

Dear Client

Thank you for Purchasing our **HTYWS-H Electrolytic Oil Moisture Analyzer**. Please read the manual in detail prior to first use, which will help you use the equipment skillfully.



Our aim is to improve and perfect the company's products continually, so there may be slight differences between your purchase equipment and its instruction manual. You can find the changes in the appendix. Sorry for the inconvenience. If you have further questions, welcome to contact with our service department.



The input/output terminals and the test column may bring voltage, when you plug/draw the test wire or power outlet, they will cause electric spark. PLEASE

CAUTION RISK OF ELECTRICAL SHOCK!

Company Address:

- ◆ T4, No. 41, High-tech 2 Road, East Lake High-tech Development Zone, Wuhan
- ◆ Sales Hotline: 86-27- 87457960
- ◆ After Service Hotline: 86-27- 87459656
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- ◆ E-mail: qiao@hvtest.cc
- ◆ Website: www.hvtest.cc

◆ **SERIOUS COMMITMENT**

All products of our company carry one year limited warranty from the date of shipment. If any such product proves defective during this warranty period we will maintain it for free. Meanwhile we implement lifetime service. Except otherwise agreed by contract.

◆ **SAFETY REQUIREMENTS**

Please read the following safety precautions carefully to avoid body injury and prevent the product or other relevant subassembly to damage. In order to avoid possible danger, this product can only be used within the prescribed scope.

Only qualified technician can carry out maintenance or repair work.

--To avoid fire and personal injury:

Use Proper Power Cord

Only use the power wire supplied by the product or meet the specification of this produce.

Connect and Disconnect Correctly

When the test wire is connected to the live terminal, please do not connect or disconnect the test wire.

Grounding

The product is grounded through the power wire; besides, the

ground pole of the shell must be grounded. To prevent electric shock, the grounding conductor must be connected to the ground.

Make sure the product has been grounded correctly before connecting with the input/output port.

Pay Attention to the Ratings of All Terminals

To prevent the fire hazard or electric shock, please be care of all ratings and labels/marks of this product. Before connecting, please read the instruction manual to acquire information about the ratings.

Do Not Operate without Covers

Do not operate this product when covers or panels removed.

Use Proper Fuse

Only use the fuse with type and rating specified for the product.

Avoid Touching Bare Circuit and Charged Metal

Do not touch the bare connection points and parts of energized equipment.

Do Not Operate with Suspicious Failures

If you encounter operating failure, do not continue. Please contact with our maintenance staff.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in Explosive Atmospheres.

Ensure Product Surfaces Clean and Dry.

— **Security Terms**

Warning: indicates that death or severe personal injury may result if proper precautions are not taken

Caution: indicates that property damage may result if proper precautions are not taken.

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I. Overview

Carl - Philip Hugh coulomb titration method for accurate measuring moisture content of samples, this method with the advantages of high precision, low cost. Widely used in electric power, petroleum, chemical, pharmaceutical, food and other industries.

Carl - Philip Hugh



II. Features

Instrument adopts a powerful new generation processors and peripheral circuits, which with excellent low-power performance makes it possible to use small battery power supply, and then achieve the portable function; measuring electrode signal as a criterion of electrolysis end, its stability and accuracy is the key factor affecting the measurement accuracy. The use of advanced devices and methods can achieve the precise detection of measuring electrode signal; with new software compensation correction algorithm to improve the measurement accuracy; large-size LCD display with touch keys, the display interface with curve is intuitive and friendly.

Main features:

1. Adopts 320x240 dot matrix LCD display, touch keys, friendly interface;
2. Using the electrolysis circuit of switch constant-current source, reduce power consumption of the instrument;
3. High-precision measuring electrode signal and detection circuit can determine the electrolysis end quickly and accurately, and with strong

anti-interference ability;

4. The use of blank current compensation and equilibrium point drift compensation to correct the measurement results;

5. Measuring electrode signal show as a bar graph on the LCD screen indicates water content of electrolyte intuitively;

6. Real-time depicts the curve of electrolysis speed changing with time during electrolysis process, the user can monitor the process of electrolysis, and can judge whether the electrolyte is ineffective according to the curve;

7. 10 gears stirring speed adjustment; auto electrolysis gains adjustment;

