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JJG

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

JJG 801-2004

Chemiluminescent NO/NO_x Analyzers

化学发光法氮氧化物分析仪

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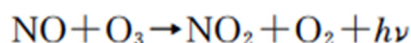
Carbon Monoxide and Carbon Dioxide Infrared Gas Analyzer

1 Scope

This Standard applies to the initial verification, subsequent verification and in-use inspection of chemiluminescence nitrogen oxide analyzer.

2 Overview

The basic detection principle of the chemiluminescence nitrogen oxide analyzer (hereinafter referred to as the "instrument") is: When nitric oxide reacts with ozone (O_3), generate excited nitrogen dioxide molecules (NO_2). The excited nitrogen dioxide molecule emits light when it returns to the ground state. The intensity of the emitted light is proportional to the concentration of nitric oxide. Detect the luminous intensity to detect the concentration of nitric oxide. The chemical reaction formula is:



Where,

$h\nu$ - Emitted light.

If there is nitrogen dioxide gas in the sample gas, the sample gas first passes through the inherent converter of the instrument to convert nitrogen dioxide into nitric oxide (NO). Then with ozone (O_3), the above chemiluminescence reaction occurs. The difference between the total amount of nitrogen oxides ($NO+NO_2$) detected (NO_x) and nitric oxide is equal to the content of nitrogen dioxide (i.e. $NO_x-NO=NO_2$).

The structure of the instrument generally includes: ozone generator, converter, detector, electronic unit.

3 Metering performance requirements

The measurement performance requirements of the instrument are specified in Table 1.

5.3 Verification methods

5.3.1 Appearance and power-on inspection

Use visual inspection and hand feel method according to requirements of 4.1.1 and 4.1.2.

5.3.2 Insulation resistance measurement

The tested instrument is not connected to the power supply. Turn on its power switch. Connect one terminal of the insulation resistance meter to the phase and middle connection lines of the power plug. The other terminal is connected to the ground terminal of the instrument. Use the insulation resistance meter to measure the insulation resistance of the tested instrument.

5.3.3 Insulation strength measurement

The tested instrument is not connected to the power supply. Turn on its power switch. Connect the two wires of the insulation strength measuring instrument to the phase wire (or neutral wire) of the power plug of the tested instrument and the chassis. Make the voltage rise steadily to 1500V. Maintain 1min. Then make the voltage drop steadily to 0V. No breakdown and arcing shall occur during the test.

5.3.4 Calibration before verification

Power on the instrument to warm up for at least 1.5h. The total flow rate monitored by the vent flow meter is greater than the flow rate required by the instructions. Access zero-point gas first. Adjust zero point. Access NO standard gas that is about 85% of the range. After the indicated value stabilizes, adjust the instrument's NO and NO_x indicated values to be consistent with the standard values.

5.3.5 Verification of indication error

According to the flow requirements during calibration, access approximately 20%, 50%, and 85% of the range of NO standard gas, respectively. Record the stable value. Perform three times for each point. Take the arithmetic average of three times as the value indicated by the instrument. Calculate the result according to formula (1). Take the maximum value of the absolute value of the result as the indication error (ΔC). For multi-range instruments, select high, medium, and low ranges for verification.

$$\Delta C = \frac{\bar{C} - C_0}{C_0} \times 100\% \quad (1)$$

Where,

Where,

$\bar{C}_{\text{NO}_2}$ - Average NO₂ of three measurements;

C₀ - NO₂ mixed gas concentration.

5.3.9 Drift verification

The drift of the instrument includes zero-point drift and range drift. After the instrument warms up, in the highest range of the instrument, access zero-point gas. At this time, record the stable reading as Z₀. Then access NO standard gas with a content of about 85% of range. Read the stable display value as S₀. Conduct continuous operation for 6h. Access zero-point gas every 1h and record the zero-point value of the instrument as Z_i. Access the same standard gas mentioned above. Record the stable indication of the instrument as S_i. Calculate the zero drift (ΔZ_i) according to formula (4). Calculate the range drift (ΔS_i) according to formula (5). Take the largest absolute value ΔZ_i as the zero drift (ΔZ). The ΔS_i with the largest absolute value is taken as the range drift (ΔS).

$$\Delta Z_i = \frac{Z_i - Z_0}{R} \times 100\% \quad (4)$$

$$\Delta S_i = \frac{(S_i - Z_i) - (S_0 - Z_0)}{R} \times 100\% \quad (5)$$

Where,

Z_i - Zero point value of the ith pass through zero gas;

S_i - Indication value of the ith accessed standard gas;

R - Full range of the instrument.

5.4 Processing of verification results

For qualified instruments verified according to this Regulation, a verification certificate will be issued. For instruments that fail to pass the verification, a verification result notification will be issued, and the unqualified items shall be indicated.

5.5 Verification cycle

The verification period of the instrument is 2 year.

After repairing or replacing the main components of the instrument, it shall be submitted for inspection at any time.

Annex A

Description of reference materials

Because the use environment of the instrument is different, the range of the instrument is different. Quite a few chemiluminescence nitrogen oxide analyzers have a very low range of use, which generally is less than 10×10^{-6} . Therefore, the gas standard substance used in the verification can also be configured with low-concentration standard gas using the ISO recognized mass flow dynamic gas distribution device. However, the high-concentration standard gas used in dynamic gas distribution must be traced to a national certified standard material with an uncertainty of 1% ($k=3$).

The current typical standard gas dilution device is based on the above principle. According to the needs of the inspected instrument, use high-purity nitrogen as diluent gas. Dilute high-concentration gas reference materials. Various standard gases with $10^{-8} \sim 10^{-2}$ content can be prepared. Its main technical performances are as follows:

- 1) Flow range: (10/2000/3000/5000) mL/min (optional);
- 2) Flow indication error limit: $\pm 0.5\%$;
- 3) Time required to convert the concentration: <60s.

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Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

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