GeminAA PLUS

Atomic Absorption Spectrometer

AAS

GBC

ISO 9001
Quality Accreditation

GBC has always placed a strong emphasis on quality in all aspects of our operation, from design and manufacture to the provision of service and support to our customers, and we are fully committed to continuous evaluation and improvement in all areas.

The GBC Quality Management System has been accredited to the ISO 9001 quality standard by Lloyd's Register Quality Assurance Limited. This certification is your assurance that the procedures and processes used to produce the goods and services which GBC provides comply with the relevant International Standard, and demonstrates commitment to meeting the needs and expectations of our customers.

Since 1978 GBC has been at the forefront of scientific technological development, manufacturing and marketing a wide range of award winning, quality scientific instruments.

GBC's Product lines

Visionary Technology

GBC Scientific Equipment will advance people's knowledge and their capacity to enhance the quality of life for all humankind.

GBC

Flame Graphite Furnace Two-in-one System

GeminAA PLUS
Atomic Absorption Spectrophotometer

Application

The GeminAA PLUS atomic absorption spectrometer can be widely used in the fields of metallurgy, petrochemicals, geology, medical science, environmental protection, scientific research, agriculture, disease control, food safety, material science, quality inspection etc. The GeminAA PLUS series can be used to analyze over 70 elements at ppm levels.

Features

Advanced Optical System

•The GeminAA PLUS features a unique suspension design for the optical system. Strong vibrations of the instrument bench or change of the environmental temperature will have no effect on the instrument's stability. (Patent No. ZL200620023296.X)
•Features 1800 lines/mm diffraction grating ,which increases resolution and energy efficiency.
•Compact optical system allows for a strong signal and very low detection limits for elements such as As, Se among others.
•Fine tuned deuterium lamp background correction and self-absorption background correction results in more accurate calibration.

Integrated Design

•The GeminAA PLUS features an integrated flame and graphite furnace design that contains the optical system, flame atomizer, graphite furnace power supply and electronics all in one unit. It is first such design and one of the most compact AAS in the world. (Patent No. L200620023298.9)
•Optimized lamp power supply technology prolongs the lifetime of element lamps.

Automated Switch between Flame and Graphite Furnace

•Features automated or manual switching between flame and graphite furnace in less than 2 seconds.
•Optics do not need to be realigned after switching. (Patent No. ZL200620023297.4)

Reliable Safety System

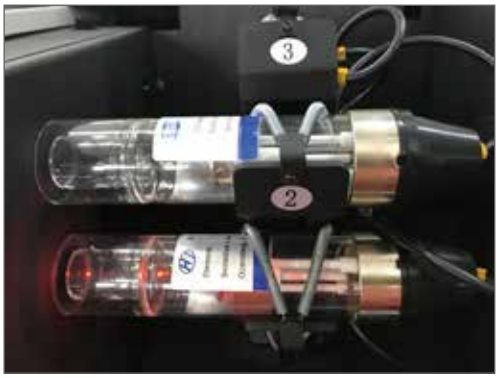
•Safe and reliable control interlocks ensure over current protection for hollow cathode lamps.
•Safety interlocks protect the user and the instrument from under pressure of the combustion gas and inert gas, combustion gas leakage, graphite furnace over-heating and abnormal flame.

Safety and Simplicity

Unique functional design enhances ease of use

Flexibility

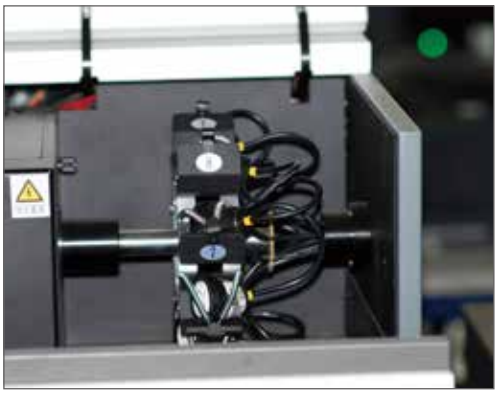
•Optional HG-01 hydride generator that utilizes a heated ceramic tube can be used to perform trace analysis of As, Pb, Se, Hg, Bi, Sb, Sn, Te with high sensitivity.
•For the GeminAA Flame, autosampler is available as an option.
•Universal autosampler included as standard with GeminAA PLUS that allows automated sample analysis for both flame and graphite furnace.
•Nitrous Oxide/Acetylene selection system included as standard.



