	Suffocation	Explosion	Spontaneous Decomposition or Combustion
Air	–	–	–
Argon	x	–	–
Nitrogen	x	–	–
Acetylene (ethyne, C <sub>2</sub> H <sub>2</sub> )	x	x	x
Nitrous Oxide (dinitrogen monoxide, N <sub>2</sub> O)	x	–	x

Contact the gas supplier for a safety data sheet containing detailed information on the potential hazards associated with the gas.

### Identifying cylinders

- Legibly mark cylinders to clearly identify the contents and status (full, empty, etc.). Use the chemical name or commercially accepted name for the gas.



## Storing cylinders

- Store cylinders in accordance with the applicable national, state, and/or local regulations and standards.
- When gas cylinders are stored in confined areas, such as a storage room, make sure that ventilation is adequate to prevent toxic or explosive accumulations of gas.  
The storage room should be well ventilated and dry. This is particularly important in confined areas.
- Do not store cylinders near elevators, gangways, or in locations where heavy moving objects may strike or fall against them.
- Use and store cylinders away from exits and exit routes.
- Locate gas cylinders away from heat sources, including heat lamps.  
Compressed gas cylinders should not be subjected to temperatures above 52 °C (125 °F).
- Do not allow ignition sources in the storage area and keep cylinders away from readily ignitable substances such as gasoline or waste, or combustibles in bulk, including oil.
- Store all gas cylinders only in a vertical position, with the valve cap in place, and fastened securely to an immovable bulkhead or a permanent wall.
- If you are storing cylinders outdoors, store them above ground on a suitable floor where they are protected against temperature extremes (including the direct rays of the sun).

### ***Handling cylinders***

- Move cylinders with a suitable hand truck after making sure that the valve cap is securely in place and that the cylinder is properly fastened to the hand truck.
- Use only approved regulators, tubing, and hose connectors. When you connect fittings, keep in mind that left-hand thread fittings are used for fuel gas connections (e.g., acetylene), whereas right-hand thread fittings are used for oxidant and support gas connections (e.g., nitrous oxide, air).
- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.
- Do not ‘crack the valve’ or open the valve of an acetylene cylinder before attaching a regulator.
- Do not attempt to refill gas cylinders.
- Check the condition of pipes, hoses, and connectors regularly, and replace any damaged parts.
- Perform periodic gas leak tests at all joints and seals of the gas system by applying an approved gas leak detection solution.

## **Safety practices for flame atomization**

### **Safety interlocks**

Perkin Elmer provides a number of safety interlocks on the burner system to monitor gas pressure and check for the proper setup of the burner head, nebulizer, and drain system. In addition a flame sensor checks that the flame is burning.

- Do not attempt to defeat these interlocks; you may compromise your own, or someone else's, safety.

### **Safe use of burner gases**

The seepage of fuel gas or fuel gas mixture from the burner system, the drain system, the gas control system, or the gas connections constitutes a serious fire hazard.

- Make sure that there are no breaks or leaks in any of these systems and that all the seals are correctly installed and in good condition.
- Regularly check for leaks at joints and seals using an approved leak test solution.
- When you perform any maintenance or installation procedures, follow the instructions in the guide exactly.
- Do not attempt to service the gas control system yourself. A Perkin Elmer service engineer, or similarly authorized and trained person, must perform the work.
- When you shut down the instrument, for example at the end of the working day, shut all the gas lines at the cylinder or regulator valves. Bleed the lines between the regulator and instrument to atmosphere before switching off the ventilation system.

### ***Air supply***

An air compressor is recommended for the air supply to the burner system. Cylinders of compressed air should only be used as an emergency or short-term solution.

- If you use cylinder air, make sure that it is compressed air and not oxygen-enriched air (e.g. breathing air); the use of oxygen-enriched air can cause a flashback of the flame.
- **Never** use oxygen as the oxidant since this can cause an explosion.

### ***Nitrous oxide***

(dinitrogen monoxide, N<sub>2</sub>O)

- Tubing and fittings carrying nitrous oxide must be free of all oil, grease, and organic materials.  
Spontaneous combustion may occur if nitrous oxide comes into contact with these materials.
- Use a double-stage or heated regulator for nitrous oxide to prevent freezing of the diaphragm and a loss of pressure regulation.
- Do not store nitrous oxide in close proximity to flammable gases, such as acetylene or hydrogen.

## Acetylene

- Always use 'Atomic Absorption Grade' acetylene (ethyne) dissolved in acetone (propan-2-one). This is satisfactory for all Perkin Elmer AA spectrometers.
- Do not store acetylene in close proximity to oxidizing gases, such as nitrous oxide.
- Use approved tubing and fittings for acetylene. Never use copper fittings since acetylene forms an explosive compound with copper.
- Prevent acetylene from coming into contact with copper, silver, mercury or gaseous chlorine.
- Periodically check for the presence of acetylene in the laboratory atmosphere, especially near the ceiling.
- For acetylene, set an outlet gauge pressure of between 85 kPa and 100 kPa (0.85–1.0 bar, 12–14.5 psig). Never allow the outlet gauge pressure to exceed 103 kPa (1.03 bar, 15 psig); acetylene can explode spontaneously above this pressure.
- Solvent Carryover.  
If the acetylene cylinder pressure falls to below 600 kPa / 6.0 bar / 87 psig (at 20 °C), some of the solvent used to stabilize the acetylene (such as acetone) may be carried over into the burner. This could influence the characteristics of the burner with a resulting influence on the analytical results.  
Change to a new acetylene cylinder when the cylinder pressure falls to below this value.

### **Safe operation of the flame**

- Before you ignite the flame make sure that:
  - The laboratory fume ventilation system is operating;
  - The burner head is installed correctly;
  - The burner end cap is secured firmly;
  - The fuel and oxidant tubing fittings are properly connected;
  - The burner unit contains the necessary solvent-resistant components if you intend to analyze samples containing organic solvents;
  - The atomizer compartment door is closed;
  - The pH of the liquid in the waste container is greater than pH 10 if you intend to aspirate cyanide solutions.
- **Do not leave the flame unattended.** Always make sure that there is a fire extinguisher near the instrument.
- Never change the gas pressure or shut a gas valve while the flame is burning.
- **Do not allow the burner head slot to become blocked. This can cause a flashback of the flame.**
- Do not place open containers of flammable liquids and solvents near to the flame. Be especially careful with samples that contain highly volatile solvents.
- When you have analyzed samples containing organic solvents, flush all traces of solvent from the burner system.

## ***The drain system***

- Always place the waste container in a well ventilated place underneath the spectrometer, **in full view** while you are working with the spectrometer. This prevents the build-up of potentially hazardous gases, and allows you to see the liquid level.
- Never use a glass waste container.
- **Do not kink, fold, or loop the drain tube.**
- Never place the drain tube directly into a laboratory sink.
- Empty the waste container frequently; especially do not allow the waste container to fill with organic solvent.
- Thoroughly flush the drain system, as described in the guide, when you shut down the system.
- Check the condition of the drain tube regularly, especially if you use organic solvents. Replace the drain tube when it first shows signs of cracking or discoloration.

## ***Flashbacks***

A flashback is an explosion of the premixed gases in the spray chamber. The safety interlocks normally prevent conditions that could cause a flashback, but if a flashback should ever occur:

- **Check that the burner head slot is clean.**
- Make sure that you are using compressed air and not oxygen-enriched air.
- Check the flow spoiler or impact bead for damage, and replace any damaged parts.
- Carefully check and tighten all connections to, and seals on, the burner unit, and check the gas flow settings before you attempt to ignite the flame. Seepage of fuel and oxidant from the spray chamber may cause a flashback.
- Check that the burner head is seated correctly.

## **Hazards with flame atomization**

### **Toxic combustion products:**

Toxic combustion products can be generated by the system, depending on the type of analyses being performed.

- You must provide an efficient laboratory ventilation system to remove toxic products generated during instrument operation.

### **High temperatures:**

The flame can generate temperatures of up to 2800 °C.

- To avoid serious burns, never touch the burner head until it has cooled to room temperature.

### **UV radiation:**

The flame, especially the nitrous oxide/acetylene flame, emits ultraviolet radiation.

- Keep the atomizer compartment door closed when the flame is burning and never directly view the flame unless you are wearing UV-absorbing glasses.

### **Acetylides:**

If you have aspirated high concentrations of copper, silver, or mercury solutions into an acetylene flame, unstable acetylides may have formed in the spray chamber. If permitted to dry, these compounds may explode.

- Aspirate solution continuously to prevent residues from drying.
- Thoroughly flush the spray chamber and drain system with water immediately after such an analysis.

### **Cyanide solutions:**

If you intend to aspirate cyanide solutions, make sure that the pH of the liquid in the waste container is greater than pH 10; toxic hydrogen cyanide gas is formed when cyanides contact acidic solutions.

- Never allow solutions containing cyanides to mix with acidic solutions.



## Safety practices for electrothermal atomization

### Safety interlocks

Perkin Elmer provides a number of safety interlocks on the graphite furnace (electrothermal atomization) system that monitor the gas pressure and the temperature of certain system components.

- Do not attempt to defeat these interlocks; you may compromise your own, or someone else's, safety.

### Inert gas

The graphite furnace requires a supply of inert gas. Perkin Elmer recommends **argon**.

Although nitrogen can be used, it is not recommended for the inert gas supply. At furnace temperatures above 2300 °C, nitrogen reacts with graphite to form toxic cyanogen gas (CN)<sub>2</sub>.

### Safety checks

- Before you start an analysis, make sure that:
  - The laboratory fume ventilation system is operating;
  - The inert gas supply is connected and set to the correct pressure;
  - The cooling water supply is turned on;
  - The autosampler waste bottle is empty.

## Hazards with electrothermal atomization

### Toxic products:

Toxic metal vapors, ozone, etc., can be generated by the system, depending on the type of analyses being performed.

- You must provide an efficient laboratory ventilation system to remove toxic products generated during instrument operation.
- If you use nitrogen as the inert gas, toxic cyanogen gas (CN)<sub>2</sub> will be produced when the furnace temperature is above 2300 °C.

### High temperatures:

The THGA graphite furnace can generate temperatures of up to 2600 °C.

- To avoid serious burns, never touch the graphite components until the furnace has cooled to room temperature.
- Do not attempt to inject a sample into the graphite tube when the furnace is hot. You may be subjected to fumes from the sudden vaporization of the sample, and may damage the pipet.

### UV radiation:

The graphite furnace emits ultraviolet radiation when it is heated to incandescence.

- Never directly view the graphite furnace unless you are wearing UV-absorbing glasses.

### Strong magnetic field:

The electromagnet generates a strong magnetic field inside the THGA furnace during measurement cycles.

- Do not operate the furnace when persons wearing electronic heart pacemakers, or having other metallic implants, are present.
- Anyone wearing a heart pacemaker or having metallic implants should remain at least 0.6 meter away from the furnace – in any direction – while the furnace is operating.

## Safety practices for FIAS and mercury/hydride systems

### **FIAS-Cells – To all users who have an MHS-20 in addition to FIAS**

- Never use the FIAS-cell for the MHS-20.
- The smaller diameter of the FIAS-cell can cause an increase in back pressure. This could force the acidic reaction mixture back into the sodium tetrahydroborate storage container where large quantities of hydrogen would be produced.

### **Safety checks**

- Before you start an analysis, make sure that:
  - The laboratory fume ventilation system is operating;
  - The tubing in the fluid system is not constricted since this could lead to a pressure build-up in the system;
  - The drain tubing is inserted in the waste container and that this container is empty.
- If you are using a flame to heat the QTA-cell or if you intend to perform flame-FIAS analyses, refer to the information under *Safety Practices for Flame Atomization* before you ignite the flame.

## **Hazards with FIAS and mercury/hydride systems**

### **Toxic products:**

Toxic metal vapors, etc., can be generated by the system, depending on the type of analyses being performed.

- You must provide an efficient laboratory ventilation system to remove toxic products generated during instrument operation.

### **High temperatures:**

The QTA-cell used for the hydride-generation technique can reach temperatures of up to 1000 °C.

- Do not touch any part of the heating mantle (electrically heated systems), or the cell holder (flame-heated systems), or the QTA-cell until they have cooled to room temperature.

### **Hazardous chemicals:**

Some of the chemicals required for analyses are corrosive and/or toxic.

- Refer to the information under *Safe Handling of Chemicals* and to the specific warnings in the documentation provided with the system before you start an analysis.

## References for laboratory safety practice

- Bretherik, L., *Bretherik's Handbook of Reactive Chemical Hazards*, 4th ed., Butterworth & Co. Ltd., London, UK, 1990.
- Bretherik, L., *Hazards in the Chemical Laboratory*, 3rd ed., Royal Society of Chemistry, London, UK, 1981.
- *CRC Handbook of Laboratory Safety*, 3rd ed., Furr, K., ed., The Chemical Rubber Co. Press, Florida, USA, 1990.
- *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, National Research Council, National Academic Press, Washington D.C., USA, 1981.
- Sax, N., ed., *Dangerous Properties of Industrial Materials*, 7th ed., Van Nostrand Reinhold, New York, 1989.
- Compressed Gas Association, Inc., Arlington, VA 22202, USA, various publications.
- Data Sheets provided by chemical manufacturers, e.g.:
  - USA, Material Safety Data Sheets (MSDS),
  - FRG, DIN-Sicherheitsblätter,
  - UK, Hazard Data Sheets.



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## **Before you install the spectrometer**

### **When the spectrometer arrives**

- Check the exterior of the shipping crate for obvious signs of damage. If the crate has been damaged, file a claim with the authorized carrier immediately and inform your nearest Perkin Elmer office.
- Contact your local Perkin Elmer office to arrange for the installation.

### **Before the service engineer arrives**

- You must prepare a suitable site for the spectrometer and any accessories. See '*Laboratory Requirements*', and the guides for any accessories.
- You must make sure that the fume ventilation system and the necessary gas supply lines and regulators are installed.
- Although you should not perform the initial installation yourself, we recommend that you read the installation instructions to learn about the spectrometer and its requirements before you start using it. These instructions are also provided in case you need to alter any of the connections or move the instrument.

### **When the service engineer arrives**

- The service engineer will remove the spectrometer from the crate and check that all parts have been delivered. If anything is missing or damaged, the service engineer will make sure that the respective parts are supplied.
- The service engineer will remove the shipping locks, perform pre-installation checks, install the spectrometer, and make sure that everything functions correctly.

## **Moving and reinstalling the spectrometer**

We recommend that only a Perkin Elmer service engineer or a Perkin Elmer trained and authorized person moves and reinstalls the spectrometer. Should you attempt to do this yourself, Perkin Elmer cannot be held responsible for any damage or malfunctioning of the spectrometer. The instructions here are primarily intended for occasions where you may want to move the spectrometer **short** distances to a new location within the laboratory. Read the instructions carefully and be sure you understand them thoroughly before you attempt to move the spectrometer. Read the detailed information given in the relevant sections of this chapter before you reinstall the spectrometer. If you intend to transport the spectrometer over a longer distance, contact your local Perkin Elmer office since internal shipping locks must be set via the service software, inside the spectrometer.

### **Preparing the spectrometer to be moved**

1. Close the AA WinLab application, then shut down the Windows operating system.
2. Switch off the spectrometer, computer and all the accessories.
3. Disconnect all the electrical cables.
4. Remove the furnace autosampler from the spectrometer (*see 'Removing the autosampler from the spectrometer' in the 'Graphite Furnace User's Guide'*).
5. Disconnect the burner gas supplies.
6. Disconnect the drain system from the burner.
7. Disconnect the furnace gas supplies.
8. Prepare the computer and other system components for transport as described in their own guides.
9. Attach the original handles securely. Only use the original handles and screws.

*Make sure that the handles are properly secure before you move the spectrometer.*

## Moving the spectrometer

**Warning: Risk of injury through lifting**

W1.4

The instrument weighs approximately 190 kg.

Improper lifting can cause painful and sometimes permanent back injury.

- Use proper lifting techniques and always use the handles to lift or move the instrument.

**Caution: Risk of damage to the instrument**

The spectrometer is a precision optical instrument. Move the spectrometer very carefully and protect it from vibrations and jolts. Do not tilt the spectrometer.

If the spectrometer must be tilted or mechanically lifted, contact your Perkin Elmer service representative before moving the spectrometer. The shipping locks must be properly secured to prevent any damage occurring if the spectrometer is tilted or jolted.

Carefully lift the spectrometer onto a movable table to transport it to the new location.

## Reinstalling the spectrometer

Reinstall the spectrometer by following exactly the procedures described in this chapter, as summarized in the steps below.

1. Prepare the new site for the spectrometer; see 'Laboratory Requirements'.
2. Remove the handles. Save the handles and screws.  
Insert the plastic plugs provided (B015-3803) into the screw holes.
3. Connect the burner and furnace gas supplies.
4. Connect the drain system to the burner.
5. Install the furnace autosampler.
6. Connect the cooling system for the graphite furnace.
7. Make sure that the main power switches of all the instruments are in the off position, then connect the electrical cables.

## Connecting the burner gases

The connectors for the burner gases are located on the rear panel of the spectrometer.

### **What you need to provide:**

- Suitable supplies of acetylene, air, and nitrous oxide. The gases must conform with the requirements listed in 'Laboratory Requirements'.
- Suitable pressure regulators and on/off valves near to the spectrometer for the gas supplies.

The gas supply systems must comply with your local safety regulations. Refer also to the information given under 'Safety Information'.



### **Warning: Flashback Hazard**

W5.9

*Perkin Elmer burner systems are designed for use with compressed air. The use of oxygen can cause an explosion in the burner system, and oxygen-enriched air can cause a flashback of the flame.*

- *Never use oxygen or oxygen-enriched air with Perkin Elmer burner systems. Use only compressed air.*

### **What is provided with the spectrometer:**

- Gas hose assemblies for acetylene, air, and nitrous oxide.  
The fittings on the gas hose assemblies are suitable for connection to most commercially available pressure regulators. These are R 3/8" standard threaded fittings. The fuel (acetylene) fitting has a left-hand thread, while the oxidant (air, nitrous oxide) fittings have right-hand threads.  
If you require an adapter for your regulator, contact the gas supplier or the regulator manufacturer, or your local Perkin Elmer office.

**To connect the gases**

**Air**

1. Make sure that the air supply is turned off.
2. Use the black hose assembly to connect a source of clean, dry, and filtered air to the fitting labelled **Air/Luft** on the rear panel of the spectrometer.

**Nitrous oxide**

1. Make sure that the nitrous oxide supply is turned off.
2. Use the blue  $N_2O$  hose assembly to connect a source of clean, dry nitrous oxide to the fitting labelled  **$N_2O$**  on the rear panel of the spectrometer.

**Acetylene**

1. Make sure that the acetylene supply is turned off.
2. Use the red  $C_2H_2$  hose assembly to connect a source of clean, dry acetylene to the fitting labelled  **$C_2H_2$**  on the rear panel of the spectrometer.

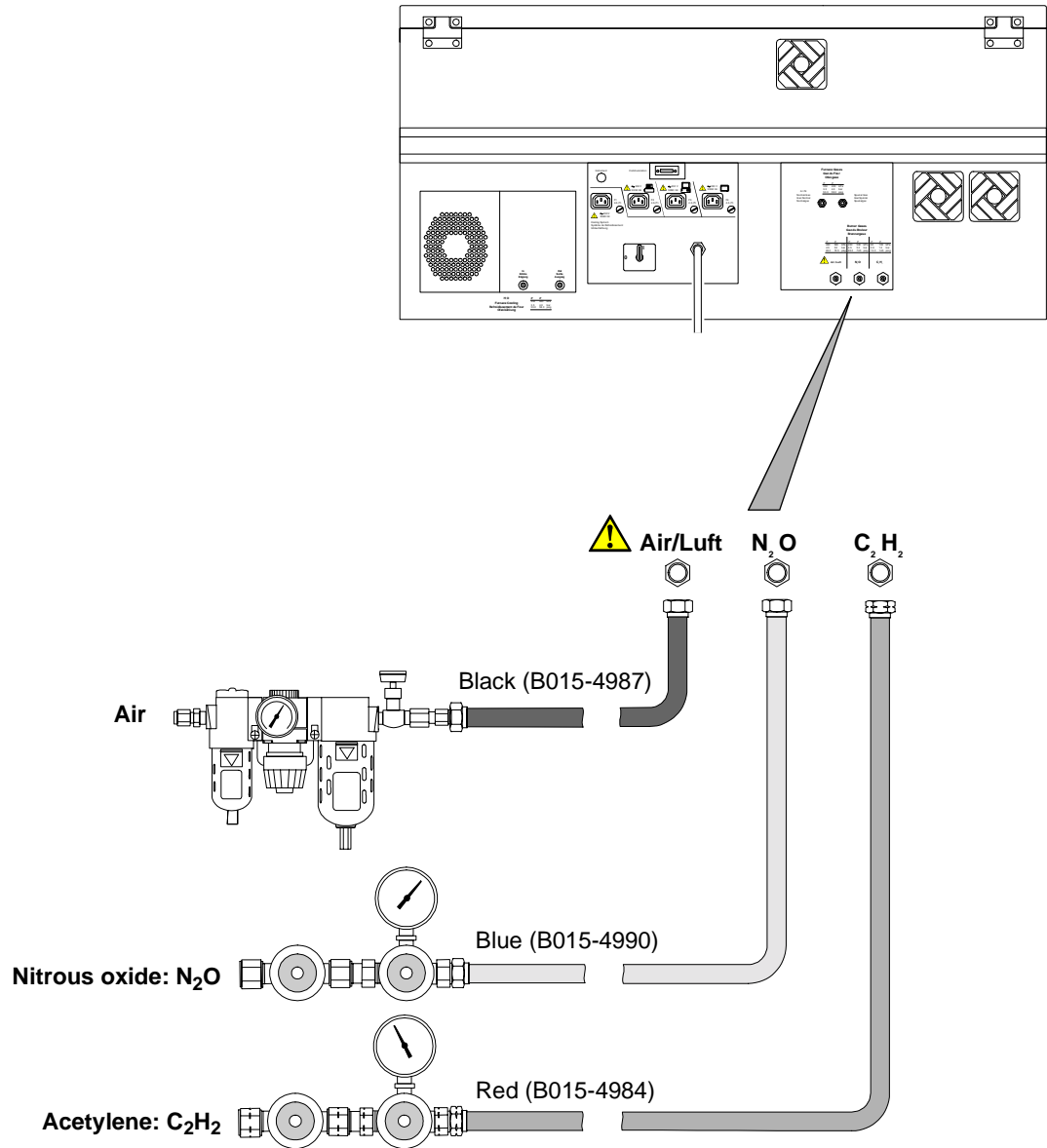


Figure 3-1. Connecting the Burner Gases

## Connecting the furnace gases

The connectors for the furnace gases are located on the rear panel of the spectrometer.

**Note:** *The furnace will operate correctly only if there is gas pressure at both the Normal Gas and Special Gas inlets. If you are using only an inert gas you must connect the gas to both inlets using the Y-connector.*

### **What you need to provide:**

- A suitable supply of argon (or nitrogen) and if necessary a suitable supply of a special gas. The gases must conform with the requirements listed in *Laboratory Requirements*.
- Suitable pressure regulators and on/off valves near to the spectrometer for the inert and special gas supplies.
- A tube cutter for the special gas tube. This is an optional accessory; Part No. 0992-3183.

The gas supply systems must comply with your local safety regulations. Refer also to the information given under '*Safety Information*'.

