

Hitachi High-Technologies

Polarized Zeeman Atomic Absorption Spectrophotometer

Z-2000 Series

HITACHI

Easier Operation, Higher Reliable Analyses,
and Higher Sensitivity Than Ever Before

This is the concept of Z-series of the polarized Zeeman AAS.

Three models are available to meet your specific need.

High Quality Excellent Sensitivity using Zeeman Method and Dual Detector.

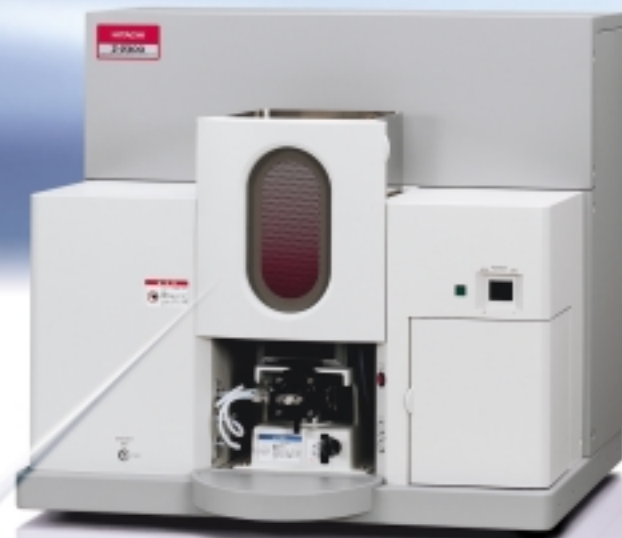
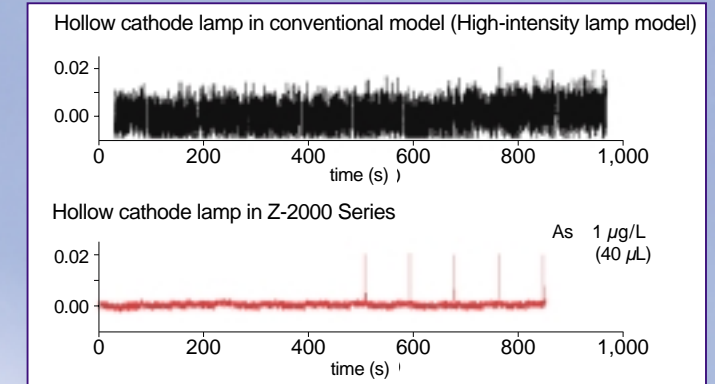
Compact Space of Installation is Reduced (Z-2300/2700)

Useful Design Slim designed with built-in Graphite Furnace Autosampler

Excellent Sensitivity.

The new optical system and the improved graphite furnace power supply circuit ensure high sensitivities. Using an ordinary hollow cathode lamp, the Z-2000 Series spectrophotometer is capable of analyzing As, Se and Sb in tap water and environmental water, which previously have only been measurable using an EDL high-intensity lamp in a conventional graphite furnace analyses.

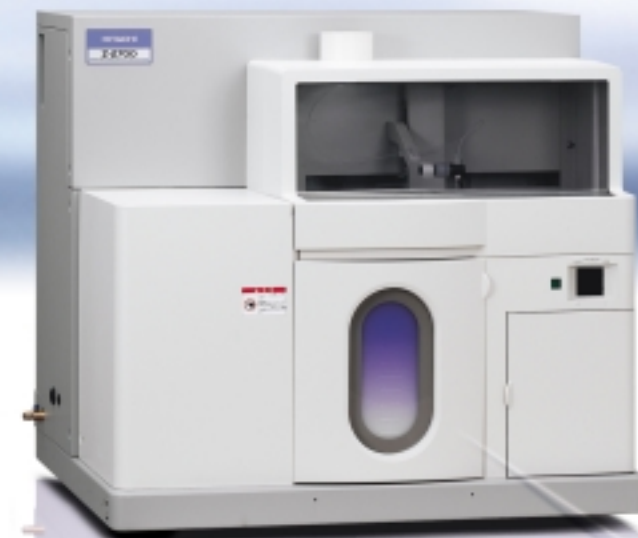
This shows how noise can be reduced significantly to ensure high sensitivity.



Z-2300
FLAME ATOMIC ABSORPTION
SPECTROPHOTOMETER



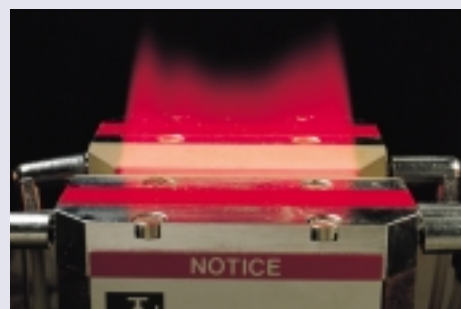
Z-2000
TANDEM TYPE ATOMIC ABSORPTION
SPECTROPHOTOMETER



Z-2700
GRAPHITE FURNACE ATOMIC ABSORPTION
SPECTROPHOTOMETER

Advanced Technology in Flame Analyses

Zeeman background correction possible even in flame analyses.



