

AA-6300

Shimadzu
Double Beam
Atomic Absorption Spectrophotometer





Atomic absorption that has evolved for the new century

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Shimadzu Double Beam Atomic Absorption Spectrophotometer

Atomic absorption that has evolved
for the new century

■ **The newly developed, high throughput dynamic beam manager system achieves measurements with the world's highest level of sensitivity (Direct determination - Flame: Pb, 0.1ppm; Furnace: Pb, 0.3ppb)**

- A next generation double beam system which drastically reduces the noise of a double beam optical system through the adoption of a high throughput dynamic beam manager system and a high speed operation digital filter.

■ **FDA 21 CFR Part 11 Compliance**

- Further evolved WizAard and CLASS-Agent software combine to achieve FDA 21 CFR Part 11 Compliance.
- WizAard alone offers comprehensive system management functions, including system policy settings, user management, log browser, audit trail, and electronic signatures.
- Combination with CLASS-Agent software achieves even more efficient database management.
- Comprehensive accuracy management functions. (QA/QC, etc.)
- Hardware validation software is also standard equipment.

■ **Switch smoothly between Flame and Furnace**

- All that is involved in switching from flame to furnace is to remove the burner head and put in place the furnace section. These steps require no tools, and can be done easily and speedily.
- Furthermore, the single autosampler can be used for both flame and furnace, which negates the need to prepare the autosampler for each analysis method.

■ **Adoption of Automatic Burner Head Height Control Mechanism**

- In addition to the automated control of the flame gas flow rate conditions, the burner head height can be automatically controlled as well. The optimal parameters for each element/ sample can be set automatically to enable continuous measurement.

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Comprehensive Flame Analysis

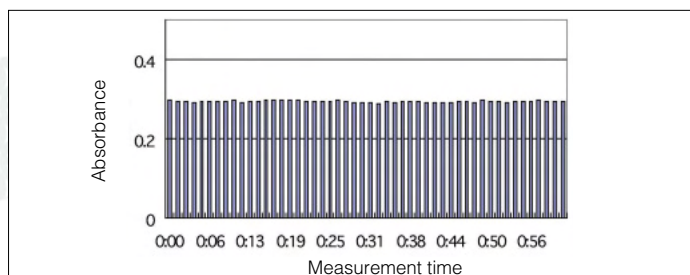


For highly sensitive and stable flame analysis

The High-Throughput Dynamic Beam Manager System developed uniquely for the AA-6300 automatically sets the photometric system to optical double-beam for flame measurement, and to electrical double-beam for furnace measurement. Furthermore, the optical system has been designed to produce its maximum performance in each of the measurement methods through the optimal adjustment of the light beam, high speed operation digital filter, and employment of optical components which suppress light loss.

Long Term Stability Because of the Double Beam

The data in the diagram below shows the flame long term stability of Cu. The results are of Cu: 2ppm, 5 repeated measurements conducted for 1 hour. A %RSD of approx. 0.5% in a total of 250 measurements is achieved.

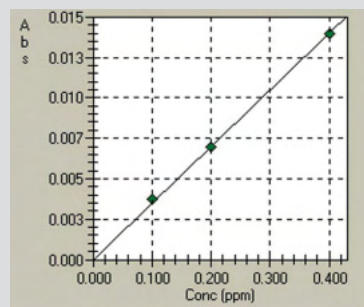


Cu Flame 60 Minute Measurement

High Sensitivity Despite the Double Beam

Direct measurement of Pb: 0.1ppm is achieved.

The diagram below is the calibration curve of Pb: 0.1ppm to 0.4ppm.

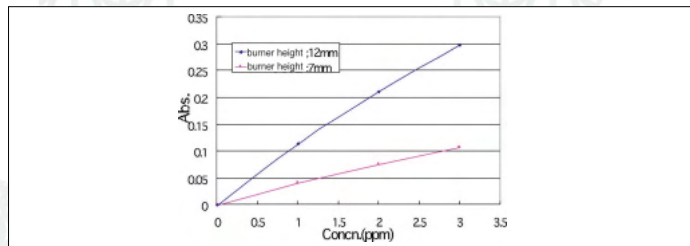


For flame analysis under optimal conditions at all times

• The effectiveness of the automatic height control mechanism for the burner head

In the flame measurement of Fe, Cr, etc., measurements can be conducted with a higher level of sensitivity by setting the burner height* lower than the height used with other elements (refer to the diagram below). The AA-6300 conducts measurements by automatically setting the optimal conditions for not just the gas flow rate, but the burner height as well for each element at all times, whether it be automatic switching measurement of multiple elements or manual measurement. Detailed methods - including the burner height - can be saved in files as measurement conditions, making it possible for anyone to conduct optimal measurements at any time.

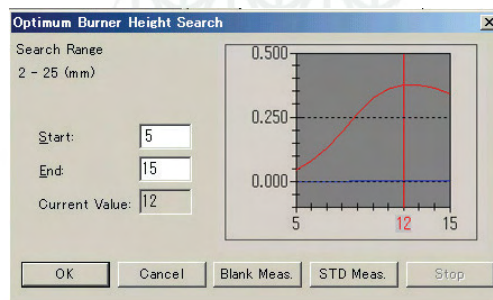
* "Burner height" is the clearance between the burner head top surface and the light axis.
As the light axis is fixed, lowering the burner increases the burner height value.



Automatic search for optimal fuel gas flow rate and optimal burner height

Each condition is automatically changed within a fixed range. The flow rate and height at which the difference in absorbance between a standard sample and a blank sample is at its maximum is displayed on a graph.

Comparison of Cr measurements using a burner height of 12mm, and a height of 7mm (the same as other elements). The sensitivity differs by about 3 times (the fuel gas flow rate is the same for both, at 3.4L/min)



Example of running an optimal burner height search

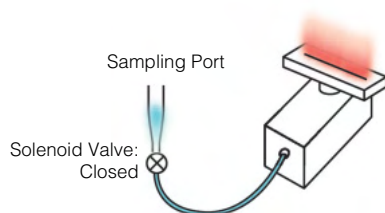
For flame analysis of trace samples

The Microsampling Method

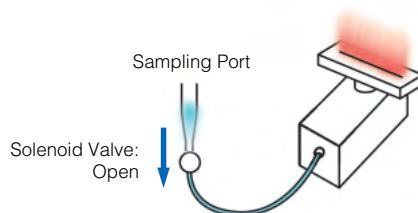
Flame measurements require at least 1 mL (1000 μ L) of solution since the sample is normally sucked in continuously. With the microsampling method, about 50 to 100 μ L of the sample is injected into the flame in one go to quantitate the sample using the height and area of the peak-shaped signal obtained. As a result, this method has the following characteristics.

- Only a small amount of sample is required.
- Multiple elements can be measured even with a small amount of sample.
- The burner slot does not get blocked so easily, even with high salt content samples.
- Working in concert with the autosampler*, automatic dilution measurements are possible.

