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JJG

NATIONAL METROLOGY & CALIBRATION REGULATION OF THE PEOPLE'S REPUBLIC OF CHINA

JJG 695-2003

Replacing JJG 695-1990

Sulfur hydrogen gas detectors

硫化氢气体检测仪

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Verification regulation of sulfur hydrogen gas detectors

1 Scope

This regulation applies to the first verification, subsequent verification and in-use inspection of hydrogen sulfide gas detectors.

2 Overview

The hydrogen sulfide gas detector (hereinafter referred to as the instrument) mainly comprises an electrochemical sensor or an optical sensor, as well as an electronic component and a display portion. The sensor converts hydrogen sulfide gas in the environment into an electrical signal and displays it in a concentration (molar fraction).

The instrument is divided into diffused type and pumped type.

3 Metrological performance requirements

3.1 Indication error

The indication error of the instrument is as shown in Table 1.

Table 1

Hydrogen sulfide gas detector	Measuring range	Limit of indication error
	Molar fraction X (H ₂ S): $\leq 100 \times 10^{-6}$	$\pm 5 \times 10^{-6}$
	Molar fraction X (H ₂ S): $> 100 \times 10^{-6}$	$\pm 5\%FS$

3.2 Repeatability

The relative standard deviation shall be not more than 2%.

3.3 Response time

For diffused-type instrument, it is not more than 60 s; for pumped-type instrument, it is not more than 30 s.

observe whether the instrument has alarm sound and whether the alarm light flashes, check the alarm set point of the instrument.

4.2 Insulation resistance

For instruments which use 220V AC, the phase-to-ground insulation resistance of the power supply is not less than 40 MΩ.

4.3 Dielectric strength

For instruments which use 220V AC, the insulation strength of the phase-connected line to ground of the power supply shall be able to withstand the AC voltage of 1500V, 50Hz, for a test duration of 1 min, without breakdown and arcing.

5 Control of measuring instrument

Instrument control includes first verification, subsequent verification, in-use inspection.

5.1 Verification conditions

5.1.1 Environmental conditions for verification

5.1.1.1 Ambient temperature: 0 ~ 40 °C (fluctuation ≤ 5 °C)

5.1.1.2 Relative humidity: ≤ 85%

5.1.2 Equipment for verification

5.1.2.1 Gas reference material

The hydrogen sulfide standard gas which has a concentration of 20%, 50%, 80% of the full scale and 1.5 times the alarm set point is used, which have an uncertainty of not more than 2% ($k = 3$).

5.1.2.2 Zero calibration gas

High-purity nitrogen or clean air.

5.1.2.3 Flowmeter

(0 ~ 1) L/min, the accuracy level is not less than level 4.

for 1 min, the current is 5 mA. Then the voltage is smoothly lowered to 0 V. The instrument shall not have breakdown and arcing during the whole test.

5.3.4 Indication error

After preheating and stabilization, the instrument uses the zero gas and a standard gas with a concentration of about 80% of the upper limit of the measurement range. After calibrating the zero point and the indication value of the instrument, within the measurement range, respectively lead in the standard gas which has a concentration of about 20% and 50%, respectively, of the upper limit of measurement range (if the instrument has two measuring ranges, it shall lead in at least one standard gas within the low measuring range). Record the actual reading after leading in the gas. Repeat the above procedures for 3 times. Use the formula (1) or (2) to calculate the indication error of each verification point:

$$\Delta_e = \frac{\bar{A} - A_s}{R} \times 100\% \quad (1)$$

$$\Delta_e = \bar{A} - A_s \quad (2)$$

Where:

$\bar{A}$ - The average of the readings;

A_s - Standard value;

R - Measuring range.

When the instrument's range is $> 100 \times 10^{-6}$, it is calculated by formula (1), take the Δ_e of the maximum absolute value as the indication error of the instrument.

When the instrument's range is $\leq 100 \times 10^{-6}$, it is calculated by formula (2), take the Δ_e of the maximum absolute value as the indication error of the instrument.

5.3.5 Repeatability

After the instrument is stabilized by preheating and its zero point calibrated by the zero point standard gas, lead in the standard gas which has a concentration of about 50% of the measuring range. After the reading is stable, record the measured value. Repeat the above measuring procedure for 6 times. Respectively record the reading A_i . The repeatability is indicated by the relative standard deviation Δ_c . Use the formula (3) to calculate the repeatability of the instrument:

When the instrument's range is $> 100 \times 10^{-6}$, it is calculated by formula (4), take the Δ_{zi} of the maximum absolute value as the zero drift of the instrument.

When the instrument's range is $\leq 100 \times 10^{-6}$, it is calculated by formula (5), take the Δ_{zi} of the maximum absolute value as the zero drift of the instrument.

Calculate the indication drift according to formula (6) or (7):

$$\Delta_{si} = \frac{(A_{si} - A_{sl})}{R} \times 100\% \quad (6)$$

$$\Delta_{si} = A_{si} - A_{sl} \quad (7)$$

When the instrument's range is $> 100 \times 10^{-6}$, it is calculated by formula (6), take the Δ_{si} of the maximum absolute value as the indication drift of the instrument.

When the instrument's range is $\leq 100 \times 10^{-6}$, it is calculated by formula (7), take the Δ_{si} of the maximum absolute value as the indication drift of the instrument.

5.3.8 Measurement of alarm error

After the instrument is stabilized by preheating, use the zero point gas and the standard gas which has a concentration of about 80% of the upper limit of the measuring range, to calibrate the zero point and the indication value of the instrument. Then lead in the standard gas which has a concentration about 1.5 times the alarm set point (A_s). Record the actual alarm concentration (A_i) of the instrument. Remove the standard gas. Lead in the zero point gas to zero the instrument. Repeat the above procedures for 3 times. Use the formula (8) to calculate the alarm set error of the instrument:

$$\Delta_{A_i} = \frac{(A_i - A_s)}{A_s} \times 100\% \quad (8)$$

Take the Δ_{A_i} of the maximum absolute value as the alarm set error of the instrument.

5.4 Processing of verification result

The instruments as verified and qualified according to the requirements of this regulation will be issued a verification certificate. The instrument failing to pass the verification will be issued a verification result notice, on which the unqualified items are indicated.

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