Principle of Polarized Zeeman Method

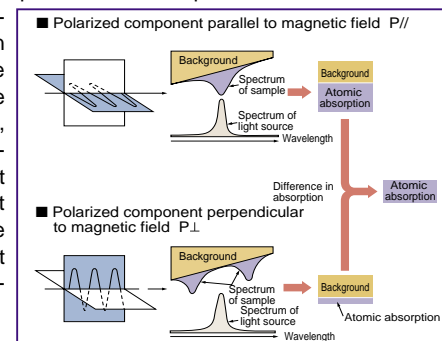
When atoms in a sample are subjected to a magnetic field, the light component polarized parallel to the magnetic field ($P_{//}$) is absorbed by the atoms, but the light component polarized perpendicular to the field (P_{\perp}) is hardly absorbed by them.

On the other hand, the background contribution from molecules and particles remains unchanged even when the magnetic field is applied to them. Therefore, the two polarized components $P_{//}$ and P_{\perp} are absorbed to the same extent by the background molecules and particles.

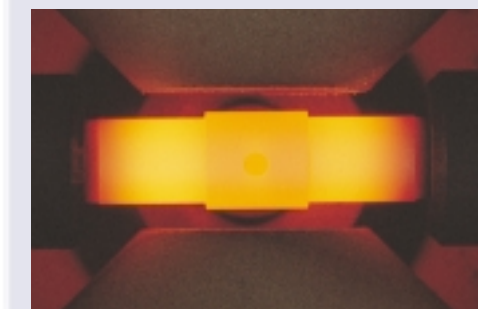
By performing a subtraction of the signals of these two components, the background absorption can be excluded to reveal the desired atomic absorption signal.

The components $P_{//}$ and P_{\perp} are measured at the same wavelength, and therefore complete double-beam photometry is used to produce accurate background correction over the entire wavelength range.

With a continuous spectral light source such as a deuterium lamp method, molecular absorption correction is possible over a limited wavelength range but neighboring-line absorption correction cannot be made. Also, with the Smith-Hieftje method, complete beam consistency is impossible at low and high current levels, and the lifetime of the dedicated light source lamp is considerably reduced.



Outstanding Performance in Graphite Furnace Analyses



Excellent accuracy and sensitivity are provided.

By using a platform cuvette a combination of the Zeeman method and the matrix modifier method permits higher accuracy in analyses.

Z-2000

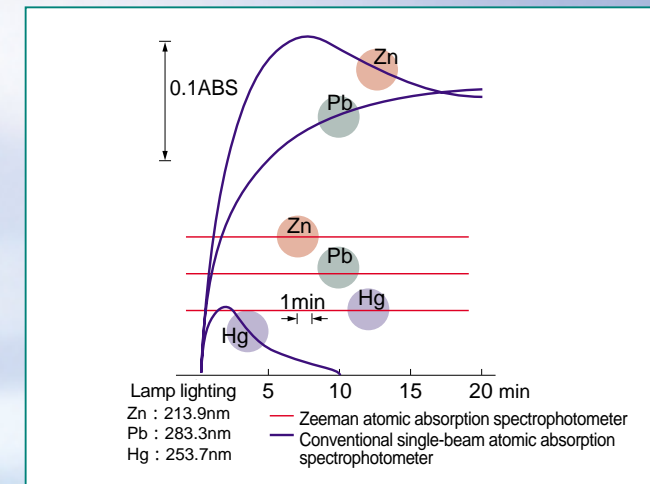
TANDEM TYPE ATOMIC ABSORPTION SPECTROPHOTOMETER

- The polarized Zeeman method featuring low noise and high stability is adopted for both flame and graphite furnace.
- High accuracy analysis is achievable with no need for moving the sample compartment or adjusting the optical system.

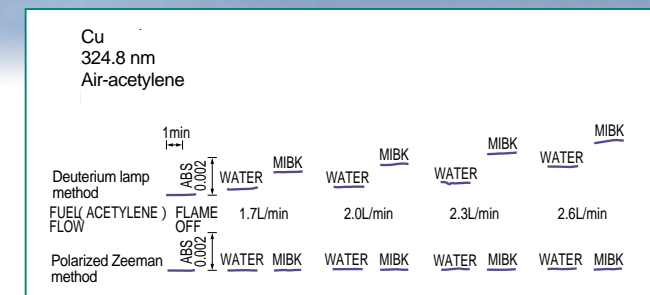
Running Cost Can be Saved by Short Startup Time.

Speedy and stable analysis is ensured by an ideal double-beam photometry in which the polarized Zeeman method is adopted for both flame burner and graphite furnace.

For example, the baseline usually takes 10 to 25 minutes to stabilize in analysis of Pb, Zn, etc. Such a stabilization time is unnecessary for the polarized Zeeman method.