8. With measuring electrode open-circuit fault, short circuit fault automatic detection functions;

9. Automatically store historical records, up to 100;

10. Calendar clock with temperature compensation is accurate, and can automatically records the date and time of test; it can run more than 10 years in the power-down state;

11. With USB interface, it is convenient to communicate with the computer.

III. Technical parameters

1. Accuracy:

Amount of electrolysis water	Accuracy
10ug~1000ug	$\pm 2\text{ug}$
>1000ug	0.2%

2. General electrical parameters:

Measurement range:	0ug-200mg
Resolution:	0.1ug
Maximum electrolytic speed:	40ug/s
Power supply voltage:	AC220V \pm 20%
Maximum power consumption:	30W
Ambient temperature:	10 ~ 35°C
Ambient humidity:	\leq 85%

Dimensions: 320×240×150(mm)
Net weight: 5kg

IV. The structure and assembly of instrument

1. Host

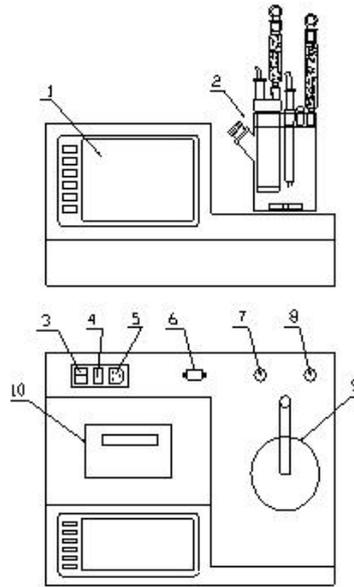


Figure 4-1 Host

- | | |
|--------------------------------------|------------------------------------|
| (1) LCD screen and buttons | (2) Electrolytic cell |
| (3) Power switch | (4) Fuse |
| (5) Power outlet | (6) RS232 interface |
| (7) Electrolytic electrode interface | (8) Measuring electrode interfaces |
| (9) Electrolytic cell stent | (10) Mini printer |

2. Electrolytic cell

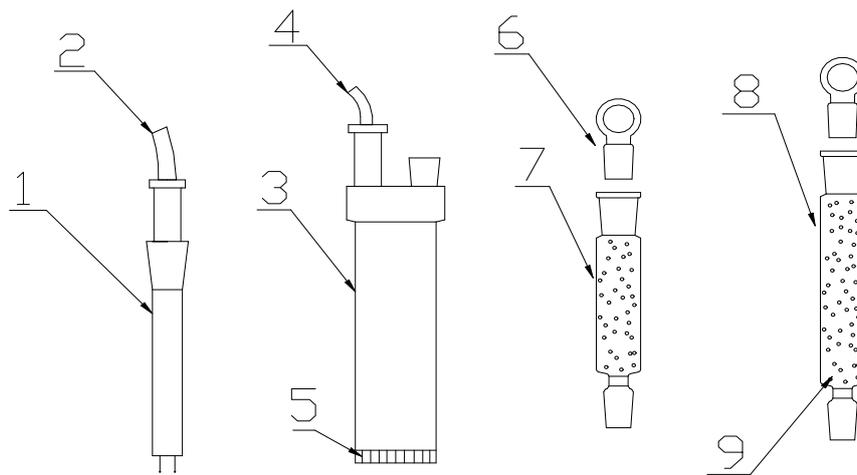


Figure 4-2 Decomposed diagram of electrolytic cell

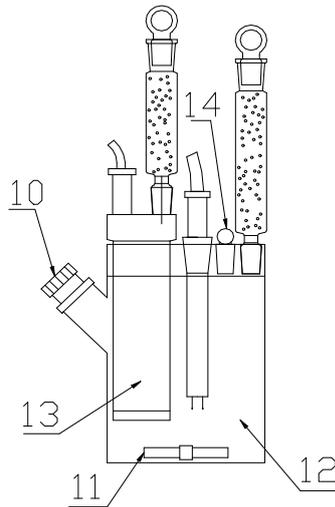


Figure 4-3 Assembly diagram of electrolytic cell

- | | |
|---------------------------------|---|
| (1) Measuring electrode | (2) Measuring electrode line |
| (3) Electrolytic electrode | (4) Electrolytic electrode line |
| (5) Ion filter membrane | (6) Glass stopper of drying tube |
| (7) Cathode chamber drying tube | (8) Anode chamber drying tube |
| (9) Silica gel (drier) | (10) Inlet |
| (11) Stir | (12) Anode chamber |
| (13) Cathode chamber | (14) Glass stopper of electrolytic cell |

3. Assembly

- (1) Put silica gel particles into the drying tube (Figure 4-2 7,8 shows)

Note: The piping of drying tube must maintain certain ventilation, cannot be completely closed, or prone to danger!

