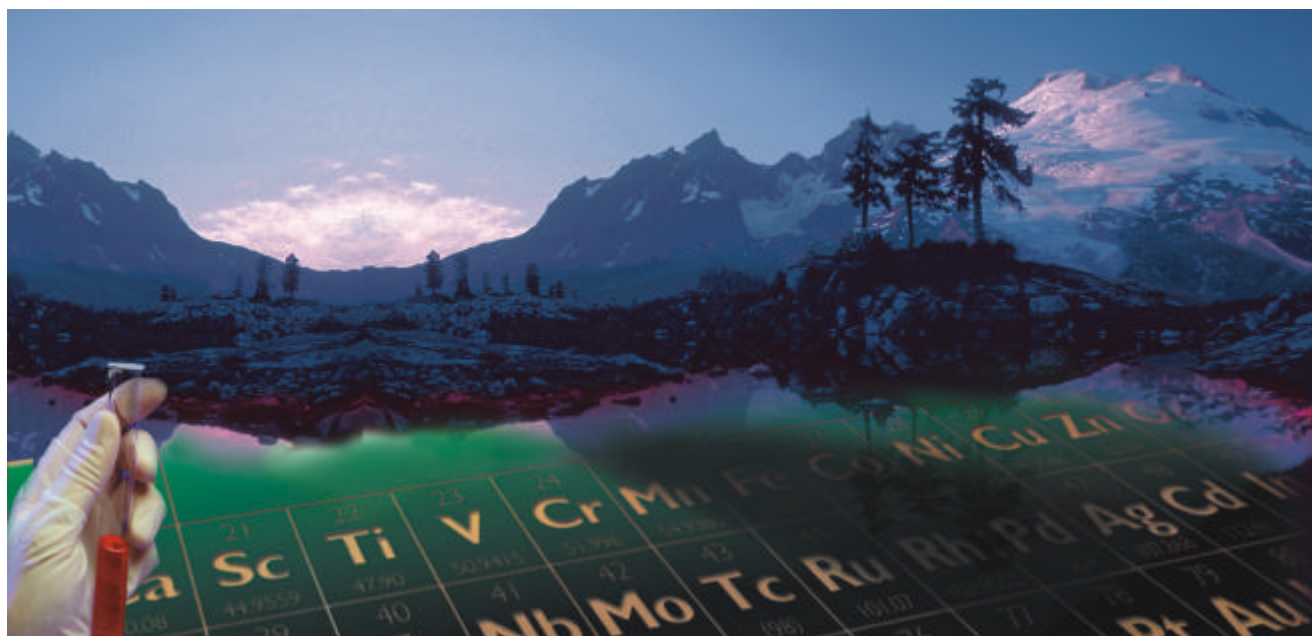




AANALYST 200



User's Guide

AAAnalyst 200 User's Guide



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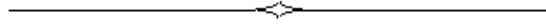
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Introduction 1

About This Manual

For complete safety label information see *AAAnalyst 200 Quick Installation and Setup Guide* (0993-6593). This User's Guide is divided into following chapters:

Chapter 1 Introduction

This chapter contains a brief introduction on the instrument, the conventions and warnings used in the manual.

Chapter 2 Safety Practices

Important safety information for the AAAnalyst 200 is provided in this chapter.

Chapter 3 Preparing Your Laboratory

The preparation of your laboratory needed for the AAAnalyst 200. Laboratory requirements for the instrument are reviewed in this chapter.

Chapter 4 System Description

This chapter contains information on the components of the AAAnalyst 200, how it works and instrument specifications.

Chapter 5 Installation

Information on installing and re-installing your AAAnalyst 200 should you ever need to move your system is provided.

Chapter 6 Setting Up Instrument

Detailed information on how to align, adjust, and optimize the AAAnalyst 200 is provided in this chapter.

Chapter 7 Touch Screens

Detailed information on how to operate the AAAnalyst 200 using the touch screen is provided in this chapter.

Chapter 8 Preparing for an Analyses

Detailed information on how to set up the AAAnalyst 200 for analyses is provided in this chapter.

Chapter 9 Maintenance

Maintenance and cleaning procedures for the various components of your AAAnalyst 200 are provided.

Chapter 10 Troubleshooting

Performance checks, troubleshooting information, software and system error messages are provided for the AAnalyst 200.

Conventions Used in this Manual

Normal text is used to provide information and instructions.

Bold text refers to text that is displayed on the screen.

All eight digit numbers are PerkinElmer part numbers unless stated otherwise.

Notes, cautions and warnings

Three terms, in the following standard formats, are used to highlight special circumstances and warnings.

NOTE: *A note indicates additional, significant information that is provided with some procedures.*

CAUTION

*We use the term CAUTION to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*



WARNING

*We use the term WARNING to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.*

Warning Labels on the Instrument



Caution, hot surface.



Caution, risk of electric shock.

Safety Practices 2

Chapter Overview

This chapter describes the general safety practices and precautions that must be observed when operating the AAAnalyst 200.

This advice is intended to supplement, not supersede, the normal safety codes in the user's country. It is also a supplement to the PerkinElmer standard Safety and Health Policy. 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 analyst and the analyst's organization.

Please consult all manuals supplied with the AAAnalyst 200 and accessories before you start working with the instrument. Carefully read the safety information in this chapter and in the other manuals supplied. When setting up the instrument or performing analyses or maintenance procedures, strictly follow the instructions provided.

Working Safely with AAnalyst 200

Built-in safety

This instrument complies with 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.

Safety interlocks

PerkinElmer provides a number of safety interlocks on its instruments that monitor such things as door locks, gas pressures, and the temperatures of various components. Do not attempt to defeat these interlocks; you may compromise your own, or someone else's, safety.

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 spectrometry instruments. Consult the guides supplied with the instruments before you start.

The persons who use this instrument and perform the routine maintenance must be suitably qualified and have received adequate training. If the instrument requires servicing, only a PerkinElmer service engineer or similarly trained and authorized person must do this.

If you use the instrument in a manner not specified in the user 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.

Precautions



WARNING

Be sure that all instrument operators read and understand the precautions listed below. It is advisable to post a copy of the precautions near or on the instrument.

The following precautions must be observed when using the AAAnalyst 200:


- Be sure that the voltage of the AAAnalyst 200 corresponds to the power line voltage used in your laboratory.
- Never remove the side panels of the AAAnalyst 200 without shutting down the instrument and disconnecting the instrument power cord from line power.
- Only high quality purge gases should be used with the AAAnalyst 200. Minimum purity of 99.9% is recommended. A high quality filter-dryer accessory is recommended for the removal of any moisture from the purge gases.

Hazards with Flame Atomization

This section contains a summary of the hazards associated with the flame atomization technique. For more detailed information see the remaining sections in this safety chapter.

High temperatures

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

	<i>To avoid serious burns, never touch the burner head until it has cooled to room temperature.</i>
WARNING	

Toxic products

- Toxic combustion products can be generated by the system, depending on the type of analyses being performed. You must provide an efficient exhaust venting system to remove toxic products generated during instrument operation.
- The materials in sample and reagent containers, and material that you collect in waste containers may include small amounts of toxic substances that were used in the analyses. You may have to dispose of these as hazardous waste.

UV radiation

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

Always wear UV-absorbing eye protection when viewing:

- The flame, especially the nitrous oxide-acetylene flame.
- Hollow cathode or electrodeless discharge lamps.
- The deuterium background correction lamp.
- 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 drain vessel 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 Conventions in the Hardware Guide

Any of the following safety conventions can be used throughout this guide:



WARNING

This is an example of a warning, a situation that could lead to a personal injury.



WARNING

*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.



WARNING

*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.

CAUTION

*We use the term **CAUTION** to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*

Symbols Used on the Instrument

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



This symbol indicates the risk of electric shock.



This symbol indicates the risk of hot surfaces.



This symbol indicates alternating current.



Indicates the off position of the main power switch.



Indicates the on position of the main power switch.

Safety Practices for Flame Atomization

Safe operation of the flame

Before you ignite the flame make sure that:

- The laboratory exhaust venting system is operating;
- The burner head is installed correctly;
- The burner end cap is secured firmly;
- 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 drain vessel 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 drain vessel 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.
- Empty the drain vessel frequently; especially do not allow the drain vessel 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.

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 or you may be exposed to potentially hazardous UV radiation.
- Always wear UV-absorbing eye protection when viewing:
 - The flame, especially the nitrous oxide-acetylene flame.
 - Hollow cathode or electrodeless discharge lamps.
 - The deuterium background correction lamp.

High Temperatures

Burner system

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.

Quartz tube atomizer

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

- To avoid serious burns, never touch any part of the QTA mount (flame-heated systems) or the QTA until they have cooled to room temperature.

Electrical Safety

The instrument has been designed to protect the operator from potential electrical hazards. This section describes some recommended electrical safety practices.



Lethal voltages are present at certain areas within the instrument. Internal maintenance of the instrument should only be performed by a PerkinElmer service engineer or similarly authorized and trained person. When the instrument is connected to line power, opening the instrument covers is likely to expose live parts. Even when the power switch is off, high voltages can still be present. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.

The instrument must be correctly connected to a suitable electrical supply. The supply must have a correctly installed protective conductor (earth ground) and must be installed or checked by a qualified electrician before connecting the instrument.



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

When working with the instrument:

- Connect the instrument to a correctly installed line power outlet that has a protective conductor connection (earth ground).
- Do not operate the instrument with any covers or internal parts removed.
- Do not attempt to make internal adjustments or replacements except as directed in the manuals.
- 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 PerkinElmer Service engineer or similarly authorized and trained person.
- Whenever it is possible that the instrument is no longer electrically safe for use, make the instrument inoperative and secure it against any unauthorized or unintentional operation. The electrical safety of the instrument is likely to be impaired if, for example, the instrument shows visible damage, has been subjected to prolonged storage under unfavorable conditions or has been subjected to severe stress during transportation.

Compressed Gases

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



WARNING

Warning: Compressed Gases

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

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 ₂ H ₂)	x	x	x
Nitrous Oxide (dinitrogen monoxide, N ₂ O)	x		x

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

Safe Handling of Gas Cylinders

Gases commonly used with the AAAnalyst 200 include acetylene, nitrous oxide, argon and nitrogen. The major hazard associated with these gases is suffocation. This can occur if the gas is allowed to escape in an enclosed area and displaces the oxygen in the air.



Contact the gas supplier for a material safety data sheet (MSDS) containing detailed information on the potential hazards associated with the gas. Carefully use, store, and handle compressed gases in cylinders. Gas cylinders can be hazardous if they are mishandled.

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

If liquid nitrogen is used, the gas cylinder must be fitted with an over-pressure regulator, which will vent the cylinder as necessary to prevent it from becoming a safety hazard.

Listed below are some general safety practices for the proper identification, storage, and handling of gas cylinders. Consult the following references for more detailed information and additional guidelines.

- Compressed Gas Association (USA), "Safe Handling of Compressed Gases in Containers," pamphlet no. P-1, 1984.
- Compressed Gas Association (USA), "The Inert Gases – Argon, Nitrogen and Helium," pamphlet no. P-9, 1992.

Identification of Gas Cylinders

- Legibly mark cylinders to identify their contents. Use the chemical name or commercially accepted name for the gas.

Storing Cylinders

Review the following precautions to ensure the safe use and storage of gas cylinders.

- Cylinders should be stored in accordance with the regulations and standards applicable to the customer's locality, state, and country.
- When cylinders are stored indoors in storage rooms, the storage room should be well ventilated and dry. Ensure that the ventilation is adequate to prevent the formation of dangerous accumulations of gas. This is particularly important in small or confined areas.
- Do not store cylinders near elevators, gangways, or in locations where heavy moving objects may strike or fall against them.

Safety Practices

- Use and store cylinders away from exits and exit routes.
- Locate cylinders away from heat sources, including heat lamps. Compressed gas cylinders should not be subjected to temperatures above 52 °C (126 °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 cylinders standing upright, fastened securely to an immovable bulkhead or permanent wall.
- When storing cylinders outdoors, they should be stored above ground on a suitable floor and protected against temperature extremes (including the direct rays of the sun).
- Mark gas cylinders clearly to identify the contents and status (full, empty, etc.).
- Do not attempt to refill gas cylinders.
- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.
- Perform periodic gas leak tests by applying a soap solution to all joints and seals.

Handling Cylinders

Review the following precautions to ensure the safe use and handling of gas cylinders.

- If it becomes necessary to move cylinders, do so with a suitable hand truck after insuring that the container cap is secured and the cylinder is properly fastened to the hand truck.
- Use only regulators, tubing and hose connectors approved by an appropriate regulatory agency.
- Arrange gas hoses where they will not be damaged or stepped on and where objects will not be dropped on them.
- Do not refill cylinders.
- Check the condition of pipes, hoses and connectors regularly. Perform gas leak tests at all joints and seals of the gas system regularly, using an approved gas leak detection system.
- Check that when the equipment is turned off, close all gas cylinder valves tightly at the cylinder. Bleed the remainder of the line before turning the exhaust vent off.

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 fluid.
- 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 PerkinElmer 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 exhaust venting system.

Operating Conditions



WARNING

Warning: Explosive Atmosphere

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

Recommended operating conditions:

- Indoors.
- The location must be free of smoke, dust, corrosive fumes, direct sunlight and excessive vibration.
- Temperature: +15 °C to +35 °C (+59 °F to +95 °F). Maximum rate of change not exceeding 3 °C (5 °F) per hour.
- Relative humidity: 20% to 80%, without condensation.
- Altitude: in the range 0 m to 2,000 m (sea level to 6562 feet).

Safe operating conditions:

- Indoor.
- Temperature: +5 °C to +40 °C (+41 °F to +104 °F).
- Relative humidity: 20% to 80%, without condensation.
- Altitude: in the range 0 m to 2,000 m (sea level to 6562 feet).

Storage conditions:

- Ambient temperature: –20 °C to +60 °C (–4 °F to +140 °F).
- Relative humidity 20% to 80%, without condensation.
- Altitude: in the range 0 m to 12,000 m (sea level to 39,370 feet).

Exhaust Venting

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 exhaust venting 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 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.

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 PerkinElmer does not take back 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 PerkinElmer EDLs (System 1 or 2) contain more than 0.05 g of analyte material.

Electromagnetic Compatibility (EMC)

Regulatory Information

United States (FCC)

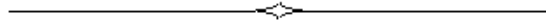
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, 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 user will be required to correct the interference at his own expense.

Europe

All information concerning EMC standards is in the Declaration of Conformity, and these standards may change as the European Union adds new requirements.

References for Laboratory Safety Practice

1. Bretherik, L., *Bretherik's Handbook of Reactive Chemical Hazards*, 4th ed., Butterworth & Co. Ltd., London, UK, 1990.
2. *Safe Practices in Chemical Laboratories*, Royal Society of Chemistry, London, UK, 1989.
3. *Hazards in the Chemical Laboratory*, 5th edition, Luxon, S.G., ed., Royal Society of Chemistry, London, UK, 1992.
4. *CRC Handbook of Laboratory Safety*, 4th edition, Furr, K., ed., The Chemical Rubber Co. Press, Florida, USA, 1995.
5. *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, National Research Council, National Academic Press, Washington D.C., USA, 1981.
6. *Sax's Dangerous Properties of Industrial Materials*, 9th edition, Sax, N.I. and Lewis, R.J., eds., Wiley, New York, USA, 1998.
7. Pohanish, R.P. and Greene, S.A., *Hazardous Materials Handbook*, Wiley, New York, USA, 1996.
8. Compressed Gas Association, Inc., Arlington, VA 22202, USA, various publications.
9. Data Sheets provided by chemical manufacturers, e.g.:
 - USA, Material Safety Data Sheets (MSDS),
 - FRG, DIN-Sicherheitsblätter,
 - UK, Hazard Data Sheets.



Preparing Your Lab 3

Introduction

The AAAnalyst 200 spectrometer has some special requirements that you must consider when setting up the laboratory. The items shown in the following checklist need to be considered when preparing the laboratory for the instrument.

Environmental Conditions

- General Laboratory Requirements
- Laboratory Space Requirements
- Exhaust Vent Requirements
- Gas Supply Requirements
- Electrical Requirements
- Lamps

Make sure your laboratory meets all of the requirements before you begin to install the system.

Environmental Conditions

The laboratory in which the AAnalyst 200 is located must meet the following conditions:

- A corrosive-free environment.
- The instrument will operate with a laboratory temperature between 15 and 35 °C (59-95 °F) with a maximum rate of change of 3 °C (5 °F) per hour.
- The environment should be relatively dust-free to avoid sample and instrument contamination problems.
- Free of excessive vibration.
- Free of direct sunlight.
- The relative humidity should be between 20% and 80%, noncondensing.
- Two types of flames are commonly used for atomic absorption flame analysis: air-acetylene or nitrous oxide-acetylene. Air acetylene is the preferred flame for the determination of about 35 elements by atomic absorption. The temperature of the air-acetylene flame is approximately 2300 °C (4200 °F). For most air-acetylene flames, the acetylene flow used is about 4 liters per minute (or 0.14 cubic feet/min). Using a heat combustion value of 1,450 BTU per cubic foot, the heat given off would be approximately 12,300 BTU per hour.

The nitrous oxide-acetylene flame has a maximum temperature of approximately 2800 °C (5100 °F) and is also used for the determination of elements which form refractory oxides. It is also used to overcome chemical interferences that may occur in flames of lower temperatures. For the nitrous oxide-acetylene flame, the acetylene flow is about 14 liters/min (or 0.5 cubic feet per min.). Using a heat of combustion value of 1,450 BTU per cubic foot, the heat given off would be approximately 43,000 BTU per hour.

General Laboratory Requirements

Operating conditions



WARNING

Warning: Explosive Atmosphere

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

Recommended operating conditions:

- Indoors.
- The location must be free of smoke, dust, corrosive fumes, direct sunlight and excessive vibration.
- Temperature: +15 °C to +35 °C (+59 °F to +95 °F). Maximum rate of change not exceeding 3 °C (5 °F) per hour.
- Relative humidity: 20% to 80%, without condensation.
- Altitude: in the range 0 m to 2,000 m (sea level to 6562 feet).

Safe operating conditions:

- Indoor.
- Temperature: +5 °C to +40 °C (+41 °F to +104 °F).
- Relative humidity: 20% to 80%, without condensation.
- Altitude: in the range 0 m to 2,000 m (sea level to 6562 feet).

Storage conditions:

- Ambient temperature: -20 °C to +60 °C (-4 °F to +140 °F).
- Relative humidity 20% to 80%, without condensation.
- Altitude in the range 0 m to 12,000 m (sea level to 39,370 feet).

NOTE: *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 recommended operating conditions.*

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 waste to accumulate in the work area. Dispose of waste correctly.
- 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.

Working with chemicals

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

- Use, store, and dispose of chemicals in accordance with the manufacturer's recommendations and the applicable national, state, and/or local regulations.
- Do not put open containers of solvent near the instrument.
- Store solvents in an approved cabinet (with the appropriate ventilation) away from the instrument.
- 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.

Location and Space Requirements

Bench and location requirements

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

- Place the spectrometer on a sturdy bench or trolley (cart) capable of sustaining the weight. 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. A movable table is very convenient, but make sure that the wheels can be securely locked.
- Position the bench or trolley out of direct sunlight and away from radiators and heaters.
- Position the system near to the electricity and gas supply points.
- Position the system so that the atomizer compartment is located beneath a suitable exhaust venting system.
- The instrument should not be against a wall, as the instrument must be accessible from the back for servicing purposes. An accessible space of at least 25.4 cm (10 in.) should be available behind the instrument.
- Make sure that there is space at the rear and sides of the system for air to circulate freely. Do not block the fan operating on the right side of the instrument.
- Make sure that there is sufficient room for you to work comfortably with the instrument, and that you can reach the connections at the rear of the instruments and the electricity and gas supply points.

Laboratory Space Requirements

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

Instrument Dimensions

AAAnalyst 200 is 700 mm wide (27.6 in.), 760-mm deep (29.9 in.), 650-mm (25.5 in.) high. The instrument weighs 49 kg (108 pounds).

The main power cable length is 2 m (6 ft).

To provide access for servicing and space for ventilation, allow at least 25.4 cm (10 in.) of space between the instrument and the laboratory walls.

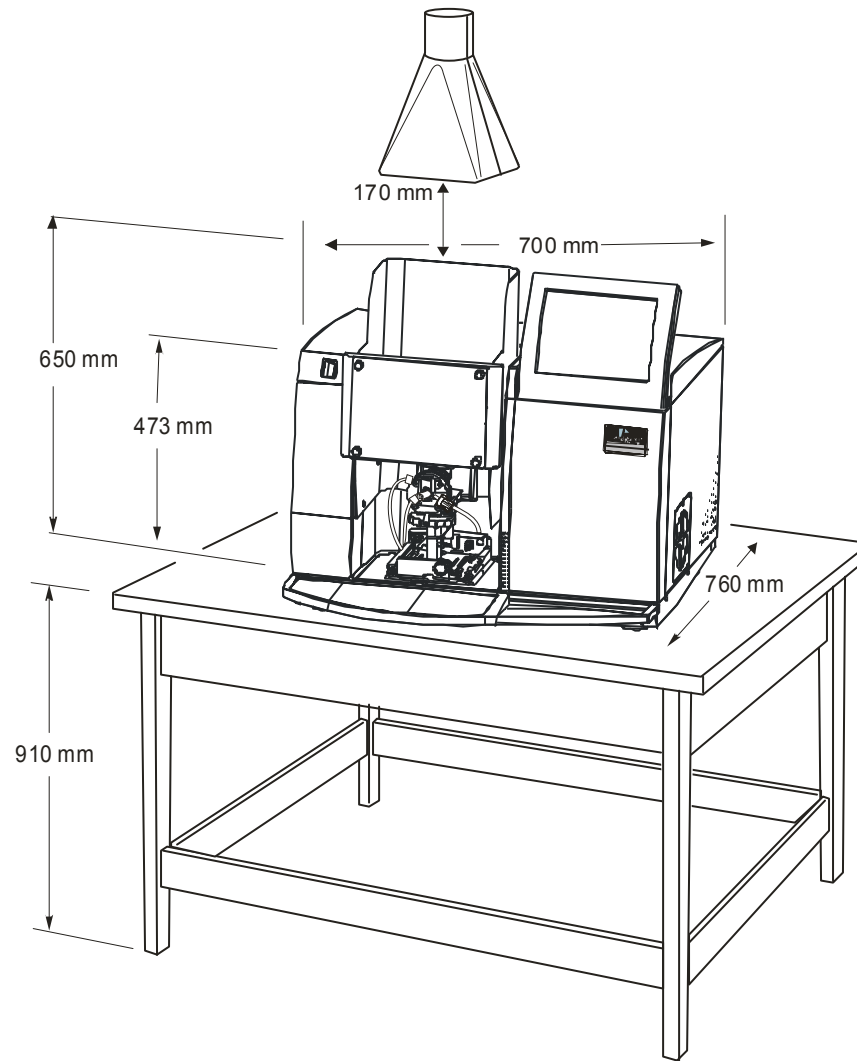


Figure 3- 1 Outside dimensions of instrument

Bench Requirement

The benchtop or area in which the AAAnalyst 200 instrument is to be installed should be large enough to accommodate the instrument and any accessories you'll be using. The instrument itself weighs 49 kg (108 lb.). If you are considering the use of other accessories, the bench you choose to use should be able to sustain as much as 136 kg (300 lbs.).

Location

Typically, the system is installed on a laboratory work bench or table. The table should be smooth, level, and free from vibration. The dimensions for the instrument are listed below and shown in the next figure. For other accessories, refer to the manuals supplied with the accessory.

The bench should be located near the required electricity and gas supplies. Allow additional power outlets for all your accessories. A distance of at least 6 inches (153 mm) should be surrounding both sides and rear of the instrument for proper ventilation. If not possible, the bench on which the instrument is placed should be on wheels so that it can be easily moved.

Accessories

Make sure that there is sufficient room near the spectrometer for any accessories. For example, we recommend that you place the (optional) flame autosampler and mercury hydride system on the left side of the instrument or on a roll cart in front of the instrument.

Printer

Refer to the manuals supplied with your printer for dimensions. The printer may be placed on the bench next to the instrument.

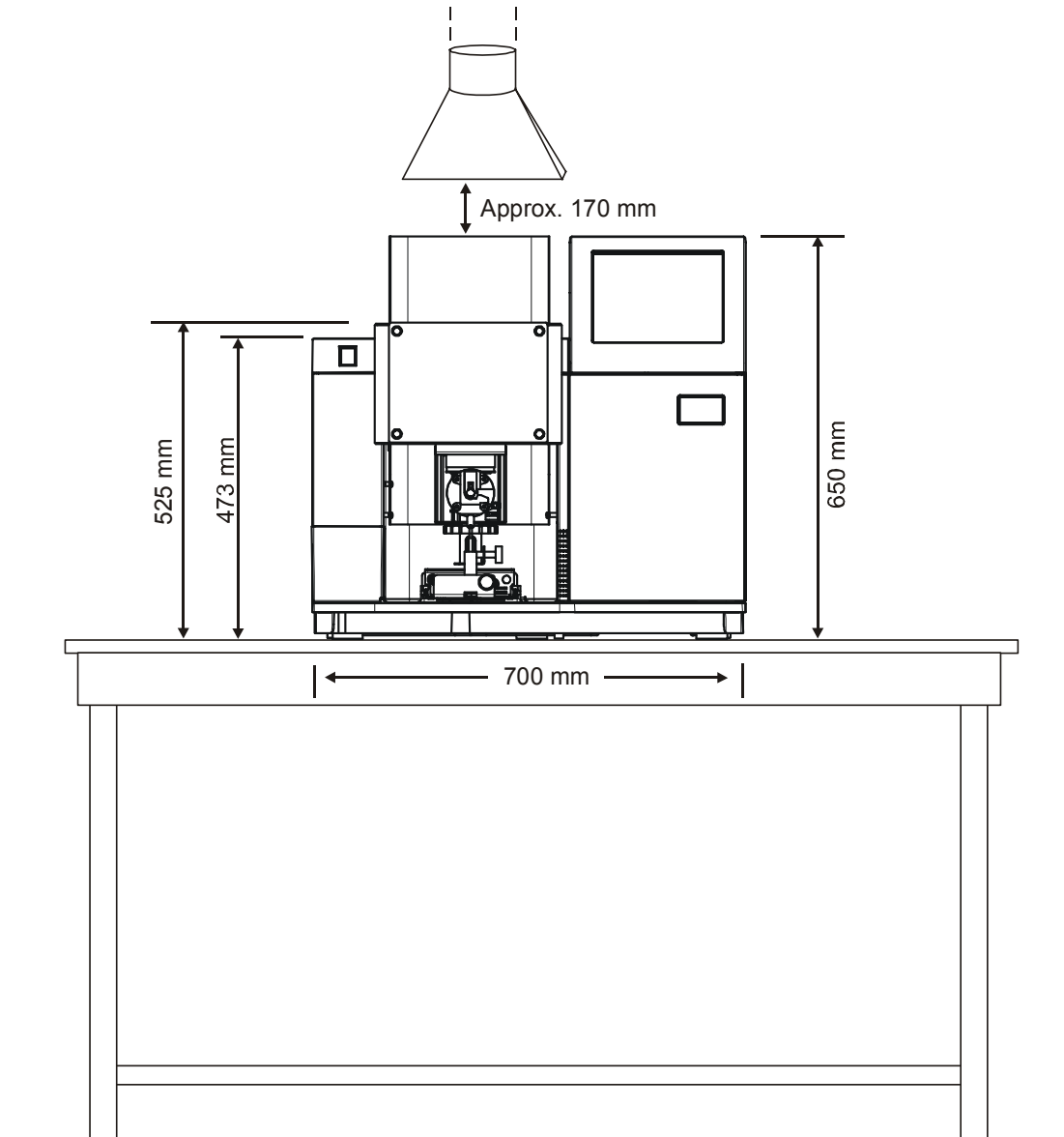


Figure 3- 2 Space requirements for the spectrometer system – front view

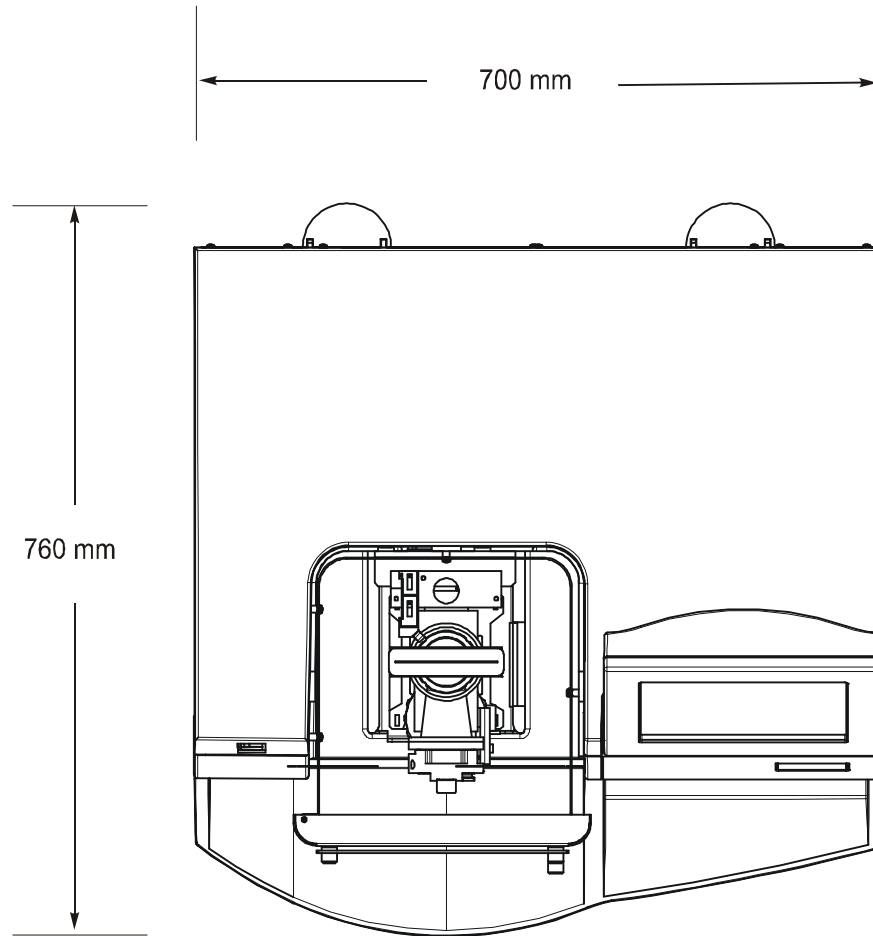


Figure 3- 3 Space requirements for the spectrometer system – top view

Exhaust Vent Requirements

Exhaust venting is important for the following reasons.

- It protects laboratory personnel from toxic vapors that may be produced by some samples.
- It helps to protect the instrument from corrosive vapors that may originate from the sample(s).
- It removes dissipated heat produced by the instrument and power supply.
- It will tend to reduce the effects of room drafts and the laboratory atmosphere on flame stability.



WARNING

The use of the AAnalyst 200 without adequate ventilation to outside air may constitute a health hazard. For example, the combustion of halogenated hydrocarbons produces toxic vapors.

Temperatures

The following temperatures have been measured with a nitrous oxide-acetylene flame: 310 °C at the vent intake, 160 °C at 2.4 meters (8 feet) from the vent intake, 105 °C at the blower intake, and 50 °C at the blower motor housing near the front bearing.

To withstand these temperatures stainless-steel tubing must be used.

NOTE: *Local electrical codes do not allow PerkinElmer Service Engineers to install the blower and vent assembly.*

Exhaust ducting

Alternatively, smooth stainless-steel tubing should be used instead of flexible stainless steel tubing where flexibility is not required to reduce system friction loss or "drag." If smooth stainless steel is used, there must be a way to move the vent hood out of the way for servicing. A length of smooth stainless steel ducting has 20-30% less friction loss than a comparable length of flexible ducting. When smooth stainless steel tubing is used, elbows must be used to turn corners. These elbows should turn at a centerline radius of 150mm with a maximum bend angle of 45 degrees to reduce friction losses, and the number of elbows should be minimized.

You must provide an efficient exhaust venting system to remove heat, toxic combustion fumes and vapors that can be generated by atomic spectroscopy instruments. We strongly recommend that you do not place the spectrometer in a chemical hood.

Additional recommendations on the venting system include the following items:

- Make sure the duct casing is installed using fireproof construction. Route ducts away from sprinkler heads.
- The duct casing and venting system should be made of materials suitable for temperatures greater than 70 °C (158 °F). They should be installed to meet local building code requirements.
- The exhaust hood opening should be about 170 mm (6.7 inches) above the top of the burner shield.
- Locate the discharge outlet as close to the blower as possible. All joints on the discharge side should be airtight, especially if toxic vapors are being vented.
- Equip the blower with a pilot light located near the instrument to indicate to the operator when the blower is on.
- Equip the outlet end of the system with a back draft damper and take the necessary precautions to keep the exhaust outlet away from open windows or inlet vents. In addition, extend it above the roof of the building for proper dispersal of the exhaust.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.
- Make sure the length of the duct that enters into the blower is a straight length at least ten times the duct diameter. An elbow entrance into the blower inlet causes a loss in efficiency.
- Position the discharge outlet away from open windows and inlet vents.

Exhaust capacity

- The system should provide a flow rate of 5600-8400 liters/minute (200–300 cubic feet/minute). Measure the flow rate at the inlet to the hood with a suitable air-flow meter to ensure that the system is drawing properly.
- Provide make-up air to the laboratory in the same quantity as is exhausted. An 'airtight' laboratory will cause a loss in efficiency in the exhaust volume.

Blower information

The required capacity of the blower depends on the duct length and the number of elbows or bends used to install the system. If an excessively long duct system or a system with many bends is used, a stronger blower may be necessary to provide sufficient exhaust volume.

The blower should be located at least 4 meters (13.1 ft) and not more than 6.5 meters (21.3 ft) from the inlet directly above the instrument, and should exhaust to the atmosphere or into a considerably wider exhaust duct.

In many countries, PerkinElmer offers an accessory blower and vent kit that will fulfill the exhaust requirements for all atomic spectroscopy instruments, or your local PerkinElmer office can supply you with the addresses of suitable suppliers.

In many countries electrical codes do not permit PerkinElmer service engineers to install the blower and vent assembly.

Blower and vent kit

The blower and vent kit (P/N 0303-0406) available from PerkinElmer contains a rotary blower with associated hardware, a hood to be located above the instrument, an adapter to connect the blower and hood to suitable metal ducting, and installation instructions. The blower requires a line voltage of 120 V or 230 V. The adapter and hood are made of stainless steel. The metal ducting required to connect the hood to the blower and for the exhaust from the blower is not included in the kit.

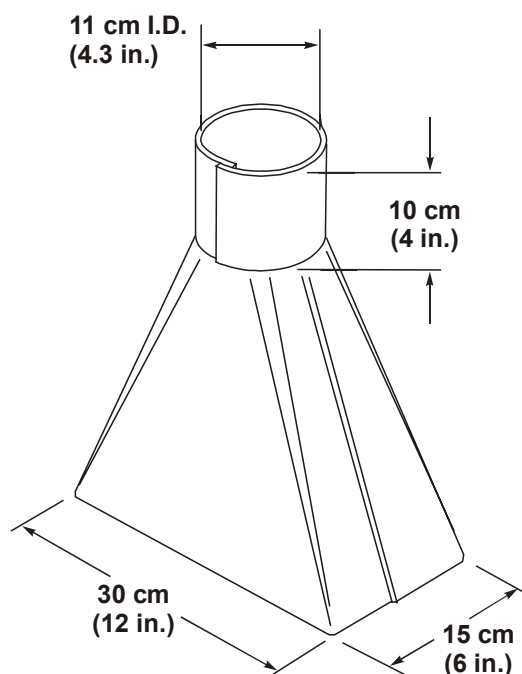


Figure 3- 4 Dimensions of a typical exhaust hood

The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building regulations. PerkinElmer 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.
An air compressor is recommended for air. A double-stage or heated regulator is recommended for nitrous oxide. Either the gas supplier or PerkinElmer can provide the correct regulators and valves.
- You must be able to reach the on/off valves easily and see the pressure indicators.

Recommendations for compressed gas systems

Gas installations

- Legibly mark gas lines and outlets to clearly identify the contents. Use the chemical name or commercially accepted name for the gas.
- Use only approved regulators, tubing, and hose connectors.
- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.
- 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 fluid.


Using gas cylinders

- Store cylinders in accordance with the applicable national, state, and/or local regulations and standards.
- Legibly mark cylinders to clearly identify the contents and status—full or empty. Use the chemical name or commercially accepted name for the gas.
- 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.
- Do not store acetylene in close proximity to oxidizing gases, such as nitrous oxide.
- Store all gas cylinders upright, with the valve cap in place, in a dry, well ventilated area, protected against temperature extremes.
- Do not locate gas cylinders near exits and exit routes, elevators, gangways, or in locations where heavy moving objects may strike or fall against them.
- Locate gas cylinders away from heat sources, including the direct rays of the sun, and away from ignition sources and readily ignitable substances, such as gasoline, oil, or combustible waste. Compressed gas cylinders should not be subjected to temperatures above 52 °C (126 °F).
- Locate all gas cylinders only in a vertical position, fastened securely to an immovable bulkhead or a permanent wall.
- 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.
- Do not attempt to refill gas cylinders.

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:

Gas	Purity	Outlet Gauge Pressure					
		kPa		Bar		psig	
		<i>P</i> _{min}	<i>P</i> _{max}	<i>P</i> _{min}	<i>P</i> _{max}	<i>P</i> _{min}	<i>P</i> _{max}
Acetylene (ethyne, C ₂ H ₂)	99.6%, atomic absorption grade in acetone (propan-2-one)	80	96	0.8	1.0	12	14
Air	oxygen < 20%; particle free; oil free; water free	300	400	3.0	4.0	44	58
Nitrous oxide (dinitrogen monoxide, N ₂ O)	99%	300	400	3.0	4.0	44	58

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 these values.

Air supply requirements

For the burner system, an air supply that is clean, dry, and oil-free is required. The air supply should provide a minimum of 28 liters/min (1 cubic foot/min) at a minimum pressure of 300 kPa (44 psig). The air supply should be suitably filtered to remove oil, water, and solid particles.

Air compressor

A small oil-less air compressor meeting the air supply requirements is available from PerkinElmer. The use of an air dryer filter is strongly recommended to remove entrained water, oil, water aerosols, and solid particles from compressed air lines. Water in the air supply can cause severe damage to the pneumatics.

Risk of damage to the instrument**CAUTION**

Water in the air supply can cause damage to the pneumatics.

Use only dry air. Bleed compressor tanks to remove water at least once a week

Air compressors are generally uncomfortably noisy to have in the immediate vicinity of the instrument. Whenever possible, locate them at some distance from the laboratory in an area providing suitable ventilation.

Air cylinders

Cylinders of compressed air can also be used but are recommended only as an emergency or short-term solution. A standard #1 size air cylinder will last only about five hours. It is common to find other than 20% oxygen in air cylinders. This can cause erratic burner operation and non-reproducible analytical results and, in extreme cases, may cause a potential safety hazard.

In general, if cylinder air is to be used, it is important to specify compressed air rather than breathing air and that the oxygen content is less than 20%.

**WARNING*****Warning: Flashback Hazard***

PerkinElmer 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 PerkinElmer burner systems.
Use only compressed air.*

Nitrous oxide supply requirements**WARNING*****Warning: Nitrous oxide is a strong oxidant and an asphyxiant***

*Nitrous oxide is an asphyxiant; it can be considered a potential hazard whenever it is stored or used in a confined space.
Spontaneous combustion may occur if nitrous oxide comes into contact with grease, oil, or other organic material.*

- *Store nitrous oxide cylinders in a well-ventilated area outside the laboratory.*
- *Do not store nitrous oxide cylinders in close proximity to flammable gases (e.g., acetylene).*
- *Make sure tubing and fittings carrying nitrous oxide are free of grease, oil, or other organic material.*

Cylinder information

The nitrous oxide supply should be at least 99% pure. Cylinders of nitrous oxide are available from local suppliers.

Nitrous oxide is supplied in the liquid state, initially at a pressure of about 5000 kPa (725 psig). A size 1A cylinder of nitrous oxide contains about 14800 liters (523 cubic feet) and will typically last for 10–12 hours of burning time.

Heated regulator

Since the nitrous oxide is in liquid form, the pressure gauge does not give a true indication of how much nitrous oxide remains in the cylinder until the pressure starts to fall rapidly as the residual gas is drawn off. When nitrous oxide is rapidly removed from the cylinder, the expanding gas causes cooling of the cylinder pressure regulator and the regulator diaphragm can freeze. This can cause erratic flame conditions or, in the most extreme case, a flashback.

It is therefore advisable to use a double-stage or heated regulator for nitrous oxide to prevent freezing of the diaphragm and a loss of pressure regulation. A suitable nitrous oxide pressure regulator is available from PerkinElmer.

Acetylene supply requirements



WARNING

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 these values.*

Acetylene can react with copper to form a readily explosive compound.

- *Never use copper tubing or fittings for acetylene gas lines.*

Grade

Suitable acetylene (ethyne), such as ‘atomic absorption grade’ or welding grade, typically has a minimum purity specification of 99.6% with the actual assay being about 99.8%. Acetylene is supplied dissolved in acetone (propan-2-one) to prevent explosive decomposition. You should not use acetylene that is dissolved in any other solvent. Experience indicates that solvents can be carried through the regulator with the acetylene and can weaken, to the point of rupture, the walls of the tubing carrying the acetylene to the burner, causing a potential hazard.

Cylinder information

A size 1A acetylene cylinder contains about 8500 liters (300 cubic feet) of acetylene and usually lasts about 30 hours of burning time with an air-acetylene flame. With a nitrous oxide-acetylene flame, the same size cylinder will last about 10 hours.

Flash arrestor

PerkinElmer recommends the use of the Flash Arrestor (P/N N930-0068). The flash arrestor provides a positive gas shutoff by checking the reverse flow under all conditions. It also stops the gas supply when a flashback occurs. The flash arrestor can be directly connected to the acetylene fuel line.

Piping/tubing/fittings

Use galvanized iron, steel, or wrought iron tubing. Never use copper tubing with acetylene. Joints may be welded or made up of threaded or flanged fittings, typically stainless steel or aluminum, or brass composed of less than 65% copper. Rolled, forged, or cast steel or malleable iron fittings may also be used. Cast iron fittings cannot be used safely for acetylene lines.

Safe use of acetylene

- Periodically check for the presence of acetylene in the laboratory atmosphere, especially near the ceiling.
- Never allow the outlet gauge pressure to exceed 103 kPa (1.03 bar, 15 psig); acetylene can explode spontaneously above this pressure.
- Prevent acetylene from coming into contact with copper, silver, mercury or gaseous chlorine.
- 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 below this value.

Electrical Requirements

The following section describes the power requirements for all the components that make up the AAnalyst 200 system.

The AAnalyst 200 spectrometer requires a stable single phase electrical supply of 100–230 VAC ($\pm 10\%$), 50 Hz or 60 Hz ($\pm 1\%$), capable of providing 300VA maximum, 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.

The line power supply point must be within 2 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.

Installation Category

The AAnalyst 200 is able to withstand transient overvoltage according to Installation Category II as defined in IEC 1010-1.

Pollution Degree

The AAnalyst 200 will operate safely in environments that contain nonconductive foreign matter up to Pollution Degree 2 in IEC 1010-1.

Instrument



WARNING

*Grounding circuit continuity is vital for safe operation of equipment.
Never operate equipment with grounding conductor disconnected.*

The instrument power cord is to be connected to a circuit with a protective circuit breaker or fuse.

NOTE: *NEMA: The National Electrical Manufacturer's Association; CEE: International Commission on Rules for the Approval of Electrical Equipment.*

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.

Please refer to the PerkinElmer Instruments *e*-ssentials catalog for a list of available lamps.



System Description 4

Introduction to this Chapter

The AAAnalyst 200 instrument line is self-contained with its built-in touch screen and burner system to perform Flame AA determinations.

There are three versions of the AAAnalyst 200 instrument. Its basic features (AAAnalyst 200 P/N B315-0050) include a touch screen, a single lamp and a burner system with automatic, computer-programmed flame gas control. It is designed for optimized, cost-effective, automatic flame and mercury/hydride analyses. The second version, AAAnalyst 200 (P/N B315-0060), has all the basic features plus it contains a built in deuterium background corrector and supports one EDL lamp. The third version, AAAnalyst 200 (P/N B315-0070), features an automated lamp turret and supports two EDL lamps.

This chapter gives a complete description overview of the AAAnalyst 200. The optional autosamplers are described later in this manual.

AAnalyst 200 Overview

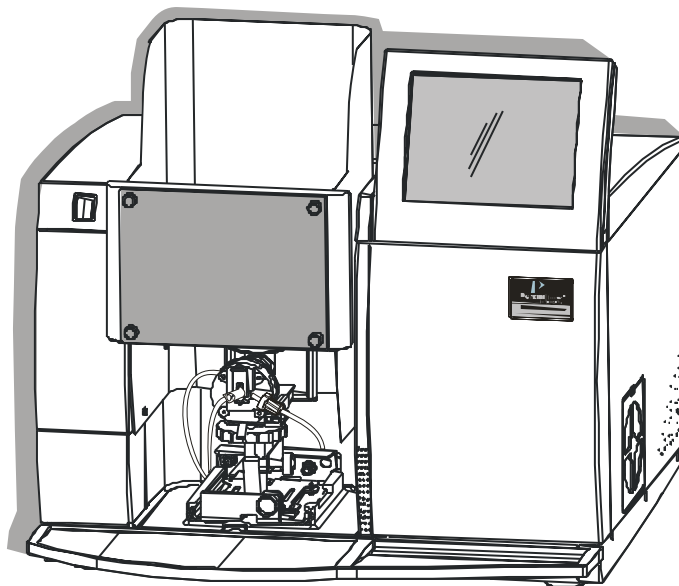


Figure 4- 1 The AAnalyst 200 Instrument

The AAnalyst 200 Atomic Absorption Spectrometer is a double-beam atomic absorption spectrometer for flame and mercury/hydride analysis. It is a sophisticated analytical system capable of performing automated single element determinations.

The AAAnalyst 200 Spectrometer System

Concept

The AAAnalyst 200 spectrometer from PerkinElmer is a compact benchtop flame atomic absorption spectrometer featuring:

- Double beam optical system optimized for maximum radiation throughput.
- Burner system for flame atomization.
- Deuterium background correction system (optional).

System components

The major components of the system are:

- The spectrometer containing the optical system, the electronics, and the atomizer compartment.
- The touch screen is the interface between you and the spectrometer, enabling you to control the spectrometer in order to perform your analyses easily and conveniently.
- The burner system.
- The printer. (This is optional but strongly recommended.)

System control

To control the spectrometer and perform your analyses, you use the touch screen.

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.

General Lamp Information

There are a number of different lamps that can be used with the AAnalyst 200 instrument: the **Lumina Hollow Cathode Lamp (HCL)** and the **Electrodeless Discharge Lamp (EDL)** (coded and non-coded). The **Intensitron Hollow Cathode Lamp** (coded and non-coded), when used with an adapter, will function on the AAnalyst 200 instrument. All three types of lamps can also be used in the AAnalyst instrument.

The type of primary source lamp required for your instrument depends on the elements to be determined. Either hollow cathode or electrodeless discharge lamps may be used. Hollow cathode lamps (HCLs) are excellent for most elements; however, there are a number of “difficult” elements for which an improved light source is desirable. Electrodeless discharge lamps (EDLs) are more intense than the HCLs. Most EDLs provide better lamp life, stability and in some cases better sensitivity.

The 3 types of lamps that can be used in the AAnalyst 200 are listed:

- the **Lumina** hollow cathode lamp (HCL)
- the *coded* **Electrodeless** discharge lamp (**EDL System II**)
- the *coded* and *non-coded* **Intensitron hollow cathode lamp (HCL)** with adaptors

The basic AAnalyst 200 instrument has a mount for a single lamp. It can, however, be purchased with an automatic four-lamp turret.

An Explanation: Hollow Cathode Lamps (HCLs)

The specific determination of one element in the presence of others is possible with the use of special light sources and careful wavelength selection in a spectrometer. A single-element lamp emits specific wavelengths of light for the element from which the cathode is constructed. There are single-element lamps for all elements commonly measured by atomic absorption. Hollow cathode lamps (HCLs) are ideal for determining most elements by atomic absorption spectroscopy. "

Refer to figure below. The basic components of an HCL are a glass cylinder filled with an inert gas (argon or neon) at low pressure, an anode, a cathode, and a quartz window with a graded seal to be used at wavelengths below 230 nanometers (nm), or a UV-transmitting glass window for lamps to be used at longer wavelengths. The cathode is a hollow cylinder of the metal whose spectrum is to be produced. Both the anode and cathode are sealed in the glass cylinder. The quartz graded seal or glass window is fused to the glass cylinder.

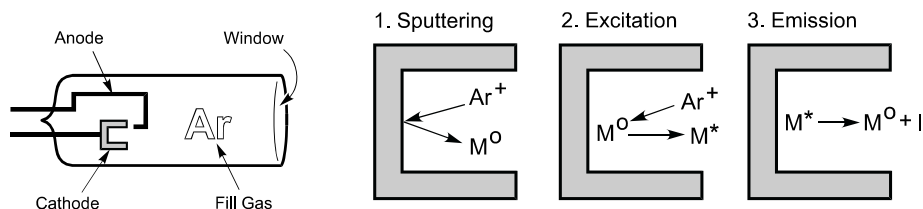


Figure 4- 2 The workings of a hollow cathode lamp (HCL).

Hollow cathode lamps emit light by the following process: the fill gas is ionized when an electrical potential is applied between the anode and the cathode. The positively charged ions collide with the negatively charged cathode and dislodge individual metal atoms in a process known as "sputtering." These sputtered metal atoms are excited through impact with fill gas ions. Light of the specific wavelengths for that element is emitted when the atom "decays" from the excited state to a more stable state.

Lumina Hollow Cathode Lamps

The Lumina hollow cathode lamps were designed for use with the AAAnalyst series of atomic absorption spectrometers. They are the latest innovation in optimizing light sources for AA spectrometers. These lamps provide fully automated wavelength, current and slit selection which results in reduced setup times for easy and accurate operation.

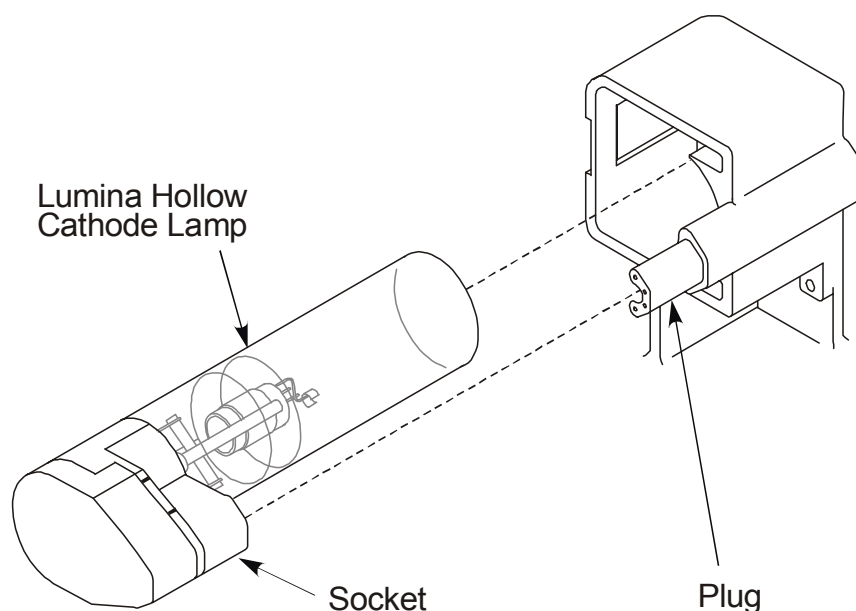


Figure 4- 3 Drawing of a Lumina hollow cathode lamp.

The Lumina HCLs are manufactured without cables. When they are used with the AAAnalyst instrument, they are installed simply by sliding the lamp into the single lamp mount or turret. Lamp alignment occurs automatically if you have the model with the automatic four-lamp turret feature.

Each Lumina HCL includes a milliamper-hour timer in its base. This allows you to monitor the lamp usage easily and accurately for Good Laboratory Practices compliance as well as lamp replacement scheduling. With a range of 0 to 10,000 milliamper-hours, the meter measures the number of milliamper-hours (i.e. lamp current X hours of operation) that your lamp has operated.

Intensitron Hollow Cathode Lamps

The AAAnalyst series spectrometers can also be used with the older coded or non-coded Intensitron hollow cathode lamps (HCLs). With the use of the proper adapter cable, Intensitron HCLs can be used with AAAnalyst instruments.

If you have a coded Intensitron HCL, there is a universal adapter cable (N305-0196) to be used with the lamp. However, lamp coding is lost, therefore lamp and element parameters must be set manually when coded HCLs and universal adapter cables are used.