### **What is provided with the spectrometer:**

- About 10 m of special gas tube, B050-8264.
- A Y-connector with automatic push-fit connectors, 0992-0179.
- Two screw connectors, R 1/4" for the gas regulator. These are not supplied with all instrument versions.

**To connect argon (or nitrogen) only**

Refer to Figure 3-2 on the following page.

1. Make sure that the argon (or nitrogen) supply is turned off.
2. Use the special tube cutter to cut two, 10 cm lengths of tube from the special gas tube. The ends of the tubes must be cut squarely.
3. Connect the long gas tube to the argon (or nitrogen) pressure regulator. Use the R ¼" screw connector provided or use a connector or adapter suitable for the gas regulator. Make sure that all the connections are secure.
4. Pass the gas tube to the rear of the spectrometer. Make sure that it cannot be damaged or strained.
5. Push the two short tubes and the long tube into the connectors on the Y-connector as shown on the following page.
6. Push the free ends of the two short gas tubes into the **Normal Gas** and **Special Gas** connectors on the manifold as shown.  
Push the tubes into the connectors until the tubes butt up to the end of the connector.

**Note:** *To disconnect the gas tube from a connector:  
Carefully push the black locking ring of the connector into the connector and pull the tube out of the connector.*



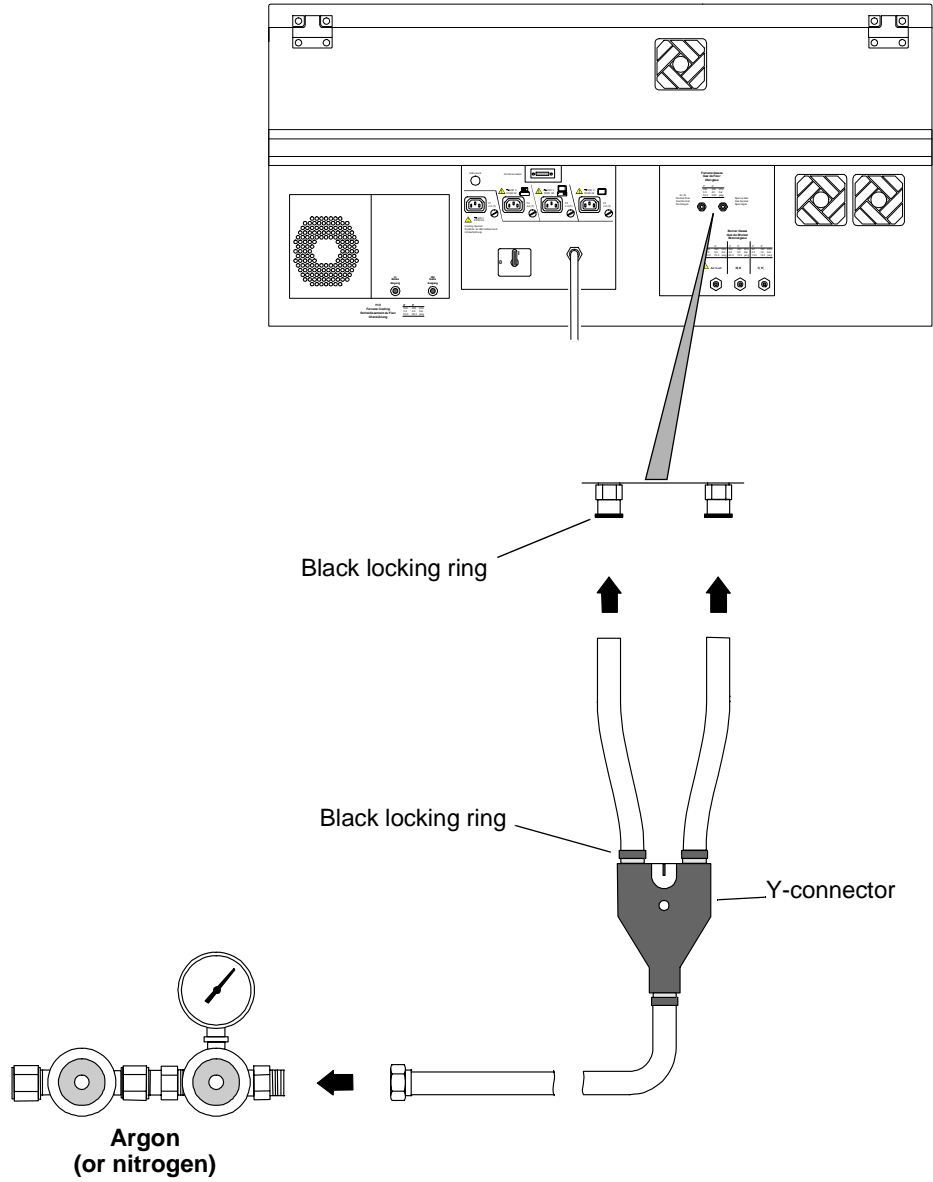


Figure 3-2. Connecting Argon (or Nitrogen) only

**To connect both argon and a special gas**

Refer to Figure 3-3 on the following page.

1. Make sure that the gas supplies are turned off.
2. Use the special tube cutter to cut the special gas tube into two pieces for the two gas supplies. The ends of the tubes must be cut squarely.
3. Connect the gas tubes to the argon (or nitrogen) and special gas pressure regulators. Use the R ¼" screw connectors provided or use a connector or adapter suitable for the gas regulator. Make sure that all the connections are secure.
4. Pass the gas tubes to the rear of the spectrometer. Make sure that they cannot be damaged or strained.
5. Push the free ends of the gas supply tubes into the **Normal Gas** and **Special Gas** connectors on the manifold as shown.  
Push the tubes into the connectors until the tubes butt up to the end of the connector.

**Note:** To disconnect the gas tube from a connector:

*Carefully push the black locking ring of the connector into the connector and pull the tube out of the connector.*

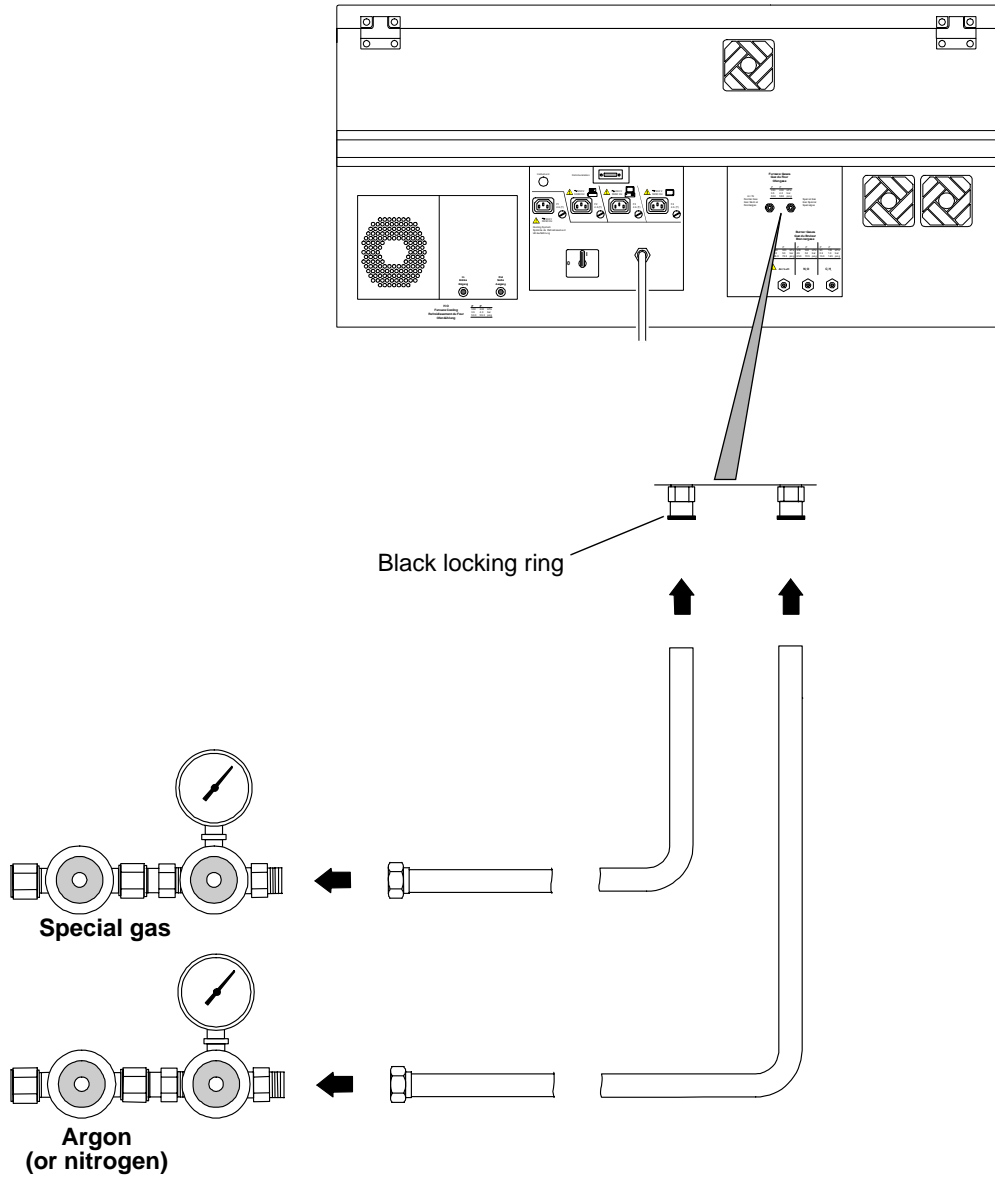


Figure 3-3. Connecting Argon (or Nitrogen) and a Special Gas

### **Connecting the drain system to the burner**

Procedures for connecting the drain system to the burner are described in '*Maintaining the drain system*' in the '*Burner System User's Guide*'.

### **Installing the furnace autosampler**

Procedures for demounting and reinstalling the furnace autosampler are described in '*Installing the furnace autosampler*' in the '*Graphite Furnace User's Guide*'.

## Installing the cooling system

A recirculating cooling system is provided with the spectrometer system. This system includes a pressure-sensitive safety switch that switches off the pump if the internal pressure in the circulatory system increases to above a safe value (see 'Cooling the furnace' in the 'Graphite Furnace User's Guide').

---

**Caution: Risk of damage to the instrument from high water pressure**

High water pressure may cause the coolant tubes on the furnace to burst. The cooling system includes a pressure-sensitive safety switch that switches off the pump if the pressure becomes too high for any reason. The pressure in the main laboratory water supply may be too high for safety.

- Never connect the spectrometer system directly to the main laboratory water supply. Always use the cooling system.
- 

## Connecting and disconnecting the water hoses

The inlet and outlet hoses are permanently attached to the cooling system. They have automatic connectors which are marked with the direction of the water flow.

1. Place the cooling system in a convenient position **on the floor** underneath the spectrometer. Do not place the cooling system on the same bench as the spectrometer since vibrations can adversely influence the spectrometer.

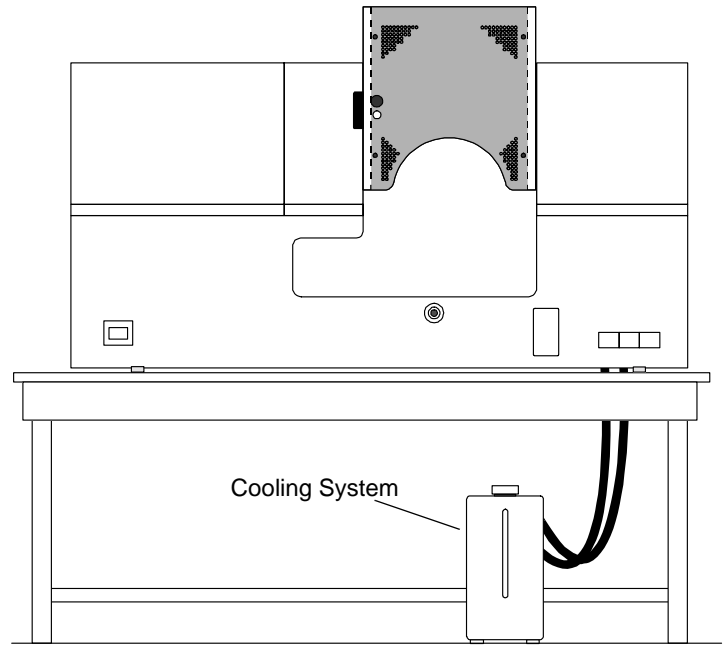
Make sure that:

- You can reach the on/off switch at the rear.
  - There is space at the rear and sides of the cooling system for air to circulate freely.
  - There is space to remove the stopper and fill the system.
  - You can see the water level indicator.
2. Pass the two hoses from the cooling system to the rear of the spectrometer. Make sure they are not strained.
  3. Push the hose connectors onto the correct fittings on the spectrometer as shown opposite.  
The connectors are spring loaded. Push them straight onto the fittings until they click into place.

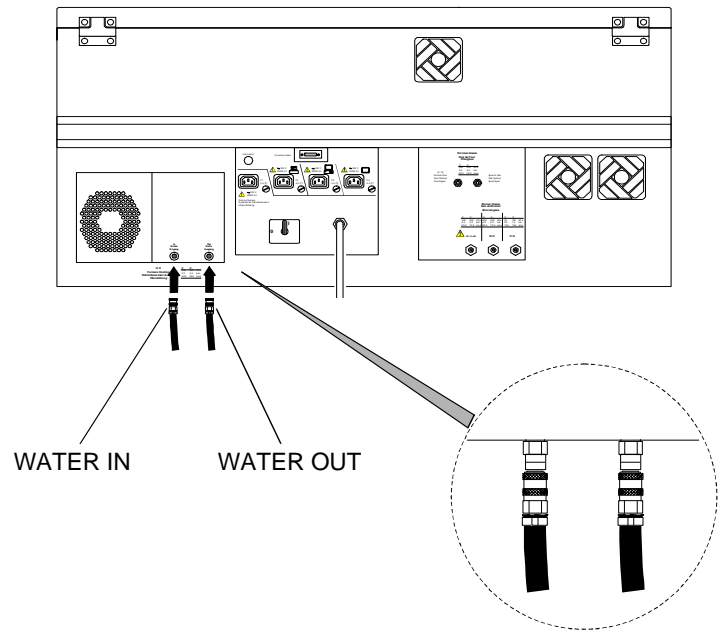
**Note:** To disconnect the water hoses:

Carefully pull the knurled locking ring down slightly, to release the lock, and pull the connector off the fitting on the spectrometer.

Locating the cooling system



Connecting the hoses

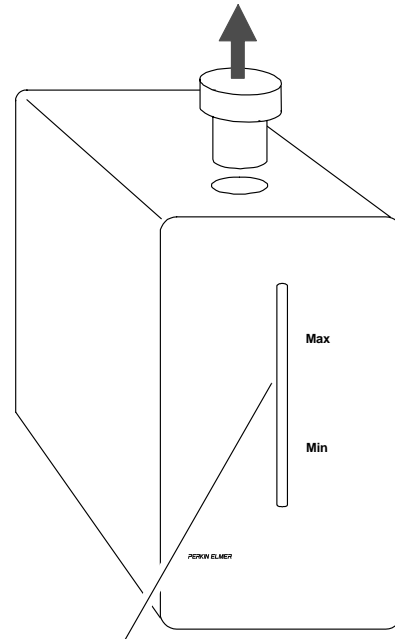


### Filling the cooling system

The cooling system is self-priming; air in the system is removed automatically as the cooling system operates. The coolant is a 1:10 solution of glycerine in water (1 part glycerine plus 9 parts water).

**Note:** The cooling system contains 0.5 L glycerine when it leaves the factory. (See 'Cooling system maintenance procedures' in the 'Graphite Furnace User's Guide' for the procedure to follow when you empty and refill the cooling system. Do not use antifreeze.)

1. Remove the stopper from the top of the cooling system – twist and pull.
2. Fill the system to the **Max** mark with deionized water or sediment free drinking water – about 4.5 L.
3. Replace the stopper securely.



Water level indicator

## Electrical connections



**Warning: Electrical Hazard**

W2.3

- To prevent potential injury to yourself and damage to the instrument, switch OFF all instruments in the system and disconnect them from the line power supply before you perform the procedures described below.

**Read the following instructions very carefully before connecting any cables.**

See 'Laboratory Requirements' for the specification of the line power supply.

### Summary

1. Make sure that the spectrometer and the cooling system are switched off.
2. Switch the circuit breaker on the rear panel of the spectrometer to the off position (marked ○).
3. Switch off the computer and all other instruments that you will connect to the spectrometer or computer. See the guides for the individual instruments for the procedure to use.
4. Disconnect the line power cords of the spectrometer and all other instruments from the line power supply.
5. Connect the instrument control cables and power cords as shown on the following page.
6. When you have completed all connections, switch on the system (*see 'Switching on the system', page 4-3*).



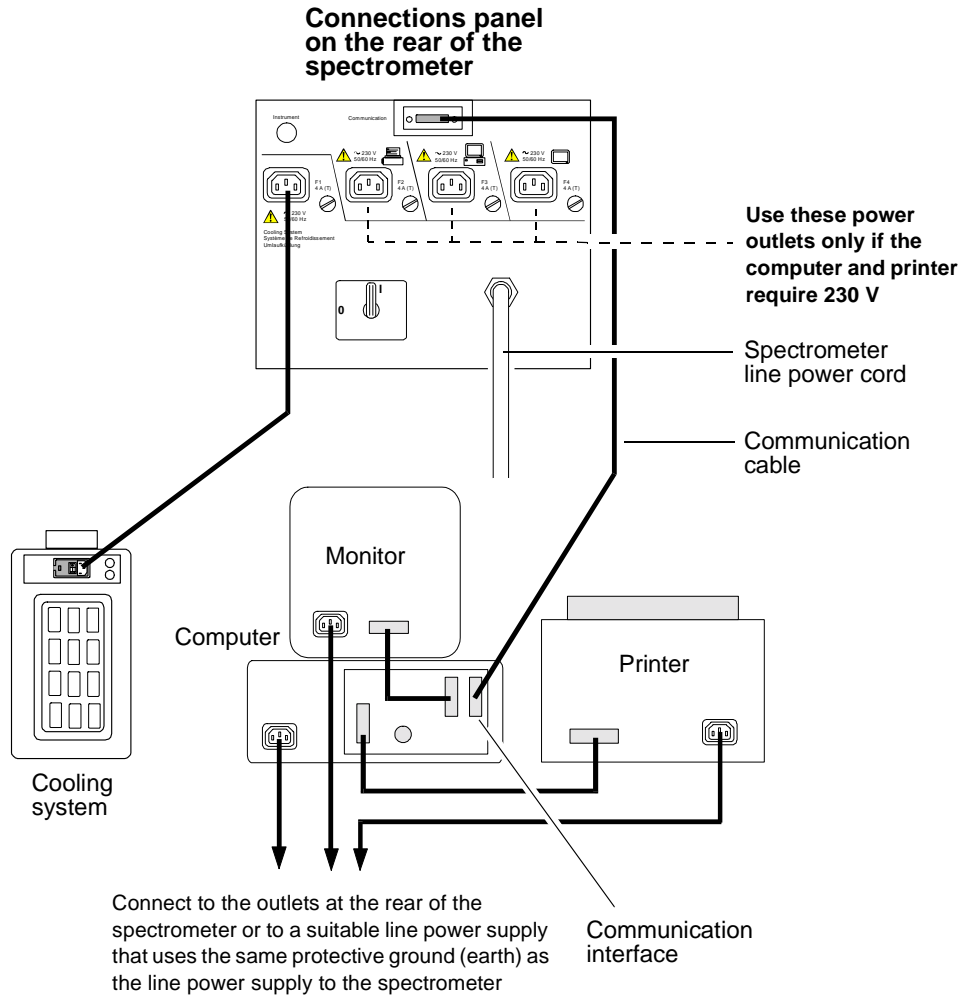


Figure 3-4. Electrical Connections



# Preparing the System for Analyses

---

# 4

<b>Contents</b>	<b>page</b>
Switching on the system .....	4-3
Installing lamps .....	4-7
Installing sample trays .....	4-11
Shutting down the system .....	4-12
Emergency shutdown .....	4-14



## Switching on the system

1. Read the safety information at the front of this guide before you operate the system.
2. Make sure that the spectrometer system and other ancillary instruments are correctly installed and connected to their power supplies.  
Make sure that the coolant hoses are connected correctly to the spectrometer. Where applicable, make sure that the cooling system is filled to the **Max** mark (see 'Filling the cooling system', page 3-17).
3. Switch on the fume ventilation system for the work area.
4. Turn on the burner gases and adjust the outlet gauge pressures to the recommended values (see Table 4-1 on page 4-5).
5. Turn on the inert (and special) gas for the furnace and adjust the outlet gauge pressures to the recommended values (see Table 4-2 on page 4-6).

**Note:** You must always turn on the air supply since air pressure is required for the internal pneumatic system. If you intend to work with only one atomizer, you only need to additionally turn on the gas supplies for that atomizer.

6. Turn on the cooling water to the system:  
Switch on the circulatory cooling system by pressing the power switch located on the rear panel.  
*You can leave this switch permanently in the on position since power is supplied by the spectrometer.*
7. Switch the circuit breaker on the rear panel of the spectrometer to the on position (marked I).  
*You can leave this switch permanently in the on position during routine operation; you switch the spectrometer system on and off via the operational on/off switch located on the front panel.*
8. Switch on the computer.  
If your computer has a power management system, switch this off.
9. Install a Lumina hollow cathode lamp in any holder in the lamp compartment (procedure: page 4-7).  
*A hollow cathode lamp must be installed in at least one holder before you switch on the spectrometer.*
10. Switch on the spectrometer system with the operational on/off switch located on the front panel.

11. If you need the diluter, autosampler, or flow injection system, switch on the respective systems.
12. If you have changed the configuration of the system, such as installed a different autosampler or added or removed any accessories, use the **Reconfigure** utility to reconfigure the software (*see the Online Help in AA WinLab*).
13. Start AA WinLab: In the AA WinLab group, double click on the AA WinLab icon.
14. Set up the various parts of the system:
  1. Install any further lamps that you require for the analyses (*procedure: page 4-7*).
  2. Set up the burner system (*see 'Setting up the system for analyses using the flame technique' in the 'Burner System User's Guide'*).
  3. Set up the graphite furnace system (*see 'Setting up the system for analyses using the furnace technique' in the 'Graphite Furnace User's Guide'*).

Procedures for shutting down the system are described on page 4-12.

In an emergency, you can shut down the system as described on page 4-14.

Table 4-1. Required Pressures for the Burner Gases

Gas	Outlet Gauge Pressure					
	kPa		bar		psig	
	$P_{min}$	$P_{max}$	$P_{min}$	$P_{max}$	$P_{min}$	$P_{max}$
Acetylene (C <sub>2</sub> H <sub>2</sub> )	90	100	0.9	1.0	13.0	14.5
Air	450	500	4.5	5.0	65.0	72.5
Nitrous oxide (N <sub>2</sub> O)	450	500	4.5	5.0	65.0	72.5

- Set the outlet gauge pressure for each gas to a value just below the maximum value ( $P_{max}$ ).
- Always set the same outlet gauge pressure for air and nitrous oxide.
- **Never** set the outlet gauge pressure to a value exceeding the maximum pressure ( $P_{max}$ ).
- Always turn on the air supply since air pressure is required for the spectrometer's pneumatic system.