(2) Put the milky white silica gel pad into stopcock, and use fastening bolt to screw uniformly. (see Figure 4-4)

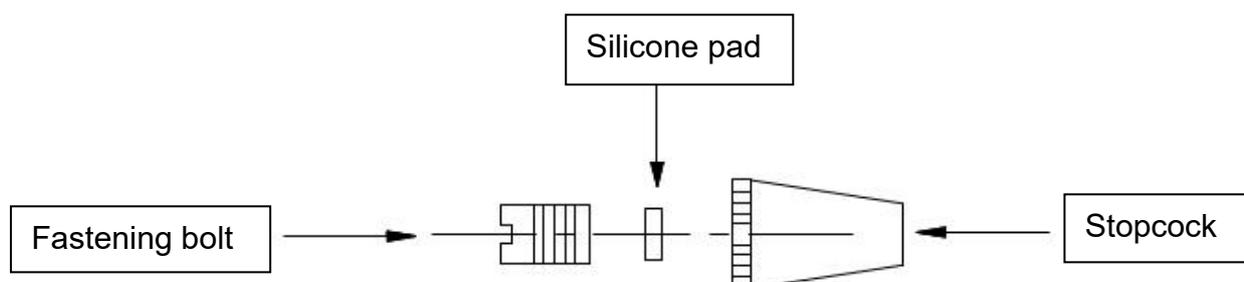


Figure 4-4 Assembly diagram of inlet stopper

(3) Put stir through the inlet into the electrolytic bottle carefully

(4) In the measuring electrode, electrolytic electrode, cathode chamber drying tube, anode chamber drying tube, inlet stopcock grinding mouth, evenly coat with a layer of vacuum grease, after the above components into the electrolytic bottle, gently rotate to let it seal well.

(5) Using a clean and dry funnel (or use change dispensers) inject 120-150 ml electrolyte into the anode chamber of electrolytic cell from the seal of electrolytic cell; Repeat process to inject electrolyte into the cathode chamber of electrolytic cell; let the liquid height of electrolyte in the cathode chamber and the anode chamber is the same. In the glass stopper of electrolytic cell evenly coat with a layer of vacuum grease, gently rotate to let it seal well.

Note: it should be operated in good ventilation environment, do not inhale or touch the reagents, if touch with the skin, rinse with water.

After completing the above steps, put the electrolytic cell into the electrolytic cell stent (Figure 4-1, 9), then the electrolytic electrode line and the measuring

electrode line with lotus plug separately insert into the electrolytic electrode interface (Figure 4-1 7) and the measuring electrode interface (Figure 4-1, 8).

V. Working principle

Reagent solution is made up of dominant iodine, pyridine with sulfur dioxide and methanol. Carl, -- Hugh reagent with water reaction principle is: based on water, the Iodine is restituted by sulfur dioxide; in the presence of pyridine and methanol, generate hydroiodic acid pyridine and methyl hydrogen sulfate.

Reaction is:



In the process of electrolysis, the electrode reaction is as follows:



Iodine (produced by anode) reacts with water to produce hydroiodic acid, until all the water reacted completely; the reaction end is instructed by a pair of detection unit which composed of platinum electrodes. Based on Faraday's law of electrolysis, number of molecules of iodine in the reaction is equal to number of molecules of water, and it has a proportional relationship with charge. The equation of water and charge as follows:

$$W = Q / 10.722 \dots\dots\dots(5)$$

Wherein: W -- Moisture content in the sample Unit: MCG

Q -- Electrolytic power Unit: Milli-Coulomb

VI. Menu and key operation instructions

Instrument uses a large-screen LCD display, with touch keys, key functions defined; users learn to use the instrument easier.

Instrument with five menus

- (1) Boot welcome menu
- (2) Setting adjustment menu
- (3) Historical record menu
- (4) Sample test menu
- (5) Measuring results menu

In the following key operation instructions, the black highlighted figures or graphics are the modified contents of the current adjustment.