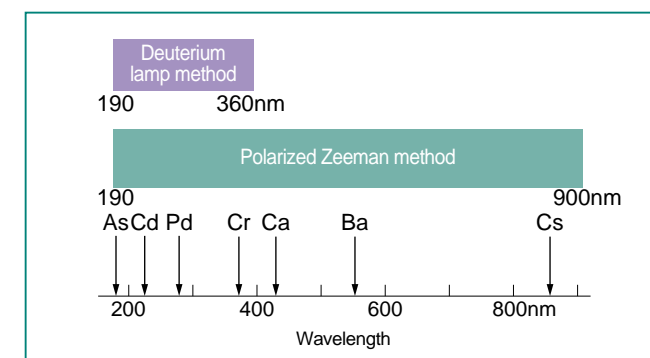


The Baseline is Not Shifted Even with Introduction of Organic Solvent.



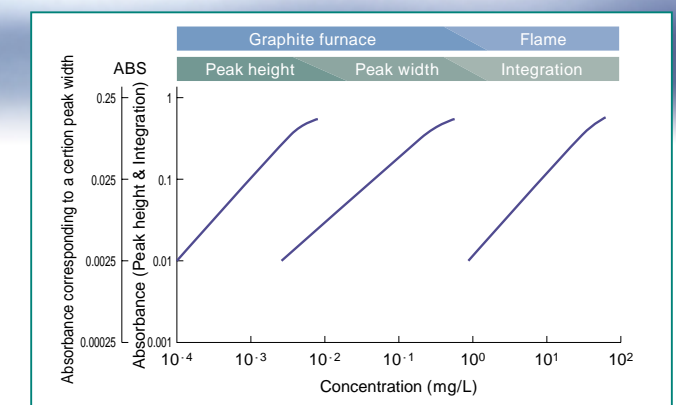
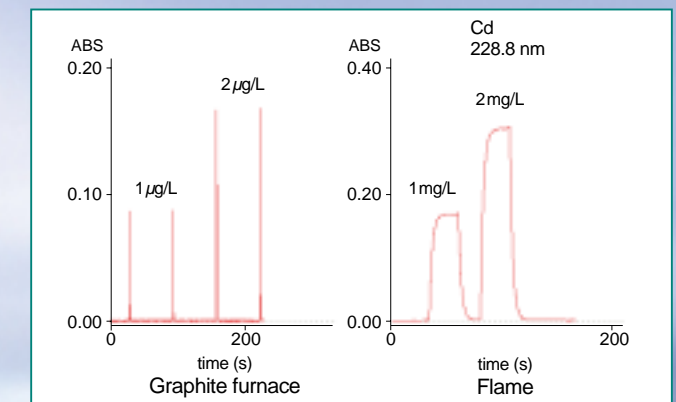
Background Correction Effective for Any Analyte Elements.

Background correction can be carried out over the entire wavelength range using light from the hollow cathode lamp for measurement. The capability of performing atomic absorption and background correction at the same wavelength and in the same spectral width is one of the major advantages of the polarized Zeeman method.



Flame Analyses and Graphite Furnace Analyses Can be Done without Replacing the Atomizer.

- Atomizer selection can be made simply through the software. It is not necessary to replace the atomizer unit nor adjust the optical axis.
- The flame method is suitable for mg/L-level analyses, and the graphite furnace method is applicable to $\mu\text{g/L}$ -level analyses and small quantity sample. Depending on the concentration of analyte and the quantity of sample, you can choose a suitable analytical method.
- In addition to the tandem arrangement, the peak width measurement method is available for graphite furnace analyses. Using this method, you can carry out measurements suitable for a particular concentration range.



Analytical Conditions are Set up Automatically.

- The large-turret lamp holder can accommodate up to eight hollow cathode lamps. The lamp position setting, fine adjustment and lamp current selection are performed automatically for the element of interest.
- A micro-drive spectrum search function is incorporated to detect spectral peaks with high accuracy.
- The analytical wavelength, slit width and detector voltage can also be set automatically.
- A spectral profile can be displayed on the monitor. Using it, the user can check neighboring spectral lines.

Random-Access Autosampling is Available.

- The random-access autosampler function enables measurement of only the samples specified by the user. This feature will contribute to reduction in measurement time and sample consumption.
- The random-access function can be set for each analyte element, allowing automatic measurement of multiple elements. On completion of measurement, the burner chamber is cleaned and then the flame is turned off automatically.



Z-2300

FLAME ATOMIC ABSORPTION SPECTROPHOTOMETER

- The polarized Zeeman method featuring low noise, high stability and high throughput is adopted for the flame burner.
- Easy Operation is supported by the analysis assist, real-time QC and easy start functions.



Combustion Conditions are Set up Automatically.

The manifold-type gas controller has a variety of devices on its metallic block. Safety in operation is ensured by means of these devices and other sensors. The combustion conditions and the flame turn-on/off sequence are controlled by the computer.

A Variety of Safety Functions are Incorporated.

