

**DW-TY-9900 Inductively Coupled Plasma Atomic Emission
Spectrometer**

Operation manual

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Chapter 1 DW-TY-9900 Inductively Coupled Plasma Atomic Emission

Spectrometer (ICP-AES) Overview

1.1 The Main Structure of ICP-AES

DW-TY-9900 Inductively Coupled Plasma Atomic Emission Spectrometer(ICP-AES) consists of sampling system, spark source, dispersion system, control and detection system, and output system.

1.2 Brief Description of the Main Working Principle of ICP-AES

ICP-AES is based on the characteristic radiation generated by the atoms or ions of the measured element being excited in the light source. By judging the existence and intensity of this characteristic radiation, qualitative and quantitative analysis of each element is carried out.

1.3 Application

As a large precision inorganic analytical instrument, DW-TY-9900 ICP Spectrometer is widely used in

1. Steel and its alloys include carbon steel, cast iron, alloy steel, high purity steel, ferroalloy, etc.
2. Non-ferrous metals and their alloys include non-ferrous metals and their alloys, rare metals and their alloys, precious metals, rare earth elements and their compounds.
3. Water quality samples such as drinking water, surface water, waste water, mineral water, electroplating waste water.
4. Environmental samples include soil atmospheric dust, fly ash.
5. Mineral samples such as geological samples, ores and minerals.
6. Inorganic non-metallic materials.
7. Chemical products include chemical reagents, inorganic materials, cosmetics, oil(gasoline, diesel, lubricating oil, C5 and other synthetic gasoline raw materials, oleic acid) petroleum catalysts, urea solutions.
8. Food and drink.
9. Animal, plant and biochemical samples such as plants, Chinese medicine and animal tissues, biochemical samples.
10. Nuclear industry products such as fuel, nuclear.

1.4 Instrument Composition and Working Principle

ICP inductively coupled plasma single-channel scanning spectrometer, is a multi-element analysis of the sequence test measuring equipment. The instrument consists of scanning spectrometer, radio frequency generator, the sample introduction system, photoelectric conversion, control systems, data processing systems, and analysis software. Plasma is generated from the triple concentric quartz tube in a torch. Argon is put into torch pipe in tangent direction, the upper part of torch is coiled with copper loop(intercom cooling water). High-frequency generator generates the high frequency current(40 MHz frequency around 1 KW power) through the coil, producing around Alternating magnetic field, ionizing to produce a small amount of argon ion and electron, in the magnetic field under the accelerated collisions with other neutral atoms, producing more electronic and ions, in the form of eddy current, EDM reacts in the plasma formed under the plasma torch(That is, plasma). The plasma temperature could be up to 10000 K or higher. Aqueous solution measured by the formation of aerosol spray into the center of the quartz torch

channel. Atomic is ionized by energy of outsiders, but the atoms are in unstable state, and from the high-level transition to the ground state, atoms will release tremendous energy, this energy is a certain wavelength of electromagnetic radiation and is sent out. Different elements have different spectral characteristics. These feature spectrum shoots grating of spectrometer through the lens, computer rotates grating by controlling the stepper motor, transmission mechanism posit elements characteristic spectra accurately to the slit, and photomultiplier change the spectrum of light intensity to the current, then deal with the circuit and V/F conversion by computer data processing, the final analysis is made by the printer.

1.5 The Main Features

1. High-quality optical components are equipped with an advanced control system, which ensures accurate scanning and positioning to obtain test result signals with high signal-to-noise ratio.
2. Imported products are used for key components to ensure the accuracy and sensitivity of the instrument.
3. Small matrix effect: 99% of the samples do not need to separate the matrix.
4. Wide measurement range: analysis from ultra-micro to constant.
5. Stability: $RSD \leq 1.5\%$.
6. Fast processing speed, sequential scanning of elements per minute up to 20 or more.
7. It can perform quantitative or qualitative analysis of 70 metal elements and some non-metal elements.
8. High stability: $RSD \leq 2.0\%$
9. The detection limit is very low: reach the national A-level standard.
10. It can do qualitative or quantitative analysis.
11. Convenient analysis software: the third-generation Chinese or English operating software based on Windows XP, Windows7, Windows8, and Windows10 platforms, it makes the operation easier, the software can be used directly without installation.

1.6 The Main Specifications

1. Scan wavelength range: 3600r/nm 180-530nm
2400r/nm 180-800nm
2. Wavelength indication error: $\leq \pm 0.03\text{nm}$, Repeatability $\leq 0.003\text{nm}$
3. Minimum spectral bandwidth: Mn 257.610nm, better than the national A-level standard ≤ 0.015
4. The detection limit(mg/L): Zn213.856nm ≤ 0.003 , Mn257.610nm ≤ 0.002 , Ba455.403nm ≤ 0.001
Ni231.604nm ≤ 0.01 , Cr267.716nm ≤ 0.007 , Cu324.754 ≤ 0.007
Stability: $RSD \leq 2.0\%$

Chapter 2 Working Environment and Facility Requirements

2.1 Working Environment

2.1.1 Room

The effective space of the room is about 12-15 square meters, which is suitable for keeping the temperature. There are reagent cabinets with standard liquid, reagent racks, computer tables and chairs, etc., and 1-2 air conditioners are installed.

2.1.2 Suitable Operating Environment

Ambient temperature: $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ (Temperature change rate within $2^{\circ}\text{C}/\text{h}$).

Relative humidity: 70% or less (dehumidifiers should be installed in areas with high environmental humidity).

Exhaust requirements: Doors and windows are tightly sealed to prevent sand and moisture from entering.

Other requirements: The room is clean, dry, free of dust, no corrosive gas, and no vibration on the ground.

Well grounded: resistance $\leq 4\Omega$.

Plasma spectroscopy is a large-scale precision optical instrument that needs to operate in a certain environment. Losing these conditions will not only make the instrument use poorly, but also the instrument's detection performance will not be fully utilized, even causing damage and shortening its life. According to the characteristics of optical instruments, there are certain requirements for ambient temperature and humidity. If the temperature change is too large, the optical element will be affected by the temperature change will produce spectral line drift, resulting in unstable measurement data, generally, the room temperature is required to be maintained at a fixed temperature between $25 \pm 3^{\circ}\text{C}$, and the temperature change should be less than $\pm 1^{\circ}\text{C}/\text{h}$. If the ambient humidity is too high, optical components, especially gratings, optical mirrors or lenses are easily damaged by moisture or have reduced performance. Electronic systems, especially the components on printed circuit boards and high-voltage power supplies, are easily damaged by moisture. The influence of humidity on the high-frequency generator is also very important. Excessive humidity will cause the plasma to be difficult to ignite, or cause high-voltage power supply and high-voltage circuit discharge to destroy components. Generally, the indoor humidity should be less than 70%, and it is best to control it between 45-60%. If necessary, an air purification device should be provided.

2.1.3 Good Dust Prevention Measures

Exhaust fans need to be installed in laboratories with spectrometers, when the exhaust fan is working, there is a pressure difference between the laboratory and the outside, a negative pressure is generated inside the laboratory, and the outdoor air containing a lot of dust flows into the room through the gaps between doors and windows. A large amount of it accumulates on various parts of the instrument, and it is easy to cause high-voltage components or connectors to ignite, circuit boards, wiring, sockets, etc., short circuits, leakage, and various faults. Therefore, frequent dust removal is required.

Especially computers, electronic control circuits, high-frequency generators, etc., are regularly

disassembled or opened, cleaned with a small brush, and at the same time, use a vacuum cleaner to absorb the dust in each part. For the negative high-voltage power cord of the photomultiplier tube, the high-voltage cords and connectors of the computer monitor, use gauze moistened with a little absolute alcohol to carefully wipe off the carbon and dust.

For the dust removal of the instrument, the help of electronic instrument repair professionals. If the user or manager of the instrument does not understand the structure of the instrument, do not move it easily to avoid accidents. The dust removal should be carried out before stopping and turning off the power supply.

2.2 Power Supply and Auxiliary Material Configuration

2.2.1 Stable Power Supply System

In order to ensure the safe operation of the ICP-AES, the power supply line must have a large enough capacity, otherwise the voltage drop of the line during the operation of the instrument is too large, which will affect the life of the instrument. As a precision measuring instrument, it also needs a relatively stable power supply, and the change in power supply voltage generally does not exceed $\pm 1\%$. If it exceeds this range, you need to use a precision purified AC power supply, as the general voltage stabilizer generates clipping when the voltage is high, it causes electric pulses, which affects the work of electronic computers, microprocessors and phase sensitive amplifiers, and causes malfunctions. The continuous sine wave power supply can ensure the normal operation of these electronic circuits. The power supply circuit of the instrument should be obtained separately from the distribution board of the power supply transformer. Try not to share a power supply line with large motors, large ventilators, air conditioners, muffle furnaces and other large electrical equipment. In order to avoid large fluctuations in the voltage of the power supply line when these electrical equipment are started, resulting in unstable operation of the instrument. Generally, the ground wire resistance of the spectrometer should be less than 4Ω , and the computer ground wire resistance should be less than 0.25Ω (ASTM) to prevent mutual interference.

In the operation of the instrument, the operator should always pay attention to the change of the power supply voltage, and you cannot work under over-voltage or under-voltage for a long time. When the instrument works under over-voltage, the life of the tube will be greatly shortened(below 20% of the normal life). If working under the condition of insufficient voltage, the temperature of the electron tube filament is too low, it will also easily cause the aging of the electron emission material, and also shorten the life of the electron tube. Large fluctuations of the power supply voltage during the operation of the instrument will also cause the instability of the output power of the high-frequency generator, which will have a great impact on the measurement results. Therefore, the quality of the power supply must be guaranteed.

2.2.2 Power Requirements

DW-TY-9900 ICP-AES needs AC single-phase 220V/50Hz power supply. If the voltage fluctuation is greater than $\pm 1V$, it needs to be equipped with 10KVA precision purification AC regulated power supply(output accuracy $\leq \pm 1\%$, response time $< 20-80ms$). The power requirements of each part are as follows:

DW-TY-9900 ICP-AES host: single-phase AC(220 ± 1)V/50Hz, 2kVA(The wire cross section is not less than 4mm²).

Microcomputer system:single-phase AC(220 ± 1)V/50Hz, 500VA

Cooling water tank:single-phase AC(220 ± 1)V/50Hz, 1.5kVA

Exhaust equipment: single-phase AC(220±1)V/50Hz, 20W

Breaker: each one of 60A, 32A, 20A, two 10A.

2.2.3 Grounding Requirements

The ICP host must be grounded reliably, and the size of the ground wire substrate should not be less than: a copper plate with a length of 400(L)mm × 300(W)mm × 3(H)mm. The lead between the substrate and the ICP should not be less than: a copper with 20(W)mm×0.5(H)mm. The copper plate needs to be buried at a depth of 2 meters underground, pour 1Kg of slat, add water, and then use a copper tape to connect to the ground of the indoor instrument. The ground wire resistance should be less than 4Ω. When burying the copper plate, remove the large stones in the soil).

2.2.4 Gas Requirements

It needs two bottles of argon gas 1-2 (purity is 99.99%) and two oxygen pressure reducing regulators. The inlet pressure is 2.5MPa, and the outlet pressure adjustment range is 0-1MPa. When in use, the outlet pressure is adjusted to 0.25 MPa.

2.2.5 Cooling Water Requirements

When installing the smart cooling water tank, add 35 liters of distilled or purified water to the PVC water tank of the cooling water tank.

2.2.6 Exhaust Requirements

The gas exhausted by the plasma chamber is mainly argon, but there will also be some metal vapors and solvents, so an exhaust duct is required, it is recommended to buy φ110PVC pipe and φ110PVC elbow tee, with an axial fan to lead the exhaust gas to the outdoors.

2.3 Other Requirements for Laboratory

A) DW-TY-9900 ICP-AES is floor-mounted and mobile and comes with its own operating table. The user only needs to prepare reagent racks and cabinets for spiked liquids and reagents and a computer table.

B) Its use environment needs to be clean and dust-free, and the room temperature should not be drastically changed. In order to prevent acid, alkali and other corrosive gases from corroding the instrument, the ICP room must be separated from the chemical room.

C) For the ICP analysis of ultra-trace amounts (especially Ca Mg Si Zn P) and elements that are easily polluted by the environment, the indoor environment and utensils should be particularly careful, and the deionized water or quartz double distilled water used must be qualified.

Chapter 3 Installation

3.1 Unboxing

A) After unboxing, checking that the instrument is complete with parts and accessories according to the packing list.

B) Please prepare the working conditions of the instrument and the necessary laboratory conditions according to the requirements of this manual.

C) Please carefully read the various instructions of the instrument, and be familiar with the principle, structure and use method of the instrument.