Note: Instrument screen without batteries does not appear battery symbol

1. Boot welcome menu

After connecting to the power cord, turn on the power switch, the LCD display as shown in Figure 6-1

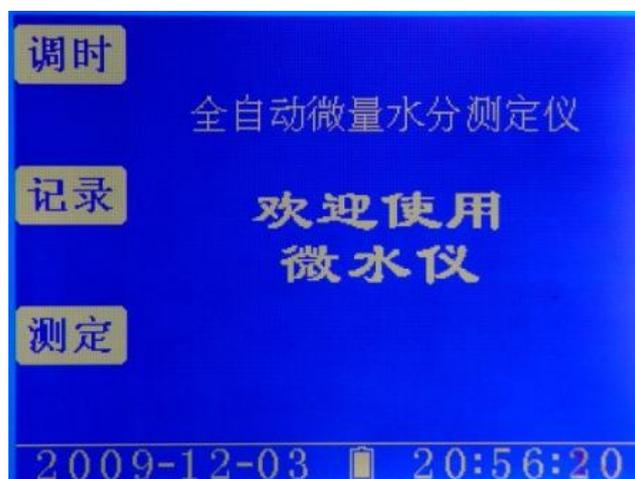


Figure 6-1

In the current display interface has the following key operations:

Setting: enter "Setting adjustment menu"

Record: enter "Historical record menu"

Test: enter "Sample test menu"

2. Time adjustment menu

In Figure 6-1, press the "adjust time" key, the LCD display as shown in Figure 6-2:



Figure 6-2

Adjusted content is divided into three parts: Date

Time

Test item

In the current display interface has the following key operations:

Item: The cursor moves up and down between date and time

Tabbing: the cursor circulates and moves around in the current line

Increase: the figure at the cursor plus 1, press the key for a long time, rapid increase in figures.

Decrease: the figure at the cursor minus 1, press the key for a long time, rapid decrease in figures.

Setting: Update the current date, time and test item. The adjusted date and time written into instruments, save the setting of test item.

Back: Exit “time adjustment menu” and return to the boot welcome menu

Figure 6-1

Test item: 0: Sample by volume, report micrograms of absolute moisture content and moisture percentage in mg / L as the unit;

1: Sample by quality, report micrograms of absolute moisture content and moisture percentage in mass ratio ppm as the unit;

2: Sample by volume, report micrograms of absolute moisture content and moisture percentage in volume ratio ppm as the unit;

3: Sample by volume, report micrograms of absolute moisture

content and moisture percentage in mass ratio ppm as the unit;

3. Historical record menu

In Figure 6-1, press the "record" key, the LCD display as shown in Figure 6-3:



Figure 6-3

Print: Print the current historical record, print content including: sample number, moisture content, moisture percentage, inspection date and inspection time.

Previous page: Show the previous historical record, record number plus 1, press the key for a long time, fast forward flip, the maximum record number is 99.

Next page: Show the next historical record, record number minus 1, press the key for a long time, fast backward flip, the minimum record number is 0.

Back: Exit "historical record menu" and return to the boot welcome menu

Figure 6-1

4. Sample test menu

In Figure 6-1, press the "test" key, the LCD display as shown below:

This function with 4 menus:

- (1) Instrument automatically electrolyze excess moisture content of reagent to reach equilibrium state as shown in Figure 6-4;
- (2) Reagent to reach equilibrium, the sample can be measured in Figure 6-5;
- (3) After the start of the measurement, wait to add the measured sample in Figure 6-6;

(4) Measuring in Figure 6-7;