*In order for it to work together with the autosampler, the microsampling kit (sold separately) is required,



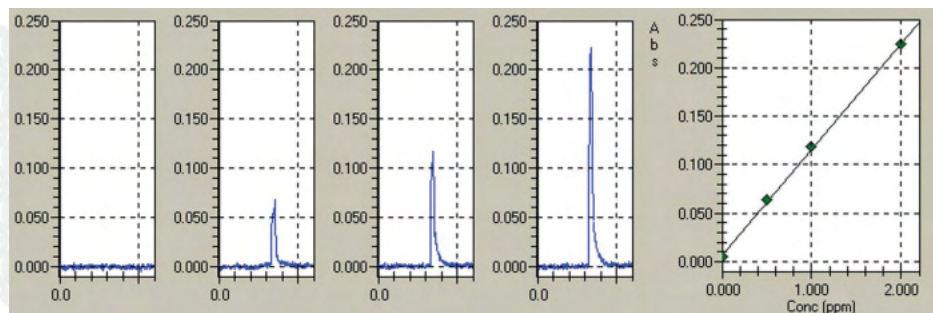
1. Inject the sample into the microsampling port



2. Open the solenoid valve and introduce in one go into the flame.

Example of Micro sampling Measurement

An example of the calibration curve obtained with the microsampling method is shown. Created by using the autosampler to dilute the 2ppm Cu standard solution. Samples can be diluted and measured in the autosampler in the same way (injection amount: 100 μ L).



For safe flame measurement

The following safety mechanisms have been incorporated.

- Safe ignition / extinction sequence
- Flashback prevention through the gas pressure monitor
- Prevention of raw gas release when the flame dies out
- Burner misuse prevention
- Automatic flame extinction in a power failure

* Furthermore, a higher level of safety is ensured through the safety inspection support provided by software, and the self-diagnostics function which determines whether the system safety mechanisms are in working order.

For flame measurement under tough conditions

The burner head is made of titanium,
The chamber is polypropylene,
The disperser is ceramic -
Durability has been taken into account as well.

Highly Sensitive & Stable Furnace



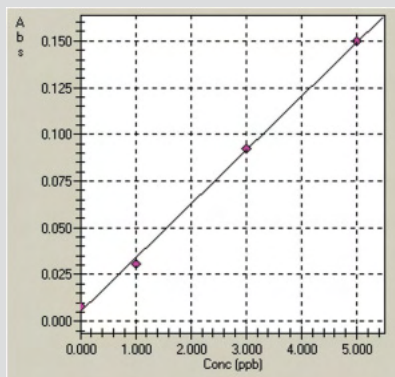
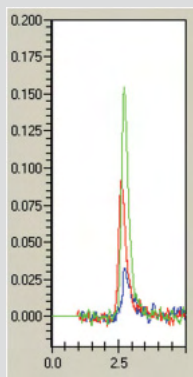
For highly sensitive furnace measurement

By uniquely controlling the flow of the gas inside the graphite tube at atomization (Patent 2067563), high sensitivity measurement has been realized to a degree that is among the best in the world (sensitivity has been increased by a maximum of 1.4 times over Shimadzu's previous products).

High Sensitivity Application Data (Se Measurement Example)

In the example of Se:

0-5ppb measurement, it is clearly evident that 1ppb of Se can be measured (20 μ L injection, Pd modifier & pyro-coated tube used)



For stable furnace measurement

• Improved stability through digital temperature control & digital gas control

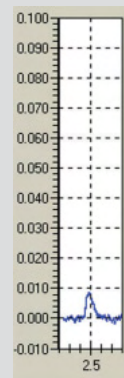
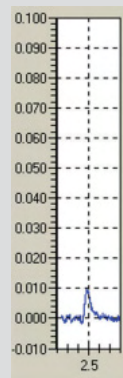
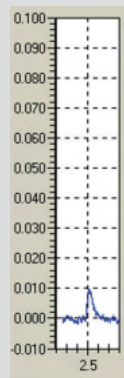
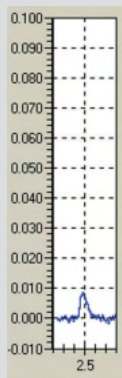
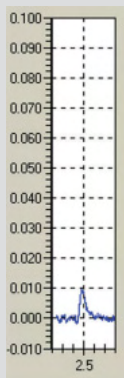
By combining a high sensitivity optical sensor and a digital temperature control system, the temperature is controlled with a high degree of precision over the entire temperature region from drying to atomization. By employing the electronic controller, the flow rate of the inner gas can be controlled precisely in 0.01L/min units.

Through these methods of control, not only the sensitivity but also the data stability is improved greatly.

Stability Application Data

Pb: 0.5ppb measurement example:

With a %RSD of approx. 5% for 5 repeated measurements, the quantitative capability is clearly adequate.



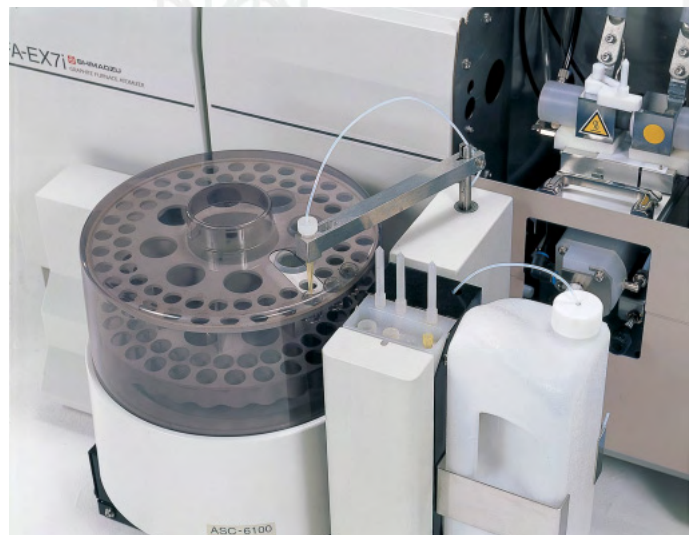
Analysis



For furnace analysis under optimal conditions at all times

Sophisticated Autosampler

- A maximum of 4 samples (such as the diluent, standard solution, sample, matrix modifier) can at first be mixed and then injected (without mixing is of course possible as well).
- Commercially available pipette tips or the Teflon tube can be selected for the injection nozzle.
- The unit can be set to automatically dilute and repeat the measurement if the calibration curve concentration is exceeded.



Example of automatic dilution and re-measurement

if the maximum concentration is set in advance, the autosampler will dilute automatically if this concentration is exceeded.

NO	Action	Sample ID	True Value (ppb)	Conc. (ppb)	Abs.	Pos.	VOL	Diluent R1	Reagent 1 R2	Total Volume	ASC DF	Actual Conc.	Actual Conc. Unit	Out of Control Remark
19	SPIKE1-2	001+@	0.2500	0.7661	0.3089	4	10	5	5	20		0.7661	ppb	
20	SPIKE1-A	001+@	0.2500	0.7558	0.3048	4	10	5	5	20		0.7558	ppb	
21	UNK2-1	003		1.8246	0.7298	5	20	0	0	20		1.8246	ppb	
22	UNK2-2	003		1.7800	0.7119	5	20	0	0	20		1.7800	ppb	
23	UNK2-AV	003				5	20	0	0	20			ppb	UNK > 1.0000
24	UNK3-1	003		0.5231	0.2123	5	5	15	0	20	4.0000	2.0924	ppb	
25	UNK3-2	003		0.5047	0.2050	5	5	15	0	20	4.0000	2.0188	ppb	
26	UNK3-AV	003		0.5138	0.2086	5	5	15	0	20	4.000	2.0552	ppb	

The table above is an example of the measurement of Cd. The maximum concentration of the calibration curve has been set to 1ppb. At 1.8ppb, the sample of [003] has exceeded the maximum concentration. As a result it has been automatically diluted by 4 times and re-measured.