D) Trainees cooperate with training engineers for instrument installation.

3.2 Installation

Take out the main unit and various accessories and supporting parts from the packing box. The bottom corner of the main unit ICP is equipped with a shock absorber when it is shipped. Remove the shock absorber after unpacking. The back of the DW-TY-9900 ICP-AES, from left to right are main ICP power socket, ground wire, cooling water inlet and outlet(two parts), plasma gas and carrier gas inlets.(Fig.1)

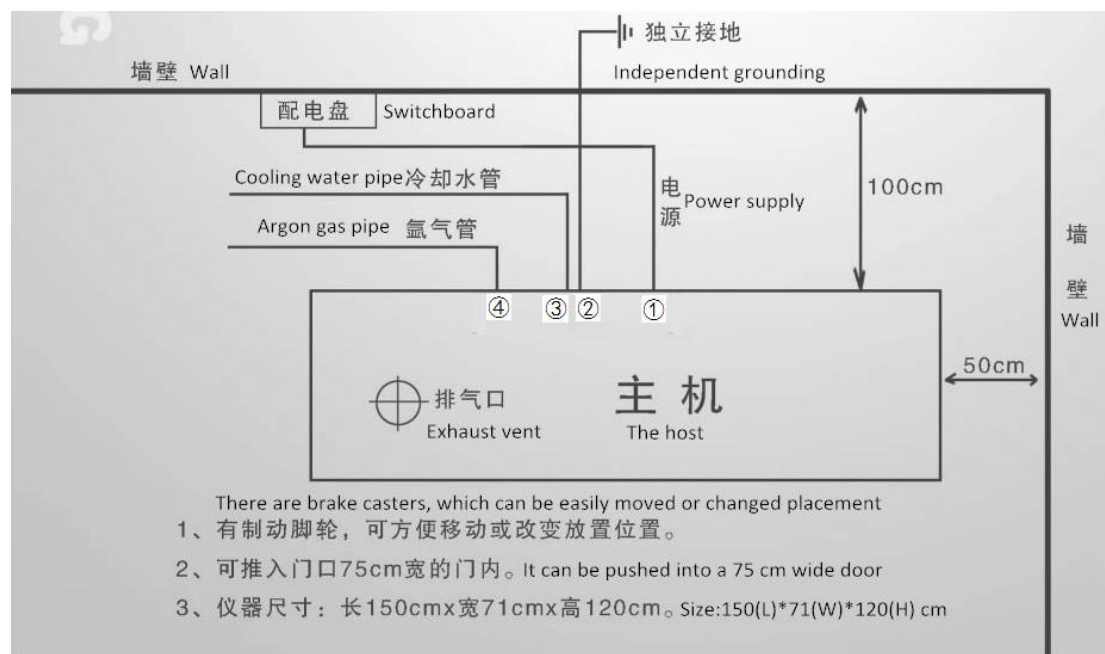


Fig.3-1 Schematic diagram of the installation position of DW-TY-9900 in the laboratory

ICP host power socket(In the picture ①): connect the AC stabilized power supply, which is connected the 60A circuit breaker of the ICP room distribution panel(the AC power supply is not necessary if the power grid is of good quality). It is best to pull the power supply in the laboratory separately from the power distribution room and separate the phase wires from other high-power equipment. The phase line of the host DW-TY-9900 ICP-AES should be separated from the phase line of the auxiliary equipment such as the cooling circulating water tank. The power supply to the DW-TY-9900 ICP-AES room should first be connected to a 60A circuit breaker, and then respectively connected to 32A, 20A circuit breakers, and 10A circuit breakers to supply

different supporting equipment(Fig.3-2 is the circuit breaker installation wiring diagram). If the distribution panel cannot be equipped with 5 circuit breakers, the axial flow fan and the computer socket can be used without circuit breakers.

Ground wire(In the picture②): the ground wire introduced from the outside is connected to it

Cooling water inlet and outlet(In the picture ③): it is connected to the water tank, the water outlet of the water tank is connected to the water inlet of the host DW-TY-9900 ICP-AES, and the water inlet of the water tank must be connected to the water outlet of the host DW-TY-9900 ICP-AES. (When the handle of the water tank valve is parallel to the water flow direction, it is open)

Plasma gas and carrier gas inlet(in the picture④): they are respectively connected to the argon cylinder with a $\phi 6$ PU tube through an oxygen pressure reducing regulator.

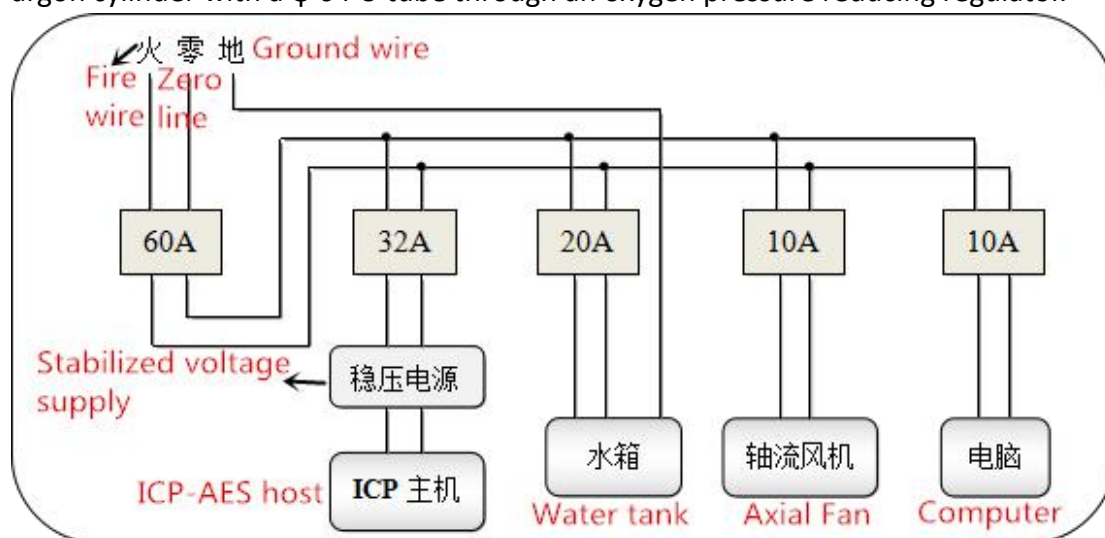
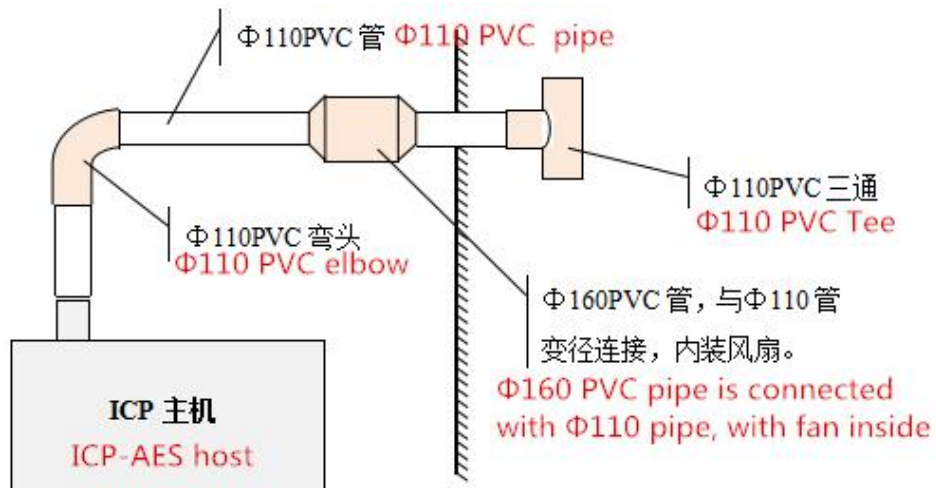


Fig.3-2 Circuit breaker installation wiring diagram

Sampling system installation: the parts of the sampling system are mostly fragile. It is recommended that users do not dispose of them by themselves, and the installation is guided by our company's engineers.

Exhaust ducts: When using DW-TY-9900 ICP-AES for analysis and testing, the exhaust gas is mainly argon, but there are also some metal vapors and various gaseous substances generated. Therefore, exhaust equipment should be installed above the DW-TY-9900 ICP-AES sampling system.

Location of suction vent: the air outlet should be installed above the plasma chamber of the ICP host, and the installation of the exhaust equipment can refer to Fig. 3-3



Exhaust system: one $\Phi 110$ PVC elbow and one tee, one pipe clamp, several $\Phi 110$ PVC pipes (about 4m).

排风系统： $\Phi 110$ PVC 弯头和三通各一个，管箍一个， $\Phi 110$ PVC 管若干（4m 左右），PVC 胶水一桶，内装风扇的 $\Phi 160$ PVC 短截管，为 ICP 厂家赠送。

Fig. 3-3 Schematic diagram of installation of exhaust equipment

Exhaust volume: the size of the exhaust air volume, it is advisable to stick a piece of paper on the air outlet, which can be gently sucked. If the exhaust air volume is too large, it will affect the flame stability, and if it is too small, it will not be able to exhaust air. The specific situation depends on the length, thickness and direction of the exhaust pipe.

Other installation: there are two sockets on the side of the ICP host, one is the control circuit power port, and the other is the serial port for communication with the computer. The power port is directly connected to the 220V power socket, and the serial port needs to be connected to the RS232 interface on the back of the computer host with the provided communication cable (when there are two RS232 interfaces on the computer, you can use any of them).

After installing the instrument, do not move the position of the instrument at will. Because the ICP-AES contains precision optical instruments, a large amount of shaking may cause the optical components of the spectrometer to be misaligned and affect the accuracy of the analysis results. If the instrument needs to be relocated, please contact the company's customer service.

Torch installation method(See below)



3.3 Acceptance

According to the above requirements and regulations, after the installation of the instrument is completed, the acceptance of the instrument can be carried out. Before acceptance, Trainees should carefully read the operating instructions, understand the functions of the various knobs of the instrument, and be familiar with the operating methods and steps of the instrument, and then start powering on the instrument. Do not allow people who do not understand the instrument to operate or disassemble the instrument, so as to avoid human malfunction or damage to the instrument.

3.4 The Packing List

No.	Item	Quantity	Specification
1	主机 ICP-AES (DW-TY-9900) Host	1 Pc	
2	计算机 Computer	1 Set	
3	打印机 Printer	1 Pc	
4	石英炬管 Quartz torch	2 Pcs	
5	高效雾化器 High efficiency atomizer	2 Pcs	
6	雾室 Fog chamber	2 Pcs	
7	雾室盖 Fog chamber cover	1 Pc	Form a complete set
8	雾室盖密封圈 Fog chamber cover sealing ring	2 Sets	1 big, 2 small
9	废水瓶 Waste bottle	2 Pcs	
10	炬管夹子 Torch clamp	2 Pcs	
11	智能温控冷却循环水箱 Temperature controlled cooling circulating water tank	1 Set	
12	排风系统 Exhaust system	1 Set	轴流风机 Axial Fan
13	主机电源线 (防水) Host power cord (waterproof)	1 Pc	4 平方防水线 4 square waterproof line
14	水管 Water pipe	15 Meters	$\Phi 10 \times 6.5$
15	气管 Gas pipe	15 Meters	$\Phi 6 \times 4$
16	气路管 Gas line	6 Meters	$\Phi 6 \times 4$
17	废液管 Waste pipe	2 Pcs	$\Phi 8 \times 5(1.2 \text{ Meters})$
18	ICP 试验台板 ICP test bench	1 Pc	
19	镜筒 Lens barrel	1 Pc	Form a complete set
20	烟筒 Lens barrel	1 Pc	Form a complete set

21	插线板 Patch panel	1 Pc	公牛双排 6 孔
22	串口电缆 Serial cable	1 Pc	自产
23	电源线 Power cable	1 Pc	主机内控制板 Host control board
24	电子管水套密封圈 Electronic tube water jacket sealing ring	2 Pcs	防腐, 防油 Anti-corrosion and oil-proof
25	精密减压阀 Precision pressure reducing valve	2 Sets	
26	精密减压阀气管接头 Pressure reducing valve air pipe joint	4 Pcs	
27	直通 Direct connection	2 Pcs	Φ6
28	三通 Tee	2 Pcs	Φ6
29	氩气瓶减压阀出口接头 Argon cylinder pressure relief valve outlet connector	2 Pcs	与气管不锈钢快速接头 Stainless steel quick coupling with trachea
30	铜板 (铜棒) 及铜带 Copper plate (copper rod) and copper strip	1 Set	接地线需要的材料 Ground wire needs to be used
31	固定铜棒扣件 Fixed copper rod fastener	1 Pc	接地线需要的材料 Ground wire needs to be used
32	ICP-AES 说明书 ICP manual	1 Pc	
33	保险管 Fuse	Each of 2 Pcs	5A, 2A, 0.2A
34	固定实验台内六角螺丝 SHCS	3 Pcs	Fixed test bench
35	光栅 3600 线/mm Grating 3600r/nm	1 Pc	
36	水管水嘴冒 Faucet	2 Pcs	

Chapter 4 Operation

4.1 Instrument Operation

Before starting the machine, the cooling water and the argon gas used for testing must be connected. Otherwise, the HK-8100 power supply cannot be turned on due to the interlock protection control of the power supply of the instrument due to the water pressure and air pressure.