Figure 6-4

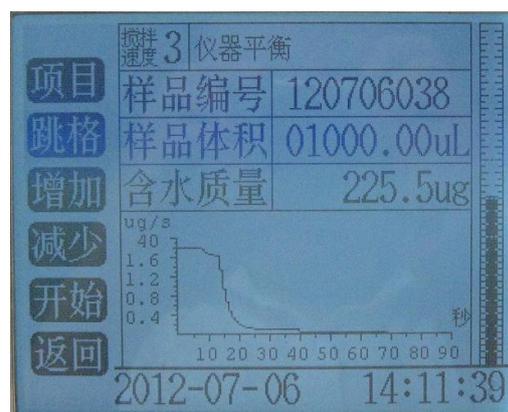


Figure 6-5



Figure 6-6

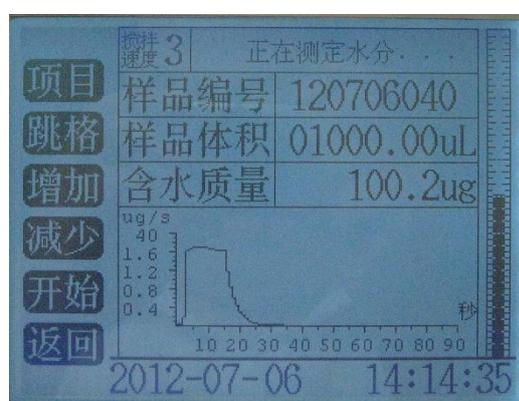


Figure 6-7

“Sample test menu” is the main menu of the instrument; the following parameters can be adjusted:

(1) Adjust the electrolyte stirring speed: make the electrolyte just can produce whirlpool, but can't produce bubbles. The adjustment range is 0-9.

Note: Stirring speed should be finished before the start of the electrolysis process; after the start of the electrolysis process to adjust will affect the test results.

(2) Adjust sample No.: in order to mark the record.

(3) Enter the sample volume or weight: as the basis for calculating the moisture content.

X-axis with three types: 90 seconds, 180 seconds, 12 minutes, automatic conversion over time.

Key functions are defined as follows:

Item: Select the item you want to adjust, circulating select in the above parameters

Tabbing: When the adjusted parameter type is a figure, tab key to horizontally move the cursor;

Increase: Increase the figure at the cursor

Decrease: Decrease the figure at the cursor

Start: If the instrument is ready, will start to electrolytic process.

Back: Return to the boot welcome menu Figure 6-1

Measurement process is described as follows:

- (1) Judge whether the measuring electrode is open or short circuit fault.
- (2) Judge whether the electrolyte is in the balance region or not, if the electrolyte is in the over iodine state, then displays the amount of water that need to add; if in the over water state, will automatically electrolyze excess moisture content to reach equilibrium state.

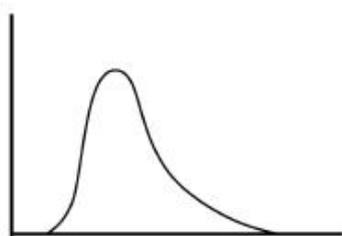
Note: For newly injected electrolyte, with 50 μ l injector through the inlet to the anode chamber of electrolytic cell slowly into water, observe the electrolyte color which from dark brown gradient to light yellow; at this time continue to inject 10 μ L water, the instrument automatically electrolyze excess moisture content until to reach equilibrium.

- (3) Electrolyte in equilibrium, it will be automatically blank current detection and electrolyte drift detection, used to correct the measurement results.
- (4) After completing the above steps, the instrument prompts the user to start measuring. At this point the sample is ready, press the start button, inject the sample to the electrolytic cell within 1 minute, more than 1 minute without injecting the sample, the instrument will automatically ignore the test results, wait for the user to start again.
- (5) After the instrument detecting the added sample, will begin to electrolytic process, accumulate moisture content and draw the electrolytic curve.

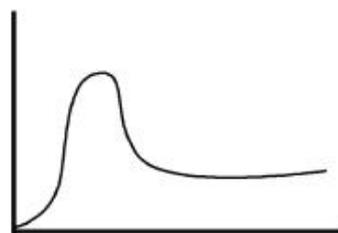
Note:

(1) Before testing the sample, the instrument should be calibrated with water. With 0.5ul injector inject 0.1ul water, then the test result of the instrument should be "100 ± 3ug (excluding the sampling error)", the general calibration 2-3 times, the result within the error range can measure sample.