For safe furnace measurement

The following safety mechanisms have been incorporated.

- Cooling water flow rate monitor,
- (Ar) gas pressure monitor,
- Overcurrent prevention device (double checked with the breaker and the optical sensor),
- Furnace block cooling check

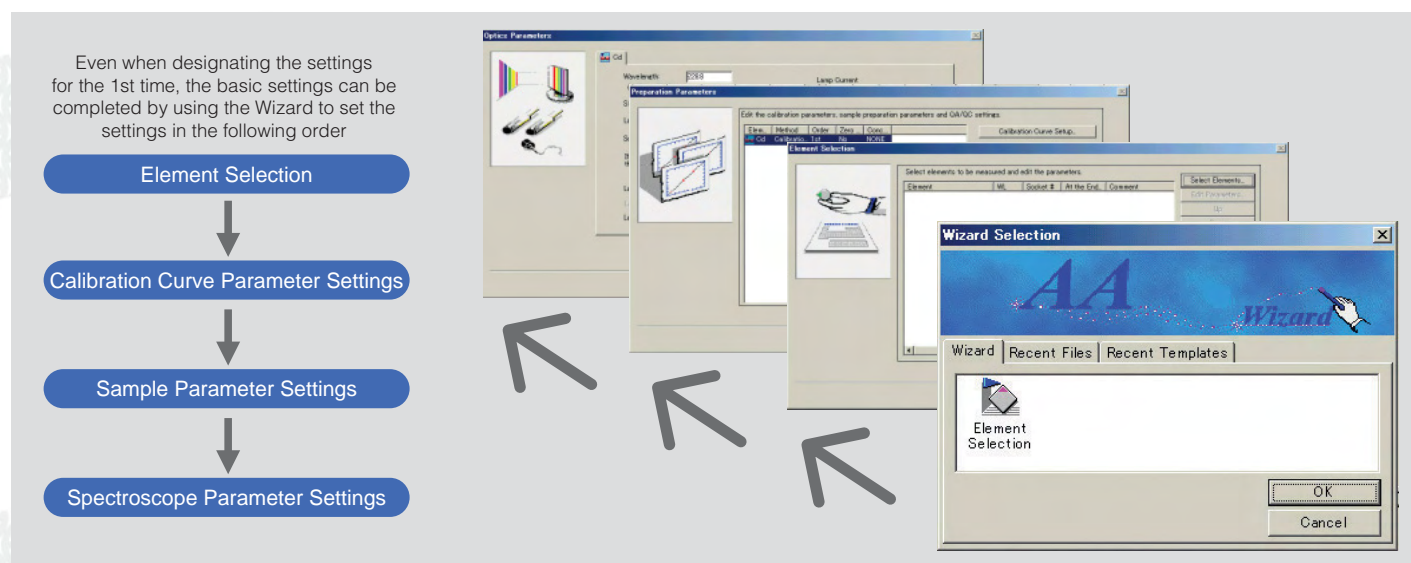
For software that is easy to understand

Characteristics of the “WizAard” Software

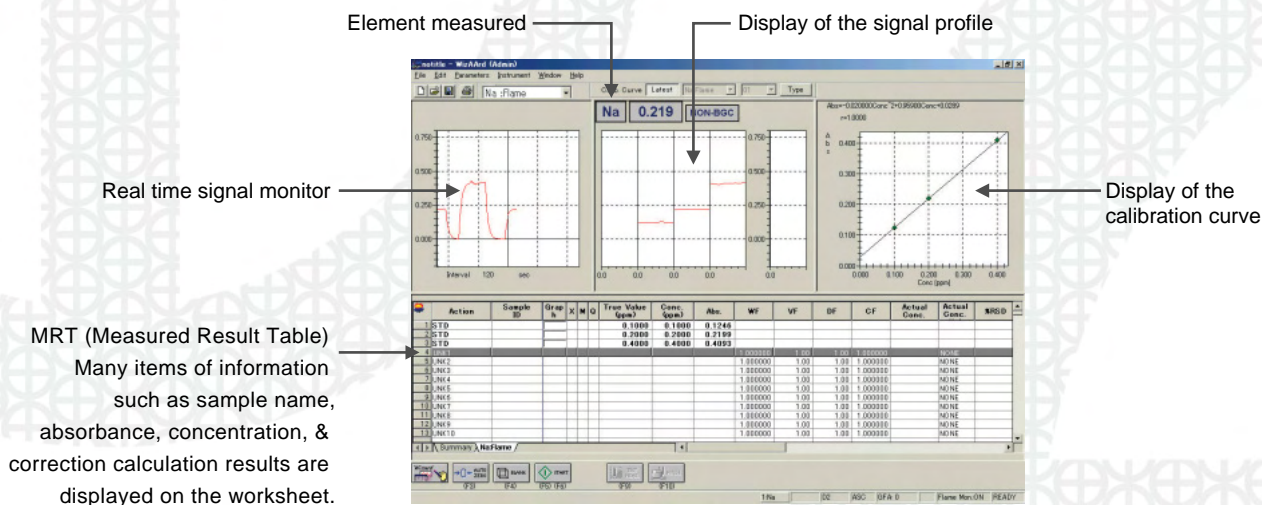
The “WizAard” software used in the AA-6300 operates on Windows XP/2000. It has the following characteristics.

- Provides a Wizard function that makes it easy to set the conditions, even for beginners.
- Equipped with a parameter editing function that enables conditions to be changed rapidly.
- The measurement screen is arranged so that the measurement status can be understood at a glance.
- Equipped with comprehensive data processing functions.
- Complies with the QA/QC of the EPA (U.S. Environmental Protection Agency).
- Equipped with user level management, audit trail, and electronic signature functions.
- Built-in hardware validation software.

Basic settings are completed by setting the measurement conditions in accordance with the “WizAard”



Measurement screen where the measurement status can be seen at a glance



and use, with a high level of security

To realize electronic records of high security

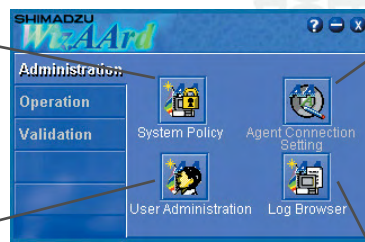
Comprehensive System Management Functions

• System Policy

The System Policy settings allow detailed specifications of password and lockout settings. Security levels can also be set by selecting preset levels from "NO restriction" to "Part11 Compatible".

• CLASS-Agent

Connection to CLASS-Agent permits effective database management for large amounts of longterm data.



• User Management

The user management functions allow user registration to restrict who uses the instrument and to determine the program operation status of each user.

• Log Browser

The Log Browser makes it easy to check a number of logs, including the system change history.

To realize the acquisition of high quality data

QA/QC Compliance

Compliance with QA/QC of the U.S. Environmental Protection Agency (USEPA) is possible.

System Suitability Test

Evaluating the performance of the instrument is easy since hardware validation software is equipped as standard. When combined with the autosampler, the wavelength accuracy, noise level, baseline drift, absorbance, repeatability etc. are inspected automatically, and the result of comparisons with the pass criteria are printed out.