4.1.1 Boot Operation DW-TY-9900 ICP-AES Follow the Steps Below

1. **Boot:** the first open cycle cooling water tank and water pump power switch, (ICP pressure switch to open, with special attention to behind the water tank connected to the valve is open - and the water in the same direction as the handle to open)
2. The ICP power supply switch closed.
3. Hop on the ICP power, pressure, etc. about 3 minutes turn off the lights, light fan switch Open → Open the argon gas cylinders, so that the output pressure control in 0.25Mpa → Open ICP carrier gas (observed whether the injection capillary is right) as the normal sample → the plasma gas open to 600 - 700 L / h carrier gas, then shut down the plasma temporarily → (fire action can be down) Press high pressure switch to open, press the light → if light fails, output power should be switched to level 1 so that the carrier gas fire → Open the loading gas → output power should switched to level 3 → Observation flame and parameters indicative KV, Ia, Ig (such as too high or too low can adjust the output power according to different samples).
4. Open the ICP software scans → click point zero automatically scan (change level of light) to find zero-light → select the building method → After the analysis of the capillary into the next measurement method of peak search of the standard peak → active the looking for peak method.

High standard to decay (the new method used, commonly used methods generally do not need the daily decay) → STD LOW to measure low standard → measured under the standard measurement STDHIGH with Standard H → Save → with the distilled water to wash the capillary → sample flask under measurement measured in analysis of samples... The results can be printed according to the situation (Afterward, wash the Capillary to ensure the next round of test).

5. Other method if needed, can be done by redo what above mentions, but do not have to searching for level of light.
6. Shutdown: from right to left adjust the output power to 0 → off by high-pressure, ICP Ar gas cylinder off the power switch → 5 minutes shut argon ICP Switch → 10-hours cooling circulating water tank and water pump power switch.

Note:(1) If peak could not be found, check if Capillary sampling is not working, or if taken the wrong standard sample

If the capillary plugs → Close flame and gently remove the spray chamber, spray gently removed from the spray chamber → Open the carrier gas on a finger to block exports of cleaning, spray a few times

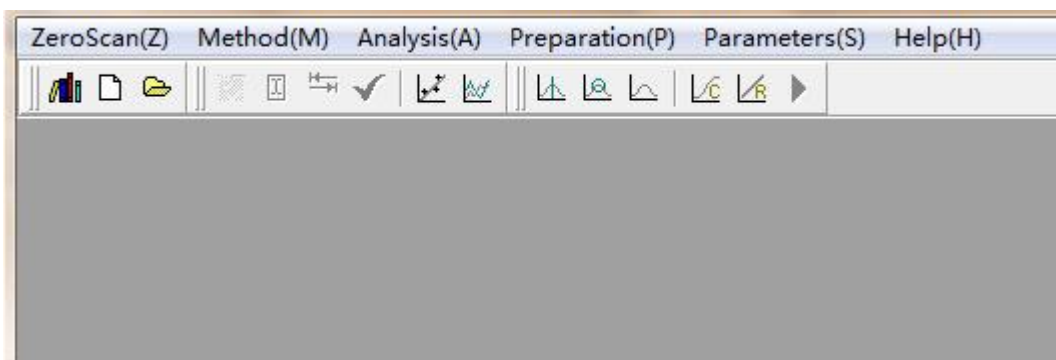
(2) Generally, regulated set pressure regulator do not need to adjust. Unless the spray breaks down, for the sprayer should be replaced with a new spray adjustable. After installation, searching for Ca peaks with distilled water and suspend the machine → peak intensity / background intensity (the peak position from the right by right-10 Next look at the

background intensity) → Finished when the maximum value.

4.2 Software Function and Operation Interface

The software uses two types of input devices, keyboard and mouse, respectively. Output device use both screen and printer, which is used to prompt analysts to the next step and how to run the process in the data, graphics, status, and display and printing. Here are the basic operations of the software.

The analysis process showed the main instrument display (see below), most of the various functions displayed on the main screen with the required size of the pop-up window shows the contents of the corresponding function. Level so that the operator was clear at a glance.



As chart analysis software main screen is divided into five regions:

The first acts of the title bar; shows the current method name (the figure shows the ICP-(Analysis: HG).

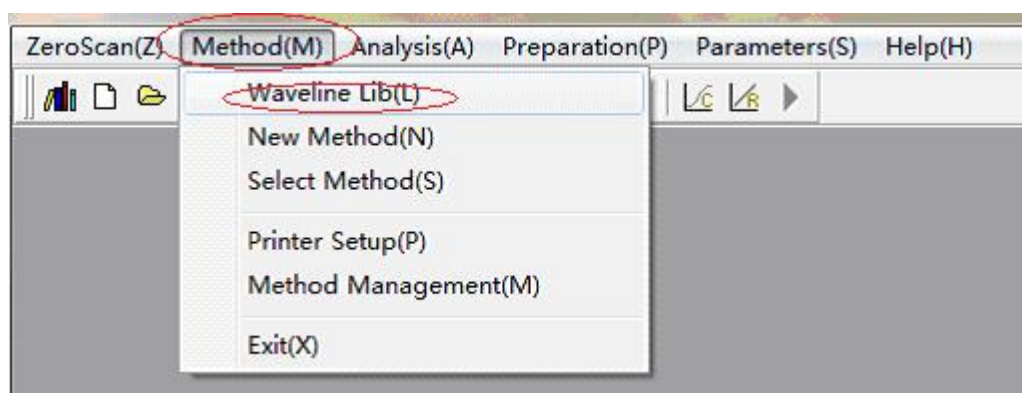
The second line is the menu bar: A total of six drop-down menu options (daily use of measurement including three drop-down menu).

The third row is a row of shortcut keys, the user can enter orders directly with the mouse click operation.

Middle of the screen working area, used to display various information and graphics, easy to operate intuitively and view.

At the bottom of the status bar, generally used to display various tips of information (that is, the bottom part of the computer screen).(The figure not shown).

Software Help menu has been a detailed description of each menu, use the following only the daily operation of the content and how to describe.



Test samples, we should first build method (if method has been established, and the direct selection method can) → drop-down menu in the measurement line Library → to select the next element of the spectrum analysis .

ZeroScan(Z) Method(M) Analysis(A) Preparation(P) Parameters(S) Help(H)

Wavelength Library

Element (S) Enter WL. (A) Del WL. (D) Interference Reset (R)

Element	WL. (nm)	Real Wavelength	Detection Limit (ug/l)	Note
Al	287.510	287.4713	75.0	110.0
Al	308.218	308.1961	45.0	780.0 0.85 Mo V
Al	309.271	309.2578	23.0	1480.0 0.35 Mo V
Al	394.401	394.3902	15.0	1480.0 0.75
Al	396.150	396.1422	26.0	2080.0 0.90 Ca Ti V
Ba	485.413	485.4013	1.3	43000.0 0.01 Ca Mo Ti
Ca	815.887	815.8880	30.0	950.0 0.75 Ca Fe

ZeroScan(Z) Method(M) Analysis(A) Preparation(P) Parameters(S) Help(H)

Enter Wavelength

WL. Lib (L) Basic WL. Select Elem. (E) Mo Select WL.

Library wavelength

Element	WL. (nm)	Detection Limit (ug/l)	Type	Relative intensity	Bec	Interfere
Mo	202.030	7.9	II	155.0	.52	Al Fe
Mo	203.844	12.0	II	90.0		Al V
Mo	204.598	12.0	II	100.0		Al
Mo	281.615	14.0	II	2400.0	.20	Al Cr Fe Mg M
Mo	201.511	18.0	II	50.0		
Mo	284.823	20.0	II	1800.0	.30	
Mo	277.54	25.0	II	1020.0	.47	
Mo	287.151	27.0	II	1180.0		
Mo	268.414	30.0	II	620.0	.55	
Mo	263.876	37.0	II	370.0		
Mo	292.339	37.0	II	680.0		

Edit wavelength

Element: Mo

WL. 202.030 Detection Limit (ug/l) 7.9

Note II 155.0 0.52 Al Fe

OK (O) Cancel (C)

In the new method, enter the method name.

ZeroScan(Z) Method(M) Analysis(A) Preparation(P) Parameters(S) Help(H)

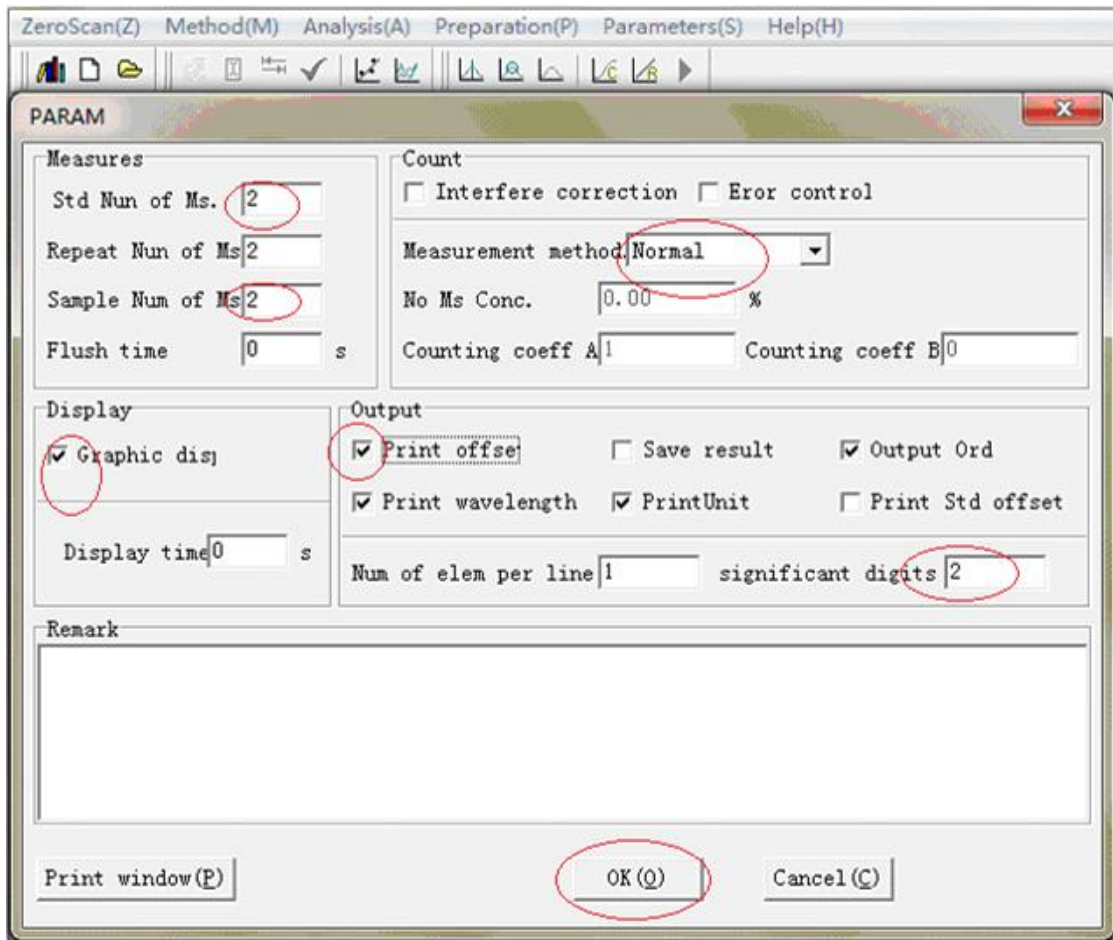
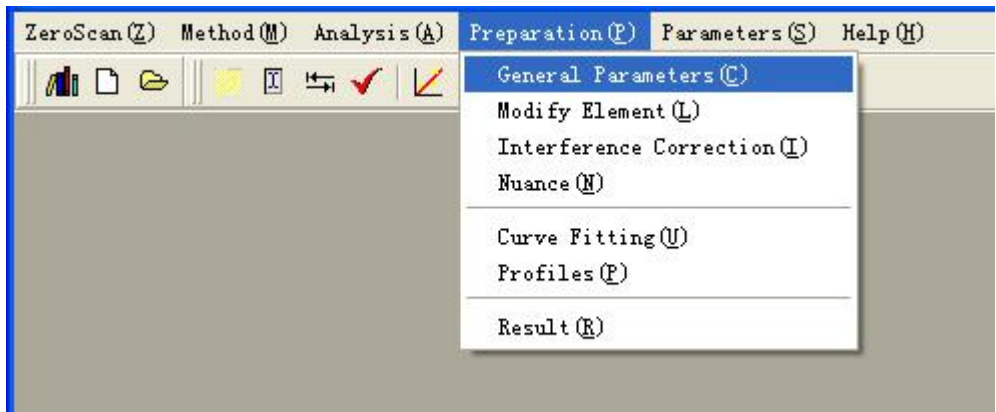
New method