- Full time monitoring of the maximum and minimum pressure of Acetylene gas
- Gas leakage check at flame turn-on
- Auxiliary gas pressure monitoring
- Automatic gas supply shut-off at turn-off of flame
- Interlock mechanism for nitrogen oxide - acetylene gas burner head
- Burner drain liquid level monitoring
- Cooling water flow rate monitoring
- Back flash prevention using auxiliary gas buffer tank at power failure
- Flame sensor error monitoring

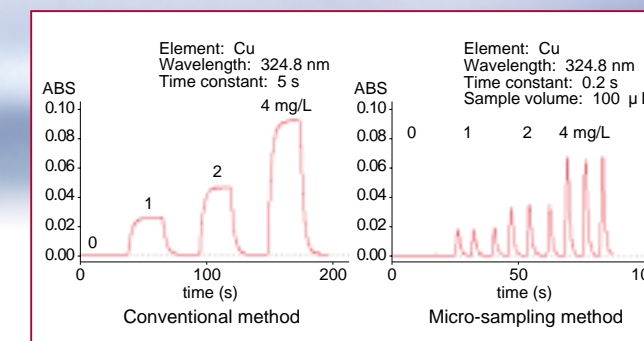
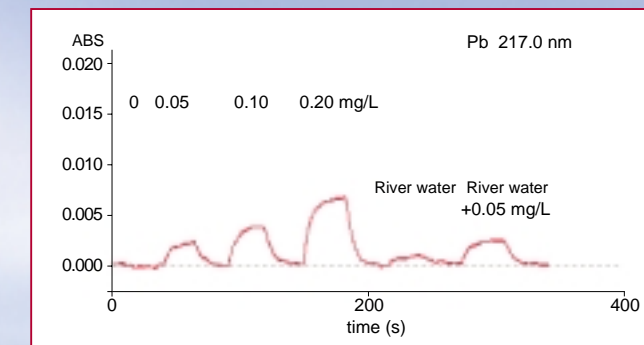
Operating Efficiency Has been Further Enhanced by Flame Switches.

The remote-control switches previously available at option are now replaced with ones standard-equipped on the main unit. Manual analysis can be carried out by switch operation on the instrument front.



Stable Baseline is Obtainable.

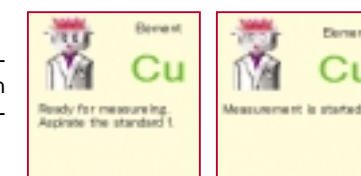
Because the flame and polarized Zeeman method provides a stable baseline, Pb of 0.1 mg/L order is accurately measurable.



The micro sampling method can also be performed efficiently.

Analysis Assist

Progress of measurement is supported by screen messages and voice guidance during analysis.



Real-time QC

QC(Quality Control) function works in parallel with also manual frame analysis.

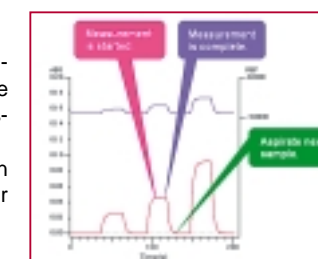
The measurement sequence need not be done over again.

- Check of calibration
- Check of concentration
- Check of QC sample

Easy Start

Measurement is automatically started at the appropriate timing which is judged by the system on sample injection.

Users can carry out an experiment without focusing their attention on the monitor.



Z-2700

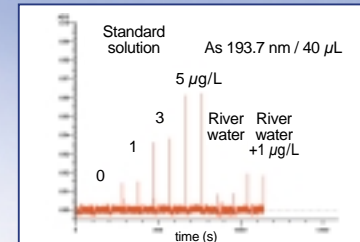
GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROPHOTOMETER

- High-accuracy background correction possible through use of DC polarized Zeeman method.
- Integral design with autosampler (built in main unit), and dustproof cover standard-equipped.



Excellent Sensitivity is Provided.

- Demonstrated below is an example of measurement (repeated two times) on river water with As added. High reproducibility of measurement can be obtained.
- A Measurement Example of As 1 $\mu\text{g/L}$ Standard Solution is shown next. An EDL high intensity lamp is not required as in As measurement. Calibration relationship can be attained at $\mu\text{g/L}$ level of As concentration, which is required for water quality analyses.



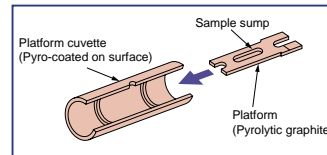
Autosampling System

- Up to 60 samples can be set.
- Up to 100 μL of sample volume can be injected. The volume of sample injection can be set in increments of 1 μL . The autosampler is extremely accurate even for a very small amount of sample.
- Five sample injection speeds can be set. By selecting the most suitable injection speed for the liquid characteristic, the reproducibility can be improved.
- The in-furnace condensation and dilution modes are available for adjusting the concentration according to a particular sample.
- Methanol, ethanol, acetone, MIBK and other organic solvent samples can be used.



