

STALWART



Flame photometer Operation Manual

Please read and adhere to all recommendations in this manual to ensure the best experience and to maintain your Meter in good working order.

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1. Introduction of the instrument

1.1. Brief introduction of principles

The flame photometer is an analytical instrument based on the emission spectrum, which uses the heat energy provided by the flame itself to stimulate some atoms in the alkali earth metal, so that these atoms absorb energy after the transition to the highest energy level, when it falls back to the normal energy level, it is necessary to release energy, the released energy has spectral characteristics, that is, in a certain wavelength range. For example, if salt is placed in a fire and the flame appears yellow, the spectrum of the energy released by the sodium atoms when the flame falls back to its normal energy level is yellow, a phenomenon called the flame color reaction. Different alkali metals or alkaline earth metals in the flame of different colors, with different filters, you can carry out qualitative tests. The intensity of the flame color is proportional to the concentration of the atoms contained in the solution, which constitutes the basis of quantitative testing, and the actual quantitative analysis can be carried out according to the Roman Gold formula. This method is often called flame photometry, and such instruments are often called flame photometers.

Because the flame temperature is not very high, the energy released by the measured atom is limited. At the same time, during the combustion process, there are self-priming and self-corrosion phenomena, so the test is linear only in the low concentration range. As a relative measuring instrument, the flame photometer cannot obtain the absolute concentration value of the measured element, that is, the concentration value of the measured sample is the relative value of the concentration of the standard solution under the same test conditions. Therefore, a set of corresponding standard solutions must be prepared before the test, and then the calibration operation is carried out, and the standard curve is drawn through the instrument, and finally the tested sample can be tested. Get its concentration value or other required calculation data.

The flame photometer produced by the company has the advantages of small size, sophisticated technology, exquisite structure, beautiful appearance, easy operation, stable and reliable results, etc., from instruments and equipment to the accuracy and precision level of analysis results, and then to the process quality control, etc., all meet the requirements of instruments and measurement indicators specified in national environmental protection standards. Now it has been widely used in metallurgy, geology, mining, petroleum, light industry, agriculture, food and environmental monitoring and other fields of major and micro-trace element analysis.

1.2. Instrument features

1.2.1. The host adopts 7-inch color capacitive touch LCD screen, which provides good user experience.

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1.2.2. Direct reading of each concentration element, high efficiency of analysis and testing.

1.2.3. low detection limit, high sensitivity, high analysis accuracy, good reproducibility.

1.2.4. The analysis speed is fast, the detection range is wide, the sample demand is small, the detection cost is low.

1.2.5. 1-9 point standard concentration calibration, a single standard sample can be used for slope recalibration, to ensure the stability of the instrument for a long time.

1.2.6. workstation software is designed with single interface and multiple functions, friendly interface, simple operation, rich and powerful functions, fast response, and can monitor data changes in real time.

1.2.7. Test data can be directly exported by USB flash drive, and can be printed directly by printer (optional).

1.2.8. Cloud connectivity (optional)

1.3. Oil-free air compressor:

1.3.1. Ultra-quiet, ultra-clean, low energy consumption, long life, high adaptability

1.3.2. Simple operation, strong practicality, high safety

1.3.3. Automatically turns off the power supply when it overheats.

1.3.4. with RCM, CE, ETL, ROHS certification.

2. Instrument installation conditions

In order to maintain the performance of this instrument, the following conditions should be met during installation:

2.1. Please install the instrument in a place that is easy to operate the power supply, and turn off the power supply in case of emergency.

2.2. Make sure that the power socket provided to the product has a reliable grounding end, and the power supply provided can meet the requirements of the input power supply of the instrument.

2.3. Non-professional or authorized personnel are prohibited from opening the instrument housing, otherwise all consequences will be borne by themselves.

2.4. The temperature is maintained at 10-35°C, and the humidity is maintained at 5-85% (no condensation).

2.5. There can be no equipment near the instrument that generates strong magnetic field strong electric field or high frequency electromagnetic wave.

2.6. The instrument should be installed in a position with good ventilation. To ensure that the room is clean, dry, no dust, no vibration, no erosion of corrosive substances, the instrument should avoid direct sunlight. And always have a fire extinguisher.

2.7. Should pay attention to the volume of waste liquid bottle to avoid waste liquid overflow.

Attention: Do not approach the combustion chamber during or after the test! Black chimney cover will burn for a long time and the temperature is very high, the user should not immediately touch, otherwise it will cause the instrument or

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personal injury, should be carried out after the instrument is cooled to room temperature.

During the test, when the instrument suddenly loses power, the main gas valve should be closed immediately.