**Warning: Acetylene – Explosion Hazard**

W5.7

Acetylene can decompose explosively at pressures higher than 103 kPa/ 1.03 bar/15 psig.

- Always make sure that the acetylene outlet gauge pressure is below this value.

Table 4-2. Required Pressures for the Furnace Gases

Gas	Outlet Gauge Pressure					
	kPa		bar		psig	
	$P_{\min}$	$P_{\max}$	$P_{\min}$	$P_{\max}$	$P_{\min}$	$P_{\max}$
Argon	350	400	3.5	4.0	50.0	58.0
Nitrogen	350	400	3.5	4.0	50.0	58.0
Special	350	400	3.5	4.0	50.0	58.0

- Set the outlet gauge pressure for each gas to a value just below the maximum value ( $P_{\max}$ ).
- **Never** set the outlet gauge pressure to a value exceeding the maximum pressure ( $P_{\max}$ ).



**Warning: Toxic Gases**

W6.1

If you use nitrogen as the inert gas, toxic cyanogen gas (CN)<sub>2</sub> will be produced when the furnace temperature is above 2300 °C.

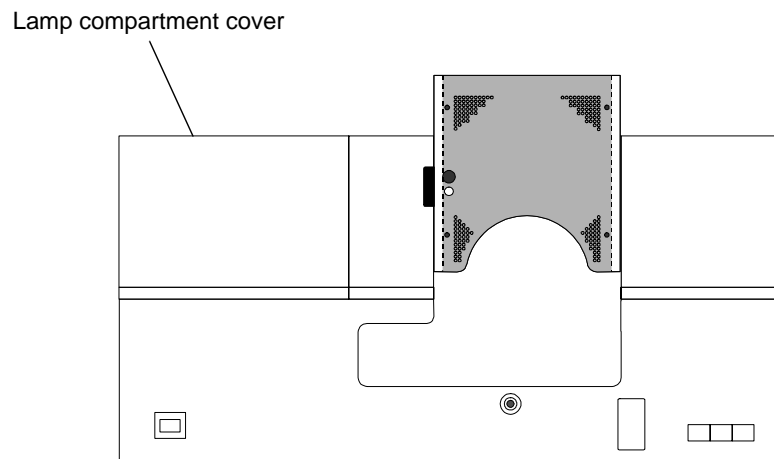
- Make sure that the main laboratory fume ventilation system removes all gases and fumes emitted by the furnace.



## Installing lamps

### Lamp compartment

The lamp compartment is located on the left-hand side of the spectrometer, beneath a hinged cover. The compartment is easily accessible from the front when the cover is open.



The spectrometer is designed to operate with Perkin Elmer Lumina hollow cathode lamps (HCLs) and coded electrodeless discharge lamps (EDLs).

The lamp compartment has holders for up to eight lamps.

You can install Lumina HCLs in all eight holders. The holders incorporate the receptacles for connection of the Lumina lamps.

You can install EDLs in holders 1–4 only. The sockets for the power supplies to the EDLs are located on the left-hand side of the lamp compartment.

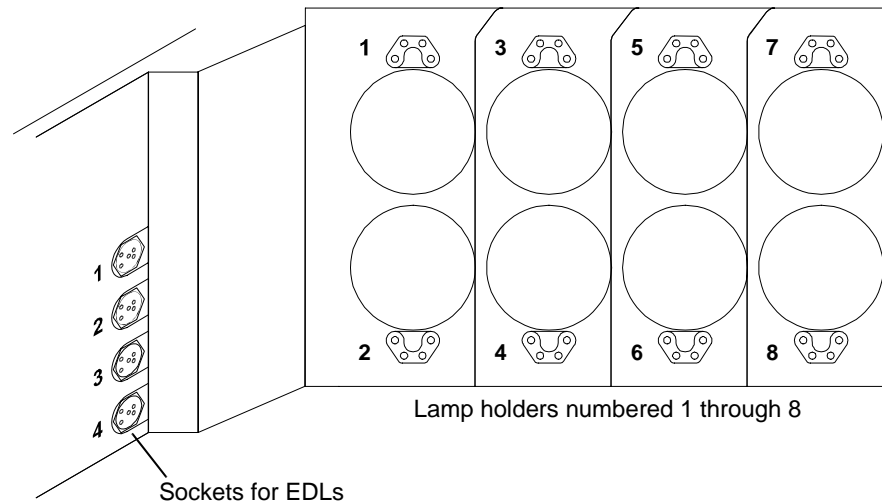


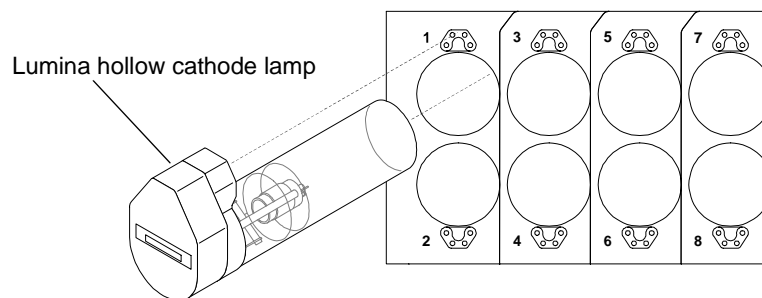
Figure 4-1. Lamp Holders in the Lamp Compartment

### Installing and connecting lamps

#### HCLs

**Note:** A hollow cathode lamp must be installed in at least one holder before you switch on the spectrometer.

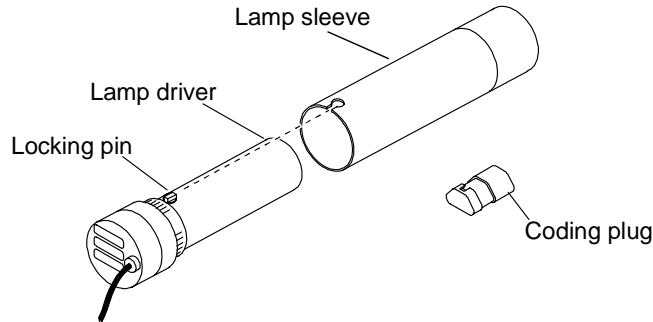
1. Open the lamp compartment cover by lifting it at the front and swinging it back.
2. Slide the Lumina lamp for the required element into the selected lamp holder and make sure that the integrated socket slides fully home over the receptacle on the lamp holder.
3. Close the lamp compartment cover.



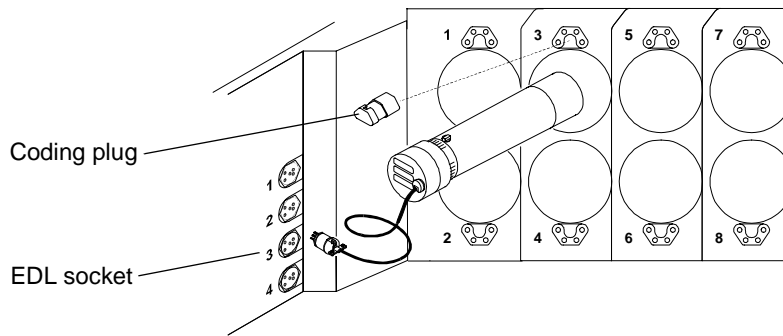
**EDLs**

You must use the lamp holders numbered 1 through 4 for EDLs.

1. Open the lamp compartment cover by lifting it at the front and swinging it back.
2. If necessary, assemble the lamp by sliding the lamp driver into the lamp sleeve for the required element. Depress the locking pin as the sleeve slides into place and make sure that the locking pin extends through the locating hole in the sleeve.



3. Slide the lamp carefully into the selected lamp holder until it butts up against the end-stop inside the holder.
4. Insert the coding plug over the receptacle on the lamp holder.
5. Insert the lamp connector into the correct EDL socket at the left-hand side of the lamp compartment. Use the receptacle that has the same number as the lamp holder.
6. Close the lamp compartment cover.



### **Removing lamps**

Do not unplug and remove lamps while they are switched on.

1. On the **Toolbar**, click on **Lamps**. The Align Lamps window appears.
2. Make sure that the lamps you want to remove are switched off:  
The **On** buttons must *not* be green. If necessary, click on the respective **On** buttons.
3. Close the Align Lamps window.
4. Unplug and remove the lamps. For EDLs, remove the coding plugs as well.

### **Tips for installing lamps**

- Use only Perkin Elmer lamps. You can use both hollow cathode and electrodeless discharge lamps.
- Do not touch the front window of the lamp; perspiration or other contamination can reduce the intensity of the radiation.
- If you install more than one lamp containing a particular element, for example, a single-element copper lamp and a multi-element lamp containing copper, the system will use the lamp in the holder with the lower number when you perform determinations of that element. Make sure that you place the preferred lamp in the holder with the lower number.
- With EDLs, connect each lamp plug to the socket that has the same number as the holder of the lamp.
- With EDLs, make sure that you use the correct coding plug and connect it to the receptacle on the lamp holder containing the EDL.
- If you use the wrong coding plug or connect the coding plug to the wrong receptacle, you will cause the spectrometer to malfunction and may cause irreparable damage to the lamp.

## **Installing sample trays**

A sample tray can be inserted into one of three locations in front of the spectrometer – on the left-hand side, in front of the atomizer compartment, and on the right-hand side. You can leave a tray permanently installed on the left-hand side if you wish. You cannot install a tray in front of the atomizer compartment or on the right-hand side as long as the furnace autosampler is installed. When the autosampler is swivelled to the standby position at the right, you can install a tray in front of the atomizer compartment.

The sample trays are robust and can support an accessory, such as a diluter, or a flame autosampler, or a flow injection system.

### ***To install the tray***

1. Hold the tray with both hands and position it in front of the location into which you wish to insert it.
2. Insert the tray support posts into the guides at the base of the instrument and slide in the tray until it hits the stop. Then gently lift the front of the tray and slide it finally into place. You can feel it lock into place.

### ***To remove the tray***

1. Gently lift the tray at the front and then pull it back to slide it out of the guides.

## Shutting down the system

**Note:** In an emergency, switch off the spectrometer using the operational on/off switch on the front panel.

The flame is automatically extinguished and the gases shut down in a safe sequence.

See page 4-14 for the procedure to follow after an emergency shutdown.

You must shut down each atomizer correctly before you shut down the spectrometer.

### To shut down the flame system

1. With the flame still burning, aspirate the correct rinsing solutions to rinse the burner system (see 'Extinguishing the flame' in the 'Burner System User's Guide' for detailed information).  
Either aspirate the solutions manually or use the flame autosampler.
2. Extinguish the flame and bleed the gas lines:
  1. In the **Flame Control** window, click on the **Flame** icon.  
The system uses a predetermined shutdown sequence to extinguish the flame safely.
  2. Shut down the gases to the spectrometer at source.
  3. In the **Flame Control** window, click on **Bleed Gases** to depressurize the gas lines.

### To shut down the furnace system

1. Flush the furnace autosampler rinsing system (see 'Autosampler maintenance procedures' in the 'Graphite Furnace User's Guide' for detailed information).
2. Shut down the furnace gases to the spectrometer at source.

### To shut down the spectrometer

1. Exit AA WinLab:  
In the **File** menu, click on **Exit**.
2. Switch off the spectrometer at the operational on/off switch on the front panel.
3. Switch off any accessories.

4. If you do not want to use the computer for other tasks, shut down the computer and printer as described in their user's guides.
5. Empty the burner drain vessel (see 'Emptying the drain vessel' in the 'Burner System User's Guide').
6. Empty the furnace autosampler waste bottle.

**Note:** *Dispose of hazardous or corrosive solutions properly and refer to your local safety regulations for proper disposal procedures.*

## **Emergency shutdown**

If a situation arises where you have to shut down the system quickly and you do not have time to carry out the correct procedure, you can use the procedure described below.

*Note: This procedure is for use in an emergency only. Do not use it as a routine shutdown procedure.*

1. Switch off the spectrometer at the operational on/off switch on the front panel.
2. Shut down the gases to the spectrometer at source.

When you return to the spectrometer, proceed as follows to shut down the system properly.

3. If you were previously running concentrated salt solutions, organic solvents, or solutions containing cyanide, copper, silver, or mercury:
  1. Remove the burner head (*see the 'Burner System User's Guide'*).
  2. Pour a large quantity of deionized water slowly through the neck of the spray chamber to thoroughly flush the chamber and the drain system.
4. Check the burner head.  
If there are deposits along the slot, clean the burner head (*see the 'Burner System User's Guide'*).
5. Reinstall the burner head.
6. Switch on and set up the spectrometer system.
7. Ignite the flame.
8. Extinguish the flame properly.



# ***Spectrometer: System Maintenance***

---

# **5**

<b><i>Contents</i></b>	<b><i>page</i></b>
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## Perkin Elmer Service

**Warning: Unauthorized Adjustments and Servicing**

W1.2

Only a Perkin Elmer service engineer or similarly trained and authorized person should be permitted to service the instrument.

- Do not attempt to make adjustments, replacements, repairs, or modifications to this instrument except as described in the documentation supplied with the instrument.

**If the spectrometer system does not function correctly...**

- Switch off the spectrometer system and make sure that it cannot be operated.
- Contact your local Perkin Elmer office.

You should only perform the maintenance procedures described in this guide. For any other maintenance or service contact your local Perkin Elmer office to arrange for a service engineer to visit.

In particular you should only allow a Perkin Elmer service engineer or similarly trained and authorized person to perform any work on:

- electrical components inside the instrument;
- the gas connections and gas system pneumatics;
- the monochromator and all other optical system components.

**Before the service engineer arrives:**

1. Make sure that the instrument and work area are clean.
2. Empty corrosive solutions from the burner drain vessel.  
Then add water to the drain trap to activate the function.
3. Empty the furnace autosampler waste bottle.

## Troubleshooting

See the *Troubleshooting Guide* supplied with the AA WinLab software. This guide includes information on problems that can arise with both the software and the spectrometer system.

## Maintenance checklist

<b>General preventative maintenance procedures</b>	
Instrument and work area	For safety reasons, and to avoid contaminating new samples, you should make sure that the instrument and the work area are always absolutely clean. This is especially important when you are working with toxic substances and when you are measuring trace amounts of any elements. Wipe up spills immediately before they can cause further contamination or damage. Before you leave the instrument standing idle for any period of time, make sure that all the components are clean.
Fume ventilation	Make sure that the main fume ventilation system functions correctly. Always switch it on when you are using the instrument.
Environmental conditions	Make sure that the environmental conditions are as described in ' <i>Laboratory Requirements</i> '.

<b>Spectrometer, maintenance checklist</b>	
External surfaces	Wipe over the surfaces with a lint-free cloth moistened with a dilute solution of laboratory detergent. The surfaces are resistant to dilute acids and alkalis, and to a lesser extent to strong acids and alkalis and organic solvents.
Air filters	Fit new filters yearly or more often in a dusty environment ( <i>procedure: page 5-9</i> ).
Atomizer compartment windows, lamp end windows	These windows do not normally require cleaning but if they become marked, e.g., with fingerprints, you can clean them ( <i>procedure: page 5-5</i> ).

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## Spectrometer maintenance procedures

### **Procedures described**

- Cleaning the windows.
- Changing the air filter.
- Resetting the circuit breaker and changing the fuses.
- Replacing the deuterium lamp.

### **Cleaning the windows of the optical system**

---

#### **Caution: Risk of damage to optical components**

*Never touch or clean the surfaces of the grating or mirrors.*

*If mirror surfaces are scratched they must be resurfaced.*

*Do not allow cleaning fluids to come into contact with any of the reflecting surfaces.*

---

Most of the optical components are under the main cover of the spectrometer and are protected by the black optics covers.

Usually these components require no maintenance, provided the laboratory fume ventilation system is working correctly and the environmental conditions are as described in '*Laboratory Requirements*'.

The only optical parts that are exposed are:

- The atomizer compartment windows.
- The windows of the lamps.
- The furnace windows. Cleaning the furnace windows is described under *System Maintenance* in the *Graphite Furnace User's Guide*.

These windows are important parts of the whole optical system. Handle them carefully, as you would any sensitive optical component. Do not directly touch the windows.

If mirror surfaces need cleaning, this must be done by a Perkin Elmer service engineer or a similarly authorized and trained person who knows the special techniques required.

**To clean the windows:**

This must be done only by a skilled person who knows the special techniques required.

*Note: The more you rub the surface of the windows, the more chance there is of scratching them. You must change scratched windows.*

1. Blow dust off optical surfaces with clean dry air before you attempt to clean them. Do not rub the surfaces.
2. Clean the window surfaces with a soft lint-free cloth moistened with spectroscopic grade alcohol. The window must dry quickly to avoid leaving drying marks.

**Keep the cleaning solutions and water away from other parts of the instrument.**

## Maintaining the electrical components

**Warning: Electrical Hazard**

W2.3

- To prevent potential injury to yourself and damage to the instrument, switch OFF all instruments in the system and disconnect them from the line power supply before you perform the procedures described below.

### Parts that may be serviced by the user

The only parts that you should attempt to maintain are those described below. The electronic components in the instrument do not contain any parts which you can maintain yourself. If there is a problem, contact your local Perkin Elmer office.

If any fuses blow frequently or if the automatic circuit breaker switch is activated frequently, contact your local Perkin Elmer office for advice.

### Resetting the automatic circuit breaker

The spectrometer has an automatic circuit breaker which prevents the system from drawing too much current.

When the circuit breaker is activated, the switch flips to the off position (marked O). This can happen while an analysis is running.

1. To reset the switch, wait a few seconds then put the switch to the on position (marked I).

If this switch is activated frequently, contact your local Perkin Elmer office for advice.

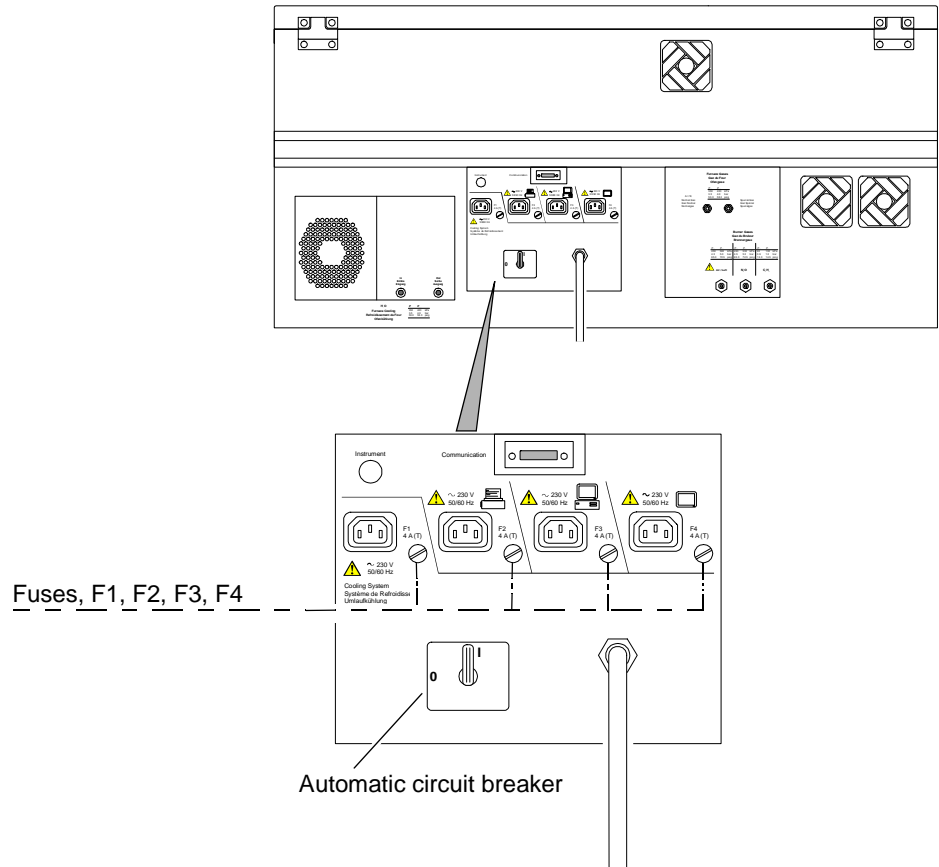
### Changing the fuses

**Warning: Electrical Hazard**

W2.9

- Use only fuses with the correct current rating and of the specified type for replacement.
- Do not use makeshift fuses and do not short-circuit the fuse holders.

1. Switch off the spectrometer and all other instruments in the system as described in the relevant guides.
2. Switch the circuit breaker on the rear panel of the spectrometer to the off position (marked O).



3. Disconnect the spectrometer's line power cord from the line power supply.
4. Disconnect all the line power cords from the sockets at the rear of the spectrometer.
5. To change the fuses numbered F1, F2, F3, F4:
  1. Insert the tip of a suitable screwdriver in the slit of the fuse holder and unscrew the fuse holder.
  2. Remove the blown fuse, then insert a new one of the correct type and rating. The correct rating is shown on the label of the fuse on the rear panel of the spectrometer.
  3. Screw the fuse holder into the correct socket.
6. Reconnect the line power cords correctly.

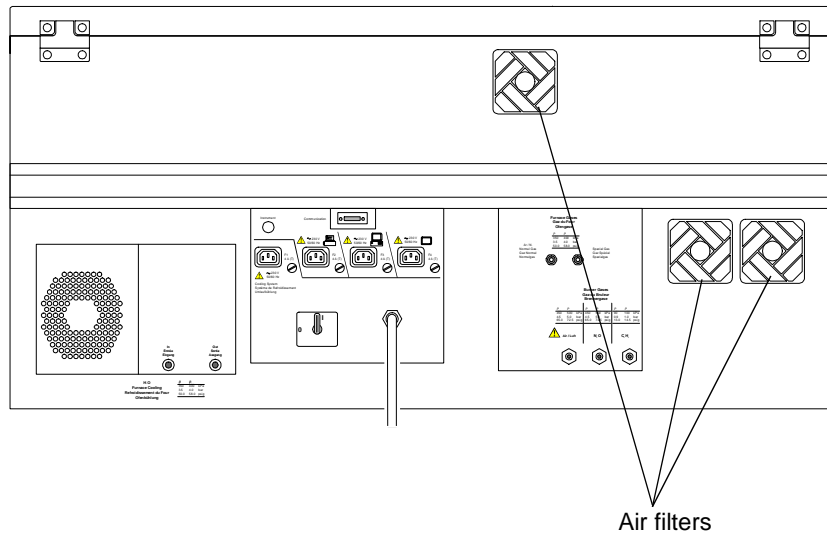


## Changing the air filters

To make sure that the electrical components in the spectrometer are properly cooled, the air filters must allow sufficient air into the instrument. Check the filters regularly and change them if they are dirty.

You should not need to change the filters more than once every year if the environmental conditions are as described under '*Laboratory Requirements*'. Replacement filters are available; see '*Parts and Supplies*' for the part number.

1. Carefully pull off the snap-on plastic grid that holds the air filter in place.
2. Replace the filter and push the grid back into place.



## Replacing the deuterium lamp

The deuterium lamp for the background corrector has a limited lifetime. After a prolonged period of operation the lamp will exhibit decreasing radiant intensity and will ultimately fail.

The lifetime of the deuterium lamp will be prolonged if you do not switch it on and off frequently.

You can replace the deuterium lamp assembly yourself. The replacement lamp is fitted in a prealigned mount.

