JJF

NATIONAL METROLOGICAL VERIFICATION REGULATIONS

OF THE PEOPLE'S REPUBLIC OF CHINA

JJG 846-2015

Dust Concentration Measuring Instruments

粉尘浓度测量仪

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Verification Regulation of Dust Concentration Measuring Instrument

1 Scope

This Regulation applies to the first verification, follow-up verification and in-use inspection of dust concentration measuring instruments (hereinafter referred to as dust meters).

2 Overview

A dust meter is an instrument used to measure the mass concentration of particulate matter suspended in the air. It can display concentration value or output concentration signal. The principle of the dust meter is mainly to convert the dust concentration signal into an electrical signal by light scattering method, β-ray method and light transmission method, and then display it through the secondary instrument.

A dust meter is generally composed of a dust concentration conversion component, a sampling head (including a cutter or separator), an air pump, a power supply, and a circuit. Some dust meters also have structures or functions such as flow meters, sampling time display or setting, sampling volume display or setting, and signal output.

According to the measurement range, the dust meter is divided into high concentration dust meter (the measurement range is generally $10mg/m^3$~$1000mg/m^3$) and low concentration dust meter (the measurement range is generally $0.1mg/m^3$~$10mg/m^3$).

3 Metering performance requirements

3.1 Indication error

Indication error shall not exceed ±20%.

3.2 Indication repeatability

Indication repeatability shall not exceed 10%. For dust meters based on the optical principle, if a standard light-transmitting film plate is used for testing, the repeatability of the indication value shall not be greater than 2%.

4 General technical requirements

4.1 Appearance and mark

4.1.1 The nameplate of the dust meter shall have the product name, model, exit-factory serial number, date of manufacture, and name of the manufacturer. The domestic dust meter shall have the mark and number of the manufacturing measuring instrument license. Explosion-proof dust meters shall have explosion-proof signs and numbers.

4.1.2 The surface of the dust meter and the sampling head (including the cutter or separator) and other components must not have obvious dents, cracks, deformations and other defects that affect normal operation.

4.1.3 The connection of dust meter is reliable. All knobs and buttons shall be able to operate and control normally. After power on, the display part shall be clear and complete.

4.2 Insulation resistance

For dust meters using AC power, the insulation resistance shall not be less than 20MΩ.

4.3 Insulation strength

For the dust meter using AC power supply, it shall be able to withstand the voltage with AC effective value of 1500V and frequency of 50Hz. Leakage current is not greater than 5mA. The duration is 1min. There is no flashover or breakdown phenomenon.

5 Measuring instrument control

Measuring instrument control includes initial verification, follow-up verification and inspection in use.

5.1 Verification environment conditions

The temperature is (15~30)℃. The relative humidity is not more than 85%. The dust meter shall be stabilized under this condition before it can be verified.

5.2 Verification equipment

5.2.1 High-concentration dust meter verification equipment

5.2.1.1 High-concentration dust generating device

When the measurement upper limit of the dust meter under verification is greater than 10mg/m^3, a high-concentration dust generating device shall be used. The concentration range is (10~1000) mg/m^3. The dust used is dry coal dust, talcum powder or other

suitable dust particles. In the test section, the deviation of the average value of three identical measurements at the sampling port of the standard sampling device and the sampling port of the dust meter under verification shall not be greater than 5%. The experimental standard deviation of central point stability (6 consecutive same measurements) shall not be greater than 5%.

5.2.1.2 Standard sampling device

The technical requirements are as follows:

A pump with less pulsation such as a vane type shall be used as the air source. The flow rate of the air source shall not be less than twice the flow rate of the dust meter. There is a flow buffer device in the gas path. Its buffer volume is not less than the rated sampling volume in 10s of the dust meter. The flowmeter accuracy level is 1.0.

5.2.1.3 Barometer: the measuring range (86~105) kPa; the allowable error limit is ±200Pa.

5.2.1.4 Stopwatch: the division value is 0.01s.

5.2.1.5 Thermometer: the measuring range is (0~50)℃; the division value is 0.1℃.

5.2.1.6 Balance: the division value is 0.1mg.

5.2.1.7 Insulation resistance meter: the output voltage is 500V; the accuracy level is 10.

5.2.1.8 Voltage withstand tester: the AC voltage is (0~1500)V; the frequency is 50Hz; the accuracy level is better than level 5.