Hollow cathode lamp

High Degree of Automation

•Automatic wavelength selection, automatic slit switch setting and automatic optimization of lamp current and gain. All operations can be completed within 40 seconds.
•Automatic flame ignition, automatic control of the deuterium lamp, and automatic switching of the graphite furnace power supply.


Eight Lamp Rotating Turret

Automatic Flame Height Adjustment

•Automatically find the optimal flame height for each elemental analysis.

Automatic Liquid Trap Protection

Flame ignition is controlled with a combination of a float inside the liquid trap and a solenoid to avoid acetylene leakage due to lack of water in the liquid trap. This increases operational safety.

Deuterium Lamp Background

When using deuterium lamp background correction, the instrument will automatically configure the deuterium lamp and optimize its position to increase the intensity between the deuterium beam and element beam to the greatest extent, which allows for the best background correction results.


Titanium Nebulizer

Graphite furnace gas saving mode

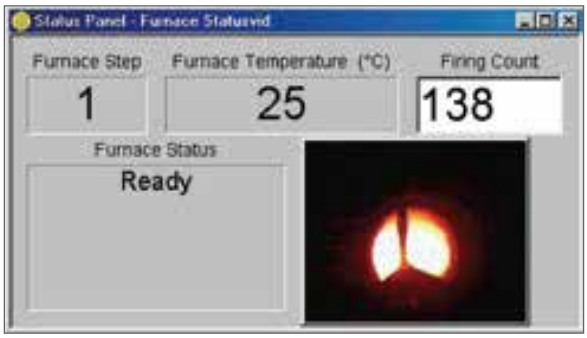
The intelligent control of the inert gas switch maximizes the effective use of inert gas and reduces waste when the gas is not needed, cutting down on the cost of operation.

Temperature correction programs

Temperature correction programs for two types of graphite tubes, standard and extended lifespan tubes, are built into the software. Using the extended lifespan tubes, for typical analysis of Pb, tube firings can reach >1,000 firings before replacement.

Graphite furnace viewing system

The graphite furnace can be observed in real time through the graphite furnace viewing system on the PC screen.The whole analysis process from sample injection to atomization can be observed. By observing the desolventizing, drying and ashing process, parameters can be optimized to obtain more accurate results. The position of injection probe and light beam can be constantly monitored to check for probe damage and alignment issues which may lead to inaccurate results.



Multi-Element analysis

•Automatic multi element analysis: After editing the method, in addition to configuring the autosampler, the instrument can automatically set method parameters, including wavelength selection, slit setting, element lamp position adjustment, burner position adjustment, deuterium lamp switch, atomizer switch, automatic ignition, and so on.

•Multi-element analysis in the same method: Multiple analyte elements can be set in the same method, analysed in sequence, and a comprehensive report can be generated and printed.

Auxiliary Gas

Auxiliary gas, such as oxygen, can be used in the internal gas path of the graphite furnace to sufficiently remove organic components of the sample during the ashing treatment phase in order to reduce interference and increase analysis accuracy.

Intelligent frequency conversion

The software can intelligently identify the power frequency and automatically match it. Suitable for dealing with power supply frequency instability or different frequency power grids.

Sensitive and Efficient

GeminAA PLUS Atomizers

Model	Description
GeminAA PLUS	Flame atomizer, graphite furnace atomizer
GeminAA Flame	Flame atomizer

Excellent Graphite Furnace

Advanced Longitudinal Heating Mode

Atomization temperature can reach 3000 ℃. This meets the atomization temperature demands of Ni, Mo, V, Co, etc.

High Stability

Advanced optics system ensures high optical energy of the instrument. High signal-noise ratio ensures repeatable data.

Maximum Sample Size Increased

Maximum sample size is 70 µL. This feature is useful for multiple samples and analysis of samples with low concentrations.

High Performance Background Correction

Continuous light source (D2) and self absorption background correction is capable of 1A of background correction.

Fast Heating

Optical temperature control greatly increases heating rate and allows for rapid atomization.

High Precision Homogeneous Heating

Unique design of the graphite furnace ensures homogeneous heating during atomization to obtain accurate data.

Convenient Injection Port

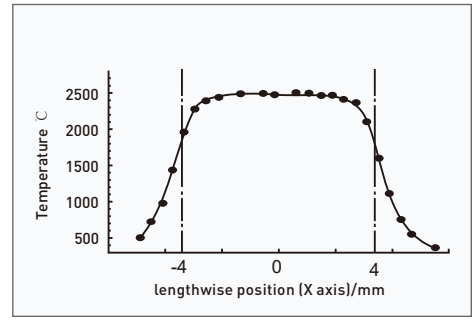
Design of the injection port simplifies sample injection and decreases error. Good precision can be obtained even by manual injection.