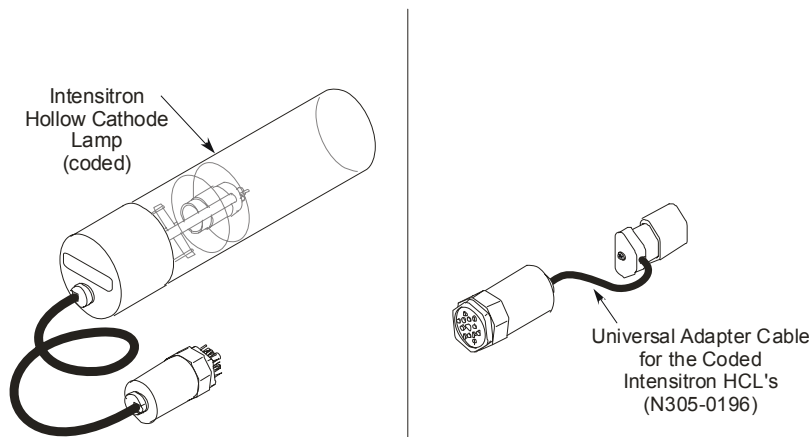


Figure 4- 4 The Intensitron hollow cathode lamp with universal adapter cable (N305-0196).

Non-coded HCLs can also be used with the appropriate adapter cable (N305-0197); however, lamp and element parameters must be set manually when non-coded lamps are used.

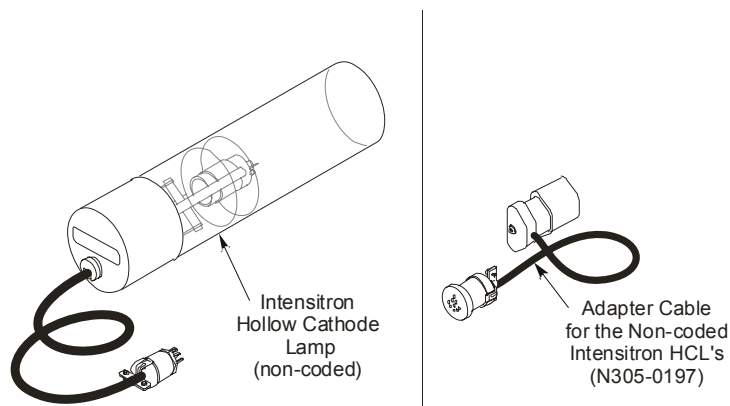


Figure 4- 5 The noncoded Intensitron hollow cathode lamp with adapter cable (N305-0197).

Electrodeless Discharge Lamps (EDL System II)

While hollow cathode lamps are an ideal source for determining most elements by atomic absorption, for volatile elements, an electrodeless discharge lamp (EDL) is recommended instead. EDLs provide greater light output for improved detection limits and precision, along with increased sensitivity and working curve linearity. EDLs also have a longer life than corresponding hollow cathode lamps. For certain elements (such as arsenic and selenium), EDLs will also provide improved sensitivity.

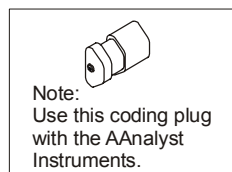
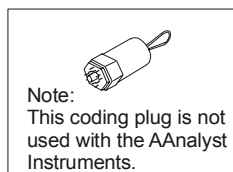
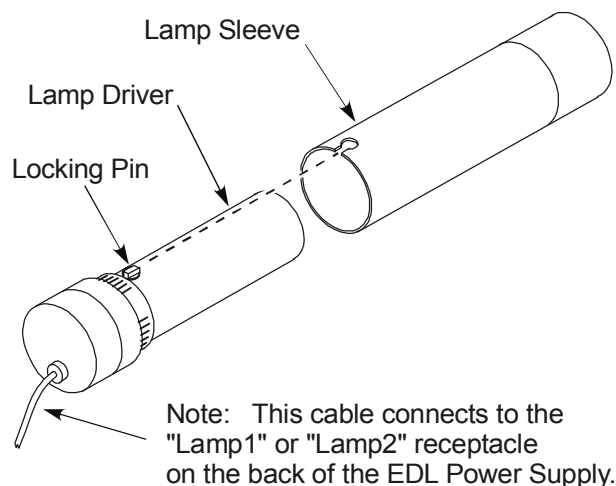


Figure 4- 6 An Electrodeless Discharge Lamp (EDL).

An EDL consists of a quartz bulb under an inert gas atmosphere, containing the element or a salt of the element for which the lamp is to be used. When an RF field is applied to the bulb, the inert gas is ionized and the coupled energy excites the vaporized analyte atoms inside the bulb, causing them to emit their characteristic spectrum. The emission spectra produced is typically much more intense than that from hollow cathode lamps, frequently tenfold larger or more.

Lamp Installation

When you first receive your instrument, there is no lamp source installed. For initial lamp installation details see, Chapter 6, *Operation of the Instrument* in this manual. If you need to replace an existing lamp see, Chapter 9, *Maintenance* later in this manual contains the various lamp replacement procedures.

Lamp Alignment

Refer to Chapter 6, *Operation of the Instrument*, in this manual for the procedures to align a lamp in an AAnalyst instrument.

Lamp Maintenance and Cleaning

There is really no maintenance procedures for any of the PerkinElmer hollow cathode lamps. If you notice fingerprints on the “window” of your lamp, wipe them off with a soft, dry, lint free cloth. Use no chemicals or water. See the section below regarding lamp life and when to replace them.

Lamp Life

Both hollow cathode and electrodeless discharge lamps have a finite lifetime. Electrodeless discharge lamps typically last longer than hollow cathode lamps for the same element. If, while aligning a lamp, you are not able to obtain a satisfactory energy value, this may indicate that the lamp is starting to deteriorate. As a hollow cathode lamp reaches the end of its useful life, the current on the lamp may be increased up to the maximum current recommended on the label. Once the intensity of a lamp begins to deteriorate, it should be replaced.

Lamp Troubleshooting

Refer to Chapter 10, *Troubleshooting*, in this manual for lamp troubleshooting information.

CAUTION

To avoid damages to the instrument, do not insert EDL's or non-linear lamps too far into the lamp holder.

The Deuterium Arc Background Corrector

An Explanation: The Deuterium Arc Background Corrector

The Deuterium Arc Background Corrector is an internally mounted assembly that provides correction for molecular absorption and light-scattering. The spectrometer uses a deuterium arc lamp to correct for background absorbance caused by non-atomic species in the atom cloud.

When the deuterium arc background corrector is used, two alternating sets of measurements are made: one with the primary source and a second with the background corrector source. The primary source measures a combination of background and atomic absorption. The continuum source measures only the background. The difference between the two measurements yields the atomic absorption.

A deuterium arc source is used for maximum wavelength coverage and intensity. The AAAnalyst can accurately handle combined atomic plus background absorption signals as large as 3 absorbance units.

The background corrector is internally installed, with its power supplied from the instrument. Power to the source is automatically and continuously adjusted to be in the optimum range for operation. The deuterium arc lamp is easily accessible, allowing convenient replacement of the lamp by the users. Instructions to replace the lamp are included in the *Maintenance* chapter.

Deuterium Alignment

Refer to Chapter 6, *Operation of the Instrument*, in this manual for the procedures to align the background corrector in an AAAnalyst instrument.

The Burner System

The burner system used in the spectrometer system is of the premix design. The measurement solution is sprayed by a pneumatic nebulizer into the burner chamber in the form of an aerosol. This aerosol is thoroughly premixed with the burner fuel and oxidant gases in the burner chamber. This gas mixture then passes through the burner slot into the flame.

The burner system comprises the following major components:

- Nebulizer
- Burner chamber (including the flow spoiler and end cap)
- Burner head
- Drain system
- Gas control system (incorporated in the spectrometer)

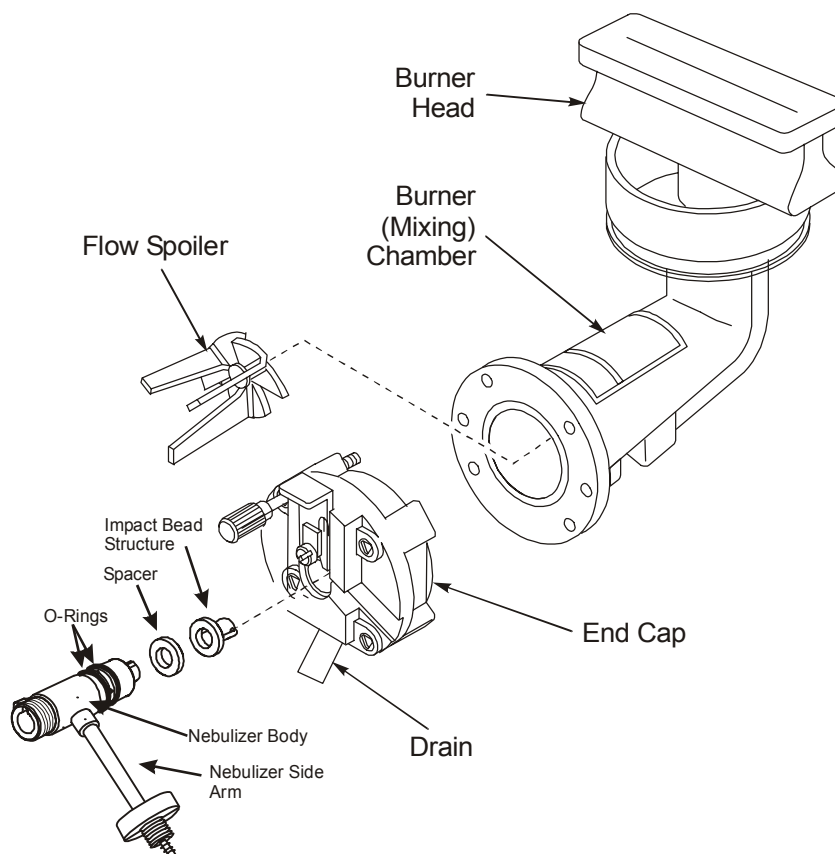


Figure 4- 7 Major components of the burner system

How the Burner System Works

The basic instrument includes a burner system for flame sampling operation. A system block diagram is shown in the next figure. As previously mentioned, the heat produced by the burner converts the sample into free atoms that can absorb the light from the source lamp for the element(s).

A sample solution is aspirated through the nebulizer and sprayed as a fine aerosol mist into the burner chamber. Here, the sample mist is thoroughly mixed with the fuel and either air or nitrous oxide gases. Fuel gas enters the chamber through the fuel inlet hose while the oxidant enters through the nebulizer side-arm and the AUX oxidant inlet.

To prevent incomplete sample atomization, a plastic flow spoiler is placed inside the chamber directly in front of the nebulizer. The nebulizer utilizes a ceramic, one-piece, impact-bead structure which improves nebulization efficiency. Larger sample droplets not carried around the flow spoiler by the gas flow are forced by the spoiler to the bottom of the chamber. This, in turn, allows only the finer sample droplets to be carried into the chamber. The larger droplets are removed through the drain.

Once the sample mist is thoroughly mixed in the chamber, it is carried to the burner head. Once there, the flame causes dislocation and atomization.

The gas control system monitors and controls fuel and oxidant flows. Burner operation, including flame ignition, flame shutoff and gas flow settings, is controlled through the instrument touch screen (AAAnalyst 200).

The next figure shows a “block diagram” of how the AAAnalyst burner system flows, from the gas supplies, to the gas box, to the burner hardware itself and out to the drain vessel.

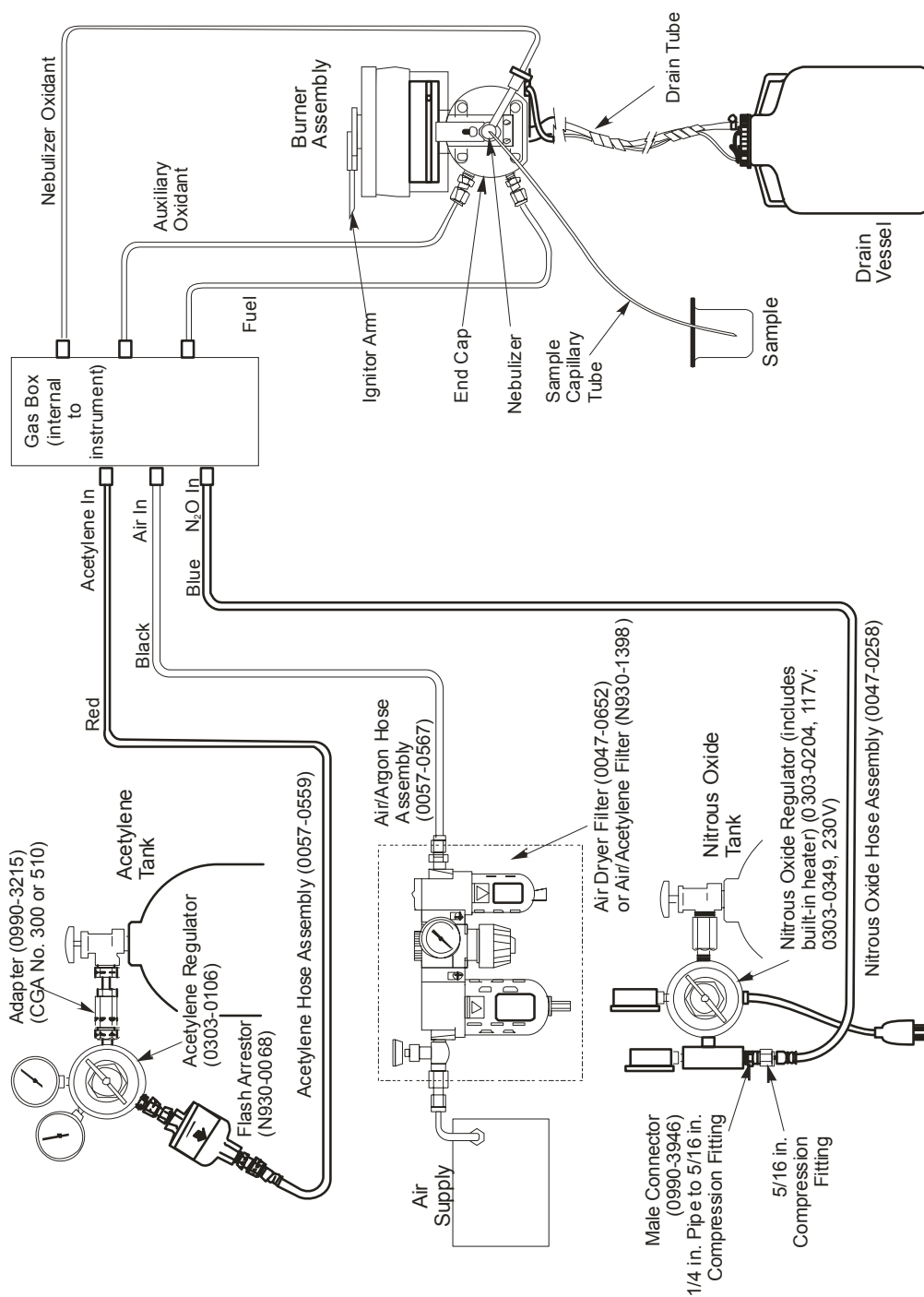


Figure 4- 8 Block diagram of the complete burner system.

The Burner Head

All the burner heads are made from titanium. The 10-cm, air-acetylene burner head is standard with the AAAnalyst instruments. All the available burner heads are listed next in numerical order.

- N040-0100: 5-cm, single-slot burner head (for nitrous oxide-acetylene operation).
- N040-0101: 5-cm, single-slot burner head (for air-acetylene operation). It features a wider slot than the nitrous oxide burner head.
- N040-0102: 10-cm, single-slot burner head (for air-acetylene operation - standard with all burners).
- N040-0103: 10-cm, three-slot burner head (for analysis of high dissolved solids content solutions with air-acetylene flames).

The 5-cm single-slot air-acetylene burner head is rotatable to 90 degrees.

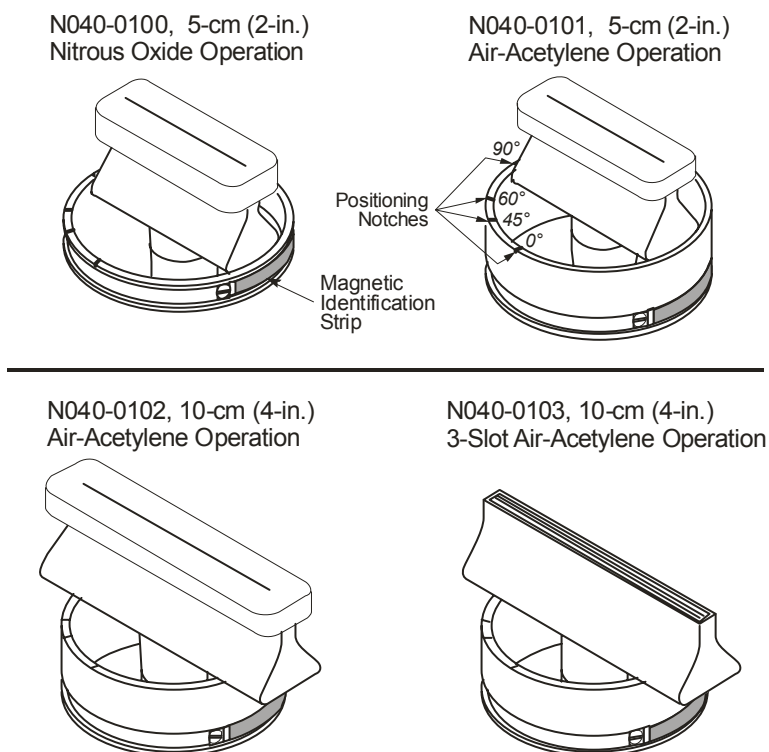


Figure 4- 9 The four available burner heads.

The Burner Mount

The quick change burner mount provides horizontal, vertical, and rotational adjustment. The quick-disconnect release lever simplifies removal of the burner assembly.

The Ignitor Assembly

The ignitor assembly includes the glow plug, the ignitor solenoid and ignitor arm, the burner head interface circuit, and the flame detect circuit. When the ignitor is activated (automatically), the glow plug is energized and heats up. The ignitor solenoid, which is also energized, swings the ignitor arm into place. The ignitor arm is a gas-capture tube through which the gases flow from the burner to the glow plug. The gases in the tube are ignited by the heat of the glow plug, which, in turn, ignites the flame at the burner head slot.

The gas controls

The gas controls provide control of the flow rates of the fuel gas (acetylene) and the oxidant (air or nitrous oxide). You select the gas flow rates and optimize the flame via the touch screen.

The gas control system is incorporated in the spectrometer. The system includes safety interlocks for the flame. If the fuel or oxidant pressure falls below a minimum value the flame is shut down in a safe sequence. The system also includes automatic sequencing of the gases when the nitrous oxide-acetylene flame is ignited or extinguished.

The burner will be shut down in a safe sequence in the event of a power failure.

NOTE: *In case of emergency, use the red emergency button located on the upper left hand side of the instrument.*

The drain system

During flame operation, measurement solution that condenses out in the spray chamber runs to waste through the siphon interlock drain trap and is collected in the drain vessel.

The siphon interlock drain trap is integral with the burner end cap and includes an internal trap to make certain that back pressure is applied to the burner chamber. This ensures that a fuel/oxidant mixture cannot enter the drain vessel. There is a magnetic float in the drain trap that shuts down the flame if the drain system is not functioning properly. If the liquid level in the trap is too low, the switch is activated and the flame is shut down.

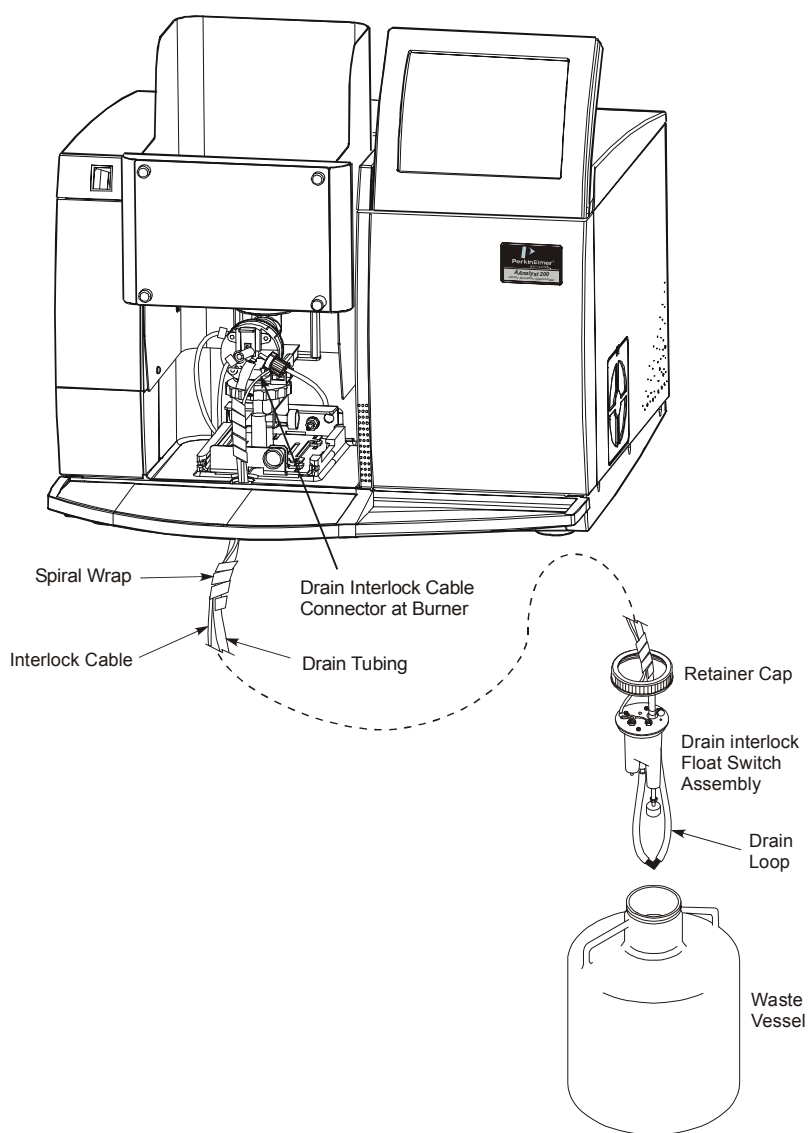


Figure 4- 10 The burner drain system and its parts

Burner Installation

The entire installation of the burner is covered in Chapter 6, *Operation* of this User's Guide Manual. The basic steps are bulleted below for your reference. Directions on how to perform each step are discussed in detail during installation.

- installing the nebulizer on the burner
- checking that the burner end cap is secure
- connecting and securing the gas hoses to the burner
- installing and securing the burner head

System Description

- installing the quick-change burner mount assembly into the instrument
- installing and connecting the burner drain system

Burner System Maintenance

Refer Chapter 9, *Maintenance*, in this User's Guide manual for extensive burner system maintenance information.

Burner System Troubleshooting

We recommend that you consult the troubleshooting information included in this manual before you call a PerkinElmer service engineer. Refer to Chapter 10, *Troubleshooting*, for your burner system troubleshooting information. Included are suggestions to help you determine systematically whether instrument problems are due to improper analytical techniques, improper selection of instrument parameters, or a malfunction of the instrument.

Burner Spare Parts and Accessories

Refer to the end of Chapter 9, *Maintenance*, for burner system spare parts information.

Connecting the Electrical Supply

A Review of the Electrical Specifications

The electrical supply voltage must be between: 100-230 VAC \pm 10%

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

The spectrometer requires either a 100/120 VAC standard 15 amp grounded outlet, or a 230 VAC outlet. In addition, the instrument consumes 300 volt amps (maximum) when configured for background correction.


The AAAnalyst 200 requires a grounded AC outlet providing voltage corresponding to the voltage range marked on the instrument (100-230 VAC).



WARNING

Do not remove or alter the ground prong on a three-prong power plug.

Installing the AC line Cord

 WARNING	<p><i>Grounding circuit continuity is vital for safe operation of equipment. Never operate equipment with grounding conductor disconnected. Do not remove or alter the ground pin on a three-prong line cord.</i></p>
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The line cord should have the electrical rating and plug appropriate for your location. See the figure below for the correct cord.

1. Select the proper line cord for your location.
2. Insure that the power switch is off and insert one side of the line cord plug into the instrument and the other side into the AC supply.




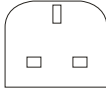



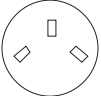


	<p><i>North America NEMA-5-15 0998-8986</i></p>		<p><i>Old British Standard BS 546 India 0999-1423</i></p>
	<p><i>Europe CEE 7 "Schuko" 0999-1415</i></p>		<p><i>British Standard BS 1363 United Kingdom 0999-1414</i></p>
	<p><i>Europe Switzerland 0999-1413</i></p>		<p><i>Australia ETSA S/86 0999-1417</i></p>
	<p><i>Europe Italy 0999-1422</i></p>		<p><i>Israel 0999-1424</i></p>
	<p><i>Denmark 0999-1416</i></p>		<p><i>Japan 0999-1425</i></p>

Figure 4- 11 The AC line cord selections for the AAnalyst instrument.

Mercury/Hydride Determination System (MHS-15)

Mercury/Hydride Systems are proven accessories for high sensitivity determinations of mercury and metallic hydride-forming elements, including As, Se, Sb, Te, Bi and Sn by atomic absorption spectroscopy.

The basic components of a mercury/hydride system are the reaction vessel and sampling cell. The sample solution reacts with a reducing agent in the reaction vessel. A spontaneous reaction occurs to form the gaseous hydride or to reduce mercury to its elemental form. The gaseous products are carried to the sample cell, a quartz cell placed in the light path of the spectrometer. The quartz cell is heated to dissociate the hydride gas into free atoms, or in the case of mercury, to prevent condensation of the water vapor.

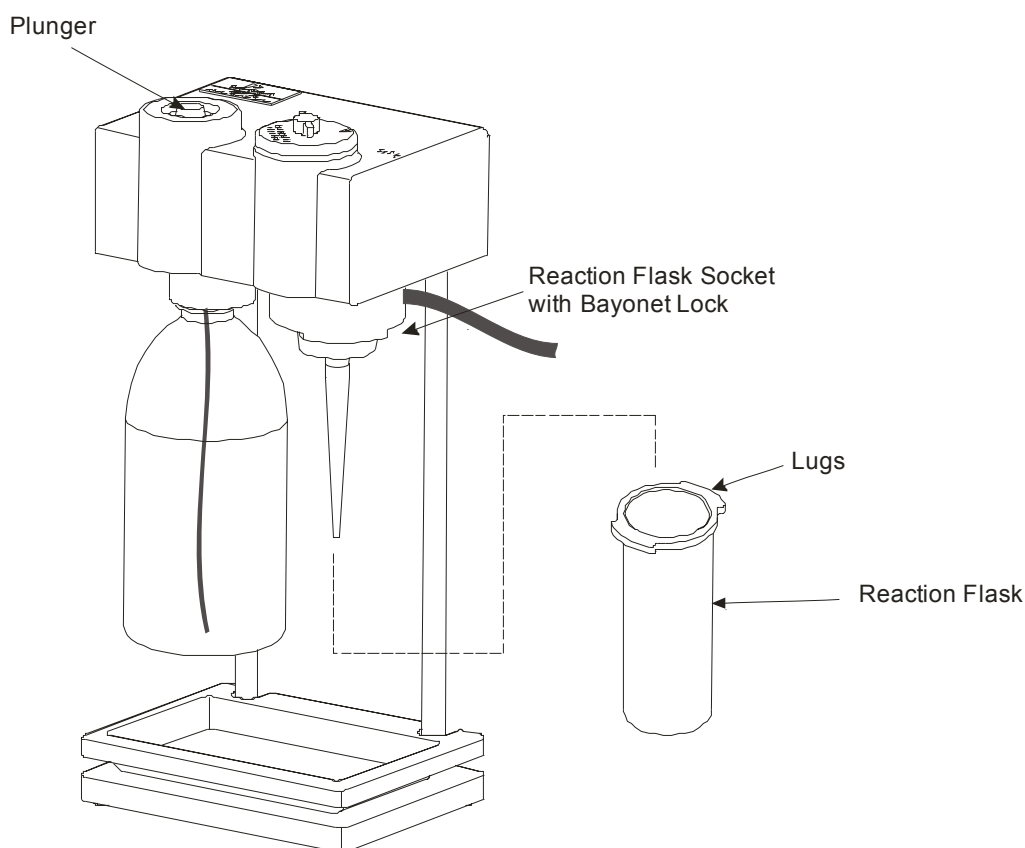


Figure 4- 12 The MHS-15 and its parts.

The MHS-15 is a manual system. The quartz cell is heated by the flame. Key operating parameters are controlled by the instrument touch screen. Data collection, calibration, and calculation functions are performed by the instrument.

The MHS-15 analyzer assembly is freestanding and is located near the sample compartment of the spectrometer. This assembly includes a reaction flask, a reservoir for the reducing agent, and all pneumatic components for control of the carrier gas and transport of metallic vapors to the quartz cell.

System Description

The cell assembly consists of a quartz cell and a mount. The mount installs on the AAnalyst burner head, positioned above the single slot in the burner head, permitting the quartz cell to be heated in the flame.

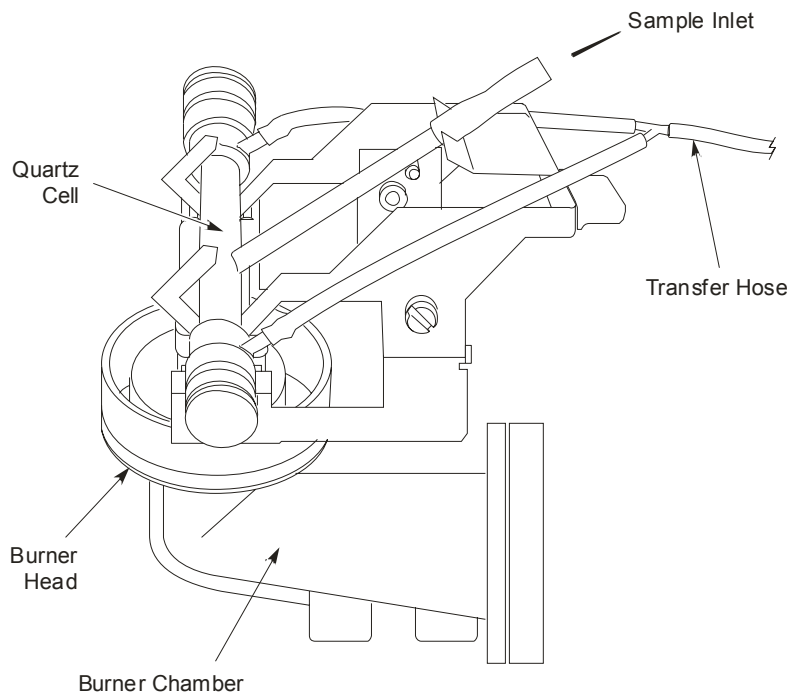


Figure 4- 13 The MHS-15 sample cell mounted on the burner.

For detailed information on the MHS-15, refer to the manual that came with the System.

Installation **5**

Introduction to the Installation Procedure

Before you start to install your AAAnalyst 200 spectrometer, please take time to read through this self-installation guide and become familiar with the steps involved. Please make sure your laboratory meets all of the requirements listed in this chapter, before you begin to install the system.

NOTE: *A CD-ROM is provided with the spectrometer that contains a video showing the complete installation procedure. We strongly recommend that you view this video before you attempt to install your spectrometer.*

Summary of the installation procedure

This summary lists the steps you must perform to install the spectrometer.

1. Inspect the shipment.
2. Unpack the spectrometer.
3. Place the spectrometer on the bench.
4. Install the touch screen.
5. Connect the gas hoses.
6. Set up the burner system.
7. Install the burner door.
8. Install the sample tray.
9. Connect the spectrometer to the electrical supply.
10. Perform the post-installation checks.

Tools required for the installation

You will need the following tools during installation of the spectrometer:

- small flat-bladed screwdriver
- two wrenches for gas fittings

When the Spectrometer Arrives

Inspect the shipment

Upon receipt of the instrument, inspect the exterior of the shipping carton for obvious signs of damage. The carton should arrive unopened and undamaged. If the carton has been damaged, file a claim with the authorized carrier immediately and inform your nearest PerkinElmer office. A representative of the shipping carrier must be present for insurance purposes.

How to unpack the spectrometer

Carefully read these instructions before you unpack the AAnalyst 200 to avoid damaging the instrument. The AAnalyst 200 is shipped in a single carton. The carton contains the instrument in the lower portion of the box with an inner tray designed to hold items in the upper portion of the box. The touch screen, atomizer compartment door, drain bottle, sample shelf, user guides, and small parts are contained in the inner tray.

1. Place the instrument carton on the floor in front of the bench on which the instrument will be placed.
2. Cut the two bands that hold the carton together, lift off the top of the carton.
3. Pull out the two foam pieces that secure the instrument in the box.
4. Remove the three small cardboard boxes from the carton.
5. Lift up and remove the carton sleeve (the sides of the box).
6. Next remove the protective wrapping around the instrument (not shown).
7. Prepare to lift the instrument out of the carton. You will need two people to do this. The bench should be nearby.



The instrument weighs 49 kg (108 lb). Use proper lifting posture when lifting the instrument out of the carton. Be aware that most of the weight is located at the right front corner of the instrument. It will want to tip forward when it is lifted out of the carton, so be prepared to support that corner.

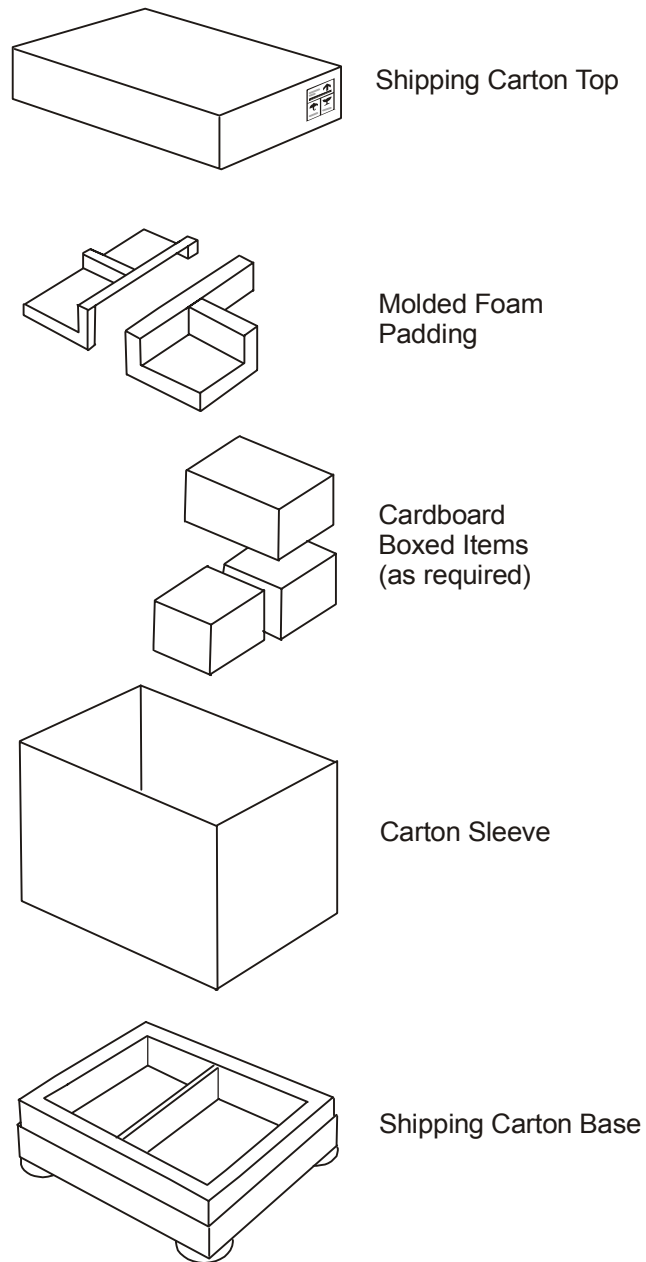


Figure 5- 1Exploded view of the shipping carton

Placing the Spectrometer on the Bench



WARNING

Risk of injury through lifting. The instrument weighs approximately 49 kg (108 lbs.). Improper lifting can cause painful and sometimes permanent back injury. Use proper lifting postures and/or mechanical lifting aids to lift or move the instrument.

1. Prepare to lift the instrument out of the carton. You will need two people to do this. The bench should be nearby.
2. Position a person on each side of the instrument as shown. Squat down and place both hands underneath the instrument – palms up. Spread your hands as far apart as possible (against the foam corners) while grasping the underside of the instrument.
3. With knees bent, simultaneously lift the instrument out of the carton as you rise to a standing position. Carefully place the instrument on the bench.

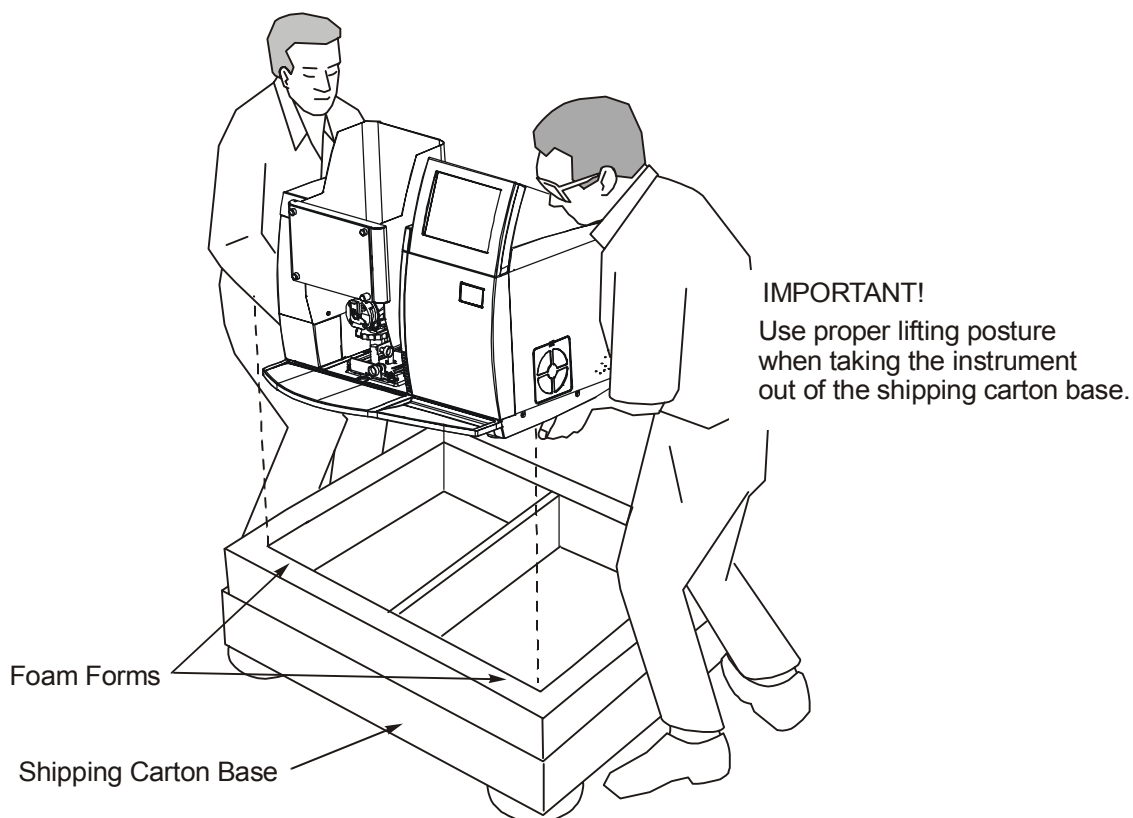


Figure 5- 2 Lifting the instrument out of the box

Carton recycling instructions

The carton can be folded down for easy storage. You can store the carton for future use (to transport the instrument), or break it down completely and give it to your local recycling center.

AAnalyst 200 Shipping List

The following parts are included in the shipment.

Table 5- 1 Shipping List

Description
AAAnalyst 200 Instrument
Burner Door (in a box)
Touch Screen (in a box)
Drain Assembly (including the drain vessel)
Installation Kit (including the multimedia CD)

AAAnalyst 200 Spares Kit

The following parts are included in the AAAnalyst 200 Spares Kit (P/N B315-0021). The kit is shipped with the instrument.

Table 5- 2 Spares Kit

Part No.	Description	QTY
B019-1060	Nebulizer tubing, 1000mm	1
B315-0458	Nebulizer tubing, 300mm (for manual sampling)	1
B050-1696	Air Filter	1
0941-0063	Serial Cable	1
0990-3004	Hose Clamp	1
0998-8986	Line Cord-North America	1
0999-1415	Line Cord Europe	1
0303-1573	Burner Cleaning Tool	1
N101-0235	Quick Start CD	1
0990-9390	AA Newsletter Subscription Form	1
0993-6643	AAAnalyst 400 Safety Booklet	1
0943-2046	Software Utilities CD	1
0993-6550	AA Instrument Maintenance Log	1
0993-8893	Software/ Spectrometer Registration Card	1

Installing the Touch Screen

The touch screen is packed separately for shipping. To facilitate installation of the touch screen you must temporarily remove the lamp door.

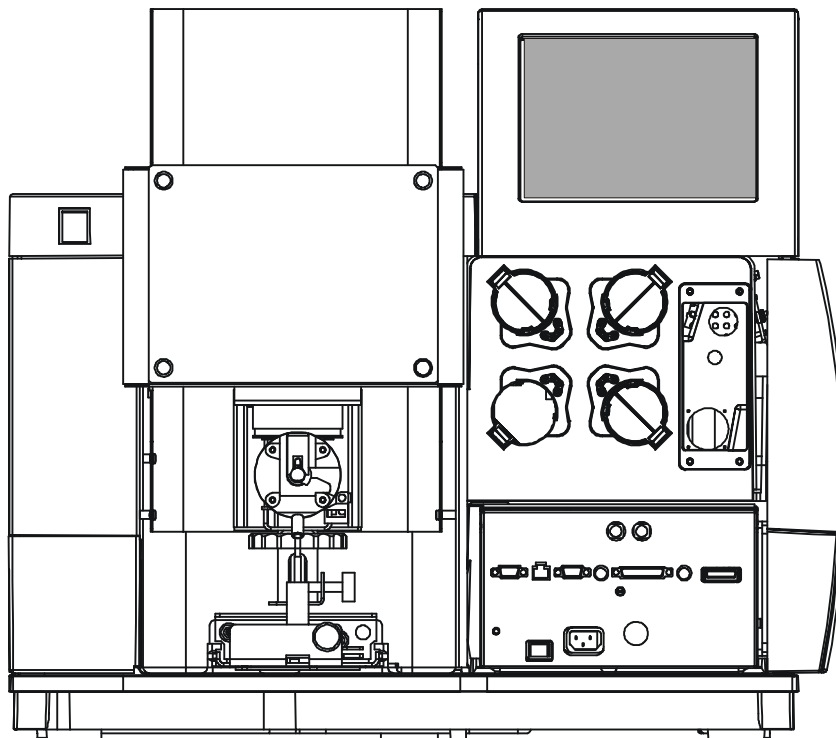


Figure 5- 3 Removing lamp door

Remove the lamp door and install the touch screen

Remove the lamp door

1. Loosen the lower securing screw with a screwdriver and place in a secure place. Gently push out the upper part of the door from the upper pin and maneuver the lower part of the door out from the instrument. Keep the screw for when you remount the lamp door.
2. Lift out the lamp door and put it in a secure location.

Install the touch screen

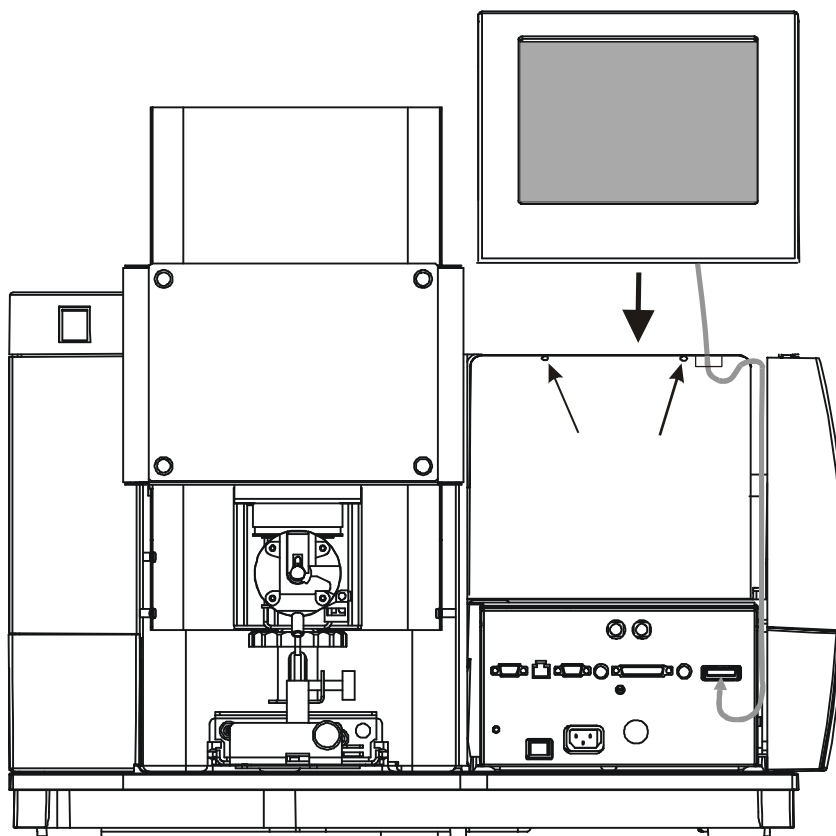


Figure 5- 4 Installing the touch screen

Locate the touch screen (packed separately).

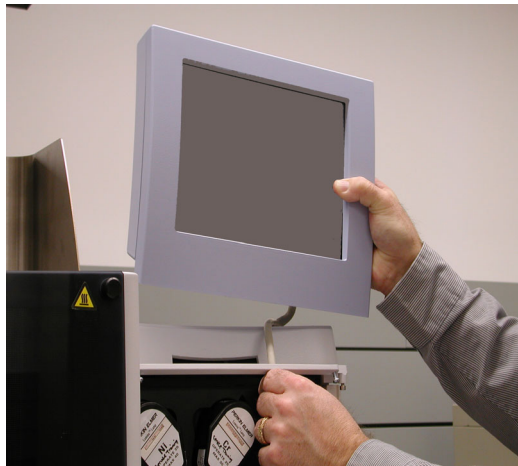
1. Thread the connector cord through the slot above the lamp compartment.



Screen 5- 1 Slot above the lamp compartment

Installation

2. Slide the touch screen over the slot in the instrument cover and gently move into place.



Screen 5- 2 Mounting the touch screen

3. Locate the screw above the lamp compartment and tighten it.



Screen 5- 3 Screw above the lamp compartment

4. Thread the connector cord into the channel.



Screen 5- 4 Cable Channel

5. Connect the display cable to the E-Box's Display Connector receptacle.



Screen 5- 5 E-Box

6. Remount the lamp door.

This completes installation of the touch screen. You must calibrate the touch screen when you put the spectrometer into operation for the first time.

Connecting the Gas Hoses

Make sure your laboratory meets all of the requirements listed in Chapter 2, before you begin to install the system.

Fittings suitable for most commonly available gas regulators are provided in the installation kit supplied with the spectrometer.

Air and nitrous oxide fittings have right-hand threads. Acetylene fittings have left-hand threads.

Gas hoses on the spectrometer



WARNING

Warning: Flammable Gases-Fire and Explosion Hazard
Acetylene is a flammable gas. Make sure that all the gas connections are gas-tight. Check the connections and gas hoses regularly for leaks using a leak testing fluid.

Gas Pressures

	Gas							
	Purge (clear line)		N ₂ O		Air (black line)		C ₂ H ₂ (red line)	
	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>
kPa	300	400	300	400	300	400	80	96
bar	3.0	4.0	3.0	4.0	3.0	4.0	0.8	1.0
psig	44	58	44	58	44	58	12	14

1. Connect the purge (clear), air (black), nitrous oxide (blue), and acetylene (red) hoses to the respective gas supplies. Fittings suitable for most commonly available gas regulators are provided in the installation kit supplied with the instrument.
2. Tighten all gas connections using the double wrench technique: hold the fitting on the regulator with one wrench and tighten the compression nut on the gas hose with the other wrench. Acetylene fittings have left-hand threads. Air and nitrous oxide fittings have right-hand threads.
3. Only high quality purge gases (Air, Ar or N₂) should be used. Minimum purity of 99.9% is recommended. A high quality filter-dryer accessory is recommended for the removal of any moisture from the purge gas.
4. Turn the gases on. Test all gas connections for leaks using an approved gas leak detection fluid.

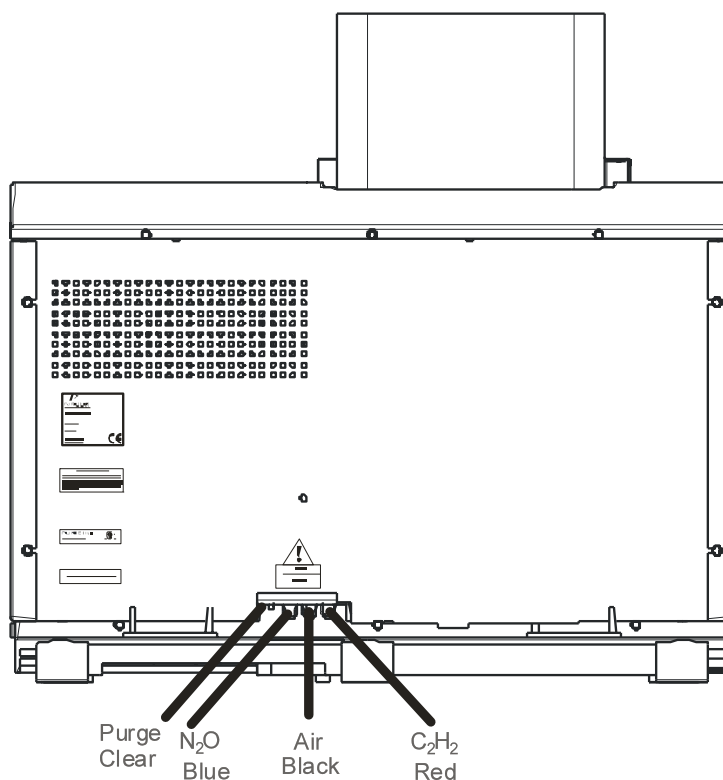


Figure 5- 5Rear view of the spectrometer showing the gas hoses

Connecting to the air supply



WARNING

Warning: Flashback Hazard

*PerkinElmer 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 rich air with PerkinElmer burner systems. Use only compressed air.***

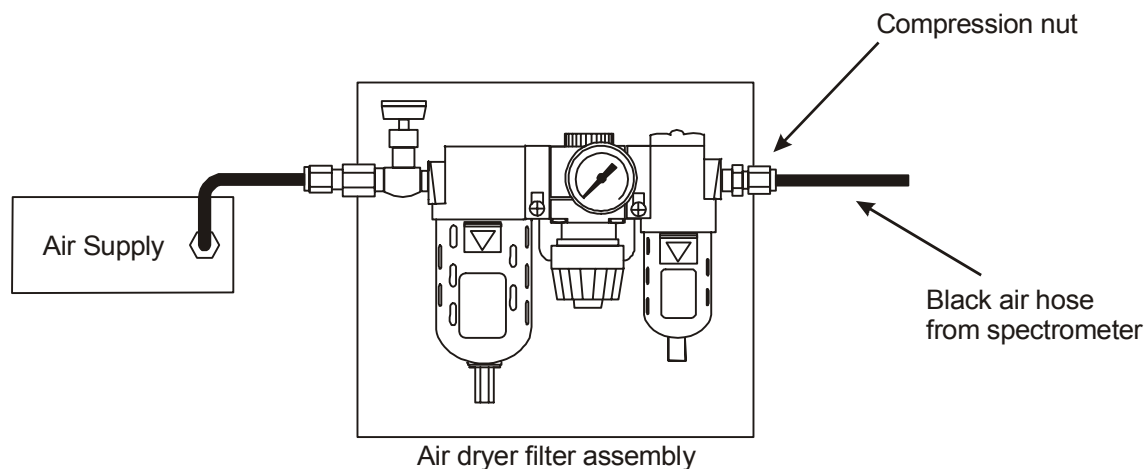


Figure 5- 6 Air supply connections showing air dryer filter assembly

1. Connect the black air hose (coming from the back of the spectrometer) to the outlet of the air dryer filter assembly.
2. Tighten the connection using the double wrench technique. Hold the fitting on the air dryer filter assembly with one wrench and tighten the compression nut on the gas hose with the other wrench.