Input method name:

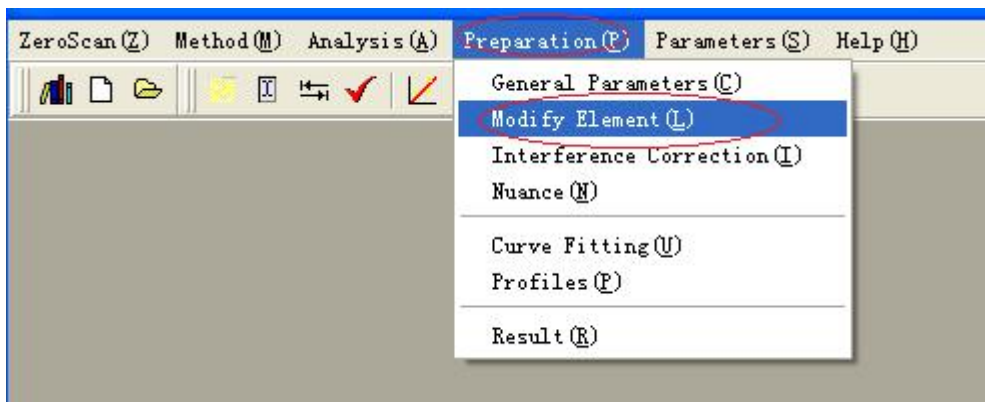
Mo_impurities_in_the

OK (O) Cancel (C)

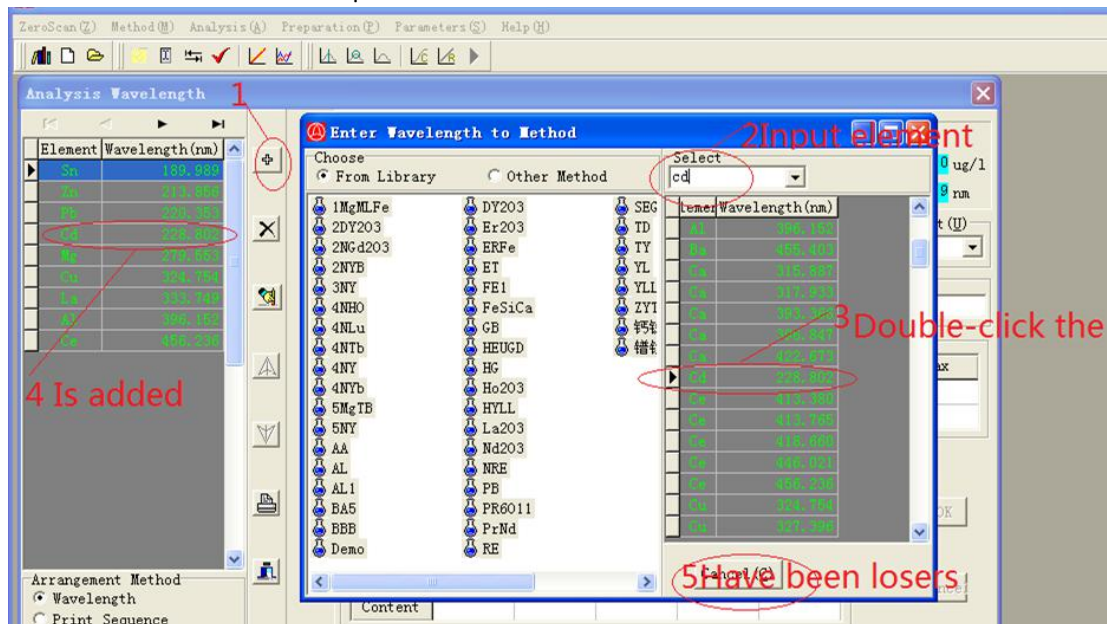
The following window appears determined→



OK displays the following window

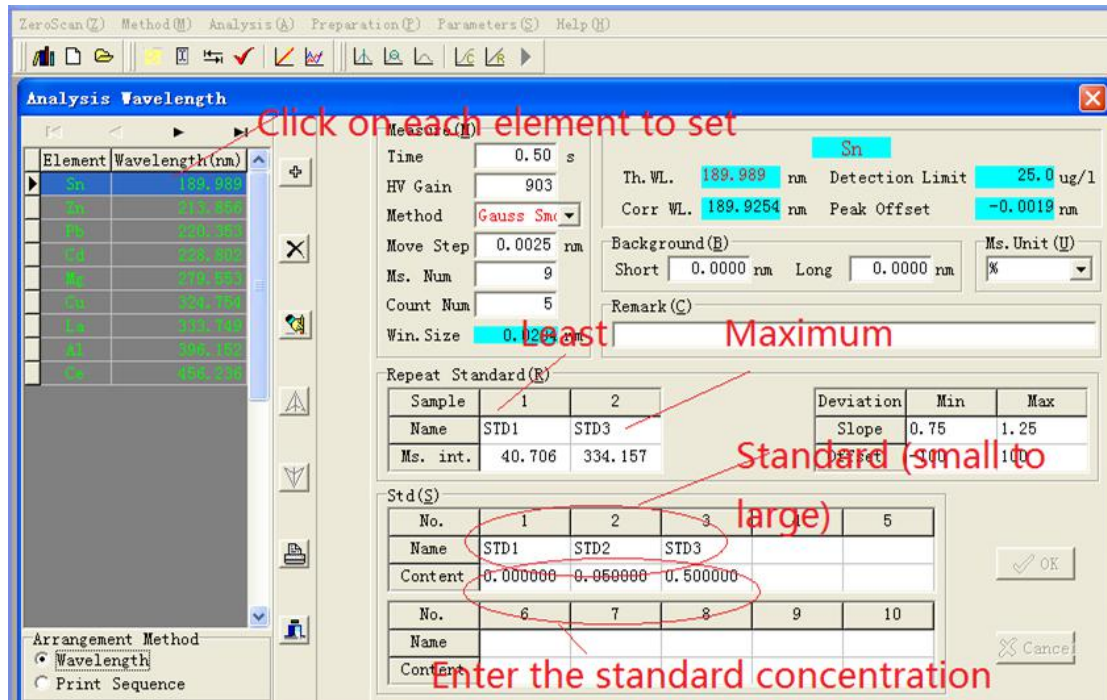


In the method, as shown by adding lines → upper right corner of input elements to be analyzed to select the elements of the spectral lines → Double Click →



→ closed or out of the first floor window into the next window →

In the window are the default subject → Others only for each element needs its own standard input is → enter the value you are prepared and STDHIGH STDLOW value → your configuration or converted units completed in the daily → analysis we need only follow the steps to complete the analysis of the task.

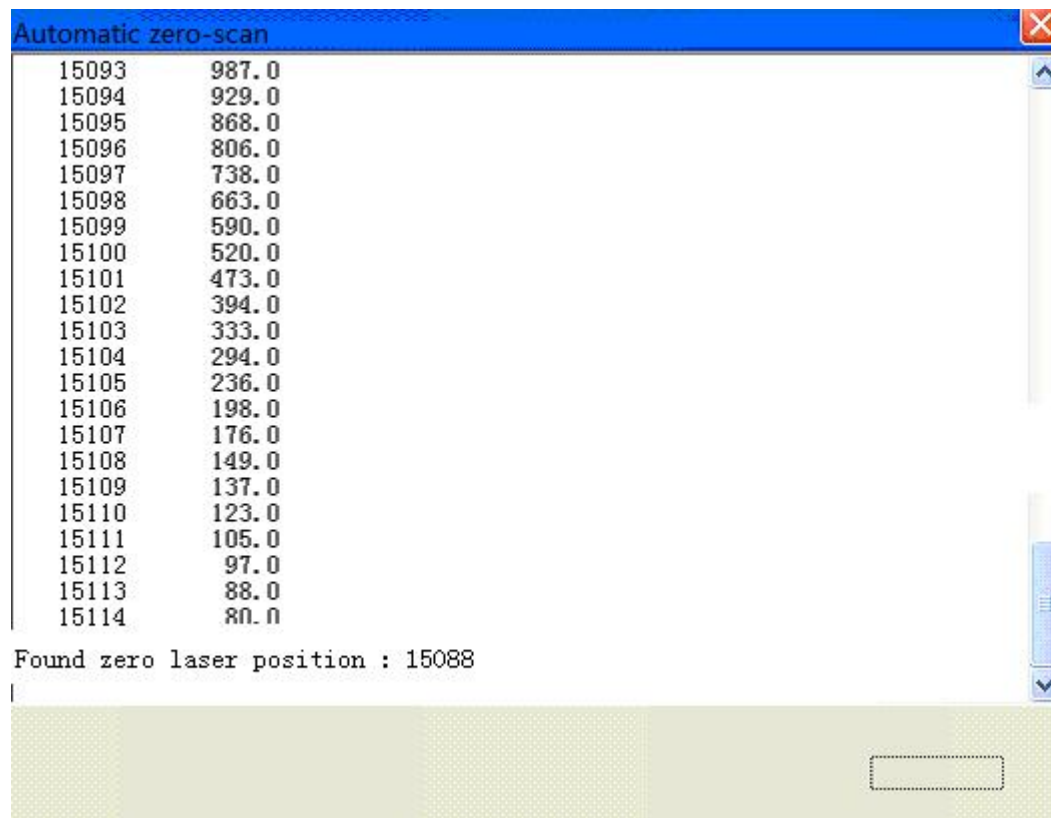
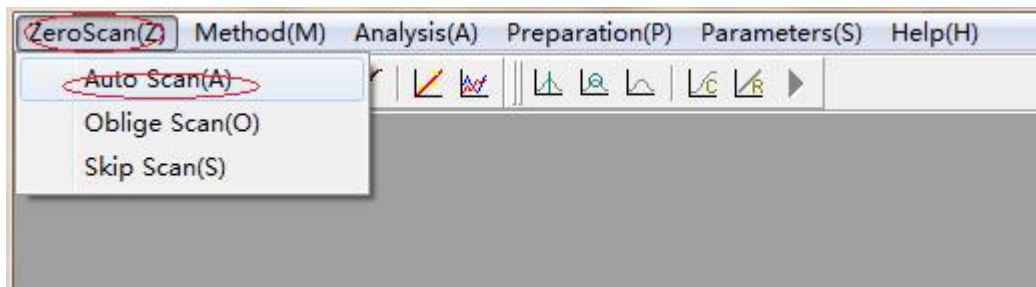


Method has been added to turn the entire spectrum to analyze the elements added to the method of → methods have been build.

