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REGULATION OF METROLOGICAL VERIFICATION
OF THE PEOPLE'S REPUBLIC OF CHINA

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Formaldehyde gas analyzers

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Verification regulation of formaldehyde gas analyzers

1 Scope

This Regulation applies to the initial verification, subsequent verification, in-use inspection of formaldehyde gas detectors (hereinafter referred to as instruments), that use the principle of electrochemical sensors and semiconductor gas sensors to measure formaldehyde content in the air. The upper limit of the verification of this Regulation is 1.5 $\mu\text{mol/mol}$. It is not applicable to formaldehyde gas detectors using the colorimetric principles.

2 Overview

The detection principle of the instrument is generally the electrochemical sensor principle and the semiconductor gas sensor principle. There are two sampling methods: inhalation and diffusion. The instrument mainly consists of sampling unit, sensor, electronic circuit, display, etc.

3 Measurement performance requirements

3.1 Indication error

The indication error shall comply with the requirements in Table 1.

3.2 Repeatability

Not more than 5%.

3.3 Response time

The response time of the instrument, which uses the inhalation sampling method, is not

greater than 90 s. The response time of the instrument, which uses the diffusion sampling method, is not greater than 180 s.

3.4 Drift

3.4.1 Zero-point drift shall not exceed $\pm 3\%$.

3.4.2 Range drift shall not exceed $\pm 3\%$.

4 General technical requirements

4.1 Appearance and structure

4.1.1 The instrument shall not have any appearance damage, that would affect its normal operation. The surface of newly manufactured instruments shall be smooth and flat, with uniform paint coating and no peeling or rust.

4.1.2 The instrument connection is reliable; each knob or button shall be able to operate and control normally.

4.2 Signs and marks

The instrument name, model, manufacturer name, exit-factory date, serial number, etc. shall be complete and clear. Those used in explosion-proof places shall have explosion-proof signs and numbers.

4.3 Power-on inspection

After the instrument is powered on, it shall be able to work normally; the display shall be clear and complete.

4.4 Insulation resistance

For instruments using AC power, the insulation resistance of the instrument shall be no less than 20 M Ω .

4.5 Insulation strength

For instruments using AC power supply, the insulation strength of the instrument power supply's phase and neutral wires to ground shall be able to withstand an AC voltage of

1.5 kV, 50 Hz, at a leakage current of 5 mA. The test lasts for 1 minute, without breakdown or arcing.

5 Control of measuring instruments

The control of measuring instruments includes initial verification, subsequent verification, in-use inspection.

5.1 Verification conditions

5.1.1 Verification environmental conditions:

5.1.1.1 Relative humidity: $\leq 85\%$; ambient temperature: $(10 \sim 35) ^\circ\text{C}$; during the verification period, the temperature fluctuation does not exceed $\pm 2 ^\circ\text{C}$.

5.1.1.2 Atmospheric pressure: $(86 \sim 106) \text{ kPa}$. During the verification period, the pressure fluctuation does not exceed $\pm 0.5 \text{ kPa}$.

5.1.1.3 AC power supply voltage: $220 \text{ V} \pm 22 \text{ V}$, $50 \text{ Hz} \pm 1 \text{ Hz}$.

5.1.1.4 There shall be no electromagnetic field interference, that affects the normal operation of the instrument.

5.1.1.5 The laboratory shall have good ventilation facilities; there shall be no interfering gases, that affect the detection accuracy in the verification environment.

5.1.2 Standard materials and equipment for verification

5.1.2.1 Use standard materials provided by organizations, which are approved by the national metrology administration department and possess the "License for Manufacturing Measuring Instruments" for corresponding standard materials. Formaldehyde gas traceability can use one of the following two methods.

a) Paraformaldehyde diffusion tube standard material

Paraformaldehyde diffusion tube standard material, which has an expanded uncertainty not greater than 2.1% ($k = 2$).

Formaldehyde dynamic gas distribution device: The uncertainty caused by the temperature, pressure, flow rate of the formaldehyde dynamic gas distribution device is not greater than 2% ($k = 2$).

b) Formaldehyde standard gas

The uncertainty of formaldehyde standard gas is not greater than 3% ($k = 2$).

5.3 Verification method

5.3.1 Appearance and power inspection

Carry out manual visual inspection, according to the requirements of 4.1.

5.3.2 Signs and marks

Carry out manual visual inspection, according to the requirements of 4.2.

5.3.3 Power-on inspection

Carry out manual visual inspection, according to the requirements of 4.3.

5.3.4 Insulation resistance

The instrument is not connected to the power supply. Turn on the power switch of the instrument. Connect one terminal of the insulation resistance meter to the phase and neutral wires of the instrument's power plug. Connect the other terminal to the protective ground terminal (or shell) of the instrument. Apply a DC voltage of 500 V for 5 seconds, to measure the insulation resistance. Instruments powered by low-voltage batteries may be exempted from this test.

5.3.5 Insulation strength

The instrument is not connected to the power supply. Turn on the power switch of the instrument. Connect the two test wires of the insulation device to the phase and neutral wires of the instrument's power plug and the protective grounding terminal of the instrument (or the shell), respectively. During the test, it shall gently rise the voltage to 1500 V; maintain the test voltage for 1 minute; then drop the voltage gently to 0 V. There shall be no breakdown or arcing during the test (leakage current is set to 5 mA). Instruments powered by low-voltage batteries may be exempted from this test.

5.3.6 Instrument adjustment

Warmup and stabilize the instrument and adjust the zero-point and indication value, according to the requirements of the instrument instruction manual.

5.3.7 Indication error

Connect the standard gas source, flow bypass system and the instrument under test (if the instrument under test has a flow bypass system, it can be directly connected to the standard gas source).

After the instrument is powered on, preheated and stabilized, calibrate the zero-point and indication value of the instrument, according to the instructions. Then introduce formaldehyde standard gases, which have a concentration of approximately 0.3

Appendix A

Performance requirements of formaldehyde dynamic gas distribution device

A.1 Introduction to formaldehyde dynamic gas distribution device

The formaldehyde dynamic gas distribution device is designed, in accordance with the standard requirements of ISO 6145(8)-2003 "Gas analysis - Preparation of calibration gas mixtures using dynamic volumetric methods - Part 8: Diffusion method". The principle of formaldehyde dynamic gas distribution is using the dynamic gas distribution diffusion tube method, which is one of the dynamic gas distribution methods. The dynamic gas distribution diffusion tube method is a standard gas preparation method, based on weighing. It uses the principle that the diffusivity of the diffused component remains unchanged, under a certain temperature and pressure. First, contain the components to be diffused in the diffusion tube; make the carrier gas continuously and steadily flows through the diffusion cell, to carry out the components that are stably diffused from the diffusion tube. Then dilute it, to obtain standard gas of different concentrations. The dynamic gas distribution diffusion tube method has a small uncertainty (1% ~ 3%), when preparing volatile, corrosive, adsorbent standard gases. The produced standard gas has low adsorption, high method accuracy, easy operation, long diffusion tube life. It can be used as a generating device for volatile, corrosive, adsorbent standard gases.

The formaldehyde dynamic gas distribution device uses a paraformaldehyde diffusion tube as the standard material for gas distribution. The gas diffused from this diffusion tube is paraformaldehyde gas. The paraformaldehyde gas is catalytically cracked into formaldehyde gas; then passed through the mixing and dilution tank, to obtain formaldehyde standard gases with different concentrations.

The schematic diagram of the formaldehyde dynamic gas distribution device design is as shown in Figure A.1.

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