Screen 5- 6 Double Wrench technique

Connecting to the nitrous oxide supply

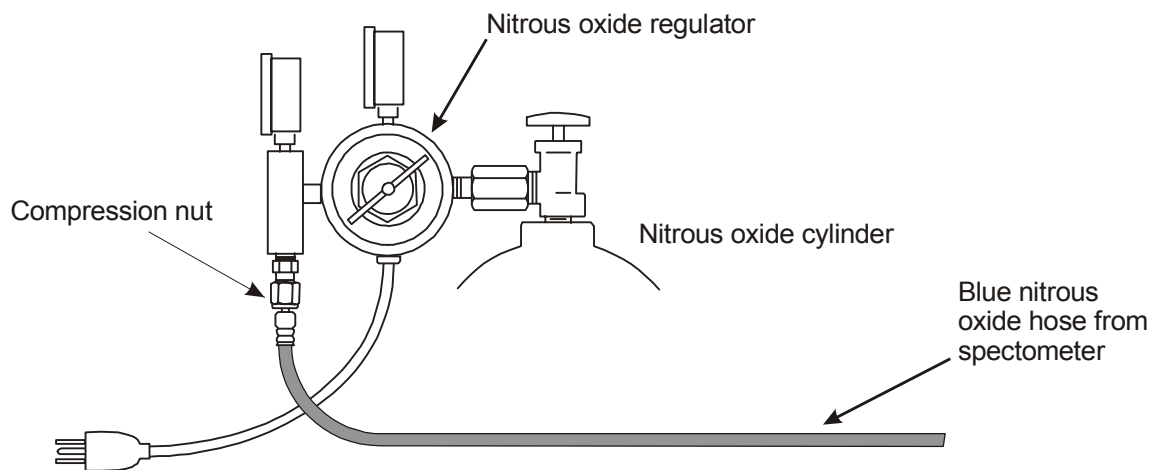


Figure 5- 7 Nitrous oxide supply connections

1. Connect the blue nitrous oxide hose (coming from the back of the spectrometer) to the nitrous oxide regulator.
2. Tighten the connection using the double wrench technique. Hold the fitting on the regulator with one wrench and tighten the compression nut on the gas hose with the other wrench.

NOTE: *If you intend to perform analyses using only the air-acetylene flame (i.e. you do not intend to analyze elements that require a nitrous oxide-acetylene flame), you will not require a supply of nitrous oxide. When shipped from the manufacturing site the blue nitrous oxide hose is fitted with a plug. Leave this plug in the free end of the hose when it is not connected to a supply of nitrous oxide.*

Connecting to the acetylene supply



WARNING

Warning: Flammable Gas – Fire and Explosion Hazard

Acetylene is a flammable gas. The seepage of acetylene from any gas connection constitutes a serious fire hazard. Make sure that all gas connections are gas tight. Check the gas connections and gas hoses regularly for leaks using a suitable leak testing fluid.

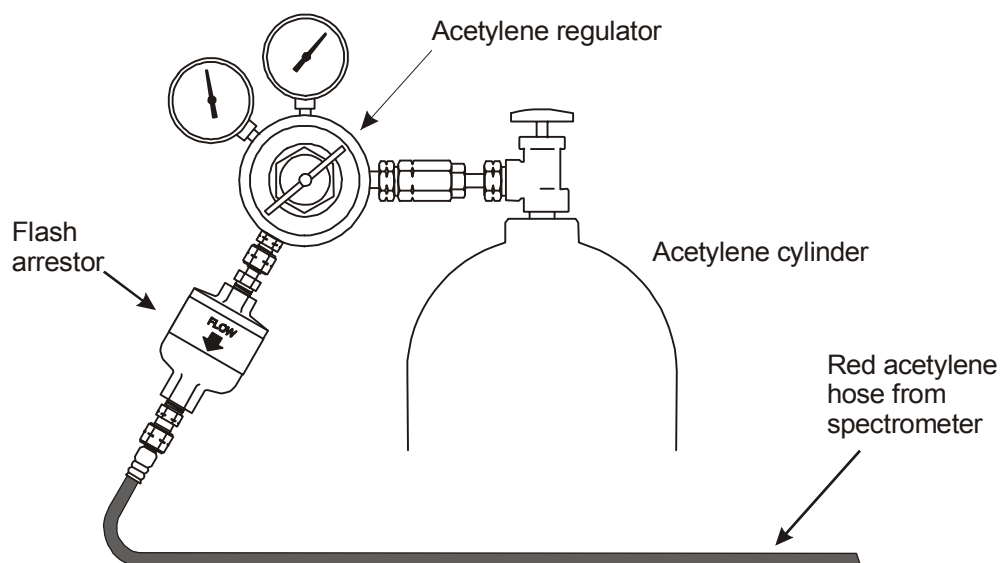


Figure 5- 8 Acetylene supply connections

1. Connect the red acetylene hose (coming from the back of the spectrometer) to the acetylene regulator.
2. Tighten the connection using the double wrench technique. Hold the fitting on the air dryer filter assembly with one wrench and tighten the compression nut on the gas hose with the other wrench.

Setting up the Burner System

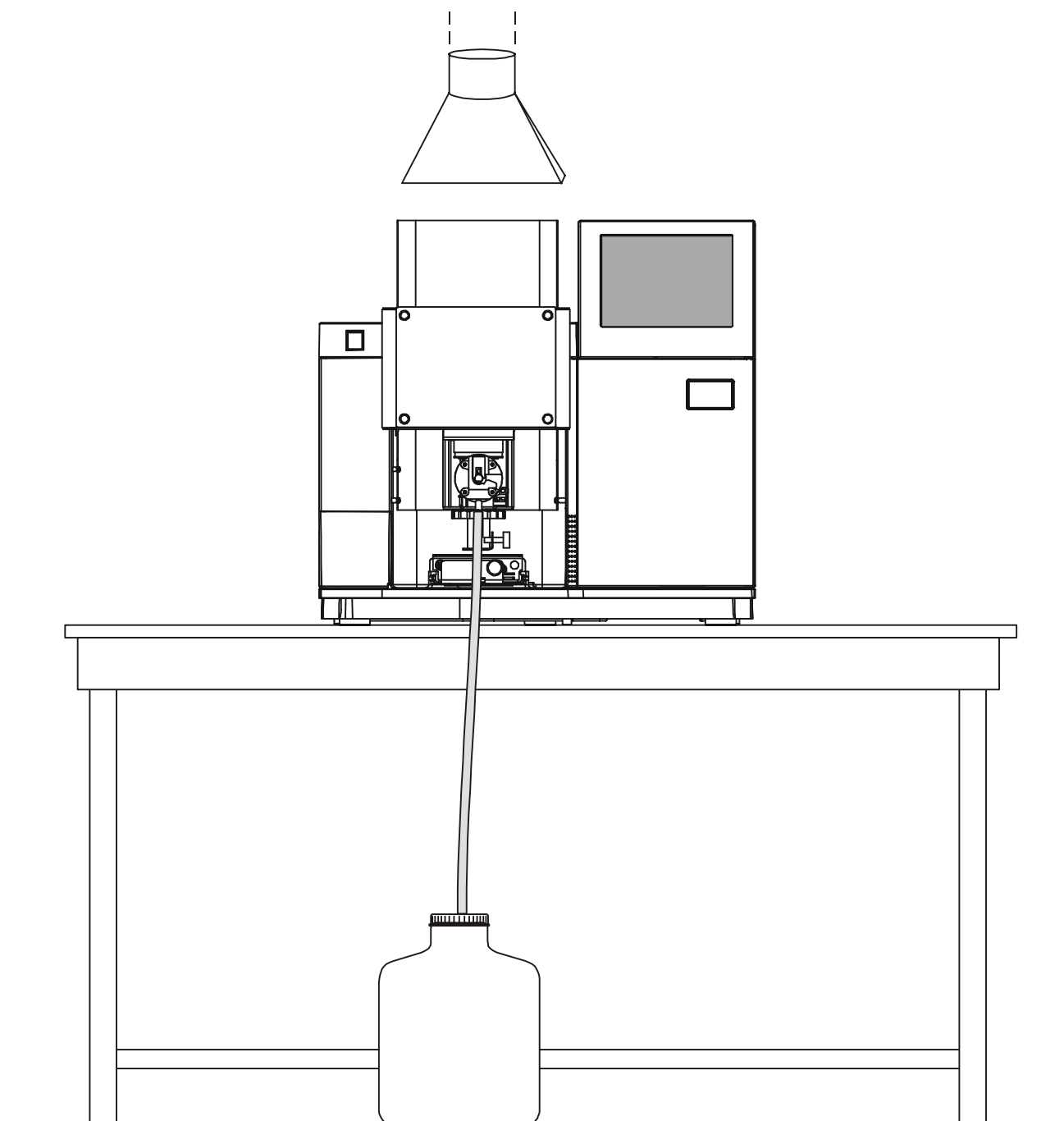


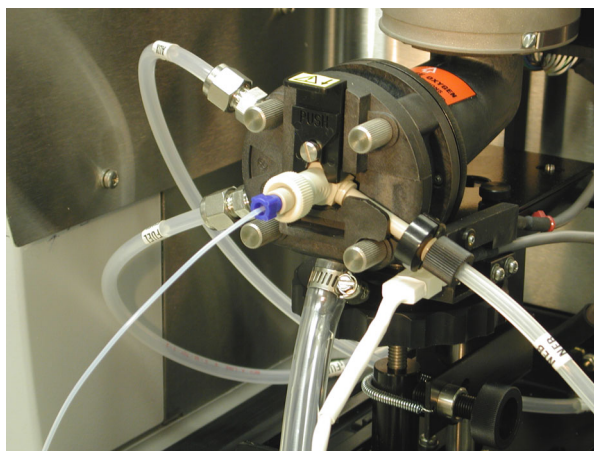
Figure 5- 9 Full view of the AAAnalyst 200 Instrument

Install the Burner Assembly

1. Carefully remove the foam packing piece from around the burner system.
2. Guide the burner assembly into the tracks of the atomizer compartment.
3. Push the burner assembly in so that the rear gas fittings line up with the gas connectors at the back of the atomizer compartment. Push the burner assembly fully in until it clicks into place and pull the lever forward to lock the burner assembly in place.

Connecting the Drain Vessel and the Drain Interlock

1. Locate the drain vessel. The drain tube and interlock cable will be attached to the drain vessel retainer cap.
2. Place the drain vessel in **full view** on the floor in front of the instrument. **Never place the drain vessel inside a cabinet.**
3. Before connecting the drain tube to the burner assembly, pour about 250 mL of water into the free end of the drain tube to fill the drain loop and to activate the drain float.
4. Place the hose clamp over the free end of the drain tubing.
5. Carefully install the free end of the drain tubing over the drain outlet, making sure that the inner lining of the drain tube does not get damaged.
6. Use a flat-blade screwdriver to tighten the hose clamp.
7. Plug the white drain interlock connector into the drain interlock plug on the burner assembly.



Screen 5- 7 Drain hose and drain interlock

Further procedures for setting up the burner system are described in Chapter 6, *Operation of the Instrument*.

Installing the Burner Door

The burner door is packed separately for shipping. Refer to the figure below when installing the door.

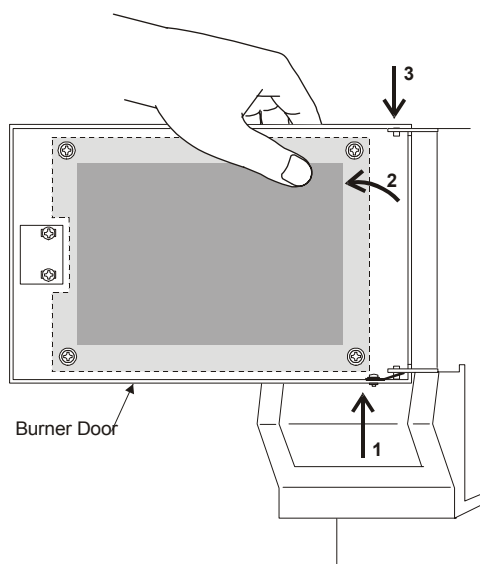


Figure 5- 10 Installing the atomizer compartment door

1. Hold the door in place next to the burner compartment.
2. Tilt the top of the door away from the upper door pin while you push the lower pin up into the hole in the door mount.
3. Drop the top pin down into the upper hole in the door mount while holding the bottom pin in place. Swing the door while letting it drop down and lock into place on the hinges.
4. Close the door. This completes the procedure for installing the burner door.

Installing the Sample Tray

The sample tray is packed separately for shipping.

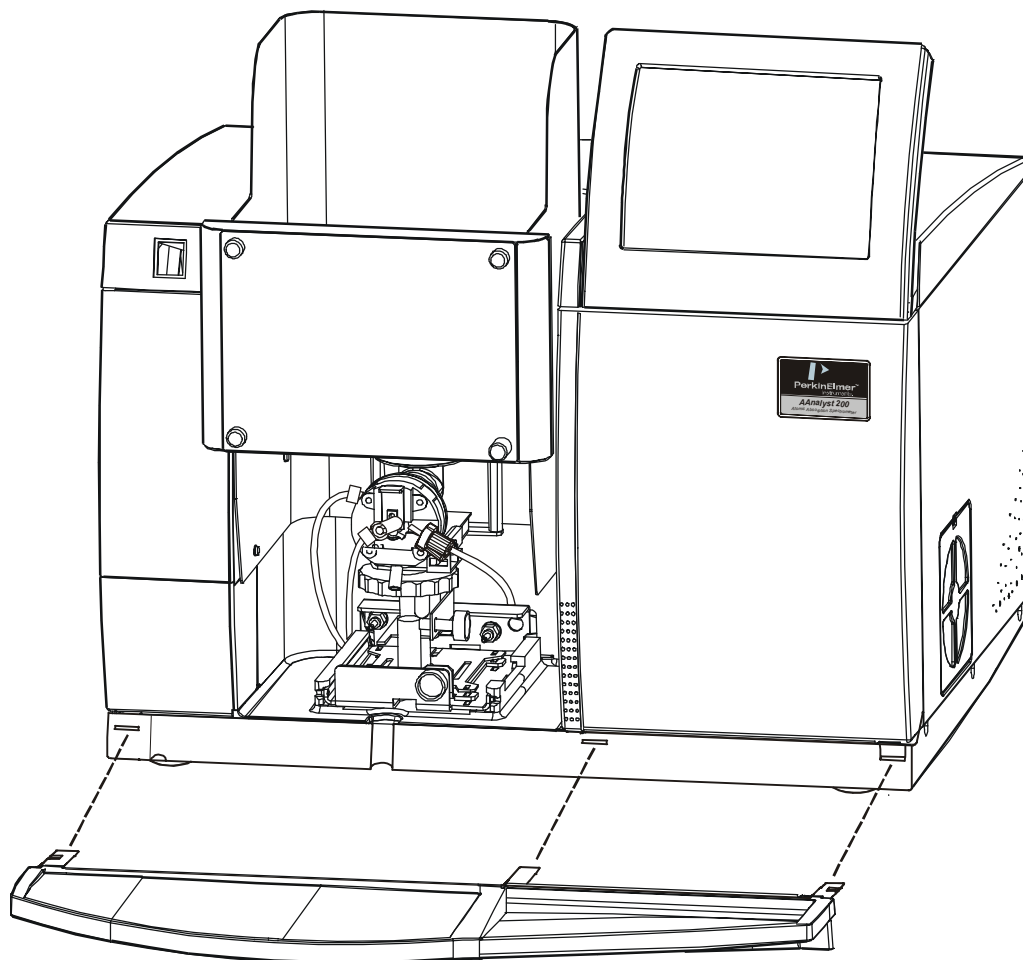


Figure 5- 11 Sample tray

1. Hold the tray with both hands in the position shown in front of the instrument.
2. Tilt the tray mounting posts downward at a slight angle as you insert them into the slots in the front of the instrument.
3. Slide the tray all the way into the front of the instrument base until it hits the stop. At that point, gently push the tray edge downward to secure it into place. You will feel it lock into place.

NOTE: Do not block access to the E-Box located behind the right front cover. Removal of the power cord from the appliance coupler will completely disconnect the AAnalyst 200 from AC power line.

This completes the procedure for installing the sample tray.

Connecting to the Electrical Supply

After you have completed the installation procedures described previously, connect the spectrometer to the electrical supply.

1. Check the line cord provided with the spectrometer to make sure that it is fitted with the correct plug for your location. If the plug is not correct, contact your local PerkinElmer office for advice.
2. Make sure that the On/Off switch on the spectrometer's E-Box (behind the lamp door) is in the Off position (depressed).
3. Pass line cord receptacle underneath through the slot at the bottom of the lamp compartment.
4. Insert the line cord receptacle into the line power input module on the E-Box.
5. Insert the line cord plug into a suitable electrical outlet.
6. Do not switch on the spectrometer yet.

The correct procedure for powering up the spectrometer is described in Chapter 6, *Operation of the Instrument*.

Switches and Connectors on the E-Box

All electronics are located in a single user-replaceable module called the E-Box. Switches and connector ports are located on the front panel of the E-Box as shown in the figure below.

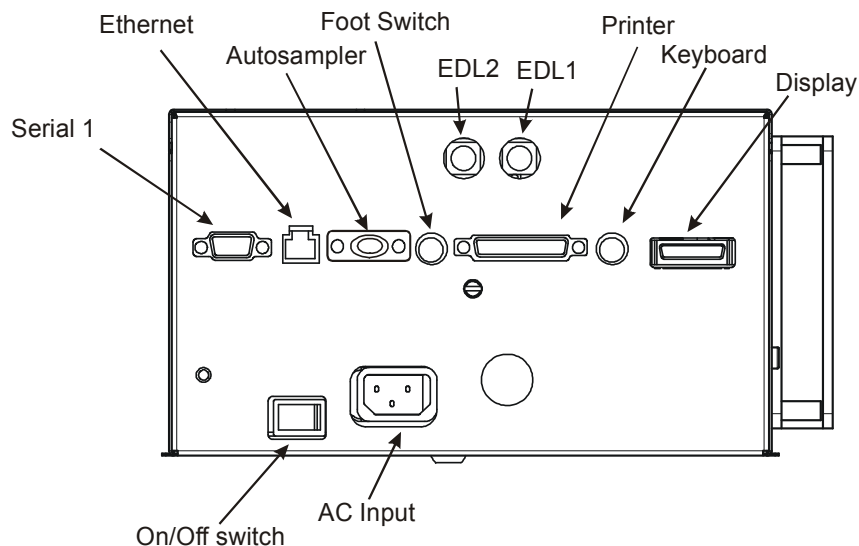


Figure 5- 12 Switches and ports on the front panel of the E-Box.

Autosampler	Connection port for autosampler.
Serial 1	Connection for serial port.
Ethernet	Connection port for the network.
Foot switch	Connection port for foot switch.
EDL 1	Connection port for EDL in lamp position 1.
EDL 2	Connection port for EDL in lamp position 2.
Printer	Connection port for printer.
Keyboard	Connection port for keyboard.
Display	Connection port for the touch screen.
On/Off Switch	Power switch.
AC Input	Connection of the power line cord.

Setting Up the AutoSampler

The AA200 Analyst supports autosampler model AS-90, AS-90 plus (p/n B314-0291), and AS-93 plus (p/n B314-0330). Depending on your autosampler model, refer to the *User's Guide* provided with your autosampler for complete installation.

Electrical connections

Connecting autosampler (AS-90 plus or AS-93 plus) to the E-Box:

1. Connect RS 232 cable to the Autosampler connector on the E-Box.
2. From the E-Box, run the RS 232 cable to the com port 2 of the autosampler.
3. Plug the autosampler power cord to the power outlet and power up the autosampler.

Your autosampler electrical connections are now complete. For complete procedure on how to select autosampler type, see Chapter 7, *TouchScreen*.

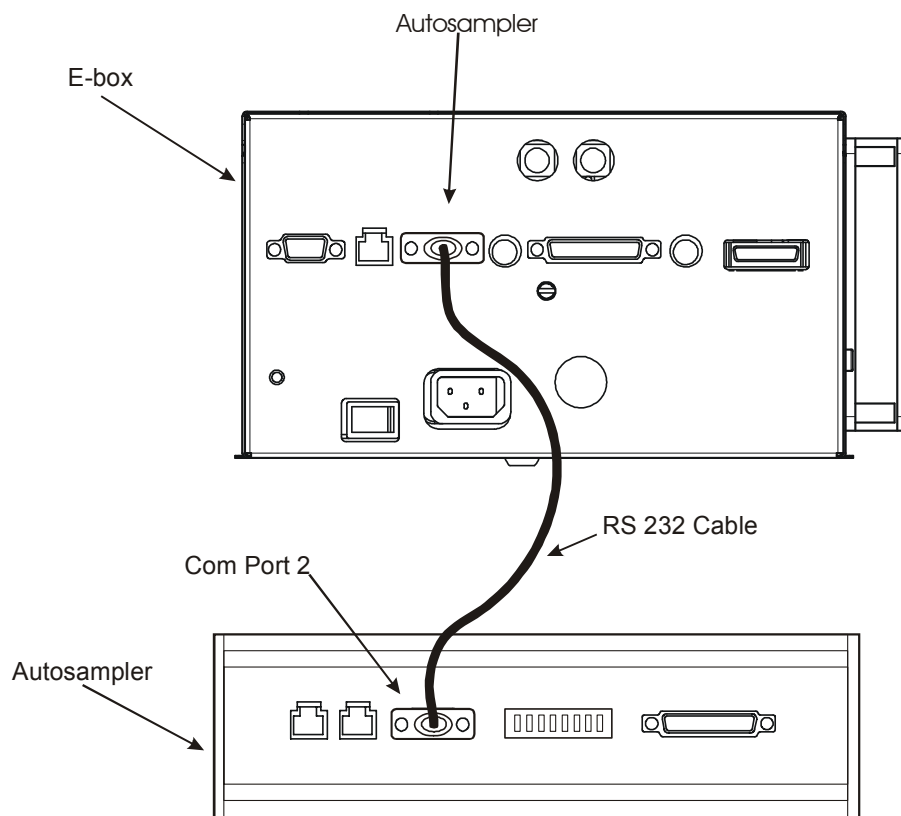


Figure 5- 13 Autosampler Connection

Connecting the Foot Switch

The AA200 Analyst supports the foot switch (p/n 0999-8306). The foot switch is an optional feature that allows the user to conveniently analyze samples without touching the analyze button on the touchscreen. The user simply steps on the foot switch and starts analyzing sample.

Electrical connections

Connecting foot switch (p/n 0999-8306) to the E-Box:

1. Connect the foot switch connector cord to the foot switch port on the E-Box.
2. Your foot switch electrical connections are now complete.

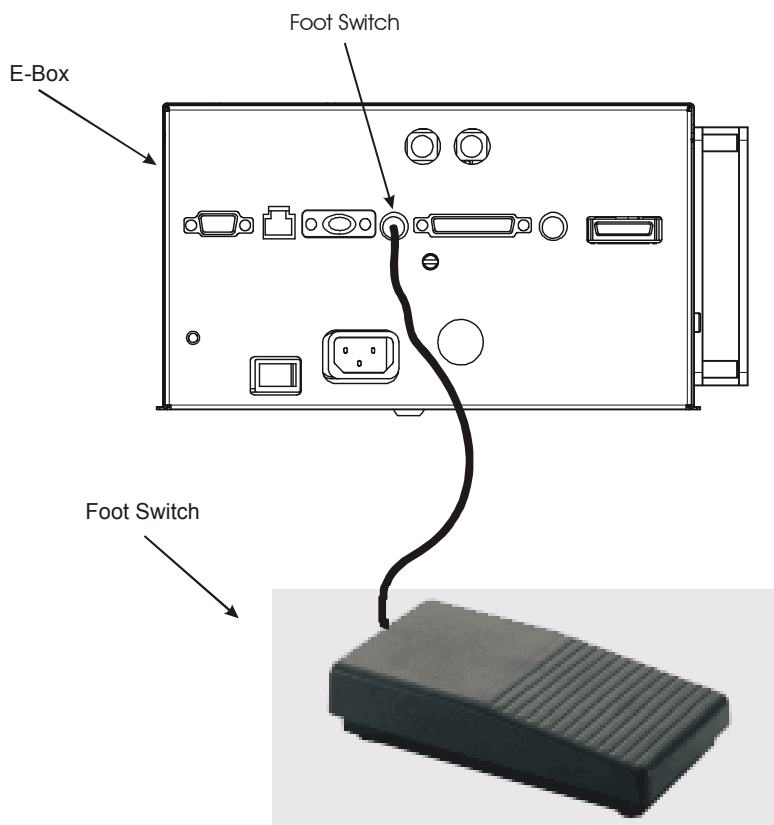


Figure 5- 14 Foot Switch

Operation of the Instrument

6

Starting Up the System

Summary of the procedure

Read the safety information at the front of this guide before you operate the system.

1. Make sure that the spectrometer system and other ancillary instruments are correctly installed and connected to their AC line power outlets.
2. If you need the (optional) autosampler, connect the autosampler to AC line power.
3. Switch on the exhaust venting system for the work area.
4. Turn on the burner gases and adjust the outlet gauge pressures to the recommended values. Always set the same outlet gauge pressure for air and nitrous oxide.
5. Install the required lamp for the analyte element.
6. Switch on the spectrometer using the AC power on/off switch, located on the E-Box.
7. Set up the burner system .
8. Procedures for shutting down the system are described in *Chapter 8, Analyzing Samples*.
In an emergency, you can shut down the system as described in *Chapter 8, Analyzing Samples*.

Required Pressures for the Burner Gases

	Gas							
	Purge (clear line)		N₂O		Air (black line)		C₂H₂ (red line)	
	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>	<i>min</i>	<i>max</i>
kPa	300	400	300	400	300	400	80	96
bar	3.0	4.0	3.0	4.0	3.0	4.0	0.8	1.0
psig	44	58	44	58	44	58	12	14

- 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}).

- Only high quality purge gases (Air, Ar or N₂) should be used. Minimum purity of 99.9% is recommended. A high quality filter-dryer accessory is recommended for the removal of any moisture from the purge gas.



WARNING

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 valve.

Setting Up the Burner System

Summary of the procedure

1. Check that the drain trap is filled with water.
2. Install the correct burner head for the type of flame that you intend to use – air-acetylene (10 cm) or nitrous oxide-acetylene (5 cm). See procedures on how to install burner head in the *Maintenance* chapter.
3. If you want to use an impact bead or spacer on the nebulizer, make sure that it is correctly installed.
4. If you intend to aspirate organic solvents, use a yellow color drain tube that is designed for organic solvents.
5. Check the burner height. Make sure the burner head is balanced at both ends and the burner head is also parallel to the light beam. See Adjusting Burner Height later in this chapter.
6. Perform the safety checks.
7. Ignite the flame.

NOTE: *Correct procedures for extinguishing the flame are described later in this chapter.*

Assembling the Quick-Change Burner Mount Assembly

Before the burner assembly can be put into the instrument, a few items need to be added or checked. The following sections give full procedures to do so.

Installing the Nebulizer on the Burner

Refer to the figure below to install the nebulizer onto the burner end cap.

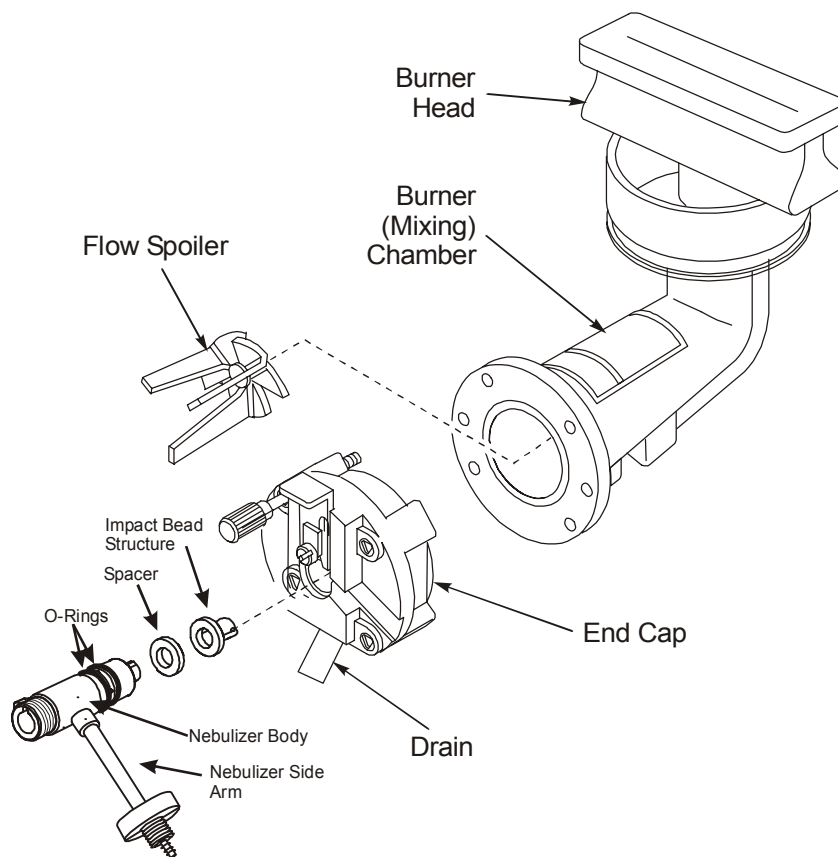


Figure 6- 1 Installing the nebulizer onto the burner end cap.

1. Feed at least 6-8 inches (152-203 mm) of capillary tubing onto the nebulizer inlet.
2. Lightly lubricate the nebulizer o-rings with the Apiezon grease supplied in the nebulizer kit.
3. Locate the nebulizer clamp (Detail A) and slide it up while inserting the nebulizer into the burner end cap. Be sure to orient the nebulizer side arm so that it will lay in the slot provided. (A gentle twisting and pushing motion might be necessary to fully seat the nebulizer in the burner end cap.)

4. Lower the nebulizer clamp until it presses against the barrel and flange of the nebulizer (shaded area). Ensure that the nebulizer is pushed in all the way and clamped in correctly. Warning, the nebulizer clamp must be lowered and locked **OVER** the nebulizer flange. Detail B shows the clamp lowered and locked correctly over the nebulizer flange.

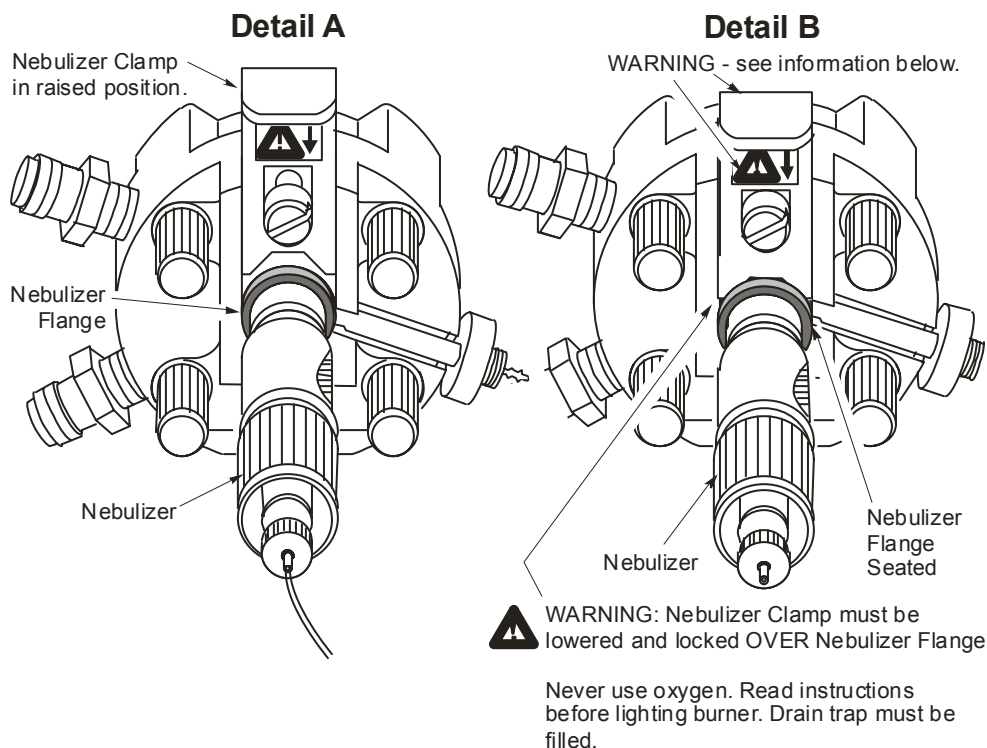


Figure 6- 2 Installing nebulizer onto the burner end

5. Next you'll connect the nebulizer oxidant hose to the nebulizer side arm. Remove the plastic nut from the nebulizer side arm. Slide the nut on the end of the hose hanging free on the burner base. The hose has white tape on it printed with the word "NEB."
6. Slide the NEB oxidant tubing onto the ridges on the nebulizer side arm.
7. Using the Apiezon grease, lightly lubricate the **OUTSIDE** of the tubing where the nut will screw onto the nebulizer ridges.
8. Finally, slide the plastic nut up the black tubing and gently thread it over the ridges on the side arm. Tighten the plastic nut just finger tight. The nebulizer is now assembled in place and secure.

Checking that the Burner End Cap is Secure

The burner end cap is assembled to the burner chamber at the factory. It is always a good idea to confirm that the screws are tight. To do so, hand-tighten (in an alternating pattern) the four knurled screws holding the burner end cap to the burner chamber. Tightening them in an alternating pattern (diagonally opposite nuts) will allow the o-ring to form a good seal. See the figure below for the location of the four knurled screws. Tighten them **only** hand tight.

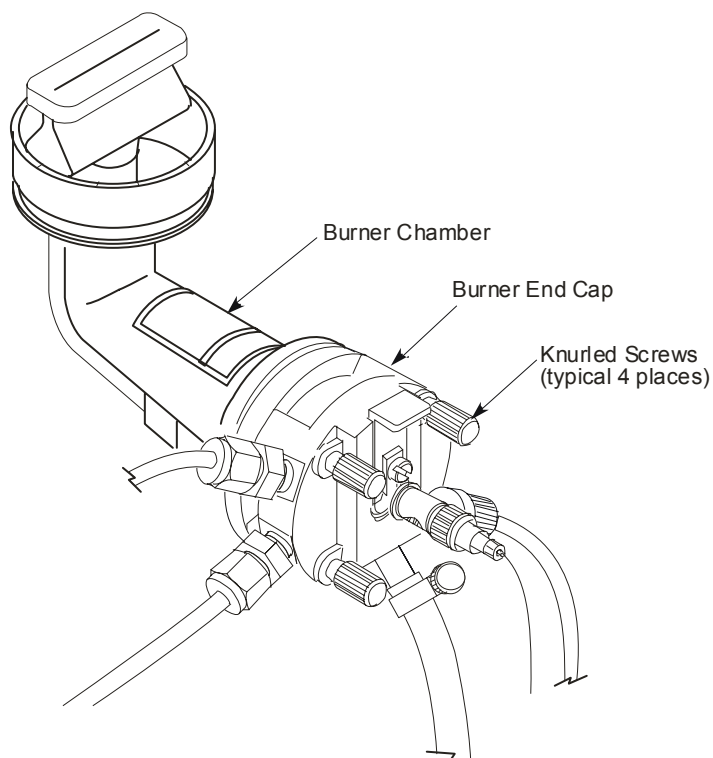


Figure 6- 3 Checking that the burner end cap is secure.

Connecting and Securing the Gas Hoses to the Burner

There are three gas hoses that are connected to the end cap on the burner assembly: the nebulizer oxidant hose, the auxiliary oxidant hose, and the fuel hose. They are pointed out in the next figure. At this point, all three hoses should already be connected to the burner. If they are not do so now. The next few paragraphs discuss how to check them.

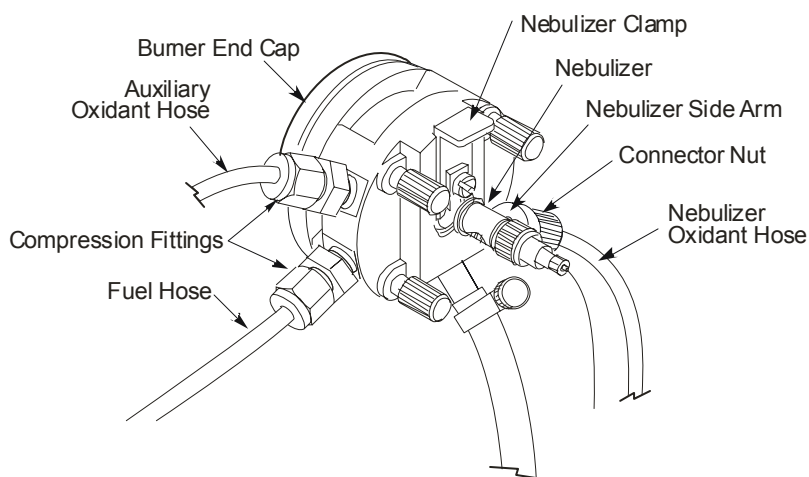


Figure 6- 4 Securing the gas hoses to the burner end cap.

The first hose is the nebulizer oxidant hose (also called the NEB). It is connected right after the nebulizer is installed. The second gas hose is referred to as the auxiliary oxidant hose (AUX). It is the other “clear” hose coming up from under the burner mounting plate and attached to the burner end cap. The hose is connected at the factory. Confirm that it is connected and that the compression fitting is tight. If it is not, do the following:

- Tighten the compression fitting hand tight plus a ¼ turn using two wrenches: one wrench to hold the nebulizer fitting and the other to turn the compression fitting.

The third hose connected to the burner is the fuel hose. It is the “clear” tubing attached to the burner end cap. (Refer to figure *Securing the gas hoses to the burner end cap.*) That hose, too, is connected at the factory. Confirm that it is connected and that the compression fitting is tight. If it is not, tighten it using the procedure that follows:

- Tighten the compression fitting hand tight plus a ¼ turn using two wrenches: one wrench to hold the nebulizer fitting and the other to turn the compression fitting.

Installing and Securing the Burner Head

The burner head is shipped from the factory already attached to the burner assembly (10 cm air/acetylene N040-0102). If it was removed or you need to change it, follow these instructions to put it back on. Make sure the magnetic strip is facing the ignitor box. You must also confirm that the burner head safety latch is positioned above the head ring. This procedure will make sure that safety latch is correctly positioned over the burner head ring.

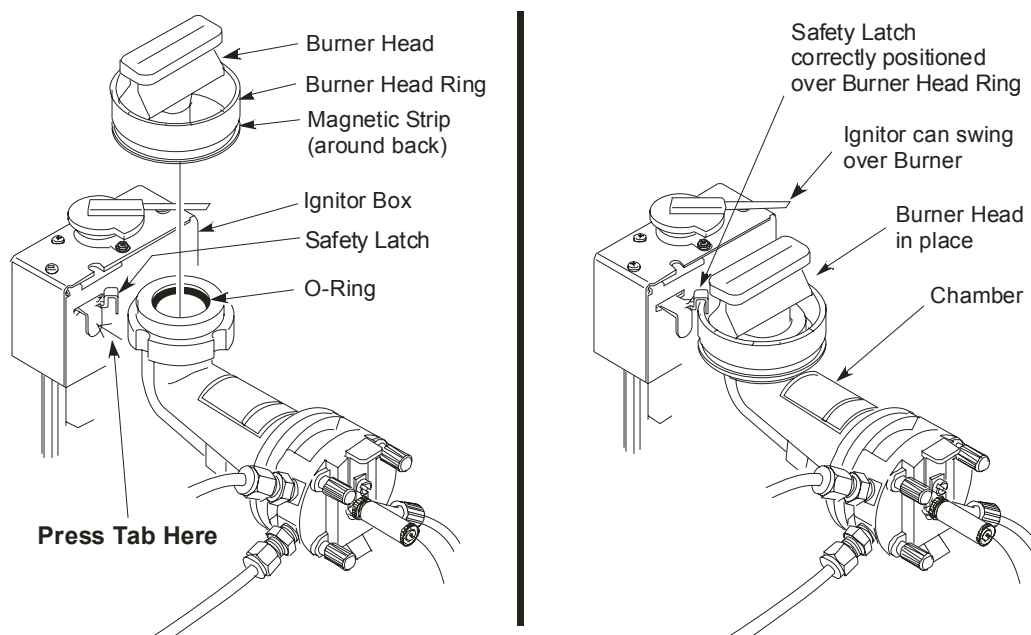


Figure 6- 5 Confirm that the burner head is in place and latched securely.

1. Press the tab on the safety latch while lowering the burner head into place inside the o-ring (see figure above).
2. Confirm that the magnetic strip on the burner head ring is positioned around back and “facing” the ignitor box. (See the left-most drawing above.)
3. Make sure to completely seat the burner head onto the chamber by gently pushing and twisting the burner head into the chamber. (See the right-most drawing above.) You will know that the burner head is fully seated because the ignitor will swing over the burner.
4. Let go of the safety latch. Look at it closely to confirm that the safety latch “hook” is positioned over the ring.

Installing Solvent-Resistant Components in the Burner

**WARNING*****Warning: Flammable Gases – Fire and Explosion Hazard***

Not all gaskets in the burner unit are suitable for use with organic solvents. Exposure to such solvents may cause the respective gaskets to swell. This may result in a seepage of gas which is a serious fire hazard.

Before you aspirate organic solutions, remove the respective gaskets and install solvent-resistant gaskets.

The standard o-ring in the burner end cap is not resistant to organic solvents. If you intend to aspirate solutions containing organic solvents you must exchange this o-ring for a solvent-resistant o-ring in the following way:

1. Where applicable, extinguish the flame, allow the burner head to cool, shut down the gases at source, and bleed the gas supply lines.
2. Open the atomizer compartment door.
3. Remove the burner head.
4. If corrosive or toxic samples were run previously, pour a large quantity of deionized water slowly through the neck of the burner chamber to thoroughly flush the inside and the drain system.
5. Remove the nebulizer from the burner end.
6. Remove the burner system from the spectrometer.
7. Take the burner chamber apart.
8. Remove the standard o-ring from the end cap and carefully fit the solvent resistant o-ring.
9. Reassemble the burner system

Installing the Burner Mount Assembly

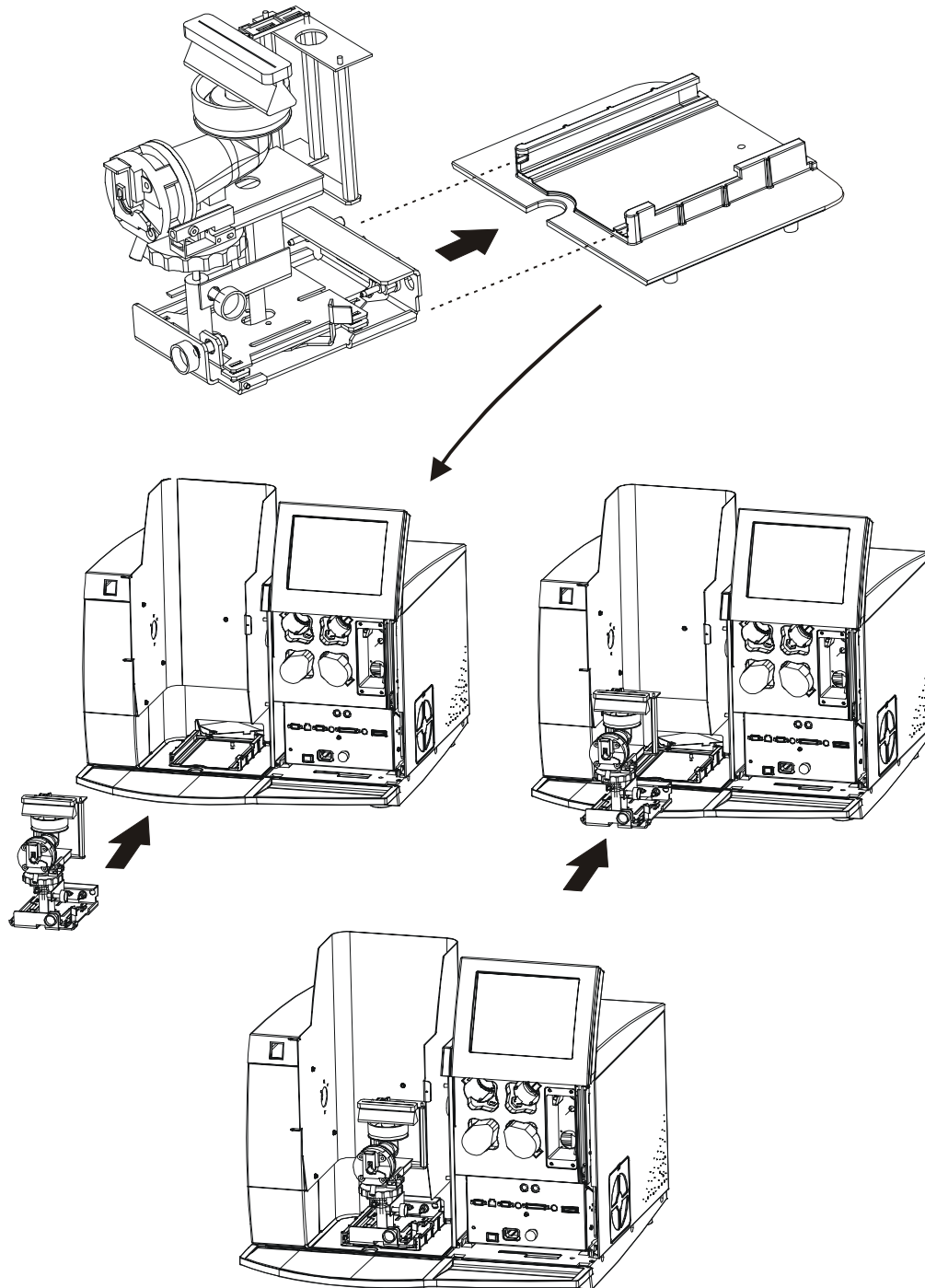



Figure 6- 6 Installing the burner mount assembly.

1. Orient the assembly to slide into the tracks as shown in the figure above.
2. Slide the assembly (along the tracks) into place in front of the instrument. When the assembly is pushed all the way in, you will hear a “clicking” sound as the three fittings seat themselves and lock into the back of the sample compartment. Pull the lever forward to lock the burner mount.

	<p><i>Warning: Flashback</i></p>
<p>WARNING</p>	<p><i>While the flame is on, DO NOT push the lever that is located on the burner mount assembly.</i></p>

Installing the Burner Drain System

Locate and unpack the drain system from the shipping carton. It includes all the parts marked in the figure below.

Connecting the Burner Drain System

1. Refer to the next figure when installing the drain system. Position the vessel on the floor underneath the front of the instrument and attach the retainer cap assembly (cap, trap and loop) to the drain vessel.
2. Hold up the free end of the drain tubing and pour approximately 250 mL of water into it until you hear the water start to drip into the vessel.

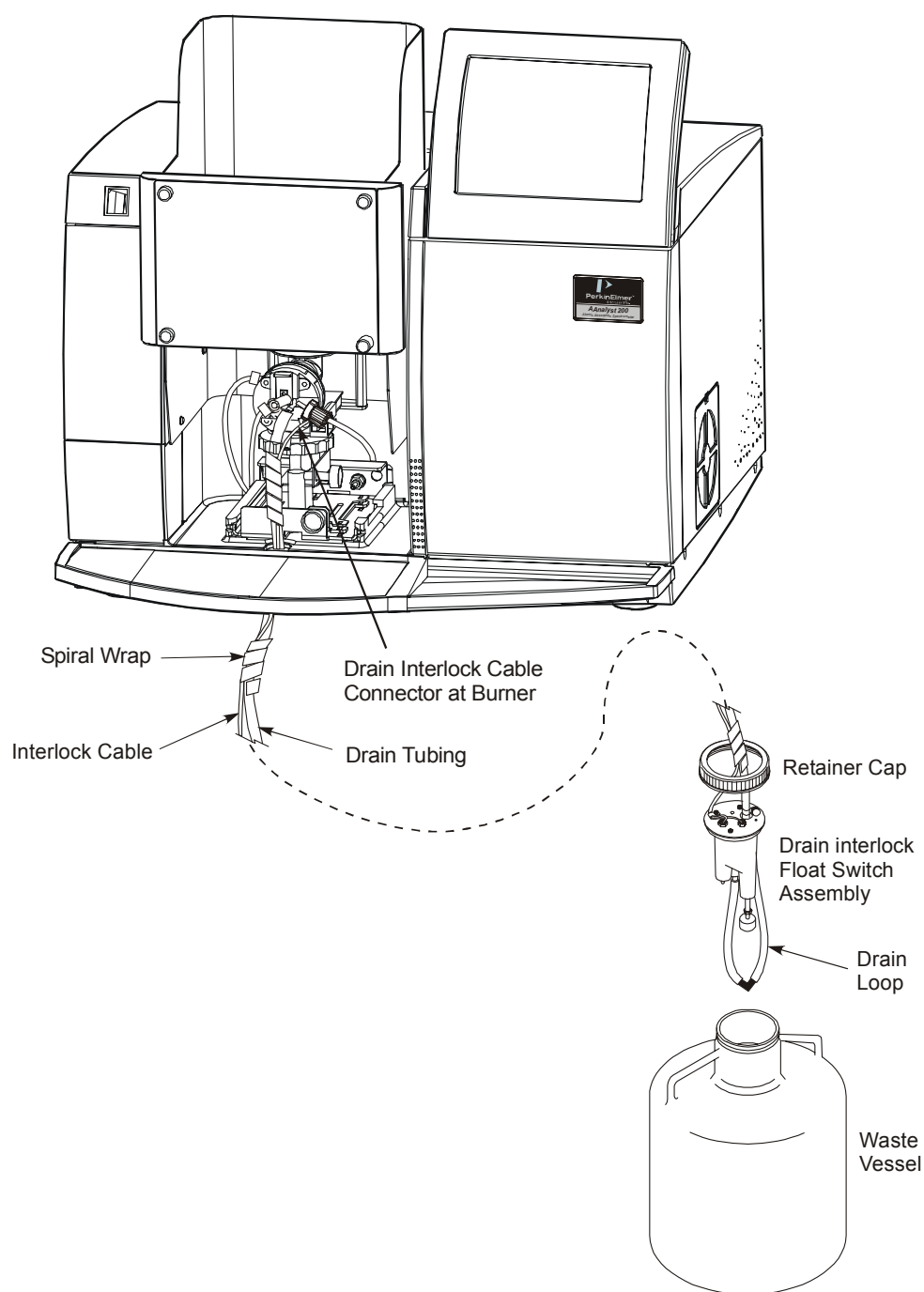


Figure 6- 7 Installing the burner drain system

3. Now attach the free end of the drain tubing outlet on the burner end cap. Tighten the drain clamp.

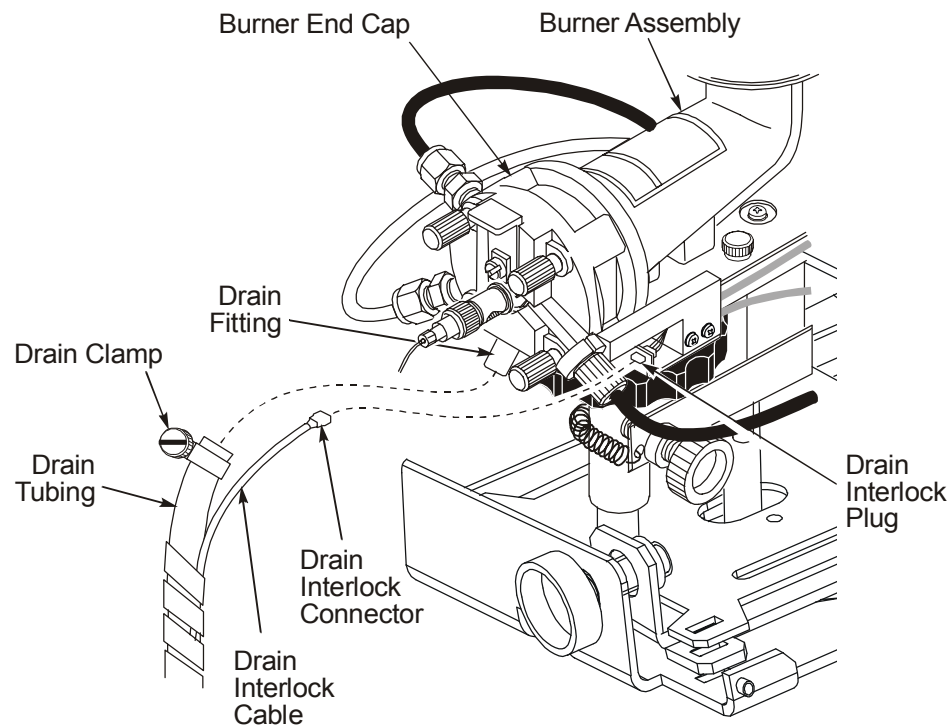


Figure 6- 8 Connecting the drain tubing and drain interlock cable.

4. Finally, you need to connect the drain interlock cable. Plug the drain interlock connector into the drain interlock plug located on the burner assembly as shown above.

Adding water to the Drain Float Assembly

Enough water must be present in the drain system to fill the drain loop and to activate the drain float assembly. If not, carry out the procedure below:

1. Loosen the drain clamp and remove the drain tubing from the drain outlet on the burner end cap (see Figure 6- 8).
2. Pour about 250 mL of water into the drain tubing.
3. Reconnect the drain tubing to the burner end cap. Replace the drain clamp and tighten securely. Installation of the burner drain is complete.