2-way background correction function to enable usage

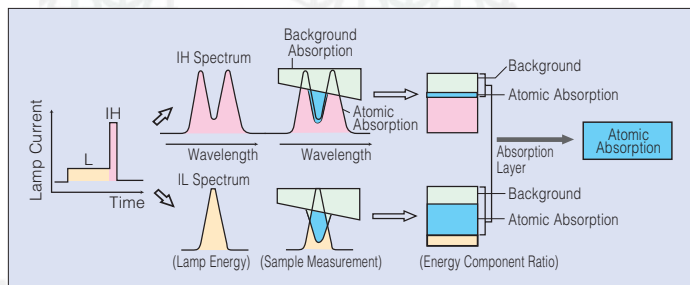
☐ Equipped as standard with the deuterium lamp method (D2 method) and the high speed Self-Reversal method (SR method)

The AA-6300 is equipped as standard with 2 background correction methods: the deuterium lamp method (D2 method) and the high speed Self-Reversal method (SR method). These can be selected at the time of measurement. Both methods are certified in accordance with the JIS standards (General rules for atomic absorption spectrochemical analysis: K0121) and the EPA (U.S. Environmental Protection Agency). Each background correction method has its own characteristics, and the ability to select a method to suit the application and objectives of the analysis is a significant benefit.

For high precision and wide range background correction : Self-Reversal Method (SR Method)

● Principle

A small current IL (about 10mA) and a large current IH (about 500mA) are applied alternately to the hollow-cathode lamp. When the current is large, there is a dip (Self Reverse) in the center of the emission spectrum of the lamp - as shown in the diagram below - because of the self-absorption of the large amounts of atomic cloud sputtered. Atomic absorption is largely unseen, and most of it is background absorption. On the other hand, the emission spectrum during the small current takes on the form of a single peak, and is affected by both atomic and background absorption. By determining the difference in absorbance between the two, an accurate correction for the background absorption can be made, and the true atomic absorption can be measured.



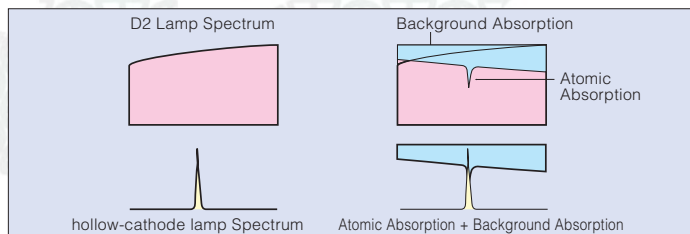
● Features

1. The accuracy of background correction is generally better than the deuterium lamp method. Since the atomic absorption and background absorption can be measured with 1 lamp, the correction error due to a mismatch of the optical axis is exceedingly small. This method is suited to the quantitation of trace constituents in matrices exhibiting complex background absorption, such as biological samples and metallic materials.
2. The background can be corrected over the entire 185nm to 900nm wavelength range.
3. The spectral interference caused by neighboring lines arising out of the resonance lines of other elements in the vicinity of the analytical line of the target element can also be corrected (refer to the table on the right hand page) .
4. The measurements feature no light loss and a high S/N ratio since a polarizer is not used.
5. The high speed illumination enables accurate measurements to be conducted without being affected by the emission noise of the atomizer.

For highly sensitive background correction : Deuterium Lamp(D2)Method

● Principle

With the deuterium lamp method, the hollow-cathode lamp and deuterium lamp are lit up alternately at high speeds. The light from the deuterium lamp maintains a width of 0.1 nm to 5nm even after it is split by the spectrophotometer. As a result, atomic absorption, which is only about 1/1000nm wide, is hardly observed, while the background absorption, such as those due to molecular absorption, which is wide, is observed. On the other hand, since the width of the light of the hollow-cathode lamp is about the same as the width of atomic absorption, the sum of the atomic absorption and background absorption is observed. The background is corrected by determining the difference between the respective absorbances.



● Features

1. The detection sensitivity is better than the Self-Reversal method. For this reason, it is suited to measurements where the matrix is simple and a highly sensitive analysis is required, such as in environmental analysis, and the measurement of ultra-trace impurities in ultrapure water.
2. As the illumination frequency is high compared to the Self Reversal method, the noise due to the emission components of the flame and graphite tube can be removed, enabling the accurate measurement of atomic absorption.
3. The conventional hollow-cathode lamp can be used as it is.

of the optimal background correction method

Examples of elements / wavelengths where spectral interference caused by neighboring lines becomes a problem

Element measured	Analytical line (nm)	Coexisting element	Absorption line (nm)
Al	309.28	Mg	309.30
As	193.76	Fe	193.73
Ca	422.67	Fe	422.64
Cd	228.80	Ni	228.84
Cu	324.75	Fe	324.73
Ga	294.36	Ni	294.39
Mg	285.21	Fe	285.18
Ni	232.00	Fe	232.04
Pb	217.00	Fe	216.95
Sb	217.58	Fe	217.55
Se	196.03	Fe	196.05
Si	251.61	Fe	251.69
Zn	213.856	Fe	213.8589

Choosing a background correction method

Samples suited to the SR method:

Samples with complex matrices (where large amounts of a specific element is included in the main constituent)

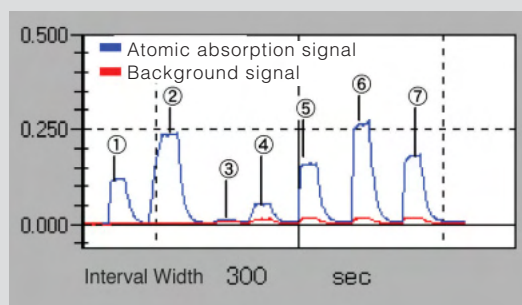
Samples suited to the D2 method:

Samples with relatively simple matrices such as purified water, drinking water, and environmental water

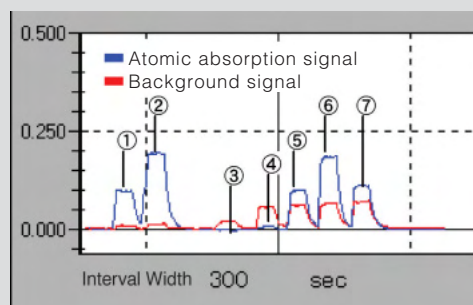
Note:

When using the SR method, the L-2433 type hollow-cathode lamp is necessary. Note that the L-2433 type can be used with the D2 lamp method as well.

When a disparity arises between the D2 method and the SR method (E.g.: measurement of trace zinc in iron)



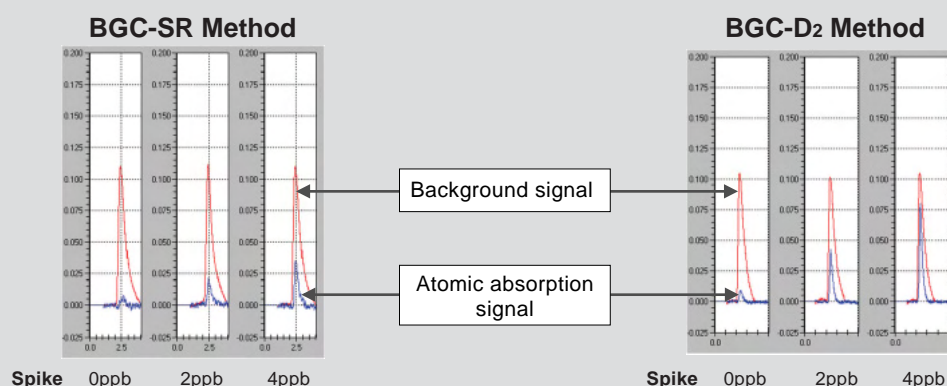
Measurement of Zn in Fe solution by the BGC-D2 method
The absorbance of ⑥ is greater than ② for the same Zn: 0.5ppm solution because of insufficient correction.



