HJ

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Specifications and test procedures for nonmethane hydrocarbons continuous emission monitoring system in stationary sources

固定污染源废气非甲烷总烃连续监测系统技术要求及检测方法

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Specifications and test procedures for nonmethane hydrocarbons continuous emission monitoring system in stationary sources

1 Scope

This standard specifies the composition structure, technical requirements, performance indicators, detection methods of nonmethane hydrocarbons continuous emission monitoring system in stationary sources.

This standard applies to the design, production, testing of nonmethane hydrocarbons continuous emission monitoring system in stationary sources.

2 Normative references

This standard refers to the following documents or their clauses. For undated reference documents, their valid versions are applicable to this standard.

GB 3836.1 Explosive atmospheres - Part 1: Equipment - General requirements

GB/T 4208 Degrees of protection provided by enclosure (IP code)

GB/T 16157 The determination of particulates and sampling methods of gaseous pollutants emitted from exhaust gas of stationary source

HJ 38 Stationary source emission - Determination of total hydrocarbons, methane and nonmethane hydrocarbons - Gas chromatography

HJ 75 Specifications for continuous emissions monitoring of SO_2, NO_X, and particulate matter in the flue gas emitted from stationary sources

HJ 76 Specifications and test procedures for continuous emission monitoring system for SO_2, NO_X and particulate matter in flue gas emitted from stationary

3 Terms and definitions

The following terms and definitions apply to this standard.

3.1

5.1.1 NMHC-CEMS shall have a product nameplate. The nameplate shall be marked with product name, model, manufacturer, exit-factory number, manufacturing date, power supply specifications, main parameter span, etc.

5.1.2 The surface of NMHC-CEMS shall be intact, without obvious defects; all parts and components shall be connected reliably; operating keys and buttons shall be flexible to use; positioning shall be accurate.

5.1.3 The panel of the NMHC-CEMS host is clearly displayed; the color is firm; the characters and markings are easy to identify; there shall be no defects, which affect the reading.

5.1.4 The shell or outer cover of the outdoor parts of NMHC-CEMS shall at least meet the requirements of IP55 protection level in GB/T 4208.

5.2 Working conditions

NMHC-CEMS shall work normally under the following conditions:

a) Indoor ambient temperature: (15 ~ 35) °C; outdoor ambient temperature: (-20 ~ 50) °C;

b) Relative humidity: ≤ 85%;

c) Atmospheric pressure: (80 ~ 106) kPa;

d) Power supply voltage: AC (220 ± 22) V, (50 ± 1) Hz.

Note: Under special environmental conditions, the configuration of system equipment shall meet the requirements of local environmental conditions.

5.3 Safety requirements

5.3.1 Insulation resistance

When the ambient temperature is (15 ~ 35) °C and the relative humidity is ≤ 85%, the insulation resistance of the system power terminal to the ground or the chassis is not less than 20 MΩ.

5.3.2 Insulation strength

When the ambient temperature is (15 ~ 35) °C and the relative humidity is ≤ 85%, the system shall last for 1 min, under 1500 V (effective value), 50 Hz sine wave test voltage; there shall be no breakdown or arcing.

5.3.3 The system shall have a leakage protection device and good grounding measures, to prevent damage to the system, which is caused by lightning strikes.

5.3.4 Installation and users shall establish effective safety measures, to prevent the leakage of flammable, explosive, toxic, harmful gases; prevent other safety risks. If the equipment installation environment has explosion-proof requirements, it must be implemented, in accordance with the relevant requirements in GB 3836.1.

5.4 Functional requirements

5.4.1 Requirements for sample collection and transmission devices

5.4.1.1 The sample collection and transmission device shall select the materials, which are resistant to high temperature, corrosion, non-absorptive, non-reactive with the pollutants under test; meanwhile, it shall not affect the normal measurement of the pollutants under test.

5.4.1.2 The sample collection device shall have the functions of heating, heat preservation, backflushing purification. The heating shall be uniform and stable. The heating temperature shall be ensured to be above 120 °C, or 20 °C higher than the flue gas temperature, whichever is higher. The heating temperature value shall be able to be displayed and queried, in the cabinet or system software.

5.4.1.3 The sample collection device shall have a particulate filtering function. The front or back end of the sampling equipment shall be equipped with a particulate filter, which is easy to replace or clean. The filter shall be able to filter particles, which has a particle size of at least 5 μm.