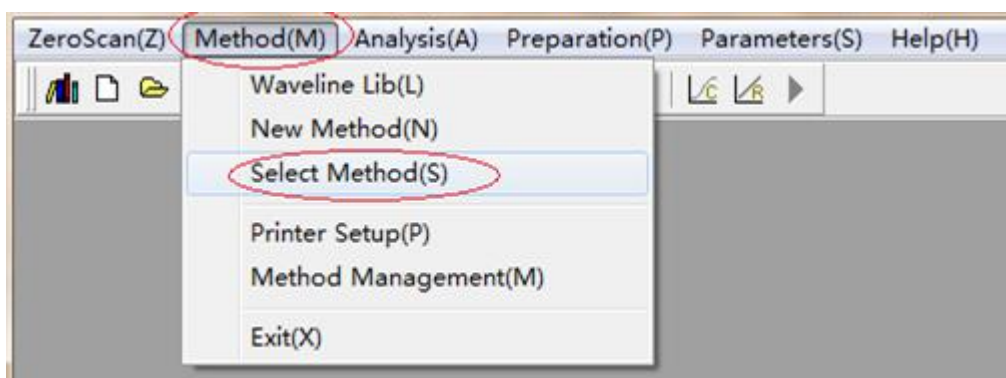
Test sequence: (method, if built)

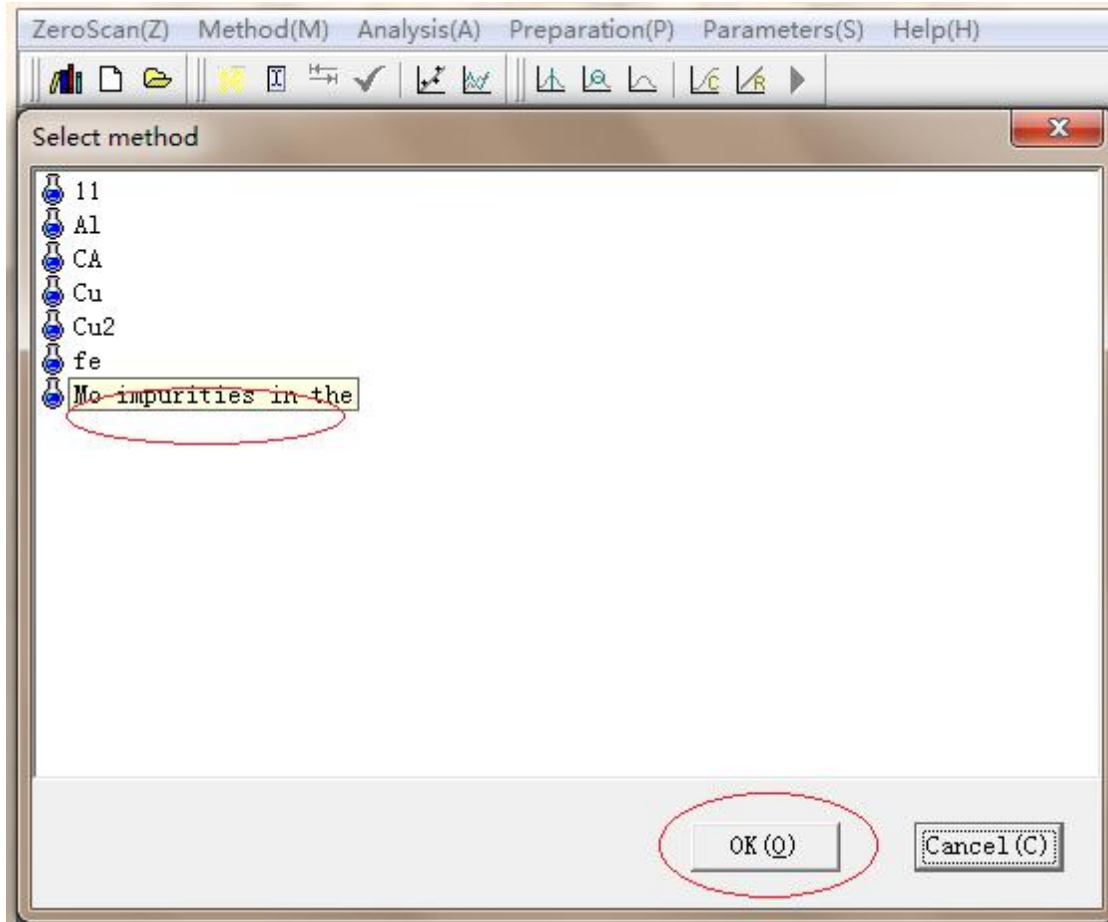
1. Selection method to find peak zero → automatic peak searching, automatic delay,

attenuation measurement standards → measure the sample.

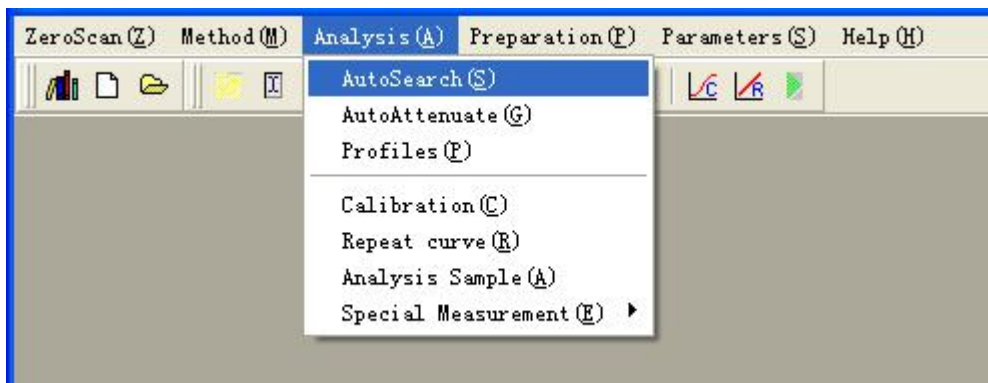


Selection Method

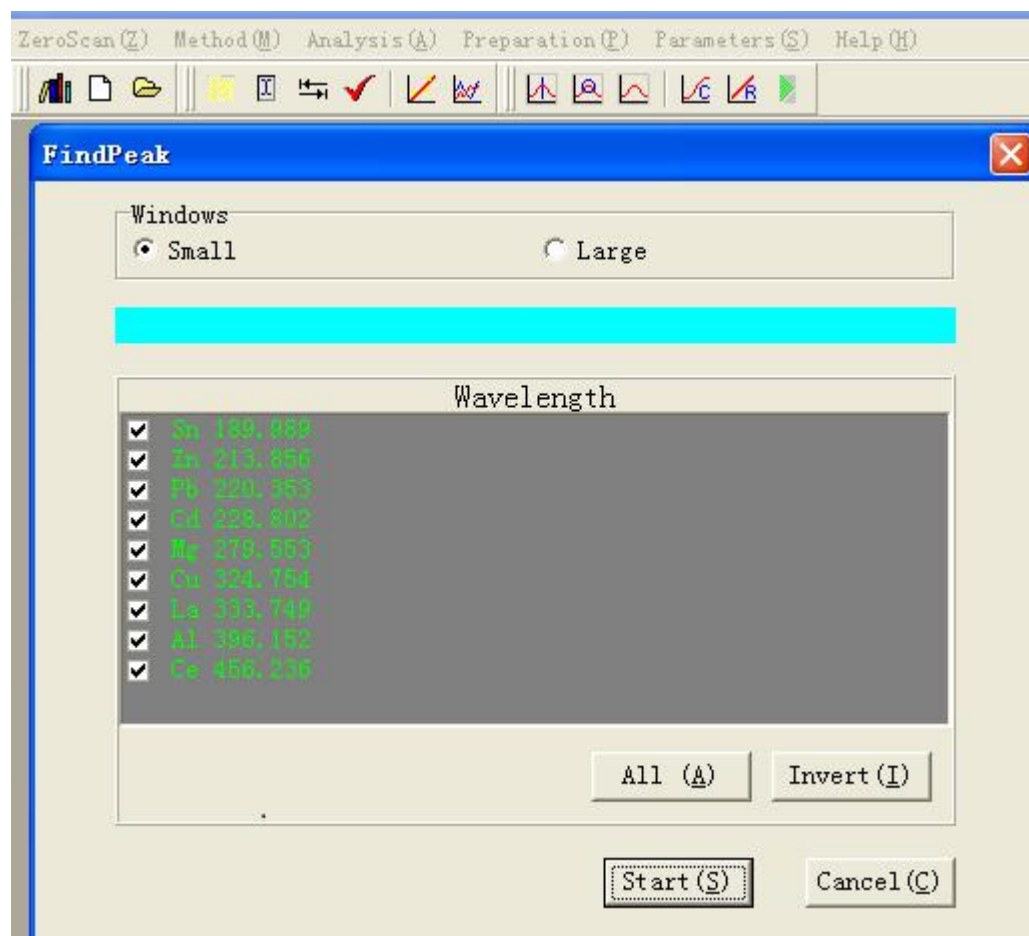


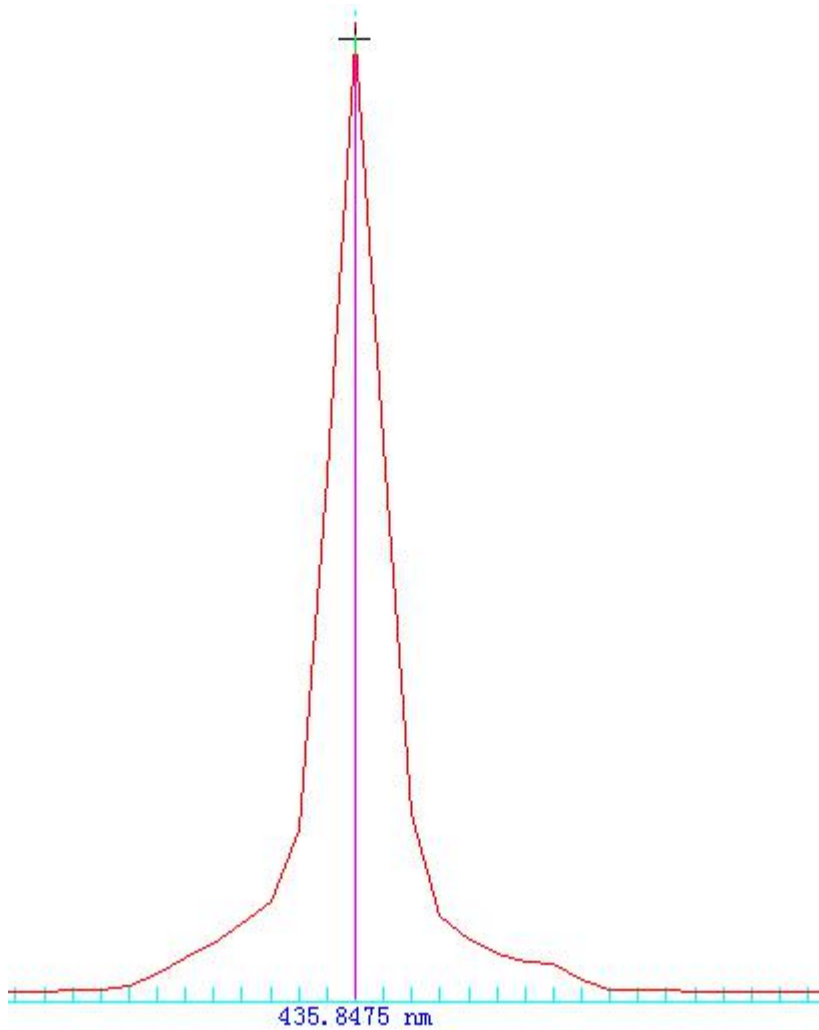


Double-click or select the following points to determine Measurement → automatic searching for peak (peak with the preparation of standard solution actively look for a good looking peak)