Installing the Lamp Compartment Door

Locate the lamp compartment cover (if it is not already on the instrument). Install the cover by following the procedures below.

1. Hold the door in place next to the lamp compartment as shown below.
2. Gently push the upper part of the door on to the upper pin and maneuver the lower part of the door over the screw hole. Tighten the securing screw with a screwdriver.
3. Close the door.

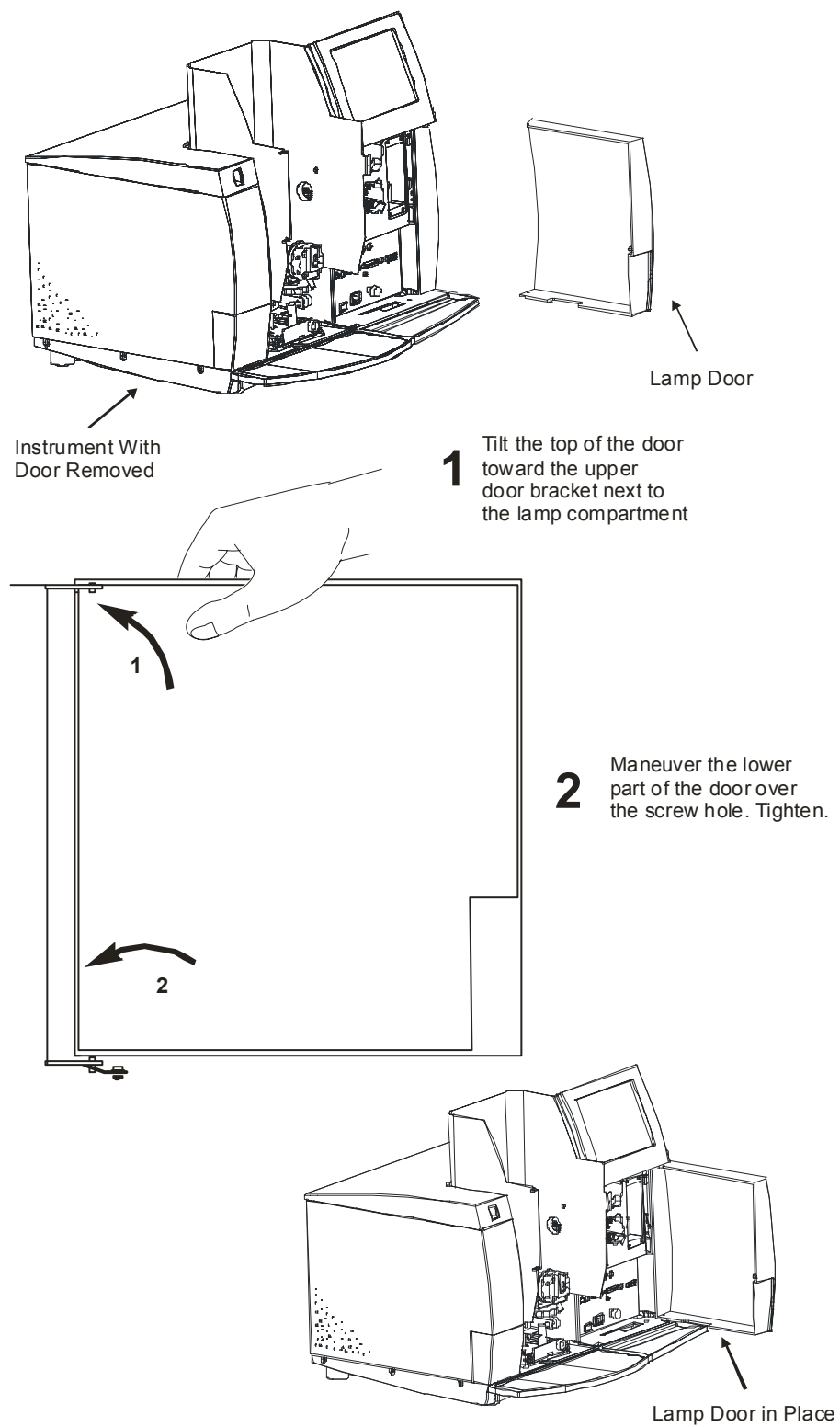
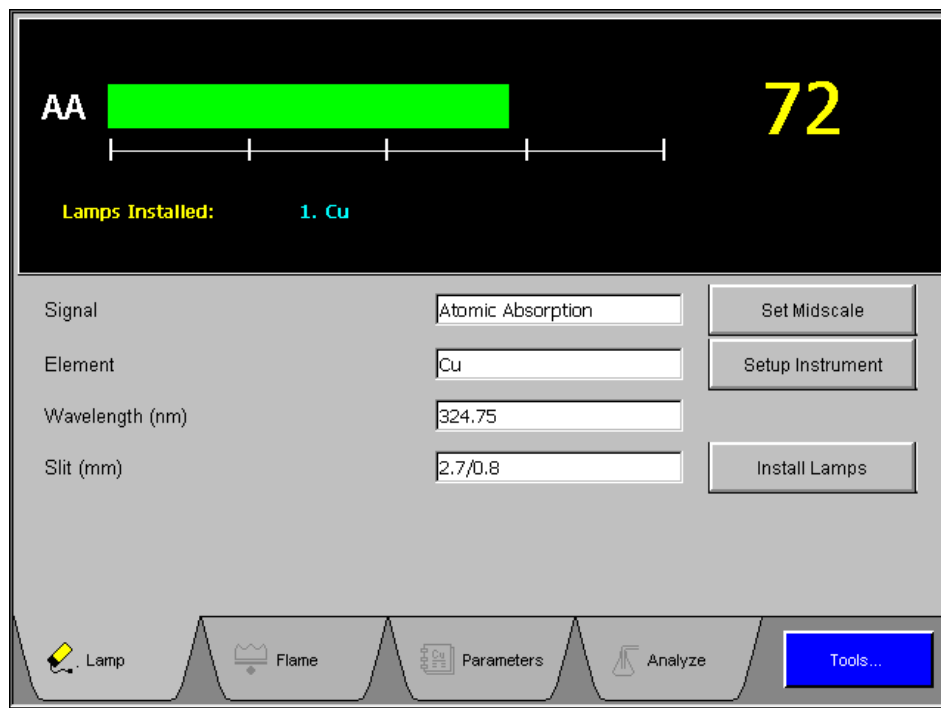


Figure 6- 9 Installing the lamp compartment cover.

User Interface



Screen 6- 1 Typical Touch Screen Display

Touch screen

You operate the spectrometer using the touch screen. The touch screen is the interface between you and the spectrometer, enabling you to control the spectrometer in order to perform your analyses easily and conveniently. The touch screen contains active areas that you touch to perform the required action.

You may find it more convenient to use a stylus or the like to touch the active areas of the touch screen. Do not use sharp, pointed objects.

A light, short touch is all that is needed. You do not need to press forcefully on an active area.

Note that when you touch an active area, various processes may be started in the spectrometer. Some of these processes take several seconds. Be patient and wait for the process to complete before touching another active area on the touch screen.

User interface components

The user interface components on the touch screen are described below.

Pages

The main displays on the touch screen are termed pages. You use the pages to set up your spectrometer and to perform analyses. The pages contain

- Entry fields which allow you to make entries via a dialog,
- Buttons that you touch to start or stop actions, or to display a dialog,
- Option Buttons that you use to select an option from a list, and
- Check Boxes that you use to switch functions on or off.

Dialogs

When you touch an entry field or certain buttons, a dialog is displayed on the touch screen.

- When you touch a numerical entry field a Numerical Entry dialog containing a numerical keyboard is displayed; this allows you to make numerical entry.
- When you touch a parameter entry field a Parameter Entry dialog is displayed; you can choose among a number of options.
- When you touch a text entry field a Text Entry dialog containing an alphanumerical keyboard is displayed; this allows you to make alphanumerical entries such as user names or file names.

Tabs

- You use the tabs to select pages, either main pages or pages within dialogs.

Installing Lamps

Three versions of the AAnalyst 200 spectrometer are offered.

- The first version is designed to operate with a single PerkinElmer Lumina hollow cathode lamp (HCL).
- The second version is designed to operate with a single PerkinElmer Lumina hollow cathode lamp (HCL) or an electrodeless discharge lamp (EDL). The second version comes with a background corrector deuterium lamp (D2).
- The third version includes a lamp turret (mount) and is designed to operate with up to four PerkinElmer Lumina hollow cathode lamps (HCLs) or with two electrodeless discharge lamps (EDLs) and two PerkinElmer Lumina hollow cathode lamps (HCLs). The third version comes with a background corrector deuterium lamp (D2).

Lamp compartment

The lamp compartment is located behind the door on the right-hand side at the front of the spectrometer. The lamp turret (mount) version shows the assigned lamp positions numbered 1 through 4.

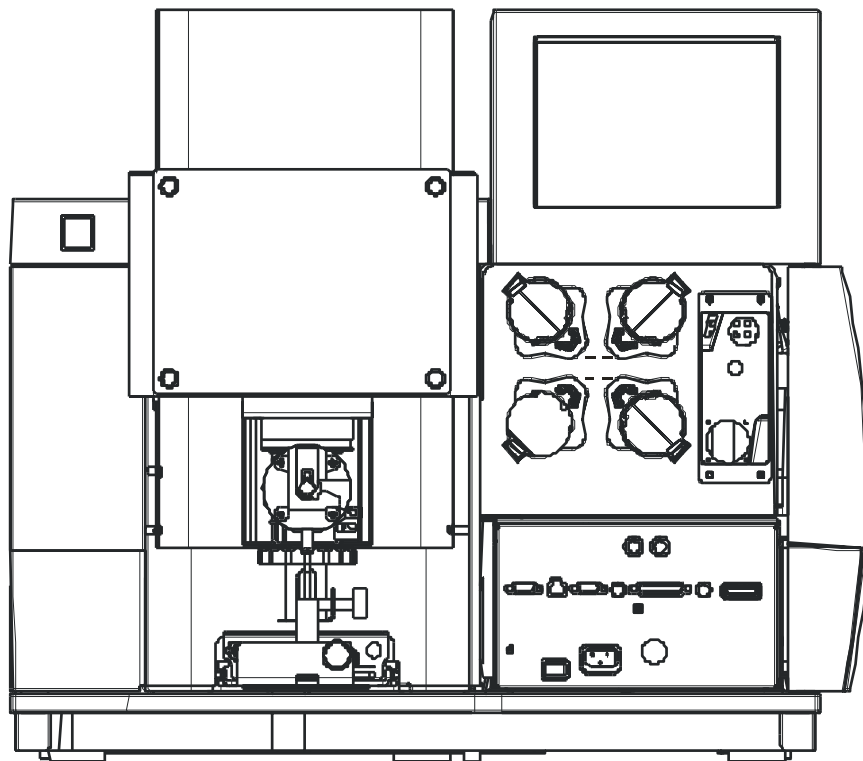


Figure 6- 10 Lamp compartment of turret version

Installing and connecting HCLs

You can use both single-element and multi-element hollow cathode lamps.

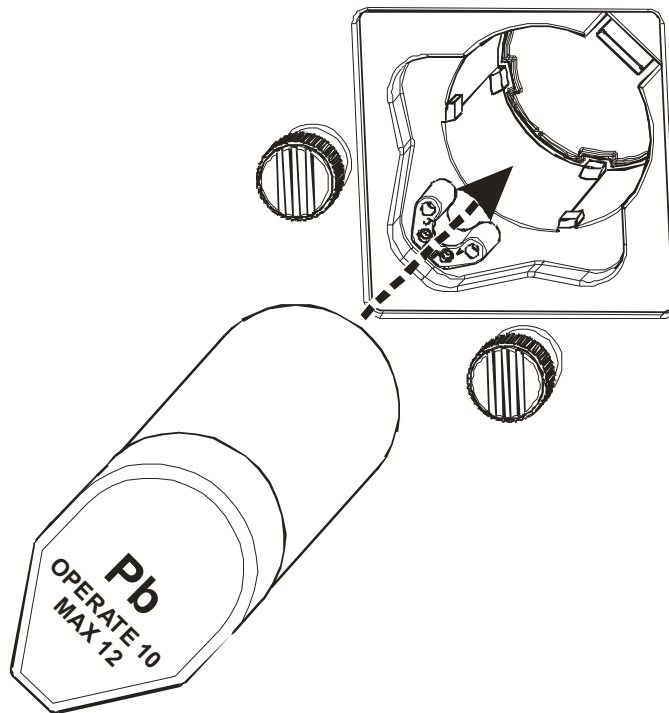


Figure 6- 11 Installing a hollow cathode lamp

1. Open the lamp door.
2. Slide the required Lumina lamp into the lamp holder and make sure that the integrated socket slides fully home over the receptacle on the lamp holder. Align the lamp.
3. Close the lamp door.

Installing and connecting EDLs

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.

Single Coded EDL

1. Open the lamp door.
2. Insert the coding plug over the receptacle on the lamp holder.

NOTE: *Do not use coding plug for uncoded EDL.*

3. Slide the lamp carefully into the lamp holder until it butts up against the end stop inside the holder.
4. Connect the lamp cable to an EDL 1 port on the E-Box. Align the lamp.

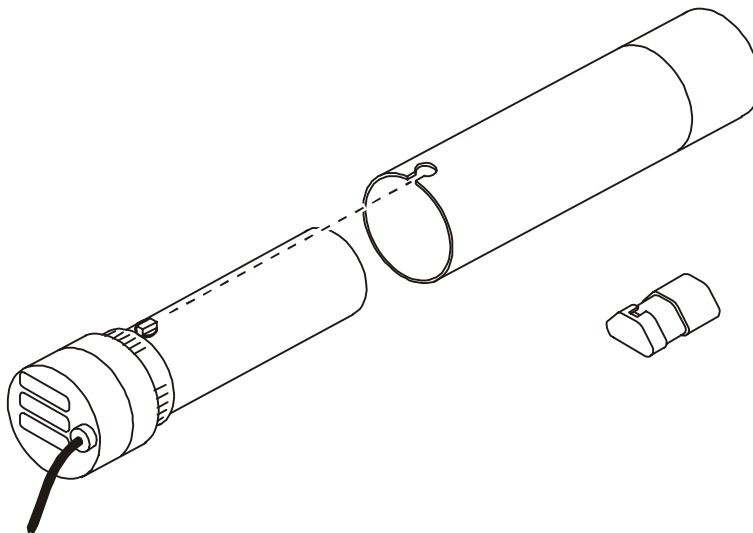


Figure 6- 12 Assembling an EDL

Installing EDLs in the turret version

NOTE: *EDLs may only be installed in positions 1 and 2 of the turret. Refer to Figure 6-15 for the assigned lamp numbers on the turret (mount).*

1. Open the lamp door.
2. Insert the coding plug over the receptacle on the lamp holder.

NOTE: *Do not use coding plug for uncoded EDLs.*

3. Slide the lamp carefully into the lamp holder until it butts up against the end stop inside the holder.
4. Depending on the lamp position of the turret, connect the lamp cable to the corresponding EDL port on the E-Box. Align the lamp.

NOTE: *Example: If the EDL lamp is installed in position 1 of the turret, connect the EDL cable to the EDL 1 port on the E-Box..*

Removing lamps

1. Do not unplug and remove lamps while they are switched on.
2. Touch the **Lamp** tab to display the Lamp page.
3. On the **Lamp** page, touch the **Install Lamps** button. The **Install Lamps** dialog is displayed.
4. Make sure that the lamp is switched off before you remove it. The **On/Off** box must **not** be checked.
5. If necessary, touch the respective **On/Off** box to switch off the lamp.
6. Touch **OK**.
7. Unplug and remove the lamp. For EDLs, remove the coding plug as well.

Tips for installing lamps

- Use PerkinElmer lamps.
- Do not touch the front window of the lamp: perspiration or other contamination can reduce intensity of the radiation.
- 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, you will cause the spectrometer to malfunction and may cause irreparable damage to the lamp.

Switching on the Spectrometer

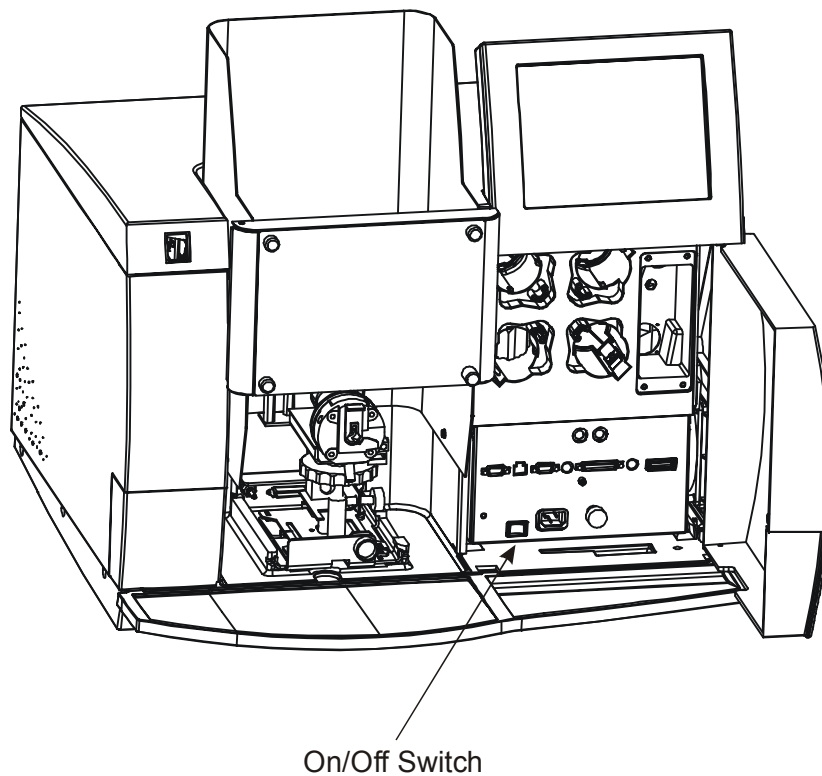


Figure 6- 13 Location of operational on/off switch

1. Open the lamp door.
2. Switch on the spectrometer with the operational on/off switch.
3. Close the lamp door.
4. Wait for the spectrometer to complete initialization. The Lamp page is displayed on the Touch Screen.

Safety Checks

Before igniting the flame, always make sure that:

- The exhaust venting system for the laboratory is switched on.
- Burner chamber is correctly installed.
- The burner head is correctly installed.
- The burner end cap is secured.
- The nebulizer is installed.
- The correct gaskets are fitted in the burner system
- The burner drain is connected to the system secured by clamp.
- The drain trap is filled and is operating correctly.
- The door of the atomizer compartment is in the closed position.
- Remove all nearby flammable chemicals.
- Fire extinguisher should be kept nearby.
- Check for chemical residue build-up on the burner head slot.
- When igniting nitrous oxide flame, warm up the burner head with air-acetylene flame for 15 minutes.
- All safety interlocks are correctly closed.

If the interlocks are not closed, one or more of the following may be the cause:

- The burner head, the nebulizer, or the drain system is not correctly installed.
- The fuel or oxidant pressure is too low.
- The liquid level in the drain trap is either too low or too high.

Using the Background Corrector

If you have a deuterium background corrector in your AAAnalyst 200, you have the choice of performing atomic absorption measurements with or without background correction.

It is an internally mounted assembly that provides simultaneous correction for molecular absorption and light-scattering. The spectrometer uses a deuterium arc lamp to correct for background absorbance caused by non-atomic species in the atom cloud.

When the deuterium arc background corrector is used, two alternating sets of measurements are made: one with the primary source and a second with background corrector source. The primary source measures a combination of background and atomic absorption. The continuum source measures only the background. The difference between the two measurements yields the atomic absorption.

A deuterium arc source is used for maximum wavelength coverage and intensity. The AAAnalyst 200 can accurately handle combined atomic plus background absorption signals as large as three absorbance units.

The background corrector is internally installed, with its power supplied from the instrument. Power to the source is automatically and continuously adjusted to be in the optimum range for operation. The deuterium arc lamp is easily accessible, allowing convenient replacement of the lamp by the users.

Optimization Procedures

Before you calibrate the spectrometer and begin analyses, you must optimize the spectrometer to obtain the best conditions for analyzing the requested element in your samples.

You can optimize:

- **The lamp:** You must align the lamp in the optical path so that maximum radiant energy passes to the detector.
- **The burner:** Initially you must adjust the burner position so that the burner head is correctly located just below the radiation beam. Since the location of maximum atom concentration in the flame varies slightly from element to element, you must optimize the burner position while aspirating a suitable standard solution so that the radiation beam passes through the region of the flame containing the highest concentration of free analyte atoms.
- **The nebulizer:** Initially you must set the solution aspiration rate. Since viscosity, density, and surface tension can influence the aspiration rate to varying degrees, you must then optimize the aspiration rate while aspirating a suitable standard solution that has a composition similar to your samples.

Aligning Lamp

After you have installed the lamp you require for your planned analyses, you must align it in the optical path so that maximum radiant energy passes to the detector. In a single lamp configuration, you must manually align the lamp position by using the adjustable knobs as shown in the figure below.

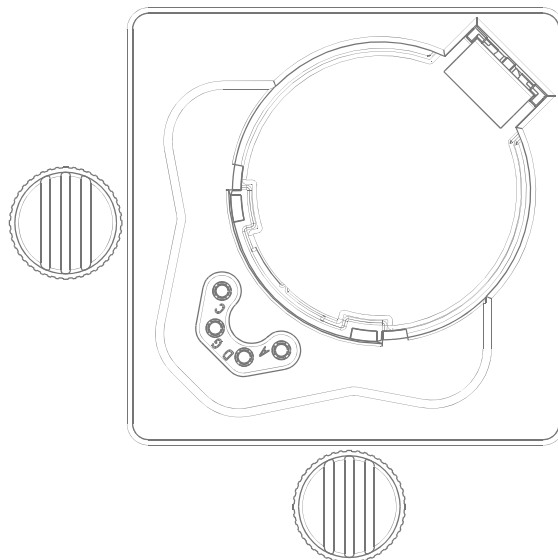


Figure 6- 14 Lamp alignment controls



Warning: UV Radiation – Risk of Eye Damage

The lamps may emit UV radiation which can damage your eyes.

Do not gaze into a lighted lamp.

Always wear UV-absorbing safety glasses when looking at the radiation from the lamps.

Align the lamp

NOTE: *For lamp optimum performance, warm HCLs for 5-10 minutes and 30 minutes for EDLs. Repeat the lamp setup procedure.*

Coded single element Lumina lamp

1. Start up the spectrometer, but do not ignite the flame.
2. Lamps Installed are automatically shown in the energy display box on the Lamp page. The element entry field box automatically shows the element installed.
3. Touch the **Setup Instrument** button on the Lamp page of the touch screen. The recommended parameters for that element are automatically set up.
 - The system automatically switches the lamp on, sets up the optical path (prism and grating), sets and peaks the wavelength, sets the slit, and performs an Automatic Gain Control (AGC) and Automatic Intensity Control (AIC).
4. Turn the two alignment controls alternately and in small increments while watching the AA bar graph and the numerical energy display. Align the lamp to obtain maximum energy.

Coded single multi-element Lumina lamp

1. Start up the spectrometer, but do not ignite the flame.
2. Lamps Installed are automatically shown in the energy field box on the Lamp page. The element entry field box automatically shows the element installed.
3. Touch the **Element** entry field box on the Lamp page to display the Select Element dialog. You select the desired analyte element from the list in the dialog.
4. Touch the **OK** button and the recommended parameters for that element are automatically set up.
5. Turn the two alignment controls alternately and in small increments while watching the AA bar graph and the numerical energy display. Align the lamp to obtain maximum energy.

Uncoded single element Intensitron lamp

1. Start up the spectrometer, but do not ignite the flame.
2. Touch the **Install Lamps** button on the Lamp page of the touch screen. The Install Lamps dialog is displayed.
3. Touch the **Element** entry field box on the Install Lamps dialog to display the Element dialog. Select the desired element.
4. Select the proper lamp type, EDL or HCL.

5. Touch the On/Off check box. If necessary, change the lamp current. Touch **OK**.
6. Touch the **Element** entry field box to select the desired element. Touch **OK**.
7. Touch the **Setup Instrument** button on the Lamp page of the touch screen. The recommended parameters for that element are automatically set up.
 - The system automatically switches the lamp on, sets up the optical path (prism and grating), sets and peaks the wavelength, sets the slit, and performs an Automatic Gain Control (AGC) and Automatic Intensity Control (AIC).
8. Turn the two alignment controls alternately and in small increments while watching the AA bar graph and the numerical energy display. Align the lamp to obtain maximum energy.

Uncoded multi-element Lumina lamp

1. Follow steps 1-5 of the coded single element Lumina lamp.
2. Touch the **Element** entry field box on the Lamp page to display the Select Element dialog. Select the desired elements. Use the **Clear** button to remove unwanted element from the selected list. Touch **OK**.
3. Touch the **Setup Instrument** button on the Lamp page of the touch screen. The recommended parameters for that element are automatically set up.
 - The system automatically switches the lamp on, sets up the optical path (prism and grating), sets and peaks the wavelength, sets the slit, and performs an Automatic Gain Control (AGC) and Automatic Intensity Control (AIC).
4. Turn the two alignment controls alternately and in small increments while watching the AA bar graph and the numerical energy readout on Lamp page. Align the lamp to obtain maximum energy.

Turret coded Lumina lamp (mount)

1. Start up the spectrometer, but do not ignite the flame.
2. If the desired element already appears in the Element entry field box, then just touch the **Setup Instrument** button.
3. If you like to select a different element, touch the **Element** entry field box on the Lamp page to display the Element dialog. Select the desired element and touch **OK**.
 - The system automatically switches the lamp on, sets up the turret and the optical path (prism and grating), sets and peaks the wavelength, sets the slit, and performs an Automatic Gain Control (AGC) and Automatic Intensity Control (AIC).

Turret uncoded Lumina lamp (mount)

1. Start up the spectrometer, but do not ignite the flame.
2. Touch the **Install Lamps** button on the Lamp page of the touch screen. Fill in the required parameters for the uncoded lamps in the Install Lamps dialog.
3. Touch the **On/Off** check box to turn the lamps on. A total of 3 lamps may be turned on, a combination of 1 HCL lamp and 2 EDLs lamps.
4. Touch the **Element** entry field box. Select the desired element from the Select Element box. Touch **OK** and the instrument performs an automatic setup.

NOTE: *To change the wavelength or slit, touch the corresponding entry field box and select the alternate wavelength or slit.*

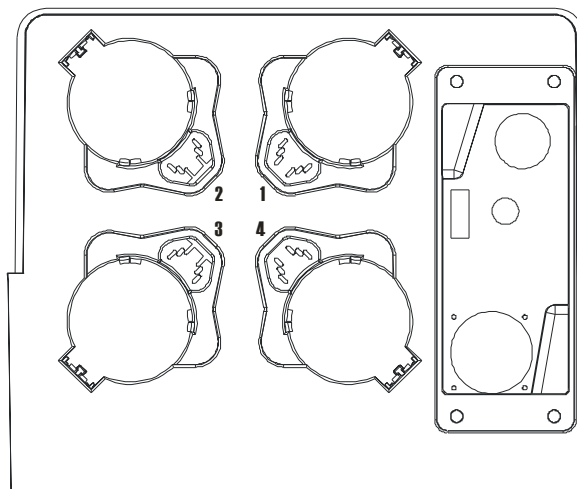


Figure 6- 15 Turret version

Setting the Burner Height

When you operate the spectrometer for the first time and every time you have disassembled the burner for cleaning, you must check and set the burner height. You must perform this procedure to make sure that the burner head is located just below the radiation beam.

1. Make sure that the burner system is set up properly and that the correct burner head for your intended analyses is installed.
2. Install a suitable lamp.
Ideally you need a lamp that emits a beam of visible radiation.
3. If not already on, power up the spectrometer. **Do Not Ignite The Flame.**
4. Hold a piece of white card above the burner head at right angles to the burner slot. Observe the light spot on the card. Ideally the radiation beam should pass over the length of the burner head and be approximately centered over the burner slot.

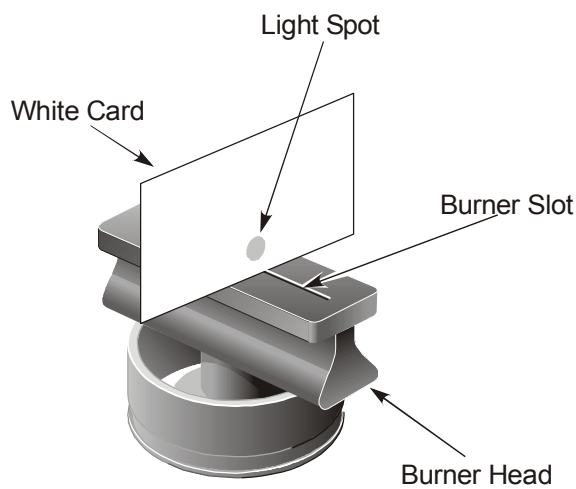


Figure 6- 16 Locating the radiation beam above the burner

- If the burner is too high so that it obstructs the radiation beam, lower it with the vertical alignment control.
- If the radiation beam is not approximately centered over the burner slot, adjust the burner position with the horizontal alignment control.

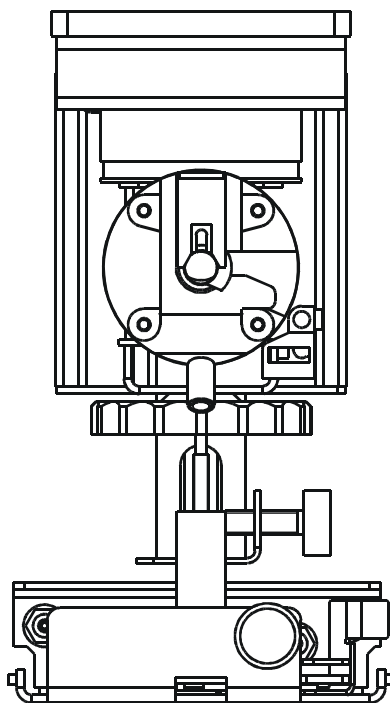


Figure 6- 17 Burner alignment controls

1. Touch the **Flame** tab to display the Flame page.
2. Lower the burner with the vertical alignment control so that the burner head is well below the radiation beam.
3. Touch the **Auto Zero Graph** button to zero the absorbance display.
4. Raise the burner with the vertical alignment control until the display indicates a slight positive absorbance reading (0.002 to 0.004 absorbance).
5. Very slowly lower the burner with the vertical alignment control clockwise until the absorbance reading returns to zero.
6. Finally, rotate clockwise the vertical alignment control an additional half-turn.

Igniting the Flame



WARNING

Warning: Flammable Gases, Fire and Explosion Hazard

Before you ignite the flame, setup your spectrometer and burner correctly and observe all the safety precautions described in your spectrometer guide.



Warning: UV Radiation Risk of Eye Damage

The flame, especially the nitrous oxide-acetylene flame, may emit UV radiation which can damage your eyes.

- *Keep the door closed when the flame is burning, unless you need to adjust the burner as described in the user documentation.*
- *Always wear the UV-absorbing safety glasses when looking at the flame.*



WARNING

Warning: Flashback

*While the flame is on, **DO NOT** push the lever that is located on the burner mount assembly.*

NOTE: *In an emergency, switch off the spectrometer using the operational on/off switch behind the lamp door or the emergency flame off switch on the front of the instrument. The flame is automatically extinguished and the gases shut down in a safe sequence. See **Chapter 8** for the procedure to follow after an emergency shutdown.*

To ignite the flame

1. Start up the spectrometer system. The power switch is on the E-Box located behind the lamp door.
2. Adjust the gas supply regulator pressure to the recommended values.
3. Perform the safety checks.
4. Touch the **Flame** tab to display the Flame page.
5. Touch the **Oxidant Tab** to display the Flame Type dialog.
6. Touch the button for the required flame type, Air-Acetylene or Nitrous Oxide-Acetylene, and then touch **OK**.

7. Ignite the flame:
Touch the **On** side of the **Flame On/Off** switch.
The indicator in the switch lights up.
8. The correct procedure to extinguish the flame is described in this chapter.
9. If the system is set up correctly the flame is ignited using default values for the gas flows. If you selected nitrous oxide as the flame type, the flame is ignited with an air-acetylene mixture, with automatic changeover to nitrous oxide after several seconds.

NOTE: *It is recommended to warm up the burner head with air-acetylene flame for 15 minutes before switching to nitrous oxide flame*

10. The flame should appear uniform and stable throughout its length. If it is not, even after warming up, you may need to clean the burner head. See the Maintenance chapter in this User's Guide Manual.
The nitrous oxide-acetylene flame may split and form a V along the burner slot when it is first ignited. As the burner head warms up, the V will close. This may take several minutes.



WARNING

When using nitrous-oxide, the flame should have a red plume. Increase the oxidant flow until the red plume is 1½ inches to 1¾ inches high.

Select an air-acetylene flame:

- If you are preadjusting the nebulizer.
- If you have installed a different nebulizer, cleaned the nebulizer, or if the settings on the nebulizer have been altered since it was last used.
- If you are using the flame to heat the quartz tube atomizer of an optional MHS-15 Mercury Hydride System.

Preadjusting the Nebulizer

In this procedure you adjust the aspiration rate (solution uptake rate) of the nebulizer. You must preadjust the nebulizer whenever you install a nebulizer or when you have partially or totally dismantled the nebulizer for any reason, such as cleaning. You must always preadjust the nebulizer before you optimize the nebulizer (see *chapter 9, Maintenance*).



Warning: Flashback Hazard

Never preadjust the nebulizer using a nitrous oxide-acetylene flame.

WARNING

Preadjust the nebulizer using an air-acetylene flame only, and make small adjustments slowly.

Preliminary steps

Prepare a blank solution and a standard solution of an element that requires an oxidizing (blue) air-acetylene flame and whose analytical line lies above 250 nm.

Recommended elements: Cu (324.8 nm), Mg (285.2 nm), or Pb (283.3 nm).

Do not use an element that is sensitive to the air/fuel ratio of the flame, e.g. Ca, Cr, Pd, Pt, Rh, Ru, Au, Ir.

The concentration of the standard solution should be in the linear range and ideally should be close to the 'sensitivity check' concentration quoted in the *Recommended Conditions* (i.e. give an absorbance reading of approximately $A = 0.2$).

NOTE: *You use this element to preadjust the nebulizer. It may be different to the element you subsequently analyze.*

1. Install a lamp for the element you have chosen.
2. Start up the spectrometer.
3. Set up the burner system .
4. Perform the safety checks. Ignite the flame.
5. Touch the **Lamp** tab to display the Lamp page.
6. For Signal select AA, noncorrected, or AA, background-corrected if you will be using background correction later.

Preadjustment procedure

1. Touch the **Flame** tab to display the Flame page.
2. Aspirate the blank solution and when the signal is steady touch the **Auto Zero Graph** button.
3. Aspirate the standard solution.
4. Turn the nebulizer regulator slowly counter-clockwise until bubbles start to appear from the end of the sample tube in the standard solution.
5. Then turn the nebulizer regulator 1 to 1½ turns clockwise.
6. Slowly continue to turn the regulator clockwise while watching the continuous graphics display. The absorbance reading will increase to a maximum before starting to decrease. Adjust the regulator to give the maximum reading.

Optimizing the Burner System

Summary of the optimization procedure

1. Perform the preliminary steps.
2. Prepare the required solutions.
3. Install a lamp for the analyte element.
4. Start up the spectrometer.
5. Set up the burner system.
6. Perform the safety checks. Ignite the flame.
7. Optimize the burner position. Optimize the nebulizer.
8. Optimize the gas flow rates.

Preliminary steps

Before you optimize the burner system for your particular analyses, perform the following preliminary steps:

1. Set up the burner system and make sure that the correct burner head is installed.
2. Check that the burner height has been correctly set.
3. Make sure that you have preadjusted the nebulizer.

Preparing the solutions

The blank and standard solutions should be the same as those you will use when analyzing samples.

1. Prepare a blank solution. Use the same solvent as you use to prepare the standard solution.
2. Prepare a standard solution of the analyte element.
The concentration of the standard solution should be in the linear range and ideally should be close to the 'sensitivity check' concentration quoted in the *Recommended Conditions* (i.e. give an absorbance reading of approximately $A = 0.2$).

Optimizing the burner position

1. Touch the **Flame** tab to display the Flame page.
2. Aspirate the blank solution and when the signal is steady touch the **Auto Zero Graph** button.
3. Aspirate the standard solution.
4. Adjust the burner position by turning the vertical and horizontal alignment controls alternately and in small increments while at the same time observing the continuous graphics display. Continue to make adjustments until you find the position that gives maximum absorbance reading.

Optimizing the nebulizer

In this procedure you optimize the nebulizer aspiration rate for the solutions you will use in the subsequent analyses.



WARNING

Warning: Flashback Hazard

When you optimize the nebulizer using a nitrous oxide-acetylene flame:

Make small adjustments slowly. Do not rotate the adjusting nut more than 1/8 of a turn in total.

1. Aspirate the standard solution.
2. Turn the nebulizer adjusting nut slowly in very small increments while at the same time observing the continuous graphics display. Adjust the regulator to give the maximum absorbance reading.

NOTE: *You should not need to move the adjusting nut very much to obtain the maximum reading if the nebulizer was correctly preadjusted..*

Optimizing the gas flows

The oxidant-to-fuel ratio affects the sensitivity of the analyses, although the magnitude of the effect varies between elements. Generally you adjust the gas flow rates to give maximum absorbance for the analyte element.

Some elements require an oxidizing air-acetylene flame (blue, fuel-lean, hot) and some require a reducing flame (yellow, fuel-rich, relatively cool).

There are two ways to alter the gas flow rates while you are performing the optimization procedure:

- Touch the flow field to display the Flow dialog and then enter the required flow rate in this dialog.

or

- Touch the increase (▶) or decrease (◀) arrows

The system checks that the flow rate values you have entered are within the safe working range.

Optimization procedure

1. Touch the **Flame** tab to display the Flame page.
2. Aspirate the blank solution and when the signal is steady touch the **Auto Zero Graph** button.
3. Aspirate the standard solution.
4. Initially, adjust the fuel and oxidant flow rates to obtain the type of flame given in the *Recommended Conditions*.
5. Then, make incremental changes to the fuel and oxidant flow rates alternately while at the same time observing the continuous graphics display. Continue to make adjustments until you find the flow rates that give maximum absorbance reading.

NOTE: *After making a small change in the flow rate, wait a few seconds to allow the flame to stabilize before making further changes.*

Rinsing the Burner System

Before you extinguish the flame or begin maintenance or disassembly procedures, you must rinse the burner system. After you extinguish the flame, allow the burner head to cool.

To rinse the system

The procedure for rinsing the burner system depends on the type of samples that you have analyzed.

Recommendations:

- If the sample solutions contained organic solvents, use a multi-rinse procedure to remove all traces of the solvents from the system.
- If the sample solutions contained toxic substances, you must rinse all traces of these substances out of the system.
- If the sample solutions contained high concentrations of copper, silver or mercury salts, which can form unstable acetylides, you must rinse all traces of these substances out of the system.

Procedures:

Aspirate deionized water for 5 minutes. If you used only aqueous solutions during the analyses do the following:

- Aspirate for 5 minutes an organic solvent that is miscible with the samples that have just been aspirated.
- Aspirate for 5 minutes methanol or another solvent that is miscible both with water and the solvent used previously.
- Aspirate 1% (v/v) nitric acid solution for 5 minutes.
- Aspirate deionized water for 5 minutes.

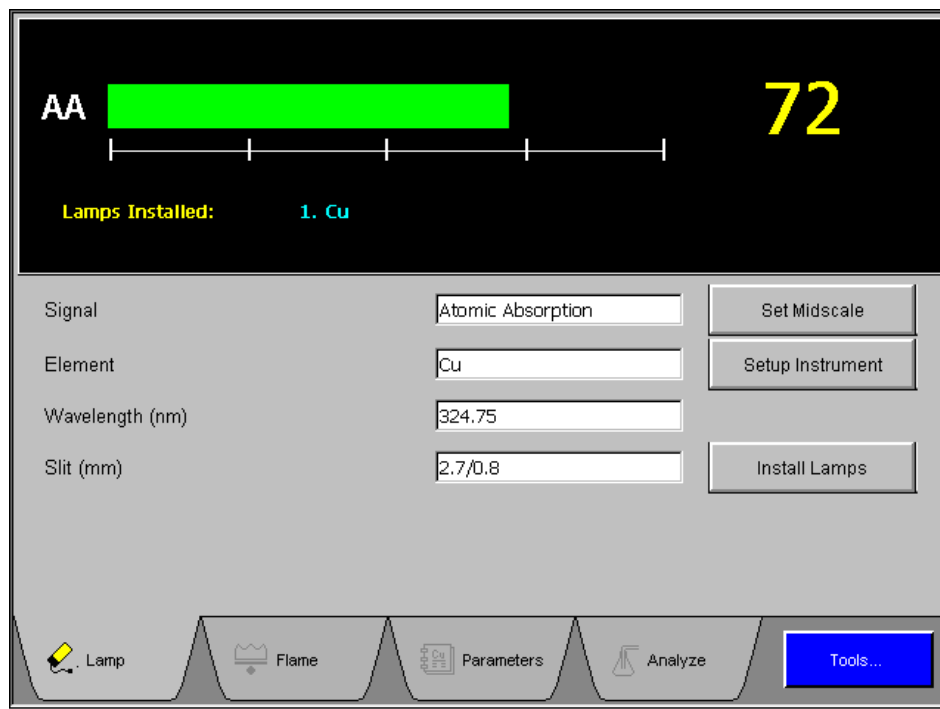
To extinguish the flame

1. With the flame still burning, aspirate the correct rinsing solutions to rinse the burner system. Either aspirate the solutions manually or use the flame autosampler.
2. Touch the **Flame** tab to display the Flame page.
3. Touch the **Off** side of the Flame **On/Off** switch. The indicator in the switch extinguishes. The system uses a predetermined shutdown sequence to extinguish the flame safely.
4. Shut down the gases to the spectrometer at source.
5. Touch the **Bleed Gases** button to depressurize the gas lines.



Touch Screens 7

User Interface



Screen 7- 1 Typical Touch Screen Display

Touch screen

You operate the spectrometer using the touch screen. The touch screen is the interface between you and the spectrometer, enabling you to control the spectrometer in order to perform your analyses easily and conveniently. The touch screen contains active areas that you touch to perform the required action.

You may find it more convenient to use a stylus or the like to touch the active areas of the touch screen. Do not use sharp, pointed objects.

A light, short touch is all that is needed. You do not need to press forcefully on an active area.

Note that when you touch an active area, various processes may be started in the spectrometer. Some of these processes take several seconds. Be patient and wait for the process to complete before touching another active area on the touch screen.

User interface components

The user interface components on the touch screen are described below.

Pages

The main displays on the touch screen are termed pages. You use the pages to set up your spectrometer and to perform analyses. The pages contain

- Entry fields which allow you to make entries via a dialog,
- Buttons that you touch to start or stop actions, or to display a dialog,
- Option Buttons that you use to select an option from a list, and
- Check Boxes that you use to switch functions on or off.

Dialogs

When you touch an entry field or certain buttons, a dialog is displayed on the touch screen.

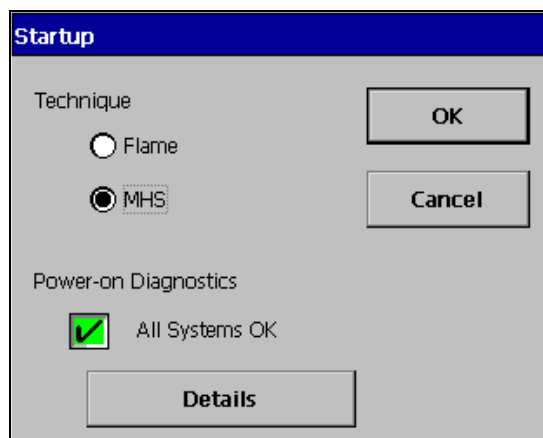
- When you touch a numerical entry field a Numerical Entry dialog containing a numerical keyboard is displayed; this allows you to make numerical entry.
- When you touch a parameter entry field a Parameter Entry dialog is displayed; you can choose among a number of options.
- When you touch a text entry field a Text Entry dialog containing an alphanumerical keyboard is displayed; this allows you to make alphanumerical entries such as user names or file names.

Tabs

- You use the tabs to select pages, either main pages or pages within dialogs.

Startup Dialog

This is the first page displayed when you start up the spectrometer. You use this page to select technique (Flame or MHS) and examines the system diagnostics. The indication that all systems are OK should be green if all entries in the Diagnostics dialog are shown OK.



Screen 7- 2 Startup Dialog

Lamp Page

You use this page to select the analyte element and the basic measurement parameters. You also use this page during optimization to align the lamp with systems utilizing manual lamp adjustment.

The screenshot shows the 'Lamp Setup Page' interface. At the top, there is a black header bar. On the left of this bar, the text 'AA' is displayed next to a bright green rectangular bar. To the right of the green bar is a horizontal scale with four tick marks. On the far right of the header bar, the number '72' is displayed in a large yellow font. Below the header bar, the text 'Lamps Installed: 1. Cu' is shown in yellow. The main body of the interface is a light gray area containing several input fields and buttons. On the left, there are four labels: 'Signal', 'Element', 'Wavelength (nm)', and 'Slit (mm)'. To the right of these labels are four corresponding input fields containing the values 'Atomic Absorption', 'Cu', '324.75', and '2.7/0.8'. To the right of these input fields are three buttons: 'Set Midscale', 'Setup Instrument', and 'Install Lamps'. At the bottom of the interface is a dark gray navigation bar. It contains five icons with labels: a yellow lamp icon for 'Lamp', a flame icon for 'Flame', a document icon for 'Parameters', a flask icon for 'Analyze', and a blue button labeled 'Tools...'.

Signal	Atomic Absorption	Set Midscale
Element	Cu	Setup Instrument
Wavelength (nm)	324.75	Install Lamps
Slit (mm)	2.7/0.8	

Lamp Flame Parameters Analyze Tools...

Screen 7- 3 Lamp Setup Page

Parameters on Lamp page

Signal	<p>Displays the current active signal.</p> <p>Touch-entry field that displays the mode of signal measurement selected for the analysis.</p> <p>You can touch this field to display the Signal dialog.</p> <p>In this dialog you can choose:</p> <p>Atomic Absorption</p> <p>The instrument measures the total absorption, including any background attenuation that is present.</p> <p>Background Corrected AA</p> <p>This feature is available if deuterium background corrector is installed. The instrument measures the total absorption from the analyte element and the background, and then measures the signal from the background. The difference between the two is the background-corrected atomic absorption.</p> <p>Flame Emission</p> <p>The system measures the total emission intensity using the technique of flame emission. The intensity of light emitted is related to the concentration of the element in the sample. Flame emission is not available in MHS technique.</p>
Element	<p>Displays the current active element.</p> <p>Touch-entry field that displays the element to be determined (analyte element).</p> <p>If you have installed a single-element coded lumina lamp, the element is displayed automatically and the recommended parameters for that element are automatically set up.</p> <p>If you have installed a multi-element coded lamp, you can touch this field to display the Element dialog. You select the desired analyte element from the list in the dialog and the recommended parameters for that element are automatically set up.</p> <p>If you have installed an uncoded lamp, touch Install Lamps button to display the Install Lamps dialog. Use this dialog to fill in the required element(s) and its parameters. Then touch the Element entry field box to select the element.</p>
Wavelength (nm)	<p>Displays the current active wavelength.</p> <p>Touch-entry field that displays the wavelength of the analytical line selected to measure the absorption.</p> <p>If more than one analytical line is available for an element, you can touch this field to display the Wavelength dialog. You select the desired wavelength in this dialog, or touch the numerical entry field and enter the</p>

desired wavelength.

Slit (nm)

Displays the current active slit. The slit width and height provides the optimum sensitivity, the best signal-to-noise ratio and good linearity of the calibration curve at the recommended wavelength.

Touch-entry field that displays the spectral width and height of the slit selected to measure the absorption.

To change the slit, touch this field to display the Slit dialog and select the required slit.

Buttons on Lamp page

Set Midscale

You touch this button to set the bar graph to mid-scale and perform AGC/AIC when you are setting up a lamp. The system does this automatically for a lamp when you select **Setup Instrument**.

Setup Instrument

When you have set the lamp parameters, touch this button to set up the system with the lamp parameters. The system switches the lamp on, sets up the optical path (prism and grating), sets and peaks the wavelength, sets the slit, and performs an Automatic Gain Control (AGC) and Automatic Intensity Control (AIC).

Install Lamps

You touch this button to display the Install Lamps dialog (see below).

Install Lamps dialog in Lamp page

Install Lamps dialog lists the element(s), lamp type and default current when using coded lamps.

On/Off	Elements	Type	Current (mA)
<input checked="" type="checkbox"/>	Cu	HCL	15
<input type="checkbox"/>	Pb	EDL	440
<input type="checkbox"/>	Na	HCL	8
<input type="checkbox"/>		HCL	0

Screen 7- 4 Install Lamp Dialog, Four Lamps

On/Off	Elements	Type	Current (mA)
<input checked="" type="checkbox"/>	Cu	HCL	0

Screen 7- 5 Install Lamp Dialog, Single Lamp

Parameters on Install Lamps dialog

On/Off	Lamps can be turned on or off by using the touch-entry field box to check/ uncheck lamps and touch the OK button.
Elements	<p>Coded lamps – the instrument detects the element(s) and automatically fills the Elements entry box.</p> <p>Uncoded lamps – the atomic symbol for the element must be entered manually. Touch the Element box lightly for the Select Element dialog.</p>
Type	<p>This shows the type of lamp installed. The instrument automatically fills in this entry for coded lamps. To change the lamp type, touch this field to display the Type dialog and select the required lamp type.</p> <p>HCL – Hollow cathode lamp</p> <p>EDL – Electrodeless discharge lamp (lamps can be connected to EDL position 1 or position 2)</p>
Current	<p>This is the operating current for the lamp. The system sets the recommended current. To change this, use the touch-entry field to view the touch number pad dialog. Use the touch number pad to enter the value.</p> <p>For uncoded lamps, enter the atomic symbol in the Elements entry-field and the system will set the current. You may change this value if necessary. When the lamp is nearing the end of its useful life, you may want to use a higher current; the maximum permitted current is shown on the label of the lamp.</p>

Entering analytical parameters

Depending on your system, you may have a single lamp or multi-lamp configuration. For procedures on how to install and align lamp see Chapter 6 *Operation of the Instrument*. Make sure the lamps are properly installed and aligned then follow the steps below for entering analytical parameters.

On the lamp page, the lamp element(s) are displayed on the upper portion of the screen.

- For a coded lamp, no entries are required for the lamp parameters. The parameters are automatically supplied and filled according to the recommended conditions by the system.

- For an uncoded lamp, you must complete the following entries: Element, Lamp Type, and current. The Wavelength and Slit Width are automatically filled in after entering the element symbol.

Coded Lamp

Single-Element Coded Lamp

1. If you installed a single-element coded lamp, the analyte appears automatically in the element entry-field box.
2. To change entries of other recommended parameters (Wavelength, Slit, Signal), touch the entry-field box to display dialogs. Touch the **Install Lamp** button to make changes to the recommended parameters in the Install Lamp dialog.
3. When lamp parameters are properly set up, touch the **Setup Instrument** button.

Multi-Element Coded Lamp

1. If you installed a multi-element coded lamp, touch the **Elements** entry-field box to display the Element dialog. Select the required analyte element from the list in the dialog and the recommended parameters for that element are set up.
2. To change entries of other recommended parameters (Wavelength, Slit Width, Signal), touch the entry-field box to display dialogs. Touch the **Install Lamp** button to make changes to the recommended parameters in the Install Lamp dialog.
3. When lamp parameters are properly set up, touch the **Setup Instrument** button.

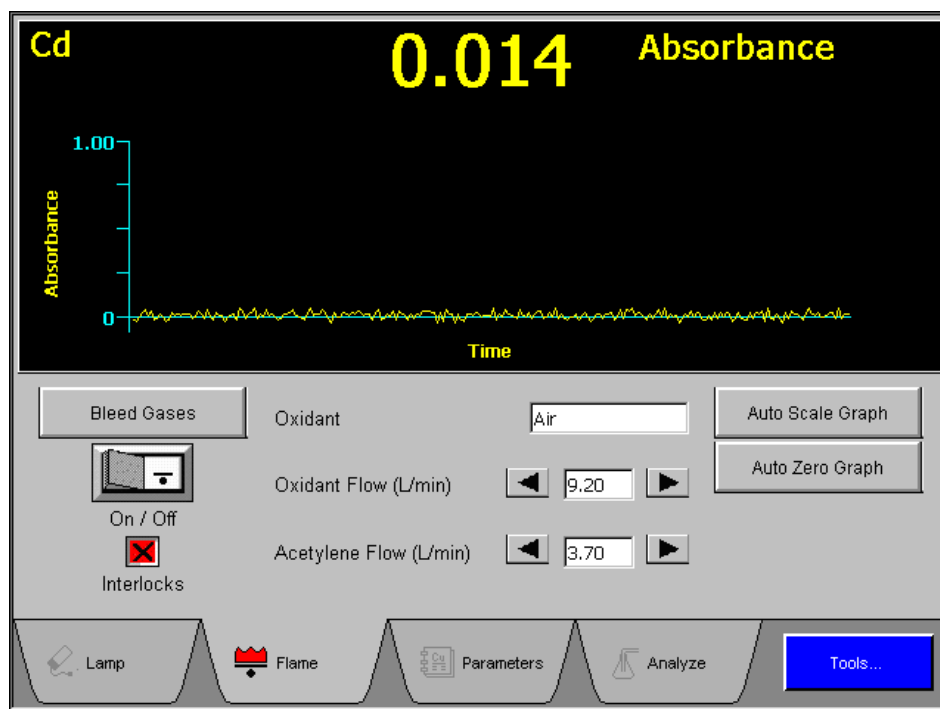
Uncoded Lamp

If you installed a single-element or multi-element uncoded lamp follow the steps below.