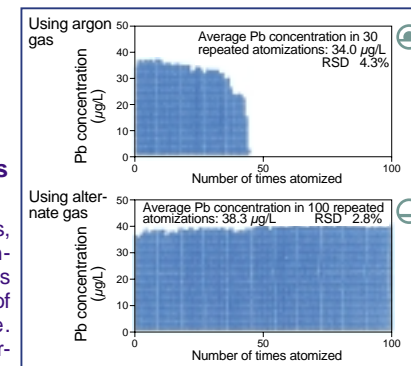
Platform Method is Applicable.

High-accuracy analyses can be made even on a sample having coexistent substances, using a platform cuvette. In this case, when the inside of the cuvette reaches thermal equilibrium, the injected sample is atomized to reduce interference by coexistent substances. In combination with interference reduction by the matrix modifier method, excellent accuracy is ensured in analyses.



Alternate Gas is Available. (Option)

At the ashing stage, an alternate gas (other than argon gas) can be used. By using argon gas containing 5 to 10% oxygen, you can reduce the background and interference. This approach is advantageous in analyses of a biological sample containing a large quantity of organic substances.



Analytical Examples of Pb in Blood

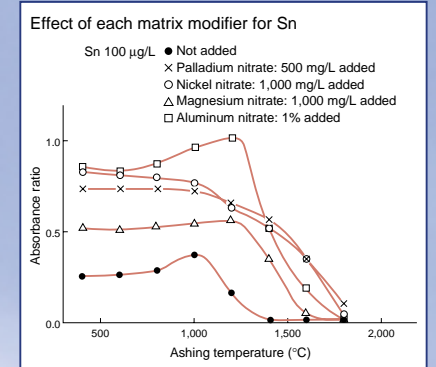
Using platform analyses, the slope of the standard-added curve is almost identical to that of the calibration curve. This proves that no interference occurs due to coexistent substances.

The sample residue condition is shown in the scheme above the data.

Four Kinds of Matrix Modifiers Can be Used Efficiently.

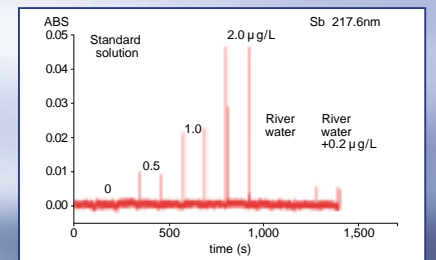
By adding a particular reagent to a sample, it becomes possible to suppress interference and increase sensitivity. Also, since the ashing temperature level becomes higher, this approach is effective for removing coexistent substances including organic species. The recovery rate of the analyte element can be enhanced, the lower limit of detection can be improved, and background components can be removed.

There are different matrix modifiers suitable for each element. Up to four kinds of matrix modifiers can be used.



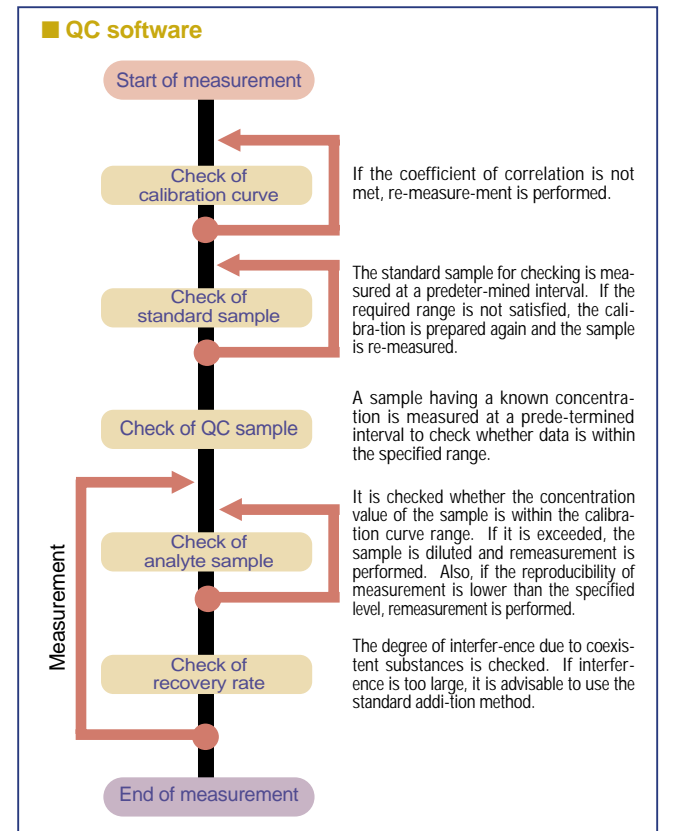
Sample Can be Condensed in Furnace.

Sb measurement can be carried out at lower concentrations due to the concentrating function provided by the autosampler. Shown at right is an example of analysis where the sample was atomized after concentrating 50 mL samples twice in the furnace.



Quality Control (QC) Functions are Incorporated.

The automatic QC sequence function carries out an operational sequence from calibration curve check to sample dilution.



Accessories

A Full Complement of Optional Accessories Available. Select These Accessories to Meet Your Specific Need.