Measurement of Zn in Fe solution by the BGC-SR method
② and ⑥ of the same Zn: 0.5ppm solution has been corrected accurately and exhibit the same absorbance.

- ① Zn 0.25ppm
- ② Zn 0.50ppm
- ③ Fe 0.1%
- ④ Fe 0.5%
- ⑤ Fe 0.5%+Zn 0.25ppm
- ⑥ Fe 0.5%+Zn 0.5ppm
- ⑦ Fe 0.75%+Zn 0.3ppm

When there is no disparity between the D2 method and the SR method (E.g.: Molecular absorption, measurement of trace lead in 2% NaCl)



Analysis of Pb in 2% NaCl solution (The sensitivity is higher with the BGC-D2 method.)

A wide variety of accessories can



To quickly and easily switch between flame and furnace

Employs the quick, tool-less switching mechanism, making it as easy and effortless as shown in the photo.



From flame...

Remove the burner head.

Attach the burner head.



...to flame

GFA-EX7i Graphite Furnace Atomizer

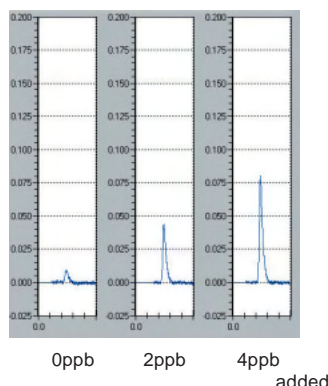
The graphite furnace design achieves

Greater

Conventional GFA			GFA-EX7(i)
Pb	0.12 ppb	Improved	0.085 ppb
Mn	0.02 ppb		0.015 ppb
			(Detection lower limit values)

Easy analysis even of high matrix

Analysis of Pb in 2% NaCl solution



Digital Temperature Control

Digital temperature control places all heating under computer control to achieve optimal heating with little temperature overshoot.

Digital Gas Control

Electronic flow controllers achieve precise inner gas flow control at every stage.

Temperature Control Over Entire Temperature Range

Accurate temperature repeatability over the entire temperature range is achieved by the high-sensitivity optical temperature sensor and built-in automatic temperature correction functions over the current control range.

Unique High-sensitivity Mode

Selecting the high-sensitivity mode during sample atomization achieves more sensitive and accurate microanalysis.

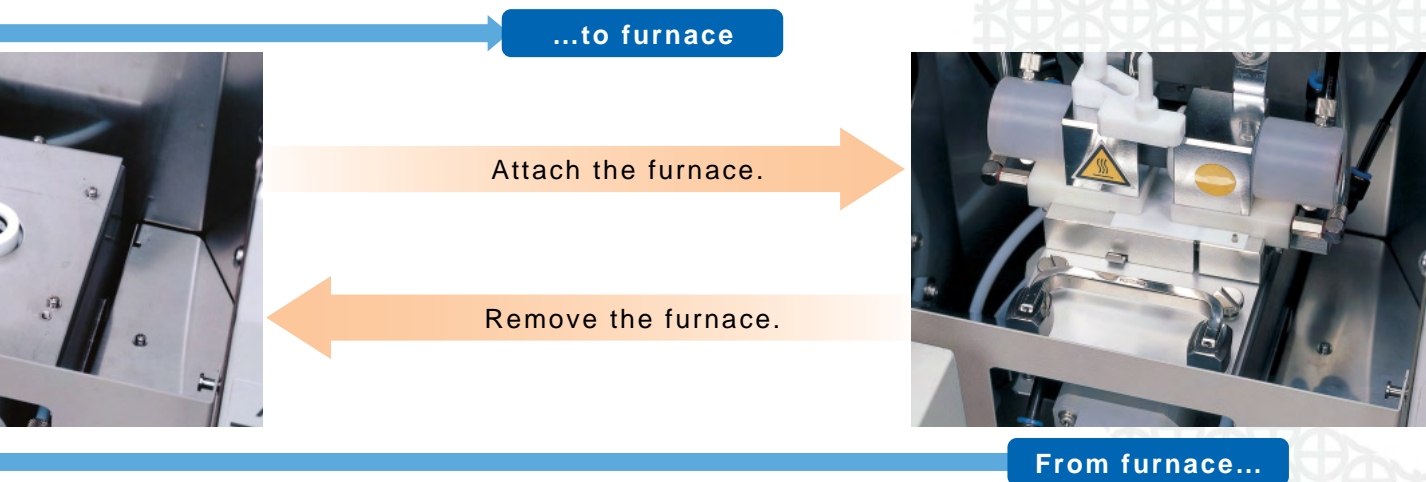
Dual Gas System

Automatic switching between two gases allows the use of air to promote the ashing of organic samples.

Variety of Graphite Tubes (Special Accessories)

Three types of graphite tube (high-density graphite tube, pyro-coated graphite tube, platform-type graphite tube) are available to suit the properties of the analyzed elements and sample.

be used effectively and easily



Various graphite tubes for the GFA-EX7i

High-density graphite tube (P/N: 206-50587)

Although it can be used with all elements, it is particularly effective for low boiling point elements (such as Cd, Pb, Na, K, Zn, Mg).



Pyro-coated graphite tube (P/N: 206-50588)

Effective for elements which tend to produce carbides easily (such as Ni, Fe, Cu, Ca, Ti, Si, V, Mo).



Platform tube (P/N: 206-50887-02)

Suppresses chemical interference caused by coexisting substances. Effective for environmental samples such as seawater and industrial waste, as well as biological samples.



Compressors, Gas Pressure Resulators

Low Noise Air Compressor (P/N: 208-91750- **)

- Working pressure: 0.5 to 0.7MPa
- Tank capacity: 15L
- Power requirements: AC100V 6.2A max. 50/60Hz
- Size: Width 380 x Depth 380 x Height 480mm
- Weight: 26kg

Air Compressor (P/N : 208-91742-91)

- Working pressure: 0.39 to 0.59MPa
- Tank capacity: 12L
- Power requirements: AC100V 4.0A max. 50/60Hz
- Size: Width 210 x Depth 411 x Height 506mm
- Weight: 16kg

Mist Separator Kit (P/N: 206-52458-91)

Completely removes oil and moisture mixed in the air supplied from the air compressor, Required at the time of air compressor use other than the above.

- Size: Width 110 x Depth 201 x Height 252mm
- Weight: Approx. 1kg

Precision Gas Pressure Regulator

Pressure regulator	P/N	Cylinder attachment screw spec.
YR-71 for C ₂ H ₂	040-72020-01	AC2 fixing bracket
MAF85S for N ₂ O	040-72019-11	W22-14RH
MAF106S for Ar	040-72019-21	W22-14RH

Accessories



Standard Accessories

AA-6300 Standard Accessories

Product Name	Quantity	Part No.
AC cable (for 100, 120V power supply voltage)	1	071-60816-12
Hose ASSY (for the gas supply Air) 5m	1	206-50389-91
Hose ASSY (for the gas supply C ₂ H ₂) 5m	1	206-50389-92
Cleaning wire (for cleaning the capillary)	1	201-79229-01
Tube (Teflon tube for sample suction)	2	204-05899-01
Tube (For suction of organic solvent samples)	1	206-50772-91
Burner slot cleaning/ burner height check card	1 (contains 10 cards)	206-52046-91
Seal joint assembly (for gas leak checks)	1	206-52039-91
Polyethylene tubing, No. 3	1 (0.3m)	200-31328-01
Polyethylene tube, 8x1 (drain tube)	1 (2.4m)	016-43201-02
Funnel ASSY (funnel section)	1	206-52021-91
Software (CD-ROM)	1	206-52062-91
RS-232C cable	1	206-50325-91

Caution

•The personal computer, display, printer, hollow cathode lamp, high temperature burner head, pressure regulator, and compressor are not included as standard.