5.4.1.4 The sample transfer pipeline shall have the functions of stable and uniform heating and heat preservation. The heating temperature shall be ensured to be above 120 °C, or 20 °C higher than the flue gas temperature, whichever is higher. The heating temperature value shall be able to be displayed and queried, in the cabinet or system software.

5.4.1.5 There shall be at least two gas transmission pipes, in the sample transmission pipeline, one is used for collection and transmission of sample gas, whilst the other is used for full process calibration of calibration gas. The system's sample collection and transmission device shall meet the requirements for completing the functions of calibrating the complete system.

5.4.1.6 The sampling pump shall have sufficient suction capacity, to overcome the negative pressure of the flue; ensure that the sampling flow is accurate, reliable, and relatively stable.

5.4.2 Pretreatment equipment

5.4.2.1 The pretreatment equipment and its components shall be easy to clean and replace. It shall be made of materials, which do not absorb and do not react

instruments.

5.4.5.3 The exhaust gas discharge pipeline of the system shall be laid in a standard manner. It shall not be placed randomly.

5.4.5.4 The tail gas discharge device of the system shall be able to ensure that the moisture in the exhaust gas does not condense, accumulate or even freeze, causing blockage of the tail gas discharge pipeline and poor exhaust. If necessary, it shall be equipped with heating or trace-heating devices, gas-liquid separation devices, etc.

5.4.5.5 The system shall be equipped with a regular automatic back-flushing device, according to the actual needs of the site, to regularly back-flush other measuring parts, such as the sample collection device, to avoid blockage caused by accumulation of particles.

5.4.5.6 The zero air pretreatment device shall have the functions of dust removal, water removal, oil removal, hydrocarbon removal. The generated zero air shall meet the requirements of 7.1.2.2.

5.4.5.7 The internal gas pipelines, circuits, data transmission lines inside the system shall be laid in a standardized manner. The pipelines of the same type shall be assembled and set as centralized as possible. Different types of pipelines OR pipelines of different functions and directions shall be distinguished by clear markings. Various wiring shall be safe and reasonable, AND easy to find, maintain, repair.

5.4.6 Requirements of calibration function

5.4.6.1 The system shall be able to be calibrated manually and/or automatically.

5.4.6.2 For the system, which adopts the extraction measurement method, it shall have a fixed and easy-to-operate calibration gas full-system calibration function.

6 Performance indicators

6.1 Laboratory testing

6.1.1 Analysis cycle

System analysis cycle: ≤ 2 min.

6.1.2 Instrument detection limit

The detection limit of the system: ≤ 0.8 mg/m^3.

For devices that use catalytic oxidation technology to oxidize gaseous organic compounds other than methane, the conversion efficiency shall not be less than 95%.

6.1.12 Parallelism

The relative standard deviation of the displayed value of the same standard sample, which is measured by three systems (sets), is not more than 5%.

6.2 On-site detection of pollutant discharge

6.2.1 Analysis cycle

System analysis cycle: ≤ 3 min.

6.2.2 24h drift

24 h zero drift and span drift: Not more than ± 3% of full scale.

6.2.3 Accuracy

When using the reference method to make measurement, the average concentration of the non-methane hydrocarbon is:

a) When < 50 mg/m^3, the absolute value of the absolute error of the average value of the measurement results of NMHC-CEMS and the reference method is ≤ 20 mg/m^3;

b) When ≥ 50 mg/m^3 ~ < 500 mg/m^3, the relative accuracy of the measurement results of NMHC-CEMS and the reference method is ≤ 40%;

c) When ≥ 500 mg/m^3, the relative accuracy of the measurement results of NMHC-CEMS and the reference method is ≤ 35%.

6.2.4 Performance indicators of exhaust gas parameters

The performance indicator requirements of exhaust gas parameters (oxygen, flow rate, flue gas temperature, humidity) shall meet the relevant requirements of HJ 76.

7 Testing method

7.1 Laboratory testing requirements and methods

7.1.1 General requirements

7.1.1.1 Take at least 3 sets of systems of the same model for simultaneous testing, at the designated laboratory site.

7.1.1.2 When the system has dual-span or multi-span (non-hardware adjustment), only the minimum span of the instrument will be tested for technical indicators. The maximum detection span of the non-methane hydrocarbon monitoring unit is 200 mg/m^3.

7.1.1.3 During the testing, in addition to system zero and span calibration, it is not allowed for unplanned maintenance, overhaul, adjustment of the system.