Hydride Generating Unit



- Using sodium borohydride, elements such as As and Se can be analyzed with high sensitivity.
 - This unit provides high sensitivity and high efficiency due to its fast performance. Using a continuous flow method, this unit allows consistent measurements under identical conditions, making it possible to increase accuracy in analyses.
- Applicable analyte elements: As, Bi, Sb, Se, Sn

Heating Absorption Cell for HFS-3

Where higher sensitivity is required in the analyses of As and Se, mount this cell on the burner for heating with an air-acetylene flame.

Mercury Analyses Unit

Mercury is evaporated by adding reductant to a sample solution, thereby ensuring high accuracy in analyses. As a reaction reagent, SnCl₂ is used.

*Desiccant dehumidifying type

Alternate Gas Unit

Using this unit, you can use an alternate gas such as Ar-O₂ mixture. This approach is advantageous in the analyses of a sample containing organic substances.

SSC-110 Flame Autosampler



Having a random access function, this autosampler can handle desired solution samples automatically to shorten the total measurement time. Also, it minimizes consumption of samples.

- Up to 80 samples can be accommodated.
- The random access function can be set for each element. Automatic multi-element measurement can be performed for up to 12 elements.
- On completion of measurement, the burner chamber is washed and then the flame is turned off automatically.

High-Temperature Burner Head

Applicable to the measurement of elements having a high dissociation energy, such as Al, B, Be, Ge, La, Nb, Si, Ta, Ti, V, W and Zr. Use this burner head in analyses with nitrogen dioxide - acetylene flame.



Acid-Resistant Burner Chamber

This burner chamber has excellent corrosion-resistance against aqua regia and hydrochloric acid. Material: Hastelloy C

High-Salt-Concentration Samples

Suitable for measurement of a sample having high concentration of salt. Use this burner in analyses with an air-acetylene flame.

Optical path length: 10 cm, Titanium



Micro-Sampling Accessory Kit

Flame measurement can be made for a sample of less than 0.5 mL. This accessory kit prevents the burner slot from being clogged by sample solution.

Glass Atomizer

Suitable for analyses of a sample solution containing acid that will dissolve metal. Even for a sample containing aqua regia, measurement can be made without corrosion.

Material: Made entirely of glass.

Hollow Cathode Lamps

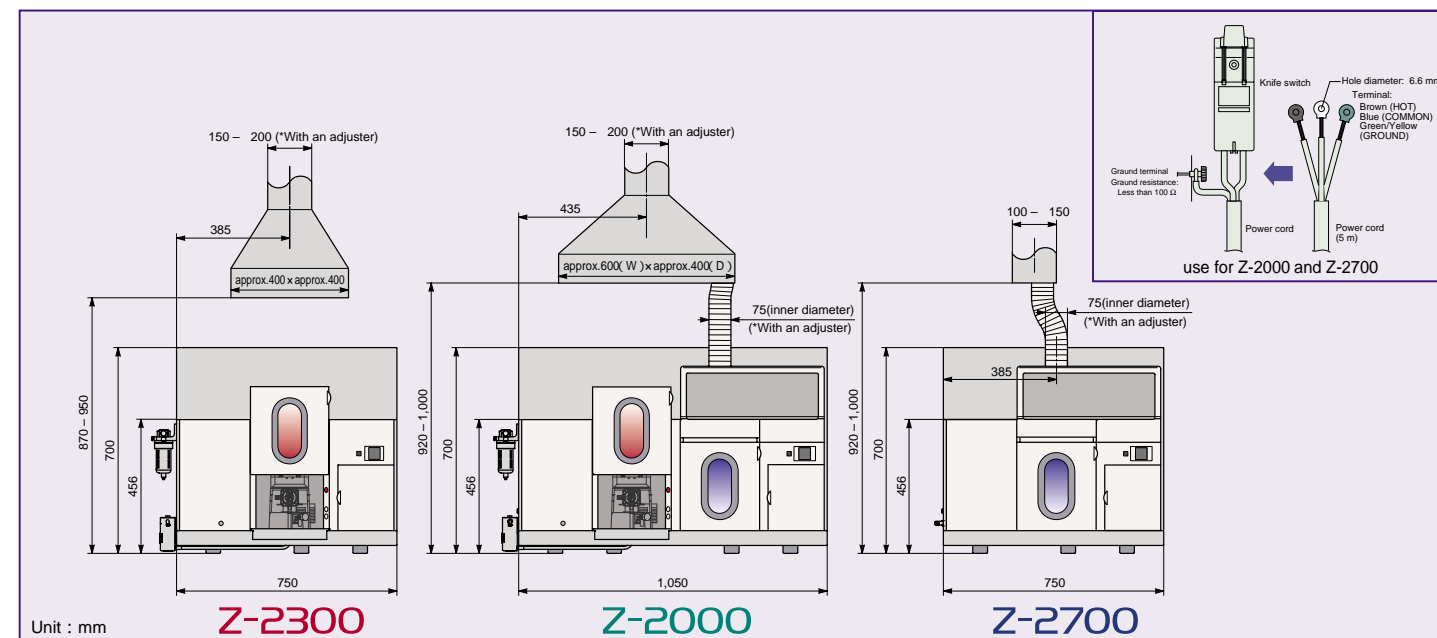


| Elements | Ag, Al, As, Au, B, Ba, Ca, Cd, Co, Cr, Cu, Fe, Ga, Hg, In, K, La, Li, Mg, Mn, Mo, Na, Nb, Ni, Pb, Pd, Pt, Rt, Rh, Sb, Sc, Se, Si, Sn, Sr, Ta, Tc, Ti, V, W, Y, Zn, Zr |
|----------|---|
|----------|---|