(2) In the normal measuring process, per 100 ml of the reagent can be used with not less than 200 mg of water reaction, if the measuring time is too long, the reagent sensitivity decreased, should replace new reagents. According to the following methods to judge whether the electrolyte is failure or not: If the electrolyte in the electrolytic process release a lot of bubbles or reagent contaminate into reddish brown, the reproducibility of the test results at this time will be reduced, but also to reach the end of time longer, this situation should replace reagents as soon as possible; according to the depicted electrolytic speed curve to judge whether the electrolyte is failure or not. (See Figure 6-8)



Reagents good



Reagents failure

5. Measuring results menu

The instrument in the electrolysis process detecting the stop signal of the measuring electrode, stop measuring. If set to gas or liquid sample measurement, calculation of moisture content immediately, generate result report sheet. LCD display as shown in Figure 6-9

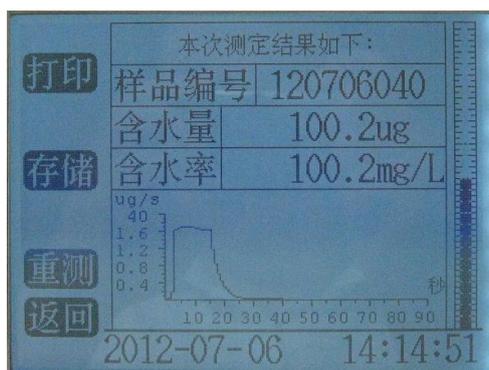


Figure 6-9

If set to a solid sample measurement, the instrument prompts to enter the sample tare weight, after entering to press the "Start" key, the instrument automatically calculates the sample weight and moisture content, generate report sheet as Figure 6-9.

The current menu, the key functions are defined as follows:

Print: Print the current measuring result report

Storage: Save the current result report as historical record

Retest: Back to the sample test menu Figure 6-5.

Back: Return to the boot welcome menu Figure 6-1

VII. Sample operation

The measurement range of the instrument is $0\mu\text{g} \sim 100\text{mg}$, in order to obtain accurate measuring results, appropriately according to the moisture content of the sample to control the sample volume.

1. Liquid sample

Measuring liquid sample: With the injector through the inlet inject the sample into the anode chamber of electrolytic cell. Needle must be wiped with filter paper before the injection, when inject the sample into the electrolytic cell, the needle of liquid injector should be inserted in the electrolyte reagents, do not touch the inner wall of electrolytic cell and the electrode.

2. Solid sample

Solid sample may be powder, granules or clumps and other shapes (large

clumps must be broken). When the sample insoluble in reagent, you must select a suitable water evaporator connected to the instrument.

The following is the dissolved solid sample in the reagent as an example to illustrate the solid sample.

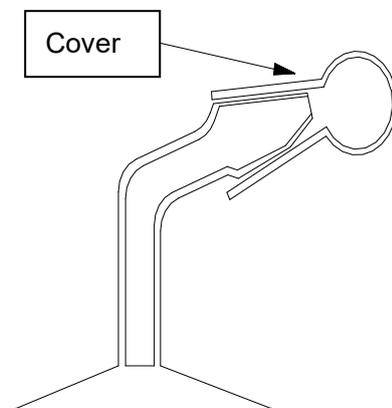


Figure 7-1

- (1) Solid injector as shown in Figure 7-1, clean with water and dry well.
- (2) Remove the cover of solid injector, encase the sample, cover immediately and accurately weighing.
- (3) Remove the inlet cocks of electrolytic cell, the injector shown in solid lines in Figure 7-2 into the inlet. The solid injector rotated 180 degrees, as shown in broken lines in Figure 7-2, the sample fall into the reagent, until the measuring completed. When solid sample fall into reagent, it shall not contact with the electrolytic electrode and measuring electrode.

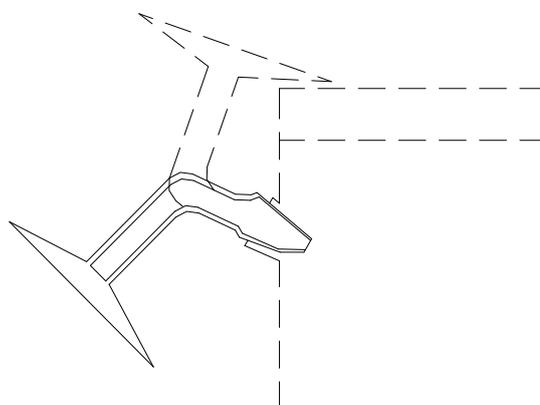


Figure 7-2

The solid injector after sampling and the cover accurately weighing again, calculate mass of the sample according to the difference between the two weighing, then to calculate moisture content.