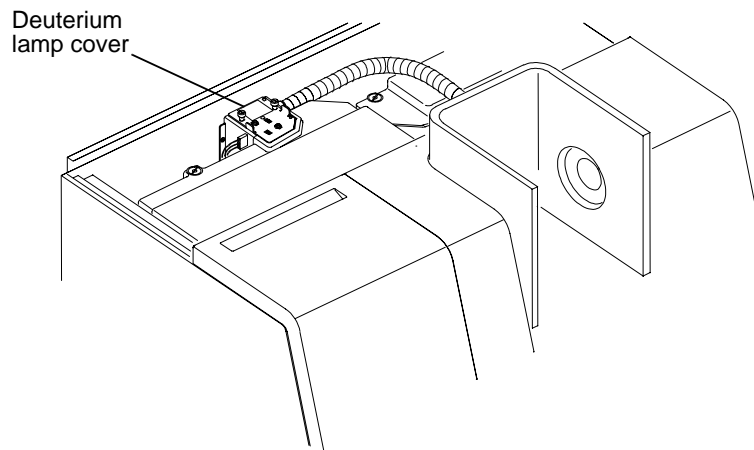


Figure 5-1. Location of Deuterium Lamp inside the Spectrometer



**Warning: Electrical Hazard**

W2.3

- To prevent potential injury to yourself and damage to the instrument, switch OFF all instruments in the system and disconnect them from the line power supply before you perform the procedures described below.

1. Switch off the spectrometer at the operational on/off switch on the front panel.
2. Switch the circuit breaker on the rear panel of the spectrometer to the off position (marked O).
3. Disconnect the spectrometer from the line power supply.

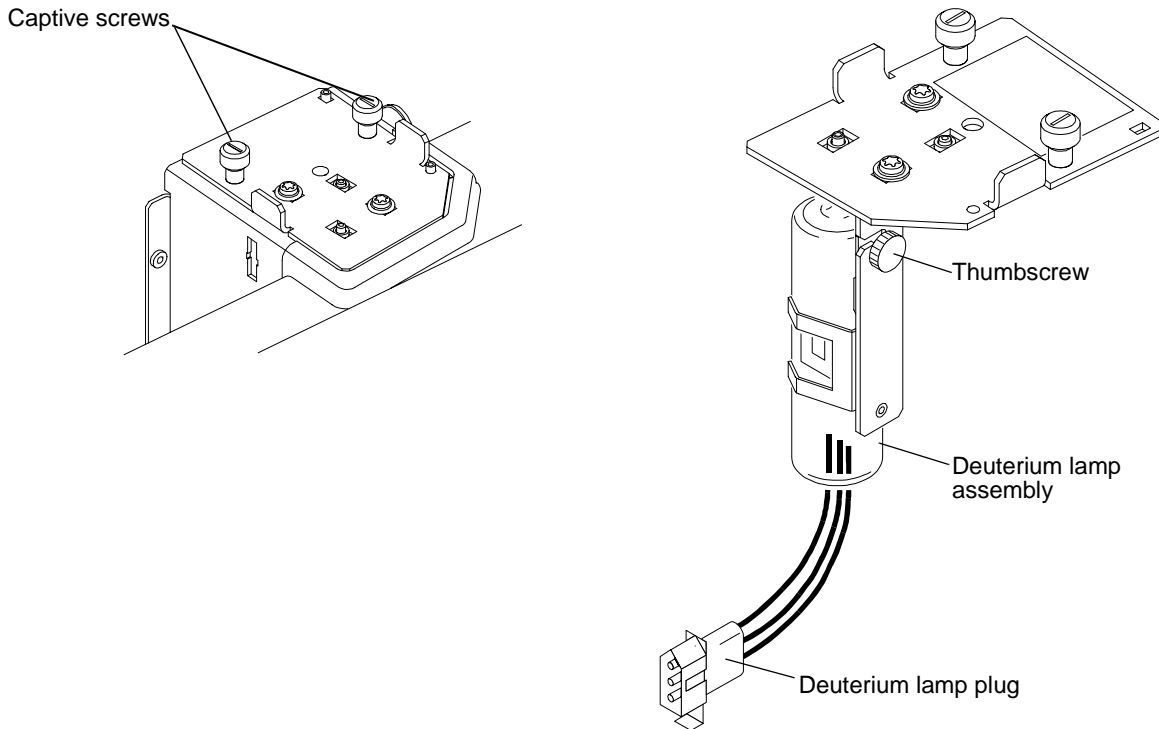


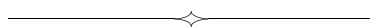
Figure 5-2. Deuterium Lamp Cover and Bracket Assembly

4. Open the top cover of the spectrometer:
  1. Remove the two securing screws; one on the left and one on the right.
  2. Swing back the cover to the open position.
5. Remove the deuterium lamp assembly:
  1. Undo the two captive screws on the deuterium lamp cover.
  2. Carefully lift up the deuterium lamp cover.  
The deuterium lamp assembly is attached to a bracket underneath the cover.
  3. Carefully place the complete assembly on top of the black optics cover.
  4. Pull out the deuterium lamp plug from the socket in the lamp compartment.  
**Do not pull on the deuterium lamp leads.**
6. Slacken the thumbscrew on the bracket and remove the old lamp assembly.  
Save the thumbscrew for use with the new lamp assembly.

7. Unpack the new lamp assembly, taking care to hold it only by the metal mount to prevent fingermarks on the lamp envelope.
8. Slip the slot at the base of the lamp mount over the stud on the lamp bracket and secure the lamp assembly with the thumbscrew saved in step 6.
9. Wipe the lamp envelope with a soft cloth moistened with alcohol to remove dirt, since this would otherwise be burned in when the lamp is hot.
10. Insert the deuterium lamp plug into the socket in the lamp compartment. The plug is asymmetric and can only be inserted in one direction.
11. Reinstall the lamp assembly:
  1. Carefully lower the deuterium lamp assembly into the lamp compartment until the lamp cover fits in place.
  2. Screw in the two captive screws on the lamp cover.
12. Close the top cover:
  1. Swing down the cover to the closed position.
  2. Screw in the two securing screws; one on the left and one on the right.

Since the deuterium lamp is fitted with a prealigned mount, you do not normally need to align the lamp.

**Note:** Do not attempt to make adjustments to the lamp bracket assembly. If there is indication that the alignment is not correct (e.g., low energy for the BG bar graph in the Align Lamps or Continuous Graphics windows), please contact your Perkin Elmer office.



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**Parts provided**

Perkin Elmer reserves the right to alter the schedule of parts provided without prior notice.

<b>Qty.</b>	<b>Item</b>	<b>Part No.</b>
1	AAAnalyst 800 atomic absorption spectrometer. . . . .	B312-0081
1	Read cable. . . . .	B312-1302
3	Special line cords . . . . .	B310-0003
1 pack	Replacement air filters . . . . .	B050-2706
4	Plugs, for handle screw holes . . . . .	B015-3803
1 pack	Replacement fuses . . . . .	B312-1303
1	AS-800 furnace autosampler . . . . .	B300-1500
1	Swing-arm mount for autosampler. . . . .	B312-0923
	<i>Further parts provided with the furnace autosampler are listed under 'Parts and Supplies' in the 'Graphite Furnace User's Guide'.</i>	
1	Cooling system . . . . .	B019-8072
1	Fuel hose assembly (red) . . . . .	B015-4984
1	Air hose assembly (black) . . . . .	B015-4987
1	Nitrous oxide hose assembly (blue) . . . . .	B015-4990
10 m	Special gas tube (FLEXO) . . . . .	B050-8264
1	Y-connector. . . . .	0992-0179
1	Drain vessel . . . . .	B312-1306
1	Sample tube . . . . .	B015-6272
5	Corkpreen gaskets for burner end cap . . . . .	0047-2014
1	O-ring for burner end cap . . . . .	B015-8690
1	O-ring for the spray chamber . . . . .	B004-7207
1	Burner head cleaning tool. . . . .	0303-1573
1 pack	Graphite tubes. . . . .	B300-0409
1 set	Graphite contacts . . . . .	B300-0410

<b>Qty.</b>	<b>Item</b>	<b>Part No.</b>
1 pack	Cleaning swabs . . . . .	B050-5368
1	Grips for graphite tube . . . . .	0990-7925
1 set	Tools, for changing contacts and furnace windows . . .	B019-3347
1	Instrument mirror . . . . .	B085-1900
1	Replacement O-ring, for front contact housing and optical sensor in the rear contact housing . . . . .	B013-2870
1	Documentation package	B312-1326



## Replacement parts

### Obtaining supplies, replacement parts, and accessories

Supplies, replacement parts, and accessories can be ordered directly from Perkin Elmer, using the part numbers quoted in this guide.

Perkin Elmer's catalog service offers a full selection of high-quality atomic spectroscopy supplies through the *Atomic Spectroscopy Supplies Catalog*.

To place an order for supplies and many replacement parts, request a free catalog, or ask for information:

- If you are located *within the U.S.*, call toll free **1-800-762-4002**, 8 a.m. to 8 p.m. EST. Your order will be shipped promptly, usually within 24 hours.
- If you are located *outside of the U.S.*, call your local Perkin Elmer sales or service office.

### What is listed in this section

This section lists the most important replacement parts for your spectrometer system. Parts listed under *Parts provided* are not repeated in this section.

Information about other parts and accessories for the system is given in the current Perkin Elmer brochures and price lists.

### Background corrector

Description	Part No.
Deuterium lamp . . . . .	B050-7404



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## **Introduction**

The AAAnalyst 800 spectrometer has some special requirements that you must consider when setting up the laboratory. The laboratory must fulfil these requirements, described in this chapter, before you can operate the spectrometer correctly.

Brochure no. L-301 – *Preparing Your Laboratory for Perkin Elmer Atomic Spectroscopy Instruments* – also contains useful information. This brochure is available from Perkin Elmer.

## **Space requirements for the spectrometer system**

The illustrations on the following pages show the dimensions of the spectrometer and the space that you require to accommodate the spectrometer, computer, and ancillary equipment.

- Place the spectrometer on a sturdy bench or trolley capable of sustaining the weight. A movable table is very convenient, but make sure that the wheels can be securely locked.
- You should have sufficient room around the instruments to reach all the connections on the rear and reach the electricity and gas supply points.
- The laboratory ventilation system needs space above the spectrometer.

### **Computer and printer**

Place the computer near the spectrometer in a convenient position for working with both instruments. A movable table, specially designed for a computer and printer, may be most convenient.

The printer needs to be in a convenient place with enough room for the paper supply to stand and feed smoothly into the printer.

### **Accessories**

Make sure that there is sufficient room for any accessories near to the spectrometer.

For example, we recommend that you place the (optional) FIAS flow injection system on a movable table in front of the atomizer compartment to minimize the length of the sample transfer tube. Make sure that the wheels of the table can be securely locked.

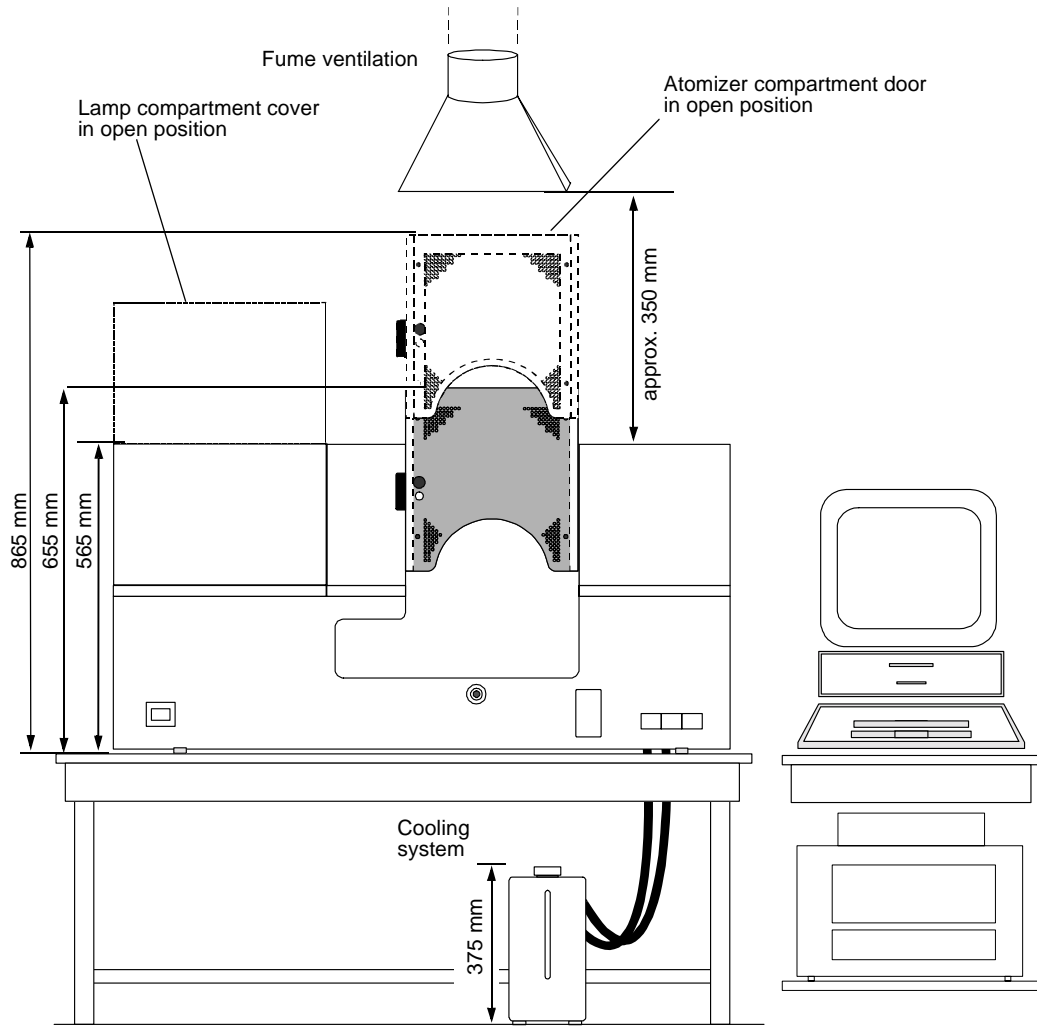


Figure 7-1. Space Requirements for the Spectrometer System (1)

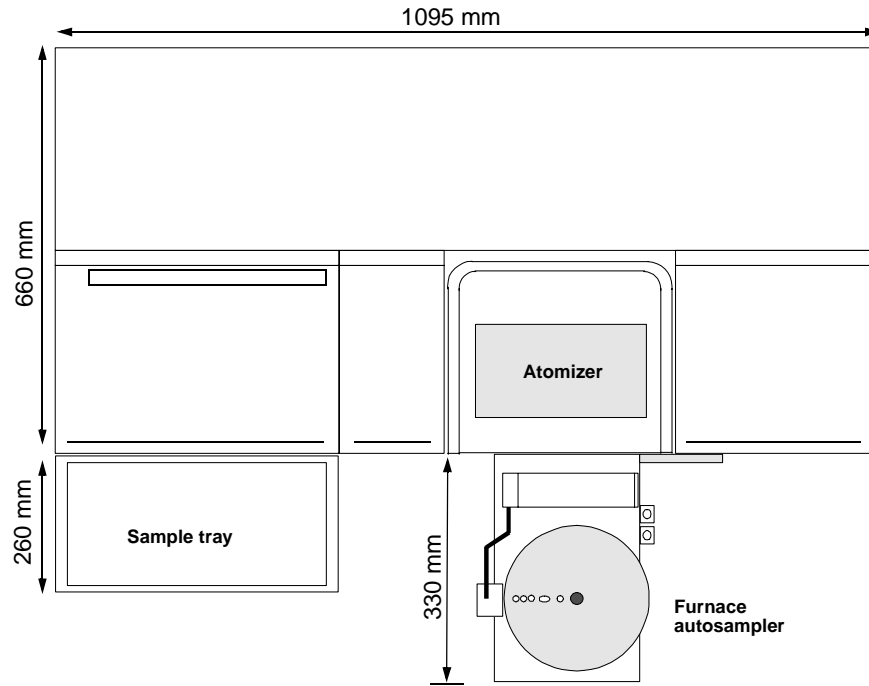


Figure 7-2. Space Requirements for the Spectrometer System (2)



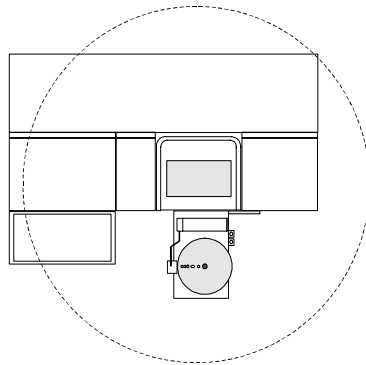
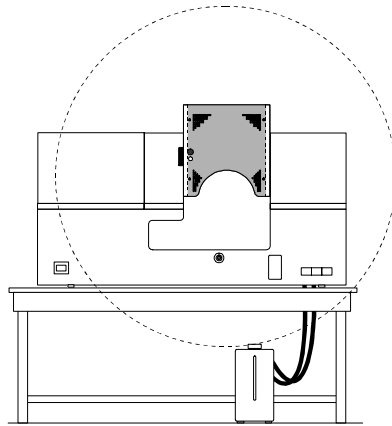
## Magnetic field

### Zeeman graphite furnace systems

The electromagnet generates a strong magnetic field inside the THGA furnace during measurement cycles.

There is a weak, accessible, stray magnetic field around the graphite furnace. This stray magnetic field can affect heart pacemakers and metallic implants up to 0.6 meter from the furnace in all directions. This stray field can also affect other instruments, watches, and magnetic storage devices.

- Do not operate the furnace when persons wearing electronic heart pacemakers, or having other metallic implants, are present.
- Anyone wearing a heart pacemaker or having metallic implants should remain at least 0.6 meter away from the furnace – in any direction – while the furnace is operating.



#### Strong Magnetic Field

Safety distance of 0.6 meter  
(24 inches) radius around the  
furnace magnet for persons  
wearing heart pacemakers

## **Electrical requirements**

Two versions of the AAnalyst 800 AA spectrometer are available to suit different line power supplies.

### **USA version – 240 V, 60 Hz**

The line power cable has a L6-20P, NEMA-configuration twistlock connector (3 wire – line, neutral, grounding), rated for 240 V/20 A, the cable is 3 meters long.

### **General version – 230 V, 50 Hz**

The line power cable has a 3-pole CENELEC connector (line + neutral + protective earth) rated for 32 A. The cable is 3 meters long.

### **General requirements**

The spectrometer requires a stable, 50 Hz or 60 Hz line power supply at the correct voltage and current rating that has a correctly wired protective earthing system (ground connection).

The line power supply should be free of line transients in excess of 50 V peak. If the electrical supply voltage produces large AC line voltage fluctuations, a qualified electrician should install a voltage regulator between the electrical outlet and the instrument.

Power consumption during furnace operation is approximately 5000 VA, at an isothermal furnace temperature of 2600 °C.

The line power supply point must be within 3 meters of the rear of the spectrometer.

We recommend that you connect the spectrometer, computer, printer, and any accessories to the same phase of the line power supply and the same protective earth.

The line power supply must conform with local safety regulations and be checked by a qualified electrician before you connect the instrument to line power.

See the guides for the computer and printer and any other instruments for information about their power requirements.

## Environmental conditions

**Warning: Explosive Atmosphere**

W1.3

*This instrument is not designed for operation in an explosive atmosphere.*

**General**

The location you choose for the spectrometer must fulfil the criteria listed below:

- Indoors.
- Free of dust, smoke and corrosive fumes.
- The work surface must be level, flat, clean, dry, and free from vibration. It should be strong and stiff enough to bear the weight of the spectrometer system over a long period without warping or bending.
- Out of direct sunlight.
- Away from radiators and heaters.
- Near to the electricity and gas supply points.
- Near to a source of cooling water for the graphite furnace.
- Have a suitable fume ventilation system.
- Have sufficient room to work comfortably with the instruments, and allow you to reach the connections at the rear of the instruments.

**Temperature**

- Between +15 °C and +35 °C.

**Humidity**

- Between 20% and 80% relative humidity (non-condensing).

## **Fume ventilation**

You must provide an efficient fume ventilation system to remove the fumes generated by the atomizer (flame, graphite furnace, or the QTA-cell of FIAS systems).

The specification for a suitable system is described in brochure no.

L-301 – *Preparing Your Laboratory for Perkin Elmer Atomic Spectroscopy Instruments.*

This brochure is available from Perkin Elmer.



**Warning: Toxic Gases – Fume Ventilation System**

*Without adequate ventilation, potentially toxic vapors can build up in the laboratory.*

- *Your laboratory must have a reliable fume ventilation system before you use this instrument.*

## Gas supply requirements

The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building regulations.

Perkin Elmer recommends that cylinders be stored outside the laboratory and that gases be piped to the spectrometer system in approved gas lines.

- The user must provide the gas supplies, regulators, connectors, and valves. A double-stage or heated regulator is recommended for nitrous oxide. Either the gas supplier or Perkin Elmer can supply the correct regulators and valves.
- You must be able to reach the on/off valves easily and see the pressure indicators.
- Consult the chapter entitled '*Safety Information*' for recommended safety procedures.



**Warning: Compressed Gases**

*High pressure gas cylinders can be dangerous if mishandled or misused.*

- *Always handle gas cylinders with caution and observe you local regulations for the safe handling of gas cylinders.*

## Burner gases

Two types of flame are commonly used for atomic absorption analyses with flame atomization: the air/acetylene flame and the nitrous oxide/acetylene flame. The specifications and requirements for the burner gases are given below:

Table 7-1. Specifications and Requirements of the Burner Gases

Gas	Purity	Outlet Gauge Pressure					
		kPa		bar		psig	
		$P_{\min}$	$P_{\max}$	$P_{\min}$	$P_{\max}$	$P_{\min}$	$P_{\max}$
Acetylene (ethyne, $C_2H_2$ )	99.996%, atomic absorption grade in acetone	90	100	0.9	1.0	13.0	14.5
Air	oxygen $\leq 20\%$ ; particle free; water free	450	500	4.5	5.0	65.0	72.5
Nitrous oxide (dinitrogen monoxide, $N_2O$ )	99.996%	450	500	4.5	5.0	65.0	72.5

- Set the outlet gauge pressure for each gas to a value just below the maximum value ( $P_{\max}$ ).
- Always set the same outlet gauge pressure for air and nitrous oxide.
- **Never** set the outlet pressure to a value exceeding the maximum pressure ( $P_{\max}$ ).



**Warning: Acetylene – Explosion Hazard**

W5.7

Acetylene can decompose explosively at pressures higher than 103 kPa/  
1.03 bar/15 psig.

- Always make sure that the acetylene outlet gauge pressure is below this value.

### **Air supply**

An air compressor is recommended for the air supply to the burner system. Cylinders of compressed air should only be used as an emergency or short-term solution. Since compressors are generally noisy, we recommend that you locate the compressor outside the laboratory.



#### **Warning: Flashback Hazard**

W5.9

*Perkin Elmer burner systems are designed for use with compressed air. The use of oxygen can cause an explosion in the burner system, and oxygen-enriched air can cause a flashback of the flame.*

- *Never use oxygen or oxygen-enriched air with Perkin Elmer burner systems. Use only compressed air.*

## Furnace gases

### Inert gas

The graphite furnace requires a supply of inert gas to prevent the tube and the analyte atoms from being oxidized when the tube is heated.

Argon is the recommended inert gas.