Software to connect AA-6300 WizAard software to CLASS-Agent

Product Name	Quantity	Part No.
WizAard-Agent connection kit	1	206-52310-92
CLASS-Public Agent Ver. 2.2 (English version) 1 license	1	223-18236-92

Caution

•Adobe Acrobat is required to handle PDF files when Agent is used.



The main accessories that can be used with the AA-6300

HVG-1(Hydride Vapor Generator) (P/N: 206-17143)



- Effective in the high sensitivity analysis of As, Se, Sb, Te, Bi. The burner height is automatically set by just placing the absorption cell on the burner head.
- When used in combination with the ASC-6100 autosampler, a maximum of 60 samples can be automatically analyzed continuously.

*The Nozzle ASSY, HVG (P/N: 206-67563) is required for combined operation with the ASC-6100.

MVU-1 A (Mercury Vaporizer Unit) (P/N: 204-21932-01)



- This analyzer employs the reduction-vaporization method as stipulated by official methods, and is designed specifically for mercury. The burner height is automatically set by just placing the absorption cell on the burner head. Flame is not used.



Special Accessories (Refer to the “AA Series Accessories” brochure for details.)

For Flame Analysis

Product Name	Part No.	Remarks
High temp. burner head (titanium)	206-50300-93	5cm slot for nitrous oxide-acetylene flame
Low noise air compressor	208-91750-**	-31 100V, -36 220/230V, For both 50Hz/60Hz
Air compressor	208-91742-91	For AC100V, both 50Hz/60Hz
Mist separator kit	206-52458-91	Required at the time of air compressor use other than the above
Precision gas pressure regulator YR-71	040-72020-01	For acetylene gas
Precision gas pressure regulator MAF85S	040-72019-11	For dinitrogen oxide gas
Precision gas pressure regulator MAF106S	040-72019-21	For argon gas

For Furnace Analysis

Product Name	Part No.	Remarks
Graphite furnace atomizer GFA-EX7i	206-52100-**	-90 200V, -93 220V, -34 230V(CE), -35 240V(CE)
High-density graphite tube	206-50587	
Pyro-coated graphite tube	206-50588	
Platform tube	206-50887-02	
Cooling water circulator CA-1112	044-01809-03	
Cooler connection kit	206-84373-91	Required to connect the GFA-EX7i and CA-1112
Regulator ASSY	206-86147-91	Pressure reducing valve for GFA-EX7i cooling water

Autosampler

Product Name	Part No.	Remarks
ASC-6100F	206-50100-**	-30 100V -39 220-240V
ASK-6100	206-50200-91	
ASK-6300	206-52140-91	Attachment kit for the flame microsampling method and furnace method
Microsampling kit	206-50950-91	Required if performing the flame microsampling method using the autosampler

Hollow-Cathode Lamp

Product Name	Part No.	Remarks
L-233 series	200-38422-**	
L-2433 series	200-38456-**	For the SR method

Other Special Accessories

Product Name	Part No.	Remarks
Mercury Vaporizer Unit MVU-1A	204-21932-**	-01, -30 CE Note 1
Hydride Generator HVG-1	206- 17143-**	-92 115V, -93 220V, -34 230V(CE) Note 2
Atomic muffle SARF-16C	208-97249	Electric cell heater for the HVG-1
Adaptor set 6300, muffle	206-52135-91	To connect the AA-6300 and atomic muffle
Photomultiplier, R787-04	200-38670	Required when performing BGC-SR measurements at wavelengths greater than 600nm

Note

1. When ordering the Mercury Vaporizer Unit (MVU-1A), order the gas flow cell (P/N201-98687), holder for the gas flow cell (P/N202-35867), and the mercury hollow-cathode lamp (P/N200-38422-28) separately.
2. The Nozzle ASSY, HVG (P/N206-67563) is required to connect the Hydride Generator HVG-1 to the autosampler (ASC-6100F).

Specifications

AA-6300

Photometric system	Wavelength range	185 to 900nm
	Mounting	Aberration-corrected Czerny-Turner mounting, Number of grating grooves: 1800lines/mm, Forcal length: 298 mm
	Bandwidth	0.2 0.7 0.7 (Low) 2,0(Low) nm (4 step automatic switching)
	Detector	Photomultiplier (short wavelengths), semiconductor (long wavelengths)
	No. of lamps mounted	6 lamps, 2 user-selected lamps can be illuminated at the same time (1 for measurement,1 warming up for next measurement)
	Photometric method	Flame: Optical double beam. Furnace: Electrical double beam
	Background correction	High-speed self-reversal method (BGC-SR), high-speed deuterium lamp method (BGC-D2)
	Lamp mode	EMISSION, NON-BGC, BGC-SR, BGC-D2,
Data processing	Software requirments	MS-Windows XP/2000
	Parameter settings	Wizard method
	Measurement mode	Flame suction method, flame microsampling method, furnace method
	Concentration conversion mode	Calibration curve method (can be selected from 1st, 2nd, and 3rd orders)
	Repeat analysis	Max. 20 times, Display of mean values, deviation (SD), coefficient of variation (RSD) Automatic exclusion of deviant value by setting SD and %RSD
	Baseline correction	Automatic correction of the baseline drift through offset processing in peak height/ peak area mode
	Signal processing interval settings	Signal processing interval setting in peak height/peak area mode
	Sensitivity correction	Automatic calibration curve correction with sensitivity monitoring
	Tabular data processing	Calculation of final concentration from sample volume, lab bench dilutions, autosampler dilutions, and weight factors
	Multi-tasking	Software such as word processors can be used while the measurements are running
	Parameters recall	Template function available
	Procedure/ results display	MRT worksheet (MRT : Measured Result Table)
	Results printout	Summary report
	QA/QC-related	It is possible to choose between aborting or continuing the measurement in the event of the reference values for the correlation coefficient, LCS, SPK, DUP, %RSD etc. being exceeded.
	Electronic records	• Management using login IDs/ passwords • Access restrictions according to user level • Recording of the log • Audit trail • Electronic signatures
Operational environment	Power requirements	AC100V, 120V, 230V $\pm 10\%$ (no sudden voltage fluctuations) 230VA, 50/60Hz
	Dimensions & Weight	Width 835 x Depth 545 x Height 460mm, 70kg (not including the flue, protruding parts)
	Ambient temp.	10°C to 35°C
	Ambient humidity	20% to 80% (however, below 70% at over 30°C)
Burner unit	Type	Air-cooled premix type
	Burner head	Made of titanium, 10cm slot (the 5cm slot for high temperature flames is optional.)
	Nebulizer	Pt-Ir capillary with teflon orifice and ceramic impact bead (Hydrofluoric acids can be used.)
	Chamber	Polypropylene
	Positioning control	Automatic search for the optimal burner height, automatic adjustment of vertical position, manual adjustment of back and forth position
Gas control unit	Flow rate control	Fuel gas, support gas, automatic flow rate setting (0.1 L/min step), automatic search for the optimal gas flow rate
	Safety measures	• Safe ignition/ extinction sequence • Automatic extinction in a power failure • Flashback prevention through gas pressure monitoring • Prevention of raw gas release when the flame dies out • Burner misuse prevention • Support for safety inspections through software, system safety mechanisms self-diagnostics function