1. From the Lamp page, touch the **Install Lamp** button. The Install Lamp dialog appears and you must manually input the required entries for each of the parameters. To input entries, touch on the entry-field box and a dialog or keypad will display.
2. After all entries are made for each of the parameters, touch **OK** to return to the Lamp page.
3. On the Lamp page, touch the **Elements** entry-field box to select an element.
4. When lamp parameters are properly set up, touch **Setup Instrument** button.

Flame page

You use this page to select the oxidant and other flame parameters, and to ignite the flame. You also use this page during optimization of the burner system and to view continuous graphical absorbance display.



Screen 7- 6 Flame Page

To switch oxidant type

1. Shut off the flame and wait until the burner head cools down.
2. To remove and install the burner head refer to chapter 9, *Maintenance*.
3. On the Flame page, touch the **Oxidant** entry field box. Select the oxidant type from the Oxidant dialog.



Screen 7- 7 Oxidant dialog

NOTE: If an air burner head is installed, the Nitrous oxide option is automatically grayed out.

Continuous Graphics Window on the Flame page

The Continuous Graphics window contains a continuous, real-time plot of absorbance (or emission) against time. The scale for Y-axis and real time absorbance default value ranges from 0.00 - 4.00 absorbance.

Parameters on Flame page

Oxidant

Touch-entry field that displays the selected oxidant: acetylene or nitrous oxide.

To select or change the oxidant, touch this field to display the oxidant dialog. Select the required oxidant in this dialog.

If you select nitrous oxide as the oxidant, the flame will be ignited with an air-acetylene mixture, with automatic changeover to nitrous oxide after a few seconds.

Oxidant Flow (L/min)

Touch-entry field, with associated arrow keys, that displays the selected oxidant flow rate in liters/min.

To change the flow rate you can either:

- Touch the field to display the Oxidant Flow dialog and enter the required flow rate in this dialog,
- or:
- Touch the increase (▶) or decrease (◀) arrows; the flow rate is changed in increments of 0.4 L/min.

Acetylene Flow (L/min)

Touch-entry field, with associated arrow keys, that displays the selected acetylene flow rate in liters/min.

To change the flow rate you can either:

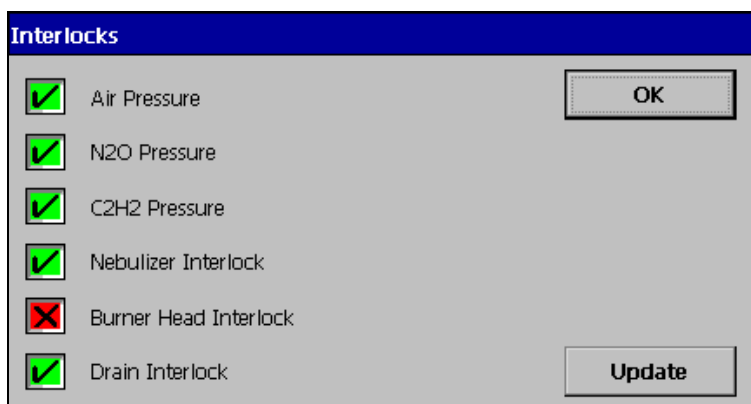
- touch the field to display the Acetylene Flow dialog and enter the required flow rate in this dialog,
- or:
- touch the increase (▶) or decrease (◀) arrows; the flow rate is changed in increments of 0.2 L/min.

Buttons on Flame page

Flame On/Off	<p>Touch the On side of this 'switch' to ignite the flame.</p> <p>Touch the Off side of this 'switch' to extinguish the flame.</p> <p>In an emergency, press the Red Emergency button located on the upper left side of the instrument. The system will extinguish the flame.</p>
Bleed Gases	After extinguishing the flame and shutting down the gases at source, touch this button to depressurize the gas lines.
Auto Scale Graph	Touch this button to resize the graph of the most recent or current absorbance reading.
Auto Zero Graph	Touch this button to set the reading for the current signal to zero on the graph.

Interlocks

The burner system has a safety feature that monitors gas pressure and checks for proper setup of the burner head, nebulizer and drain system. A green check mark shows that all safety interlocks are satisfied and that you can ignite the flame. A red cross mark indicates an unsatisfied safety interlock. You must correct the hardware condition causing the problem before attempting to ignite the flame. Touch the interlock field box to view the status of safety interlocks.



Screen 7- 8 Interlock Dialog

NOTE: *If air-acetylene is used in place of N₂O, the ✗N₂O pressure interlock will be ignored and flame will light.*

Parameters Page

You enter the analytical parameters on the Parameters page. This page comprises two subpages:

- Spectrometer subpage
- Calibration subpage

Spectrometer subpage

You enter spectrometer-related parameters on the this page. This is always the first page shown when you touch the **Parameters** tab.

Spectrometer

Integration Time (sec)

Replicates

Print ☐ Method ☐ Replicates

Measurement ☒ Peak Height ☐ Peak Area

Smoothing Points

Peak Plot Scale ☒ Automatic ☐ Fixed (abs)

Navigation: Spectrometer, Calibration

Bottom Bar: Lamp, Flame, Parameters, Analyze, Tools...

Screen 7- 9 Spectrometer Subpage, MHS Technique

Spectrometer

Integration Time (sec)

Replicates

Read Delay (sec)

Print ☐ Method
☐ Replicates

Sample Handling ☒ Manual Data Display
☐ Manual Continuous Graphics Display
☐ Autosampler

Navigation: Spectrometer, Calibration

Bottom Bar: Lamp, Flame, Parameters, Analyze, Tools...

Screen 7- 10 Spectrometer Subpage, Flame Technique

Items on this page

Integration Time (sec)	<p>Touch-entry field that displays the selected integration time. This is the time period over which the spectrometer takes a measurement. The longer the time, the greater is the level of signal integration.</p> <p>To change the integration time, touch this field to display the number pad dialog. Enter the required integration time and then touch OK.</p>
Replicates	<p>Touch-entry field that displays the selected number of replicate measurements. The selected number of measurements are performed on each solution (blank, standard, and test sample).</p> <p>To change the number of replicates, touch this field to display the Replicates dialog. Enter the required number of replicates and then touch OK.</p>
Read Delay (sec)	<p>Touch-entry field that displays the selected read delay. This is the time period that the spectrometer waits before it starts to measure the signal. A read delay is typically used to allow the flame to stabilize after a change of solution.</p> <p>To change the read delay, touch this field to display the Read Delay dialog. Enter the required read delay and then touch OK.</p>
Print	<p>This item allows you to select the information you would like to have printed together with the analytical mean and statistical results. You select whether printing should be on or off via the Printer On/Off button on Analyze page.</p>
Sample Handling	<p>When the (optional) autosampler is installed, you can choose between manual data display, manual continuous graphics display, and autosampler.</p>
Measurement (MHS only)	<p>Peak Height measures the largest signal during the Read Time after the selected smoothing is applied. Peak Area measures the area under a peak in absorbance-seconds.</p>
Smoothing Points (MHS only)	<p>Smoothing Points uses the Savitsky-Golay smoothing algorithm to a group of n data points, where n can be 0, 5, 9, 19, and 37. Smoothing is applied to the geographical display and used in the calculation of the Peak Height, when the Peak Height measurement mode is selected.</p>
Peak Plot Scale (MHS only)	<p>Automatic sets the scale based on the highest point on the plot being displayed. Fixed absorbance is manually setting peak scales.</p>

Calibration subpage

1. Touch the **Calibration** tab to display this subpage.
2. You select the required calibration equation units and enter the concentrations of the standards (calibration solutions) on this page.

Screen 7- 11 Calibration Subpage

Items on this page

Spectrometer

Calibration Equation

Touch-entry field that displays the selected calibration equation

To change the calibration equation, touch this field to display the Calibration Equation dialog. Select the required calibration equation and then touch **OK**.

Units

Touch-entry field that displays the selected units of concentration.

To change the units of concentration, touch this field to display the Units dialog. Select the required units and then touch **OK**.

Figures After Decimal Number of decimal places used for inputting standard concentrations and reporting calculated concentrations.

Standard Concentrations

1 – 8 Touch-entry fields that display the selected concentrations of up to 8 standards (calibration solutions).

To enter the concentration of a standard, touch the required field to display the Standard Conc. dialog. Enter the required concentration and then touch **OK**.

Reslope Reslope can only be used with equations linear through zero, non-linear through zero, and linear through zero calculated intercept. Touch-entry field that displays the selected concentrations of the reslope solution. The reslope option allows you to make small corrections to the calibration curve using a single standard to compensate for minor changes in instrument conditions. A reslope standard near the middle of the calibration range usually gives the best results.

To enter the concentration of a reslope solution, touch this field to display the Reslope dialog. Enter the required concentration and then touch **OK**.

Reslope would appear in **Analyze** page as one of the standard selections when the appropriated standard calibration equation is selected. if the calibration equation, Through Zero had been selected.

Calibration Equation dialog in Calibration subpage

The calibration equation describes the mathematical relationship between the absorbance reading and the concentration of the analyte in the solutions being measured. Various calibration equations are available, depending on whether the calibration curve is linear or non-linear, whether it passes through the origin or makes an intercept with the absorbance axis, and on the technique of calibration used.

Nonlinear Through Zero: Select this option if you expect the concentration of the analyte in your samples to be outside the linear range.

This option covers the widest concentration range and you need a larger number of standards (calibration solutions) to establish the calibration curve. A calibration curve defined using this equation is forced to pass through zero absorbance and zero concentration (i.e. the origin).

Linear Through Select this option if you expect the concentration of the analyte in your

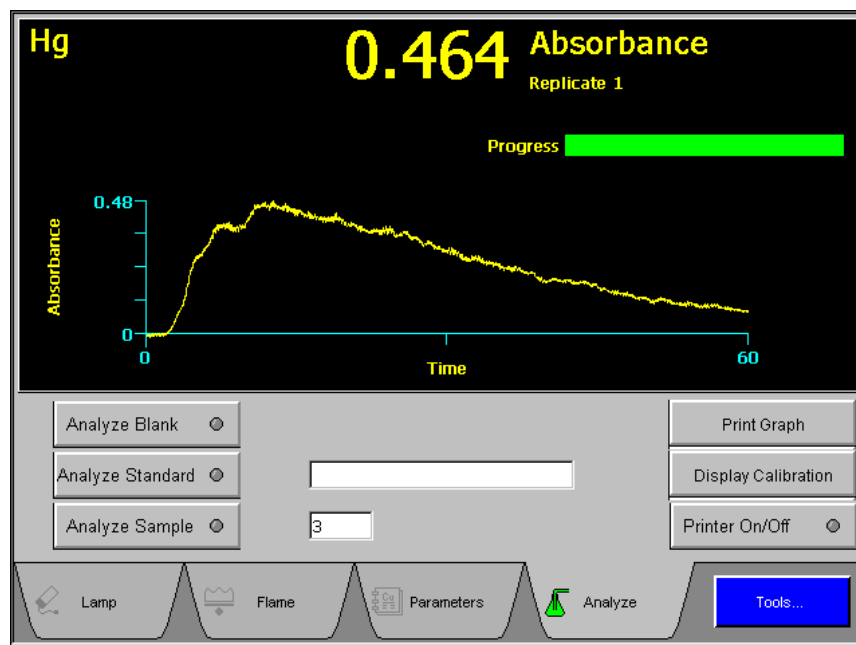
Zero:	<p>samples to be within the linear range.</p> <p>A calibration curve defined using this equation is forced to pass through zero absorbance and zero concentration (i.e. the origin).</p>
Through Zero: Method Addition	<p>You select the analyte addition technique when the composition of the sample is unknown and the matrix causes an interference that varies in magnitude from sample to sample. With this technique, every unknown sample is calibrated individually.</p> <p>A calibration curve defined using this equation is forced to pass through zero absorbance and zero concentration (i.e. the origin).</p>
Analyte Addition Calibrate	<p>You can select the technique of addition calibration when the matrix causes an interference, but the matrix is consistent in all the unknown samples. You establish the calibration curve for the first unknown sample using the analyte addition technique and then use this calibration curve to measure all subsequent samples.</p>
Calculated Intercept: Linear	<p>This option allows the intercept of the calibration curve with the absorbance axis to be calculated rather than forced through zero. In the calculation algorithm the blank solution is treated as another point on the curve.</p>
Calculated Intercept: Analyte Addition	<p>You select the analyte addition technique when the composition of the unknown sample is unknown and the matrix causes an interference that varies in magnitude from sample to sample. With this technique, every unknown sample is calibrated individually.</p> <p>The intercept of the calibration curve with the absorbance axis is calculated rather than forced through zero.</p>
Bracketing Calibration	<p>This option is applicable over a restricted concentration range at higher concentration levels. The concentrations of the standards bracket the concentrations of the unknown samples and only a limited section of the calibration curve is used for the evaluation.</p>

Analyze Page: Manual Data Display

This window allows users to manually analyze a solution and view the results in the Result Window that appears on the Analyze Sample Page. When the system finishes the analysis of each solution, data will appear at the bottom of the scrolling display as it is generated and the user will have the option of scrolling backward to review previous data.

Sample	Mean	SD	RSD (%)	Replicates
Blank	0.100	0.000	0.000	0.100 0.100 0.100
Autozero Performed				
Standard 1	0.400	0.000	0.000	0.400 0.400 0.400
Standard 1 Applied				
Sample 001	5.000	0.000	0.000	5.000 5.000 5.000

Screen 7- 12 Analyze Samples Page : Manual Data Display, Flame Technique



Screen 7- 13 Analyze Samples Page : Manual Data Display, MHS Technique

Results Window on the Sample Page

This window displays the standards and sample measurements.

Sample	This displays specific sample identifier about each solution analyzed. For example: blank, standard 1, standard 2, sample 1, sample 2, etc.
Mean	This displays the mean concentration in sample units or absorbance.
SD	This displays the standard deviation.
RSD (%)	This displays the relative standard deviation, also referred to as the coefficient of variation.
Replicates	This displays the replicate information for each replicate analyzed in concentration or absorbance.

Buttons on Analyze Samples page

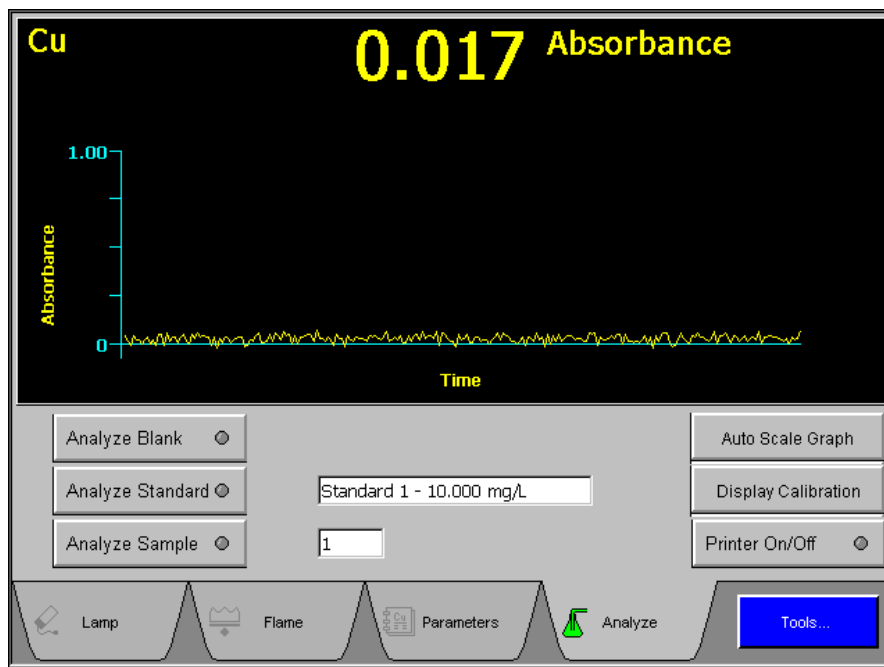
Analyze Blank	To analyze the blank defined in the method, touch this button. A green light appears on this button when selected.
Analyze Standard	To analyze the standard indicated in the standard concentration box, touch this button. A green light appears on the button when selected. The system analyzes the standard and creates a calibration curve. Standards can be reanalyzed by selecting the standard from the Standard Concentration Box .
Analyze Sample	To analyze the sample indicated by the sample number entry field, touch this button. A green light appears on the button when selected. Samples can be reanalyzed by selecting the sample from the Sample Number Box .
Display Calibration	To display the calibration curve window, touch this button.
Printer On/Off	<p>By default the print function is On and the results will print when the printer queue is full. The green light indicate that it is On. To turn print function Off, touch Printer On/Off button.</p> <p>You may print the results without waiting for the printer queue to fill up by touching the Printer On/Off button.</p>

Items on Analyze Samples page

Standard Concentration Box	Touch this entry-field box to view the standard concentration dialog. Use the dialog to select the standard concentration you want to analyze. A calibration curve is created after blank and selected standard are run.
Sample Number Box	This entry field shows the sample No. of the sample you are currently analyzing. If you wish to analyze a different sample, touch this entry-field box to view the sample number dialog.

Analyze Samples Page: Manual Continuous Display

This window displays the continuous graphics at the top of the screen. The display contains a continuous, real-time plot and a numerical reading for the signal. The plot and the numerical value are continuously updated to the current reading. The analysis is limited to only one replicate per sample.



Screen 7- 14 Analyze Samples Page – Manual Continuous Display

Continuous Graphics Window on the Analyze Page: Manual Continuous Display

The Continuous Graphics window contains a continuous, real-time plot of absorbance (or emission) against time. The scale for Y-axis and real time absorbance default value ranges from 0.00 - 4.00 absorbance.

Buttons on Analyze page

Analyze Blank	To analyze the blank defined in the method, touch this button. A green light appears on this button when selected.
Analyze Standard	To analyze the standard indicated in the Standard Concentration Box, touch this button. A green light appears on the button when selected. The system analyzes the standard and creates a calibration curve.
Analyze Sample	To analyze the sample indicated by the sample number entry-field box, touch this button. A green light appears on the button when selected.
Display Calibration	To display the calibration curve window, touch this button.
Auto Scale Graph	Touch this button to resize the graph of the most recent or current absorbance reading.
Printer On/Off	By default the print function is On and the results will print when the printer queue is full. The green light indicate that it is On. To turn print function Off, touch Printer On/Off button. This will print any results in the printer queue.

Entry Fields on Analyze page

Standard Concentration	Touch this entry-field box to view the standard concentration dialog. Use the dialog to select the standard concentration you want to analyze. The standard concentration will automatically increment after each standard run. A calibration curve is created after all blanks and selected standards are run.
Sample Number	This entry-field box shows the sample number of the sample you are currently analyzing. If you wish to analyze a different sample, touch this entry-field box to view the sample number dialog. The sampler number will automatically increment after each sample run.

Analyze Page: Autosampler

This window allows users to setup and perform an automated analyses. Results of each analysis is displayed on the Results Window. When the system finishes the analysis of each solution, the most recent results are added to the bottom of the Results Window.

Cu **5.000** **mg/L**
 Mean
 RSD (%): 0.000

Progress

Sample	Mean	SD	RSD (%)	Replicates
Blank	0.100	0.000	0.000	0.100 0.100 0.100
Autozero Performed				
Standard 1	0.400	0.000	0.000	0.400 0.400 0.400
Standard 1 Applied				
Sample 001	5.000	0.000	0.000	5.000 5.000 5.000

Analyze All ☐ Sample Locations: 10 to 50
 Calibrate ☐ Recalibration Frequency: 0 Display Calibration ☐
 Analyze Samples ☐ Autosampler Tray: E(200) Printer On/Off ☐

Lamp Flame Parameters Analyze Tools...

Screen 7- 15 Analyze Page – Autosampler

Results Window on the Analyze Page: Autosampler

This window displays the standards and sample measurements.

Sample	This displays specific information about each solution analyzed. For example: blank, standard 1, standard 2, sample 1, sample 2, etc.
Mean	This displays the mean concentration in sample units or absorbance.
SD	This displays the standard deviation.
RSD (%)	This displays the relative standard deviation, also referred to as the coefficient of variation.
Replicates	This displays the replicate information for each replicate analyzed.

Buttons on Analyze Samples page

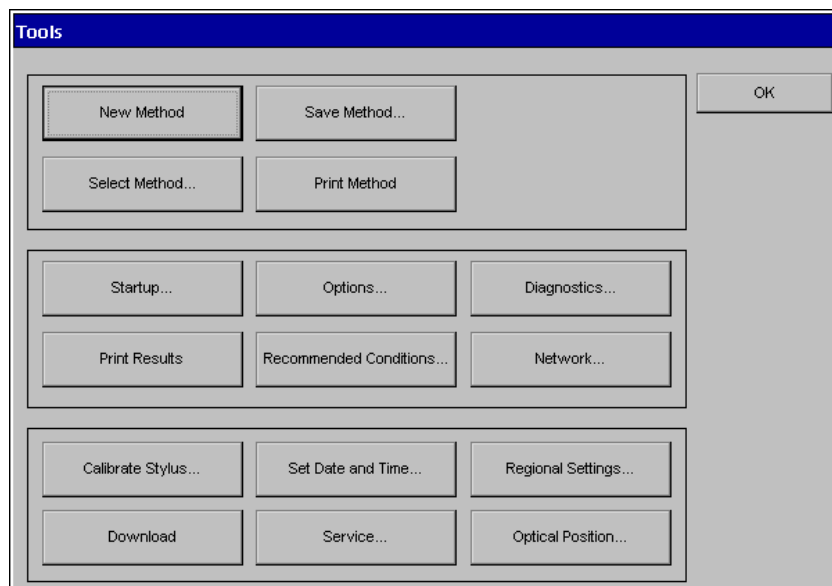
Analyze All	By touching this button, the system will start an automated analysis of the blank, standards, and samples. A green light appears on the button when selected.
Calibrate	Touch this button to start the calibration sequence. The system uses the blank and standards defined in the method.
Analyze Samples	To analyze samples, touch this button. A green light appears on the button when selected. The system will analyze sample range specified in the Sample Locations entry-field box.
Display Calibration	To display the calibration curve window, touch this button.
Printer On/Off	By default the print function is On and the results will print when the printer queue is full. The green light indicate that it is On. To turn print function Off, touch Printer On/Off button. This will print any results in the printer queue.

Parameters on Analyze Samples page

Autosampler Tray	This shows the name of the sample tray currently selected. To select a different tray, touch this entry-field for tray dialog.
First Sample Location	This shows the starting position of the sample located on the autosampler tray. To change the start sample location, touch this entry-field for a number-pad entry dialog.
Last Sample Location	This shows the terminating position of the sample located on the autosampler tray. To change the terminating sample location, touch this entry-field for a number-pad entry dialog.
Recalibration Frequency	The system analyzes the calibration blank and all the calibration standards (or reslope if selected and defined), then creates a completely new calibration curve. To set the frequency, touch this entry-field for the number-pad dialog.

Tools Dialog

You can access the Tools dialog by touching the blue **Tools...** button located on the bottom of the touchscreen. This dialog is a collection of function and utility buttons.



Screen 7- 16 Tools Dialog

Buttons on Tools

Select Method Touch this button to open a dialog of stored methods. A stored method can be retrieved by selecting the name of the method.

Save Method Touch this button to store methods. Use the touch keyboard to enter the name and description of your method in this pop-up dialog.

New Method Touch this button to create a new method, this will clear the current active method.

NOTE: The current active method should be saved before touching this button.

Options Touch this button to view the options dialog. This dialog allows the users to select languages, autosampler model, and to set beep function on or off.

Diagnostics This button displays the diagnostic dialog, used to make sure that your instrument and its accessories have been installed properly and are functioning properly.

Recommended This button displays the Recommended Conditions

Conditions	<p>dialog, which shows recommended analytical conditions for determining the active element.</p> <p>The data tab displays the recommended setup and diagnostic parameters of wavelength, slit width, relative noise, characteristic concentration, sensitivity check, and linear to mg/L.</p> <p>The remark tab displays special conditions about the element that you are determining.</p> <p>To view a different element for recommended conditions, the element in lamp page must be changed.</p>
Network	<p>This button displays the Network dialog, that is use to setup a network connection between the instrument and a stand-alone or a network computer. Once a network connection is established, all the analyses result data will automatically be saved.</p>
Calibrate Stylus	<p>Touch this button to run a system utility to recalibrate the touch screen if the screens are not responding properly to your touch.</p>
Print Method	<p>Touch this button to print the current active method.</p>
Service	<p>This button is to be used by service engineers.</p>
Download	<p>This button is to be used to upgrade software.</p>
Set Date and Time	<p>Touch this button to set time zone, daylight saving, date, and time.</p>
Regional Setting	<p>Touch this button to format date and time display.</p>
Startup	<p>Touch this button to change technique.</p>
Optical position	<p>Touch this button to show a plot of the most recent wavelength peaking operation for diagnostic purposes.</p>

Recommended Conditions

You use this page to show the recommended analytical conditions for determinations using the flame technique. The analytical conditions shown can often be used to produce acceptable results for determining elements in samples with a simple matrix.

Recommended Conditions

Element

Cu

OK

Data

Remarks

Atomic Absorption

Wavelength (nm)	Slit Width (nm)	Relative Noise	Char. Conc. (mg/L)	Sensitivity Check (mg/L)	Linear To (mg/L)
324.75	2.7/0.8	1	0.025	1.3	1.6
327.40	2.7/0.8	1.1	0.055	2.6	1.6
216.51	1.8/1.35	7.2	0.15	6.5	6.5
249.22	2.7/1.35	1.7	2	100	30

Oxidant

Air

Oxidant Flow (L/min)

10

Acetylene Flow (L/min)

2.5

Flame Emission

Oxidant

N2O

Wavelength

327.40

Oxidant Flow (L/min)

6

Slit

1.8/0.6

Acetylene Flow (L/min)

7.5

Print

Screen 7- 17 Recommended Conditions Dialog

Network Dialog

AAAnalyst 200 data can be saved to a stand-alone computer or to a network computer using a LAN connection. Once a network connection is established, all the analyses result data will automatically be saved.

To establish connection between a stand-alone computer and the AA200 instrument, follow the procedure below. It is recommended that you contact your system administrator to setup connections for network computer.

Stand-Alone Computer

1. Use a crossover cable (P/N 0941-0061) to connect the AA200 instrument to a computer.
 - Connect the crossover cable to the Ethernet port of the E-Box (see *chapter 5* for connectors on the E-Box).
 - From the E-Box, run the crossover cable to the Ethernet port of the computer.
2. From the AA application (Touch Screen) touch the **Tools...** button to access the Tools dialog.
3. Touch the **Network...** button on the Tools dialog to access the Network dialog.

Screen 7- 18 Network Dialog

4. At the top of the Network dialog, click on the **Store Data on Network Drive** check box to turn the store data function on.

Network Setup

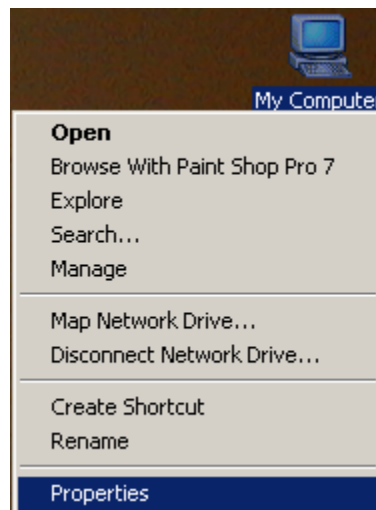
5. In the Network Setup section of the Network dialog, choose **Specify an IP address** option. Enter the suggested IP Address and Subnet Mask below.
 - IP Address – 10.0.0.1
 - Subnet Mask – 255.255.255.0

NOTE: *Entries for Default Gateway are not needed for a stand-alone computer.*

Storage Location

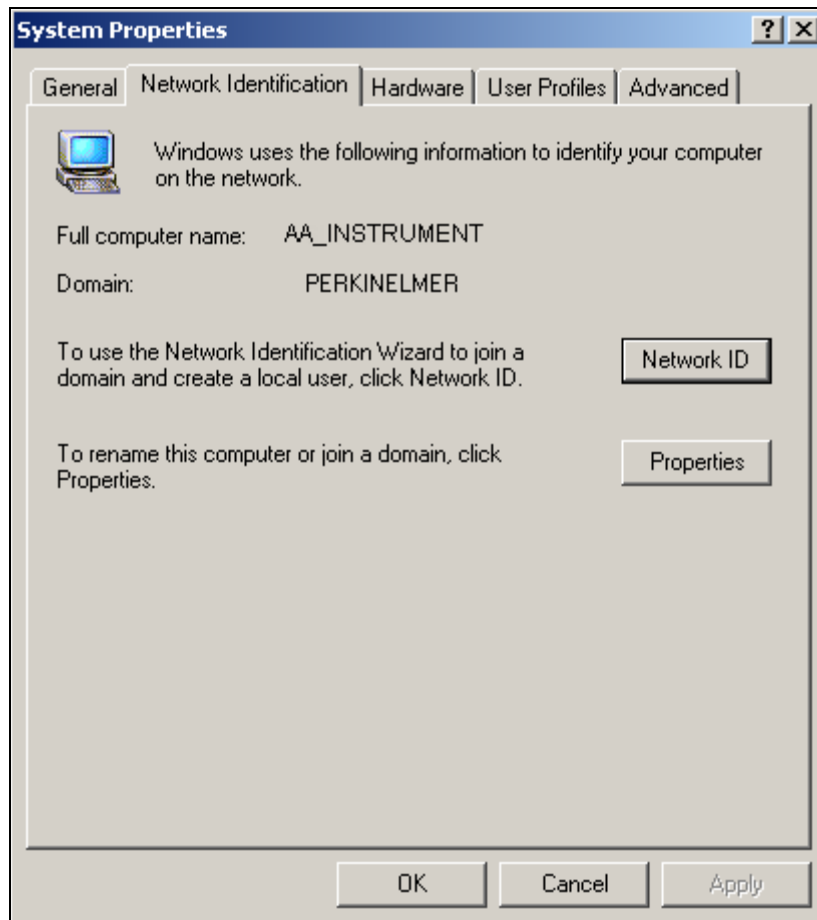
In the Storage Location section of the Network dialog, fill in the entries for Computer Name, Share Name, User Name, and Password.

6. Computer Name – Enter the name given to identify the stand-alone computer. To locate the computer name, do the following procedure on the stand-alone PC.
 - Point to the **My Computer** icon, and right click the mouse once.
 - A shortcut menu appear and select **Properties**.



Screen 7- 19 Shortcut Menu

- System Properties dialog appear and select the **Network Identification** tab.

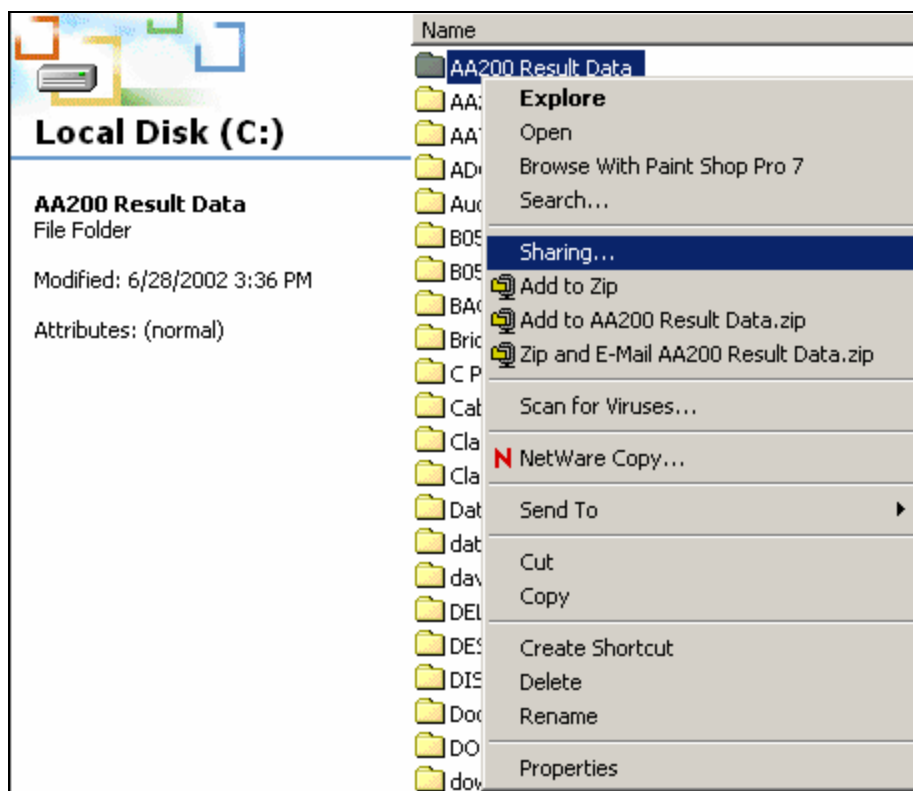


Screen 7- 20 System Properties

7. Share Name – A name of a drive or folder on the directory that allows other users permission to access it.

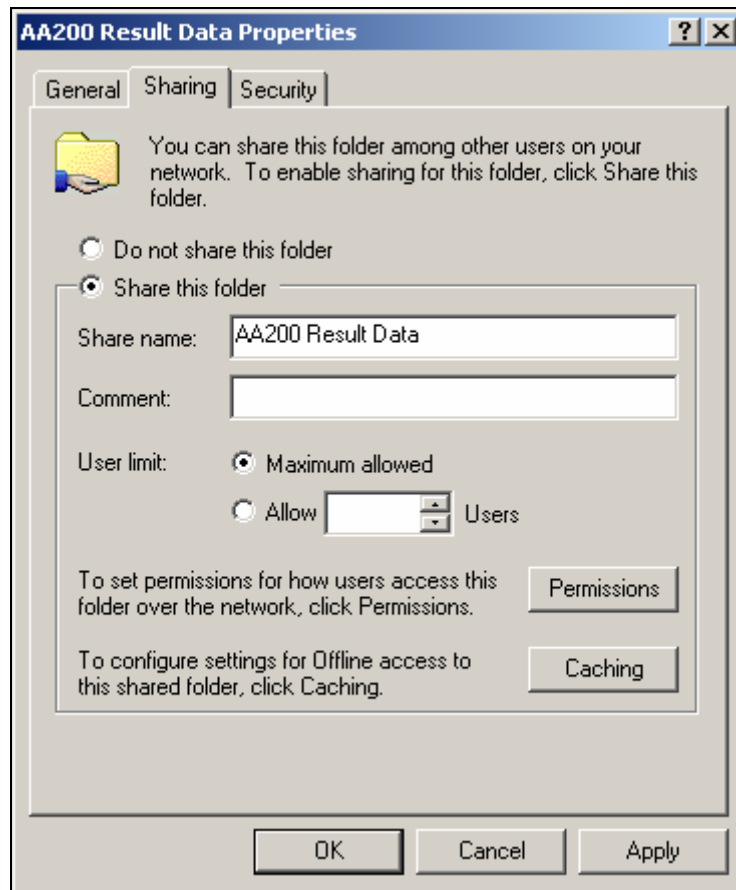
If you do not already have an existing shared drive or folder and need to create a shared drive or folder, follow the procedure below.

- Open Windows Explorer and right click on the desired drive or folder to make it sharable.
- From the shortcut menu, choose **Sharing**.



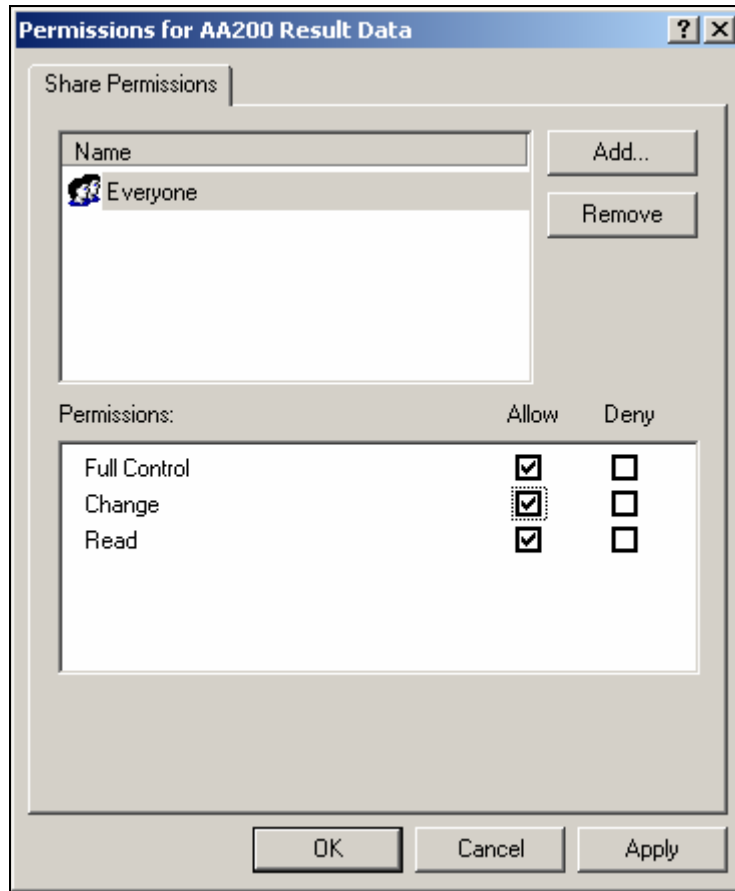
Screen 7- 21 Shortcut menu

- Properties folder appear and select **Share this folder** option.



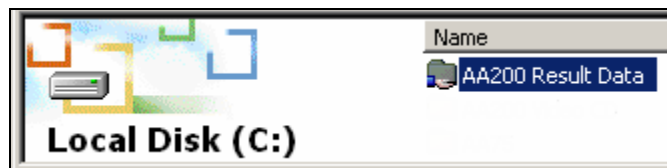
Screen 7- 22 Properties dialog

- Click the **Permissions** button to set users permissions to the shared drive or folder.



Screen 7- 23 Permissions dialog

- Click **OK** and the desired drive/ folder is now shared.



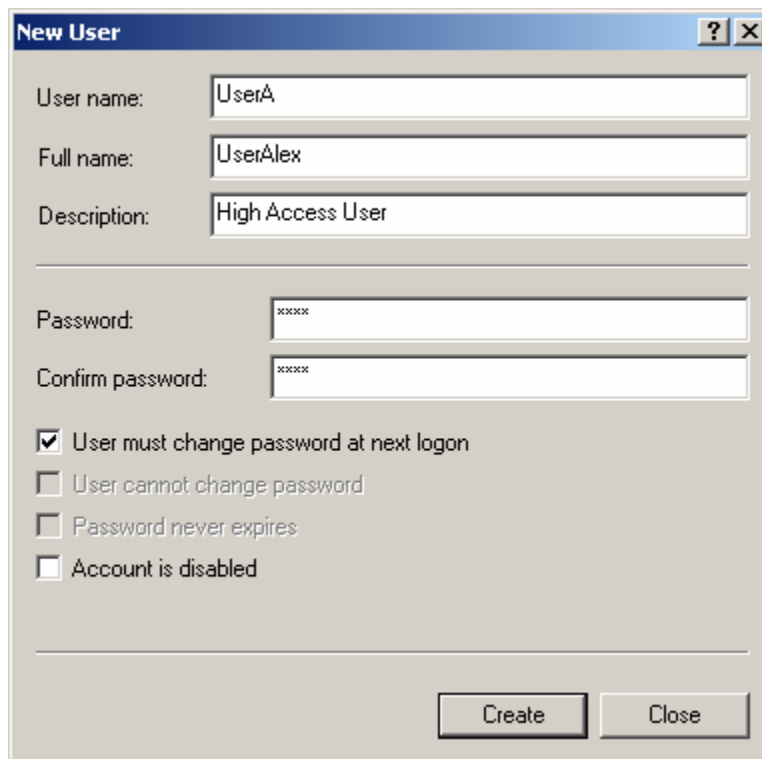
Screen 7- 24 Shared folder

8. User Name and Password – Enter the user's name and password in the Network dialog.

If you do not already have a user's name and password, follow the procedure below.

- Select **Start>Settings>Control Panel**. The Control Panel dialog appears.
- Double click **Administrative Tools>Computer Management**. The Computer Management dialog appears.
- In the directory tree on the left of the Computer Management dialog drill down select **System Tools>Local Users and Groups>Users**.
- From the Action menu, select **Action>New User**. The New User dialog appears.

- Fill in the dialog completely giving the User Name, Full Name, Description, Password, and password options.



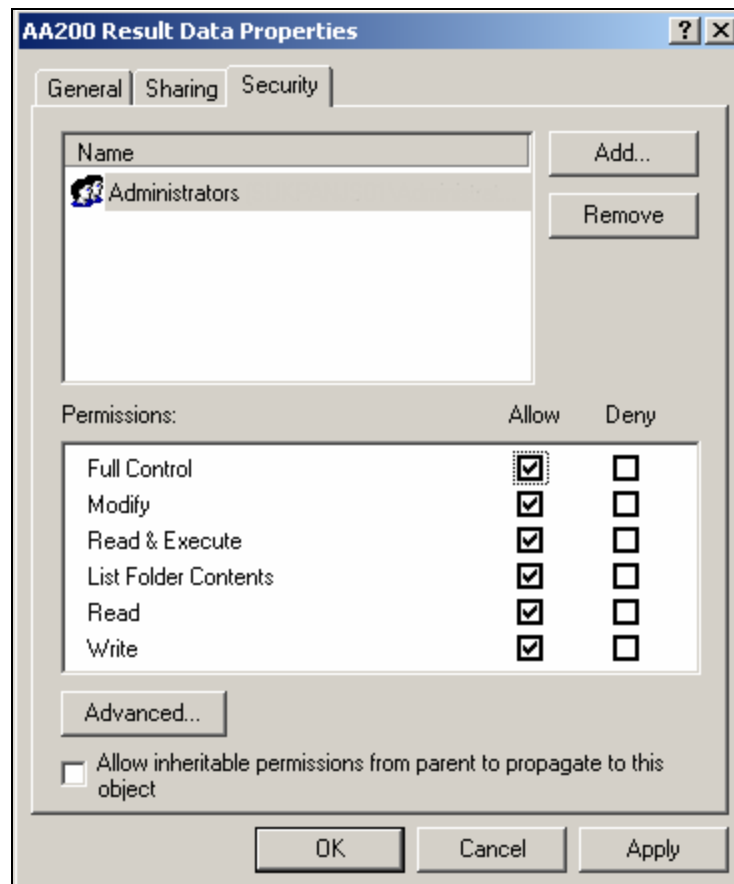
Screen 7- 25 New User dialog

NOTE: *It is suggested that the "User must change password at next logon" is selected as the password option. This will allow the User's password to be unknown to anyone other than that User. It is also important to provide the full name of each user. The Enhanced Security software uses the full name to identify the user in all of its logging features.*

- Double-click on **UserA**. A Properties dialog appears for UserA.
- Click on the **Member Of** tab, and then add UserA to the desired group using the **Add** button. We will add UserA to the **Administrators** Group. We also need to add UserA to the Users Group. Click **OK**.

To set permissions for the AA200 Result Data directory:

- From the C:\ directory, right mouse click on the **AA200 Result Data** folder.
- Select **Properties**.
- Click on the **Security Tab**.
- Deselect Allow inheritable permissions from parent to propagate to this object.

**Screen 7- 26 Properties dialog**

- From the Security dialog, highlight **Administrators** and click **Add**. Click **OK**.
- Select **Full Control** for the Administrators.
- Click **Apply**, then Click **OK**.

Network Computer

Depending upon the network configuration, it may be a Static or a Dynamic network. It is best to contact your System Administrator for network setup.

Network Setup

For Dynamic IP Network, do the following:

- Select **Obtain an IP address via DHCP** option on the Network dialog.
- Enter the **Instrument ID** in the entry field box.

NOTE: *Each AAnalyst 200 instrument must have a unique ID. For example, AA200_1, 1 is the ID number for AA200 instrument 1. The ID can range from 0-255.*

For Static IP Network, do the following:

- Select **Specify an IP address** option on the Network dialog.
- Fill in the entries for **IP Address**, **Subnet Mask**, and **Default Gateway**.

Once the Network Setup is completed, continue on to Storage Location part of the Network dialog. See steps 6-8 of the Stand Alone section for full instructions for setting up Storage Location.

NOTE: *Certain permissions and restrictions should be set forth by an IT System Administrator. Once the shared drive or folder is on the network, you can secure it by setting and allowing certain users/groups rights to the shared drive/folder.*

Download

To download new software/ firmware, it is necessary to first establish a connection between a computer and the AA200 instrument using Microsoft ActiveSync program.

Download Requirement

- Computer running Windows NT, 2000, or XP.
- RS 232 female to female Serial Cable
- Microsoft ActiveSync file (msasync.zip) from QuickStart CD (0993-6637), Download folder

Follow the procedure below to download software/ firmware.

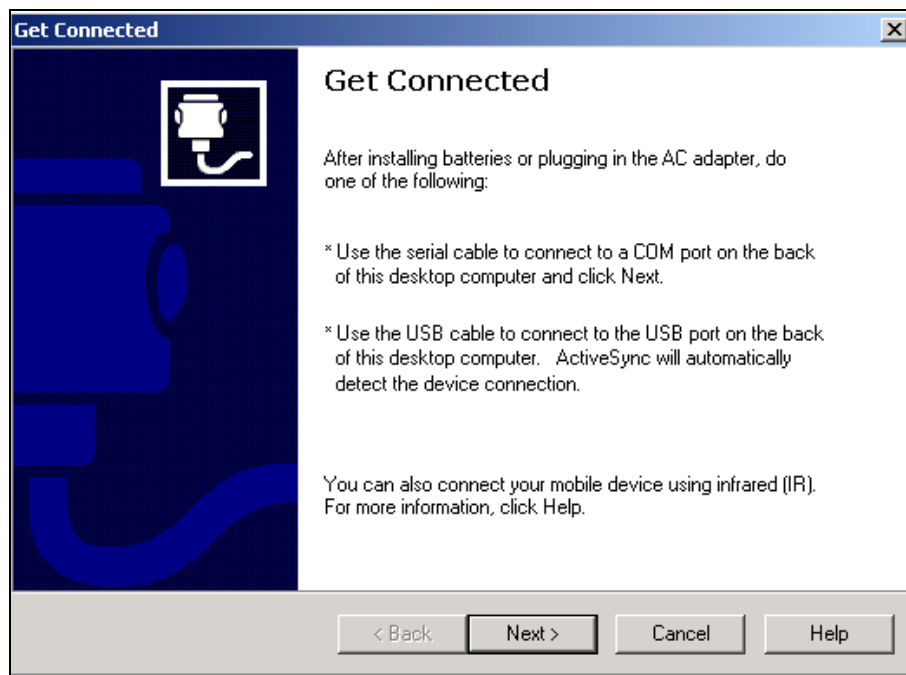
Connection Setup

1. Install **Microsoft ActiveSync** if not already installed.
2. Follow the setup wizard from the Microsoft install shield.



Screen 7- 27 Microsoft ActiveSync Install Shield

3. Pause at the Get Connected window and physically connect the RS 232 serial cable from the E-Box to the computer.
 - Connect RS 232 serial cable to the serial 1 of the E-Box.
 - From the E-Box, run the RS 232 serial cable to the comport 1, 2, 3, or 4 of the computer.

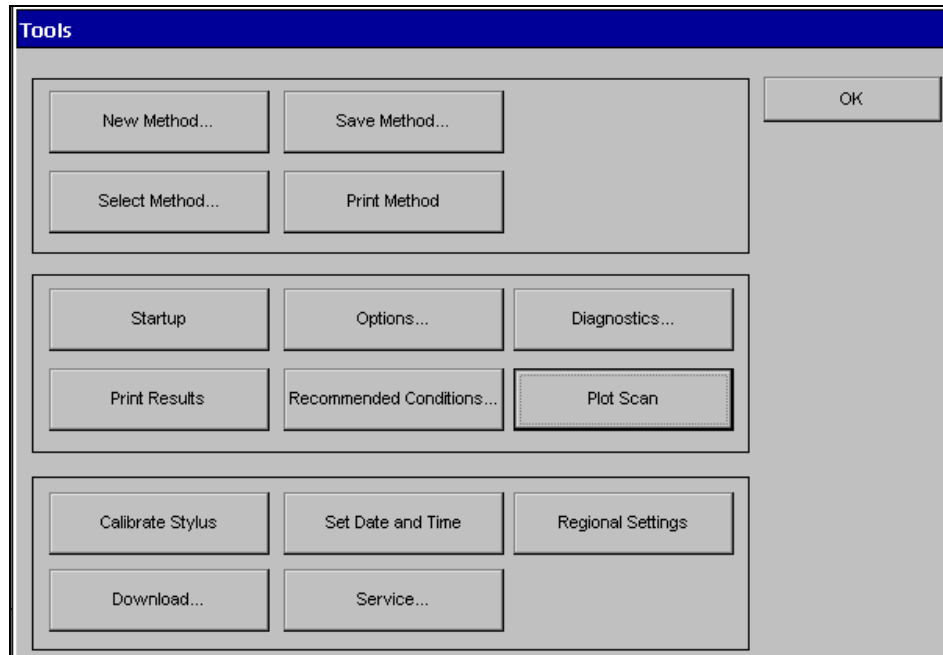


Screen 7- 28 Get Connected Window

4. From the AA application (Touch Screen) touch the **Tools...** button to access the Tools dialog.

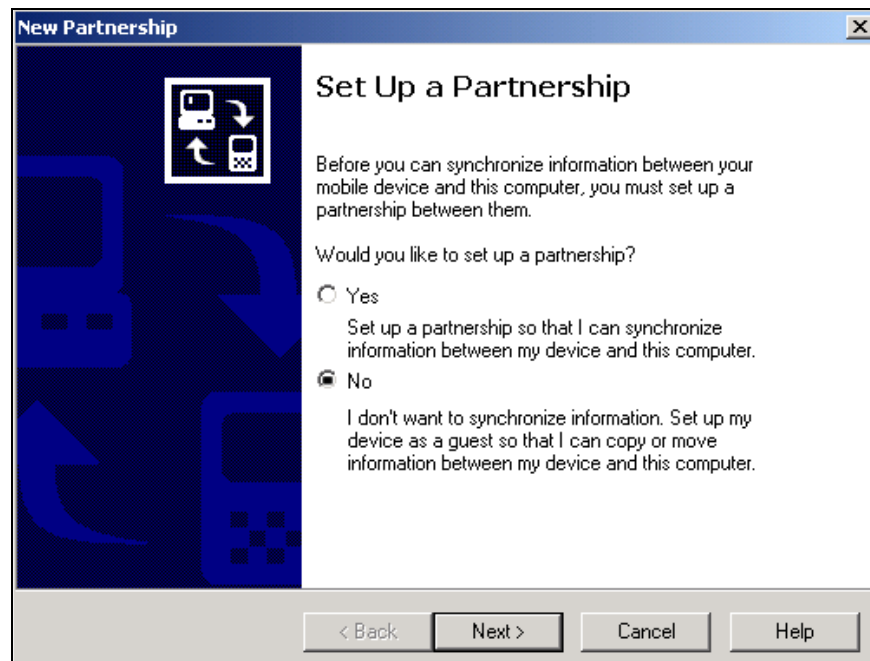
CAUTION

Do not power off the instrument or disconnect the serial cable while downloading. There is a slight risk of application failure to recover.




Screen 7- 29 Tools Dialog from the Touch Screen

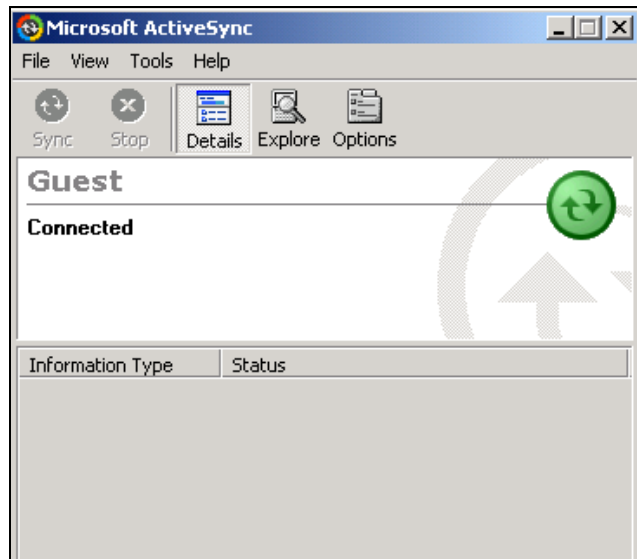
5. Touch the **Download** button from the Tools dialog to start the download.
6. Continue from the Get Connected window and click **Next**.
7. If the Partnership dialog appears, select the **No** option button and then click **Next**.



