



ANY SAMPLE CAN BE RAPIDLY ANALYZED
WITH NO CHEMICAL PRETREATMENT

AUTOMATIC MERCURY ANALYZER

MERCURY/SP-3D



Fig.1

■ FEATURES

- 1 Very wide application - without "Pretreatment"**
 - Solid / Liquid / Gas
- 2 Ultra high sensitivity - Wide range**
 - 0.01ng ~ 1000ng.
- 3 High precision - Satisfactory reliability**
 - Long MTBF - long life mercury lamp, only clean dry air and mercury gas pass through the absorption cell.
- 4 Easy to use - Low running cost**
 - LCD panel shows the analyzing procedure and result.
- see P.4 SPECIFICATIONS MD-1 Message.
 - Only ambient air is used for all analyzing procedure.
Neither gas cylinders nor special gas are needed.

We believe the key to total mercury analysis is to enhance the thermal decomposition-gold amalgamation method. This is achieved in a system which combines carefully configured ceramics-based hardware with proven software. Results obtained with this system will equal or surpass the performance of highly skilled and experienced analysts who employ other methods. Even a novice will achieve superior results without lengthy training. Careful, comprehensive design and testing of a complete and integrated system of hardware and software are essential if reliable results are to be achieved.

THERMAL DECOMPOSITION, GOLD AMALGAMATION AND COLD VAPOR ATOMIC ABSORPTION METHOD

UOP Method-938, IFP Method MA-4-9606(Adopted)

INTRODUCTION

The MERCURY SP-3D is an automatic mercury analyzer. Two steps gold amalgamation method by heating decomposition with ceramic tube and boat is adopted.

Any sample (solid, liquid, gas) can be rapidly analyzed with no sample pretreatment procedure and with high sensitivity and precision.

The MERCURY SP-3D contains three main blocks, MERCURY ATOMIZER (to be abbreviated to MA hereinafter), MA CONTROLLER (to be abbreviated to MA-1 hereinafter) and MERCURY DETECTOR (to be abbreviated to MD-1 hereinafter) as shown in Fig. 1.

The MA decomposes analytical samples by heating to separate mercury from the gaseous products. The separated mercury is sent to the MD-1 where the cold vapor atomic absorption method is applied for determination of its amount. Digital display of the MD-1 displays amount of mercury contained in weight (ng) and mercury concentration in ppb, ppm, ng/m³.

What is necessary for the operating staff is only to press the 'START' switch after feeding a sample into the MA to obtain the result.