A variety of cuvettes are available to meet specific purposes of measurement of particular samples.

| Cuvettes | Purpose, temperature, injection volume | Configuration | Features | Suitable fields |
|--|--|---------------|--|---|
| 7J0-8880 Pyro tube HR | Element analyses with high vapor pressure to 2,800°C to 100 µL 10 pieces/pack | | Generation of carbide can be reduced. Applicable elements: Ba, Ca, Co, Cr, Mn, Mo, Ni, Pd, Pt, Sr, Ti, V | Applicable to analyses of samples in any field. Particularly suitable for high-sensitivity analyses. |
| 7J0-8885 Graphite tube HR | Element analyses with low vapor pressure to 2,800°C to 50 µL 10 pieces/pack | | The atomizing temperature is high. | Applicable to general purpose analyses in any field. |
| 7J0-8890 Cup-type cuvette HR | Element analyses with high vapor pressure to 2,100°C to 50 µL 10 pieces/pack | | <ul style="list-style-type: none"> The sample injection port is large, and diffusion of sample solution can be prevented. Suitable for analyses of a sample having high concentration of organic components, such as blood and urine. Useful for a sample that will bubble at the drying stage. Reproducibility can be enhanced. | Serum, blood, urine, biological samples |
| 7J0-8895 Platform-type cuvette HR 190-6008 Platform | For reduction in matrix to 2,600°C to 40 µL 10 pieces/pack | | <ul style="list-style-type: none"> The sample is heated by radiating heat. Atomization is made at a thermal equilibrium level of gas temperature. Re-combination of coexistent substances and analyte element in the tube can be prevented. Also, interference by matrix can be reduced. Reproducibility can be enhanced. | Serum, blood, urine, biological samples, iron, raw material samples. The platform (190-6008) is put into the platform-type cuvette. Pyro-coating applied. Attaching/detaching jig (190-6009) is required. |
| 172-8805 Ring | Ring for mounting cuvette on electrode part 4 pieces/pack | | Support | |

Installation conditions



| | | |
|---------------------|---|--|
| Water supply /drain | Cooling water | ø12 mm chemical fluid tap (outer diameter) |
| | Water flow rate | Flow rate: 0.5 mL/min (flame) |
| | | Flow rate 2.0 mL/min (graphite furnace) |
| | Water pressure | 35 to 500 kPa |
| | Water supply port | Within 4 m |
| Water drain port | Height: 100 mm or less Opening diameter: 50 mm or more | |
| Gas* | Gas | Supplied pressure (Secondary pressure setting) |
| | Argon | 500 kPa |
| | Acetylene | 90 kPa |
| | Hydrogen | 100 kPa |
| | Nitrogen dioxide | 400 kPa |
| Air | 500 kPa | |
| Room temperature | 5 to 35°C | |
| Humidity | 45 to 65%RH | |

| | | | | |
|--------------|---------------------------|-------------------------------------|---------------|--------------|
| Duct | Material | Stainless steel | | |
| | Dimensions | Approx. 600(W) × 400(D) mm (Z-2000) | | |
| | | Approx. 400(W) × 400(D) mm (Z-2300) | | |
| Suction | ø100 to ø 150 mm (Z-2700) | | | |
| Power supply | Model | Main unit (without PC) | | |
| | | Z-2000 | 220/230/240 V | 6 kVA |
| | Z-2300 | 115/220/230/240 V | 0.2 kVA | Single phase |
| | Z-2700 | 220/230/240 V | 6 kVA | Single phase |

*Install the gas cylinders at a dedicated storage place, provide metallic piping from the gas cylinder storage place to the installation location, and attach a stop valve at each end of pipe.
*Acetylene gas cylinder that is using DMF as the solvent can not be used.
NOTICE: For proper operation, follow the instruction manual when using the instrument.
Specifications in this catalog are subject to change with or without notice, as Hitachi High-Technologies continues to develop the latest technologies and products for our customers.