3.Instrument structure

3.1. Structural system

3.1.1. Atomization system

The atomization system consists of an air compressor, an air filter pressure reducing valve and a atomization chamber.

3.1.1.1. Air compressor

Air compressor is oil-free, its output maximum pressure is 0.40MPa, air flow: 23-25L/min. Power supply voltage: 220V-240V/50HZ, with independent power switch.

3.1.1.2. Air filter pressure reducing valve

After the air output of the air compressor passes through the air filter pressure reducing valve, it becomes more pure, dry and pressure stable. With dual functions of air filtration and decompression, the instrument adjusts the pressure by pulling up the knob at the top of the valve, clockwise the working pressure increases, and the reverse decreases. The water generated by the operation of the air compressor can be automatically discharged, without the user's manual discharge.

3.1.1.3. atomization chamber

The role of the atomizing chamber is to further refine the test liquid and evenly mix it with the gas to obtain a stable laminar flame. In order to achieve this purpose, the atomizer is often equipped with an impact ball, a spoiler and a waste liquid discharge outlet. After the large droplets or droplets agglutinate, they are discharged from the waste liquid port, and then the small and uniform diameter of the fine fog particles are introduced into the burner.

3.1.2. Gas system

3.1.2.1. Liquefied gas

The combustion of this instrument uses liquefied gas as fuel, English abbreviation LPG. If you smell a bad smell in the workplace, be vigilant and carefully check whether there is a liquefied gas leak. Just in case.

The LPG cylinder of the machine is provided by the user. When purchasing LPG, it is necessary to check the qualification of the supplier, that is, the safety of the cylinder must be recognized by the local technical supervision department. The workplace must be well ventilated, the cylinder must be placed upright, and it is absolutely prohibited to fall horizontally. Keep flammable materials away from direct sunlight. Ensure that the cylinder temperature must be below 40 ° C. The service life of rubber hose should not exceed one year.

If the main valve is very tight and difficult to open, please do not use a hammer or wrench to knock; A leak in the pressure regulator and cylinder outlet may cause the pressure regulator to fail.

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In case of unexplained liquefied gas leakage, it is necessary to close the cylinder switch immediately, open the doors and Windows in time, do not switch electrical appliances, and do not let objects collide. Report to relevant departments if necessary.

3.1.2.2. Gas flow regulating valve

The stability of the instrument test and the flame stability are closely related, first set the gas flow control valve to the minimum, and then turn a big circle, click the "ignition" key, after the ignition is successful, fine-adjust the gas flow control valve to control the flame stability, to the ideal flame size.

① Ignition device: Click the "ignition" button in the screen, the ignition device automatically switches on the power supply, the pulse generator starts to work, and the ignition electrode generates high-voltage sparks at the edge of the combustion head. The liquefied gas overflowing from the combustion head is automatically ignited when it hits an electric spark.

② flameout protection device: When the flame is accidentally extinguished or not ignited, the thermocouple automatically closes the gas solenoid valve, cuts off the liquefied gas, and plays a safety protection role.

3.1.3. Measuring device

The measuring device consists of optical and electronic circuits. The optical part consists of a protective glass (to keep it clean) and an interference filter. The protective glass can prevent the chimney from fouling the interference filter and burning the flame heat, thus extending the life of the interference filter. To test different metal atoms, the corresponding wavelength should be selected. If the user needs to test other metal atoms, the filter can be replaced to meet the requirements of the test. The electronic circuit device converts light energy into electrical energy, amplifies the signal, and turns the analog amount into a digital display on the display screen by the CPU data processor. The CPU data processor can also perform a group of data segmentation method or linear regression method to test the tested sample, avoiding the cumbersome calculation of the operator. Test data can be saved or printed out.

4. Instrument installation and debugging

4.1. Installation

4.1.1. The cylinder liquefied gas outlet is equipped with JYT-0.6 pressure reducing valve, the joint of the pressure reducing valve is left screw, that is, left screw is tight, right screw loose, pay attention to be tightened. The outlet of the pressure reducing valve and the gas inlet of the instrument are conical joints, which are connected with rubber tubes and must be clamped with fixed collets. After installation, turn on the cylinder switch and check whether there is liquefied gas leakage at the joint. You can apply soapy water to the joint to observe whether there is foam.

4.1.2. Connect the air compressor outlet to the air inlet of the air filter reducing valve on the instrument. When installing, insert the nozzle into the nozzle. If you can pull it out by hand, reinstall it. When removing the pipe, push the joint end in and pull the pipe out.

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4.1.3. Insert one end of the latex tube (waste liquid) into the outlet of the waste liquid cup, and hang the other end at the container storing waste liquid.