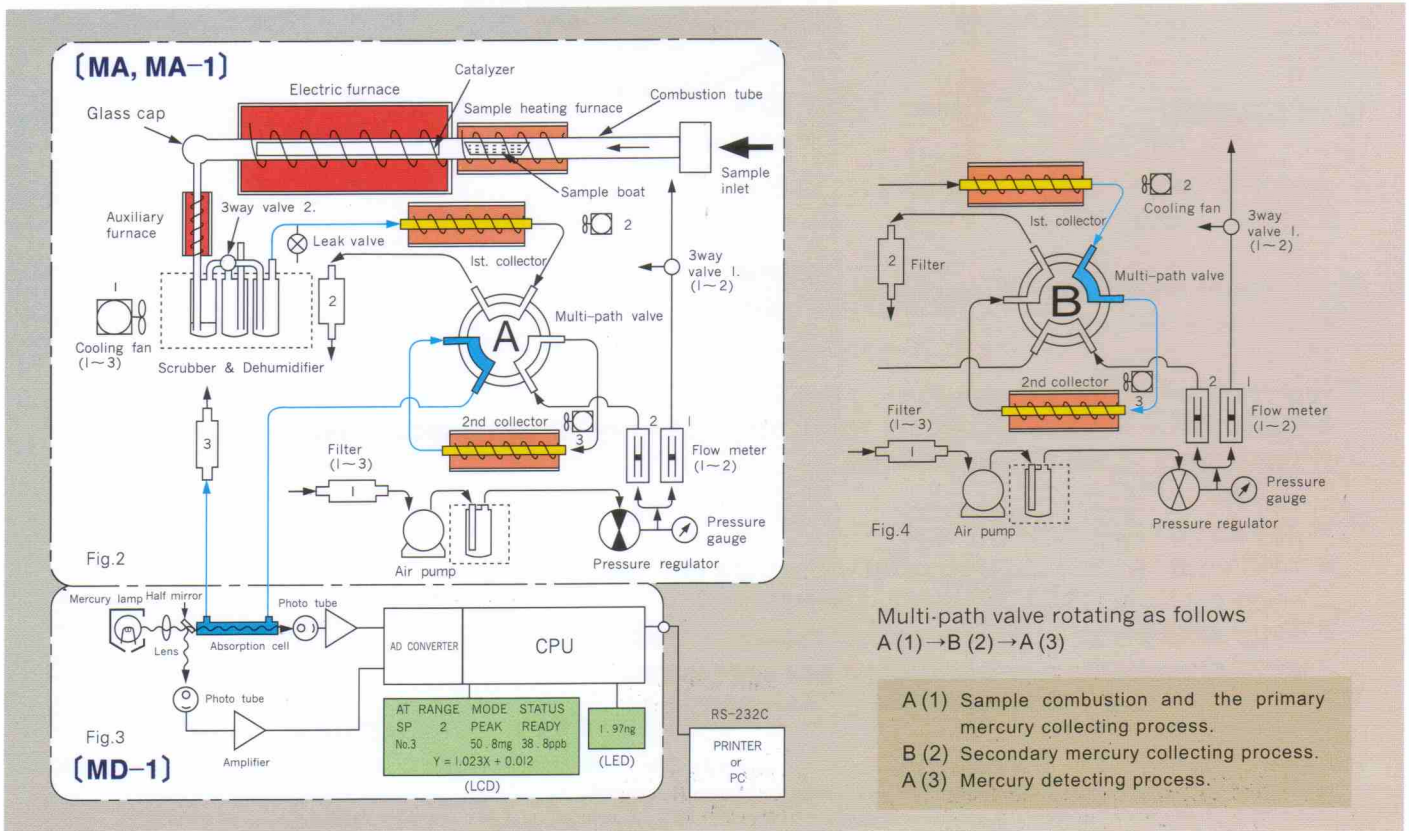
PRINCIPLE OF INSTRUMENTS

All operations from the sample decomposing process to the mercury detection after feeding a sample are automatically carried out with the MA-1. The fed sample is decomposed by heating. Only mercury vapor in the gaseous products is collected in the mercury collector (Diatomite grain coated with gold) as gold amalgam.

Mercury is set free as atomic mercury by heating the mercury collector and is detected at the absorption cell by the cold vapor atomic absorption.

The mercury collector can be used again after setting the mercury free and being cooled. To eliminate the bad influence of gaseous products other than mercury on the atomic absorption analysis, temperature biased two-steps collecting process is adopted. As the result, the mercury vapor is refined and only pure mercury vapor passes through the absorption cell.

FLOW CHART



■ USE THE SP-3D FOR

1.	Standard Reference Material — NIST (NBS, SRM) : 1515, 1568a, 1575, 1577a, 1630, 1633a, 1633b, 1646 NIES : No. 5, No. 10, No. 13 BCR : No. 180 CTA-VTL-2 USGS : AGV-1, BCR-1, G-2, etc.
2.	Living thing — Blood, Urine, Hair, Organs, Plankton, etc.
3.	Food — Rice, Rice-bran, Fish, Butter, Margarine, Milk, Mother's milk, Vegetable, Gelatine, etc.
4.	House furnishings — Cleaner, Paints, Adhesive, Wax, Shoes cream, Sanitary furnishings, Cloth, etc.
5.	Medicine, Cosmetic — Hand cream, Lipstick, Hair lotion, Medicine of cold, Gelatine capsule, etc.
6.	Reagents — H_2SO_4 , NaOH, $Ca(OH)_2$, Na_2CO_3 , etc.
7.	Solid — Coal (Worldwide), Soil, Ore, Fertilizer (Potash-, Sulfate-, Organic-), Feed, Sewage sludge, Plastics (Polyethylene, Intermediate product of ethyleneplant) etc, Wood, Leaf, Paper, etc.
8.	Liquid — Sea water, River water, Lake water, Rain water, City water, Waste water of plant, Crude oil, Naphtha, Heavey oil, Coat tar, Gas condensate, etc.
9.	Gas — Environment atmosphere, Working environment, Semi-conductor producing gas, Flue gas of coal-fired power plant, Flue gas of incineration plant, Flue gas of nonferrous metal smelthing plant, Natural gas, Soil gas for investigating underground resources, etc.