If you cannot obtain argon, you can use purified nitrogen, but nitrogen does not provide such efficient protection as argon at temperatures above 2000 °C.

Nitrogen can also react with the samples and the graphite tube at typical atomization temperatures.



#### Warning: Toxic Gases

W6.1

If you use nitrogen as the inert gas, toxic cyanogen gas (CN)<sub>2</sub> will be produced when the furnace temperature is above 2300 °C.

- Make sure that the main laboratory fume ventilation system removes all gases and fumes emitted by the furnace.

### Special gas

For some applications you may want to use a special gas. A typical example is the use of air during one of the pyrolysis steps to better ash organic materials.

Table 7-2. Specifications and Requirements of the Furnace Gases

Gas	Purity	Outlet Gauge Pressure						Max. Flowrate
		kPa		bar		psig		L/min
		$P_{\min}$	$P_{\max}$	$P_{\min}$	$P_{\max}$	$P_{\min}$	$P_{\max}$	1.2
Argon	99.996%	350	400	3.5	4.0	50.0	58.0	1.2
Nitrogen	99.996%	350	400	3.5	4.0	50.0	58.0	1.2
Special	particle free; water free	350	400	3.5	4.0	50.0	58.0	1.2

- Set the outlet gauge pressure for each gas to a value just below the maximum value ( $P_{\max}$ ).
- **Never** set the outlet pressure to a value exceeding the maximum pressure ( $P_{\max}$ ).



## **Cooling the spectrometer system**

### ***Furnace cooling***

The graphite furnace uses water cooling to allow the graphite tube to return to its equilibrium temperature (approximately ambient) quickly between measurements (*see 'Cooling the furnace' in the 'Graphite Furnace User's Guide'*).

### ***Spectrometer cooling***

Cooling coils are incorporated in the spectrometer's power supply to maintain the electronic components at a comfortable working temperature.

### ***Cooling system***

Perkin Elmer offers a recirculating cooling system; it is included with certain spectrometer systems and is offered as an option for others. It provides coolant at a constant temperature and flow, to allow the most reproducible analytical conditions. It also makes the system independent of external water supplies and saves water (*see 'Cooling the furnace' in the 'Graphite Furnace User's Guide'*).

Power requirements: 230 V; 50/60 Hz (electrical power is supplied by the spectrometer)

Part Number: B019-8072

## **Lamps**

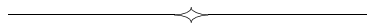
These are often called primary source lamps, atomic absorption source lamps, spectroscopic lamps, or line sources.

You need to provide the lamps for your particular applications.

Brochure no. L-656 – *Hollow Cathode Lamps and Electrodeless Discharge Lamps for Atomic Absorption*, contains descriptions of all the lamps that are available.

## **Computer and printer**

Perkin Elmer offers a suitable computer for controlling the spectrometer and a suitable printer. Contact your local Perkin Elmer office for more information. If you are not using the computer offered with the spectrometer by Perkin Elmer, or an identical model with the correct specification, Perkin Elmer cannot accept responsibility for incorrect functioning of the spectrometer system.



# ***Spectrometer: System Description***

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# **8**

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## **The AAnalyst 800 Spectrometer System**

### **Concept**

The AAnalyst 800 spectrometer from Perkin Elmer is a compact, high performance atomic absorption spectrometer incorporating a burner system for flame atomization and a graphite furnace for electrothermal atomization. The spectrometer is capable of fully automatic single-element analyses. The complete system is operated from the associated computer using the AA WinLab software.

### **Features of the AAnalyst 800 System**

- Two fully integrated atomizers: a burner system for flame atomization and a graphite furnace for electrothermal atomization. Atomizer changeover is automatic at the click of a mouse button.
- Transversely-heated graphite furnace featuring full Stabilized Temperature Platform Furnace (STPF) technology.
- Longitudinal Zeeman-effect background correction for electrothermal atomization.
- Deuterium background correction for flame atomization.
- Automated self-optimization of the burner system.
- High capacity furnace autosampler.
- Easy-to-use AA WinLab software with which you control the spectrometer system. AA WinLab also incorporates a range of powerful quality control functions.

### **System components**

The AAnalyst 800 is a compact benchtop spectrometer. The major components of the system are:

- The spectrometer, containing the optical system, the electronics, and the atomizer compartment.
- The burner system, mounted on a carriage that can be driven into and out of the atomizer compartment by software command (*see 'Burner system design' in the 'Burner System User's Guide' for more information*).
- The graphite furnace, mounted on a carriage that can be driven into and out of the atomizer compartment by software command (*see 'Furnace design' in the 'Graphite Furnace User's Guide' for more information*).
- The furnace autosampler, mounted on a swing arm in front of the atomizer compartment (*see 'Autosampler design' in the 'Graphite Furnace User's Guide' for more information*).
- The furnace cooling system (*see 'Cooling the furnace' in the 'Graphite Furnace User's Guide' for more information*).
- The computer and the associated AA WinLab software.
- The printer; this is optional but strongly recommended.

### ***System control***

To control the spectrometer and perform your analyses, you use the AA WinLab application program, which runs under the Microsoft Windows 95 operating system. The computer keyboard, the screen, and the mouse form the user interface.

When you switch on the spectrometer system it performs an initialization procedure to check the instrument. While the spectrometer is operating, the control system continually monitors many instrument functions. It generates appropriate messages when a problem occurs and prevents potentially hazardous situations from arising.

You can obtain more information about the application program in the AA WinLab online help.

### ***Accessories***

Perkin Elmer offers autosamplers for operation with the burner system, flow injection systems, diluters, and much more. Please contact your local Perkin Elmer office to obtain more information.

## **The optical system**

The AAnalyst 800 uses a double-beam optical system. Front-surfaced, reflecting optical components are used throughout. The mirror surfaces are coated with silica for durability.

The lamp compartment has positions for up to eight spectral sources. The radiation from the requested source lamp is reflected by a movable mirror into the optical path.

For flame atomization a beam splitter splits the radiation into a sample beam and a reference beam. The sample beam passes through the atomizer while the reference beam passes around the atomizer and is conducted by a fiber optic. The sample and reference beams are measured simultaneously.

For electrothermal atomization the beam splitter is moved out of the optical path and a single-path optical configuration is used. Due to the Zeeman principle, the double-beam function is retained.

The Littrow-configuration monochromator has a large area reflecting grating blazed at two wavelengths; 236 nm for operation in the UV spectral range and 597 nm for operation in the visible spectral range. The monochromator offers a choice of three spectral slit widths. Two slit heights are available for each slit width. The high slits are used with the flame technique while the low slits are used with the graphite furnace technique. The detector is a segmented array of discrete photodiodes.

For continuum source background correction with the flame technique, the radiation from the deuterium lamp is merged with the source radiation at the beam splitter.

The inverse longitudinal Zeeman effect is used for background correction with the graphite furnace technique. This system of background correction is described in the '*Graphite Furnace User's Guide*'.



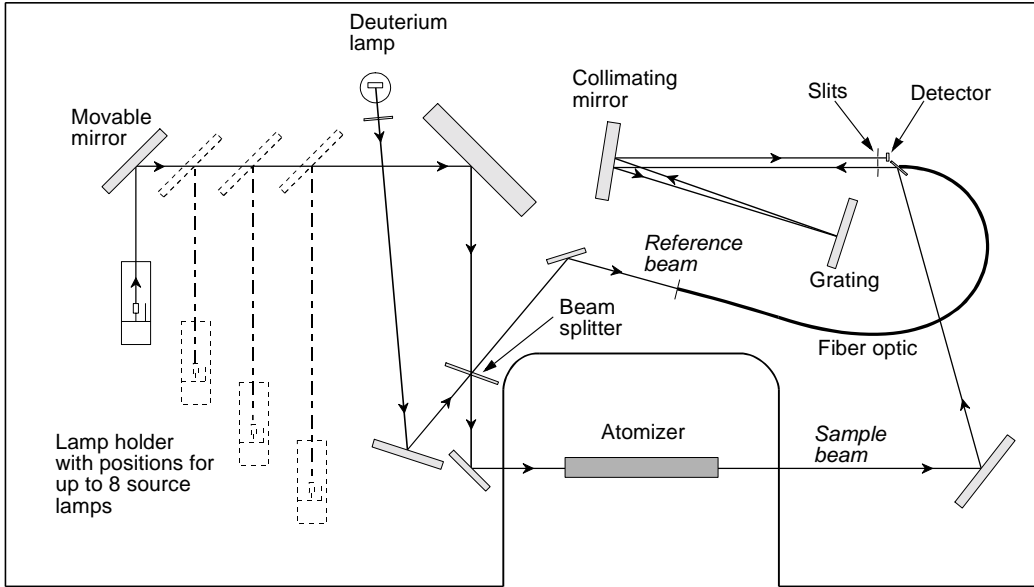


Figure 8-1. Optical System

**The gas and cooling connectors**

<b>Item</b>	<b>Designation</b>	<b>Function</b>
<b>Furnace Cooling</b>		
1	In	Fitting for connection of the cooling water inlet hose to the spectrometer.
2	Out	Fitting for connection of the cooling water outlet hose from the spectrometer.
<b>Furnace Gases</b>		
3	Ar/N <sub>2</sub> Normal Gas	Connector for the connection of the normal gas supply to the furnace (argon or nitrogen).
4	Special Gas	Connector for the connection of the special gas supply to the furnace. If you are not using a special gas, you must also connect the normal gas to this connector.
<b>Burner Gases</b>		
5	Air/Luft	Fitting for connection of the air supply to the spectrometer. The air supply is required for the burner and also for the pneumatic system in the spectrometer.
6	N <sub>2</sub> O	Fitting for connection of the nitrous oxide supply to the burner.
7	C <sub>2</sub> H <sub>2</sub>	Fitting for connection of the acetylene supply to the burner.

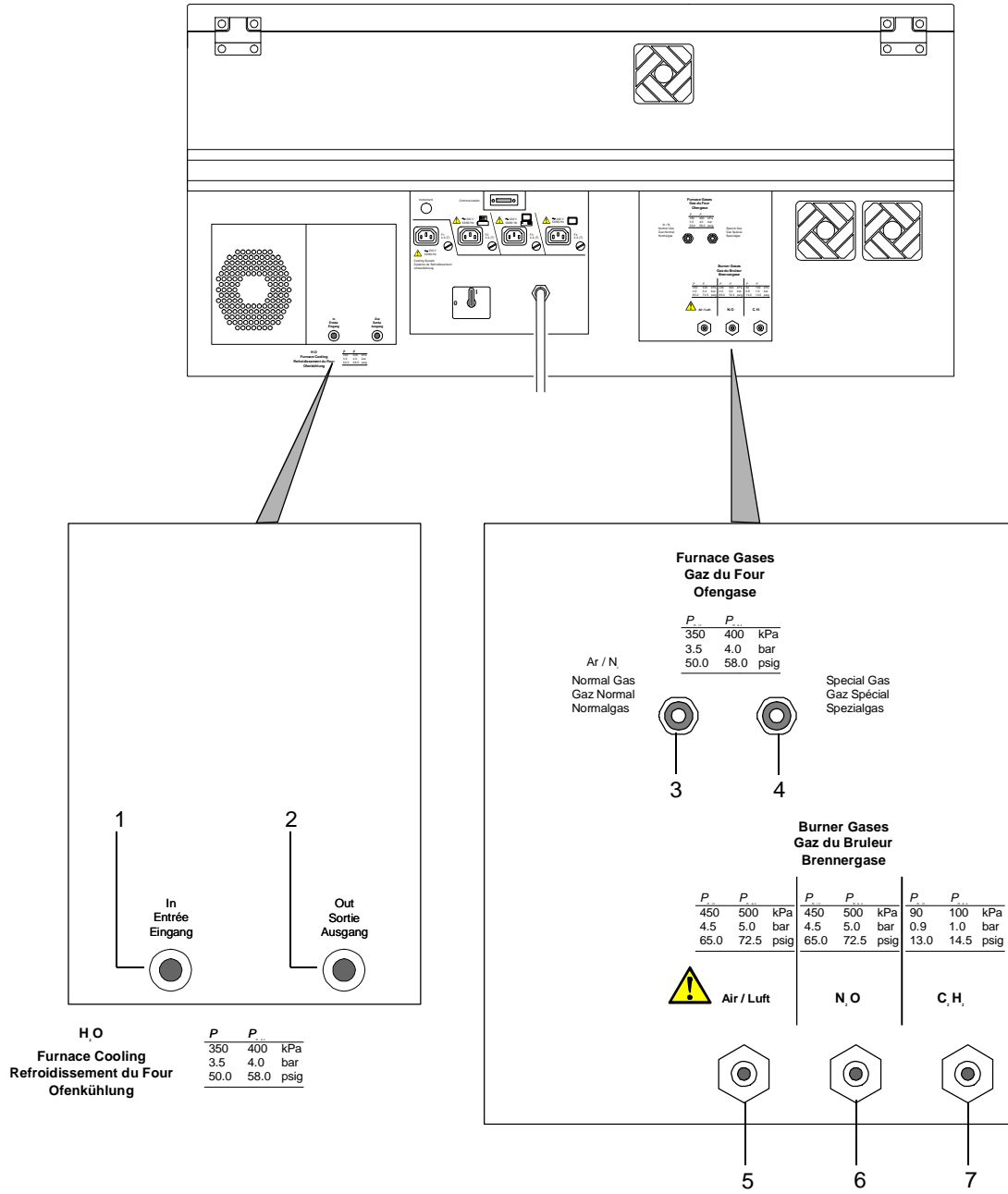





Figure 8-2. Gas and Cooling Connectors on the Rear Panel

## The electrical connectors and switches

### Connectors and controls on the rear panel

Item	Designation	Function
1	<b>Communication</b>	Socket for the communication cable connecting the spectrometer to the computer.
2	<b>Instrument</b>	Socket for a read cable to an external instrument to activate a read cycle.
3	<b>Cooling System</b> ~230 V 50/60 Hz	Power outlet for the cooling system. Connect the cooling system to this socket. <b>Do not connect other equipment to this power outlet.</b>
4	 ~230 V 50/60 Hz	Power outlet for a printer.
5	 ~230 V 50/60 Hz	Power outlet for a computer.
6	 ~230 V 50/60 Hz	Power outlet for a monitor.
7	○ 	Circuit breaker. An automatic switch that prevents the system from drawing too much current. It can also be used to isolate the spectrometer system from the line power supply.
8	---	Captive line power cord for the complete system.
9	<b>F1</b>	Fuse for the cooling system power outlet; 4 A slow-blow (T).
10	<b>F2</b>	Fuse for the printer power outlet; 4 A slow-blow (T).
11	<b>F3</b>	Fuse for the computer power outlet; 4 A slow-blow (T).
12	<b>F4</b>	Fuse for the monitor power outlet; 4 A slow-blow (T).

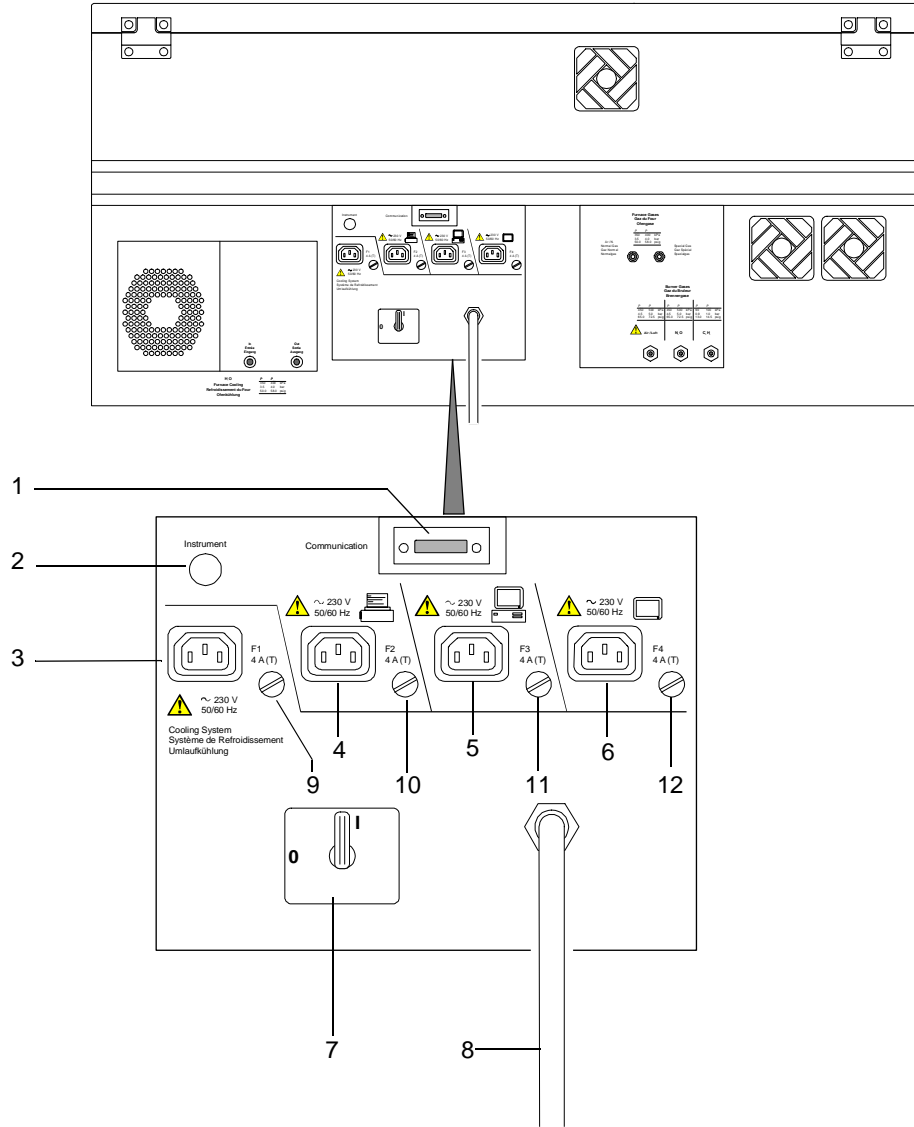


Figure 8-3. Electrical Connectors and Switches on the Rear Panel

### Switches and ports on the front panel

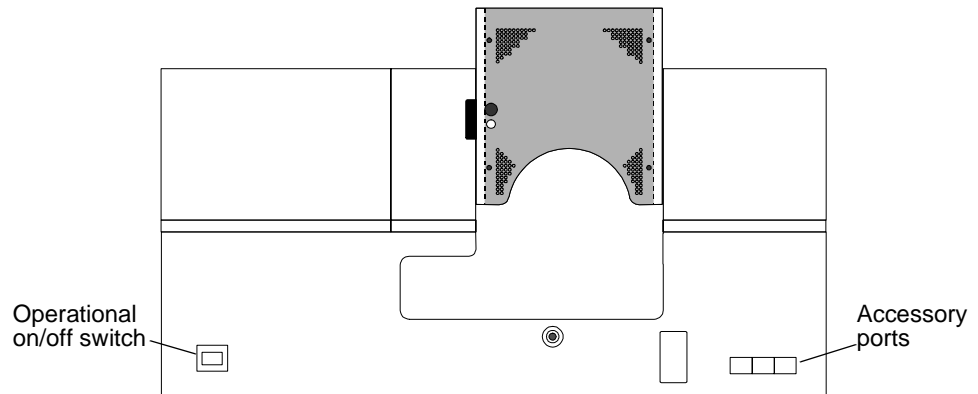


Figure 8-4. Switches and Ports on the Front Panel

### Operational on/off switches

#### Spectrometer

You normally switch the system on and off with the operational on/off switch on the front panel of the spectrometer.

#### Cooling system

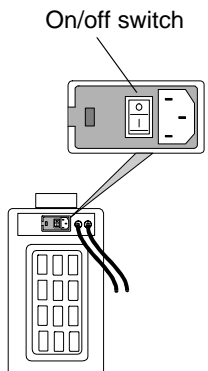
The cooling system requires a 230 V line power supply, which is supplied and controlled from the spectrometer. A special line power cord is provided for this purpose. Do not connect the cooling system to an external power source. You can leave the on/off switch on the cooling system in the 'on' position since the system is controlled from the spectrometer.

#### Accessory ports

Three accessory ports are located on the front panel of the spectrometer behind slide-up covers. You use these ports to connect certain accessories to the spectrometer, such as the furnace autosampler or a diluter.

The ports provide the electrical supply and control signals for operation of the accessories.

#### Cooling System



**Technical data**

<b>Principle</b>	Atomic absorption spectrometer. Computer controlled, using a special application program running under a graphical user interface. Real-time double-beam, all-reflecting optical system (single-path for furnace operation). Front-surfaced optics protected by a silica coating. AC modulated spectral line sources.
<b>Monochromator</b>	Littrow configuration grating monochromator. Grating: ruled area: 64 mm x 72 mm, 1800 lines/mm blaze wavelengths: 236 nm and 597 nm Focal length: 267 mm Slit widths 0.2, 0.7 and 2.0 mm Wavelength range: 190–870 nm Reciprocal linear dispersion: 1.6 nm/mm (nominal)
<b>Detector</b>	Segmented discrete solid-state detector with CMOS charge amplifier array; software-controlled automatic gain control (AGC).
<b>Lamps</b>	Line radiation sources. Positions for up to 8 lamps in lamp compartment. Single- and multi-element hollow cathode lamps (HCLs) and up to 4 electrodeless discharge lamps (EDLs) can be used.
<b>Background correction</b>	Continuum source (deuterium lamp) for the flame technique. Inverse longitudinal Zeeman effect for the graphite furnace technique.
<b>Atomizers</b>	Flame atomization: Premix burner system with pneumatic nebulizer and interchangeable burner heads; automatic changeover between air/acetylene and nitrous oxide/acetylene flames. Electrothermal atomization: Transversely-heated graphite furnace incorporating an electromagnet for longitudinal Zeeman-effect background correction.