Advanced Graphite Furnace

Graphite electrodes can be replaced when worn to ensure stable conductivity of graphite parts. (Patent No. ZL200720104071.1)

Titanium Nebulizer and Burner

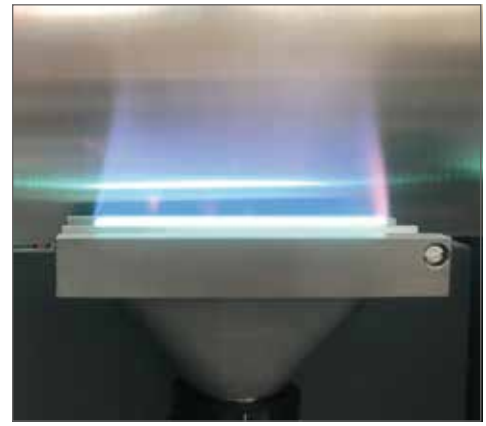
Utilizing aerospace technology, the industrial grade pure titanium nebulizer and 100 mm burner head is cast using the paraffin method. These parts have excellent resistance to corrosion and oxidation, can withstand high temperatures, and are extremely durable.



Iso-temperature Line During Atomization

Convenient Injection Port

Graphite Furnace and Graphite Cone



Pure titanium burner

Easy to use Software

Powerful Windows®
GeminAA PLUS Software

Powerful Automated Data Processing Workstation Meets GMP Certification Requirements

• User friendly operating interface

Window based operating platform supports multiple languages, such as Chinese, Korean, etc. Obtain analysis reports quickly and easily.

• Powerful sample analysis functions and fault-tolerant processing, flexible curve fitting equation

• Instrument adopts network port communication, allows remote transfer of instrument data

• Report printing function

Flexible report printing function, to print report according to user settings.

• Data management functions

Back up function for historical data management and related follow up processing, with functions such as access control, permission allocation, audit trail, electronic signature, and backup recovery.

• QA/QC control function

The QA/QC feature allows for automated determination of whether the analysis result or some function of the result exceeds user-defined limits. If the result exceeds the limit, the system automatically runs the analysis again according to setup parameters. Functions of QA/QC include standard deviation (SD) detection, relative standard deviation (RSD) detection, correlation coefficient detection, QC detection, baseline drift (sensitivity correction) detection, sample upper limit detection (automatic online dilution).

• Instrument control

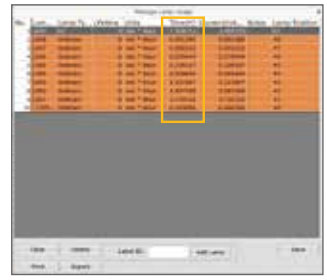
Automated selection of element lamps, wavelength scanning, slit switching, setup of lamp current.

• Status Monitoring

Real-time dynamic monitoring of working conditions. For flame method: type of burner head (air + acetylene or nitrous oxide + acetylene), water level of the liquid trap, status and pressure of the combustion gas and the oxidant gas, flow rate of the combustion gas, acetylene leakage alarm. For graphite furnace method: over current protection, water temperature, water flow rate, pressure of the inert gas.

• Light on time management function

Record HCL usage time automatically.



• Graphite tube firing frequency tracking.

High Accuracy Graphite Furnace Analysis System

The most important specification of a graphite furnace analysis system is the repeatability of analysis results . The precision requirement of trace analysis depends on the concentration level of the sample, which varies based on application. A quality graphite furnace analysis system must satisfy all such requirements. Additionally, it must have accurate temperature control, high quality graphite tubes, a fast heating system, fast signal processing electronics and easy to use analysis software.

High Precision Analysis of Boundary Wavelength Elements

Boundary atomic absorption wavelengths elements include As (193.7 nm) and Cs (852.1 nm). Their spectral lines have very low energies on the high or low end of the monochromator grating. Analysis performance of these two elements can be used to evaluate the optical characteristics of an instrument. Analysis results of these two elements by graphite furnace method are shown in Figure 1.