Graphite Furnace Atomizer GFA-EX7i	Heating control system	Drying: Current control system through automatic temperature calibration Ashing, atomization; digital temperature control via optical sensor system
	Heating temp, range	• Room temperature to 3000°C
	Heating conditions setting	• Max. 20 stages • 2 line switching of the inner gas type • Setting of the high sensitivity mode • Enrichment inside furnace Max. 20 time • Optimal temperature program search function
	Safety measures	• Cooling water monitor • Gas pressure (2 line) monitor • Overcurrent protection • Furnace block cooling check
	Cooling water, Ar gas	Cooling water: 0.6 to 1.5L/min (supply pressure 0.08 to 0.15MPa), water temp. 10 to 30°C Ar gas: Max. 3.5L/min, supply pressure 0.32 to 0.38MPa
	Power requirements	AC200V $\pm 5\%$, max. 6000VA, both 50/60Hz
	Dimensions & weight of power supply unit	• 255 W mm x 428 D mm x 460 H mm, 41 kg

- Auto sampler **ASC-6100F**
- Furnace kit **ASK-6100**
ASK-6300

Specifications common to flame and furnace

Function	<ul style="list-style-type: none"> • Zero point detection • Auto rinse • Auto diagnosis • Random access
Max. no. of samples/ reagents	<ul style="list-style-type: none"> • For reagents - 8 positions 60 samples (both can be accessed randomly)
Sample Container	<ul style="list-style-type: none"> • 16mL sample vial (test tube for flame suction), or 2mL (sample cup for flame micro-sampling/furnace) • 40mL sample vial (glass container for flame suction), or 20mL (sample cup for flame micro-sampling/furnace)
Nozzle rinse	<ul style="list-style-type: none"> • Solvent discharge method (during flame micro-sampling/ furnace measurement) • Solvent aspiration method (during flame measurement)
Rinse water bottle	2L
Power requirements	AC100V, 100VA, both 50/60Hz
	ASC-6100F: 330 W x 285 H x 280 D mm, 7.5kg
	If the ASC/ASK is combined: 360 W x 360 H x 280 D mm, 15kg

Furnace / (flame micro-sampling) specifications

Sampling function	<ul style="list-style-type: none"> • Automatic dilution • Automatic reagent addition
Syringe	250 μ L
Injection volume	2 to 100 μ L
Repeatability	1%R.S.D. (20 μ L)
Carryover	<ul style="list-style-type: none"> • Rinse port Below 0.00001 • Mixing port Below 0.00001
Mixing port cleaning	Solvent discharge method Solvent discharge and rinse with next sample
Mixing function	Uses the mixing port Max, mixable volume 600 μ L
No. of reagents added	Max. 4 solutions The injection order of the sample and reagent can be set (when not mixing) The number of solutions that can be mixed are: <ul style="list-style-type: none"> • Calibration curve method: Max. 5 solutions • Standard addition method: Max. 6 solutions
Automatic dilution reanalysis	With the calibration curve created by the measurement results for an unknown sample. <ul style="list-style-type: none"> • Diluted by the factor that is automatically calculated so that it falls within the calibration curve range. • To be set to 10 times in all cases when the factor cannot be calculated.

Personal Computer Specifications

A PC, display, and printer which satisfy the following specifications are required separately.

<ul style="list-style-type: none"> • Compatible OS: Microsoft Windows XP/2000 • RAM: More than 128MB • FDD: at least one 3.5 inch floppy disk drive • Display: XGA(1024 x 768) or better • Keyboard 	<ul style="list-style-type: none"> • CPU: Pentium II 200MHz or better • HDD: More than 20MB required to install the AA software • CD-ROM drive (for installing the software) • RS232C serial port: at least 1 port • Mouse or pointing device • Printer
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Note

- The PC, display, and printer are not included in the standard configuration. Make arrangements to obtain these separately.
- The ASC-6100F, ASK-6100, ASK-6300, GFA-EX7i are special accessories.
- The separate micro-sampling kit is required for flame micro-sampling measurement.
- Windows is a registered trademark of Microsoft Corporation, USA.

Installation Requirements



Precautions concerning the handling and installation location of the system

1. The Table

Prepare a table that is 150cm long (170cm if installing the GFA-EX7i), more than 70cm deep, and strong enough to bear a load of 200kg. Leave a 15 to 20cm space to the rear when installing the system. (The ASC is attached to the instrument. The table is not required for the entire area of the ASC bottom surface.)

2. Ventilation

The room must be ventilated as the combustible gas used in the atomic absorption spectrophotometer may ignite.

3. Flammables

When measuring inflammable samples, take care with the handling of flammables. In addition, a fire extinguisher must be placed just in case there is an accident.

4. The Waste Duct

A duct for discharging the combustion gas of the burner must be installed above the atomic absorption spectrophotometer.

5. Condensation

Avoid using the system in an environment where condensation is likely to occur. The system may not operate normally.

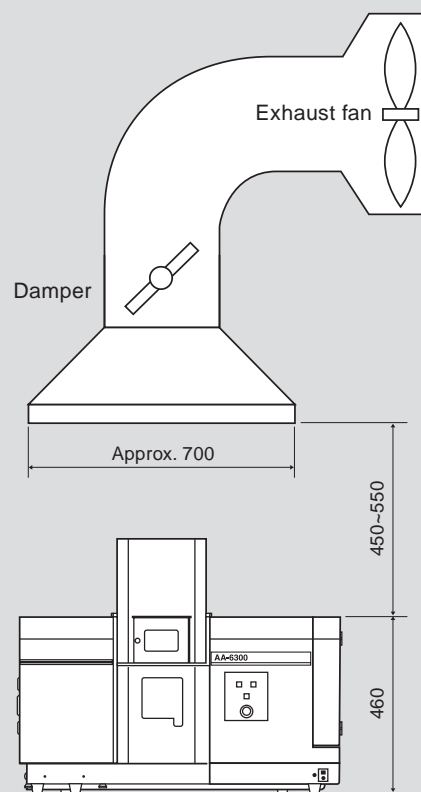
6. The Gas Piping

The cylinder must be placed outdoors. Use metal piping up to within 5m of the system (inner diameter greater than 7mm). Do not use pipes made of copper, silver or mercury (including alloys) for the acetylene piping. Inspect rubber hose sections. Pay particular attention to ensure that there are no gas leaks due to deterioration of the hose.