4.1.4. The power line is connected to the instrument and the power grid, and the power grid outlet of the air compressor should be equipped with a switching device. The power supply of the grid must be well grounded.

4.1.5. If you want to connect with the computer, you can use the USB cable to connect the computer and the instrument, and install the corresponding software on the computer (optional).

4.2. Debugging

4.2.1. Check the atomizer

4.2.1.1. Turn on the air compressor power supply. Unplug the adjustment knob on the air filter pressure reducing valve, and then turn the adjustment knob clockwise or counterclockwise to adjust the pressure to about 0.15MPa.

4.2.1.2. Insert the capillary into the distilled water, the instrument at room temperature, take off the chimney cover can see the water mist floating out, but can not be observed after the fire.

4.2.1.3. Check whether water is discharged from the waste liquid cup. If the drainage is not smooth, pinch the latex tube under the atomization chamber several times by hand until the water droplets flow out evenly and orderly.

(The above process can be performed when the instrument is not turned on)

4.2.2. Start the instrument

4.2.2.1. First open the instrument power supply, then open the air compressor, at the same time put the capillary into the distilled water, observe the atomization and waste liquid outflow, the new machine or the instrument that is not used for a long time, until the waste liquid cup is discharged and then ignition operation.

4.2.2.2. Hold the top of the protective glass, gently place it in the combustion chamber, and put on the chimney cover.

4.2.2.3. Open the liquefied gas cylinder switch, adjust the flow control valve to the minimum, and then turn a big circle, click the "ignition" key, ignition operation, the instrument emits a "answer answer" ignition sound, you can see the spark from the observation window. After the ignition is successful, the black chimney cover is removed from the lower part of the chimney, and the gas flow regulating valve is fine-adjusted to control the flame stability until the flame becomes a light blue cone with an ideal flame height of about 4 cm; If the ignition is not successful, the instrument will make an error sound, you can turn the flow control valve to increase the gas flow, and then press the ignition key to re-ignite. After the ignition is successful, the position of the flow control valve can be fixed in the subsequent test process, without repeated adjustment.

In the process of use due to the use of gas or other reasons caused by flameout, the instrument will automatically close the gas solenoid valve to prevent gas overflow.

4.2.2.4. Preheating process: Due to the combustion of the flame, the injection of the sample is a dynamic process. At first, the normal temperature state, and

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then the heating process, when the gas and sample amount is determined, the flame tends to thermal equilibrium, then the flame is more stable, the excitation energy is constant, and the reading is stable.

The instrument is preheated with distilled water for 30 minutes before stability tests can be performed. (Note that after the instrument is ignited, it can not be empty burned, and the capillary must be put into the water to inject the sample, while ensuring that the waste liquid cup has water discharge.)

4.2.3. Instrument shutdown

Before shutdown, clean the instrument with distilled water in the burning state for 5 minutes. When shutting down, the LPG cylinder is first closed (clockwise tightening), and the flame is extinguished after the residual LPG in the pipeline is completely burned. After shutdown, the flow control valve of the instrument does not need to be rotated, and the next use only needs to open the switch on the LPG cylinder and press the ignition key at the same time, and the flame state does not need to be adjusted or slightly adjusted.

5. Instrument interface

5.1. Create a curve

If the user creates a standard curve, click [New curve] to set the appropriate parameters.

5.1.1. Curve name: Users can set the name of the calibration curve, which is convenient for future query.

Fitting mode: Users can choose the appropriate fitting mode according to the actual test accuracy needs. Linear fitting: $y=kx+b$; Linear zero-crossing fitting: $y=kx$ piecewise fitting method.

5.1.2. Measurement mode: Standard sample method: Prepare a standard solution of known concentration to establish a calibration curve. Coefficient method: Input the known coefficient K and B values to establish a calibration curve.

5.1.3. Number of samples: When using the standard sample method to establish a calibration curve, the user can enter the number of calibration points (2-9 standard points) according to the test accuracy requirements. If the content change of the measured solution is stable, only two standard values need to be set at the lower end and higher end of the sample content, otherwise several more points should be set.

5.1.4. Establishment of standard curve (standard sample method) : Input the concentration of each test liquid in the concentration column (y column). Put the sample tube into the pre-prepared standard solution successively. After the energy value is slightly stable, click the [read] key to read the energy value corresponding to the concentration of the series standard solution. If it is a mixed solution, click the [Read] key in the corresponding element test bar to calibrate the energy value of each element in turn.