<b>Signal handling</b>	<p>Time average, peak average, peak height, peak area.</p> <p>Measurement ranges:</p> <ul style="list-style-type: none"><li>absorbance: -0.5 to 2.000</li><li>concentration: 0.00001 to 9999 concentration units</li><li>expansion factor: 0.01 to 100</li><li>read time: 1 to 60 s</li><li>read delay: 0 to 60 s</li></ul>
<b>Calibration</b>	<p>Automatic zeroing, resloping, and recalibration.</p> <p>Calibration/recalibration using up to 15 calibration solutions ('standards'). Calibration coefficients determined by a least squares procedure.</p> <p>Analytical curve technique:</p> <ul style="list-style-type: none"><li>• Linear with zero or non-zero intercept.</li><li>• Non-linear, 2-coefficient, or 3-coefficient, zero or non-zero intercept.</li></ul> <p>Analyte addition technique:</p> <ul style="list-style-type: none"><li>• Zero or non-zero intercept.</li><li>• Additions calibrate (zero intercept).</li></ul>
<b>Computer</b> (minimum requirement)	<p>PC with Intel Pentium processor, 16 MB RAM, CD-ROM drive.</p> <p>Hard disk space: 30 MB minimum free for AA WinLab, Database and GPIB software, additional space required for storing results and methods.</p> <p>Microsoft Windows 95 operating system.</p> <p>Perkin Elmer offers a suitable PC for controlling the spectrometer system.</p>
<b>Application program</b>	<p>Special application program: AA WinLab.</p> <p>Online help function.</p> <p>Hard disk or floppy storage of measurement data, signals, and completed analytical methods.</p> <p>Special Reporter, Reformatter, and Library Manager applications for generating data reports and reformatting data for export to other data handling programs.</p>
<b>Graphics</b>	<p>High resolution display of the signals.</p> <p>Simultaneous display of the corrected analyte signal and the background signal.</p> <p>Calibration curve display.</p> <p>Storage and recall of transient absorbance signals.</p> <p>Hard copy printout of screen graphics on an associated printer.</p>
<b>Power requirements</b>	<p>230 V single-phase, 50 Hz, power consumption 5000 VA, -or- 240 V single-phase, 60 Hz, power consumption 5000 VA</p>







# Translations

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## **Symbols used on the instrument**

Any of the following symbols can be used on the instrument:

<i>dansk</i>	<b><i>De markeringer, som benyttes på dette apparat</i></b> <i>Enhver af de følgende markeringer kan benyttes på apparatet:</i>
<i>Deutsch</i>	<b><i>Symbole am Gerät</i></b> <i>Eines der folgenden Symbole kann sich am Gerät befinden:</i>
<i>español</i>	<b><i>Pictogramas usados en el equipo</i></b> <i>Usted puede aplicar al equipo cualquiera de los siguientes pictogramas:</i>
<i>français</i>	<b><i>Symboles utilisés sur l'instrument</i></b> <i>Tous les symboles suivants peuvent être utilisés sur l'instrument :</i>
<i>italiano</i>	<b><i>Contrassegni utilizzati sullo strumento</i></b> <i>Qualsiasi dei seguenti contrassegni può essere utilizzato sullo strumento:</i>
<i>Nederlands</i>	<b><i>Markeringen op het Instrument</i></b> <i>De volgende markingen kunnen op het instrument gebruikt worden:</i>
<i>português</i>	<b><i>Marcações usadas no aparelho</i></b> <i>Qualquer uma das marcações seguintes podem ser usadas no aparelho:</i>
<i>suomea</i>	<b><i>Laitteessa käytetyt merkit</i></b> <i>Laitteessa voidaan käyttää seuraavia merkkejä:</i>
<i>svenska</i>	<b><i>Apparatens symboler</i></b> <i>Följande symboler kan finnas på apparaten:</i>



This symbol indicates that there is a potential hazard and that the user must look in the guide for an explanation of the hazard and how to avoid it.

<i>dansk</i>	Dette symbol angiver, at der foreligger en mulig fare, og at brugeren skal se i håndbogen efter en forklaring på faren, og hvordan faren kan undgås.
<i>Deutsch</i>	Dieses Symbol bedeutet, daß hier eine mögliche Gefahr besteht und der Benutzer im Handbuch nachschlagen muß, um eine Beschreibung der Gefahr und deren Vermeidung zu erhalten.
<i>español</i>	Este símbolo indica que existe un peligro potencial y que el usuario tiene que consultar el manual para hallar una explicación del peligro y de los modos de evitarlo.
<i>français</i>	Ce symbole indique un danger potentiel et invite l'utilisateur à consulter le manuel d'utilisation pour obtenir un exposé de ce danger et les moyens de l'éviter.
<i>italiano</i>	Questo simbolo indica un pericolo potenziale e che l'operatore deve consultare il manuale per eventuali spiegazioni riguardo ad eventuali pericoli e su come evitarli.
<i>Nederlands</i>	Dit symbool geeft aan dat er gevaar bestaat en dat de gebruiker in het handboek de uitleg daarvan dient na te kijken en hoe het vermeden kan worden.
<i>português</i>	Este símbolo indica que existe um perigo potencial e que o utilizador deve consultar o manual para obter uma explicação sobre o perigo e saber como o pode evitar.
<i>suomea</i>	Tämä symboli merkitsee, että on olemassa potentiaalinen vaara ja että käyttäjän täytyy katsoa käsikirjasta vaaran selitystä ja kuinka se vältetään.
<i>svenska</i>	Symbolen innebär möjlig fara. Användaren skall se i användarhandboken för att få förklaringar och anvisningar om hur faran skall undvikas.



This symbol indicates the risk of electric shock.

---


<i>dansk</i>	Dette symbol angiver risikoen for elektrisk stød.
<i>Deutsch</i>	Dieses Symbol warnt vor Gefahr durch elektrischen Strom.
<i>español</i>	Este símbolo indica la existencia de riesgo de electrocución.
<i>français</i>	Ce symbole indique un risque d'électrocution.
<i>italiano</i>	Questo simbolo indica il pericolo di folgorazione.
<i>Nederlands</i>	Dit symbool geeft aan dat er gevaar voor een elektrische schok bestaat.
<i>português</i>	Este símbolo indica o perigo de choques eléctricos.
<i>suomea</i>	Tämä symboli varoittaa sähköiskun vaarasta.
<i>svenska</i>	Symbolen innebär fara för elektriska stötar.



This symbol indicates the risk of hot surfaces.

---

<i>dansk</i>	Dette symbol angiver risikoen for varme overflader.
<i>Deutsch</i>	Dieses Symbol warnt vor Gefahr durch heiße Oberfläche.
<i>español</i>	Este símbolo indica peligro de tocar superficies candentes.
<i>français</i>	Ce symbole indique un risque de surfaces chaudes.
<i>italiano</i>	Questo simbolo indica il pericolo di superfici molto calde.
<i>Nederlands</i>	Dit symbool geeft aan dat er gevaar voor hete oppervlaktes bestaat.
<i>português</i>	Este símbolo indica o perigo de superfícies quentes.
<i>suomea</i>	Tämä symboli varoittaa kuumista pinnoista.
<i>svenska</i>	Symbolen innebär fara för heta ytor.

	This symbol indicates the off position of the main power switch or circuit breaker. With the switch in this position, the instrument is disconnected entirely from the line power supply.
<i>dansk</i>	Dette symbol angiver hovedafbryderen eller kredsløbsafbryderens slukket-position. Når afbryderen står i denne position, er apparatet fuldstændigt skilt fra strømtilførslen.
<i>Deutsch</i>	Dieses Symbol zeigt die Stellung Aus des Netzschalters oder Leistungsschalters. Wenn der Schalter auf dieser Position steht, ist das Gerät vollständig vom Netzstrom getrennt.
<i>español</i>	Este símbolo indica que el interruptor principal de la red o del cortacircuitos está desconectado. Cuando el interruptor se encuentra en esta posición, el equipo está desconectado por completo de la toma de corriente.
<i>français</i>	Ce symbole indique que l'interrupteur ou le coupe-circuit principal est en position 'arrêt'. Quand l'interrupteur est dans cette position, l'instrument est complètement déconnecté de l'alimentation secteur.
<i>italiano</i>	Questo simbolo indica la posizione di spento dell'interruttore principale di alimentazione o il separatore di circuito. Se l'interruttore si trova in questa posizione lo strumento è scollegato completamente dall'alimentazione elettrica.
<i>Nederlands</i>	Dit symbool geeft aan dat de hoofdkrachtschakelaar of stroombreker uitstaat. Met de schakelaar in deze stand is het instrument geheel afgesloten van de lijnvoeding.
<i>português</i>	Este símbolo indica a posição desligada do interruptor principal de corrente ou do disjuntor. Estando o interruptor nesta posição, o aparelho é desligado totalmente da rede de fornecimento de corrente.
<i>suomea</i>	Tämä symboli ilmoittaa, että pääkytkin tai katkaisija on pois päältä. Kun kytkin on tässä asennossa, laite on erotettu kokonaan verkkovirrasta.
<i>svenska</i>	Symbolen visar att huvudströmbrytaren eller strömkretsbytarens står i från-läge. När brytaren står i detta läge är apparaten helt frånkopplad från nätet.



<b>I</b>	This symbol indicates the on position of the main power switch or circuit breaker. With the switch in this position, the instrument is connected to the line power supply but is not necessarily switched on and operational.
<i>dansk</i>	Dette symbol angiver hovedafbryderen eller kredsløbsafbryderens tændt-position. Når afbryderen står i denne position, er apparatet forbundet med strømtilførslen, men ikke nødvendigvis tændt og driftsklar.
<i>Deutsch</i>	Dieses Symbol zeigt die Stellung Ein des Netzschalters oder Leistungsschalters. Wenn der Schalter auf dieser Position steht, wird das Gerät mit Netzstrom versorgt, muß jedoch nicht notwendigerweise eingeschaltet und betriebsbereit sein.
<i>español</i>	Este símbolo indica que el interruptor principal de la red o del cortacircuitos está conectado. Cuando el interruptor se encuentra en esta posición, el equipo está conectado a la red eléctrica, pero no está necesariamente encendido o en estado operacional.
<i>français</i>	Ce symbole indique que l'interrupteur ou le coupe-circuit principal est en position 'marche'. Quand l'interrupteur est dans cette position, l'instrument est connecté à l'alimentation secteur, mais n'est pas nécessairement en circuit et opérationnel.
<i>italiano</i>	Questo simbolo indica la posizione di acceso dell'interruttore principale di alimentazione o il separatore di circuito. Se l'interruttore si trova in questa posizione lo strumento è collegato all'alimentazione elettrica ma non è necessariamente attivo e operativo.
<i>Nederlands</i>	Dit symbool geeft aan dat de hoofdkrachtschakelaar of stroombreker aanstaat. Met de schakelaar in deze stand is het instrument aangesloten aan de lijnvoeding maar behoeft niet aan te staan en in werking te zijn.
<i>português</i>	Este símbolo indica a posição ligada do interruptor principal de corrente ou do disjuntor. Estando o interruptor nesta posição, o aparelho está ligado à rede de fornecimento de corrente, o que não significa necessariamente que também esteja ativado e operacional.
<i>suomea</i>	Tämä symboli ilmoittaa, että pääkytkin tai katkaisija on päälle kytketty. Kun kytkin on tässä asennossa, laite on liitettyä verkkovirtaan, mutta sitä ei ole välttämättä kytketty päälle eikä se ole välttämättä käyttövalmis.
<i>svenska</i>	Symbolen visar att huvudströmbrytaren eller strömkretsbytare står i till-läge. När brytaren står i detta läge är apparaten ansluten till nätet men inte nödvändigtvis tillslagen och driftklar.



This symbol indicates the operational on/off switch.

---

<i>dansk</i>	Dette symbol angiver betjenings-tændt/sluk-kontakt.
<i>Deutsch</i>	Dieses Symbol kennzeichnet den Bereitschaftsschalter.
<i>español</i>	Este símbolo indica el interruptor operacional con./desc.
<i>français</i>	Ce symbole représente l'interrupteur d'arrêt/marche.
<i>italiano</i>	Questo simbolo indica l'interruttore acceso/spento opzionale.
<i>Nederlands</i>	Dit symbool geeft de aan/uit schakelaar aan.
<i>português</i>	Este símbolo indica o interruptor de ligar/desligar o funcionamento.
<i>suomea</i>	Tämä symboli tarkoittaa päälle/pois -käyttökytkintä.
<i>svenska</i>	Symbolen visar apparatens till/från-knapp.

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This symbol indicates alternating current.

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<i>dansk</i>	Dette symbol angiver vekselstrøm.
<i>Deutsch</i>	Dieses Symbol kennzeichnet Wechselstrom.
<i>español</i>	Este símbolo indica la existencia de corriente alterna.
<i>français</i>	Ce symbole représente le courant alternatif.
<i>italiano</i>	Questo simbolo indica corrente alternata.
<i>Nederlands</i>	Dit symbool geeft wisselstroom aan.
<i>português</i>	Este símbolo indica corrente alterna.
<i>suomea</i>	Tämä symboli merkitsee vaihtovirtaa.
<i>svenska</i>	Symbolen indikerar växelström.



This symbol indicates that there is a potential hazard due to a strong magnetic field and that persons wearing heart pacemakers or other metallic implants should remain at least 0.6 m away from the furnace.


<i>dansk</i>	Stærkt magnetfelt: Personer med hjerte-pacemaker eller andre metalliske implantater skal overholde en afstand på mindst 0.6 meter fra ovnen.
<i>Deutsch</i>	Magnetfeld: Herzschrittmacherträger und Personen mit Metall-Implantaten müssen zum Magneten einen Sicherheitsabstand von mindestens 0,6 m um den Magneten einhalten.
<i>español</i>	Campo magnético intenso: Las personas que tengan marcapasos o prótesis metálicas deben mantener una distancia mínima de 0,6 m del horno.
<i>français</i>	Champ magnétique intense: Tout personne ayant un stimulateur cardiaque ou des implants métalliques doit rester éloignée d'au moins 0,6 m du four.
<i>italiano</i>	Forte campo magnetico: Chiunque dovesse essere portatore di pacemaker o di implantati metallici deve soffermarsi ad una distanza minima di 0,6 metri dal forno.
<i>Nederlands</i>	Sterke magnetisch velden: Draggers van een pacemaker of metalen implantaten mogen niet binnen een straal van minimaal 0.6 meter bij de oven komen.
<i>português</i>	Forte campo magnético: Portadores de marca-passo ou pessoas com implantes metálicos devem manter uma distância mínima de 0,6 metros do forno.
<i>suomea</i>	Voimakas magneettikenttä: Kaikkien henkilöiden, joilla on sydämentahdistin tai muita metallisia istutteita, tulee pysyä vähintään 0.6 metrin päässä uunista – joka suuntaan – uunin ollessa käynnissä.
<i>svenska</i>	Starka magnetfält: Personer med pacemaker eller metallimplantat skall hålla ett avstånd på minst 0,6 meter till ugnen.



## Warning messages

This section contains translations of the warnings used in this guide.

<i>dansk</i>	<b><i>Oversættelser af advarsler</i></b> <i>Denne del indeholder oversættelserne af de advarsler, som er indeholdt i denne håndbog.</i>
<i>Deutsch</i>	<b><i>Übersetzungen der Warnungen</i></b> <i>Dieser Abschnitt enthält die Übersetzungen der in diesem Handbuch verwendeten Warnungen.</i>
<i>español</i>	<b><i>Traducciones de las advertencias</i></b> <i>Esta sección contiene traducciones de las advertencias utilizadas en el presente manual.</i>
<i>italiano</i>	<b><i>Traduzione dei simboli di avvertenza</i></b> <i>La presente sezione contiene la traduzione dei simboli di avvertenza utilizzati nel presente manuale.</i>
<i>Nederlands</i>	<b><i>Vertalingen van de Waarschuwingen</i></b> <i>Dit gedeelte bevat vertalingen van de waarschuwingen gebruikt in dit handboek.</i>
<i>português</i>	<b><i>Traduções de avisos</i></b> <i>Esta secção contém traduções dos avisos usados no manual.</i>
<i>suomea</i>	<b><i>Varoitusten käännökset</i></b> <i>Tämä osa sisältää tässä käsikirjassa käytettyjen varoitusten käännökset.</i>
<i>svenska</i>	<b><i>Översättning av varningstexter</i></b> <i>Detta avsnitt innehåller översättningar av de varningstexter som används i handboken.</i>

	<p>This symbol alerts you to situations that could result in <b>personal injury</b> to yourself or other persons. Details about these circumstances are in a box like this one.</p>
<i>dansk</i>	<p>Dette symbol gør Dem opmærksom på situationer, som kan medføre <b>kvæstelser</b> af Dem selv eller andre personer. Detaljer vedrørende disse omstændigheder er indrammet på tilsvarende måde som denne henvisning.</p>
<i>Deutsch</i>	<p>Dieses Symbol warnt vor Situationen, in denen Sie oder andere Personen <b>verletzt</b> werden können. Einzelheiten darüber sind in einem Rahmen wie diesem angegeben.</p>
<i>español</i>	<p>Este símbolo le advierte de situaciones que pueden provocar <b>lesiones corporales</b> a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.</p>
<i>français</i>	<p>Ce symbole vous signale des situations pouvant occasionner des <b>dommages corporels</b> à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.</p>
<i>italiano</i>	<p>Questo simbolo segnala situazioni che possono generare <b>incidenti a voi stessi o ad altre persone</b>. Troverete informazioni su tali circostanze in un riquadro come questo.</p>
<i>Nederlands</i>	<p>Dit symbool maakt U attent op situaties die tot <b>verwondingen</b> voor Uzelf of anderen kunnen leiden. Bijzonderheden over deze omstandigheden staan in een kader zoals dit.</p>
<i>português</i>	<p>Este símbolo alerta para situações que poderão causar um <b>ferimento ao usuário</b>. Detalhes referentes a estas circunstâncias encontram-se referidos numa caixa como esta.</p>
<i>suomea</i>	<p>Tämä symboli haluaa kiinnittää huomiotasi tilanteisiin, joiden seurauksena voi olla itsesi tai muiden <b>henkilöiden loukkaantuminen</b>. Yksityiskohtaisia tietoja tällaisista tapauksista on tämäntapaisessa ruudussa.</p>
<i>svenska</i>	<p>Denna symbol används för situationer där det finns risk för <b>personskador</b> om användaren inte följer anvisningarna. Detaljerad information ges i en ruta som denna.</p>

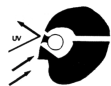


This symbol alerts you to the risk of **electric shock** that could result in **personal injury** to yourself or other persons.  
Details about these circumstances are in a box like this one.

<i>dansk</i>	<i>Dette symbol gør Dem opmærksom på risikoen for <b>elektrisk stød</b>, som kan medføre <b>kvæstelser</b> af Dem selv eller andre personer. Detaljer vedrørende disse omstændigheder er indrammet på tilsvarende måde som denne henvisning.</i>
<i>Deutsch</i>	<i>Dieses Symbol warnt vor Gefahr durch <b>elektrischen Stromschlag</b>, durch den Sie oder andere Personen <b>verletzt</b> werden können. Einzelheiten darüber sind in einem Rahmen wie diesem angegeben.</i>
<i>español</i>	<i>Este símbolo le advierte del peligro de <b>descarga eléctrica</b> que puede provocar <b>lesiones corporales</b> a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.</i>
<i>français</i>	<i>Ce symbole vous avertit d'un risque <b>d'électrocution</b> pouvant occasionner des <b>dommages corporels</b> à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.</i>
<i>italiano</i>	<i>Questo simbolo vi mette in guardia da <b>folgorazione</b> che può causare <b>incidenti a voi stessi o ad altre persone</b>. Troverete informazioni su tali circostanze in un riquadro come questo.</i>
<i>Nederlands</i>	<i>Dit symbool maakt U attent op het risico van <b>electrische schokken</b> die tot <b>verwondingen</b> voor Uzelf of anderen kan leiden. Bijzonderheden over deze omstandigheden staan in een kader zoals dit.</i>
<i>português</i>	<i>Este símbolo alerta para um risco de um <b>choque eléctrico</b> que poderá causar um <b>ferimento ao usuário</b>. Detalhes referentes a estas circunstâncias encontram-se referidos numa caixa como esta.</i>
<i>suomea</i>	<i>Tämä symboli haluaa kiinnittää huomiotasi <b>sähköiskun</b> vaaraan , jonka seurauksena voi olla itsesi tai muiden <b>henkilöiden loukkaantuminen</b>. Yksityiskohtaisia tietoja tällaisista tapauksista on tämäntapaisessa ruudussa.</i>
<i>svenska</i>	<i>Denna symbol används för situationer där det finns risk för <b>elektriska stötar</b> som kan ge <b>personskador</b> om användaren inte följer anvisningarna. Detaljerad information ges i en ruta som denna.</i>

	<p>This symbol alerts you to the risk of <b>hot surfaces</b> that could cause <b>personal injury</b> to yourself or other persons. Details about these circumstances are in a box like this one.</p>
<i>dansk</i>	<p>Dette symbol gør Dem opmærksom på risikoen for <b>varme overflader</b>, som kan medføre <b>kvæstelser</b> af Dem selv eller andre personer. Detaljer vedrørende disse omstændigheder er indrammet på tilsvarende måde som denne henvisning.</p>
<i>Deutsch</i>	<p>Dieses Symbol warnt vor Gefahr durch <b>heiße Oberflächen</b>, durch die Sie oder andere Personen <b>verletzt</b> werden können. Einzelheiten darüber sind in einem Rahmen wie diesem angegeben.</p>
<i>español</i>	<p>Este símbolo le advierte del peligro de que las <b>superficies candentes</b> provoquen <b>quemaduras</b> a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.</p>
<i>français</i>	<p>Ce symbole vous avertit d'un risque de <b>surfaces chaudes</b> pouvant occasionner des <b>dommages corporels</b> à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.</p>
<i>italiano</i>	<p>Questo simbolo vi mette in guardia da <b>superfici molto calde</b> che possono causare <b>incidenti a voi stessi o ad altre persone</b>. Troverete informazioni su tali circostanze in un riquadro come questo.</p>
<i>Nederlands</i>	<p>Dit symbool maakt U attent op het risico van <b>hete oppervlaktes</b> dat tot <b>verwondingen</b> voor Uzelf of anderen kunnen leiden. Bijzonderheden over deze omstandigheden staan in een kader zoals dit.</p>
<i>português</i>	<p>Este símbolo alerta para um risco de <b>superfícies quentes</b> que poderão causar um <b>ferimento ao usuário</b>. Detalhes referentes a estas circunstâncias encontram-se referidos numa caixa como esta.</p>
<i>suomea</i>	<p>Tämä symboli haluaa kiinnittää huomiotasi <b>kuumiin pintoihin</b>, joiden seurauksena voi olla itsesi tai muiden <b>henkilöiden loukkaantuminen</b>. Yksityiskohtaisia tietoja tällaisista tapauksista on tämäntapaisessa ruudussa.</p>
<i>svenska</i>	<p>Denna symbol används för situationer där det finns risk för <b>varma ytor</b> som kan ge <b>personskador</b> om användaren inte följer anvisningarna. Detaljerad information ges i en ruta som denna.</p>





This symbol alerts you to the risk of **ultraviolet radiation** that could cause **eye damage** to yourself or other persons.  
Details about these circumstances are in a box like this one.

<i>dansk</i>	<i>Dette symbol gør Dem opmærksom på risikoen for <b>ultraviolet stråling</b>, som kan medføre <b>ødelæggelse af øjnene</b> for Dem selv eller andre personer. Detaljer vedrørende disse omstændigheder er indrammet på tilsvarende måde som denne henvisning.</i>
<i>Deutsch</i>	<i>Dieses Symbol warnt vor Gefahr durch <b>UV-Strahlung</b>, die bei Ihnen oder anderen Personen zu <b>Augenverletzungen</b> führen können. Einzelheiten darüber sind in einem Rahmen wie diesem angegeben.</i>
<i>español</i>	<i>Este símbolo le advierte del peligro de que usted u otras personas sufran <b>lesiones en los ojos</b> a consecuencia de la <b>radiación ultravioleta</b>. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.</i>
<i>français</i>	<i>Ce symbole vous avertit d'un risque de <b>rayonnement ultraviolet</b> pouvant occasionner des <b>lésions oculaires</b> à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.</i>
<i>italiano</i>	<i>Questo simbolo vi mette in guardia da <b>radiazione ultravioletta</b> che può causare <b>lesioni agli occhi a voi stessi o ad altre persone</b>. Troverete informazioni su tali circostanze in un riquadro come questo.</i>
<i>Nederlands</i>	<i>Dit symbool maakt U attent op het risico van <b>ultraviolette straling</b> dat tot <b>verwondingen</b> voor Uzelf of anderen kan leiden. Bijzonderheden over deze omstandigheden staan in een kader zoals dit.</i>
<i>português</i>	<i>Este símbolo alerta para um risco de <b>radiação ultravioleta</b> que poderá causar <b>ferimentos aos olhos</b> do usuário. Detalhes referentes a estas circunstâncias encontram-se referidos numa caixa como esta.</i>
<i>suomea</i>	<i>Tämä symboli haluaa kiinnittää huomiotasi <b>ultraviolettisäteilyn</b> vaaraan, jonka seurauksena voi olla <b>silmävammat</b> itsellesi tai muille henkilöille. Yksityiskohtaisia tietoja tällaisista tapauksista on tämäntapaisessa ruudussa.</i>
<i>svenska</i>	<i>Denna symbol används för situationer där det finns risk för <b>ultraviolett strålning</b> som kan ge <b>ögonskador</b> om användaren inte följer anvisningarna. Detaljerad information ges i en ruta som denna.</i>

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**Caution:**

The term CAUTION alerts you to situations that could result in **serious damage to the instrument** or other equipment.

