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NATIONAL ENVIRONMENTAL PROTECTION STANDARD
OF THE PEOPLE'S REPUBLIC OF CHINA

HJ 870-2017

**Stationary Source Emission -
Determination of Carbon Dioxide -
Non-Dispersive Infrared Absorption Method**
固定污染源废气 二氧化碳的测定 非分散红外吸收法

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Stationary Source Emission - Determination of Carbon Dioxide - Non-Dispersive Infrared Absorption Method

1 Scope

This Standard specifies the non-dispersive infrared absorption method for determination of carbon dioxide in the stationary source emission.

This Standard is applicable to the determination of carbon dioxide in the stationary source emission.

Under the condition that the instrument range is 20% (volume concentration), the detection limit of this Standard is 0.03% (0.6g/m³); while the lower limit of determination is 0.12% (2.4g/m³).

2 Normative References

The contents of this Standard refer to the following documents or their terms. For the undated references, only the valid version applies to this Standard.

GB/T 16157 The Determination of Particulates and Sampling Methods of Gaseous Pollutants Emitted from Exhaust Gas of Stationary Source

HJ/T 373 Technical Specifications of Quality Assurance and Quality Control for Monitoring of Stationary Pollution Source

HJ/T 397 Technical Specifications for Emission Monitoring of Stationary Source

3 Terms and Definitions

3.1 Zero gas

The gas with no measurement components or less than the specified value; the concentration of other component does not interfere with the measurement component results or the interference of the measurement component may be negligible.

3.2 Calibration span

6 Reagents and Materials

6.1 Standard gas of carbon dioxide

The commercial certificated standard gas with uncertainty $\leq 2\%$.

6.2 Zero gas

Nitrogen gas with purity $\geq 99.99\%$ or clean air not interfering the determination.

7 Apparatus

7.1 Carbon dioxide detector by non-dispersive infrared absorption method

7.1.1 Composition

Instrument consists of: analyzer (including gas flow meter and flow control unit, air pump, detector, etc.), sampling tube (including dust filter device and heating and heat preservation device), air guiding pipe, dehumidifying device, portable printer, etc.

7.1.2 Performance requirements

- a) Calibration error: not exceeding $\pm 5\%$;
- b) System bias: not exceeding $\pm 5\%$;
- c) Zero drift: not exceeding $\pm 3\%$;
- d) Span drift: not exceeding $\pm 3\%$;
- e) Has the function to eliminate the interference;
- f) The dehumidifying device shall meet the requirements of GB/T 16157;
- g) Has the function to show the sampling flow rate; the measurement range and accuracy of gas flow meter shall meet the requirements of the instrument;
- h) The heating and heat preserving temperature of the sampling tube: it may be set or adjusted within $120^{\circ}\text{C}\sim 160^{\circ}\text{C}$.

7.2 Steel cylinder of standard gas

It is equipped with adjustable pressure reducing valve, adjustable rotor flowmeter and air guiding tube.

7.3 Gas collecting bag

8.5 Sample determination

8.5.1 Place the front end of the sampling tube of the instrument in the exhaust pipe; block the sampling hole, so that it does not leak gas.

8.5.2 Start the air pump; conduct sampling determination according to the sampling flow specified by the detector. After the detector is stable, save the measurement data in minutes; take the average value of the measure data for at least continuous 5 minutes as the one measurement value.

8.5.3 After the end of one measurement, use the zero gas to clean the instrument according to the instruction manual of the instrument.

8.5.4 After obtaining the measurement result, use zero gas to clean the instrument. When the indication value returns to near zero point, turn off the power and finish the measurement.

9 Results Calculation and Expression

9.1 Results calculation

9.1.1 Calculation of exhaust flow rate

According to the provisions of GB/T 16157, calculate the dry exhaust flow rate Q_{sn} (m^3/h) under the standard state (273K, 101.325kPa).

9.1.2 Calculation of carbon dioxide concentration

The concentration (g/m^3) of carbon dioxide in the stationary source emission shall be calculated as per the following formula:

$$\rho = 19.6 \times \omega \quad (1)$$

Where:

ρ – mass concentration of carbon dioxide in the dry exhaust under the standard state, in g/m^3 ;

ω – volume concentration of carbon dioxide in the measured exhaust determined by the instrument, in %.

9.1.3 Calculation of carbon dioxide emission rate

$$G = \rho \times Q_{sn} \times 10^{-3} \quad (2)$$

The relative standard deviations in the laboratory are: 0.05% ~ 0.12%, 0.01% ~ 0.20%, 0.04% ~ 0.13%;

The relative standard deviations among laboratories are: 3.4%, 2.1%, 3.2%;

The repeatability limits are: 0.04%, 0.06%, 0.02%;

The reproducibility limits are: 1.3%, 1.0%, 0.52%.

10.2 Accuracy

Determination of carbon dioxide standard gases at concentration levels of 5.01%, 15.1%, 20.0% in 6 laboratories:

Relative errors are: -1.9% ~ 2.0%, -1.4% ~ 1.7%, -0.08% ~ 0.06%;

Final values of relative errors are: $-0.17\% \pm 2.6\%$, $-0.10\% \pm 2.1\%$, $0.02\% \pm 0.10\%$.

11 Quality Assurance and Quality Control

11.1 Before monitoring, measure the zero gas and carbon dioxide standard gas; calculate the calibration error and system bias. If the calibration error and/or system bias does not meet the requirements of Items a) and b) in 7.1.2; then find out the causes; and conduct the corresponding repair and maintenance till the requirements are met.

11.2 After monitoring, measure the zero gas and carbon dioxide standard gas again; calculate the calibration error and system bias. If the calibration error and system bias meet the requirements of Items a) and b) in 7.1.2; the determination results of the sample are judged to be valid; otherwise, the determination results of the sample are judged to be invalid.

NOTE: The inspection of the calibration error of the whole system including sampling tube, air guiding pipe, dehumidifying device, etc. can be taken to replace the inspection of the calibration error and system bias of the analyzer [its evaluation shall implement the requirements of Item a) in 7.1.2].

11.3 The determination results of the sample shall be within 20%~100% of the calibration span; otherwise, the calibration span shall be re-selected.

11.4 At least once inspection for zero drift and span drift shall be carried out every half a year; the results shall meet the requirements of Items c) and d) in 7.1.2; otherwise, timely maintain and repair the instrument.

11.5 Perform linear calibration against the instrument by standard gas with low (<20% C.S.), medium (40%~60% C.S.), high (80%~100% C.S.) concentration at least once

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