Screen 7- 30 New Partnership Dialog

8. The Microsoft ActiveSync window appears and displays the status of the connections between the E-Box and the computer.

NOTE: A green icon  located on the lower right hand corner of the taskbar indicates successful connection.



Screen 7- 31 The Microsoft ActiveSync window shows the connection.

9. Connection is established.

Downloading

Once the connection is established between the computer and the E-Box, continue with the procedure below for downloading.

1. Insert the QuickStart CD (0993-6637) into the computer and use the browser to find **Update.bat** file.
2. Double click on the **Update.bat**.
3. The command prompt window appears and the download of the software/ firmware to the E-Box begins.
4. A successful download will display '*Download is Completed*' on the command prompt.
5. Reboot the AAnalyst 200 instrument by powering it down and back up.


```

C:\WINNT\System32\cmd.exe
A:\>CeRun "\storage card\killer.exe"
A:\>CeCopy "pc:IP_storage2reg.exe" "ce:\storage card\IP_storage2reg.exe"
Copying PC:IP_storage2reg.exe to CE:IP_storage2reg.exe
2560 bytes in 3 sec
A:\>CeCopy "pc:autosamp.htm" "ce:\storage card\web\autosamp.htm"
Copying PC:autosamp.htm to CE:autosamp.htm
9430 bytes in 4 sec
A:\>CeCopy "pc:flame.db" "ce:\storage card\db\flame.db"
Copying PC:flame.db to CE:flame.db
15320 bytes in 8 sec
A:\>echo Download is completed!
Download is completed!
A:\>pause
Press any key to continue . . . _

```

Screen 7- 32 Command Prompt Window

Application Launch Failure

Use the following procedure below if the application fail to launch.

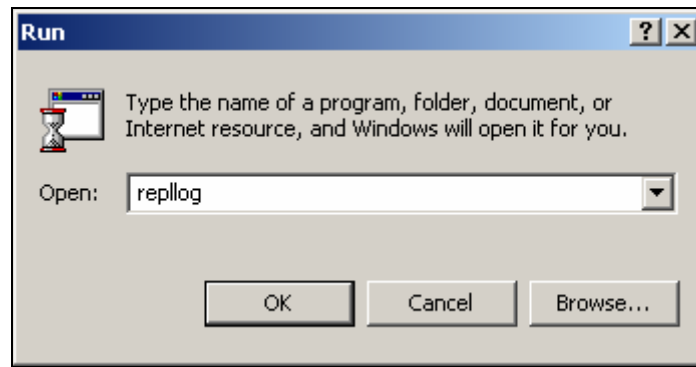
1. Follow steps 1-4 from the **Connection Setup** procedure.
2. Connect the keyboard to the E-Box.
3. Power on the AA200 instrument and wait until the screen shows an arrow on top of the splash screen.
4. Timing is crucial: just as the arrow appears, use the keyboard to press the **ESC** key continuously until a blue PerkinElmer Instrument screen appears on the touch screen.

NOTE: Press **CTRL** + **ESC** key to display the **Start** menu.

5. Use the arrow keys on the keyboard to Select **Run** or touch **Run** on the touch screen.
6. Enter the word 'killer.exe' in the dialog box and touch **OK**.

NOTE: Allow 10 seconds for Killer.exe to terminate all running windows and programs.

7. Use the arrow keys on the keyboard to Select **Run** or touch **Run** on the touch screen.
8. Enter the word 'repllog' in the dialog box and touch **OK**.



Screen 7- 33 Run Dialog

9. Follow steps 7-10 from the Connection Setup procedure.
10. Follow steps 1-4 of the Downloading procedure.
11. Reboot the AA200 instrument.

Importing AAnalyst 200 into Microsoft Excel

AAAnalyst 200 stores data in flash memory as long as the instrument is powered on. Using the procedure below, data stored on the AAnalyst 200 can be imported into Microsoft Excel for permanent storage or for custom printing and reporting.

NOTE: *If Microsoft Office is not available, this procedure can also be used to open results using Windows Notepad or Wordpad.*

To import data into Microsoft Excel:

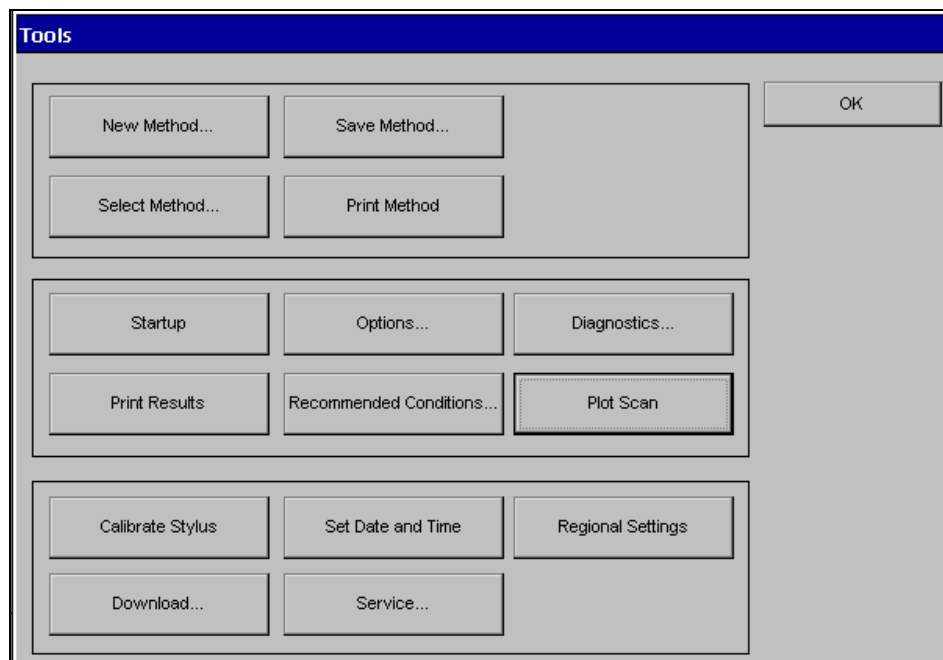
1. Insert the AAnalyst 200 Quick Start CD into the CD-ROM drive.
2. In the Main menu of the AAnalyst 200 Quick Start program, click on **Quit** in the lower right part of the window. This will exit the AAnalyst 200 Quick Start program.
3. Use the Windows Explorer to search for **MSASYNC.EXE** file. It is located in the D:\download directory\MSASYNC.EXE. (Where the D is the letter of your CD-ROM drive).
4. Double click on the **MSASYNC.EXE** file. A dialog will appear indicating that MS Active Sync is being extracted.
5. Following extraction of MS Active Sync, a Setup dialog will appear.



Screen 7- 34 Microsoft ActiveSync Install Shield


6. Proceed with the setup, by clicking **Next** on each page that appears.
7. Connect the serial cable (part number 0941-0063) to the serial connections on the front of the AAnalyst 200 E-Box and at the rear of the computer.
8. Power on the AAnalyst 200 (if it is not already on).
9. On the AAnalyst 200 touch screen, touch the **Tools...** button to access the Tools dialog.

10. From the Tools dialog, touch the **Download** button.



Screen 7- 35 Tools Dialog from the Touch Screen

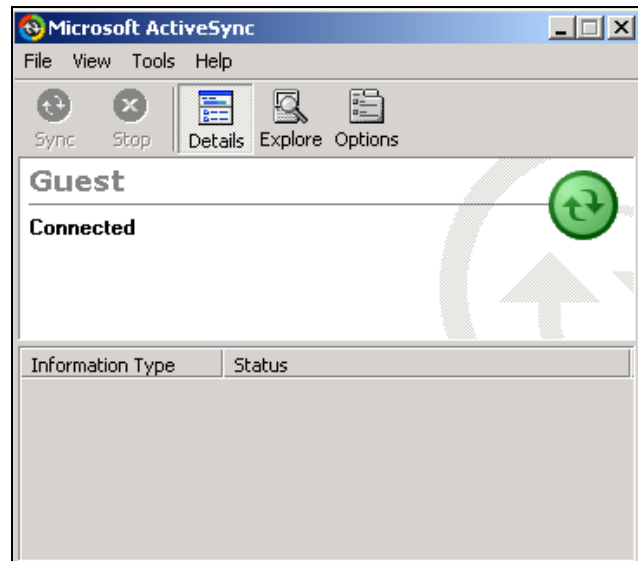
11. A message indicating “System will stop the application to prepare for a download” will appear. Touch **OK**.
12. If a partnership dialog box appears on the computer screen, select the **No** option button and then click **Next**.

NOTE: A green icon  located on the lower right hand corner of the taskbar indicates successful connection.



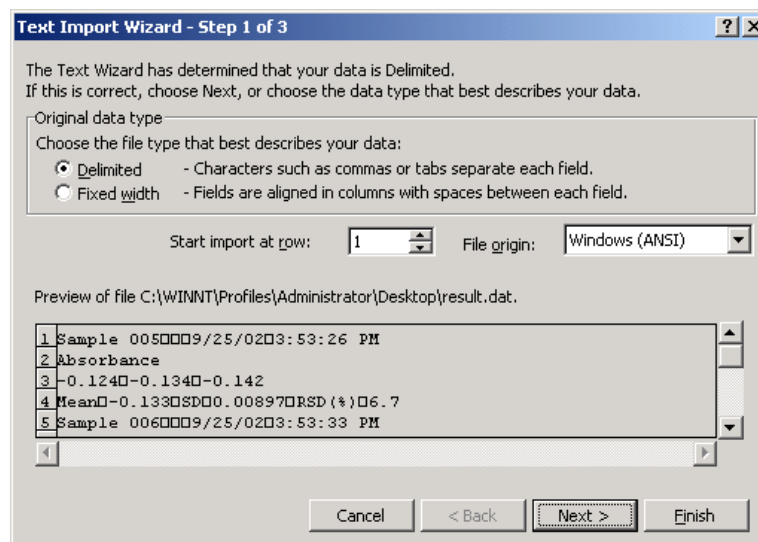
Screen 7- 36 New Partnership Dialog

13. When the ActiveSync window appears on the screen, click the **Explore icon**. A window appear displaying thumbnails of files and folders stored on the AAAnalyst 200.



Screen 7- 37 The Microsoft ActiveSync window shows the connection

14. Double click on **My Computer** and then on **result** directory.
15. Click on the **result.dat** and copy the file to the computer clipboard. Select **Copy** from the Edit menu or press **Ctrl + C**.
16. Within Windows Explorer, paste **result.dat** file into the desire directory. Select Paste from the Edit menu or press **CTRL + V**.
17. Launch Microsoft Excel and select **Open** from the File menu. Navigate through the Open dialog folder to search and open **results.dat** file that was previously copied to the desired directory.
18. When the Excel Text Import Wizard window appears, select the **Delimited** option and click **Next**.



Screen 7- 38 Text Import Wizard, Step 1

19. In the second window of the Text Import Wizard, select **Tab** and **Space** checkboxes. The lower pane shows a preview of how the result data will be displayed in Excel. Click **Next**.

Text Import Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

☒ Tab ☐ Semicolon ☐ Comma
☒ Space ☐ Other:

☒ Treat consecutive delimiters as one

Text qualifier:

Data preview

Sample	005	9/25/02	3:53:26	PM	
Absorbance	-0.124	-0.134	-0.142		
Mean	-0.133	SD	0.00897	RSD (%)	6.7
Sample	006	9/25/02	3:53:33	PM	

Buttons: Cancel, < Back, Next >, Finish

Screen 7- 39 Test Import Wizard, Step 2

20. In the last window of the Wizard, select the desire options from the Column data format section. Click **Finish** to complete the importing process.

Text Import Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Column data format:

☒ General
☐ Text
☐ Date:
☐ Do not import column (skip)

Data preview

General	General	General	General	General	General
Sample	005	9/25/02	3:53:26	PM	
Absorbance	-0.124	-0.134	-0.142		
Mean	-0.133	SD	0.00897	RSD (%)	6.7
Sample	006	9/25/02	3:53:33	PM	

Buttons: Cancel, < Back, Next >, Finish

Screen 7- 40 Test Import Wizard, Step 3

21. Select **Save As** from the File menu to save your result as an excel file.

Analyzing Samples **8**

Sequence of Operations

The diagram below shows the sequence of operations that you must perform to analyze samples using the AAAnalyst 200 spectrometer. The pages and dialogs that you require for each step are shown.

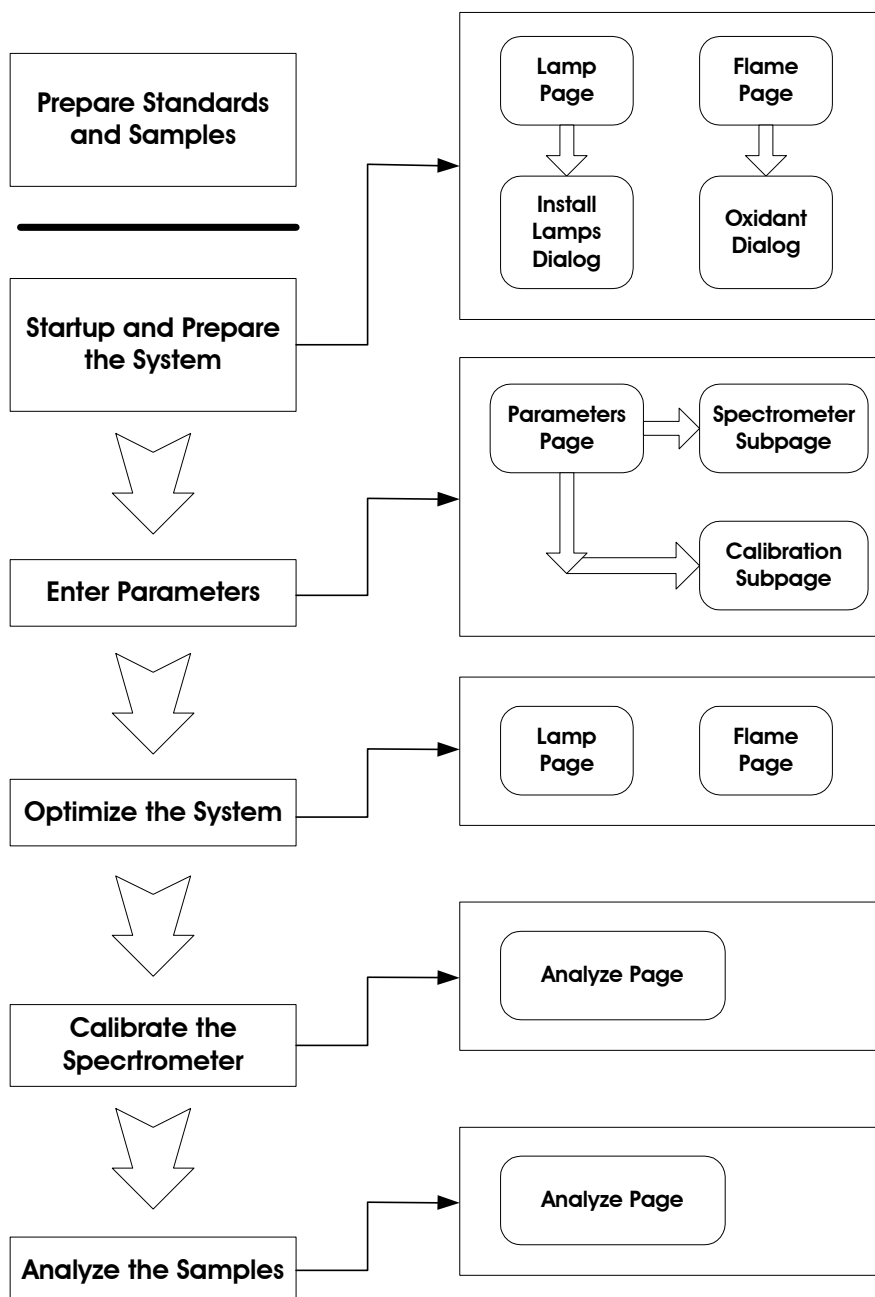


Figure 8- 1 Sequence of operation chart.

Manual Flame Analyses

Overview

Once the system has been powered up and optimized, analyzing samples is simply a matter of entering parameters, then aspirating solutions of a blank, standards, and samples. The AAnalyst 200 has the capability to use up to eight calibration standards and a choice of calibration equations. An example of an aspirating sequence for linear calibration is shown below:

Blank

↓

Standard 1

Standard 2

Standard 3

↓

Sample 1

Sample 2

↓

Recalibrate or Reslope

↓

Sample 3

Sample 4

etc.

For nonlinear zero-intercept or linear zero-intercept calibration, you can aspirate a reslope standard at any point after the first sample is run.

This section contains an example of how to run AA Flame analyses manually using linear, nonlinear and analyte additions techniques. The examples take you step-by-step through the required procedures.

Analyzing Samples using Linear/ Non-Linear Calibration

The following example describes how to run samples using the linear calibration technique. It should be noted that the same steps are carried out when using the nonlinear calibration technique. The only difference is in setting up the calibration type. Instead of selecting linear for the calibration type, you select nonlinear.

EXAMPLE: Determining copper using linear calibration

The procedures in this example assume that you have performed the set-up procedures in Chapters 3, 4, 5, and 6, in which case the instrument will be on and the flame ignited.

This example runs a blank, 3 standards, 2 test samples, a reslope standard, and 2 more samples.

The following steps are used in our example:

1. Prepare solutions
2. Enter parameters
3. Run the blank
4. Run the standards
5. Run the samples
6. Run the reslope standard
7. Run the remaining samples

Prepare solutions

In this example, we used a copper lamp and solutions of copper for our determinations. However, you do not have to use copper. For your convenience in making substitutions we have included a table of recommended concentrations for Ag, Mg, Mn, and Pb.

1. Prepare about 200-250 mL of 1% v/v HNO₃ to use as a blank solution.
2. Prepare about 200-250 mL each of three standard in 1% v/v HNO₃ of the element you want to determine. Suggested standard concentrations (mg/L) for five elements are shown in the following table:

Table 8- 1 Suggested Standards

Element	Standard 1 (mg/L)	Standard 2 (mg/L)	Standard 3 (mg/L)	Reslope (mg/L)
Ag	2	6	12	12
Cu	4	15	30	30
Mg	0.25	0.75	1.5	1.5
Mn	1	3	6	6
Pb	10	30	60	60

- For samples 1, 2 and 3, use Standards 1, 2, and 3, respectively.

Data Display

If you selected **Manual Data Display** for Sample Handling on Spectrometer subpage, continue as described in this section.

Enter parameters on Lamp page

- If not already done, install and align the required lamp. For more information see Chapter 6, *Operation of the Instrument*.
- Enter lamp parameters. For more information on how to enter analytical parameters refer to Chapter 7, *Touch Screen*.

On Flame page

- Install burner head see Chapter 6, *Operation of the Instrument*.
- Adjust the burner height see Chapter 6, *Operation of the Instrument*.
- Adjust fuel/oxidant flows.
- Check interlocks see Chapter 7, *Touch Screen*.
- Ignite flame see Chapter 6, *Operation of the Instrument*.
- Adjust the nebulizer see Chapter 9, *Maintenance*.
- Optimize the burner system see Chapter 6, *Operation of the Instrument*.

On Parameters page, Spectrometer subpage:

1. Enter 1 second for the **Integration Time**.
2. Enter 3 for the number of **Replicates**.
3. Enter 3 seconds for the **Read Delay**.
4. Enter the required Print parameters, method, and replicate.
5. Select **Manual Data Display** for Sample Handling.

Spectrometer

Integration Time (sec)

Replicates

Read Delay (sec)

Print ☒ Method ☒ Replicates

Sample Handling ☒ Manual Data Display ☐ Manual Continuous Graphics Display ☐ Autosampler

Lamp Flame Parameters Analyze Tools...

Spectrometer Calibration

Screen 8- 1 Parameters page, Spectrometer subpage.

On Parameters page, Calibration subpage:

Select the Calibration Equation.

1. For this example select **Linear Through Zero**. Enter mg/L for Units.

On Parameters page, Calibration subpage, Standard Concentration section:

1. Enter the concentration of the first standard for the element that you are determining (e.g., 4 mg/L for copper).
2. Enter the concentration of Standard 2 for the element you are determining (e.g., 15 mg/L for copper).
3. Enter the concentration of Standard 3 for the element you are determining (e.g., 30 mg/L for copper).

For the above example we will only be calibrating with three standards.

Analyzing Samples

- Enter the concentration of the Reslope standard (e.g., 30 mg/L for copper).

Parameter entry is now complete. Proceed to the next step.

Calibration

Calibration Equation: Linear Through Zero

Units: mg/L

Standard Concentrations

Figures After Decimal: 3

1	4.000	5	
2	15.000	6	
3	30.000	7	
4		8	

Reslope: 30.000

Navigation: Lamp, Flame, Parameters, Analyze, Tools...

Right Panel: Spectrometer, Calibration

Screen 8- 2 Parameters page, Calibration subpage.

Analyze samples

As measurements are made, the results appear on the analyze screen. You may view the calibration curve at anytime of the analyses by touching the display calibration button.

- Touch the **Analyze** tab to display the Analyze page.
 - Touch the **Printer On/Off** button if you wish the results to be printed.
1. Run the blank
 - Aspirate the blank solution.
 - Touch the **Analyze Blank** button.
 2. Run the standards
 - Aspirate Standard 1, then touch the **Analyze Standard** button.
 - Aspirate Standard 2, then touch the **Analyze Standard** button.
 - Aspirate Standard 3, then touch the **Analyze Standard** button.

NOTE: After a standard is analyzed, the next standard concentration is automatically incremented in the standard entry-field box.. You have the option of using the automatically filled entry or you may select a different standard concentration to be analyzed by using the standard touch entry-field box. The dialog display a list of standard concentrations that you can choose from.

Run the samples

- Aspirate Sample 1, then press the **Analyze Sample** button.
- Aspirate Sample 2, then press the **Analyze Sample** button.

NOTE: After a sample is analyzed, the next sample ID is automatically incremented in the sample entry-field box. You may select a sample ID by touching the sample-entry field box to view a dialog that contains list of sample ID (i.e. numeric numbers).

Run the reslope standard

1. Run the blank.
2. Aspirate the Reslope Standard (we used Standard 3 for our Reslope Standard), then press the **Analyze Standard** button.

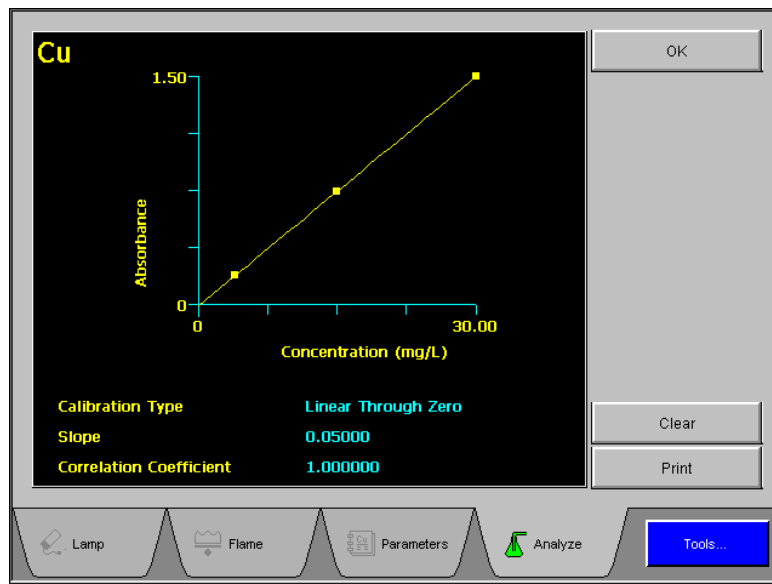
Run the remaining samples

1. Aspirate Sample 3, then press the **Analyze Sample** button.
2. Aspirate Sample 4, then press the **Analyze Sample** button.

The results are displayed and printed.



Screen 8- 3 Analyze page



Screen 8- 4 Display Calibration screen

Continuous Display

If you selected **Manual Continuous Graphic Display** for Sample Handling on Spectrometer subpage, continue as described in this section.

Enter parameters on Lamp page

1. If not already done, install and align the required lamp. For more information see Chapter 6, *Operation of the Instrument*.
2. Enter lamp parameters. For more information on how to enter analytical parameters refer to Chapter 7, *Touch Screen*.

On Flame page

1. Install burner head see Chapter 6, *Operation of the Instrument*.
2. Adjust the burner height see Chapter 6, *Operation of the Instrument*.
3. Adjust fuel/oxidant flows.
4. Check interlocks see chapter 7, *Touch Screen*.
5. Ignite flame see Chapter 6, *Operation of the Instrument*.
6. Adjust the nebulizer see Chapter 9, *Maintenance*.
7. Optimize the burner system see Chapter 6, *Operation of the Instrument*.

On Parameter page, Spectrometer subpage:

1. Enter 1 second for the **Integration**.

NOTE: *The default for Replicate in continuous mode is 1.*

2. Enter 0 seconds for the **Read Delay**. The default value is zero.
3. Enter the required **Print** parameters.
4. Select the information you would like to have printed together with the analytical results.
5. Select **Manual Continuous Graphic Display** for Sample Handling.

Spectrometer

Integration Time (sec) 1.0

Replicates 1

Read Delay (sec) 0

Print ☐ Method ☒ Replicates

Sample Handling ☐ Manual Data Display ☒ Manual Continuous Graphics Display ☐ Autosampler

Spectrometer

Calibration

Lamp Flame Parameters Analyze Tools...

Screen 8- 5 Parameter page, Spectrometer subpage.

On Parameters page, Calibration subpage:

Select the **Calibration Equation**.

1. For this example select **Linear Through Zero**. Enter mg/L for Units.

On Parameters page, Calibration subpage, Standard Concentrations section:

1. Enter the concentration of the first standard for the element that you are determining (e.g., 4.0 for copper).
2. Enter the concentration of Standard 2 for the element you are determining (e.g., 15.0 for copper).
3. Enter the concentration of Standard 3 for the element you are determining (e.g., 30.0 for copper).

For the above example we will only be calibrating with 3 standards.

Calibration

Calibration Equation: Linear Through Zero

Units: mg/L

Standard Concentrations

Figures After Decimal: 3

1: 4.000 5:

2: 15.000 6:

3: 30.000 7:

4: 8:

Reslope: 30.000

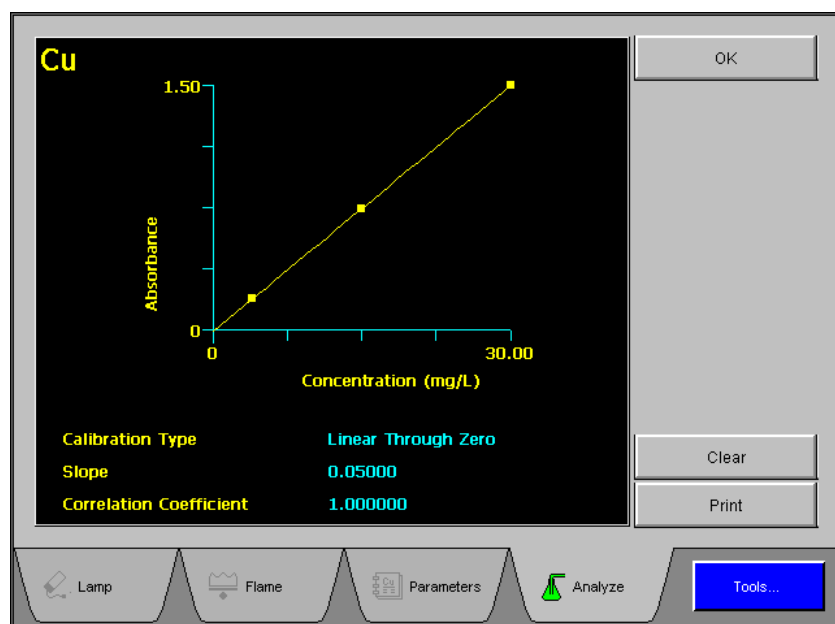
Navigation: Lamp, Flame, Parameters, Analyze, Tools...

Screen 8- 6 Parameter page, Calibration subpage.

Parameter entry is now complete. Proceed to the next step.

Analyze samples

As measurements are made, the results appear on the Analyze screen. You may view the calibration curve at anytime of the analyses by touching the calibration curve button.



Screen 8- 7 Display Calibration screen

Analyzing Samples

- Touch the **Analyze** tab to display the Analyze page.
- Touch the **Printer** button if you wish the results to be printed.

NOTE: Check printer function, the printer maybe already on.

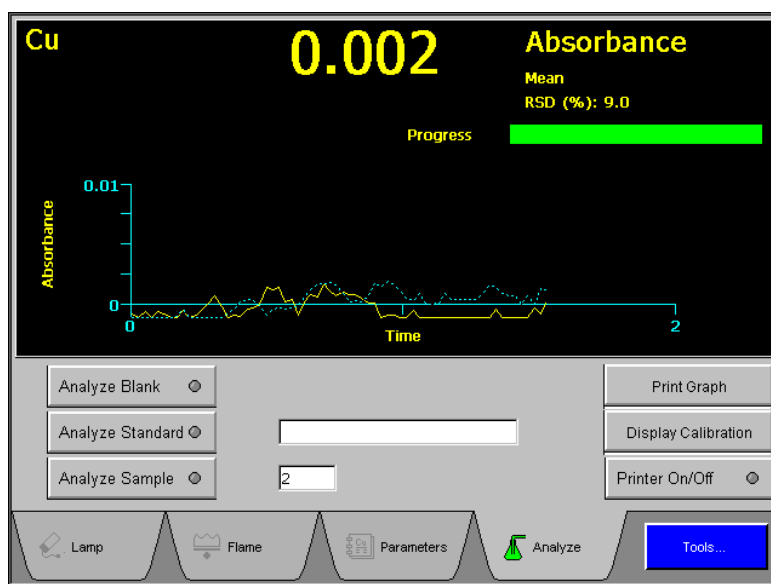
1. Aspirate the blank
2. Touch **Analyze Blank** button.
3. Aspirate Standard 1, then touch the **Analyze Standard** button.

NOTE: After a standard is analyzed, the next standard concentration is automatically incremented in the standard entry-field box. You have the option of using the automatically filled entry or you may select a different standard concentration to be analyzed by using the standard touch entry-field box. The dialog display a list of standard concentrations that you can choose from.

4. Aspirate Standard 2, then touch the **Analyze Standard** button.
5. Aspirate Standard 3, then touch the **Analyze Standard** button.
6. To view the calibration curve, touch the **Display Calibration** button.
7. Aspirate sample 1, then touch the **Analyze Sample** button.

NOTE: After a sample is analyzed, the next sample ID is automatically incremented in the sample entry-field box. You may enter a sample number by touching the sample-entry field box to use the keypad.

8. Aspirate sample 2, then touch the **Analyze Sample** button.



Screen 8- 8 Analyze page

Automated Flame Analyses

If you selected **Autosampler** for Sample Handling on Spectrometer subpage, continue as described in this chapter.

Overview

Once the system has been powered up and optimized, analyzing samples is simply a matter of entering parameters, then the autosampler starts aspirating solutions of a blank, standards, and test samples. The AAAnalyst 200 has the capability to use up to eight calibration standards and a choice of calibration equations. An example of an aspirating sequence for linear/ nonlinear calibration is shown below:

Blank

Standard 1

Standard 2

↓

Standard 8

Sample 1

Sample 2

↓

Sample 20

Recalibrate

Sample 21

Sample 22

etc.

For nonlinear or linear calibration, you can instruct the autosampler to aspirate a reslope standard at any point after the first sample is run.

This chapter contains an example of how to run AA Flame analyses with an autosampler using linear, nonlinear and analyte additions techniques. The examples take you step-by-step through the required procedures.

Analyzing Samples Using Linear Calibration

The following example describes how to run samples using the linear calibration technique. It should be noted that the same steps are carried out when using the nonlinear calibration technique. The only difference is in setting up the calibration type. Instead of selecting nonlinear for the calibration type, you select linear.

EXAMPLE: Determining copper using linear calibration

The procedures in this example assume that you have performed the set-up procedures in Chapters 3, 4, 5, and 6, in which case the instrument will be on and the flame ignited.

This example runs a blank, 4 standards, and 3 test samples. We instructed the autosampler to perform a reslope after the second test sample.

1. Carry out the following steps to duplicate our example:
2. Prepare solutions. Set up the autosampler
3. Load the autosampler
4. Enter parameters
5. Start the run

Detailed procedures follow.

Prepare solutions

In this example, we used a copper lamp and solutions of copper for our determinations. However, you do not have to use copper. For your convenience in making substitutions we have included a table of recommended concentrations for Ag, Mg, Mn, and Pb.

1. Prepare about 200-250 mL of 1% v/v HNO₃ to use as a blank solution.
2. Prepare about 200-250 mL each of three standard in 1% v/v HNO₃ of the element you want to determine. Suggested standard concentrations for five elements are shown in the following table:

Table 8- 2 Suggested Standards

Element	Standard 1 (mg/L)	Standard 2 (mg/L)	Standard 3 (mg/L)	Reslope (mg/L)
Ag	2	6	12	12
Cu	4	15	30	30
Mg	0.25	0.75	1.5	1.5
Mn	1	3	6	6
Pb	10	30	60	60

3. For samples 1, 2 and 3, use Standards 1, 2, and 3, respectively.

Set up the autosampler

The autosampler you intend to use must be connected to the spectrometer. Installation procedures are described in the *User's Guide* provided with the autosampler.

Set up the autosampler by following the directions given in Chapter 6, *Operation of the Instrument*.

Load the autosampler

In the autosampler tray, location zero (0) is reserved for the wash, (1) is for blank, and locations 2 through 9 are reserved for standard solutions. The last standard location is reserved for reslope.

If not already done, load the autosampler tray with a blank, standards, and samples.

Enter parameters

Refer to Chapter *Touch Screen*, section *Analyze Page: Autosampler*, if you require information on how to enter analytical parameters. Fill in the entries for autosampler tray, first and last sample location, and recalibration frequency.

If not already done, install and align the required lamp, and ignite the flame.

On Parameters page, Spectrometer subpage:

1. Enter 1 second for the **Integration Time**.
2. Enter 3 for the number of **Replicates**.
3. Enter 3 seconds for the **Read Delay**.
4. Enter the required **Print** parameters.

Analyzing Samples

5. Select the information you would like to have printed together with the analytical results.
6. Select **Autosampler** for Sample Handling.

Spectrometer

Integration Time (sec)

Replicates

Read Delay (sec)

Print ☐ Method ☒ Replicates

Sample Handling ☐ Manual Data Display ☐ Manual Continuous Graphics Display ☒ Autosampler

Spectrometer Calibration

Lamp Flame Parameters Analyze Tools...

Screen 8- 9 Parameters page, Spectrometer subpage.

On Parameters page, Calibration subpage:

1. Select the **Calibration Equation**.
2. For this example select **Linear Through Zero**. Enter mg/L for Units

On Parameters page, Calibration subpage, Standard Concentrations section:

1. Enter the concentration of the first standard for the element that you are determining (e.g., 4 mg/L for copper).
2. Enter the concentration of Standard 2 for the element you are determining (e.g., 15 mg/L for copper).
3. Enter the concentration of Standard 3 for the element you are determining (e.g., 30 mg/L for copper).

For the above example we will only be calibrating with three standards.

- Enter the concentration of the Reslope standard (e.g., 30 mg/L for copper).

Screen 8- 10 Parameters page, Calibration subpage.

Parameter entry is now complete on the Parameter page. At this point, the autosampler tray should be filled with blank, standards, and samples. All of the parameter entries on the Analyze page should be completed by now. Proceed to the next step.

Analyze Page

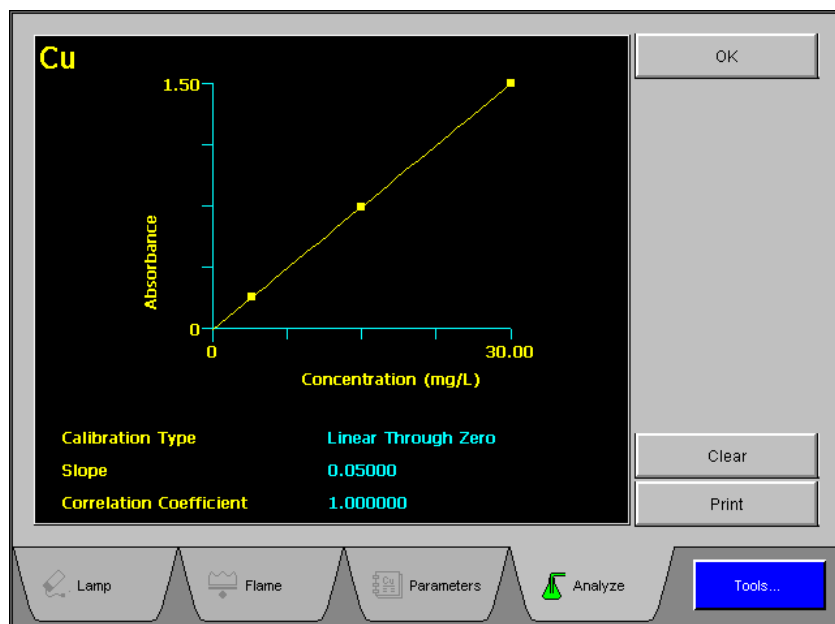
The results appear on the analyze screen in the order of the solutions analyzed. The most recent results are displayed at the top of the screen.

- Touch the **Analyze** tab to display the Analyze page.
- Touch the **Printer On/Off** button if you wish the results to be printed.

Calibrate

Use this procedure to establish your calibration curve before analyzing samples. This procedure will analyze your blank and standards only.

1. Touch the **Calibrate** button on the Analyze Sample screen. A green light indicate that it is on.
2. Touch the **Display Calibration** button to view the standard calibration curve.



Screen 8- 11 Display Calibration screen.

When you are satisfied with your calibration curve you may proceed to the next step.

Analyze Samples

Use this step to analyze samples only.

1. Touch the **Analyze Samples** button to begin analyzing samples. A green light indicate that it is on.
2. Touch the **Display Calibration** button to view the calibration curve at anytime during the run.
3. Proceed to the next step.

NOTE: To stop analyzing samples, touch the **Analyze Sample** button to turn the function off.

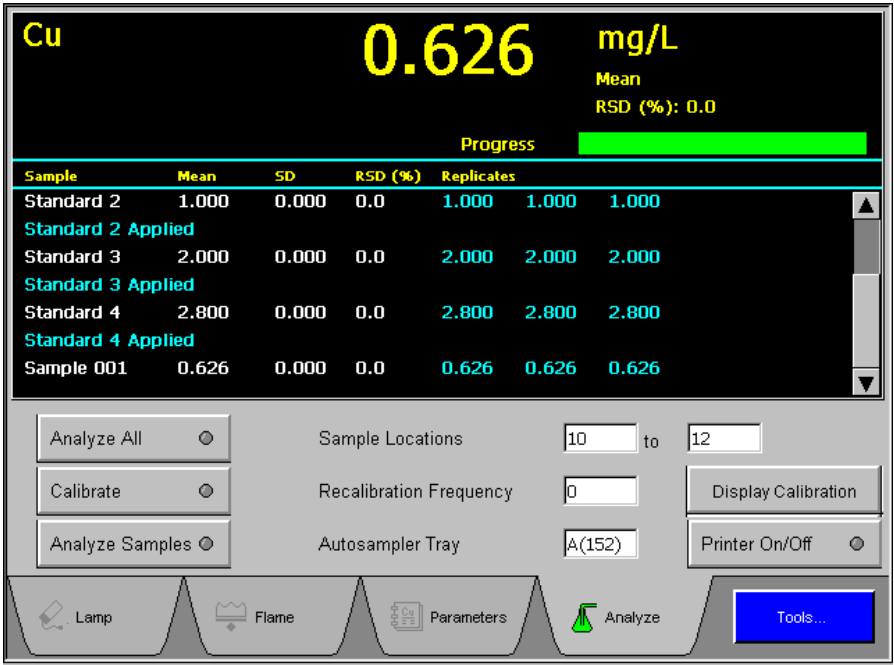
Analyze All

This step will start analyzing your entire run (blank, standards, and samples).

1. Touch the **Analyze All** button to begin your run. A green light indicate that it is on.
2. Touch the **Display Calibration** button to view the standard calibration curve at anytime during your run.

NOTE: To stop the run, touch the **Analyze All** button to turn the function off. If you were in the middle of running your samples and would like to continue the run, you must change the parameter of First Sample Location on the Analyze Samples page to the desired sample location then touch the **Analyze Samples** button.

The results are displayed and printed.



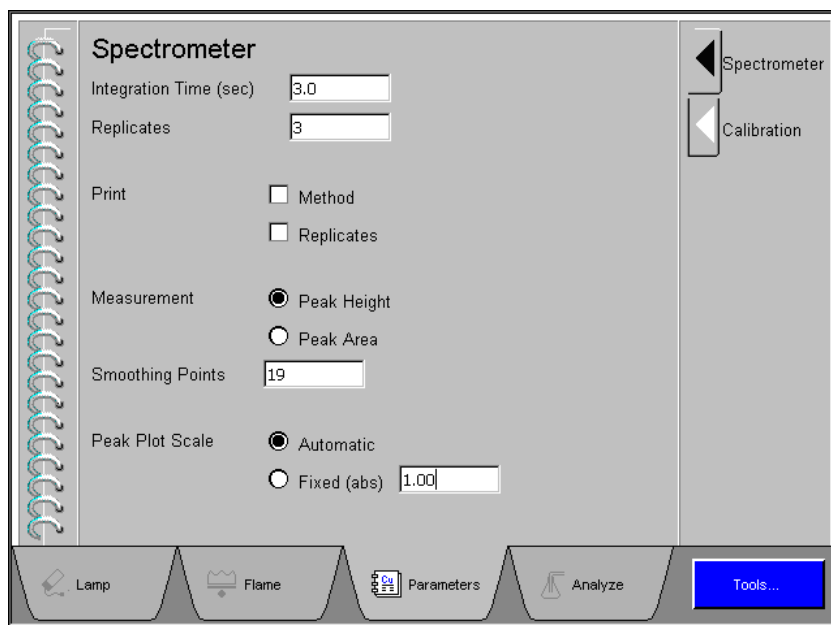
Screen 8- 12 Analyze page

Manual Analyses: Data Display MHS-Technique

If you have selected **MHS** technique from the Startup dialog, continue as described in this chapter.

Setting Up MHS-15 Analyses

1. Read the safety information in the handbooks for your system before you operate the spectrometer.
2. Make sure that the analyzer assembly and quartz cell are correctly installed. See the handbooks for your system. Switch on the fume ventilation system for the work area.
3. Switch on the AA200 instrument. See Chapter 6, *Operation of the Instrument*.
4. Select the MHS technique from the startup screen or from the tools menu → startup.
5. Select or fill the required touch entry fields on the Parameters page, Spectrometer subpage.



Screen 8- 13 Parameters page, Spectrometer subpage.

6. Install and align the lamps that are required. See chapter 6, for "*Aligning Lamps*".
7. Follow the procedures for setting up Flame Analyses including setting up and adjusting the burner and igniting the flame in chapter 6.
8. Once you are ready to perform the analysis, see the procedures for Manual Flame Analyses in this chapter.

NOTE: To initiate the read, touch the **Analyze Samples** button on the Analyze page. Wait for the specified BOC time to elapse (typically 2 seconds), then press the plunger down on the MHS-15.

Shutting Down The System

NOTE: *In an emergency, switch off the spectrometer using the operational on/off switch behind the front door or use the emergency flame off switch (see page 8-24). The flame is automatically extinguished and the gases shut down in a safe sequence.*

Shutting off the Flame

1. With the flame still burning, aspirate the correct rinsing solutions to rinse the burner system. Either aspirate the solutions manually or use the flame autosampler.
2. Touch the **Flame** tab to display the Flame page.
3. Touch the **Flame On/Off** switch.
4. The indicator in the switch extinguished.

The system uses a predetermined shutdown sequence to extinguish the flame safely.

NOTE: *If a nitrous oxide flame is shut down, the system will switched to an air acetylene flame and wait approximately two seconds before extinguishing the flame.*

5. Shut down the gases to the spectrometer at the source.
6. Touch the **Bleed Gases** button to depressurize the gas lines.

Shutting off the Spectrometer

1. Switch off the spectrometer at the operational on/off switch on the front panel.
2. Switch off any accessories.
3. Empty the burner drain vessel.

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. Press the **Emergency Red** button located on the upper left hand side of the instrument.
2. When flame is extinguished, shut off gases at source and bleed.
3. Switch off the spectrometer at the operational on/off switch on the front panel.
4. If you were previously running concentrated salt solutions, organic solvents, or solutions containing cyanide, copper, silver, or mercury proceed as follows to shut down the system properly. Wait until the instrument cools down, then proceed as follows:
 - Remove the burner head.
 - Pour a large quantity of deionized water slowly through the neck of the burner chamber to thoroughly flush the chamber and the drain system.
 - Check the burner head.
 - If there are deposits along the slot, clean the burner head.
 - Reinstall the burner head.

Rinsing the Burner System

Before you extinguish the flame or begin maintenance or disassembly procedures, you must rinse the burner system.

To rinse the system

The procedure for rinsing the burner system depends on the type of samples that you have analyzed.

Recommendations:

- If the sample solutions contained organic solvents, use a multi-rinse procedure to remove all traces of the solvents from the system.
- If the sample solutions contained toxic substances, you must rinse all traces of these substances out of the system.
- If the sample solutions contained high concentrations of copper, silver or mercury salts, which can form unstable acetylides, you must rinse all traces of these substances out of the system.

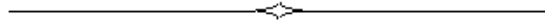
Procedures:

If you used only aqueous solutions during the analyses.

- Aspirate deionized water for 5 minutes.

If you used organic solvents during the analyses.

- Aspirate for 5 minutes an organic solvent that is miscible with the samples that have just been aspirated.
- Aspirate for 5 minutes methanol or another solvent that is miscible both with water and the solvent used previously.
- Aspirate 1% (v/v) nitric acid solution for 5 minutes.
- Aspirate deionized water for 5 minutes.



Maintenance 9

Introduction

This chapter describes the routine maintenance procedures required to keep your instrument in proper working condition and to ensure the highest possible level of performance. It includes maintenance checks that should be done on a daily basis and maintenance procedures that should be done periodically depending on instrument use. This chapter is divided into several sections, each section covering maintenance procedures for a particular component of the system.

You should perform only the maintenance procedures described in this chapter. If additional maintenance is required, contact a PerkinElmer Service Engineer.

CAUTION

Before using any cleaning or decontamination methods except those specified by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment..

General Maintenance Checklist

The following checklist describes general maintenance procedures.

- For safety reasons, and to avoid contaminating new samples, you should ensure that the work area is kept absolutely clean. This is especially important when working with toxic substances and when measuring trace amounts of any elements.
- Clean up spills immediately, using a spill clean-up kit approved by your organization.



WARNING

In accordance with safe laboratory practices, spilled material should be cleaned up and disposed of properly, taking into consideration the following:

- *location and size of the spill;*
- *chemical and physical properties of the material;*
- *hazardous properties of the material; and*
- *types of personal protective equipment that might be needed.*

Instrument Maintenance Checklist

CAUTION

Flame should be turned off while performing the instrument maintenance checklist.

To properly maintain the spectrometer instrument, do the following as required:

- Clean the exterior of the instrument.
- Inspect and clean any fans and filters.
- Monitor tank pressures
- Inspect the burner assembly (see checklist later in this chapter).
- Inspect the drain system.
- Optical: Check the window surfaces in the sample compartment for fingerprints, dirt, lint, etc. Clean the windows with a tuft of cotton moistened with a dilute solution of isopropanol followed by several rinsing with deionized water.
- If the energy of the primary source lamp is too low, refer to the lamp troubleshooting information in the *Troubleshooting* chapter of this manual. The lamp may need to be realigned, or replaced if it is old.
- If the intensity of the deuterium arc background corrector source is too low, refer to the troubleshooting information in the *Troubleshooting* chapter of this manual. The background corrector source lamp may need to be realigned or replaced.
- Normally, the spectrometer optics will require little or no maintenance. However, low energy lamp readings, or noisy or erratic results may indicate that the optics require cleaning or alignment. This should only be done by a PerkinElmer service engineer.

A service technician may clean the mirrors by careful use of a clean cotton cloth moistened with a clean solvent such as alcohol. Quick drying of the surfaces is important. Do not rub optical surfaces.

CAUTION

If mirror surfaces become dirty (e.g., from exposure to laboratory vapors), cleaning should be done only by a PerkinElmer service engineer. If a service engineer is not available, a skilled technician may clean the surfaces as described below. Special care must be taken to avoid scratches which would require replacement of the mirrors.

CAUTION

Never touch or clean the grating surfaces. Fingerprints or scratches will adversely affect the dispersion characteristics of the grating and impair the operation of the instrument.

Cleaning the Instrument

Exterior surfaces may be cleaned with a soft cloth, dampened with a mild detergent and water solution. Do not use abrasive cleaners or solvents. Use the same technique to clean the sample compartment windows, too.

Checks

Periodic Checks

The frequency of maintenance required will be determined by the amount of use the system receives, the cleanliness of the environment, and the number and nature of the samples being analysed.

Instrument parts that require periodic checks:

- Nebulizer: Check the wear and tear of the o-rings on the end caps and on the burner head. To replace the o-rings, see *Disassembling the Burner Chamber* later in this chapter.
- Drain System Maintenance: Check for wear and/or chemical attack. The drain tubing should be clear with as few bends as possible. The drain system should be replaced if it has deteriorated. See *Drain System Maintenance* later in this chapter.
- Burner System: Check for uneven flame and deposits build up along the burner slot.
- Air Filters: Should be replaced yearly or as needed in a dusty environment.

Spectrometer Maintenance Checklists

Maintenance checklists for the spectrometer system are presented below.

General preventative maintenance procedures	
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 exhaust 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 Chapter 2.

Spectrometer, maintenance checklist	
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.
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 with a tuft of cotton moistened with a dilute solution of isopropanol.
Air filters	Replace filter yearly or more often in a dusty environment.


Burner Maintenance Checklist

Maintenance checklists for the burner system are presented below.

Burner system, maintenance checklist

If you analyze samples that have 'dirty' matrices, such as blood, sugar or oil, you will probably have to clean the components more often than if you were analyzing 'clean' samples, such as drinking water.

Burner system	<p>Always rinse the burner system correctly before extinguishing the flame.</p> <p>If you are analyzing <i>samples with high solids content</i>: Clean the burner chamber at least once daily.</p> <p>If you are using <i>organic solvents</i>: Clean the burner chamber before you switch to aqueous solutions. Empty the drain vessel and dispose of hazardous solutions properly.</p> <p>If you are analyzing <i>samples containing high concentrations of copper, silver, or mercury</i>: Thoroughly flush the burner chamber and drain tube immediately after completing such analyses. Empty the drain vessel and dispose of hazardous solutions properly.</p>
Burner head	<p>Inspect the burner head for deposits before igniting the flame. The burner should provide an even flame over the length of the burner slot. An uneven flame may indicate that the slot needs cleaning. See page 9-20 for cleaning procedure.</p> <p>Check the width of the burner slot periodically.</p>
Nebulizer	If there is an obstruction in the nebulizer, clear it using a copper cleaning wire.
Drain system	Flush the drain system thoroughly at the end of each working day by pouring water down the neck of the burner chamber.
Drain vessel	Empty the drain vessel regularly. Do not allow it to fill with corrosive, toxic, or organic solutions. Dispose of hazardous solutions properly.
Drain trap	Periodically remove the drain trap and clean.
Drain tube	Inspect the drain tube regularly for wear and/or chemical attack. Replace it if it has deteriorated.
O-rings	Check the condition of the o-rings regularly: burner end cap o-ring; o-ring in neck of burner chamber; three o-rings on the nebulizer.
Gas hoses	Check the gas hoses regularly for leaks, particularly at the fittings, using a proprietary leak testing fluid. Call a PerkinElmer service engineer if a leak is detected.
Acetylene	If the cylinder pressure falls to below 600kPa (6bar; 85 psig) some of the solvent used to stabilize the acetylene (e.g. acetone) may be carried over into

cylinder	the burner. This could influence the characteristics of the burner. Always change to a new acetylene cylinder when the cylinder pressure falls to below this value.
<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Warning: Unauthorized Adjustments and Servicing</p> <p><i>Only a PerkinElmer service engineer or similarly trained and authorized person should be permitted to service the instrument.</i></p> </div> </div> <p>WARNING</p>	

If the spectrometer system does not function correctly...