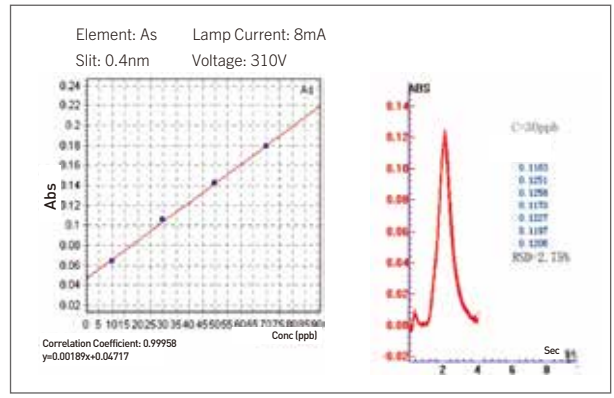


Figure 1 Linearity and RSD% of element As

The figures to the right show an RSD of 2.95% for 7 consecutive manual samples of 20 µL of 5 µg/L Cs solution, and an RSD of 2.75% for 7 consecutive manual samples of 20 µL of 30 µg/L As solutions.

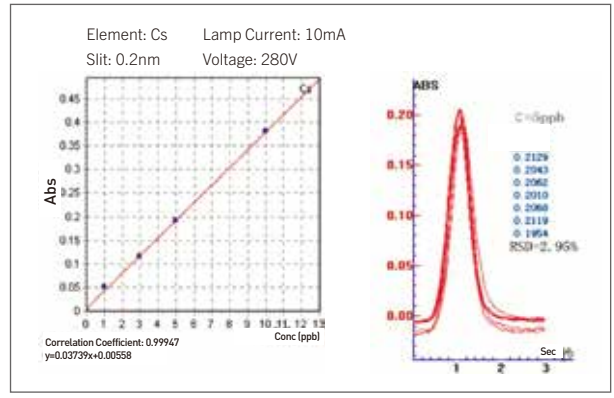


Figure 2 Linearity and RSD% of element Cs

Analysis of Cadmium (Cd) and High Atomization Temperature Element Molybdenum (Mo)

Cadmium is analysed by graphite furnace due to its high sensitivity. High atomization temperature element Molybdenum can easily form a carbide in graphite furnace, so its analysis data reflects high temperature characteristics of the graphite furnace, the quality of graphite tubes and the sensitivity of high atomization temperature elements.

Below are the graphite furnace analysis results for Cd and Mo.

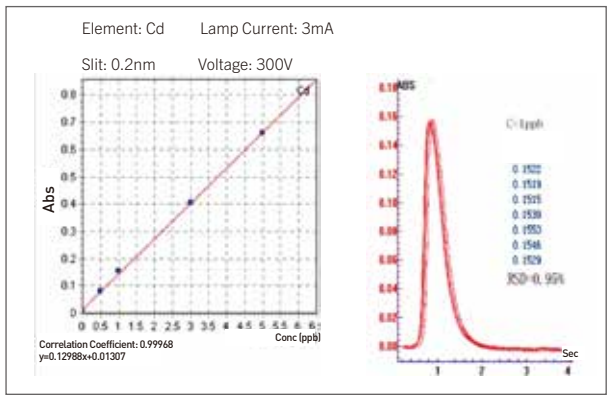


Figure 3 Linearity and RSD% of element Cd

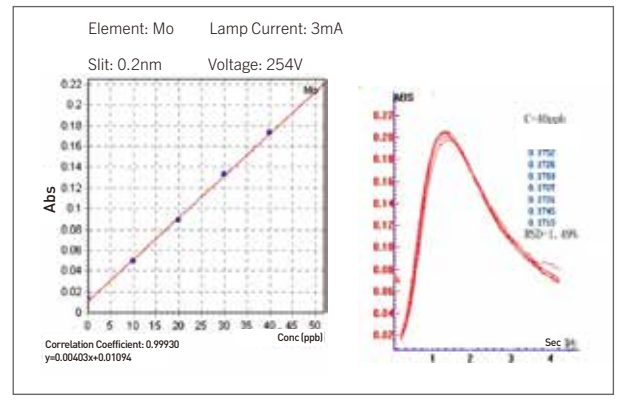


Figure 4 Linearity and RSD% of element Mo

The figures above show an RSD of 0.95% for 7 consecutive manual samples of 20 µL of 1 µg/L Cd solution, and an RSD of 1.49% for 7 consecutive manual samples of 20 µL of 40 µg/L Mo solutions.

The linearity of the results shown above in addition to using a EHT of no more than 300 V shows the sensitivity and stability of the graphite furnace system. Even for a high atomization temperature, low sensitivity element such as Mo, the system delivers satisfactory sensitivity.