7. Facilities for Furnace Measurement

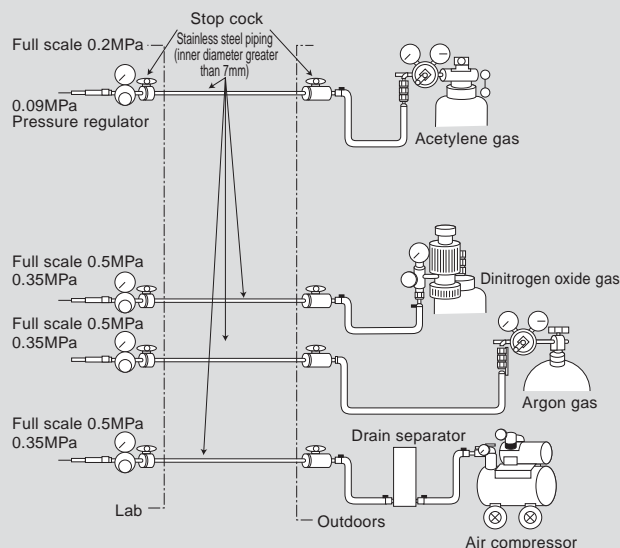
A mains water facility which provides water at a flow rate of 0.6 to 1.5L/min, with a water pressure of 0.08 to 0.15MPa, and at a water temperature of 10 to 30°C is required within 7m of the system (if the water pressure of the facility is high, the pressure can be reduced with the special accessory pressure reducing valve). If a facility such as the one described is not available, make separate arrangements to obtain the special accessory cooling water circulator and cooler connection kit. The maximum consumption of the argon gas for furnace measurement is 3.5L/min.

Example of ventilation implementation



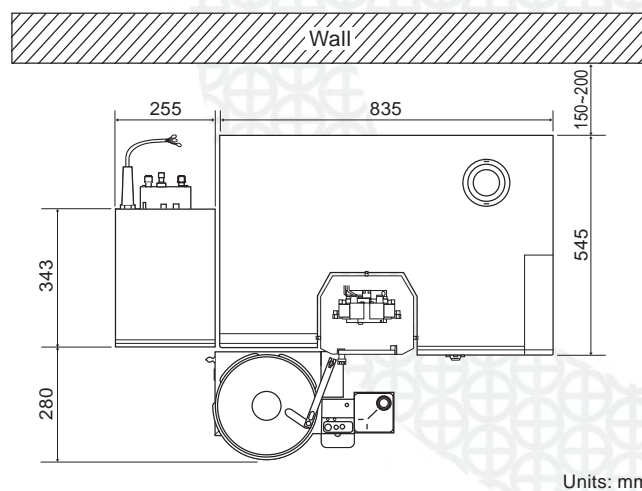
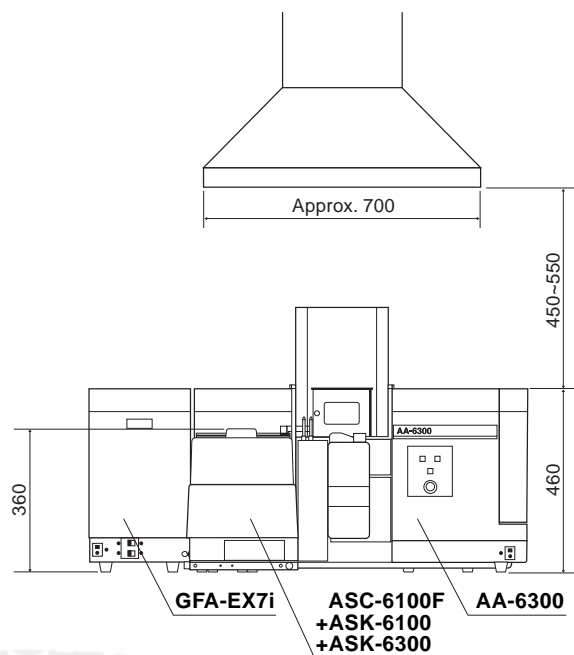
Units: mm

Example of recommended piping for the atomic absorption system



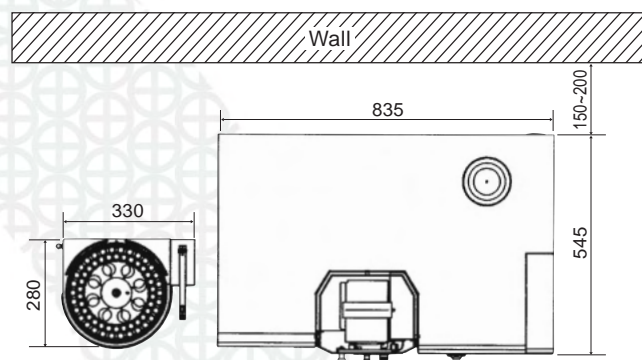
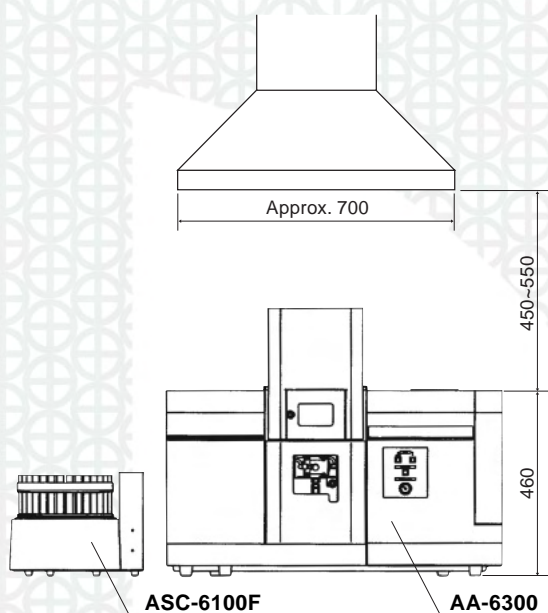
External Dimensions

• For a full system



Units: mm

• For a flame system



Units: mm

Note

- The personal computer and printer are not shown above.

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Note that, in some situations, measurements may be conducted using flames other than those indicated in the table on the right.

Color indicates either the flame type or measurement method

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The hollow-cathode lamp is a consumable as well. By knowing the usage frequency of each lamp, the lamps can be managed efficiently. "WizAArd" is equipped with a Lamp History function, which displays the cumulative no. of hours for which each lamp has been used. As these are managed using the lamp ID, the lamps can be managed individually even if there is more than one lamp of the same element.

Lamp History								
	Lamp ID	Element	Lamp Type	Life Time	Used Time	Unit	Judge	Comment
1	Q1	Q1	Q1	5000	0:0	hrs	OK	
2	A1-1	A1	Normal	5000	0:0	mAhrs	OK	
3	A1-1	A1	Normal	5000	0:0	mAhrs	OK	
4	A1-1	A1	Normal	5000	0:0	mAhrs	OK	
5	A1-1	A1	Normal	5000	0:0	mAhrs	OK	
6	B-1	B	Normal	5000	0:0	mAhrs	OK	
7	B-1	B	Normal	5000	0:0	mAhrs	OK	
8	B-1	B	Normal	5000	0:0	mAhrs	OK	
9	B-1	B	Normal	5000	0:0	mAhrs	OK	
10	C-1	C	Normal	5000	0:0	mAhrs	OK	
11	C-1	C	Normal	5000	0:0	mAhrs	OK	
12	C-1	C	Normal	5000	0:0	mAhrs	OK	
13	C-1	C	Normal	5000	0:0	mAhrs	OK	
14	C-1	C	Normal	5000	0:0	mAhrs	OK	
15	C-1	C	Normal	5000	0:0	mAhrs	OK	
16	C-1	C	Normal	5000	0:0	mAhrs	OK	
17	E-1	E	Normal	5000	0:0	mAhrs	OK	
18	E-1	E	Normal	5000	0:0	mAhrs	OK	



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