Fig. 5

■ OPTIONS

1. Recording unit - Please make sure recording device is needed, such as "Printer (PR-1) or PC & Software".
2. Pipette set (200) - Pipette and tips with high accuracy and high reliability.
3. Heat-treating furnace (NEW-2) - Temperature can be raised up to 800°C, and "Temperature distribution" inside of furnance is good.
4. Auto-transformer - In case "Voltage" of electric source in not 100V AC.
5. AC stabilizer (ASA-20 II) - In case fluctuation of source voltage is over $\pm 5\%$.
6. Air sampler (PS-4) is available if you want to measure the "Mercury in air" (For other gases, please contact to NIC's Tech. Center).
7. Mercury collector tube (M-160) is available for collecting mercury in gaseous sample, (5pcs / set).
8. Standard (Hg) gas box (MB-1) is available for calibration for gaseous sample.
9. Heating unit of mercury collector tube (RH-S4).
10. Reducing vaporization unit①(S) - In case measurement is done, by "Reducing Vaporization - Gold amalgam method" (ppt level in water)②(R-3) - In case measurement is done, by "Reducing Vaporization method".
11. Sample keeping vessel (SK-1) - To prevent contamination of the sample caused by Mercury in room air.
12. Sample inlet cap for Light Naphtha (CP-1)

■ EXAMPLE FOR SETTING OF THE SP-3D (TOP VIEW)

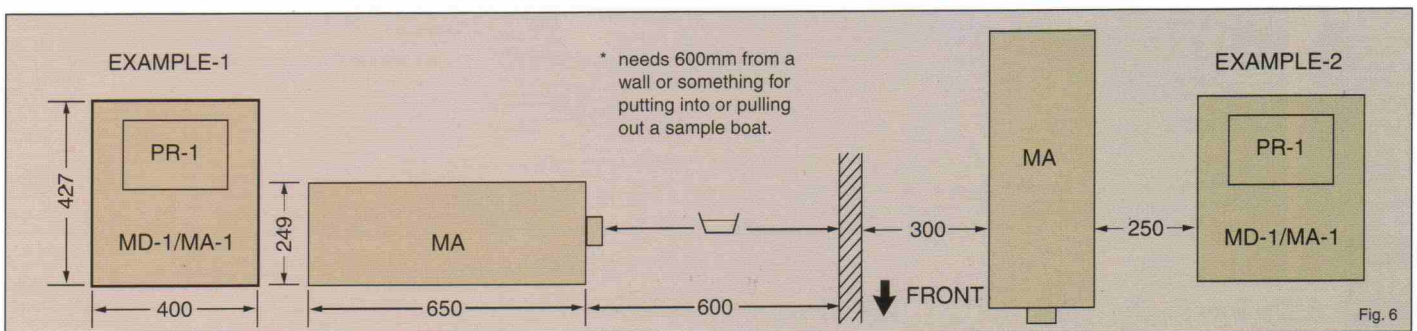


Fig. 6

*NIC is committed to the concept that hardware and software must be properly integrated in any system which performs mercury analysis by the thermal decomposition method. When you need a new software package to deal with a new type of sample, our technical staff will be ready to provide complete support without additional charge.