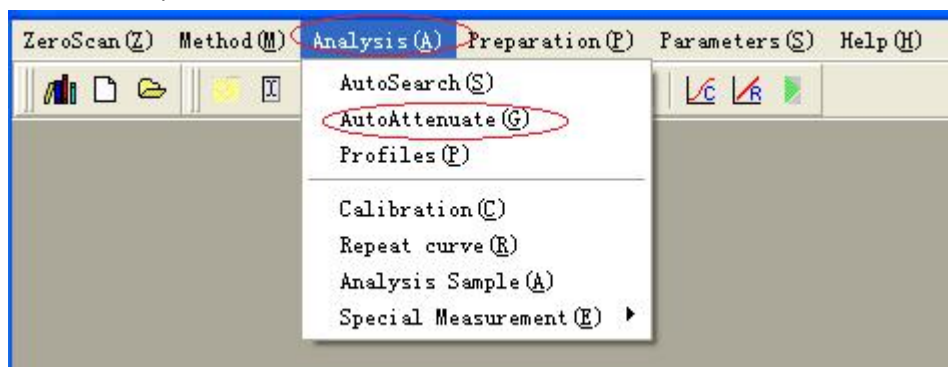


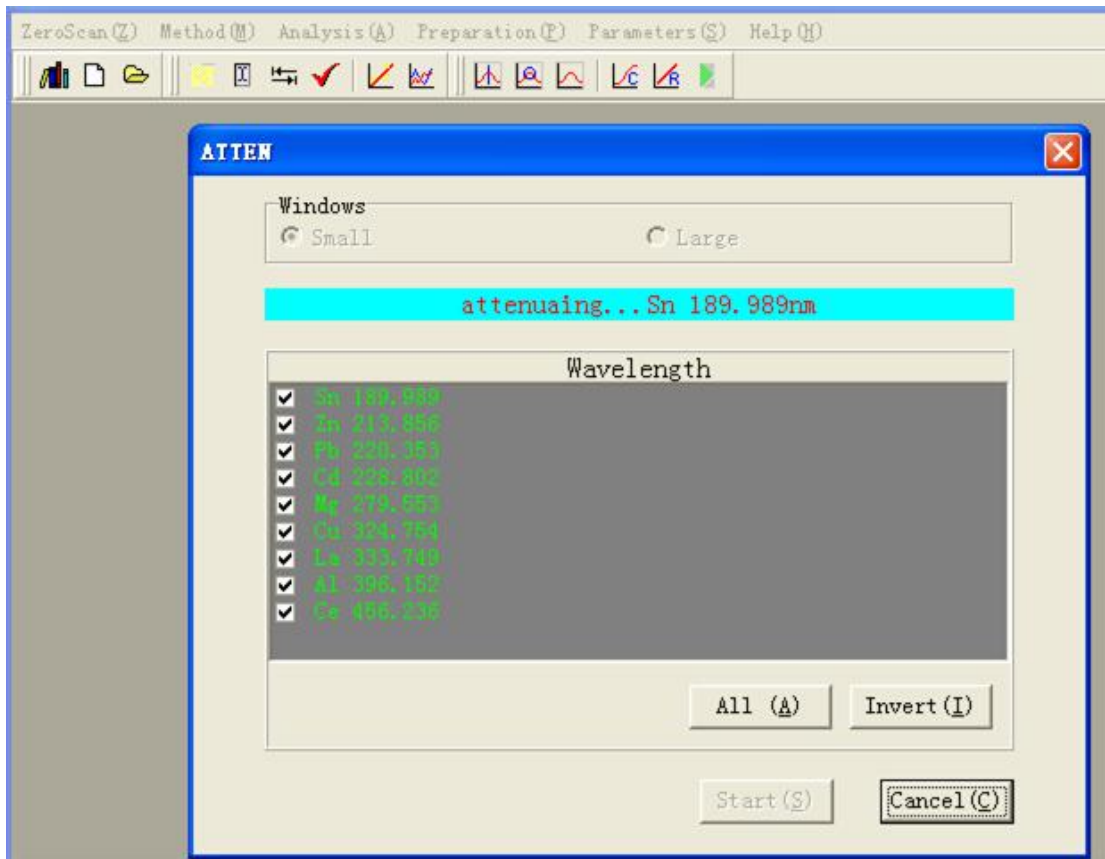
Automatic peak search





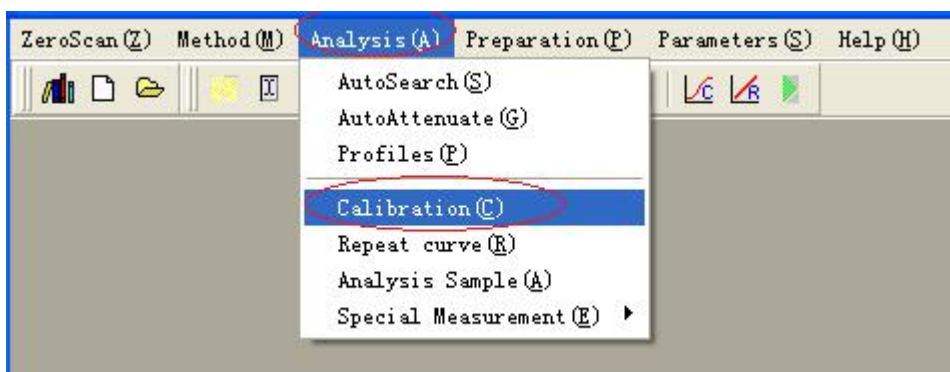
→ automatic attenuation measurement in the analysis (using standard solutions prepared from standard to high attenuation) as shown below
 (The first method requires the establishment of the future does not need automatic attenuation)

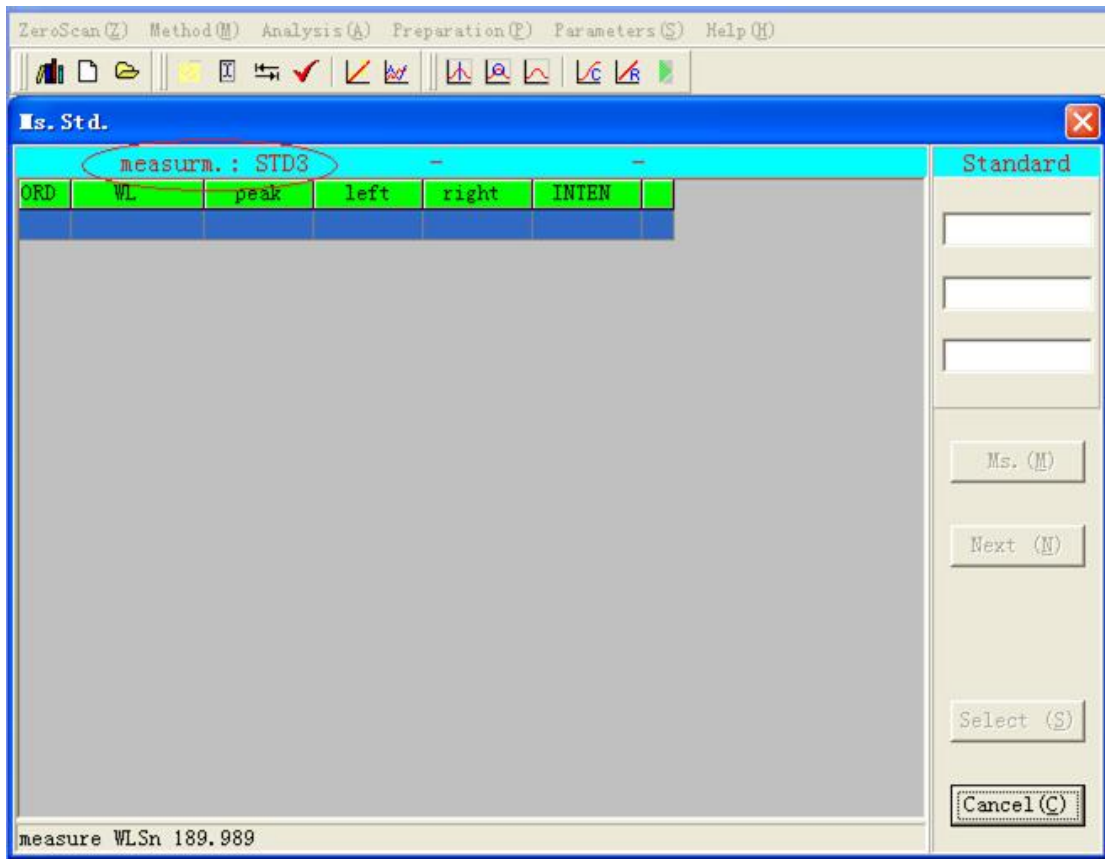
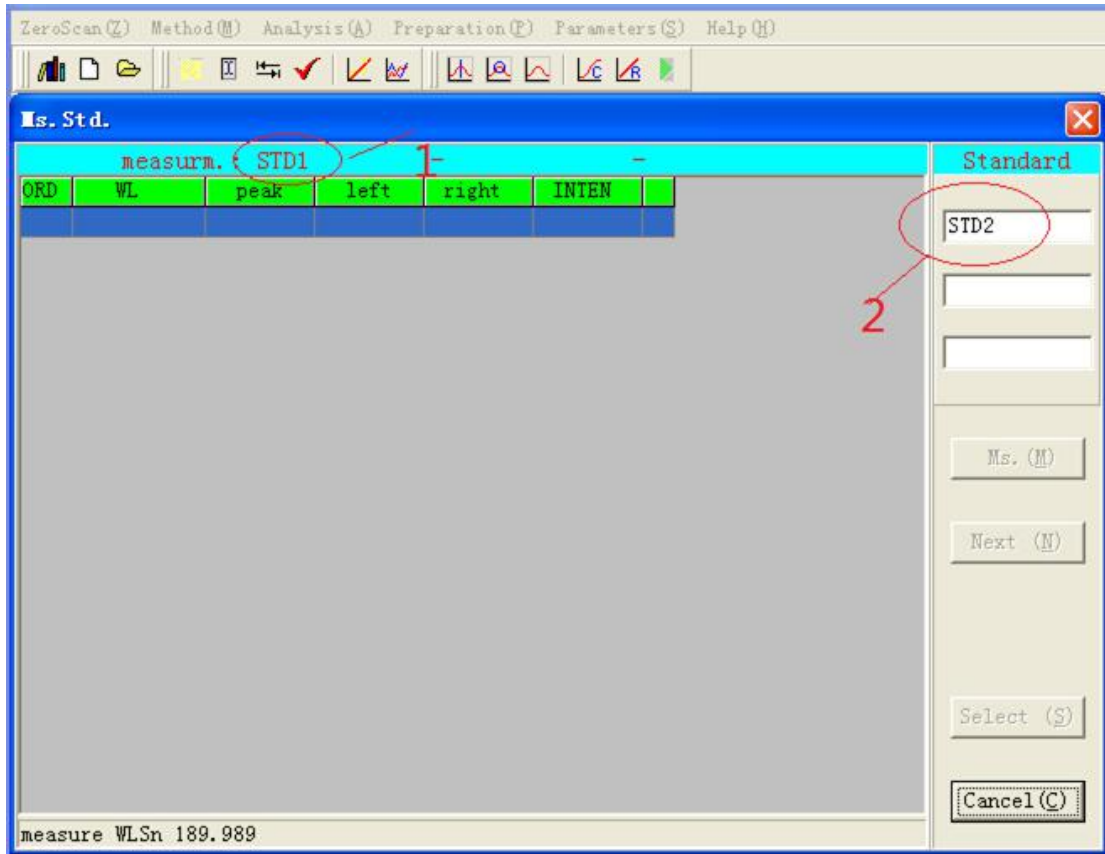


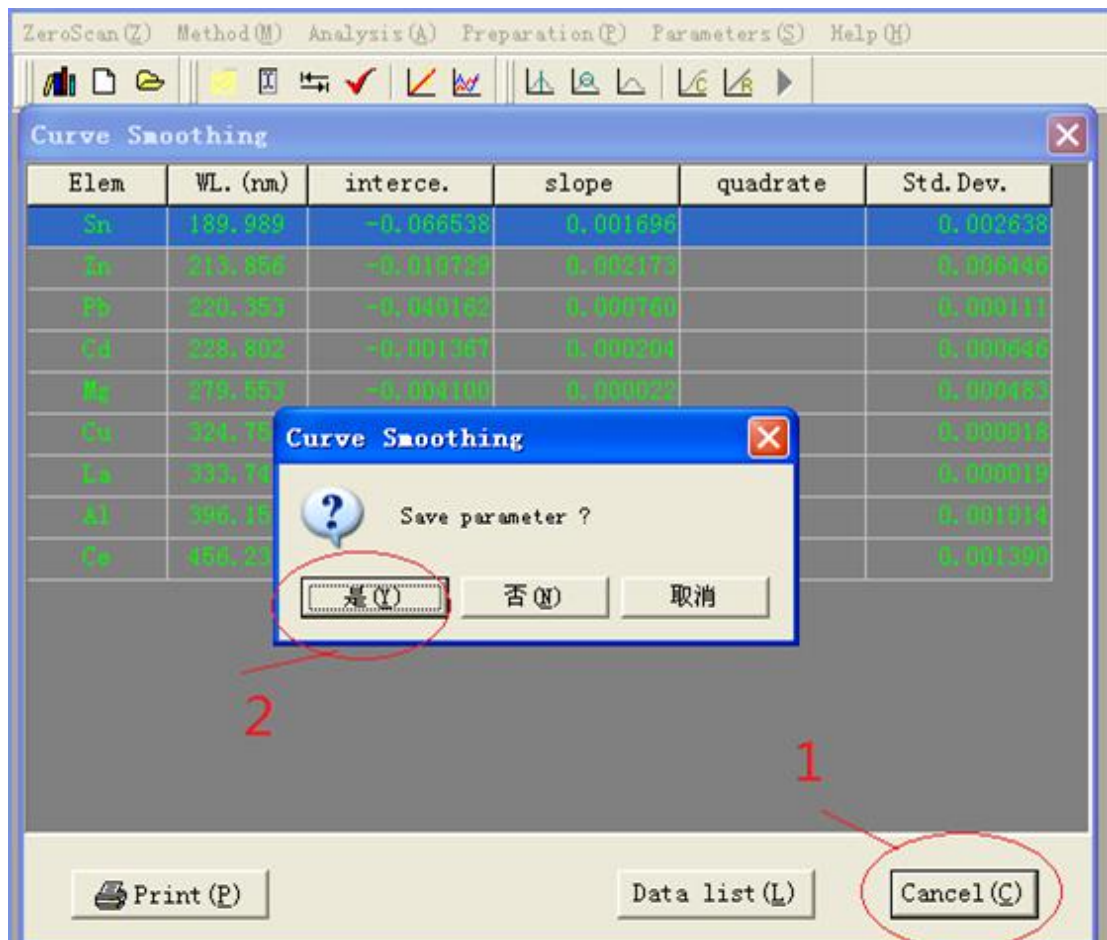


Measurement standards in the analysis and measurement of the sample (analysis sample) (to select multiple windows).