State of the art Graphite Tube Design

The graphite tube is the core component of the graphite furnace system. In addition to using high grade graphite material, a sound mechanical design of the graphite tube is a key factor to creating an isothermal state. Figure 5 shows a cross-sectional view and figure 6 is a temperature diagram of the GeminAA PLUS graphite tube.

To create isothermal conditions in the atomization zone, two partitions with a smaller inner diameter were added in the middle of the graphite tube. The tube wall between the two rings was thinned in order to increase the electric current density to ensure isothermal conditions in the 8 mm long, 170 mm^3 volume atomization zone. This design increases the sensitivity and precision while reducing the interferences of the system. Figure 6 shows the isothermal condition of the 8 mm long atomization zone. The maximum capacity of the tube is 70 µL.

As you can see, the GeminAA PLUS graphite furnace analysis system is an excellent analysis system with high accuracy and precision, and can compete with any advanced graphite furnace system on the market. Additionally, the small graphite furnace with low energy cost (maximum 4KW, 220 V) is economical and suitable for lab use.

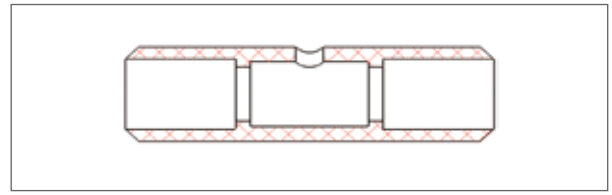


Figure 5 Cross-Sectional View Graphite Tube

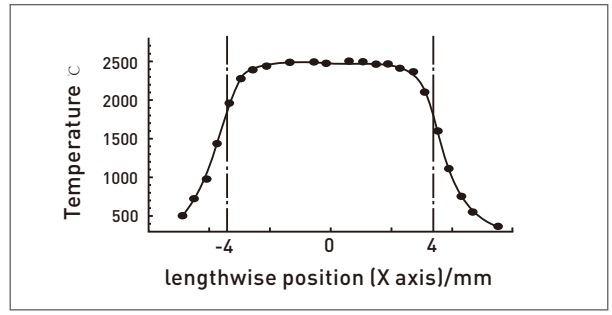


Figure 6 Temperature Diagram of the Graphite Oven

Comprehensive and Compact

Specifications

Optical System

Wavelength range: 190~900 nm

Monochromator: C-T Grating Monochromator
Wavelength repeatability: ≤0.05 nm
Blaze Wavelength: 250 nm
Resolution: better than 0.1 nm

Spectral bandwidth: Automatic switching between 5 levels: 0.1, 0.2, 0.4, 1.0, 2.0 nm
Wavelength accuracy: ± 0.1 nm
Grating: 1800 lines/mm
Base line Stability: ≤0.003A/30 min (Static)
≤0.002A/30 min (Dynamic)

Flame Method

Benchmark Concentration of Cu: ≤0.02 μg/mL/1%
Precision RSD: ≤0.45%
Position Adjustment: Adjustable height and angle. Flame to hydride can be switched in less than 1 minute.

Detection Limit: ≤0.003 μg/mL
Burner: 50 mm stainless steel burners and 100 mm interchangeable all-titanium burners

Background Correction

Background correction is available for both flame and graphite furnace method.
Correction mode: Deuterium lamp, Self absorption background correction (optional).
Correction capability: When background absorption is approximately 1.0 Abs, the instrument is capable of a background correction of 60 times or more.

Graphite Furnace Method

Benchmark Concentration of Cd: 0.3×10^{-12} g
Temperature Range: Room temperature to 3000 ℃
Temperature Control Program: Max 20 step temperature program. 3 modes of temperature rise: step, slope and flat.
Heating Modes: Max power heating and optical control rapid heating .

Detection Limit: 0.2×10^{-12} g
Precision RSD: ≤1.8 %
Optical Control Temperature Rise Rate: ≥3000 ℃/s
Max Power Temperature Rise Rate: ≥2000 ℃/s

Temperature control modes:
Power control mode: Accuracy ≤1%, Reproducibility ≤0.5%
Optical control mode: Optional

Data Processing

Measurement methods: Flame absorption, flame emission, graphite furnace, and hydride method
Analysis method: Linear fitting, nonlinear fitting, standard addition method
Report output: Calibration curve, spectrum, analysis conditions, analysis parameters, and analysis results can be automatically recorded and printed.