After the curve is established, click [Save] to enter the sample test interface directly. The new curve will be saved in the instrument, and the user can call the standard curve at any time. If the r value does not meet the experimental

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requirements, the user will prepare the standard solution again after determining that the concentration of a standard solution is wrong, and the curve will be established by referring to the above operation method. If the concentration value is not entered in the concentration column, the instrument will report an error after clicking the [Save] key, prompting the user to operate incorrectly.

5.2. Store or call curves

Curve information: By opening the curve library, you can view and call the established working curve. Select the curve file to be called and click [Use] to enter the test interface directly. The curve information will also be displayed on the main interface of the instrument. Click [Delete] to permanently delete the curve. If it is a mixed-label curve, you can click the corresponding element at the lower end of the curve details interface to view the details of creating the corresponding element curve.

5.3. Sample testing

Select the appropriate standard working curve in the main interface curve library, click [Use], you can view the curve details in the curve information bar, then the sample test can be carried out on the main interface of the instrument. The test result of the mixed label solution can be tested at the same time. The energy value is displayed after the element symbol, and the concentration value is displayed in the box below. When testing unknown samples, after the concentration value is slightly stable, click [HOLD] key to lock the test data or directly click [Save] key to save the test data. Click [Print] to print the current test data, click [View] to query the current or historical test data.

5.4. View or export data

Click [View], the user can view the test results in the interface. Up to 200 pieces of data can be stored for viewing and analysis, and current or historical data can be printed via thermal printer (optional). Support U disk to transfer all test data to the computer, exported data can be opened in EXCEL table for editing.

5.5. Single point calibration

If a single test sample volume is large, in order to ensure the high accuracy of the test, a single point calibration should be carried out on the standard curve. Click the "Calibrate" button to calibrate the curve using a standard solution with a known concentration (the instrument selects the highest concentration by default).

5.6. Menu

5.6.1. Time setting

In this interface, you can set the time and record the test time, which is convenient to query and record the experimental data in the future.

5.6.2. Data Export

Support U disk to transfer all test data to the computer (optional), the exported data can be opened in EXCEL table for editing.

5.6.3. Restoring the factory defaults

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Click [Factory recovery], all the test data saved in the instrument will be deleted, the user should be careful to click the button or timely backup the test data during use.

5.6.4. Measurement Settings

Users can set the main interface display elements according to the needs of the test sample. Unselected elements are not displayed on the main screen. Each element can be adjusted to 3 levels of sensitivity: low, medium and high, the higher the sensitivity, the higher the test accuracy, and the relatively longer the detection time.

Select the corresponding concentration unit according to the test requirements. Click [Save] to save the Settings.

5.6.5. General Settings

The user can adjust the instrument prompt tone, screen brightness and automatic sleep time on this interface (setting 0 indicates that the instrument is long bright).

5.6.6. Instrument maintenance

This interface is mainly used for instrument maintenance and operation. If the user is not familiar with the instrument, do not click the button on this interface at will.

5.6.7. Cloud Interconnection The interface needs to be activated.

6. Unit conversion

K: $1\text{mmol/L} \approx 39\mu\text{g/mL}$ $1\mu\text{g/mL} \approx 0.0256\text{mmol/mL}$

Na: $1\text{mmol/L} \approx 23\mu\text{g/mL}$ $1\mu\text{g/mL} \approx 0.0435\text{mmol/mL}$

Li: $1\text{mmol/L} \approx 6.9\mu\text{g/mL}$ $1\mu\text{g/mL} \approx 0.145\text{mmol/L}$

Ca: $1\text{mmol/L} \approx 40\mu\text{g/mL}$ $1\mu\text{g/mL} \approx 0.025\text{mmol/L}$

Ba: $1\text{mmol/L} \approx 137\mu\text{g/mL}$ $1\mu\text{g/mL} \approx 0.007\text{mmol/L}$

7. Preparation of standard mother liquor

7.1. Potassium standard mother liquor: 2.5mmol /L

Put the superior grade pure potassium chloride solid reagent into the weighing dish and put it in the oven, bake it in the oven at $130^{\circ}\text{C} \sim 150^{\circ}\text{C}$ for 2 hours, and then put it in the dryer to cool at room temperature.

Accurately weigh 93.19mg potassium chloride on the analytical balance, place it in a 500mL volumetric bottle, wash the beaker with a small amount of water three times, pour the lotion into the volumetric bottle, and then dilute it with water to full scale and shake well.

7.2. Sodium standard mother liquor: 10mmol/L

The preparation method is the same as above. Accurately weigh 1168.8 mg sodium chloride and dilute it to 2000mL.