Testing standards

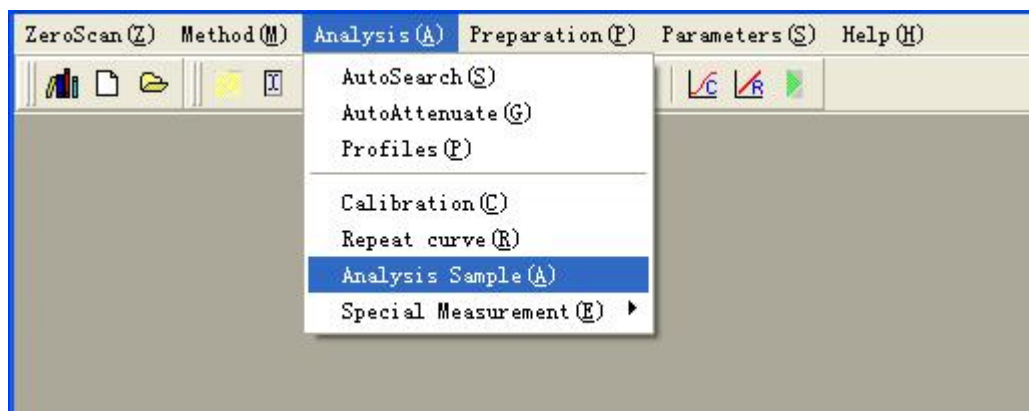


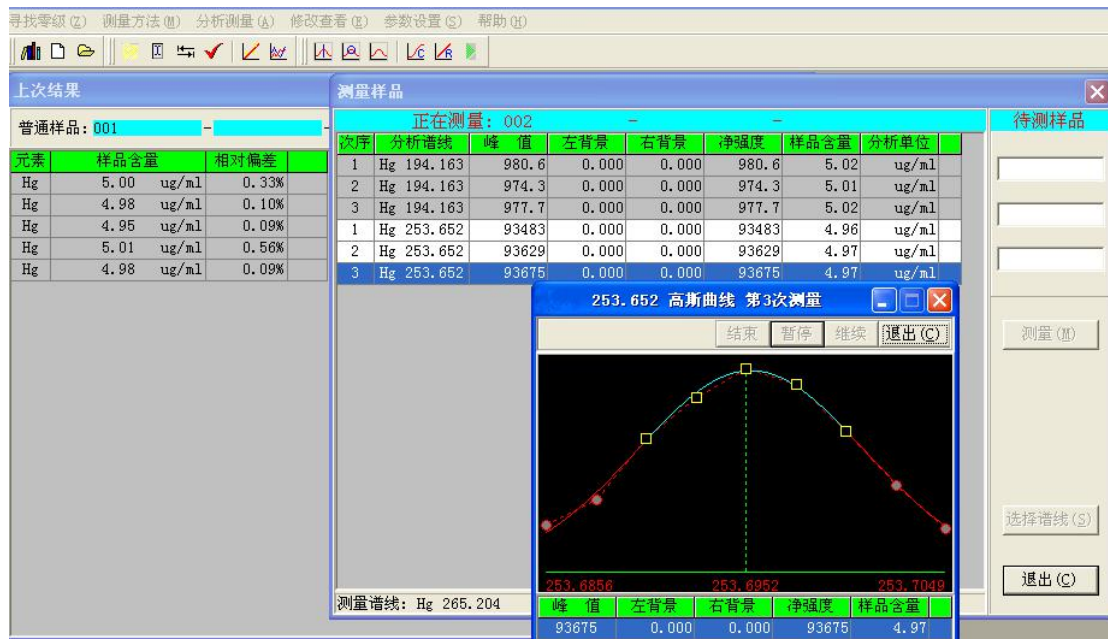
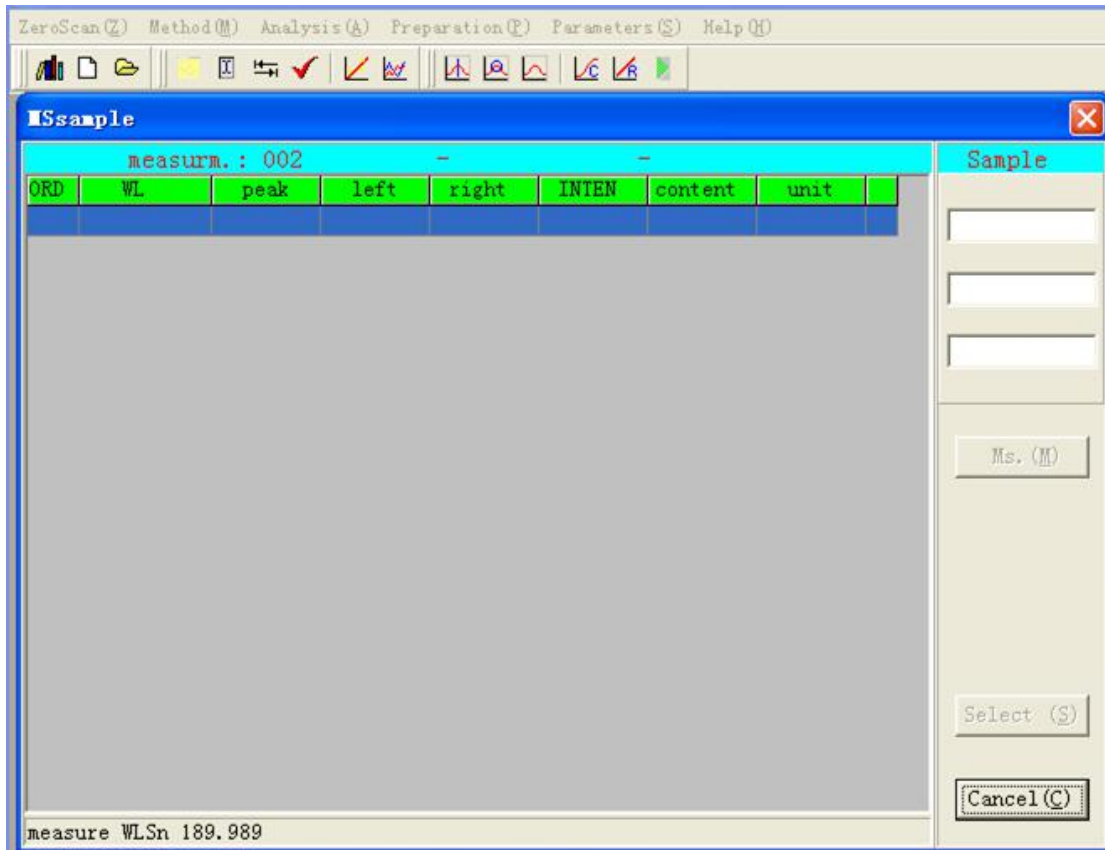




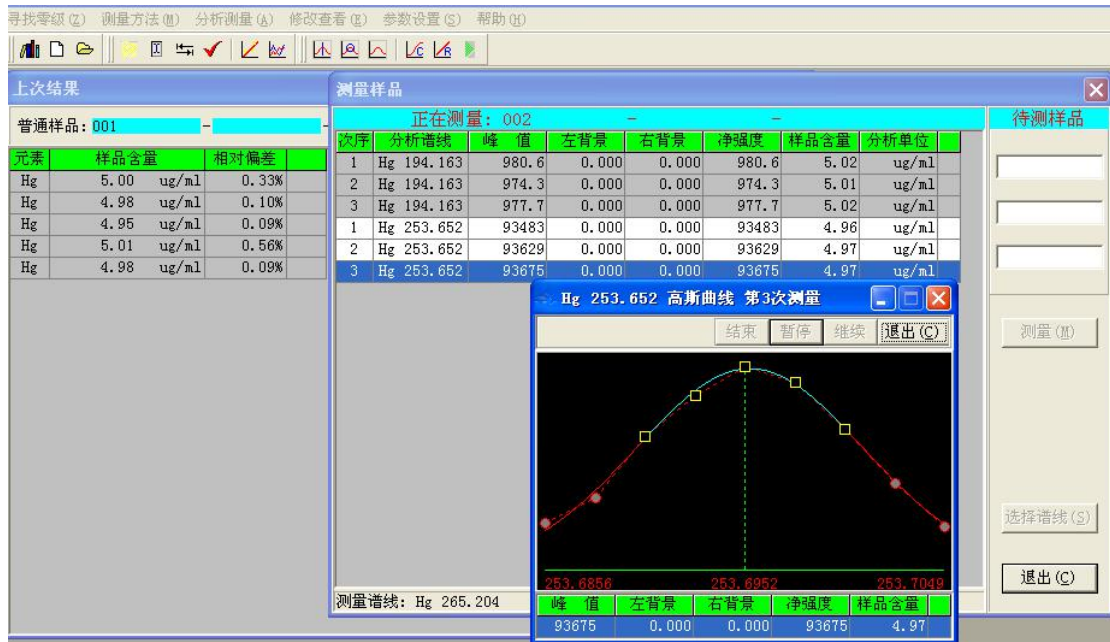
After you finish testing the standard point of exit to save.

Test sample

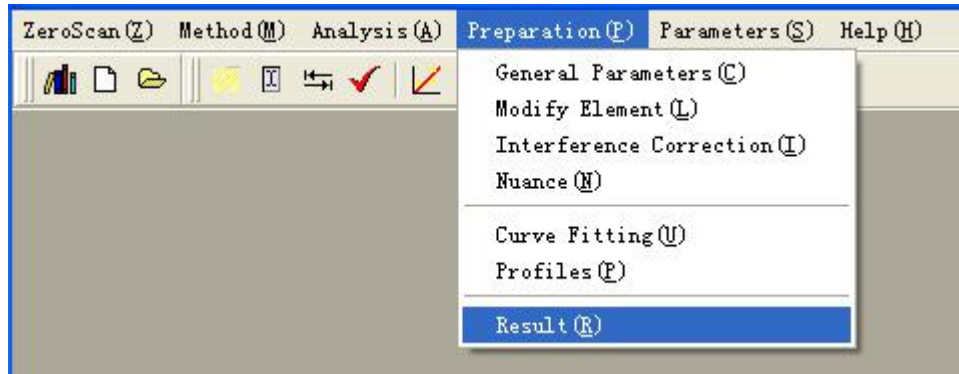




Historical database free to choose to print to analyze data (hold down the Ctrl key, point to print the number).



Test results and historical data



record - [number: 14]