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

You should only perform the maintenance procedures described in this guide. For any other maintenance or service contact your local PerkinElmer office to arrange for a service engineer to visit. In particular you should only allow a PerkinElmer service engineer or similarly trained and authorized person to perform any work on:

1. Electrical components inside the instrument (excluding the E-Box);
2. The gas connections and gas system pneumatics;
3. The monochromator and all other optical system components.

Before the service engineer arrives

- Make sure that the instrument and work area are clean.
- Empty corrosive solutions from the burner drain vessel.
- Then add water to the drain trap to activate the function.

Changing the Air Filter

1. To make sure that the electrical components in the spectrometer are properly cooled, the air filter must allow sufficient air into the instrument. Check the filter regularly and change it if it is dirty.

You should not need to change the filter more than once every year if the environmental conditions are as described in the Spectrometer Maintenance Checklist of this chapter. Replacement filters are available; see Replacement Parts and Accessories later at the end of this chapter, for the part number.

2. Locate the air filter on the right side of the instrument.
3. Depress the latch and lift out the plastic grid that holds the air filter in place.
4. Replace the air filter and then put the grid back into place.

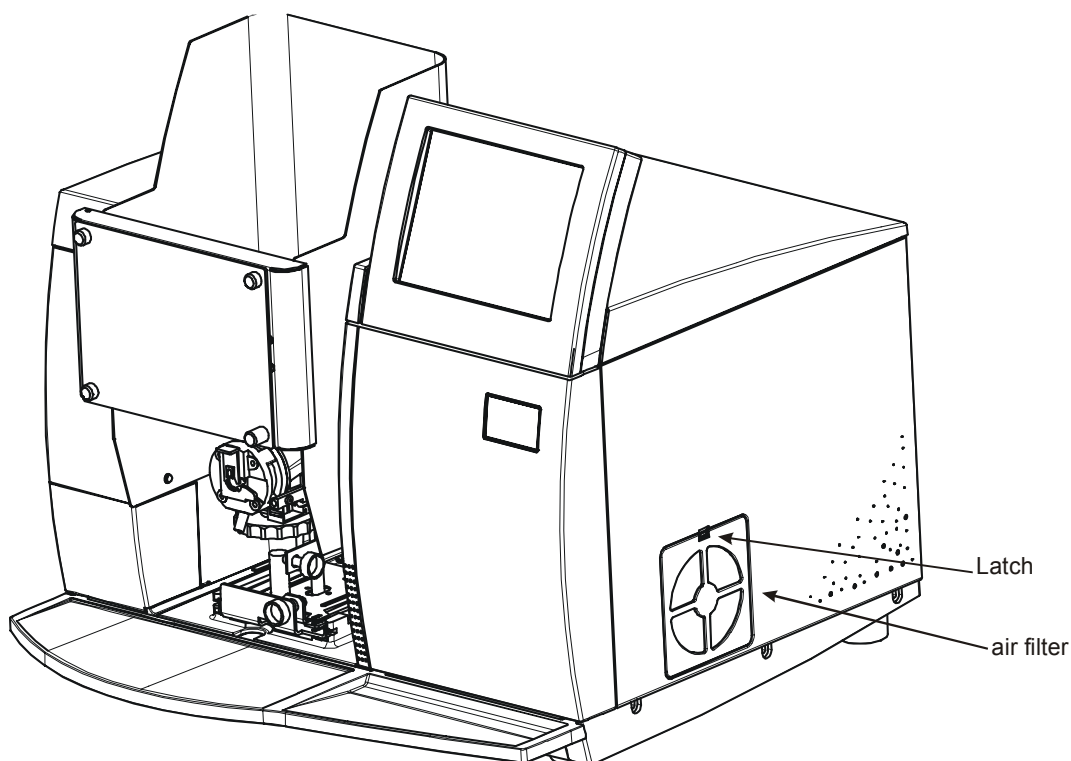


Figure 9- 1 Air Filter

Extinguishing the Flame

Before you extinguish the flame or begin maintenance or disassembly procedures, you must rinse the burner system. After you extinguish the flame, allow the burner head to cool.

To extinguish the flame

1. With the flame still burning, aspirate the correct rinsing solutions to rinse the burner system. Either aspirate the solutions manually or use the flame autosampler.
2. Touch the **Flame** tab to display the **Flame page**.
3. Touch the **Off** side of the **Flame On/Off** switch. The indicator in the switch extinguishes. The system uses a predetermined shutdown sequence to extinguish the flame safely.
4. Shut down the gases to the spectrometer at source.
5. Touch the **Bleed Gases** button to depressurize the gas lines.

Cleaning the Burner Chamber

NOTE: *Do not scrape the plastic components with metal tools. Do not soak the burner chamber in acid or use abrasive cleaner.*

1. Remove the burner system from the atomizer compartment and take the burner chamber apart.
2. Clean the burner chamber and flow spoiler with a soft brush and a mild laboratory detergent solution.
3. Clean the inside of the burner end cap with a soft brush and a mild laboratory detergent solution.
4. After cleaning, rinse thoroughly with deionized water.
5. Reassemble the burner system.

Cleaning the burner chamber after use with organic solvents

If you aspirate aqueous samples immediately after organic samples (e.g. oils or MIBK extracts), the absorption signals can be noisy and erratic. After aspirating organic samples, perform the procedure below to prevent contamination of subsequent aqueous samples.

1. Aspirate for 5 minutes an organic solvent that is miscible with the samples that have just been aspirated.
2. Aspirate methanol or another solvent miscible with both the organic solvent and water, for 5 minutes.
3. Aspirate 1% nitric acid solution for 5 minutes.
4. Flush the drain tube thoroughly with water. Empty the collection vessel and refill with water. Dispose of hazardous or corrosive solutions properly and observe local codes concerning the effect of the waste on the environment.

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

Cleaning the burner chamber after aspirating solutions containing Cu, Ag, or Hg

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

1. Aspirate dilute acid (1% (v/v) HCl solution) for 5 minutes before turning off the flame.
2. Extinguish the flame and allow the burner head cool.
3. Remove the burner head.
4. Pour about 500 mL of deionized water slowly through the neck of the burner chamber to thoroughly flush the chamber and the drain system.
5. Empty the drain vessel.

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

Removing the Burner Door

Refer to the figure below when removing the burner door.

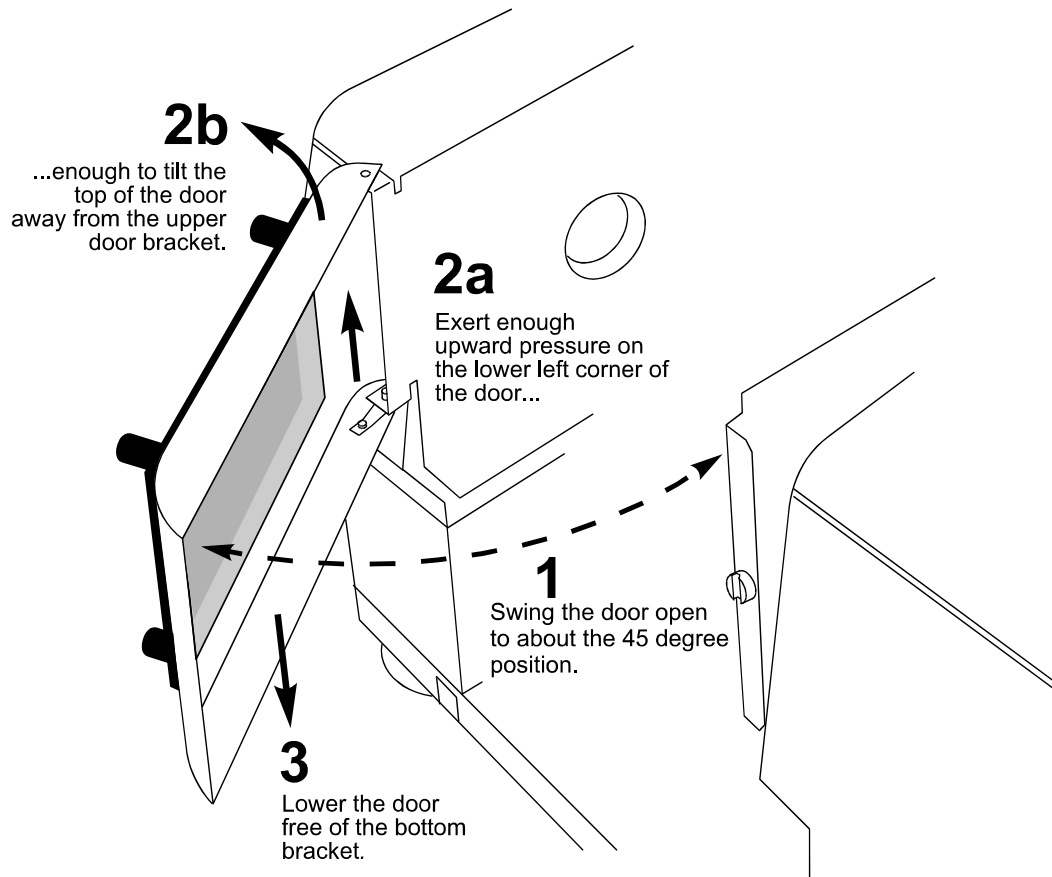


Figure 9- 2 Removing the burner door.

1. Swing the door open to about the 45° position.
2. Exert enough upward pressure on the lower left corner of the door to tilt the top of the door away from the upper door bracket.
3. Lower the door free of the bottom bracket. Removal is complete.

Replacing the Burner Door

Refer to the figure below when re-installing the burner door.

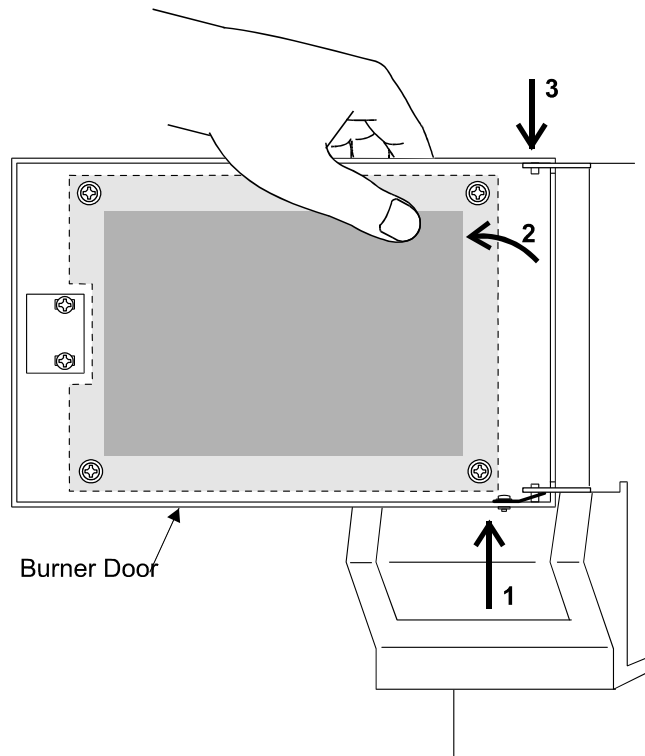


Figure 9- 3 Replacing the burner door

1. Hold the door in place next to the burner compartment as shown in the figure above.
2. Tilt the top of the door away from the upper door pin while you push the lower pin into the hole in the door mount.
3. Drop the top pin down into the upper hole in the door mount while holding the bottom pin in place. Swing the door while letting it drop down and lock into place on the hinges.
4. Close the door. Re-installation is complete.

Cleaning the Burner System

The nature of the samples aspirated determines how frequently you need to clean the burner system.

- The burner should provide an even flame over the length of the burner slot. An uneven flame may indicate that the slot needs cleaning. A badly clogged slot may cause a flashback of the flame.
- Aspirating samples with high solids content may cause deposits to build up along the burner slot.
- Prolonged operation of the nitrous oxide-acetylene flame may cause deposits of pyrolytic carbon to build up along the burner slot.



WARNING

Unstable acetylides, which are likely to explode when dry, may be formed when aspirating high concentrations of silver, copper, or mercury salts into an acetylene flame.



WARNING

Warning: Hydrochloric and Nitric Acids – Risk of Burns

Hydrochloric (HCl) and nitric (HNO₃) acids are corrosive and can cause severe burns.

CAUTION

*If high concentrations of Cu, Ag, or Hg have been aspirated into an acetylene flame, **clean the burner chamber immediately after use** by following the procedures in this section called **Cleaning the Burner After Aspirating Cu, Ag, or Hg sample**.*

Flashbacks

A flashback is an explosion of the premixed gases in the burner 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.
- Check that the burner head is seated correctly.
- Check the flow spoiler or impact bead for damage, and replace any damaged parts.
- Make sure that you are using compressed air and not oxygen enriched air.
- 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 burner chamber may cause a flashback.

Cleaning the Burner Head

Quick cleaning procedure

1. Extinguish the flame, allow the burner head to cool, shut down the gases at source, and bleed the gas supply lines.
2. Open the atomizer compartment door.
3. Remove the burner head.
4. Carefully work along and through the burner head slot with the cleaning tool provided. Do not nick the edges of the slot.

NOTE: *The cleaning tool resembles a strip of thin metal sheet. Do not use other tools to clean inside the burner slot since they may have burrs that could nick the slot.*

5. Rinse the burner head well with deionized water and make sure that all scrapings are removed from inside and outside the burner head.
6. Blow the burner head dry with clean compressed air.
Wear safety glasses when doing this.
7. Reinstall the burner head.
8. Close the atomizer compartment door.

Complete cleaning procedure

If the quick cleaning procedure, above, fails to remove deposits or if you wish to clean the burner head more thoroughly, see *Cleaning the Burner Chamber* on page 9-14.

Checking the slot width

Over time, the burner slot becomes wider due to abrasion. The level of abrasion depends on the types of solutions you are aspirating. A burner slot that is too wide causes unstable flame conditions and, in the worst case, may cause a flashback of the flame. For this reason you should check the width of the burner slot at regular intervals.

A set of feeler gauges is required to check the slot width. The table below specifies the correct slot width and the feeler gauge required for checking.

Table 9- 1 Slot Width and Feeler Gauge.

Burner Head	Slot Width	Tolerance	Feeler Gauge for check
air-acetylene	0.65 mm (0.026 inch)	+0.075/–0.025 mm (+0.003/–0.001 inch)	0.7 mm (0.030 inch)
N ₂ O-acetylene	0.5 mm (0.020 inch)	±0.025 mm (±0.001 inch)	0.5 mm (0.020 inch)

To check the slot width:

1. Carefully slide the specified feeler gauge through the length of the burner slot.
2. The gauge must fit tightly in the slot.
3. If the gauge is loose in the slot, the slot is too wide.
Then, discard the burner head and use a new one.

Burner head surface

The condition of the top surface of the burner head along the slot influences the stability of the signals. Discard the burner head if the top surface is corroded.

Pre-Conditioning a New Burner or Drain Tube

NOTE: *This is important procedure MUST be performed when a new burner or drain tubing is installed.*

This procedure should be done directly after installation of a new burner and repeated if the drain tube or any of the sample introduction system components are replaced.

In order for a new sample introduction system to aspirate sample and drain smoothly, all the internal surfaces need to be prepared. This is easily accomplished by aspirating a 50/50 solution of water and methanol for approximately 5 minutes.

Removing the Burner Head

To remove the burner head, press the tab on the safety latch found on the ignitor box. At the same time, gently pull and twist the burner head in an upward direction until it comes off the chamber (right most drawing below).

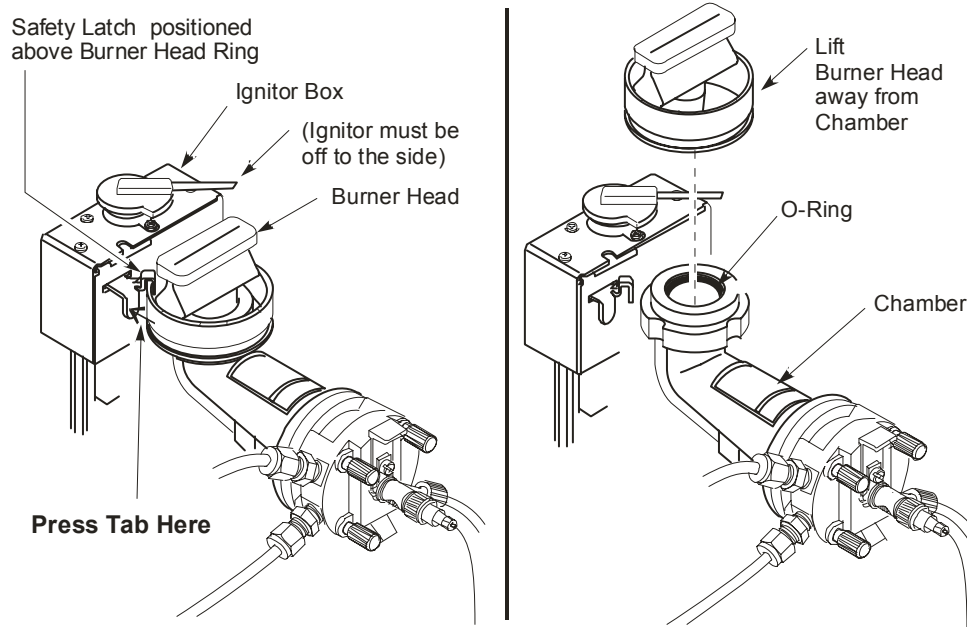


Figure 9- 4 Removing the burner head from the burner chamber.

Removing the Burner Assembly from the Instrument

1. Extinguish the flame, turn off the gases, and **power down the instrument**. Let the burner head cool. Open the burner door.
2. Disconnect the drain tube, unplug the drain interlock connector.
3. Locate the locking pin on the burner assembly and pull upward to unlock the lever.

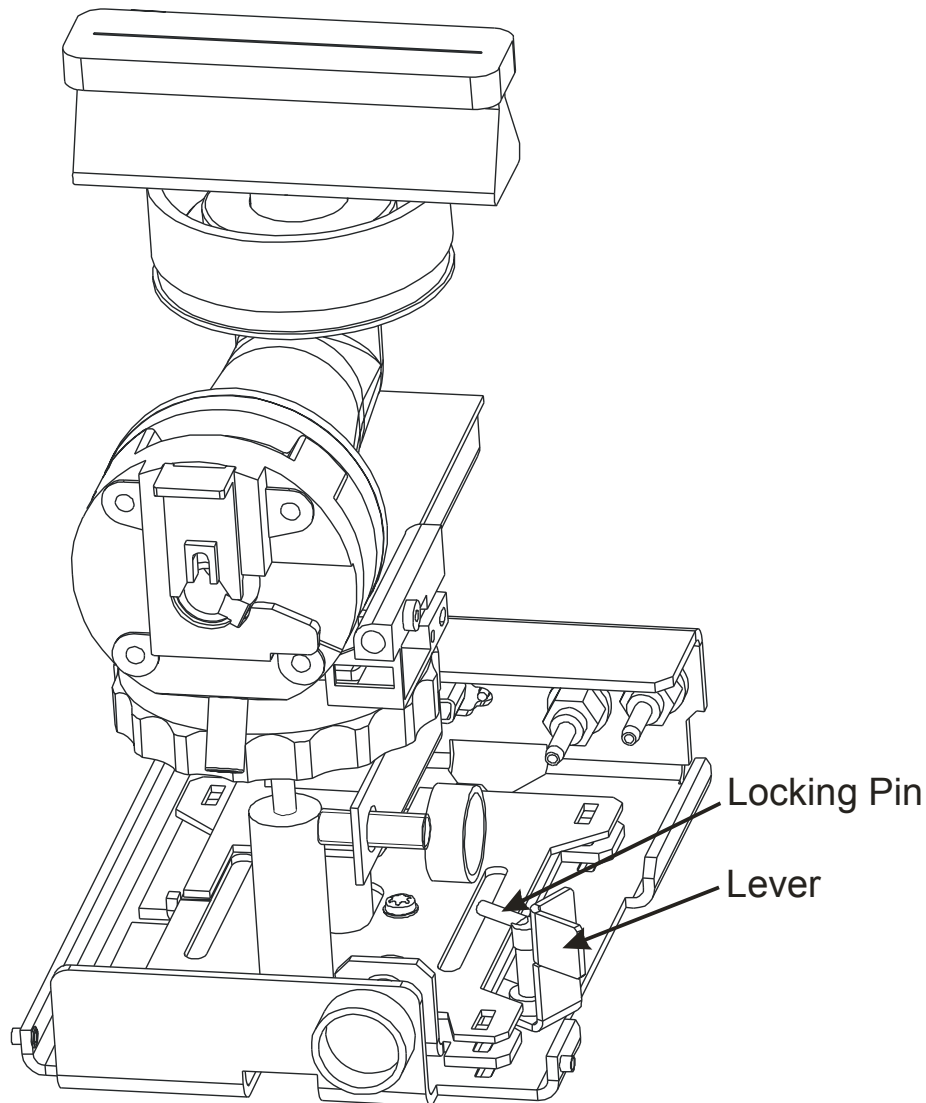


Figure 9- 5 Burner side view

4. Push the lever forward to release the burner assembly.
5. Slide the assembly out and place the burner assembly on a bench.
6. The assembly is now ready for servicing.

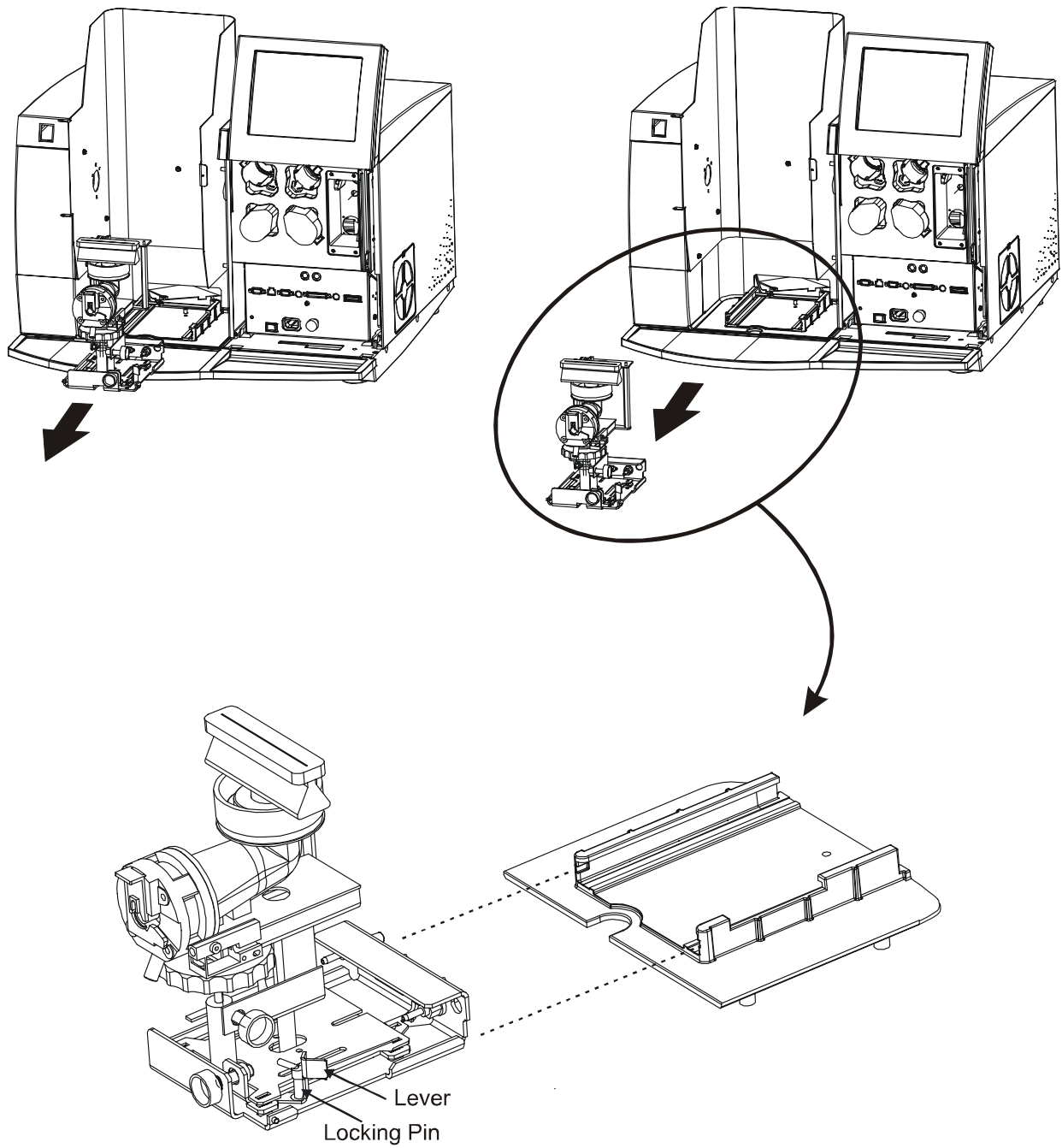


Figure 9- 6 Removing the burner assembly from the instrument.

Disassembling the Burner Chamber

These procedures assume that you have removed the burner assembly from the instrument and placed it on a workbench. Next you will disassemble it.

1. Press the safety latch tab on the ignitor box while gently pulling and twisting the burner head until it comes off the chamber.
2. Unscrew the retaining ring (Figure below) and pull out the burner o-ring.

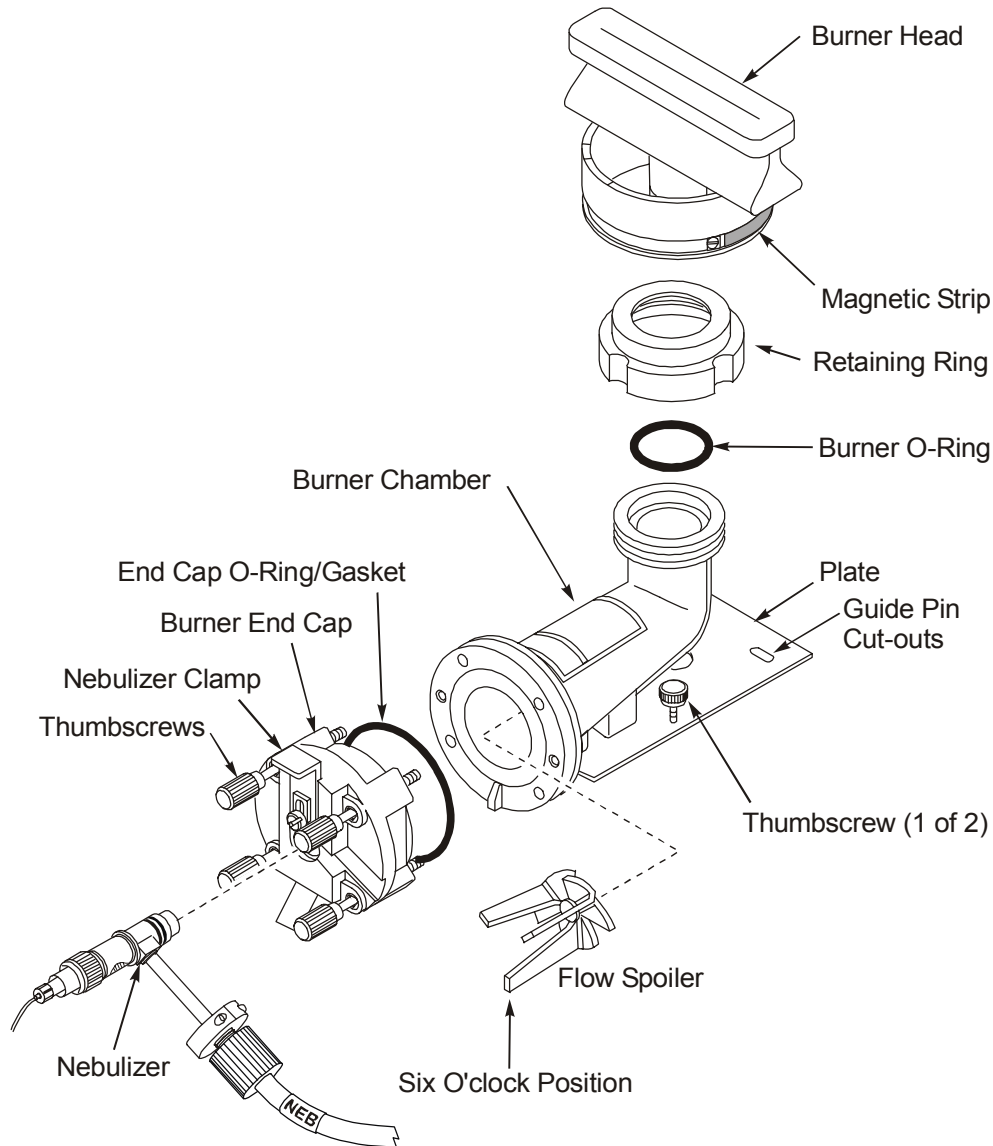


Figure 9- 7 Exploded view of the burner chamber assembly.

3. Lift the nebulizer clamp and carefully rotate the nebulizer arm clockwise (slightly) slide out the nebulizer. Put it to the side.
4. If you feel you'll need to completely remove the end cap from the chamber, continue with steps 5 - 7. Otherwise, unscrew the four thumbscrews holding the burner end cap and carefully let the end cap hang down (you don't have to disconnect any of the hoses). Now skip down to step 8.

5. (Optional) To completely remove the burner end cap, disconnect the auxiliary oxidant hose and the fuel hose from the burner end cap using the “double wrench” method (one wrench to hold the nebulizer fitting and the other to turn the compression fitting).

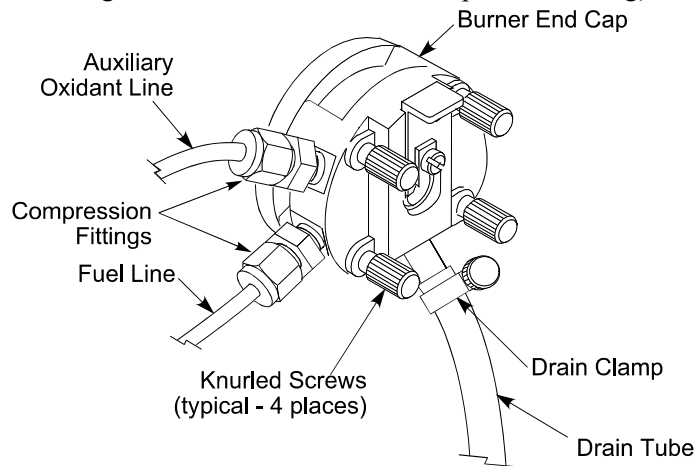


Figure 9- 8 Removing the burner end cap.

6. (Optional) Disconnect the drain tube and clamp (if they are in place).
7. (Optional) Unscrew the four knurled screws holding the end cap to the burner chamber and carefully remove the end cap.
8. Remove the flow spoiler from inside the burner chamber
9. Unscrew the two thumbscrews holding the burner chamber and plate to the burner assembly (one thumbscrew can be seen under the burner chamber in Figure 9- 7 Exploded view of the burner chamber assembly. Lift the burner chamber and plate from the assembly.
10. Clean the chamber. Place parts in an ultrasonic cleaner and let them soak in a detergent solution in the machine until they are completely clean.
11. Remove, rinse with deionized water and allow to dry.

Reassembling the Burner System

After you have completed maintenance procedures, reassemble the burner system as given below.

To reassemble the burner chamber

1. Before you reassemble the burner system, verify that the o-rings are in good condition. If an o-ring appears damaged, replace it.
2. Screw the two thumbscrews holding the burner chamber and plate to the burner assembly.
3. Place the flow spoiler inside the burner chamber.
4. Screw the four knurled screws holding the end cap to the burner chamber and carefully attach the end cap.
5. Connect the drain tube and clamp.
6. Connect the auxillary oxidant hose and the fuel hose to the burner end cap using the “double wrench technique” method (one wrench to hold the nebulizer fitting and the other to turn the compression fitting).
7. Carefully slide the nebulizer into the end cap and lock into place with the nebulizer clamp.
8. Place the burner o-ring into the burner chamber and screw on the retaining ring.
9. Press the safety latch on the ignitor box while gently pushing and twisting the burner head onto the chamber.

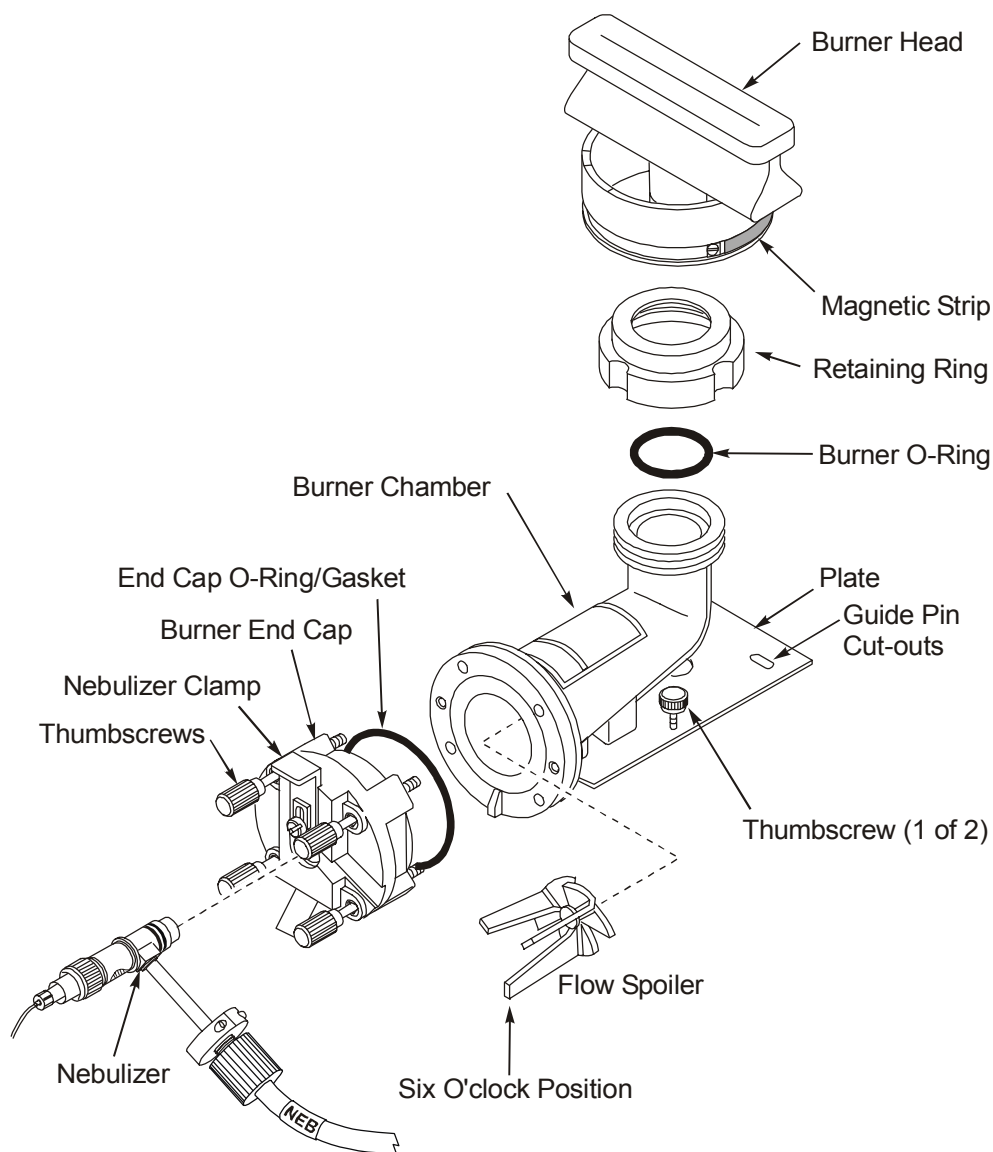


Figure 9- 9 Exploded view of the burner chamber assembly

To install the burner in the spectrometer

1. Guide the burner assembly into the tracks of the atomizer compartment.
2. Push the burner assembly in so that the rear gas fittings line up with the gas connectors at the back of the atomizer compartment. Push the burner assembly fully in until it clicks into place. Pull the lever forward and insert the locking pin to lock the burner assembly in place.
3. Locate the drain vessel. The drain tube and interlock cable will be attached to the drain vessel retainer cap.
4. Place the drain vessel in **full view** on the floor in front of the instrument. **Never place the drain vessel inside a cabinet.**
5. Before connecting the drain tube to the burner assembly, pour about 250 mL of water into the free end of the drain tube to fill the drain loop and to activate the drain float.


6. Place the hose clamp over the free end of the drain tubing.
7. Carefully install the free end of the drain tubing over the drain outlet, making sure that the inner lining of the drain tube does not get damaged.
8. Use a flat-blade screwdriver to tighten the hose clamp.
9. Plug the white drain interlock connector into the drain interlock plug on the burner assembly as shown in the photograph below.

Further procedures for setting up the burner system are described in Chapter 6, *Operation of the Instrument*.

To install the burner head

1. Put the burner head back onto the burner chamber while pressing the safety latch tab.
2. Position the magnetic strip on the burner head ring around the back of the assembly – it should face the ignitor box. Release the safety latch. Be sure the burner head is fully seated on the chamber. A gentle twisting and pushing may be necessary. You will know that the burner head is fully seated because the ignitor will swing over the burner.
3. Put the burner assembly back into the instrument.
4. Check the burner alignment. You should readjust the burner any time the burner is cleaned or the burner head is replaced.

Installing AAAnalyst Nebulizer

 WARNING	<p><i>Warning: Flammable Gases – Fire and Explosion Hazard</i></p> <p><i>The use of the wrong type of nebulizer for your burner system may result in a seepage of fuel gas which is a serious fire hazard.</i></p> <p><i>Use only the nebulizers specified for the burner system.</i></p>
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Install the AAAnalyst nebulizer using the following procedure:

1. Before you install the nebulizer, verify that the o-rings are in good condition. If an o-ring appears damaged, replace it.
2. Holding the nebulizer with one hand, remove the gas supply connector nut on the nebulizer side arm and place it over the end of the NEB oxidant tubing.
3. While holding the nebulizer firmly, gradually and carefully slide the (NEB) gas supply tubing over the barbs on the nebulizer side arm.

NOTE: *Carefully tilt the tubing up and down and rotate it while sliding it over the barbs.*

4. Screw the connector nut onto the nebulizer side arm. Tighten the connector nut so that the side-arm threads are covered by the nut.

CAUTION *Excessive tightening could result in damage to the nebulizer when you remove the nut.*

5. Apply a small amount of Apiezon grease onto the o-rings (P/N 0990-2015). The nebulizer will then slide easily into the end cap when you perform steps 5 and 6, below.
6. Lift the end-cap spring clamp and insert the nebulizer in the center of the end cap. Then release the spring clamp while you make sure the spring clamp slips over the nebulizer flange.

CAUTION *Use care installing the nebulizer as the impact bead is quite fragile.*

7. Rock the nebulizer slightly to make sure it is set correctly in the end cap. If excessive movement doesn't occur, it is set properly.
8. The nebulizer installation is complete.

Drain System Maintenance

Drain system maintenance includes cleaning (or flushing) the drain system, replacing the drain tubing and emptying the drain vessel when full. Replacing the drain trap and switch assembly must be done by trained service personnel only. The figure below shows all the parts of the AAAnalyst 200 drain system.

The drain hose and vessel must be checked periodically for wear and/or chemical attack. The drain tubing should be clear with as few bends as possible. The drain system should be replaced if it has deteriorated.

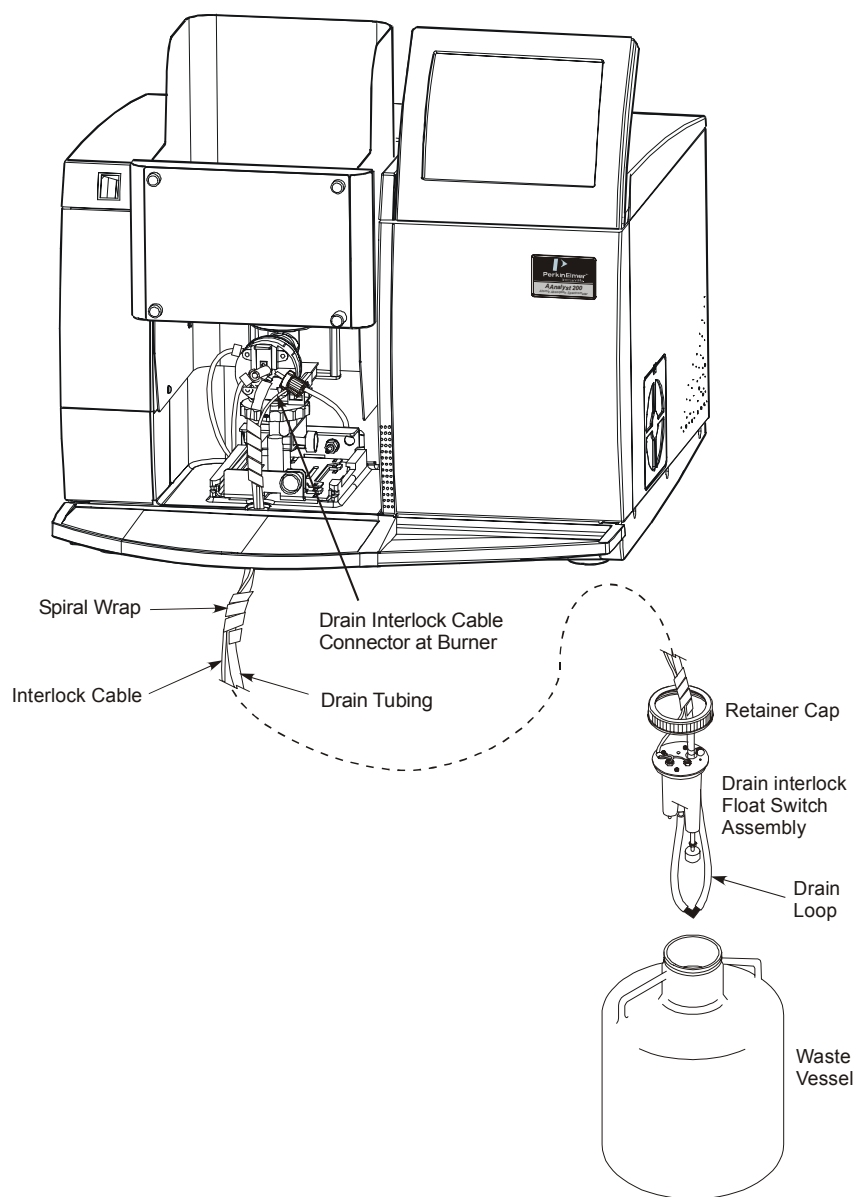


Figure 9- 10 The burner drain system.

Cleaning (or flushing) the Drain System

It is recommended that the drain system be flushed thoroughly with water at the end of each working day to remove caustic, corrosive, or organic waste materials that could otherwise damage the burner chamber or drain tubing.

To flush the system, remove the burner head then slowly pour about 500 mL of water into the burner chamber. Allow the water to drain into the drain vessel.

Replacing the Drain Tubing

If the drain tubing (P/N 0250-7987) is damaged or extremely dirty and needs to be replaced, refer to the next figure and proceed as described next.

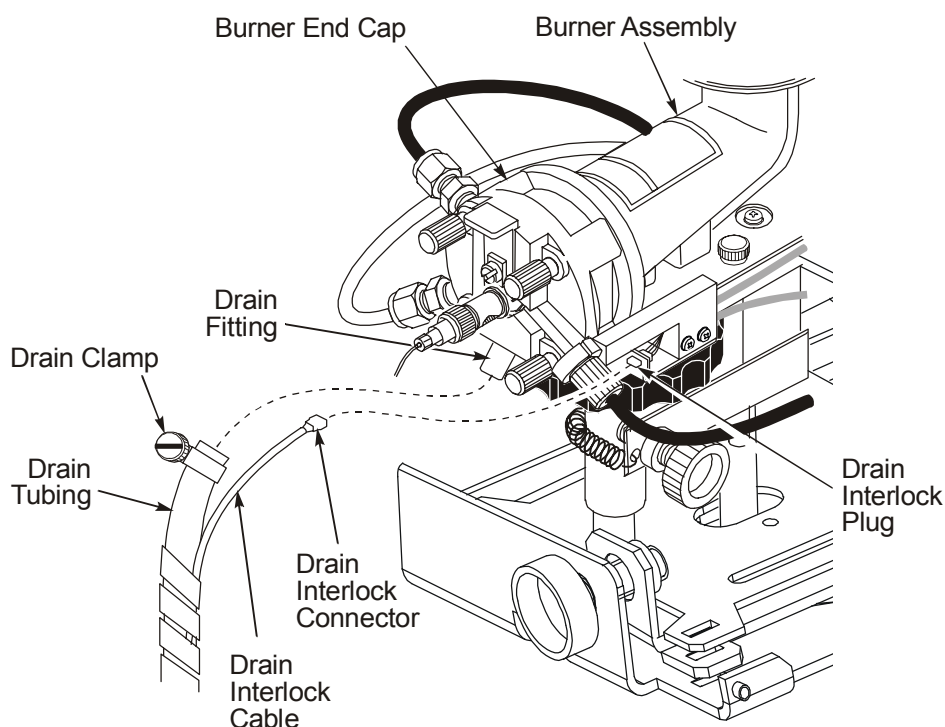


Figure 9- 11 Replacing the drain tubing



WARNING

Dispose of drain vessel waste in accordance with the regulations applicable to your locality, state, and/or country.

1. Turn off the AAAnalyst 200 power switch.
2. Empty the drain vessel.
3. Unplug the drain interlock connector from the burner (see figure Figure 9- 11).
4. Remove the spiral wrap from the drain tubing by unwrapping it. This will release the drain interlock cable.
5. Disconnect the drain tubing from both the drain vessel and the drain outlet on the burner end cap by loosening the clamps on each end of the tubing. Once the clamps are loosened, the tubing should easily pull out.
6. Place the new piece of drain tubing (P/N 0250-7987) next to the drain interlock cable and carefully rewrap the spiral wrap around them both.
7. Place the drain clamp on the upper end of the new drain tubing. Then attach the tubing to the drain outlet on the burner end cap. Tighten the clamp securely.
8. Place the other drain clamp on the lower end of the drain tubing. Then attach the tubing to the drain trap switch assembly. Tighten the clamp securely.
9. Plug the drain interlock connector into the receptacle under the burner. Make sure the interlock connector is plugged in all the way.
10. Go to "Preparing the New Drain Tubing for Use" (next).

Preparing the New Drain Tubing for Use

NOTE: *This important procedure MUST be performed at this point of the drain tube replacement process.*

In order for the sample introduction system to drain smoothly, the internal surface of the new drain tube needs to be prepared. This is easily accomplished when you:

1. Aspirate a 50/50 solution of water and methanol for approximately 5 minutes.
2. Replacement and preparation is now complete.

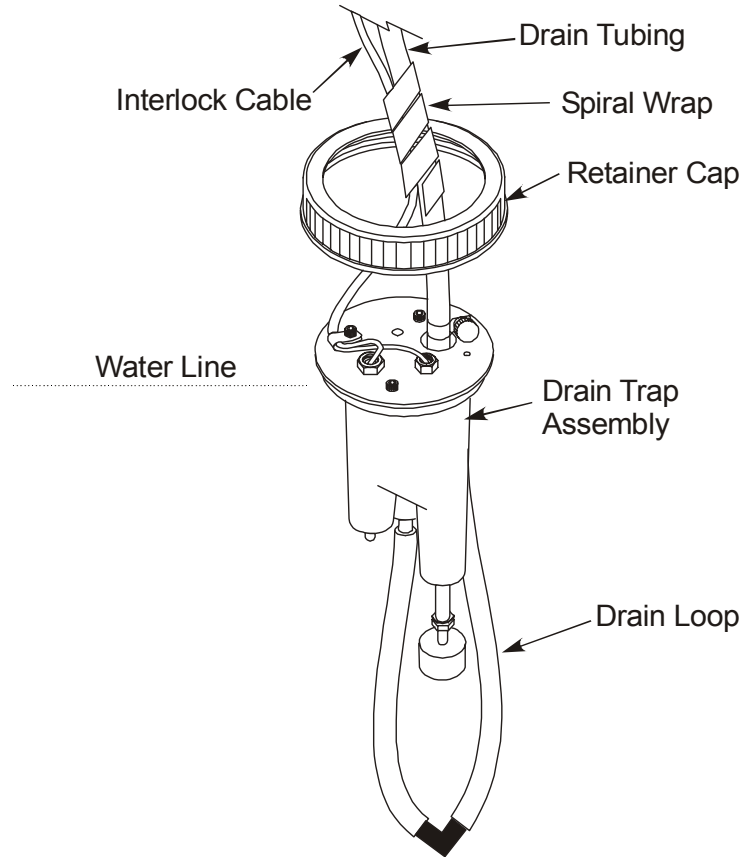


Figure 9- 12 The drain trap assembly.

Adding Water to the Drain Float Assembly

Enough water must be present in the drain system to fill the drain loop and to activate the drain float assembly. If not, carry out the following procedure:

1. Loosen the drain clamp and remove the drain tubing from the drain outlet on the burner end cap.
2. Pour about 250 mL of water into the drain tubing.
3. Carefully reconnect the drain tubing to the burner end cap. Replace the drain clamp and tighten securely. Installation of the burner drain is complete.

Cleaning the Nebulizer

To maintain optimum nebulizer performance you must periodically clean the capillary assembly, and occasionally replace the sample tube.

When you aspirate concentrated samples with complex matrices, it is especially important to keep the burner chamber and nebulizer free of deposits. It is beneficial to periodically aspirate a dilute surfactant solution, such as 0.1% Triton X100, for several minutes to keep the system clean. The surfactant will encourage constant drainage, which is essential for optimum burner system performance.

If you suspect that the nebulizer is causing low absorbance readings or poor sensitivity (e.g. cannot obtain expected characteristic concentration), before cleaning the nebulizer check that:

- The sample tube is in good condition (i.e. no kinks), is not too long, and is clean. With a longer sample tube, the rate of sample uptake, and thus the sensitivity, will decrease. Recommended length: 20 cm.
- The burner head is clean.
- The burner is correctly optimized.
- Correct operating parameters are used.

Clearing an obstruction in the nebulizer

Clean the nebulizer capillary whenever you notice degradation in absorbance values due to blockage of the capillary. There are two ways to clean the capillary holder:

- The first (simplified) way should be used if the nebulizer is not difficult to clear. This method involves simply passing one of the cleaning wires, supplied, through the capillary holder.
- The second (complete) procedure requires shutting down the spectrometer, removing the nebulizer from the end cap, and replacing the capillary tubing. This procedure must be performed if you have no success with the first method.

Simplified Cleaning Procedure For AAAnalyst Nebulizer

For simplified (light) cleaning of a standard the AAAnalyst nebulizer capillary holder, proceed as follows

1. Unscrew the capillary tubing from the nebulizer.
2. Take one of the cleaning wires (P/N 0303-0135) supplied, and push it through the capillary holder from its wider (open) end.

NOTE: *It may take several attempts to pass the wire through the nebulizer.*

3. Repeat step 2 several times. Then replace the capillary (sample) tubing.

Maintenance

4. Run one or more standards to determine if the capillary holder has been cleared. If it has been cleared, proceed with normal spectrometer operation; otherwise, proceed with the next procedure.

Complete Cleaning Procedure of AAnalyst Nebulizer

To clean a stubborn blockage from the nebulizer, perform the procedure below.



WARNING

Wear protective gloves when you remove the nebulizer from the end cap if you were analyzing toxic samples.

Removal and Disassembly the Nebulizer

1. Turn off the spectrometer and turn off all gas supplies.
2. Lift the end-cap spring clamp.
3. Rotate counter clockwise and gently pull the nebulizer out of the burner end cap.
4. After removing the nebulizer from the end cap, **carefully** remove the nebulizer gas supply tubing (labelled NEB) from the nebulizer side arm as follows:
 - First loosen the connector nut (P/N N037-1485), see Figure 9- 13.
 - Then, while holding the nebulizer assembly in one hand, rock the gas supply tubing with the other hand while gently coaxing the tubing from the barbs at the end of the nebulizer side arm.
5. Remove the impact bead and, if using the impact bead spacer, remove the spacer as well. **Handle with care.** (See the next page for instructions.)
6. Unscrew the capillary tubing.
7. Refer to Figure 9- 13 and loosen and then remove the adjustment nut (P/N N037-1492) and locking ring.
8. Remove the capillary assembly from the nebulizer body.

Cleaning

1. While holding the capillary assembly in one hand, take one of the cleaning wires (P/N 0303-0135) supplied.
2. Push it through the capillary assembly from its wider (open) end.