Details about these circumstances are described in a message similar to this one.

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*dansk*

**Bemærk:**

Angivelsen CAUTION (BEMÆRK) gør Dem opmærksom på situationer, som kan medføre **alvorlig ødelæggelse af apparatet** eller andet udstyr.

Detaljer vedrørende disse omstændigheder er beskrevet i henvisninger svarende til denne.

*Deutsch*

**Achtung:**

Der Ausdruck CAUTION (ACHTUNG) warnt vor Situationen, die eine **ernste Beschädigung des Geräts** oder anderer Systemteile zur Folge haben können. Einzelheiten darüber sind auf die gleiche Weise wie dieser Text hervorgehoben.

*español*

**Advertencia:**

El término CAUTION (ADVERTENCIA) le previene de situaciones que pueden provocar **averías graves en éste u otros equipos**.

En los recuadros como éste se proporciona información sobre este tipo de circunstancias.

*français*

**Attention:**

Le terme CAUTION (ATTENTION) vous signale des situations susceptibles de provoquer de **graves détériorations de l'instrument** ou d'autre matériel.

Les détails sur ces circonstances figurent dans un message semblable à celui-ci.

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→ **Caution** (continued)

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<i>italiano</i>	<b>Attenzione:</b> <i>Con il termine CAUTION (ATTENZIONE) vi si mette in guardia da situazioni che possono comportare il serio danneggiamento della strumentazione o di altre apparecchiature. Troverete informazioni su tali circostanze in un riquadro come questo.</i>
<i>Nederlands</i>	<b>Let op:</b> <i>De term CAUTION (LET OP) maakt U attent op situaties die tot ernstige beschadigingen aan het instrument of andere apparaten kunnen leiden. Bijzonderheden over deze omstandigheden worden beschreven in een mededeling gelijk aan.</i>
<i>português</i>	<b>Atenção:</b> <i>O termo CAUTION (ATENÇÃO) alerta para situações que poderão causar danificação do aparelho. Detalhes referentes a estas circunstâncias encontram-se referidos numa caixa como esta.</i>
<i>suomea</i>	<b>Huomio:</b> <i>CAUTION (HUOMIO) haluaa kiinnittää huomiotasi tilanteisiin, joiden seurauksena voi olla laitteen tai muiden varusteiden vakava vaurioituminen. Tällaiset tapaukset selostetaan yksityiskohtaisesti tämälntapaisessa huomautuksessa.</i>
<i>svenska</i>	<b>Observera:</b> <i>Termen CAUTION (OBSERVERA) skall göra användaren uppmärksam på att apparaten eller annan utrustning kan ta allvarlig skada om anvisningarna inte följs. Detaljerad information ges i en ruta som denna.</i>

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	<b>Warning: Unauthorized Adjustments and Servicing</b>	W1.2
	Only a Perkin Elmer service engineer or similarly trained and authorized person should be permitted to service the instrument.	
	<ul style="list-style-type: none"> <li>Do not attempt to make adjustments, replacements, repairs, or modifications to this instrument except as described in the documentation supplied with the instrument.</li> </ul>	
dansk	<b>Advarsel: Ikke-tilladte indstillinger og arbejder på apparatet</b>	
	Vedligeholdelse af apparatet er kun tilladt for Perkin Elmer kundeservice-ingeniøren eller tilsvarende uddannede og autoriserede personer.	
	<ul style="list-style-type: none"> <li>Prøv ikke på at foretage indstillinger, udskiftninger, reparationer eller ændringer af apparatet, som ikke er beskrevet i den dokumentation, der er vedlagt apparatet.</li> </ul>	
Deutsch	<b>Warnung: Unzulässige Arbeiten am Gerät</b>	
	Wartungs- oder Reparaturarbeiten oder Justierungen, die in der Benutzerdokumentation zum Gerät nicht beschrieben sind, dürfen nur vom Perkin Elmer Kundendienst oder von entsprechend ausgebildeten und autorisierten Fachkräften ausgeführt werden.	
español	<b>Advertencia: Ajustes y servicios sin autorización</b>	
	Tan sólo un ingeniero de Servicio Técnico de Perkin Elmer o una persona de formación y autorización similares podrán realizar trabajos de revisión y mantenimiento del instrumento.	
	<ul style="list-style-type: none"> <li>No intente realizar ningún tipo de ajuste, sustitución o reparación en este aparato, a excepción de lo descrito en la Documentación del Usuario que se adjunta.</li> </ul>	
français	<b>Danger: Réglages et entretien non autorisés</b>	
	Seul un ingénieur du service après vente Perkin Elmer ou une personne autorisée et de même formation sont autorisées à intervenir sur l'instrument.	
	<ul style="list-style-type: none"> <li>Ne pas essayer d'effectuer des réglages, des remplacements, des réparations ou des modifications sur cet instrument d'une manière autre que celle décrite dans la documentation fournie avec l'instrument.</li> </ul>	



→ **Warning** (continued)

W1.2

<i>italiano</i>	<p><b>Pericolo: Regolazioni e manutenzione non autorizzati</b> L'asservimento dello strumento è permesso esclusivamente ad un tecnico di assistenza della Perkin Elmer oppure da simile persona addestrata e autorizzata.</p> <ul style="list-style-type: none"> <li>• Non provare ad eseguire regolazioni, sostituzioni, riparazioni o modifiche a questo strumento se non come descritto nella documentazione allegata allo strumento.</li> </ul>
<i>Nederlands</i>	<p><b>Waarschuwing: Ongeautoriseerde aanpassingen en service</b> Alleen een Perkin Elmer service-monteur of een gelijksoortig opgeleid en geautoriseerd persoon mag service verlenen aan het instrument.</p> <ul style="list-style-type: none"> <li>• Probeer niet zelf aanpassingen aan dit instrument aan te brengen, het te repareren of te veranderen behalve zoals beschreven in de documentatie die bij het instrument geleverd is.</li> </ul>
<i>português</i>	<p><b>Aviso: Trabalhos não permitidos no aparelho</b> Trabalhos de manutenção apenas podem ser executados pelo Serviço Técnico da Perkin Elmer ou por pessoal especializado devidamente formado e autorizado.</p> <ul style="list-style-type: none"> <li>• Não tente realizar ajustamentos, substituições, reparações ou modificações neste aparelho que não estejam descritos na documentação fornecida com o aparelho.</li> </ul>
<i>suomea</i>	<p><b>Varo: Luvattomat säätö - ja huoltotyöt</b> Laitteen huoltotyöt saa antaa vain Perkin Elmer -huoltoteknikoiden tai vastaavasti koulutettujen ja valtuutettujen henkilöiden tehtäväksi.</p> <ul style="list-style-type: none"> <li>• Älä tee muita säätö-, vaihto-, korjaus- tai muutostöitä tässä laitteessa kuin sellaisia, jotka on selostettu laitteen mukana toimitetussa dokumentaatiossa.</li> </ul>
<i>svenska</i>	<p><b>Varning: Icke tillåtna arbeten på apparaten</b> Endast servicepersonal från Perkin Elmer eller personal med liknande utbildning och behörighet får utföra servicearbeten på apparaten.</p> <ul style="list-style-type: none"> <li>• Underhålls- eller reparationsarbeten, justeringar eller ändringar som inte finns beskrivna i användarmanualen till apparaten får inte utföras.</li> </ul>



**Warning: Explosive Atmosphere**

W1.3

*This instrument is not designed for operation in an explosive atmosphere.*

*dansk***Advarsel: Eksplosive omgivelser**

*Dette apparat er ikke konstrueret til brug i eksplosive omgivelser.*

*Deutsch***Warnung: Explosionsfähige Atmosphären**

*Das Gerät darf nicht in explosionsfähigen Atmosphären betrieben werden.*

*español***Advertencia: Atmósfera explosiva**

*Este aparato no está diseñado para utilizarlo en atmósferas explosivas.*

*français***Danger: Atmosphère explosive**

*Cet instrument n'est pas conçu pour fonctionner dans une atmosphère explosive.*

*italiano***Pericolo: Atmosfera esplosiva**

*Questo strumento non è concepito per operare in atmosfera esplosiva.*

*Nederlands***Waarschuwing: Explosiegevaarlijke omgevingen**

*Dit instrument mag niet in een explosiegevaarlijke omgeving gebruikt worden.*

*português***Aviso: Atmosferas explosivas**

*O aparelho não pode ser utilizado em atmosferas explosivas.*

*suomea***Varo: Räjähdyksvaarallinen ympäristö**

*Tätä laitetta ei saa käyttää räjähdysvaarallisessa ympäristössä.*

*svenska***Varning: Explosiv atmosfär**

*Apparaten är inte avsedd att användas i explosionsfarliga miljöer.*

	<b>Warning: Risk of injury through lifting</b>	W1.4
	<p>The instrument weighs approximately 190 kg. Improper lifting can cause painful and sometimes permanent back injury.</p> <ul style="list-style-type: none"> <li>• Use proper lifting techniques to lift or move the instrument.</li> <li>• Use proper lifting techniques and always use the handles to lift or move the instrument.</li> </ul>	
dansk	<p><b>Advarsel: Risiko for kvæstelser ved at løfte</b> Apparatet vejer omtrent 190 kg. Hvis det løftes forkert, kan det forårsage smertefulde og til tider permanente rygskader.</p> <ul style="list-style-type: none"> <li>• Benyt korrekte løfteanordninger til at løfte eller flytte apparatet.</li> <li>• Benyt en korrekt løfteteknik og brug altid håndtagene til at løfte eller flytte apparatet.</li> </ul>	
Deutsch	<p><b>Warnung: Verletzungsgefahr durch Heben einer schweren Last</b> Das Gerät hat eine Masse von ca. 190 kg. Falsches Anheben kann schmerzhafte und unter Umständen bleibende Rückenschäden zur Folge haben.</p> <ul style="list-style-type: none"> <li>• Wenden Sie zum Anheben oder Bewegen des Geräts nur geeignete Techniken an.</li> <li>• Wenden Sie zum Anheben oder Bewegen des Geräts nur geeignete Techniken an und benutzen Sie immer die Tragegriffe.</li> </ul>	
español	<p><b>Advertencia: Peligro de lesiones por alzamiento</b> El aparato pesa 190 kg aproximadamente. Si lo alza de manera indebida puede sufrir usted lesiones dolorosas y en ciertos casos permanentes en la espalda.</p> <ul style="list-style-type: none"> <li>• Aplique técnicas apropiadas para alzar o mover el aparato.</li> <li>• Aplique técnicas apropiadas de alzado y no deje de usar jamás las manijas para alzar o mover el aparato.</li> </ul>	
français	<p><b>Danger: Risque de blessure lors de la manutention</b> L'instrument pèse environ 190 kg. Une manipulation incorrecte peut entraîner des douleurs au dos risquant de perdurer.</p> <ul style="list-style-type: none"> <li>• Utiliser des techniques de levage appropriées pour lever ou déplacer l'instrument.</li> <li>• Utiliser des techniques de levage appropriées et utiliser toujours les poignées pour lever ou déplacer l'instrument.</li> </ul>	





→ <b>Warning</b> (continued)		W1.4
<i>italiano</i>	<p><b>Pericolo: Rischio di infortunio in caso di sollevamento</b>            Lo strumento pesa all'incirca 190 kg.            Se sollevato senza le dovute precauzioni è possibile che si causino dolorosi e permanenti infortuni alla schiena.</p> <ul style="list-style-type: none"> <li>• Muovere o sollevare lo strumento utilizzando le oopportune tecniche di sollevamento e di spostamento.</li> <li>• Usare le giuste tecniche di sollevamento ed utilizzare sempre le manopole per sollevare o spostare lo strumento.</li> </ul>	
<i>Nederlands</i>	<p><b>Waarschuwing: Kans op letsel door optillen</b>            Het instrument weegt ongeveer 190 kg.            Op een onjuiste manier tillen kan tot pijnlijk en soms permanent rugletsel leiden.</p> <ul style="list-style-type: none"> <li>• Til of verzet het instrument op de juiste manier.</li> <li>• Til op de juiste manier en gebruik altijd de handvaten om het instrument op te tillen of te verplaatsen.</li> </ul>	
<i>português</i>	<p><b>Aviso: Risco de ferimento ao levantar o aparelho</b>            O aparelho pesa aprox. 190 kg.            O seu levantamento incorrecto poderá causar ferimentos dolorosos e por vezes permanentes nas costas.</p> <ul style="list-style-type: none"> <li>• Use meios de levantamento adequados para levantar ou movimentar o aparelho.</li> <li>• Use meios de levantamento adequados utilize sempre os manípulos para levantar ou movimentar o aparelho.</li> </ul>	
<i>suomea</i>	<p><b>Varo: Loukkaantumisvaara laitetta nostettaessa</b>            Laite painaa noin 190 kg.            Epäasianmukaisesta nostamisesta voi olla seurauksena kivuliaat ja mahdollisesti pysyvät selkävammat.</p> <ul style="list-style-type: none"> <li>• Käytä asianmukaista nostotekniikkaa laitteen nostamisessa ja siirtämisessä.</li> <li>• Käytä asianmukaista nostotekniikkaa ja tartu aina kahvoihin, kun nostat tai siirrät laitetta.</li> </ul>	
<i>svenska</i>	<p><b>Varning: Risk för personskada vid lyft</b>            Apparaten väger ca 190 kg.            Felaktiga lyft kan ge svåra och ibland bestående ryggskador.</p> <ul style="list-style-type: none"> <li>• Använd rätt lyftteknik när apparaten skall lyftas eller flyttas.</li> <li>• Använd rätt lyftteknik och använd alltid handtagen när apparaten skall lyftas eller flyttas.</li> </ul>	



**Warning: Electrical Hazard**

Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective conductor (earth/ground) terminal is likely to make the instrument dangerous.

Intentional interruption is prohibited.

**Lethal voltages are present in the instrument**

- Even with the power switch off, line power voltages can still be present within the instrument.
- When the instrument is connected to line power, terminals may be live, and opening covers or removing parts (except those to which access can be gained without use of a tool) is likely to expose live parts.
- Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.

dansk

**Advarsel: Fare på grund af elektricitet**

Enhver afbrydelse af beskyttelseslederen inde i eller udenpå apparatet eller fjernelse af beskyttelseslederen (jord/stel) kan gøre apparatet farligt.

Bevidst afbrydelse er forbudt.

**Der er livsfarlige spændinger i apparatet**

- Selv når hovedafbryderen er slået fra, kan der stadig være netstrømsspændinger inde i apparatet.
- Når apparatet er tilsluttet til strømmettet, kan enhederne være spændingsførende; hvis man åbner afskærmninger eller fjerner dele (bortset fra de dele, man kan komme frem til uden brug af værktøj), kan spændingsførende dele blive blottet.
- Selv når apparatet er slukket, og strømforbindelsen er afbrudt, kan kondensatorerne i apparatet være ladet med farlig spænding.

Deutsch

**Warnung: Gefährdung durch Elektrizität**

Das Gerät muß zum Betrieb immer geerdet sein. Auf keinen Fall die Schutzleiter im Gerät oder in der Netzzuleitung trennen oder entfernen.

**Gefährliche Spannung im Gerät**

- Auch in ausgeschaltetem Zustand kann an einigen Stellen im Gerät Netzspannung anliegen, wenn das Gerät am Stromnetz angeschlossen ist.
- Auch bei ausgeschaltetem Gerät und getrennter Netzverbindung können Kondensatoren im Gerät noch mit gefährlicher Spannung geladen sein.



→ **Warning** (continued)

W2.1

*español***Advertencia: Peligro eléctrico**

Cualquier interrupción del conductor de protección dentro o fuera del aparato, o la desconexión del terminal del mismo (toma de tierra) pueden ocasionar serios peligros al manejar el equipo.

Prohibida la interrupción intencionada.

**En el aparato existen voltajes letales**

- Incluso con el interruptor desconectado puede haber voltaje dentro del equipo.
- Cuando el aparato se encuentre conectado a la red eléctrica, los terminales pueden estar bajo corriente y éstos quedar expuestos al abrir las cubiertas o al extraer componentes (exceptuando aquellos a los cuales se puede acceder con la mano).
- Los condensadores internos del aparato pueden permanecer cargados incluso cuando el aparato haya sido desconectado del voltaje de línea.

*français***Danger: Risque d'électrocution**

Toute interruption du conducteur de protection à l'intérieur ou à l'extérieur de l'instrument ou déconnexion du raccord du conducteur de protection (terre) peut rendre l'instrument dangereux.

Il est interdit d'interrompre volontairement ce conducteur.

**Tensions résiduelles mortelles dans l'instrument**

- Même lorsque l'interrupteur est sur arrêt, des tension résiduelles peuvent encore être présentes dans l'instrument.
- Lorsque l'instrument est relié au secteur, les raccords peuvent être sous tension, et des parties sous tension peuvent être découvertes en ouvrant des capots ou en retirant des pièces (à l'exception de celles auxquelles il est possible d'accéder manuellement).
- Les condensateurs contenus dans l'instrument peuvent encore être chargés, même si l'instrument a été déconnecté de toutes sources de tension.

*italiano***Pericolo: Rischio di folgorazione**

Qualsiasi interruzione del conduttore di protezione all'interno o all'esterno dello strumento o il suo scollegamento (terra) può rendere pericoloso lo strumento. Qualsiasi interruzione intenzionale è proibita.

**All'interno dello strumento sono presenti tensioni mortali**

- Anche se l'interruttore principale è spento è possibile che all'interno dello strumento siano presenti tensioni simili a quelle di rete.
- Quando lo strumento è collegato alla rete elettrica è possibile che i terminali siano lucidi e scoperti; aprendo i coperchi protettivi o staccando dei componenti (fatta eccezione per quelli a cui è possibile accedere senza l'uso di utensili) è possibile esporre parti lucide.
- Anche dopo che lo strumento è stato scollegato da qualsiasi sorgente di tensione è possibile che i condensatori all'interno dello strumento siano carichi.

→

→ <b>Warning</b> (continued)		W2.1
<i>Nederlands</i>	<p><b>Waarschuwing: Risico's door electriciteit</b>  <i>Het instrument moet voor de werking altijd geaard zijn. In geen geval mag de aarding van het instrument of de netvoeding worden onderbroken of worden verwijderd.</i></p> <p><b>Er zijn dodelijke voltages in het instrument aanwezig</b></p> <ul style="list-style-type: none"> <li>– Ook in uitgeschakelde toestand kan, wanneer het instrument op de netvoeding is aangesloten, op sommige plaatsen in het instrument netspanning staan.</li> <li>– Als het instrument aan lijnvoeding is aangesloten, kan er nog steeds op sommige aansluitpunten netspanning staan, en door het openen van deksels of het verwijderen van onderdelen (behalve die waartoe men toegang heeft zonder gereedschap te gebruiken) kunnen onderdelen die onder spanning staan tevoorschijn komen.</li> <li>– Ook bij uitgeschakeld instrument en in een onderbroken netvoeding kunnen condensatoren in het instrument nog een gevaarlijke lading bevatten.</li> </ul>	
<i>português</i>	<p><b>Aviso: Perigo por electricidade</b>  <i>Qualquer interrupção dos condutores de protecção à terra no interior ou exterior do aparelho ou o desligamento do condutor de protecção à terra (terra/massa) tornará o aparelho perigoso. Qualquer interrupção deliberada é proibida.</i></p> <p><b>Tensão perigosa no aparelho</b></p> <ul style="list-style-type: none"> <li>– Mesmo desligado, o aparelho poderá ainda ter tensão de rede em alguns pontos enquanto estiver ligado à rede de corrente.</li> <li>– Enquanto o aparelho estiver ligado à alimentação de corrente os terminais podem estar sob corrente, e o abrir de coberturas ou o retirar de peças (excepto aquelas às quais se pode ter acesso sem ter de usar ferramenta) poderá expor peças sob corrente.</li> <li>– Mesmo com o aparelho desligado e a ligação à rede de corrente interrompida, os condensadores dentro do aparelho ainda poderão ter uma tensão perigosa aplicada.</li> </ul>	



→ <b>Warning</b> (continued)		W2.1
<i>suomea</i>	<p><b>Varo: Vaarana sähkö</b>  Jos suojajohdin keskeytetään laitteen sisä- tai ulkopuolella tai suojajohtimen liitin (maadoitus) irrotetaan, laitteesta tulee vaarallinen. Suojajohtimen tahallinen keskeytys on kielletty.</p> <p><b>Laitteessa on hengenvaarallista jännitettä.</b></p> <ul style="list-style-type: none"> <li>– Vaikka pääkytkin olisikin kytketty pois päältä, laitteessa voi olla vielä paikoittain varautunutta verkkovirtajännitettä.</li> <li>– Verkkovirtaan liitetyn laitteen liittimissä voi olla jännitettä. Jos suojakannet avataan tai osia poistetaan, tällöin voidaan joutua kosketukseen jännitettä johtavien osien kanssa (poikkeuksena osat, joihin pääsee käsiksi ilman työkaluja).</li> <li>– Laitteen sisässä olevat kondensaattorit voivat olla vielä varautuneita, vaikka laite olisikin kytketty irti kaikista jännitelähteistä.</li> </ul>	
<i>svenska</i>	<p><b>Varning: Fara p g a elektricitet</b>  Apparaten skall alltid vara jordad.  Man får inte under några omständigheter bryta eller avlägsna jordledaren i apparaten eller strömkretsen.</p> <p><b>Livsfarlig spänning i apparaten</b></p> <ul style="list-style-type: none"> <li>– Även när apparaten är avstängd kan nätspänning förekomma inuti apparaten.</li> <li>– När apparaten är ansluten till elnätet kan uttagen i apparaten vara spänningsförande. Om man öppnar höljen eller tar bort delar (förutom de som är åtkomliga utan verktyg) kan spänningsförande delar bli åtkomliga.</li> <li>– Även när apparaten är avstängd och skild från elnätet kan kondensatorerna i apparaten vara laddade med farlig spänning.</li> </ul>	

**Warning: Electrical Hazard**

- To prevent potential injury to yourself and damage to the instrument, switch OFF all instruments in the system and disconnect them from the line power supply before you perform the procedures described below.

dansk

**Advarsel: Fare på grund af elektricitet**

- For at undgå faren for kvæstelser for Dem selv og faren for beskadigelse af apparatet, skal alle apparater i systemet være SLUKKET, og strømforbindelsen skal være skilt, inden De udfører de arbejder, som er beskrevet nedenfor.