5.2.2 Low-concentration dust meter verification equipment

5.2.2.1 Low-concentration dust generating device

When the measurement upper limit of the dust meter under verification is less than or equal to 10mg/m^3, a low-concentration dust generating device or a standard particle generating device shall be used. The concentration occurrence range is (0.1~10) mg/m^3. The dust used is dry coal dust, talcum powder, monodisperse polystyrene particles, and other suitable particles whose particle size is smaller than or equal to the cut particle size of the tested dust instrument. In the test section, the deviation of the average value of the three same measurements at the sampling port of the reference dust meter and the sampling port of the measured meter shall not be greater than 5%. The experimental standard deviation of central point stability (6 consecutive same measurements) shall not be greater than 5%.

5.2.2.2 Technical requirements for reference dust meter

Reference dust meter: the measuring range is (0.1~10) mg/m^3; the maximum allowable error is not more than ±5%; the repeatability of indication value is not more than 3%

For instruments with total dust sampling function, the indication error testing adopts its total dust sampling function. For a dust meter that can only measure respirable dust (or with a single particle size cutter), the standard sampling device shall be connected to the same separation device (or a single particle size cutter) as the tested dust meter.

The dust meter and standard sampling device shall preferably be placed in a dusty environment. But its blocking area to the flow field shall not exceed 5%. If it is placed outside the dusty environment, the sampling head and filter membrane shall be placed in the dusty environment. The shape, size and material of the sampling transfer tubes shall be exactly the same. Ensure the same transmission efficiency for the sampled dust.

Before the test, relevant preparation shall be done according to the requirements of the dust meter instruction manual, for example, determine the dust coefficient (K value) of the test dust.

5.4.2.2 When the upper limit of the measurement range of the dust meter is greater than 10mg/m^3, the verification system for measuring the error of the indication value can refer to the device shown in Figure 1.

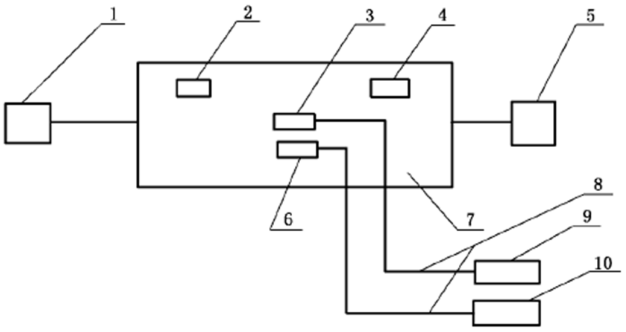

Figure 1 -- Schematic diagram of dust measurement error verification with transmission tube

1 - dust supply device; 2 - wind speed measurement point; 3 - thin-walled standard sampling pipe; 4 - dust concentration monitoring probe; 5 - fan; 6 - sampling port for tested dust meter; 7 - Dust concentration verification device test section; 8 - transmission pipe; 9 - standard sampling device with filter membrane; 10 - tested dust meter

Select 3 measurement points of about 20%, 50% and 80% of the concentration range tested by the dust meter. Use a standard sampling device and a dust meter to sample under the same conditions. Evenly record 6 stable dust concentration display values of the dust meter every time. Take the arithmetic mean value as the displayed concentration value of the dust meter ρ_1. Use the sampling flow rate of the standard sampling tube, sampling time, and the mass of the increased dust before and after the filter membrane sampling (generally controlled at 1mg~5mg) and other parameters to

calculate the dust concentration according to formula (1) as the standard dust concentration ρ_0^1. Repeat the above operation 3 times for each measurement point. Take the arithmetic mean of 3 ρ_1^1 and ρ_0^1 respectively as ρ_1 and ρ_0. Then use formula (2) to calculate the indication error of this point.

$$\rho_0^1 = \frac{m_2 - m_1}{q_V \cdot t} \times 1\ 000 \qquad (1)$$

Where,

ρ_0^1 - the concentration of standard dust mass, mg/m^3;

m_1 - the mass of the filter membrane before collecting dust, mg;

m_2 - the mass of dust collected by the filter membrane, mg;

q_v - the sampling flow rate, L/min;

t - the sampling time, min.

$$\delta = \frac{\rho_1 - \rho_0}{\rho_0} \times 100\% \qquad (2)$$

Where,

δ- the Indication error, %;

ρ_1 - the average value displayed by the dust meter, mg/m^3;

ρ_0 - the average value measured by the standard sampling device or displayed by the reference dust meter, mg/m^3.