Print Record (P) All Print (A) Print Prev

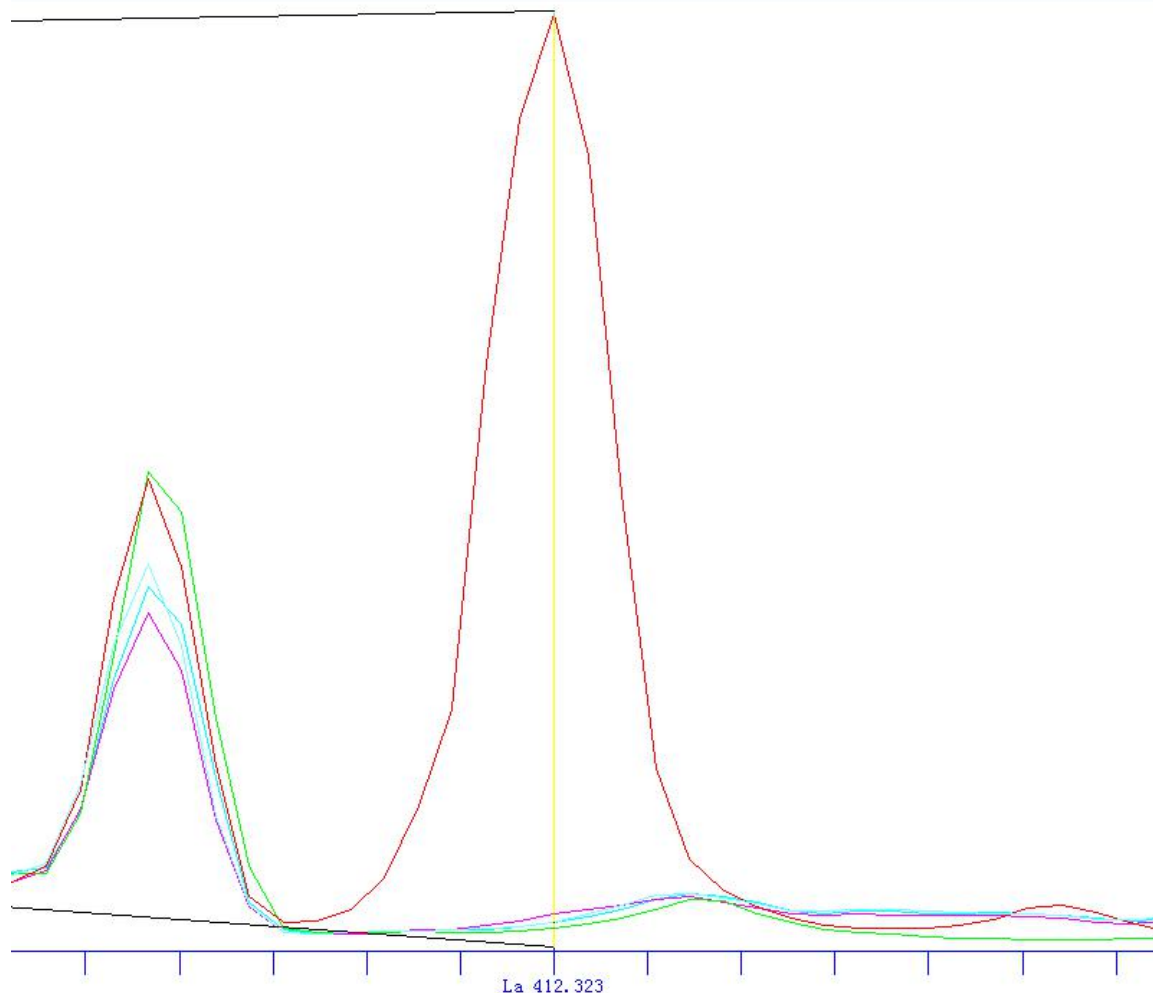
First Part	Second Part	Third Part	Sample Typ	Element	WL. (nm)	Measurement Value	Std. Dev.	Rel. Dev.
1-2.2mm			General	Hg	253.652	93483	4	0.000
2-3.0mm			General	Hg	253.652	93629	4	0.000
3-3.5mm			General					
Zn90%-10%Al			General					
Zn85%-15%Al			General					
(85-90)%	(15-10)%		General					
Zn85%-15%Al			General					
			General					
2.2mm			General					
Zn90%-10%Al			General					
2.2mm	稀释20倍		General					
Zn90%-10%Al			General					
2.2mm			General					

Measurement Data

2013-10-21 16:54:23

method		铁丝镀层		页码 (Page Num) 1	
General : Zn90%=10%Al -				2013-10-21 16:54:23	
元素 E	WL. (nm)	Ms.	Measurement Value	Std. Dev.	Std. Dev/Rel. Dev
Zn	213.856		88.9132 %	0.7920	0.89%
Al	396.152		11.0868 %	0.1285	0.16%

At the same time the software developed for the professional spectrum analysis capabilities, even the most professional personnel must be based on the function of a good analysis. The function - Analysis of Measurement - Spectrum ray trace - Professionals can make the sample case - tracing the edit icon in the View → view of spectrum. The line spectrum is easily to identify whether the interference, see the letter back ratio can be set to automatically deduct the background and so on.



Routine software analysis procedure is as follows,
 Find zero peak → Selection of measurement, measure and analyse →
 Automatic peak search automatic attenuation → sample measurement standards → sample measurement standards .

Chapter 5 Daily Maintenance and Precautions

5.1 Daily Maintenance

1. Ambient temperature: The normal working environment temperature requirement of ICP spectrometer ($25^{\circ}\text{C} \pm 3^{\circ}\text{C}$) (temperature change rate within $2^{\circ}\text{C}/\text{h}$).
2. Relative humidity: the relative humidity should be below 70% for storage and normal operation. If the humidity is strong, please equip a dehumidifier.
3. The room is clean, dry, free of dust, corrosive gas, acid mist, etc., and no vibration on the ground. Doors and windows are tightly sealed to prevent sand and moisture from entering. Especially after testing the sample (because it is a corrosive solution, the volatilized gas will easily corrode the instrument) is not allowed to be placed in the ICP room.
4. Good grounding (resistance $\leq 4\Omega$) often check whether the ground wire of the connected instrument is disconnected.
5. Exhaust the air well, otherwise the trace acid mist discharged by the instrument will corrode the optical system and optical components of the instrument (especially the grating and concave lens, once corroded, it cannot be repaired).
6. Gas: Ordinary samples do not require oxygen but only argon, and the purity of argon is at least 99.99%. Oil samples need oxygen, ordinary oxygen is sufficient. Special attention should be paid to the incorrect connection of oxygen and argon in the test oil. The orange connection port of the ICP spectrometer is oxygen and blue is argon. The light emitted from the torch during ignition should be white. If it is blue or pink or other colors, it means that the argon is not pure, so you should change to a bottle of argon.
7. In the first stage of the use of the quartz torch, it is found that there is a lot of dirt at the nozzle or the center channel is blocked. It needs to be used (1:1 acid soaking) for 2 hours and then rinsed with pure water and dried.
8. Whether the atomizer enters the oil or the aqueous solution, if there are large particles or colloidal solutions, the atomizer will be blocked. It is not that the oil is blocked, and the aqueous solution is not blocked. There are two kinds of atomizer blockages, one is that the blockage is colloid, which must be soaked with acid. The clogged colloid must be soaked in acid for 2 hours and then rinsed with pure water and dried for use. After the atomizers are plugged, there are 3 ways to deal with them, the first method is that the operator can turn on the carrier gas to slowly pull out the atomizer, block the front nozzle with your fingers and blow it several times or put it in the water and blow it several times. The second method is that if the atomizer is severely blocked, the operator can remove the atomizer and poke it through the nozzle of the atomizer with your hair, and repeat it several times. The third method is that replace the atomizer, heat(1:1) hydrochloric acid or nitric acid, and then remove it, soak the atomizer in acid for 24 hours and then wash it out for use(acid liquid cannot be placed in the instrument room to avoid corrosion of the instrument).
9. The voltage is single-phase 220V. Voltage fluctuation $\pm 1\text{V}$ (otherwise, a precision purified AC regulated power supply can be installed, the accuracy requirement is $\leq 1\text{V}$, and the response time is 20-80ms)
10. The cooling water tank needs to be changed once every 1-2 years (adding water requires distilled water or deionized water). When changing the water, pay special attention to the reverse connection of the inlet and outlet pipes (the outlet of the water tank is connected to the ICP inlet,

and the inlet of the water tank is connected to the outlet of the instrument). After changing the water tank, pay attention to exhaust the air in the water pump and pipeline, otherwise the water in the water tank may not circulate due to the air when the water pump is turned on.

11. If the instrument has been running for 2 years, the transmission system needs to be refueled. First, disconnect the main control panel on the side of the instrument and remove the back panel of the instrument(the top panel behind the instrument). To find a brush dipped in alcohol to wash off the greasy or dust on the transmission system. After the alcohol evaporates, use a clean plastic dropper to drip watch oil or sewing machine oil onto the copper gear of the transmission system. Finally, connect the power cord of the main control board on the side of the instrument, and open the ICP-AES working software to observe whether the transmission system rotates. If it rotates, everything is normal.

12. Frequently scrub the sample room and test bench to remove dust and waste liquid. So as not to corrode the sample chamber and instruments.

13. After the exhaust is turned on, the vent above the torch in the sample chamber should be able to gently such a piece of paper, or the operator can feel the suction force. If there is no suction, it means that the axial fan has a problem and should be replaced as soon as possible, otherwise, the smoke and acid mist cannot be discharged, and the instrument will be corroded. If the grating corrodes, the loss will be large.

14. If the ICP-AES is not running, the power cord of the side main control board must be disconnected. Otherwise, the heating components of the main control board are prone to aging if the power is frequently on, and the main control board is likely to burn if it rains and thunders.

5.2 Precautions for Turn On/Off

Before turn on the measurement, you need to make various preparations in advance to avoid damage to the instrument frequently during a period of time. Because when the instrument is turned on, the instantaneous strong current impact can easily cause the tube filament to fuse, or short-circuit between electrodes, and cause premature aging of the tube. Therefore, as far as possible to minimize the shutdown during use.

Delayed shutdown of cooling system: after the power of the ICP-AES host is turned off, it is generally necessary to turn off the power of the cooling water tank after a delay of 10 minutes to ensure that the heat inside the tube is fully dissipated.

Argon pressure: the pressure of argon used in ICP-AES must be controlled at 0.25MPa—0.3MPa and kept stable. To check whether the plasma gas pressure is stable within 5-10 minutes after each opening. If there is any pressure fluctuation, the operator must immediately turn off the gas and check the cause, and then turn on the gas again after troubleshooting.

Timely repair: during the analysis, the operation of the instrument should be observed at any time. If there is an abnormal situation, the flame must be turned off immediately, and the reason must be checked or reported to the relevant personnel for handling. The abnormal situation can be eliminated before proceeding.

Computer dedicated: the computer used by the ICP-AES analyzer must be dedicated, and no one is allowed to install programs and use the network on it.

Use place: there should be no acid, alkali or other corrosive gas, steam or smoke, so as not to damage the instrument.

Ground wire maintenance:water the buried wire in dry season to keep the grounding well.

Cooling water quality: the cooling water of the water tank is generally replaced once a year, and

the joint should be replaced when there are impurities such as metal oxides at the water pipe joint.

5.3 Precautions for Daily Maintenance

1. To replace the parts installed on the working coil(such as the torch), the high-voltage power supply must be turned off(or the ICP power supply).
2. When performing maintenance on the power box, the operator must shut it down for 30 minutes before you can handle it, so as to avoid the high-voltage electric energy stored in the high-voltage filter capacitor from discharging, causing equipment or personal injury.

Chapter 6 Common Fault Diagnosis Analysis and Elimination

Failure Phenomenon	Cause Analysis			Elimination Method
Turn on the power switch, the indicator light is not bright or the filament of the tube is not bright.	Power box 2A, 5A fuse blown			Replace the fuse
	The cooling water tank pump is not turned on			Turn on the water pump and check if the water pressure is sufficient
	The argon cylinder valve is not opened or the argon gas is exhausted			Open the argon valve or change the cylinder
When the high voltage is off, the off indicator does not light up	Damaged indicator			Replace the "high voltage off" button (the light is inside the button)
	The high-voltage electromagnetic contactor is damaged, or the auxiliary contact wiring is disconnected/falling off, etc.			Replace the contactor, or restore the normal connection after finding the wiring fault
High voltage cannot be turned on	Unplug the high-voltage line on the high-voltage board of the power box to see if the high-voltage switch can be turned on	No	High voltage board failure	Contact the manufacturer to replace the high-voltage board
			The power resistance in the high frequency box is damaged	Replace the power resistor after confirmation (contact the manufacturer for accessories)
			Damaged tube	Contact the manufacturer to replace the tube
	Yes	High voltage filter capacitor is damaged	Contact the manufacturer to replace the filter capacitor	
		Damaged choke coil or high-voltage silicon stack	Contact the manufacturer to replace damaged parts	
	The capacitor in the high-frequency box is			Contact the

There is anode current but no grid current	damaged, or the connection is faulty		manufacturer for maintenance
	Whether the tube is damaged(It can be used to measure the insulation resistance between the poles with a 2500V megohmmeter, and the resistance between any two poles is $\geq 20M \Omega$ is normal).		If damaged, contact the manufacturer to replace the tube
It is difficult to ignite	Indoor humidity is too high, Relative Humidity $\leq 75\%$		Take measures to reduce humidity
	The argon gas is impure (the spark should be white and not green or blue during ignition)		Replace the argon gas that meets the requirements of use
Extinguishing	No gas preloaded before ignition		Re-ignite, re-ignite after preloading gas
	Air leakage at the junction of pipe and atomizer		Tighten the connector, if the atomizer is damaged, contact the manufacturer for replacement
	Insufficient tube power		Replace the tube
When you click to scan, a small window pops up showing that there is no such interface and the serial port is not connected.	Click on My Computer→Properties→Hardware→Device Manager→Port, Check if there is an available serial communication port(such as COM1, COM3, or COM4, etc.)	Yes	Whether the serial port head is firmly inserted, you can unplug it and reconnect it; whether the communication chip of the main control board is damaged, if it is damaged, contact the manufacturer to ask for the chip and replace it
		No	If the computer has more than one serial port, you can change to another serial port to test. If you can't solve it, you can contact the

			manufacturer for maintenance.
The method of replacing tube:unplug the water pipe connecting the ICP and the water tank→Open the ICP back shell→Open the high-frequency box and gradually remove the parts connected to the tube→After changing the tube, install it again→Reconnect the boiling water pipe (note the water in and out)→Check if it leaks→Boot test			