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National Metrological Verification Procedures of the People's Republic of China

JJG 376-2007

Electrolytic Conductivity Meters

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Verification Regulation of Electrolytic Conductivity Meters

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Replacing JJG 376-1985

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JJG 376-2007 Corrigendum

Page 3	Row 8, Column 6 in Table 1: The value " ± 0.2 " shall be " ± 2.0 ".
Page 4	Penultimate line 4: The value "0.25" shall be "0.25%".

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Verification Regulation of Electrolytic Conductivity Meters

1 Scope

This regulation applies to the first-time verification, subsequent verification, and in-use inspection of electrolytic conductivity meters. Calibration of resistivity meter, salinity meter based on the electrical conductivity measurement principle, and TDS measurement instrument can reference to this regulation.

2 Normative references

OIML R68 Edition 1985 Calibration method for conductivity cell

BS EN 60746-3:2002 Expression of performance of electrochemical analyzers - Part 3: Electrolytic conductivity

3 Terminology and measuring unit

3.1 Electrolytic conductance

The ratio of current and electric potential difference when ionic charge of conductivity cell moves in the electrolyte solution.

$$G = \frac{I}{U} \quad (1)$$

Where:

G — conductance, S;

I — current through the electrolyte solution, A;

U — Electric potential difference between the electrodes, V.

Resistance is the reciprocal of conductance, unit is Ω .

3.2 Electrolytic conductivity of the electrolyte solution

Conductivity of electrolytic solution is defined by the following formula:

$$\kappa = \frac{j}{E} \quad (2)$$

Where:

k — Electrical conductivity, $S \cdot m^{-1}$;

4 Overview

Conductivity meter is used to measure the electrolyte solution conductivity. The measuring principle of conductivity meter is based on the relationship [formula (4)] of conductivity, electric conductance, and conductance cell's constant: Apply alternating electrical signals between electrodes of conductance cell to measure the solution conductivity; obtain the conductivity according to the imputed conductance cell's constant.

Conductivity meter is mainly consisted of two parts - the electronic unit and the sensor unit. Electronic unit usually includes signal generator, measuring unit (alternating current bridge or proportional amplifier), detector and reading part, as well as the unit for conductance cell's constant adjustment, temperature compensation and temperature measurement function. Sensor unit mainly includes conductance cell, generally it also includes a temperature sensor which is used for electrical signal transmission between the solution and electronic unit, and to measure the temperature of the solution.

Verification of conductivity meters includes 2 parts - electronic unit verification and instrument verification. This regulation divides the conductivity meters into 8 levels - 0.2, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 4.0, according to verification results of cited error of electronic unit. The metrological performance of each level is shown in Table 1.

5 Measuring performance requirements

5.1 The electronic unit repeatability

Verification results shall comply with the provisions of Table 1.

5.2 Electronic unit cited error

Verification results shall comply with the provisions of Table 1.

5.3 Indication error of conductance cell's constant

Verification results shall comply with the provisions of Table 1.

5.4 Indication error of temperature coefficient

Verification results shall comply with the provisions of Table 1.

5.5 Indication error of temperature measurement

Verification results shall comply with the provisions of Table 1.

5.6 Instrument cited error

Verification results shall comply with the provisions of Table 1.

7.3.5 Indication error of temperature coefficient

- 1) According to Figure 1. Connect to any standard conductivity G_s (for example 100uS) on the medium range. Place the constant adjustor at K_{cellR} (usually 1.000 cm⁻¹). Temperature coefficient is set to 0.00% or "no compensation"; or adjust the temperature indication value to be instrument reference value T_R (usually 25 °C). Read the electrolytic conductivity meter's measurement value K_{MR} .
- 2) Set temperature coefficient $\alpha = 2.00\% \cdot ^\circ\text{C}^{-1}$. Adjust the temperature sensor simulation resistance. Make temperature indication value as $T = 15\text{ }^\circ\text{C}$. Read the electrolytic conductivity meter's measurement value K_{MV} . Calculate the indication error of temperature coefficient according to Formula (9).

$$\Delta\alpha = \frac{K_{MR} - K_{MV}}{K_{MV}(T - T_R)} \times 100 - \alpha \quad (9)$$

- 3) Adjust the temperature sensor simulation resistance. Make the temperature indication value as $T = 35\text{ }^\circ\text{C}$. Operate according to step 2), calculate the indication error of temperature coefficient.
- 4) Set the temperature coefficient $\alpha = 1.50\% \cdot ^\circ\text{C}^{-1}$. Repeat steps 2 and 3).
- 5) Set the temperature coefficient $\alpha = 2.50\% \cdot ^\circ\text{C}^{-1}$. Repeat steps 2 and 3).

If the electrolytic conductivity meter has no temperature compensation function, this item may be exempted.

Notes: 4) and 5) are the required operation for first-time verification of instrument.

7.3.6 Indication error of temperature

- 1) Connect the electrolytic conductivity meter with electronic unit of temperature sensor. Place it in the same thermostatic bath with standard thermometer. Standard thermometer and temperature sensor shall be as close as possible.
- 2) Control the thermostatic bath's temperature to be the instrument's reference temperature T_R (usually 25 °C). At the same time, read standard thermometer measurement value T_s and electrolytic conductivity meter's temperature measurement value T_M . Calculate the indication error of temperature of single measurement according to Formula (10).

$$\Delta T = T_M - T_s \quad (10)$$

- 3) According to the step 2), repeat for 3 times. Calculate the arithmetic mean of indication error of 3-times temperature to be the indication error of instrument temperature measurement.

IV. Conclusion:

According to the verification results, this instrument conforms to 0.5-level.

_____ **END** _____

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