Take the indication error with the largest absolute value among the three measuring points as the indication error of the dust meter.

5.4.2.3 When the upper limit of the measuring range of the tested dust meter is less than or equal to 10mg/m^3, the verification of the indication error shall be made by referring to the reference dust meter.

The system for verifying dust meters using low-concentration dust generators and reference dust meters is shown in Figure 2.

The system for verifying dust meters using standard particle generators and reference dust meters is shown in Figure 3.

For optical dust meters, if a standard light-transmitting film is used for testing, it shall be tested continuously and independently for 6 times around 50% of its range. Calculate its repeatability according to formula (3).

5.4.4 Insulation resistance

Use an insulation resistance meter to measure the insulation resistance between the two poles of the power jack of the dust meter to the ground and the exposed metal parts on the shell. Take the minimum value as the insulation resistance of the dust meter.

5.4.5 Insulation strength

Connect the output terminal of the withstand voltage tester to the AC input terminal of the dust meter and the exposed metal parts of the shell, respectively. Make the withstand voltage tester output 1500V AC voltage. Keep it for 1min. Observe whether the dust meter has broken down or is arcing.

5.5 Processing of verification result

A verification certificate will be issued to the dust meter that meets the requirements of this Regulation after verification (see B.1 and B.2 for the format of the inner page). For dust meters that do not meet the requirements of this Regulation, a notification of verification results shall be issued (see B.1 and B.3 for the format of the inner pages). See Annex C for the original record format.

5.6 Verification period

The verification cycle of the dust meter is generally not more than 1 year. When the dust meter is repaired or the main parts are replaced, it shall be sent for verification in time.

Annex A

Calibration method for indication error of reference dust meter

A low-concentration dust generator or a standard particle generator shall be used. The particle size of the standard particles shall be less than or equal to the selected particle size of the particle size cutter of the tested dust meter. Connect the reference dust meter to the dust concentration generating device shown in Figure A.1 for testing. The methods are as below:

A.1 For instruments with total dust sampling function, the indication error testing adopts its total dust sampling function. For a dust meter that can only measure respirable dust (or with a single particle size cutter), the standard sampling device (shall meet the requirements of 5.2.1.2) shall be connected to the separation device (or a single particle size cutter) same as the reference dust meter.

A.2 The reference dust meter and standard sampling device shall preferably be placed in a dusty environment. But its blocking area to the flow field shall not exceed 5%. If it is placed outside the dusty environment, the sampling port shall be placed in the dusty environment. The shape, size and material of the sampling tubes shall be exactly the same. The transmission path of sampled dust shall be the same.

A.3 Use the dust concentration generating device to generate 0.5mg/m^3, 1mg/m^3, 3mg/m^3, 7mg/m^3 or a stable dust environment of about 20%, 50%, and 80% of the measured concentration range (select appropriate 3 concentration test points within its measurement range). Then use the standard sampling device and the reference dust meter to sample and measure under the same conditions. Record the 6 dust concentration display values of the reference dust meter evenly each time. Take the arithmetic mean value as the display concentration value ρ_1^1 of the dust meter for this time (for the tested dust meter that can directly display the average value of the concentration during the sampling period, the displayed average value can be read directly; for the tested dust meter that can only display the cumulative concentration value, divide the cumulative concentration value by the set sampling time to get the average concentration of the testing point). The dust concentration calculated according to formula (1) is taken as the standard dust concentration ρ_0^1 using parameters such as the sampling flow rate of the standard sampling (pipe) device, sampling time, and the mass of the increased dust before and after filter membrane sampling. Repeat the above operation 3 times for each measurement point. Take the arithmetic mean of 3 ρ_1^1 and ρ_0^1 respectively as ρ_1 and ρ_0. Then use formula (2) to calculate the dust concentration indication error of the verification point. In the written results of the calibration of the

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