Main Unit with Integrated Graphite Furnace Power Supply

Dimensions: 880 (L) x 540 (W) x 450 (H) mm, 125 kg
Power Supply: ~220 V 50 Hz single phase, main unit power: 200 W, graphite furnace power: 4 KW

Accessories

HG-01 Hydride Generator

Featuring peristaltic pump injection, electrothermal ceramic heated quartz tube atomizer, capable of performing high sensitivity ultra-micro analysis for eight elements (As, Se, Hg, Pb, Bi, Sb, Sn, Te) with typically low sensitivity by AAS. The HG-01 has simple operation, quick analysis, low interference and can be easily connected with any GeminAA instrument to perform hydride-atomic absorption analysis.

Features

•Samples are continuously pumped by 3 channels using a peristaltic pump. Injection volume is 1~5 mL.
•Uses Tygon wear-resistant durable pump tube. The life span of these pump tubes can be as long as 500~1000 hr.
•Using a uniquely designed ceramic electric heating tube, the HG-01 is oxidation-resistant and expels no waste. It can withstand temperatures of up to 1000 ℃ for many hours with no damage to the quartz tube.
•Temperature control is fast and accurate. The temperature range is room temperature~950 ℃ with an accuracy of ±2 ℃.The optimal atomizing temperature can be quickly reached and precisely controlled.
•Compact design and easily mounted on the AAS in the flame nebulizer base position.

AS-600 Integrated Flame Graphite Furnace Autosampler

•Holds up to 133 sample vials (including 5 reagent vials). Supports various types of sample trays, as well as plastic and quartz sample vials.
•Allows automatic injection for flame and graphite furnace. Eliminates the need to move the autosampler when switching methods, once installed. When not in use, can still inject sample manually without disassembling autosampler.
•Control of sampling depth and injection depth via software.
•Fully automated computer-controlled operation, from taking up sample to taking different standards and chemical modifiers.
•After the solution is injected, graphite furnace heating program will start automatically.
•After each injection, system will immediately run an automated rinse program, to eliminate sample contamination.
• Automatic concentration and dilution.
•Graphite furnace supports hot injection.

Ordering Information

99-0714-00 **GeminAA PLUS**

Each GeminAA PLUS is supplied with universal autosampler for flame and graphite furnace, air-acetylene burner, nitrous oxide-acetylene burner, spray chamber, titanium nebulizer, gas hoses, operation manual and software for operation of the instrument and all accessories

99-0726-00 **GeminAA Flame**

Each GeminAA Flame is supplied with air-acetylene burner, nitrous oxide-acetylene burner, spray chamber, titanium nebulizer, gas hoses, operation manual and software for operation of the instrument and all accessories.

Accessories

96-0314-00	Self absorption background correction GeminAA
96-0321-00	Super lamp power supply (must be factory fitted)
41-0353-00	GeminAA coded lamp recognition
99-0727-00	AA3-6-03X nitrous oxide device, includes nitrous oxide-acetylene burner
99-0728-00	GeminAA burner, air-acetylene all-Titanium
99-0729-00	GeminAA burner, nitrous oxide-acetylene stainless steel
99-0730-00	GeminAA nebulizer, Titanium
99-0734-00	GeminAA nebulizer, high performance glass
75-0054-00	Air compressor 220/240 V, 50 Hz
75-0055-00	Air compressor 110 V, 60 Hz
75-0056-00	Air compressor 220 V, 60 Hz
96-0104-00	Refrigerated cooling system 220 V, 50 Hz
96-0104-01	Refrigerated cooling system 115V, 60 Hz
45-0030-00	Graphite furnace tube, pyrolytically coated - GeminAA (each)
45-0024-00	Graphite furnace tube, pyrolytically coated, premium - GeminAA (each)
41-0354-00	Lamp, deuterium GeminAA
67-0450-00	Valve, oxygen pressure reducing model YQY-12 (available for air, N2, Ar)
67-0451-00	Valve, acetylene pressure reducing model YQY-213
96-0320-00	Computer with installed and test software GeminAA

Autosamplers

99-0715-00	AS-600 Flame and graphite furnace autosampler
99-0705-00	AS-500 Graphite furnace autosampler
99-0704-00	AS-200 Flame autosampler

Hydride

99-0702-00	HG-01 Hydride generator

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GBC Scientific Equipment
Manufacturer of world-class scientific instruments and accessories
— AAS, HPLC, ICP-OES, ICP-TOFMS,UV-Vis and XRD

1/2 Naxos Way
Keysborough Victoria 3173
Australia

Telephone: +61 3 9588 6666
Fax: +61 3 9588 6677
Email: gbc@gbcsci.com
Web: **www.gbcsci.com**

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