Specifications

| Model | Z-2000 | Z-2300 | Z-2700 |
|--------------------------------------|---|--------------------------------------|---|
| Analytical method | Flame/Graphite furnace | Flame | Graphite furnace |
| Measurement mode | Atomic absorption and flame photometry | | Atomic absorption analyses |
| Optics | Double-beam method (Polarized Zeeman method) | | |
| Background correction | Polarized Zeeman method | | |
| Monochromator | | | |
| Mount/diffraction grating | Czerny-Turner mount, 1800 Lines/mm, Blazed at 200 nm | | |
| Wavelength range, setting | 190 to 900 nm, Automatic spectral peak setting | | |
| Focal length, reciprocal dispersion | 400 nm, 1.3 nm/mm | | |
| Slit width | 4 steps (0.2, 0.4, 1.3, 2.6 nm) | | |
| Detector | PhotomultiplierA-2 pieces | | |
| Light source | | | |
| Number of lamps, turn-on current | 8 Lamps (turret), 2 Lamps simultaneous lightning, 2.5 to 20 mA (average amperage) | | |
| Lamp positioning | Automatic position setting, fine adjustment function | | |
| Flame section | | | |
| Zeeman-effect magnet | 0.9 Tesla permanent magnet | | — |
| Burner | Pre-mix fish-tail type | | |
| Ignition method | Pilot flame automatic ignition | | |
| Burning condition setting | Automatic flow rate setting of combustion gas | | |
| Safety monitoring function | Optical flame monitoring, flame sensor error detection, fuel/auxiliary gas pressure monitoring, drain liquid monitoring, cooling water flow monitoring, flash-back shock absorption, safety fire extinguishing at power failure (buffer tank method), flow stop check at flame turnoff, prevention of restart at reconnection of power, N:O select safety mechanism | | |
| Graphite furnace section | | | |
| Zeeman-effect magnet | 1.0 Tesla permanent magnet | — | 1.0 Tesla permanent magnet |
| Temperature control | 50 to 2,800°C, overcurrent prevention | | 50 to 2,800°C, overcurrent prevention |
| Heating current control | Optical temperature control, constant current control | | Optical temperature control, constant current control |
| Gas flow rate control | Sheath gas: Ar gas, 3 L/min. Carrier gas: Ar gas 0, 10, 30, 200 mL/min.(4 steps) | | Sheath gas: Ar gas, 3 L/min. Carrier gas: Ar gas 0, 10, 30, 200 mL/min.(4 steps) |
| Safety monitoring control | Ar gas pressure monitoring, cooling water flow monitoring, heating furnace temperature monitoring | | Ar gas pressure monitoring, cooling water flow monitoring, heating furnace temperature monitoring |
| Graphite autosampler | | | |
| Number of sample containers | 60 pcs(1.5 mL container), 96micro plate [option] | — | 60 pcs(1.5 mL container), 96micro plate [option] |
| Modifier container | 5 pcs(25 mL container) | | 5 pcs(25 mL container) |
| Sample injection volume | 1 to 100 µL | | 1 to 100 µL |
| Sample injection reproducibility | RSD 1% or less(5 to 100µL) | | RSD 1% or less(5 to 100µL) |
| Sample injection speed | Selectable in 5 steps | | Selectable in 5 steps |
| Rinse solution discharge | 1 mL | | 1 mL |
| Applicable solvents | Aqueous solution, ethanol, methanol, acetone, MIBK | | Aqueous solution, ethanol, methanol, acetone, MIBK |
| Carry-over | 10 ⁻⁵ or less(for standard aqueous solution sample) | | 10 ⁻⁵ or less(for standard aqueous solution sample) |
| Heating injection function | Yes | | Yes |
| Number of nozzle washings | 5 times | | 5 times |
| Sample condensation (in furnace) | 1 to 25 times | 1 to 25 times | |
| Sample dilution (in furnace) | 1 to 100 times | 1 to 100 times | |
| Data processing | | | |
| Signal measurement method | Integration, peak height, peak area, peak width | | |
| Kinds of signals | Zeeman AA, sample, reference, and emission intensity | | |
| Calibration curve | Standard sample: Up to 10 points, Calibration curve preparation: Least-squares method and Newton method, Approximation function: 3 kinds, Sensitivity correction function, standard addition method, sample standard addition method | | |
| Data processing | Calculation mode, peak width cut-off height specifiable, removal/restoration/replacement of measurement result, change of order number of calibration curve, sample blank processing, zero correction of calibration curve, Baseline correction statistical calculation (mean value, standard deviation, relative standard deviation, determination coefficient) | | |
| Quality Control function | Sample check (detection limit, reproducibility), STD check, Quality Control sample check, calibration curve check, recovery check, element, measurement check | | |
| Parameter/data saving, Help function | Measurement result and measurement signal, instrument status/error information, Instruction message for preventing errors, analytical information | | |
| Dimensions/ weight | 110(W)×63(D)×70(H)cm/189 kg | 75(W)×63(D)×70(H)cm/106 kg | 75(W)×63(D)×70(H)cm/139 kg |
| Power | 220/230/240 V, 6 kVA, 50/60 Hz | 115/220/230/240 V, 0.2 kVA, 50/60 Hz | 220/230/240 V, 6kVA, 50/60 Hz |

Recommended Computer Requirements : IBM PC/AT compatible, Microsoft Windows® XP

*Windows is a registered trademark of Microsoft Corporation, U.S.A.

Notice: For proper operation, follow the instruction manual when using the instrument.

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Printed with soy ink on 100% recycled paper.

Printed in Japan(H) HTB-E020 2004.3