SPECIFICATIONS

1. Mercury atomizer MA

Method	: Two-steps gold amalgamation method by heating decomposition with a ceramic tube.
Carrier gas	: Purified dry air (incorporated system)
Sample	: Solid, liquid and gas
Scrubber	: Buffer solution and distilled water
Dehumidifier	: Electronic cooling
Dimensions	: 650W x 249D x 525H (mm)
Weight	: 30kg

2. MA controller MA-1

Heating	: 6 sample heating modes
Interlocking	: Interlock circuit with the MD-1 is provided.
Indication	: (1) Heating mode, (2) Sequence
Dimensions	: 400W x 421D x 135H (mm)
Weight	: 14kg
Power	: Single phase 100V AC \pm 5%, 50 or 60Hz, 1.6KVA

3. Mercury detector MD-1

Detecting method	: Nondispersive double beam cold vapor atomic absorption.
Light source	: Low pressure mercury discharge lamp with thermostatic chamber
Detector	: Photo tube.
Wave length	: 253.7nm
Display (LED)	: Digital display of the mercury quantity (ng)
(LCD)	: Concentration: ppb, ppm, ng/m ³ Auto Calibration: 1 point calibration 2 points calibration Multipoint calibration, Manual input Message: Self-diagnosis function (then error message) An equation of calibration curve Measuring condition (Upper functions are performed by a interlocution between operator and CPU)
Sensitivity Range	: 0.01ng in the mercury quantity. : 0 to 2ng, 0 to 20ng, 0 to 200ng, 0 to 1000ng, 4-ranges changeover.
Zero Compensation	: Automatic zero compensator is provided. According to the measuring ranges, a measuring method can be automatically selected out of the two methods. (a) Peak intensity method for the ranges of 0 to 2ng and 0 to 20ng. (b) Integral intensity method for the ranges of 0 to 200ng, and 0 to 1000ng.
Interlock	: Interlock circuits with the MA is provided.
Output	: RS-232C for the printer or PC
Dimension	: 400W x 421D x 135H (mm)
Weight	: 10kg
Power	: Single phase 100V AC \pm 5%, 50 or 60Hz, 70VA

SITE REQUIREMENTS

1. Room to be installed

Room temperature	: 10°C to 30°C
Relative humidity	: 80% or less
Vibration	: There must be no such vibration as may be distinctly sensed by the human body.
Other	: The instrument must not be exposed to direct sun light and the air from an airconditioner, etc.

2. Facilities

Power requirement	: Single phase 100V AC, 50 or 60Hz
Voltage fluctuation	: Within \pm 5%
Power capacity	: 1.7k VA (total of three plug receptacles)
Quality of source	: Surgeous noise to be undetected.
Grounding	: Grounding resistance less than 100 Ω
Space for installation	: Not less than 1200W x 800D mm Table to be provided to bear about 100kg in weight.

If SP-3D is installed in the mercury contaminated room, blank will be high and varied considerably at the time of analysis, because sample is polluted by mercury.
For example:
The room, in which Polarograph is used; The room, in which Polarograph "was" used; The room, adjacent to above; are supposed to be paid attention to.
OPTION 12. (SK-1) reduces those phenomena described above.

STANDARD ACCESSORIES

● Sample boat	10
● Sample boat stand	4
● Sample boat poker	1
● Mercury collector reagent poker	1
● Quartz wool, 1g	1
● Tweezers, spoon	1 each
● Crucible	4
● Combustion tube	1
● Glass cap for combustion tube	1
● Mercury collector tube (M-65)	1
● Additive B and M, 500g	1 each
● Buffer solution (PH6.86), 500ml	1
● Dismounting tool	1
● Thermal isolation tape, Pencil(2B)-lubricant for glass cap	1 each
● Grounding wires (3m, 0.7m)	1 each
● Cables (Power; 2m, Interlock)	—
● Tubes (Teflon, Tygon, Silicon rubber)	—
● Fuses, Joints, O-rings	—
● Instruction manual, Table of heating mode	1 each

OPTIONS— see P.3

NIC MERCURY ANALYZERS

AM, DM, EM, PM, RA, TM, etc.

We have variety of mercury analyzers - So, if you have any problem about mercury analysis, please contact out Tech. Center.

NIC is a group of dedicated professionals continuously developing leading edge MERCURY instrumentation firmly based on science and technology.

Specifications Subject to Change without Notice

NIPPON INSTRUMENTS CORPORATION

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