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NATIONAL METROLOGICAL VERIFICATION REGULATIONS
OF THE PEOPLE'S REPUBLIC OF CHINA

JJG 551-2003

Sulfur Dioxide Gas Detectors

二氧化硫气体检测仪

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Sulfur Dioxide Gas Detectors

1 Scope

This Standard applies to the initial verification, subsequent verification and in-use verification of the sulfur dioxide gas detector in the air.

2 Overview

The sulfur dioxide gas detector (hereinafter referred to as the detector) is mainly composed of a chemical principle sensor or a physical principle sensor plus electronic components and a display part. The sensor converts the sulfur dioxide gas in the environment into an electrical signal. Then it is processed by electronic parts. Display as concentration value.

The detector is divided into diffusion type and pump suction type.

3 Metering performance requirements

3.1 Indication error

According to the different uses of the detector, it can be divided into two categories, as shown in Table 1.

Table 1 -- Detector category and indication error

3.2 Repeatability

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

3.3 Response time

It is not more than 60s for the diffusion type detector, not more than 30s for the pump suction type detector.

4.3 Insulation strength

For the detector that uses 220V alternating current, the phase of the power supply and the insulation strength of the interconnection line to the ground shall be able to withstand the test that the AC voltage is 1500V, 50Hz, lasts for 1min. There shall be no breakdown and arcing.

5 Measuring instrument control

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

5.1 Verification conditions

5.1.1 Verification of environmental conditions

5.1.1.1 Ambient temperature: (0~40)°C (fluctuation is less than $\pm 5^{\circ}\text{C}$)

5.1.1.2 Relative humidity: $\leq 85\%$

5.1.1.3 Atmospheric pressure: (86~106)kPa

5.1.2 Verification equipment

5.1.2.1 Gas reference material

Use the sulfur dioxide standard gas provided by the unit with the corresponding standard material "License for Manufacturing Measuring Instruments" approved by the national measurement administration. Its expanded uncertainty is 2% ($k=3$).

5.1.2.2 Zero calibration gas

Use high-purity nitrogen with a purity of 99.999%; or clean air with a sulfur dioxide content of less than 1×10^{-6} .

5.1.2.3 Flowmeter

0~1L/min; the accuracy level is not lower than level 3.

5.1.2.4 Stopwatch

Use electronic stopwatch or mechanical stopwatch.

5.1.2.5 Insulation resistance meter (500V)

5.1.2.6 Insulation strength tester (greater than 2.5kV)

Under the specified environmental conditions, after the detector is warmed up and stabilized, use zero-point calibration gas to calibrate the instrument zero point. Access standard gas with a concentration of about 80% of the range. Read the stable value. Remove the standard gas. Make the detector display zero. Then access the standard gas of the above concentration. At the same time, use a stopwatch to record the time from the moment the standard gas is introduced to the time when the detector displays 90% of the first stable value, which shall be the response time of the detector. Repeat the above steps 3 times. Take the arithmetic average value as the response time of the detector.

5.3.7 Zero drift and stability

Under the specified environmental conditions, after the detector is warmed up and stabilized, use zero-point gas and standard gas whose concentration is about 80% of the upper limit of the measurement range to calibrate the zero point and upper limit of the instrument. Access zero-point standard gas. Adjust the instrument zero potentiometer. Adjust the display value of the detector to 10% of the range (if the zero point of the detector is not adjustable, read the value directly). After the detector stabilizes, record the value C_{01} . Then access the standard gas with a concentration of about 80% of the detector range. After the detector stabilizes, record the reading C_{s1} . Remove the standard gas. Access zero-point gas. Remove the zero-point gas after the detector returns to zero. The detector runs continuously for 6h. Repeat the above steps once every 1h interval (discontinuous measuring instrument runs continuously for 1h; determine once every 10min interval). Record the readings C_{0i} and C_{si} separately. Calculate the zero drift (Δ_{0i} or Δ_{0ri}) according to formulas (4) and (5):

$$\Delta_{0i} = C_{0i} - C_{01} \quad (4)$$

$$\Delta_{0ri} = \frac{C_{0i} - C_{01}}{R} \times 100\% \quad (5)$$

Where,

Δ_{0i} - Zero drift of the detector (absolute value);

Δ_{0ri} - Zero drift of the detector (relative value);

C_{0i} - The i^{th} zero drift reading of the detector;

C_{01} - The first zero drift reading of the detector.

Take the largest absolute value Δ_{0i} or Δ_{0ri} as the zero drift value of the detector.

Calculate the stability (Δ_{si} or Δ_{sri}) according to formulas (6) and (7):

$$\Delta_{si} = C_{si} - C_{s1} \quad (6)$$

$$\Delta_{sri} = \frac{C_{si} - C_{s1}}{R} \times 100\% \quad (7)$$

Where,

Δ_{si} - Stability of the detector (absolute value);

Δ_{sri} - Stability of the detector (relative value);

C_{si} - The i^{th} stability reading of the detector;

C_{s1} - The first stability reading of the detector.

Take the largest absolute value Δ_{si} or Δ_{sri} as the stability of the detector.

5.3.8 Alarm setting error

Under the specified environmental conditions, after the detector is warmed up and stabilized, use zero-point gas and standard gas whose concentration is about 80% of the upper limit of the measurement range. Calibrate the zero point and indication value of the detector. Then access standard gas with a concentration of about 1.5 times the alarm set point (A_s). Record the actual alarm concentration value of the detector (A_i). Remove the standard gas. Access zero-point gas to make the detector return to zero. Repeat the above steps 3 times. Calculate the alarm setting error δ_{Ai} of the detector according to formula (8):

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

Take the largest absolute value of δ_{Ai} as the alarm setting error of the detector.

5.4 Verification result processing

The detector that has been verified to meet the requirements of this Regulation will be issued a verification certificate. The detector that does not meet the requirements of this Regulation will be issued a verification result notice and indicate the unqualified items.

5.5 Verification period

The verification period of the detector is generally 1 year. If there is any doubt about the test data of the detector or the main parts of the detector are replaced and repaired, they shall be submitted for inspection in time.

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