7.3. Mixture of potassium 0.04mmol/L and sodium 1.40mmol/L

With a 50 ml clean burette, the above 32 mL potassium standard mother liquor and 280 mL sodium standard mother liquor were absorbed and injected into the

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same 2000 mL volumetric bottle. After injection, wash burette with water and pour lotion into volumetric bottle. Then dilute with water to full scale and shake well.

Users can prepare standard solutions of different concentration units according to the above unit conversion calculation.

8. Maintenance and repair

8.1. Precautions

8.1.1. In order to ensure the safety of the experiment, the presence of inspection personnel should be ensured during the operation of the instrument.

8.1.2. Gas and combustion air must be dry, pure and no pollution, do not use the instrument in a high humidity, a lot of dust environment, air compressor can not be in addition to air, do not add other liquids.

8.1.3. Flammable and explosive materials should not be placed around the instrument and cylinder. The experimental environment must be well ventilated, and strong exhaust devices can be set up where conditions permit or instruments can be operated in the fume hood.

8.1.4. A stable 220V power supply voltage must be used, and there can be no electrical equipment with large power and frequent start-up near the working environment. The ground cable must be grounded reliably. Do not replace the ground cable with the neutral wire.

8.1.5. During the operation, the combustion chamber and chimney cover are very hot, and you can not put your body close or touch it with your hand. After the air compressor is used for a long time, some parts will be very hot, and they should be cooled to room temperature before contact.

8.1.6. The waste liquid flowing from the waste liquid cup should be collected centrally, not disposed of at will, and properly treated.

8.1.7. Regular maintenance, keep the atomization chamber, combustion head clean. After each completion of the test work, it should be ensured that the distilled water is injected for at least 5 minutes, so that the atomization chamber is fully cleaned and the sample tube is prevented from being contaminated and blocked.

8.1.8. In testing some samples with large surface tension, it is necessary to add an appropriate amount of surfactant, while paying attention to adding the same amount in the sample, standard solution and blank.

8.1.9. The standard solution must be accurately prepared, long-term storage should pay attention to storage conditions, and to add appropriate antibacterial agents. No samples can be stored in sodium glass containers.

8.1.10 The sample can not contain granular matter, to be filtered before testing, often pay attention to the height of the liquid level during operation, only absorb the upper solution when sampling.

8.1.11. Before any repair, maintenance and cleaning of the instrument, be sure that the equipment is powered off.

8.2. Care and maintenance

8.2.1. Air filter drainage

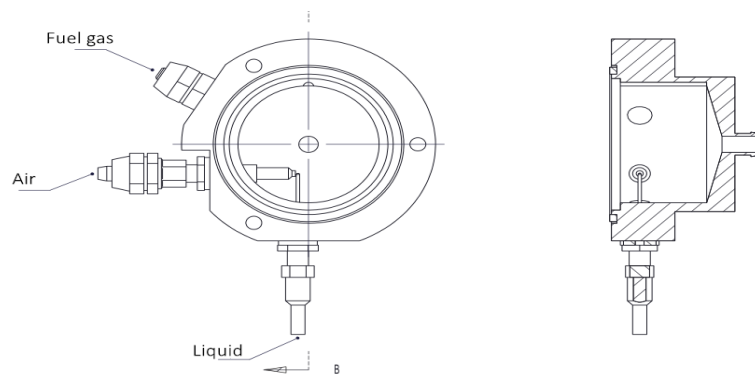
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This instrument can automatically carry out drainage treatment. After the test is completed and the air compressor is closed, the valve of the filter pressure reducing valve will be automatically reset due to the pressure action, and the water will be automatically drained. A rag can be placed below to catch the water.

8.2.2. Cleaning

After each test, there should be about 5 minutes of distilled water cleaning. That is, the injection capillary tube is burned in distilled water as normal for 5 minutes, and the atomization chamber and combustion head are cleaned in circulation.

8.3. Cleaning of atomizing chamber



8.3.1. Unscrew the three fixing screws at the lower end of the atomization chamber and remove the atomization chamber;

8.3.2. Screw off the nut of the sample tube and nozzle, remove the sample tube and nozzle, clean with detergent, and then reinstall it;

8.3.3. Close the gas valve, open the air compressor, insert the capillary into the solution, and observe the atomization effect. If there is no sampling or poor atomization effect, the mutual position of the sampling tube and nozzle can be adjusted to produce atomization effect, and then screw the nut to fix it.

8.3.4. The atomization chamber is re-installed with the instrument, in the case of suction sample, the aerosol phenomenon can be clearly observed at the end of the combustion head.

Since the date of purchase of the instrument by the user, in the case of non-human damage, within 12 months due to poor manufacturing and can not work normally, the manufacturer is responsible for free repair. (excluding consumable parts)