3. Gas Sample

In order to make the moisture in the gas be absorbed by reagent, you must use a connector which control sample to inject to the electrolytic cell at any time (see Figure 7-3). when measuring the moisture in the gas sample, the electrolytic cell must be injected into about 150 ml reagent to ensure the moisture in the gas absorbed adequately, while the gas flow rate should be controlled at about 500 ml / minute, if the reagent in the measuring process significantly reduced, should be injected into about 20 ml glycol (also according to the actual measured object to add to the other chemical reagents).

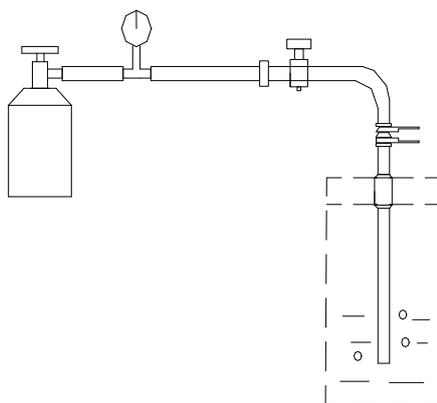


Figure 7-3

VIII. Maintenance

1. Place to put the instrument

- (1) Put it in the cool place, the indoor temperature at 5 °C ~ 35 °C.
- (2) Do not install the instrument in the humidity, power fluctuations environment.
- (3) Do not place the instrument in the corrosive gas environment.

2. The replacement of silicone pad

The silicone pad used for a long time will make the pinholes no shrinkage, and cause the entry of the moisture in the atmosphere, then affect the measurement. So it should be replaced in time (see Figure 4-4).

3. The replacement of silica gel

The silica gel in the drying tube from blue to light blue, should be replaced new silicone, do not encase silicone powder, otherwise will cause electrolytic cell cannot exhaust, then terminate electrolysis.

4. The maintenance of electrolytic cell ground

Every 7~8 days rotate about the electrolytic cell ground, when cannot rotate easily, should be re-coated with a thin layer of vacuum grease and reload, or used for a long time is not easy to remove.

If the electrode cannot be removed, do not force to pull out, at this moment the correct approach is the whole electrolytic cell all soaked in warm water immediately for 24 to 48 hours.

5. Cleaning of the electrolytic cell

Open all the glass mouth of the electrolytic cell bottle, the electrolytic cell bottle, drying tube, sealing plug can be cleaned with water. After washing put them in about 80 °C drying oven and then cooled naturally. Electrolytic electrode cannot be washed with water; clean it with anhydrous alcohol, then use a hair dryer to blow dry.

Cleaning should be careful not to wash the electrode line as shown in Figure 8-1.

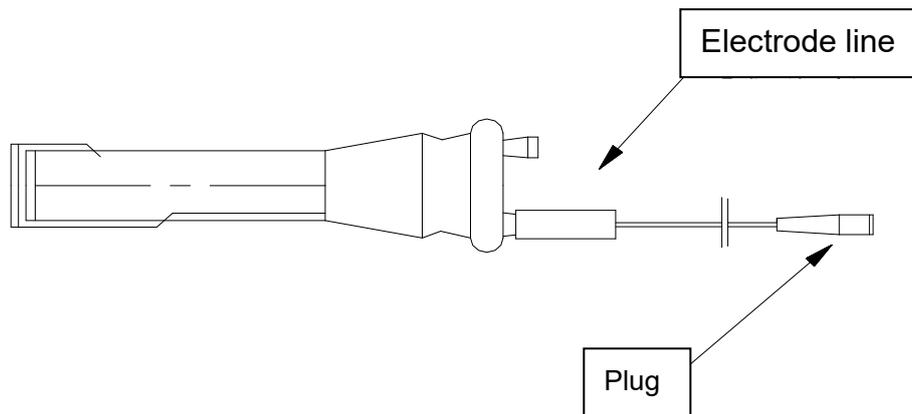


Figure 8-1

IX. Common troubleshooting

1. No display

Check the power cable, power switch, battery (portable instrument with battery).

2. Measuring electrode open

Check whether the connection that measuring electrode connect to the instrument plug is good or not, the cable is broken or not.

3. When electrolysis, electrolysis speed is always zero

Check whether the connection that electrolytic electrode connect to the instrument plug is good or not, the cable is broken or not.

4. Water calibration results is small, after sampling the instrument do not detect the sample

Check the electrolyte is failure or not.

5. Electrolytic process can not end

Check the electrolyte is failure or not.