NOTE: *It may take several attempts to pass the wire through the nebulizer.*

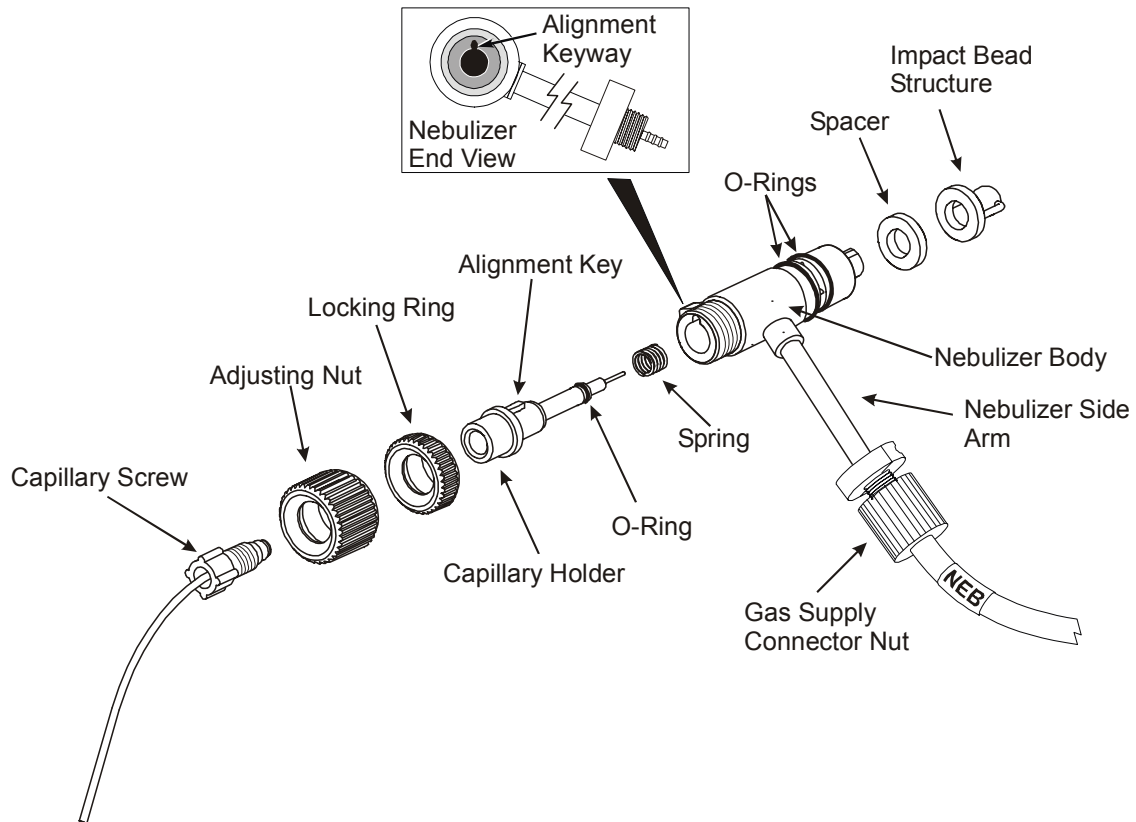


Figure 9- 13 Standard nebulizer assembly

Removing and replacing the nebulizer's impact bead

The AAAnalyst nebulizer utilizes a ceramic, one-piece, impact-bead structure (P/N B050-5086) which improves nebulization efficiency. The bead itself is held by two **fragile** support arms.

The bead structure mounts directly on the nebulizer's body assembly, see Figure 9- 14.

To Install Impact Bead

1. Hold the impact bead by its base and carefully push it onto the body of the nebulizer in front of the venturi.
2. Then rotate it, holding only the base, approximately 1/8 turn clockwise, i.e., until it reaches a stop.

To Remove Impact Bead

1. Hold the impact bead by its base only.
2. Rotate it approximately 1/8 turn counter clockwise before carefully lifting it from the nebulizer's body assembly.

Installing Spacer

The nebulizer assembly can be used with or without the spacer. Maximum sensitivity for Air-Acetylene elements can be achieved without the use of the spacer.

The addition of the spacer reduces the amount of sample delivered to the flame. It is recommended to use the spacer for all elements analyzed with the nitrous oxide-acetylene flame and for elements which are air-acetylene flame sensitive such as calcium, chromium and gold. When analyzing some complex sample matrices, it may be desirable to add the spacer to reduce chemical interferences.

To Install Spacer

1. Hold the impact bead by its base only.
2. Rotate it approximately 1/8 turn counter clockwise before carefully lifting it from the nebulizer's body assembly.
3. Place the spacer onto the back of the nebulizer and replace the impact bead.
4. Rotate the bead 1/8 turn clockwise to "lock" the bead in place.

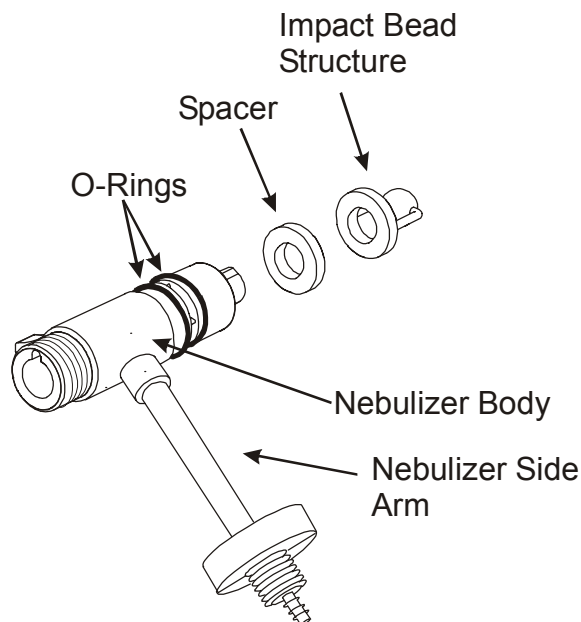


Figure 9- 14 Installing Spacer onto the Nebulizer

Adjusting the Nebulizer for Maximum Absorbance

Adjust the nebulizer to achieve maximum absorbance as follows:

1. Ignite the flame. Refer to the procedure for igniting the flame in Chapter 6, *Operation of the Instrument*.
2. Set up the spectrometer for the determination of copper, magnesium, or another element which has an absorbing wavelength above 250 nm and whose sensitivity is not dependent on the fuel/oxidant ratio. **Do not select an element requiring a nitrous oxide-acetylene flame.** If necessary, adjust the burner height using the procedure described in Chapter 6, *Operation of the Instrument*.
3. Aspirate a blank and let the flame stabilize as described Chapter 6, *Operation of the Instrument*.
4. If you see bubbles at the end of the capillary tube (in the sample solution), loosen the nebulizer locking nut and slowly turn the adjustment nut clockwise until the bubbling stops.
5. Aspirate a standard and adjust the burner position as described in Chapter 6, *Operation of the Instrument*. Optimize the burner position by using the rotational and horizontal adjustment knobs identified in Chapter 6, *Operation of the Instrument*.
6. While still aspirating the standard, turn the nebulizer locking nut clockwise until it is free of the nebulizer adjustment nut.
7. Slowly turn the nebulizer adjustment nut counter clockwise until bubbles begin to appear at the end of the capillary tube in the sample solution.
8. Slowly turn the nebulizer adjustment nut clockwise until the absorbance goes to a **maximum and then begins to decrease**.
9. Lock the nebulizer adjustment nut in its current (optimum) position by turning the nebulizer locking nut counter-clockwise while carefully holding the nebulizer adjustment nut.
10. Check the characteristic concentration as instructed in the User's Guide.

Using Organic Solvents

It is often beneficial to lower the nebulizer uptake rate when aspirating organic solvents. The normal nebulizer uptake rate is typically 6-8 mL/min.

By reducing the uptake rate to 2-4 mL/min, it is usually possible to operate with a leaner (blue) flame than is possible with higher nebulizer uptake rates. This leaner flame typically provides improved precision, particularly when aspirating xylene.

To adjust the nebulizer uptake rate, unlock the nebulizer locking nut and rotate the nebulizer adjustment nut until you locate a position which provides reduced sample uptake. Then lock the nebulizer locking nut.

NOTE: *The uptake rate is easily measured by using a graduated cylinder.*

Maintaining Optimum Nebulizer Performance

To maintain optimum nebulizer performance, you must periodically clean the capillary assembly, and occasionally replace the capillary (sample) tubing. See Figure 9- 13 for an exploded view of the nebulizer.

Also, the nebulizer is only a part of the overall burner system. For optimum burner-system performance, it is important to periodically clean the nebulizer, burner chamber, burner heads, and the end cap.

When aspirating concentrated samples with complex matrices, it is especially important to keep the burner chamber and nebulizer free of sample deposits. In addition to regular cleaning, it is beneficial to periodically aspirate a dilute surfactant solution, such as 0.1% Triton X100, for several minutes to keep the system clean.

The surfactant solution will encourage constant drainage, which is required for obtaining optimum burner system performance.

When using the AAnalyst nebulizer, the impact bead may have to be replaced. Also, to avoid damage to the impact bead, the bead should be removed when cleaning the capillary holder assembly. Steps for removing and replacing the bead are included in this instruction document.

Cleaning the nebulizer

1. After you have taken the nebulizer apart, clean the components as follows:
2. Clean the capillary assembly using a mild laboratory detergent solution, or a solvent such as isopropanol, preferably in an ultrasonic bath.
3. Clean the nebulizer body and any other parts that appear dirty in a mild laboratory detergent solution, or a solvent such as isopropanol, preferably in an ultrasonic bath.
4. Rinse all the cleaned components thoroughly with deionized water.
5. Inspect the o-rings (1 on the capillary assembly, and two on the nebulizer body) and clean them if necessary in mild laboratory detergent solution, followed by a thorough rinsing with deionized water.
If they look damaged, replace them.
6. After you have cleaned the components, reassemble the nebulizer.

Reassembly and Replacement

Reassembling the nebulizer

NOTE: *If not already done, inspect the tiny o-rings on the capillary assembly for damage and replace them if necessary. Lightly lubricate the surface of the o-rings with a minimum of Apiezon grease. Make sure that no grease gets onto the tip of the capillary.*

1. Slide the spring back onto the capillary assembly (if it was removed).
2. Slide the assembled capillary assembly into the nebulizer body.
3. Line up the alignment key with the keyway in the nebulizer body.
4. Push the capillary assembly in until it bottoms out in the nebulizer body.
5. If you inserted the capillary assembly correctly, it should move freely in and out of the nebulizer body. If it does not, remove and reinstall, paying particular attention to the alignment key.
6. Screw the adjusting nut onto the nebulizer body.

NOTE: *If not already done, inspect the two o-rings on the end of the nebulizer body for damage and replace them if necessary. Lightly lubricate the two o-rings on the end of the nebulizer body with a minimum of Apiezon grease. Take care not to get grease on other parts of the nebulizer.*

7. Where applicable, refit the **fragile** impact bead and spacer.
8. Reattach the nebulizer sample tube to the nebulizer by screwing the connector into the nebulizer body.
9. Reinstall the nebulizer in the end cap.

Replacing Parts of Wear

Burner System O-Rings

There are o-rings in the neck of the burner chamber and in the burner end cap. You must check the condition of these o-rings at regular intervals and replace them if they are damaged or show signs of deterioration.



WARNING

Warning: Flammable Gases – Fire and Explosion Hazard

If the o-rings in the burner system are damaged or have deteriorated, they may no longer form a proper seal. This may result in a gas leak which is a serious fire hazard.

Check the condition of the o-rings regularly and replace them if they are damaged or show signs of deterioration.

1. Take the burner system apart.
2. O-ring located in the neck of the burner chamber. Carefully lever the o-ring out of the neck of the burner chamber using a plastic pipette tip or the like.

NOTE: *Never use sharp or pointed tools to remove the o-ring. Examine the o-ring. If it is damaged, replace it.*

1. Place the o-ring back into the neck of the burner chamber and press it down with your finger.
2. O-ring located in the burner end cap. Very carefully roll out the o-ring with your finger.
3. Examine the o-ring. If it is damaged, replace it.
4. Gently place the o-ring back into the end cap and press it into place with your finger.
5. Reassemble the burner system.

Nebulizer O-Rings

There are 3 o-rings on the nebulizer. Always carefully check the condition of these o-rings whenever you take the nebulizer apart.

E-Box

All electronics are located in a single user-replaceable module called the E-Box. The operator can just slide the module out from the instrument and replace it with a new one.

CAUTION	<i>Using excessive force and not aligning the module on the track can damage the E-Box.</i>
----------------	---

Removing the E-Box

1. Extinguish the flame (if lit).
2. From the front of the instrument, swing open the compartment door and locate the E-Box.
3. Turn the power switch off and remove the AC power cord from the E-Box.
4. Disconnect power cord and all cables that are connected to the ports on the front of the E-Box.
5. Unscrew the door using an Allen wrench.
6. Unscrew the flathead locking screw located below the printer connection port.
7. Use the E-Box knob to pull the module and gently slide it out on the track.
8. See the next section to replace the E-Box.

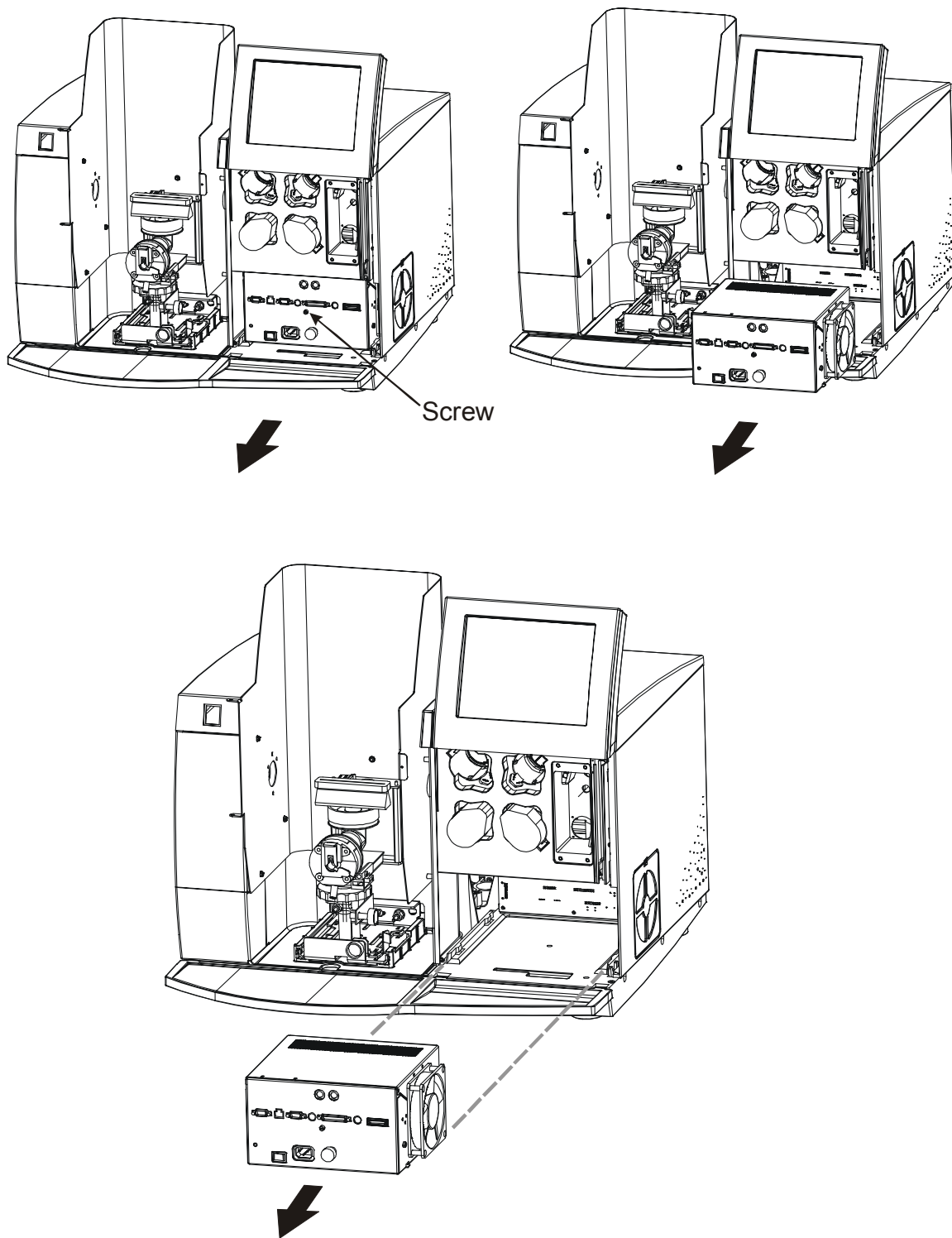


Figure 9- 15 Removing the E-Box from the instrument

Replacing the E-Box

CAUTION	<i>Using excessive force and not aligning the module on the track can damage the E-Box.</i>
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1. Position the E-Box to align on the module track.
2. Gently push the E-Box until it is secured in place.
3. Screw the locking screw to fully secure the E-Box.
4. Reconnect the necessary cables to the ports on the module.
5. Reattach the compartment door.
6. Connect the AC line cord to the E-Box and power up the instrument.
7. Close the compartment door.

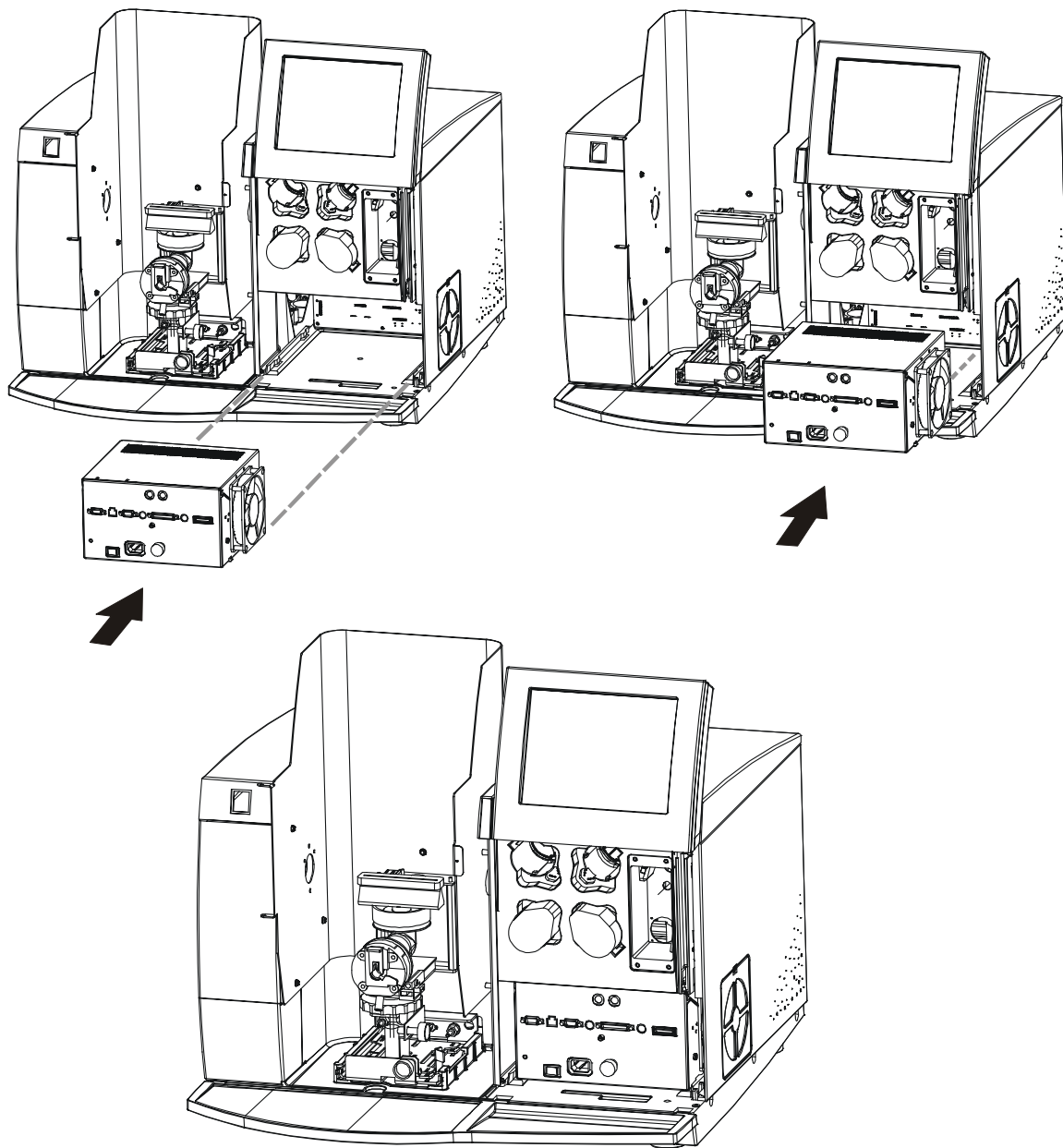


Figure 9- 16 Replacing the E-Box.

Maintaining the Acetylene Supply



WARNING

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.

- Depressurize both the fuel and oxidant gas hoses at the end of the working day or if you are not going to use the instrument for an extended period. Close the cylinder valves to avoid the possibility of gas hoses being subjected to the full cylinder pressure in the event that a pressure regulator should fail.
- Acetylene is supplied dissolved in a solvent such as acetone, and a small amount of solvent carryover with the acetylene is normal. However, as tank pressure falls, the relative amount of solvent entering the gas stream increases and can give erratic results, particularly for elements such as calcium, tin, chromium, molybdenum and others whose sensitivity is highly dependent on the fuel: oxidant ratio. The pressure drop is not linear with gas removal since the acetylene is dissolved in a solvent, and a pressure of 600 kPa (6 bar; 85 psig) at ambient temperature indicates that the cylinder is nearly empty. For this reason, replace acetylene cylinders when the cylinder pressure drops to about 600 kPa (6 bar, 85 psig).
- Always store and use acetylene cylinders vertically, rather than horizontally, to prevent liquid acetone from reaching the cylinder valve.
- The practice of ‘cracking the valve’ of an acetylene tank (that is, opening the valve slightly for a very short period previous to attaching the regulator) is not recommended. While such an action will clear the valve opening of dust or dirt particles and may remove acetone from the cylinder valve, it is a potentially hazardous practice and one which should never be attempted in the presence of an open flame, sparks or other possible sources of ignition.

Replacing the Lamps



WARNING

Always wear UV-absorbing safety glasses when installing, replacing or aligning hollow cathode lamps or electrodeless discharge lamps.

The ultraviolet radiation emitted by these lamps can harm your eyes.

Lamp Compartment Location

The next figure shows where the lamp compartment is located on the instrument. Access to the lamp compartment is at the front of the spectrometer. This allows for easy lamp replacement. If you swing open the lamp compartment cover (it is the door below the Touch Screen), the lamp compartment can be seen inside.

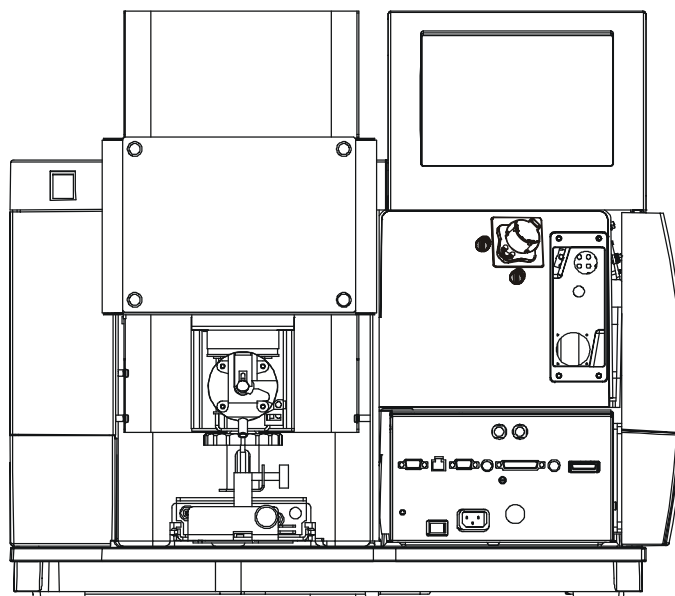


Figure 9- 17 Accessing the lamp compartment.

Replacing the Deuterium Arc Background Corrector Lamp



WARNING

Since the instrument cover will be removed, this procedure should be done by a skilled person who is trained in the servicing of optical and electrical components and is aware of the hazards of high voltage electronics.

Equipment Needed

You'll need to gather the following items in order to replace the deuterium lamp:

- the deuterium arc lamp - P/N N037-0119
- ultraviolet-absorbing safety glasses
- flat bladed screwdriver
- phillips head screwdriver

Removing the Deuterium Lamp Assembly

1. Turn OFF the power switch and unplug the power cord from the E-Box.



WARNING

Wait a sufficient amount of time for the background corrector lamp to cool before replacing it.

The lamp is very hot after use.

2. Swing open the lamp compartment door.
3. Locate the deuterium lamp assembly in the instrument (it is inside the large rectangular block to the right of the lamp compartment).
4. Unscrew the 4 corner phillips screws that hold the deuterium lamp plate in place. Don't let any of the 4 screws drop into the instrument.
5. Carefully lift the assembly away from the housing and unplug the deuterium connector.
6. Remove the assembly completely from the instrument and place it on the lab bench.

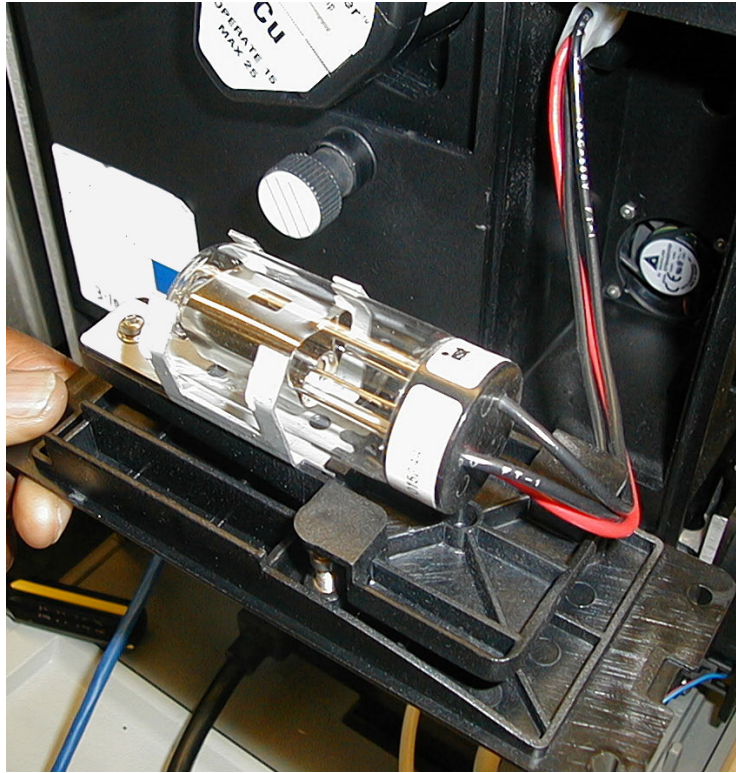


Figure 9- 18 Deuterium lamp assembly.

Replacing the Deuterium Lamp

Use great care when handling the deuterium lamp, it is fragile.

<p>CAUTION</p> <p><i>When handling the new lamp, do not handle the glass – only the metal lamp bracket. You don't want to get fingerprints on the viewing area of the lamp, as this will decrease the UV performance and damage the lamp.</i></p>
--

1. Once you have removed the deuterium lamp assembly from the instrument, place the assembly on the lab bench.
2. Unscrew the bracket thumbscrew.
3. Slide the bracket and bulb to remove it from the assembly.

NOTE: Remember, when handling the new lamp, do not handle the glass – only the metal lamp bracket.

4. Replace the assembly with a new bracket/ bulb set by sliding under the two plastic tabs.
5. Rescrew the bracket assembly.
6. You have completed replacing the deuterium lamp.

Reassembling the Deuterium Lamp Assembly

Next you will put the deuterium lamp assembly back into the instrument.

1. Plug in the lamp cable.
2. Gently set the deuterium lamp plate assembly back into place in the instrument.
3. Reinstall the 4 phillips head screws into the plate and tighten down the cover.

Reassembly is complete. Next you may have to align the deuterium lamp.

Aligning Deuterium Lamp



Figure 9- 19 Location of the alignment screws of the deuterium lamp.

1. Set up the standard conditions for copper (including slit).
2. Go to BG mode (background corrected-AA), and after warming the lamp for several minutes.
3. Adjust the alignment screws (Figure 9- 19) to obtain maximum energy/counts.
4. Place a white card in the center of the sample compartment and note the positions of the beams from the deuterium lamp and the Hollow Cathode Lamp. To complete the peaking procedure, **if the beams are not coincident** (the same centers), tweak the alignment screws to center the Hollow Cathode Lamp beam inside the deuterium arc lamp beam. The next figure illustrates the “ideal” appearance of the two beam.

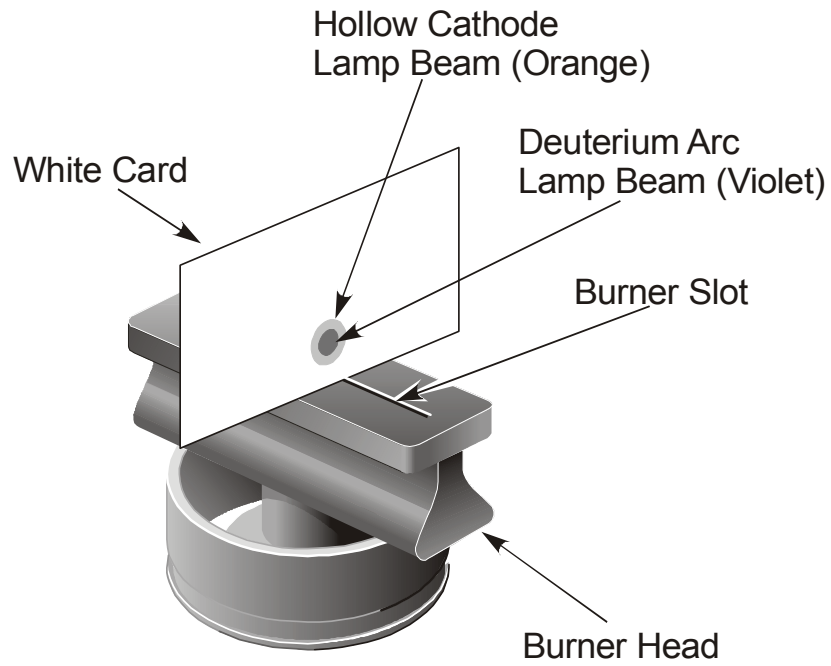


Figure 9- 20 The centering of the two lamp beams.

The alignment procedure is now complete.

AS-90plus and AS-93plus Autosampler Maintenance

Routine Maintenance

Minimal routine maintenance is required. Keep the carousel clean and try to avoid spills. Do not use abrasives to clean the clear plastic carousel cover. Do not use organic solvents to clean the carousel cover.

For more information, refer to the manuals received with the Autosamplers. For the AS-90plus Autosampler, see manual B314-0291 and for the AS-93plus Autosampler, see manual B314-0330.

Spare Parts

If corrosive solutions are being routinely analyzed, a corrosion-resistant, platinum-rhodium probe is available to replace the standard stainless-steel version on the AS-90plus and AS-93plus Autosamplers. You may find it convenient to purchase additional sample trays, so that samples may be loaded into a second carousel while the first is still in use. For spare parts, refer to the AS90 or AS93 manuals provided with the Autosamplers or the *e*-ssentials catalog.

Servicing

Servicing of the Autosamplers may only be performed by a trained PerkinElmer Service Representative. Contact your local PerkinElmer representative to schedule a service call.

MHS-15 Mercury/Hydride System Maintenance

Refer to the *MHS-15 User's Guide (0993-5288)* for maintenance details.

Replacing or Installing the MHS-15 Quartz Cell Holder

This section describes how to install the quartz cell holder (B300-0350) onto the burner head. The following section describes how to then install the quartz cell, the flame (if lit) and allow adequate time for the burner head to cool.

1. Make sure the two adjusting screws in each clamp are loose. Place the securing clamps of the cell holder bracket over the ends of the burner head.

Rear View

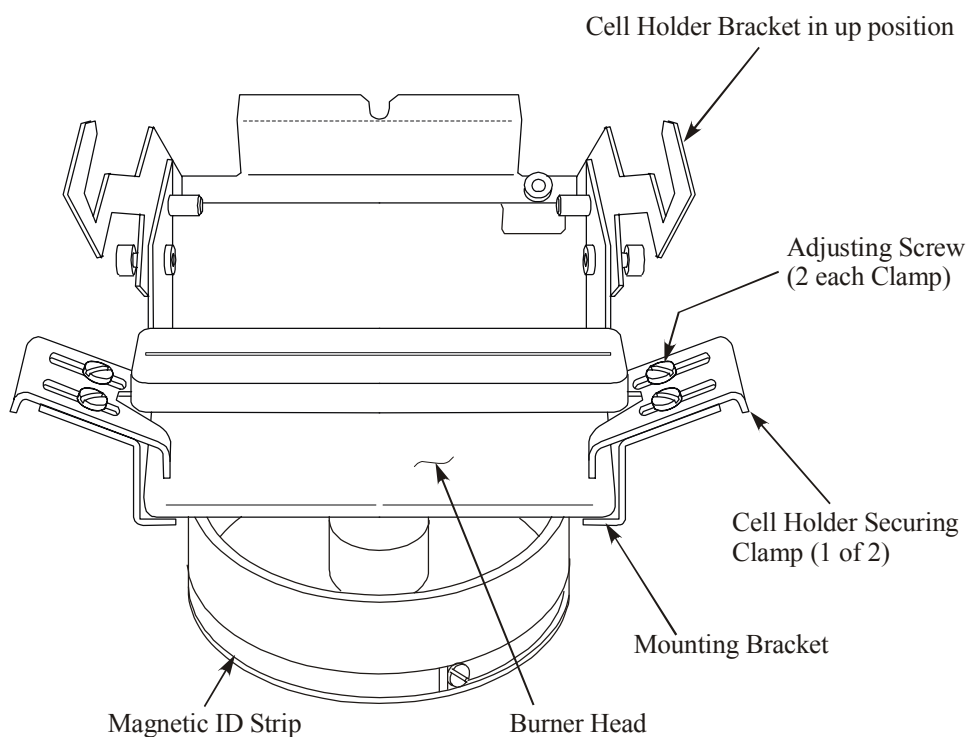


Figure 9- 21 Mounting the quartz cell-holder onto the burner head (rear view).

2. Refer to the next figure and align the "V" in the cell holder with the slot in the burner head.

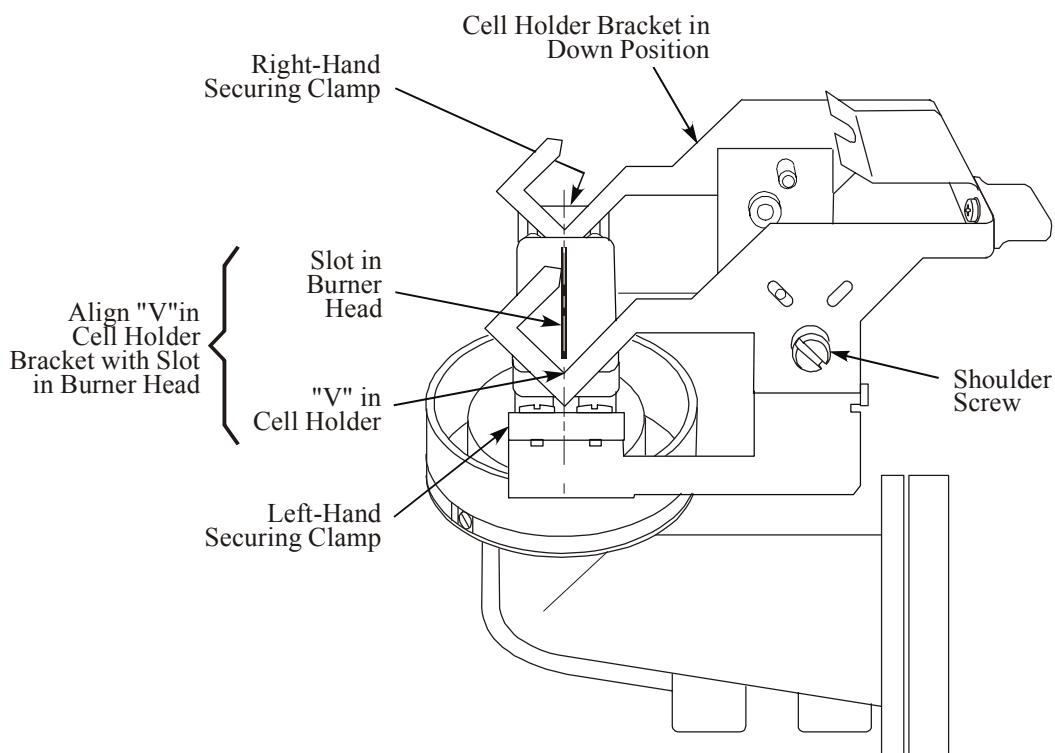


Figure 9- 22 Adjusting the position of the cell-holder bracket.

3. Tighten the four clamp-adjusting screws.

Replacing or Installing the MHS-15 Quartz Cell onto the Holder

After installing the cell holder, install the quartz cell as follows:

1. Rotate the cell holder bracket to the "up" position.
2. Place the quartz cell in the cell holder as shown in the next figure.



WARNING

Be certain that the transfer hose cannot become pinched or kinked in any way. A restriction in the hose may lead to a pressure build-up in the system which can cause an explosion.

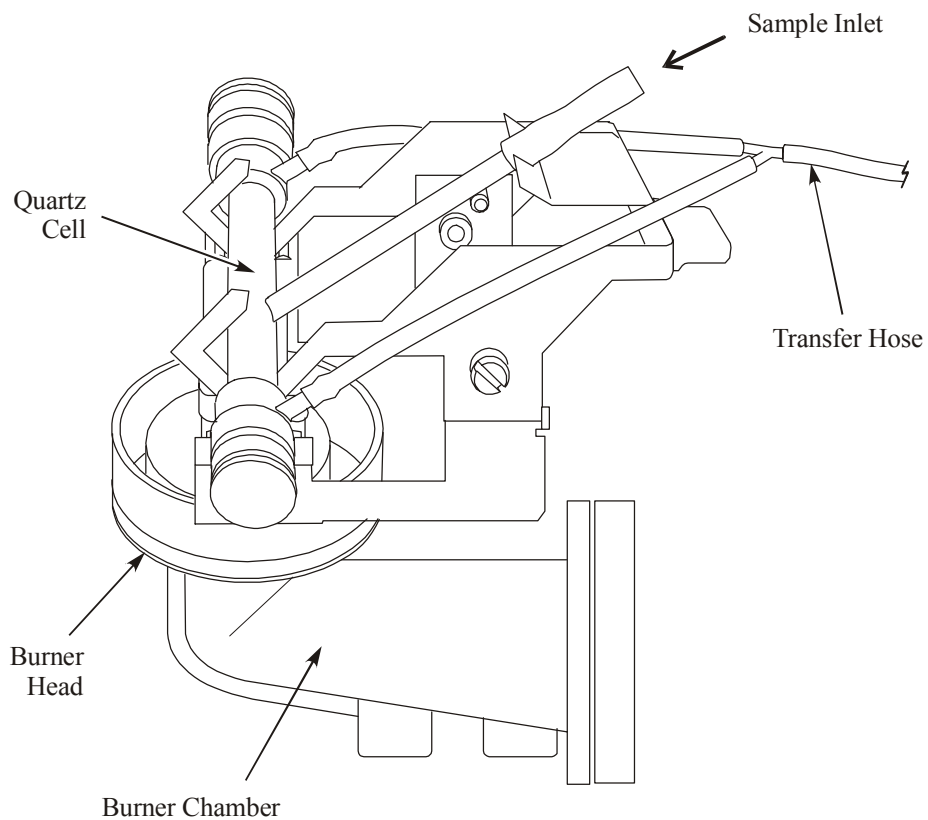


Figure 9- 23 Installing the quartz cell onto the holder.

3. Carefully lower the cell-holder bracket to the "down" position.

Replacement Parts and Accessories

The following is a partial list of common consumable parts and accessories. For more information, refer to the *e*-ssentials catalog.

Burner Head and Accessories

Description	PE Part Number
5-cm, single slot, N ₂ O/ Acetylene	N040-0100
5-cm, single slot, air/ Acetylene	N040-0101
10-cm, single slot, air/ Acetylene (standard)	N040-0102
10-cm, three slot, air/ Acetylene	N040-0103
Flow spoiler	B315-0443
Burner Head cleaning tool	0303-1573

Burner Gasket Kit

Description	PE Part Number
O-Ring Burner Cap	Standard
	Organics Corkprene
	Organics Kalrez®
O-ring for the burner chamber/burner head	0990-2219

Nebulizer and Components

Description	PE Part Number
Nebulizer	B315-0520
Spacer	B315-0531
Impact Bead	B050-5086
Capillary Holder Assembly	B315-0525

Drain System

Description	PE Part Number
Drain tube	0250-7987

Deuterium Background Correction Lamp

Description	PE Part Number
Background Corrector D ₂ Lamp Assembly	B315-0160

Plug Adaptors for use of HCL

Description	PE Part Number
Plug Adapter for use of coded Intensitron HCL	N305-0196
Plug Adapter for use of non-coded Intensitron HCL	N305-0197

Autosamplers

Description	PE Part Number
AS-90plus Autosampler	B314-0291
AS-93plus Autosampler	B314-0330

MHS

Description	PE Part Number
MHS-15 Mercury/Hydride System	B314-0760
Holder for Flame-heated FIA/MHS-15 Cell	B300-0350

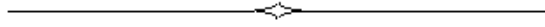
Spectrometer components

Description	PE Part Number
Air filter	B050-1696
Stylus (pkg 5)	N315-0183
Foot switch	B315-0627

Ordering Supplies and Accessories

Supplies, accessories, and replacement parts can be ordered directly from PerkinElmer. PerkinElmer offers a full selection of high-quality atomic spectroscopy supplies through the PerkinElmer *e*-ssentials Catalogue.

To place an order for supplies and many replacement parts, to request a free catalogue, or to ask for information, call your local PerkinElmer representative.



Troubleshooting 10

Introduction

PerkinElmer spectrometers are designed for routine, trouble-free operation. Many errors are diagnosed immediately as they occur and a message containing details of the problem appears in the Diagnostics window. Often this information enables you to solve the problem quickly. Some difficulties may not be so easily diagnosed and solved. For this purpose, troubleshooting suggestions are included to help you determine whether the difficulties are due to unsuitable analytical techniques, incorrect instrument parameters, or a malfunctioning of the instrument. If, after checking the instrument against the symptoms described below, the instrument appears to be malfunctioning, we strongly recommended that you contact your local PerkinElmer service representative. Servicing of the instrument by someone other than a PerkinElmer trained and authorized person will render the warranty null and void.

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Flame Analysis Troubleshooting

Some possible problems associated with flame analyses are listed below along with probable causes and suggested remedies. It is suggested that you use this checklist to diagnose possible problems before contacting service for assistance.

	Possible Cause of Problem	Check and/or Remedy
Results erroneously high	Corrections may not have been made for reagent blank.	Zero the instrument while aspirating a reagent blank.
	Ionization enhancement may be present in sample or blank.	Add approximately 1000 mg/L of an easily ionized salt (such as potassium, lithium, or lanthanum) to samples, standards, and blank.
	Standard solutions may have deteriorated or may have been improperly made.	Restandardize with a proven standard.
	Background absorption (molecular absorption, light scattering, etc.) may be present. This is especially likely to occur below 330 nm or where a high concentration of a refractory matrix is encountered.	Use a background corrector or, if applicable, use a nitrous oxide-acetylene flame.
	The sample matrix may be less viscous than the standards.	Remake the standards in the same matrix as the samples or use the method of additions.
Results erroneously low	Matrix interferences (chemical, bulk, viscosity) may be present.	Separate the interferent, match the sample matrix in your standards, or use the method of additions. Add matrix modifiers required to control chemical interferences.
	Ionization enhancement may be present in the standard but not the sample.	Add approximately 1000 mg/L of an easily ionized salt (such as potassium, lithium, or lanthanum) to samples, standards, and blank.
	Standard solutions may have been improperly made.	Rerun proven standards.
	Blank solution may be contaminated.	Change blank.

	Possible Cause of Problem	Check and/or Remedy
	The flame may have been too rich or too lean for the element being determined.	Refer to the recommended flame conditions in the Standard Conditions window for the element or the <i>Analytical Methods</i> manual.
Cannot get close to suggested characteristic concentration	You may not be comparing the characteristic concentration specified for the wavelength you are using.	Recheck the characteristic concentration for the wavelength.
	The instrument may not be using the correct wavelength.	Check the wavelength. If a problem is found, contact a PerkinElmer service engineer for assistance.
	If the element is easily ionized, ionization suppressant may be required.	Add approximately 1000 mg/L of an easily ionized salt (such as potassium, lithium, or lanthanum) to samples, standards, and blank.
	The fuel and oxidant flows may not be set properly or the wrong type of flame may be being used.	Adjust the gas flows or change to a nitrous oxide-acetylene flame if appropriate.
	Slit width may be too wide.	Check recommended settings in the Standard Conditions window for the element being determined.
	Nebulizer may not be adjusted properly.	Adjust the nebulizer using the information given in this <i>User's Guide</i> .

	Possible Cause of Problem	Check and/or Remedy
Cannot get close to suggested characteristic concentration (continued)	The nebulizer may be clogged.	Clean the nebulizer using the procedure given in this User's Guide.
	Lamp current may be improperly set (too high).	Reset lamp current.
	Too much liquid may be building up in the burner chamber.	Check for proper drainage.
	The burner head may be skewed in the light path.	Position the burner head so that it is parallel to the light beam.
	The burner position may be incorrect.	Adjust the horizontal, vertical, and rotational position using the information in this User's Guide.
	The instrument may have been autozeroed while a sample was being aspirated.	Autozero the instrument while aspirating a blank.
Cannot get suggested detection limits	Characteristic concentration may not be within 20% of the standard conditions value.	Check to make sure the characteristic concentration is within 20% of the specified value. If it is not, refer to the information on characteristic concentration above before performing the following checks.
	Integration time may be insufficient.	Try longer integration time.

	Possible Cause of Problem	Check and/or Remedy
Data noisy with flame off	Incorrect wavelength may have been selected.	Use the most sensitive wavelength listed in the Recommended Conditions window for the element being determined.
	Lamp current may be too low or the lamp may be at the end of its useful life.	Increase lamp current or replace lamp.
	Lamp may be unstable or weak.	Replace lamp or increase the lamp current. Or try using the next widest slit setting. (Although this may affect sensitivity)
	The optics may require cleaning.	Contact a PerkinElmer service representative.
Data noisy when aspirating blank	Burner may be contaminated.	Clean the burner head and burner chamber as described in the <i>Maintenance</i> chapter. Check for proper drainage.
	Noise may be due to a highly absorbing flame in far ultraviolet range.	Use background correction or vary the gas flows to minimize flame absorption or maximize flame stability.
	Noise may be due to a weak lamp coupled with a highly absorbing flame.	increase the lamp current to the max rating replace the lamp use the next widest slit setting (although this may affect the sensitivity) select a different wavelength or separate analyte element from a highly emissive matrix by chemical means.
	Noise may also be due to acetone carryover from the acetylene supply.	Check the acetylene cylinder pressure. For more information, refer to the <i>User's Guide</i> .
Background correction not producing expected results	Background corrector source lamp may need replacement or alignment.	Refer to the troubleshooting information on the deuterium arc background corrector later in this chapter.

Flame/Burner Troubleshooting

	Possible Cause of Problem	Check and/or Remedy
Flame does not ignite	The interlocks may not be satisfied (for one or more of the possible reasons listed below).	Check the interlocks. Refer to the possible causes listed below.
	Fuel or oxidant may not be on or at the proper pressures.	Check fuel and oxidant. Check that the pressure is maintained during the ignition cycle.
	The proper burner head may not be installed or fully seated. The 5-cm N ₂ O burner head must be used for all nitrous oxide-acetylene analyses. (N ₂ O/C ₂ H ₂)	Check to make sure the correct burner head is installed, fully seated and secured.
	The drain interlock may not be connected.	Make sure the drain interlock connection has been made.
	The level of liquid in the drain vessel may be too low.	Pour about 200-300 mL of deionized water into the neck of the burner or directly into the top of the drain hose.
	The level of liquid in the drain vessel may be too high.	Empty the drain vessel.
	The fuel/oxidant flow stopped after 15 seconds.	Try igniting the flame again.
	The nebulizer interlock may not be satisfied.	Check that the nebulizer is properly installed with the side-arm locked in place.

Flame does not ignite (continued)	The flame may not ignite if the ignitor tube is not positioned directly above the burner slot.	Try igniting the flame a second or third time.
Burner flashes back	Flashbacks can be caused by any of the reasons listed below.	Carefully inspect the burner system for possible causes, referring to the ones listed below. Reignite the flame only after the problem has been corrected. Contact a PerkinElmer service representative for assistance.
	Fuel and oxidant gas lines may have been inadvertently switched.	Check the connections at the burner and at the gas supplies.
	The burner system may leak.	Check the condition of all o-rings (burner head, end cap, o-ring on nebulizer front end cap). Replace o-rings that show signs of wear (cracking, swelling). Inspect the inner surface of the burner chamber for pitting and replace if necessary. Check drain connections for leaks.

	Possible Cause of Problem	Check and/or Remedy
Burner flashes back (continued)	There may be a break or leak in the drain tubing.	Inspect tubing and replace if necessary.
	The burner head may be clogged.	Check the burner head and clean if necessary.
	Gas flows may be set incorrectly.	If running samples in organic solvents, a flame that is too lean can cause a flashback. If a lean flame is required, adjust the nebulizer uptake rate.
	Gas connections may be loose or a leak may have occurred.	If you suspect a leak in the gas lines, immediately close the cylinder valve. If you need assistance, contact the gas supplier or a PerkinElmer service representative. Gas hoses and connections can be checked for leaks by applying a soapy solution and checking to see if bubbles appear.
	The air supply may contain excess oxygen.	Be sure the air supply contains less than 20% oxygen.
	The wrong gas supplies may be in use.	Check the source of the gases.

Lamp Troubleshooting

Some possible problems are listed below along with probable causes and suggested remedies. It is suggested that you use this checklist before contacting PerkinElmer.

	Possible Cause of Problem	Check and/or Remedy
Lamp will not fit in the turret	If the lamp diameter is smaller than 2 inches, it needs a special adapter.	Use the Small Lamp Adapter Kit (P/N 0303-0870).
Lamp connector will not fit the plug on the instrument	If the lamp is not a Lumina lamp, it needs an adapter.	Connect the lamp to the turret using the non-coded lamp adapter (P/N N305-0196 or N305-0197).
	If the lamp is not manufactured by PerkinElmer, it may need a special adapter cable.	Contact the lamp manufacturer for further information.
	The lamp may not be plugged into the lamp compartment.	Connect the lamp using an adapter cable if necessary.
Hollow cathode lamp will not light	Instrument is off or not plugged in.	Turn instrument on or plug into line power.
	Lamp not plugged in.	Connect lamp.
	Lamp worn out or damaged.	Try another lamp.
	Insufficient lamp current.	Set the proper current.
EDL (Electrodeless Discharge Lamp) will not light	The lamp may not be connected to the EDL power supply.	Check the lamp cable; plug it in if it is not already.
Lamp energy value is too low	The lamp may not be properly aligned.	Single lamp unit: Adjust the position of the lamp. Instrument with Turret: the turret is self aligning.
	The lamp may be starting to deteriorate.	It may be possible to continue using a hollow cathode lamp for a short period of time by increasing the lamp current up to the maximum value listed on the label on the lamp. Otherwise, it may be necessary to replace the lamp.
	Possible Cause of Problem	Check and/or Remedy
Lamp energy value is too low (continued)	The hollow cathode lamp current may be too low.	Adjust the lamp current. Use the recommended value listed on the lamp label.

The electrodeless discharge lamp current setting may be too low.	Adjust the lamp current. Use the recommended value listed on the lamp label.
The slit width may be too small.	Check the recommended settings for the element in the Recommended Conditions window.
The wrong wavelength for the element may be specified.	Refer to the Recommended Conditions window for the element.

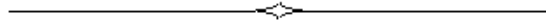
Troubleshooting Deuterium Background Corrector Problems

Background correction requires the use of both the primary and the continuum source. It is important that these sources be of similar intensity and pass through exactly the same area of the sample cell. There are three possible problems that may be observed when the background corrector source lamp is not aligned or needs replacing:

- Measurements are excessively noisy.
- The intensity of the background source may be much less than the intensity of the primary source.
- Background absorbance may not be properly corrected. You can check this by measuring a sample containing only matrix components with no analyte.

These problems indicate that the background corrector source is either not properly aligned or should be replaced. Refer to the section called *Replacing the Deuterium Lamp* in *Maintenance* chapter if it needs replacing.

	Possible Cause of Problem	Check and/or Remedy
Background source intensity is much lower than the primary source	May not need to use the background corrector.	Determine if the background corrector should be used. It is useful up to about 400 nm.
	The intensity is not matched.	1). Reduce the hollow cathode or the EDL current in order to reduce the primary source intensity. This may increase the noise for the determination. 2). In addition (or alternatively) increase the slit width (this may increase the possibility of spectral interferences or increase the calibration curvature).
	The deuterium lamp may need replacing (B315-0160).	Replace the lamp.



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