Deutsch

**Warnung: Gefährdung durch Elektrizität**

- Um Verletzungsgefahr durch elektrische Spannung und Beschädigungsgefahr der Geräte zu vermeiden, schalten Sie alle Geräte des Meßplatzes AUS und trennen Sie die Netzverbindungen, bevor Sie irgendwelche elektrischen Verbindungen herstellen oder ändern.

español

**Advertencia: Peligro eléctrico**

- Para evitar posibles daños personales y al equipo, apague todos los módulos del sistema y desconéctelos de la toma de corriente antes de ejecutar las operaciones descritas más abajo.

français

**Danger: Risque d'électrocution**

- Afin d'éviter des blessures éventuelles et des détériorations de l'instrument, mettez tous les instruments du système hors tension et les déconnectez de l'alimentation secteur avant d'exécuter les procédures décrites ci-après.

italiano

**Pericolo: Rischio di folgorazione**

- Prima di procedere alle operazioni descritte sotto, per prevenire lesioni personali o danni allo strumento, spegnete tutti gli strumenti all'interno del sistema e scollegateli dall'alimentazione elettrica.

Nederlands

**Waarschuwing: Risico's door electriciteit**

- Om gevaar voor letsel aan Uzelf en beschadiging aan het instrument te voorkomen, schakelt U voordat U de handelingen verricht die hieronder zijn beschreven, alle instrumenten UIT en ontkoppelt U de netvoeding.




→ <b>Warning</b> (continued)		W2.3
<i>português</i>	<b>Aviso: Perigo por electricidade</b> <ul style="list-style-type: none"><li>• A fim de evitar o perigo de ferimento por tensão eléctrica e o perigo de danificação dos aparelhos, <b>DESLIGUE</b> todos os aparelhos do sistema e interrompa as ligações à rede antes de realizar os trabalhos seguidamente referidos.</li></ul>	
<i>suomea</i>	<b>Varo: Vaarana sähkö</b> <ul style="list-style-type: none"><li>• Jotta loukkaantumisilta ja laitevaurioilta vältytään, kytke kaikki järjestelmän laitteet <b>POIS PÄÄLTÄ</b> ja erota ne verkkovirrasta, ennen kuin suoritat jäljempänä selostettuja toimenpiteitä.</li></ul>	
<i>svenska</i>	<b>Varning: Fara p g a elektricitet</b> <ul style="list-style-type: none"><li>• För att undvika eventuella personskador och skador på apparaten skall samtliga apparater stängas AV och skiljas från elnätet innan du utför något av nedanstående arbeten.</li></ul>	

	<b>Warning: Electrical Hazard</b>	W2.9
	<ul style="list-style-type: none"> <li>• Use only fuses with the correct current rating and of the specified type for replacement.</li> <li>• Do not use makeshift fuses and do not short-circuit the fuse holders.</li> </ul>	
<i>dansk</i>	<b>Advarsel: Fare på grund af elektricitet</b> <ul style="list-style-type: none"> <li>• Sikringerne må kun udskiftes med sikringer med den korrekte spændingsstyrke og af den angivne type.</li> <li>• Benyt ikke nødsikringer, og undlad at kortslutte sikringsholderne.</li> </ul>	
<i>Deutsch</i>	<b>Warnung: Gefährdung durch elektrischen Strom</b> <ul style="list-style-type: none"> <li>• Verwenden Sie nur Sicherungen des gleichen Typs und mit der angegebenen Belastbarkeit.</li> <li>• Verwenden Sie keine Behelfssicherung und schließen Sie nicht den Sicherungshalter kurz.</li> </ul>	
<i>español</i>	<b>Advertencia: Peligro eléctrico</b> <ul style="list-style-type: none"> <li>• Utilice únicamente fusibles con el amperaje correcto y con el tipo especificado para su reemplazo.</li> <li>• No use fusibles improvisados ni cortocircuite los portafusibles.</li> </ul>	
<i>français</i>	<b>Danger: Risque d'électrocution</b> <ul style="list-style-type: none"> <li>• N'utiliser pour le remplacement que des fusibles d'ampérage correct et de type spécifié.</li> <li>• Ne pas utiliser de fusibles provisoires et ne pas court-circuiter les porte-fusibles.</li> </ul>	
<i>italiano</i>	<b>Pericolo: Rischio di folgorazione</b> <ul style="list-style-type: none"> <li>• Se necessario sostituirli, utilizzare esclusivamente fusibili di corretto tipo e valore.</li> <li>• Non utilizzare fusibili di fattura artigianale e non cortocircuitare i tienifusibili.</li> </ul>	





→ <b>Warning</b> (continued)		W2.9
<i>Nederlands</i>	<p><b>Waarschuwing: Risico's door electriciteit</b></p> <ul style="list-style-type: none"> <li>• Gebruik ter vervanging alleen zekeringen met het juiste stroombereik en van het aangegeven soort.</li> <li>• Gebruik geen noodzekeringen en sluit de zekeringhouders niet kort.</li> </ul>	
<i>português</i>	<p><b>Aviso: Perigo por electricidade</b></p> <ul style="list-style-type: none"> <li>• Ao substituí-los, use apenas fusíveis com a amperagem correcta e do tipo especificado.</li> <li>• Não use fusíveis provisórios e não curto-circuite os porta-fusíveis.</li> </ul>	
<i>suomea</i>	<p><b>Varo: Vaarana sähkö</b></p> <ul style="list-style-type: none"> <li>• Käytä vaihtosulakkeina vain sulakkeita, jotka on mitoitettu oikealle virran voimakkuudelle ja joiden tyyppi on ohjeiden mukainen.</li> <li>• Älä käytä apusulakkeita äläkä oikosulje sulakealustoja.</li> </ul>	
<i>svenska</i>	<p><b>Varning: Fara p g a elektricitet</b></p> <ul style="list-style-type: none"> <li>• Använd endast rätt typ av säkringar med korrekt strömvärde vid byte.</li> <li>• Använd inte provisoriska säkringar och kortslut inte säkringshållaren.</li> </ul>	

	<p style="text-align: right;">W5.7</p> <p><b>Warning: Acetylene – Explosion Hazard</b>          Acetylene can decompose explosively at pressures higher than 103 kPa / 1.03 bar / 15 psig.          • Always make sure that the acetylene outlet gauge pressure is below this value.</p>
<p><i>dansk</i></p>	<p><b>Advarsel: Acetylen – Eksplosionsfare</b>          Acetylen kan nedbrydes eksplosionsagtigt ved tryk over 103 kPa / 1.03 bar / 15 psig.          • Forvis Dem altid om, at acetylen-udgangsmåletrykket ligger under denne værdi.</p>
<p><i>Deutsch</i></p>	<p><b>Warnung: Acetylen – Explosionsgefahr</b>          • Stellen Sie für Acetylen keinen höheren Ausgangsdruck als 103 kPa (1,03 bar) ein. Bei höheren Drücken kann Acetylen spontan zerfallen und explodieren.</p>
<p><i>español</i></p>	<p><b>Advertencia: Acetileno – Peligro de explosión</b>          El acetileno puede descomponerse y ocasionar explosiones a presiones superiores a 103 kPa / 1.03 bar / 15 psig.          • Tenga cuidado siempre de mantener la presión del manómetro de acetileno por debajo de este valor.</p>
<p><i>français</i></p>	<p><b>Danger: Acétylène – Risque d'explosion</b>          L'acétylène peut se décomposer de manière explosive à des pressions supérieures à 103 kPa / 1.03 bar / 15 psig.          • Toujours vérifier que la pression de l'acétylène sur le manomètre de sortie est inférieure à cette valeur.</p>



→ <b>Warning</b> (continued)		W5.7
<i>italiano</i>	<p><b>Pericolo: Acetilene – Pericolo di esplosione</b> L'acetilene può decomporre in maniera esplosiva a pressioni superiori a 103 kPa / 1.03 bar / 15 psig.</p> <ul style="list-style-type: none"> <li>• Assicuratevi sempre che la lancetta del manometro di uscita dell'acetilene rimanga al di sotto di tali valori.</li> </ul>	
<i>Nederlands</i>	<p><b>Waarschuwing: Acetyleen – Explosiegevaar</b> Acetyleen kan spontaan ontbinden bij een druk hoger dan 103 kPa / 1.03 bar / 15 psig.</p> <ul style="list-style-type: none"> <li>• Zorg er altijd voor dat de druk van de acetyleen-uitlaatmeter niet boven deze waarde uitkomt.</li> </ul>	
<i>português</i>	<p><b>Aviso: Acetileno – perigo de explosão</b> Se a pressão for superior a 103 kPa / 1.03 bar / 15 psig, o acetileno poderá desintegrar-se de repente e explodir.</p> <ul style="list-style-type: none"> <li>• Assegure-se de que o manómetro de pressão de saída do acetileno indica sempre uma pressão inferior a este valor.</li> </ul>	
<i>suomea</i>	<p><b>Varo: Asetyleeni – räjähdysvaara</b> Asetyleeni voi hajota räjähdysenomaisesti, jos paine on suurempi kuin 103 kPa (1.03 bar).</p> <ul style="list-style-type: none"> <li>• Varmistu aina siitä, että asetyleenin lähtöpaine painemittarissa on alle tämän arvon.</li> </ul>	
<i>svenska</i>	<p><b>Varning: Acetylen – explosionrisk</b> Acetylen får inte utsättas för högre tryck än 103 kPa / 1,03 bar / 15 psig. Vid högre tryck bryts acetylenet ned och kan explodera.</p> <ul style="list-style-type: none"> <li>• Se till att utgångstrycket för acetylen ligger under detta värde.</li> </ul>	

	<b>Warning: Flashback Hazard</b>	W5.9
	<p>Perkin Elmer burner systems are designed for use with compressed air. The use of oxygen can cause an explosion in the burner system, and oxygen-enriched air can cause a flashback of the flame.</p>	
	<ul style="list-style-type: none"> <li>• Never use oxygen or oxygen-enriched air with Perkin Elmer burner systems. Use only compressed air.</li> </ul>	
dansk	<p><b>Advarsel: Flammetilbagestød</b>  Perkin Elmer brændersystemer er beregnet til brug med trykluft. Brugen af ilt kan forårsage en eksplosion i brændersystemet, og luft med ilttilsætning kan forårsage et flammetilbagestød.</p> <ul style="list-style-type: none"> <li>• Benyt aldrig ilt eller luft med ilttilsætning ved Perkin Elmer brændersystemer. Benyt kun trykluft.</li> </ul>	
Deutsch	<p><b>Warnung: Sauerstoff und mit Sauerstoff angereicherte Luft</b>  • Verwenden Sie für Perkin Elmer Brenner nur Druckluft. Sauerstoff oder sogenannte 'Atemluft' sind nicht zulässig. Bei Verwendung von Sauerstoff besteht Explosionsgefahr. Mit Sauerstoff angereicherte Luft kann einen Flammenrückschlag verursachen.</p>	
español	<p><b>Advertencia: Peligro de retroceso de la llama</b>  Los sistemas Perkin Elmer de mecheros están diseñados para funcionar con aire comprimido. El empleo de oxígeno puede ocasionar una explosión en el sistema de mecheros y el aire enriquecido con oxígeno puede provocar la retrogresión de la llama.</p> <ul style="list-style-type: none"> <li>• No use nunca oxígeno ni aire enriquecido con oxígeno al trabajar con sistemas de mecheros Perkin Elmer. Use siempre aire comprimido.</li> </ul>	
français	<p><b>Danger: Risque de retour de flamme</b>  Les systèmes de brûleurs Perkin Elmer sont conçus pour être utilisés avec de l'air comprimé. L'utilisation d'oxygène peut provoquer une explosion dans le système de brûleur, et l'air suroxygéné peut provoquer un retour de flamme.</p> <ul style="list-style-type: none"> <li>• Ne jamais utiliser d'oxygène ou d'air suroxygéné avec les systèmes de brûleurs Perkin Elmer. N'utiliser que l'air comprimé.</li> </ul>	



→ **Warning** (continued)

W5.9

<i>italiano</i>	<p><b>Pericolo: Pericolo di ritorno di fiamma</b>  <i>I sistemi di combustione della Perkin Elmer sono concepiti per funzionare con aria compressa. L'uso di ossigeno può causare l'esplosione del sistema di combustione mentre aria arricchita di ossigeno può causare un violento ritorno di fiamma.</i></p> <ul style="list-style-type: none"> <li>• <i>Non utilizzare mai ossigeno o aria arricchita di ossigeno all'interno di sistemi di combustione della Perkin Elmer.</i></li> </ul>
<i>Nederlands</i>	<p><b>Waarschuwing: Terugslag van de vlam</b>  <i>Perkin Elmer brandersystemen zijn ontworpen voor gebruik met perslucht. Bij het gebruik van zuurstof bestaat explosiegevaar in het brandersysteem, en zgn. ademlucht kan een terugslaan van de vlam veroorzaken.</i></p> <ul style="list-style-type: none"> <li>• <i>Gebruik nooit zuurstof of zgn. ademlucht voor Perkin Elmer brandersystemen. Gebruik alleen perslucht.</i></li> </ul>
<i>português</i>	<p><b>Aviso: Retrocesso da chama</b>  <i>Os sistemas de queimadores Perkin Elmer são concebidos para o uso com ar comprimido. O uso de oxigénio poderá causar uma explosão no sistema do queimador. Ar enriquecido com oxigénio pode causar um retrocesso da chama.</i></p> <ul style="list-style-type: none"> <li>• <i>Nunca utilizar oxigénio ou ar enriquecido com oxigénio em sistemas de queimadores Perkin Elmer. Use unicamente ar comprimido.</i></li> </ul>
<i>suomea</i>	<p><b>Varo: Vaarana liekki takaisinlyönti</b>  <i>Perkin Elmer-poltinjärjestelmät on tarkoitettu käytettäväksi paineilmalla. Hapen käytöstä voi seurata räjähdys poltinjärjestelmässä ja hapen rikastama ilma voi aiheuttaa liekin takaisinlyönnin.</i></p> <ul style="list-style-type: none"> <li>• <i>Älä koskaan käytä hapetta tai hapella rikastettua ilmaa Perkin Elmer -poltinjärjestelmissä. Käytä ainoastaan paineilmaa.</i></li> </ul>
<i>svenska</i>	<p><b>Varning: Risk för bakeld</b>  <i>Perkin Elmers brännarsystem är avsedda för användning med tryckluft. Syre kan framkalla explosioner i brännarsystemet och syreanrikad luft kan orsaka bakeld.</i></p> <ul style="list-style-type: none"> <li>• <i>Använd inte syre eller syreanrikad luft i Perkin Elmers brännarsystem. Använd endast tryckluft.</i></li> </ul>


	<p style="text-align: right;">W6.1</p> <p><b>Warning: Toxic Gases</b>  <i>If you use nitrogen as the inert gas, toxic cyanogen gas (CN)<sub>2</sub> will be produced when the furnace temperature is above 2300 °C.</i></p> <ul style="list-style-type: none"> <li>• <i>Make sure that the main laboratory fume ventilation system removes all gases and fumes emitted by the furnace.</i></li> </ul>
<i>dansk</i>	<p><b>Advarsel: Giftig forbrændingsgas</b>  <i>Ved anvendelse af kvælstof som inertgas dannes der giftig dicyan (CN)<sub>2</sub> ved ovntemperaturer over 2300 °C.</i></p> <ul style="list-style-type: none"> <li>• <i>Forvis Dem om, at hoved-udsugningsanlægget udsuger de forbrændingsgasser, som emitteres af ovnen.</i></li> </ul>
<i>Deutsch</i>	<p><b>Warnung: Giftiges Abgas</b>  <i>Bei Verwendung von Stickstoff als Inertgas bildet sich bei Ofentemperaturen über 2300 °C giftiges Dicyan (CN)<sub>2</sub>.</i></p> <ul style="list-style-type: none"> <li>• <i>Es muß sichergestellt sein, daß die aus dem Graphitofen austretenden Abgase von der Haupt-Absauganlage sicher abgesaugt werden.</i></li> </ul>
<i>español</i>	<p><b>Advertencia: Gases tóxicos</b>  <i>Si se utiliza nitrógeno puro como gas inerte, al aumentar la temperatura del horno por encima de 2300 °C se producirá gas cianógeno (CN)<sub>2</sub>, que es tóxico.</i></p> <ul style="list-style-type: none"> <li>• <i>Cerciórese de que el sistema principal de extracción de humos elimine todos los gases y humos emitidos por el horno.</i></li> </ul>
<i>français</i>	<p><b>Danger: Gaz toxiques</b>  <i>Si de l'azote est utilisé comme gaz inerte, du gaz cyanogène (CN)<sub>2</sub> toxique se forme lorsque la température du four dépasse 2300 °C.</i></p> <ul style="list-style-type: none"> <li>• <i>Vérifier que le système principal d'extraction des fumées élimine tous les gaz et fumées émis par le four.</i></li> </ul>



→ **Warning** (continued)

W6.1

<i>italiano</i>	<p><b>Pericolo: Gas tossici</b>  <i>Se usate l'azoto quale gas inerte allora, quando il forno raggiunge temperature al di sopra di 2300 °C, si formerà del gas cianogeno tossico (CN)<sub>2</sub>.</i></p> <ul style="list-style-type: none"> <li>• <i>Assicuratevi che l'impianto principale di estrazione fumi del laboratorio elimini tutti i gas e le esalazioni emesse dal forno.</i></li> </ul>
<i>Nederlands</i>	<p><b>Waarschuwing: Giftig afvoergas</b>  <i>Bij gebruik van stikstof als inertegas wordt bij een oventemperatuur van meer dan 2300 °C het giftige dycyaan (CN)<sub>2</sub> gevormd.</i></p> <ul style="list-style-type: none"> <li>• <i>Zorg ervoor dat alle gassen en dampen die uit de grafietoven komen, door de hoofdafzuiging worden afgezogen.</i></li> </ul>
<i>português</i>	<p><b>Aviso: Gás de escape venenoso</b>  <i>Ao utilizar nitrogénio como gás inerte a uma temperatura de forno superior a 2300 °C, forma-se cianeto (CN)<sub>2</sub> venenoso.</i></p> <ul style="list-style-type: none"> <li>• <i>Assegure-se de que os gases de escape que saem do forno são seguramente aspirados pelo sistema exaustor principal.</i></li> </ul>
<i>suomea</i>	<p><b>Varo: Myrkylliset kaasut</b>  <i>Jos käytät inerttikaasuna tyypeä, syntyy myrkyllistä syaanikaasua (CN)<sub>2</sub>, jos uunin lämpötila on yli 2300 °C.</i></p> <ul style="list-style-type: none"> <li>• <i>Varmistu siitä, että laboratorion savunpoistojärjestelmä poistaa kaikki uunista lähtevät kaasut ja savukaasut.</i></li> </ul>
<i>svenska</i>	<p><b>Varning: Giftiga gaser</b>  <i>Om kväve används som inert gas bildas en giftig cyangas (CN)<sub>2</sub> när ugnstemperaturen överstiger 2300 °C.</i></p> <ul style="list-style-type: none"> <li>• <i>Se till att utsugssystemet suger ut alla gaser och ångor som avges i ugnen.</i></li> </ul>

	<div style="text-align: right;">W7.1</div> <p><b>Warning: Strong Magnetic Field</b></p> <ul style="list-style-type: none"> <li>• Do not operate the furnace when persons wearing electronic heart pacemakers, or having other metallic implants, are present.</li> <li>• Anyone wearing a heart pacemaker or having metallic implants should remain at least 0.6 meter away from the furnace – in any direction – while the furnace is operating.</li> </ul>
dansk	<p><b>Advarsel: Stærkt magnetfelt</b></p> <ul style="list-style-type: none"> <li>• Undlad at betjene ovnen, hvis der er personer til stede med elektronisk hjerte-pacemaker eller andre metalliske implantater.</li> <li>• Personer med hjerte-pacemaker eller andre metalliske implantater skal overholde en afstand på mindst 0.6 meter fra ovnen – i alle retninger – mens ovnen er i gang.</li> </ul>
Deutsch	<p><b>Magnetfeld - Lebensgefahr für Herzschrittmacherträger</b></p> <ul style="list-style-type: none"> <li>• Herzschrittmacherträger und Personen mit Metall-Implantaten müssen zum Magneten einen Sicherheitsabstand von mindestens 0,6 m in jeder Richtung um den Magneten einhalten.</li> <li>• Halten sich Herzschrittmacher- oder Metallimplantatträger innerhalb des Sicherheitsabstands von 0,6 m auf, darf der Magnetofen nicht aktiviert werden</li> </ul>
español	<p><b>Advertencia: Campo magnético intenso</b></p> <ul style="list-style-type: none"> <li>• No ponga el horno en funcionamiento cuando haya cerca personas con marcapasos o con prótesis metálicas.</li> <li>• Las personas que tengan marcapasos o prótesis metálicas deben mantener una distancia mínima de 0,6 m del horno (en cualquier dirección) mientras éste se encuentre en funcionamiento.</li> </ul>
français	<p><b>Danger: Champ magnétique intense</b></p> <ul style="list-style-type: none"> <li>• Ne pas faire fonctionner le four en présence de personnes ayant un stimulateur cardiaque ou d'autres implants métalliques.</li> <li>• Tout personne ayant un stimulateur cardiaque ou des implants métalliques doit rester éloignée d'au moins 0,6 m du four pendant le fonctionnement de celui-ci.</li> </ul>





→ **Warning** (continued)

W7.1

<i>italiano</i>	<p><b>Pericolo: Forte campo magnetico</b></p> <ul style="list-style-type: none"> <li>• Non mettete in funzione il forno se sono presenti persone portatrici di pacemaker elettronico o comunque che presentano altri implantati metallici.</li> <li>• Chiunque dovesse essere portatore di pacemaker o di implantati metallici deve soffermarsi ad una distanza minima di 0,6 metri dal forno (in ogni direzione) mentre esso è in funzione.</li> </ul>
<i>Nederlands</i>	<p><b>Waarschuwing: Sterke magnetisch velden</b></p> <ul style="list-style-type: none"> <li>• De oven niet gebruiken als dragers van pacemakers en personen met metalen implantaten aanwezig zijn.</li> <li>• Draggers van een pacemaker of metalen implantaten mogen niet binnen een straal van minimaal 0.6 meter bij de oven komen – in alle richtingen – als de oven in werking is.</li> </ul>
<i>português</i>	<p><b>Aviso: Forte campo magnético</b></p> <ul style="list-style-type: none"> <li>• Não use o forno enquanto estiverem portadores de marca-passo cardíaco ou pessoas com outros implantes metálicos por perto.</li> <li>• Portadores de marca-passo ou pessoas com implantes metálicos devem manter uma distância mínima de 0,6 metros do forno – em todas as direcções – enquanto o forno estiver em funcionamento.</li> </ul>
<i>suomea</i>	<p><b>Varo: Voimakas magneettikenttä</b></p> <ul style="list-style-type: none"> <li>• Älä käytä uunia, jos läsnä on henkilöitä, jotka käyttävät elektronista sydämentahdistinta tai joilla on muita metallisia istutteita.</li> <li>• Kaikkien henkilöiden, joilla on sydämentahdistin tai muita metallisia istutteita, tulee pysyä vähintään 0.6 metrin päässä uunista – joka suuntaan – uunin ollessa käynnissä.</li> </ul>
<i>svenska</i>	<p><b>Varning: Starka magnetfält</b></p> <ul style="list-style-type: none"> <li>• Personer med pacemaker eller metallimplantat får inte vistas i närheten av ugnen när den används.</li> <li>• Personer med pacemaker eller metallimplantat skall hålla ett avstånd på minst 0,6 meter i alla riktningar till ugnen när den används.</li> </ul>







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