7.1.1.4 If the test is interrupted due to power supply problems, after the power supply returns to normal, continue testing; the completed test indicators and data are valid.

7.1.1.5 If the test is interrupted due to a system failure, restart the test after the system returns to normal; the completed test indicators and data will be invalid. During the test period, the number of system failures per unit (set) is ≤ 2.

7.1.1.6 For systems with automatic calibration function, it may set any cycle; the system will perform automatic calibration; during the testing, the automatic calibration cycle shall be set to ≥ 24 h.

7.1.1.7 For the test data of each technical indicator, it adopts the final result, which is recorded by the system data collection and processing unit.

7.1.1.8 The mass concentration of pollutants, in this standard, is the dry mass concentration of carbon, in the standard state.

7.1.2 Standard material requirements

7.1.2.1 Calibration gas: Commercially available certified calibration gas, which has an uncertainty of ≤ 2.0%.

7.1.2.2 Nitrogen or clean air can be used for zero gas (zero point gas), of which hydrocarbons shall not exceed 0.3 mg/m^3.

7.1.2.3 Span calibration gas adopts methane or propane calibration gas; its concentration is within the span of (80% ~ 100%) full scale. The calibration gas of lower concentration can be obtained, by diluting the calibration gas of high concentration. The precision of the dilution device shall be within 1.0%.

7.1.3 Laboratory testing methods

7.1.3.1 Analysis cycle

The analysis cycle time refers to the time interval, between the two sets of measurement results, which are given, during continuous operation of NMHC-CEMS. There are 3 measurements in 3 consecutive days. The daily analysis cycle time shall meet the requirements of Table 3.

7.2 On-site testing requirements and methods

7.2.1 General requirements

7.2.1.1 The on-site pollution source discharge testing is allowed only, after all the laboratory test indicators have passed.

7.2.1.2 The technical requirements for on-site installation and commissioning of the system shall comply with the relevant content of the HJ 75 standard.

7.2.1.3 The sampling location, number of sampling holes, sampling point settings of the system reference method on-site shall meet the relevant requirements of the GB/T 16157 standard.

7.2.1.4 On-site testing includes initial inspection, 90-day operation, re-inspection. After NMHC-CEMS debugging is completed, the initial inspection can be carried out, within 168 hours of normal operation. After the initial inspection is qualified, it will enter the 90-day on-site operation period. After the 90-day operation meets the requirements, the re-inspection will be carried out.

7.2.1.5 During the initial inspection and re-inspection, in addition to system calibration, it is not allowed to carry out unplanned maintenance, overhaul, adjustment of the system.

7.2.1.6 During the initial inspection and re-inspection, if the test is interrupted, due to the on-site pollution source emission failure or power supply problem, after the troubleshooting or the power supply returns to normal, continue the testing; the completed test indicators and data are valid. If the test is interrupted due to a system failure, the test ends.

7.2.1.7 For systems with automatic calibration function, any cycle can be set; the system will perform automatic calibration. During the testing period, the automatic calibration cycle shall be set to ≥ 24 h.

7.2.1.8 During the 90-day on-site operation period, it shall carry out the necessary calibration, maintenance, overhaul, in accordance with the quality assurance plan. The system shall remotely transmit the on-site monitoring data, as required. If the 90-day remote transmission rate of valid data reaches more than 90%, the on-site operation test passes; otherwise, the operation period is extended, until the requirements are met. If the system data is missing OR the transmission is interrupted, due to on-site power supply problems or system failures, the data will be invalid, during this period of time.

7.2.1.9 The test data of each technical indicator adopts the final result, which is recorded by the data collection and processing unit.

7.2.1.10 The requirements for standard materials are consistent with the

laboratory testing requirements, as shown in 7.1.2.

7.2.2 On-site testing methods

7.2.2.1 Analysis cycle

The on-site testing method of the analysis cycle time is consistent with the laboratory testing method, as shown in 7.1.3.1. The results shall meet the requirements of Table 4.

7.2.2.2 24h drift

The detection methods of on-site 24h zero drift and span drift are consistent with the laboratory detection methods, as shown in 7.1.3.5. The results shall meet the requirements of Table 4.

7.2.2.3 Accuracy

a) When the analysis cycle time and 24h drift detection pass, the accuracy testing can be performed.

b) After NMHC-CEMS under test runs stably, perform zero point and span calibration, respectively.

c) After the NMHC-CEMS under test is synchronized with the reference test method, to measure the non-methane hydrocarbon emissions on site, the data collector continuously records the measured value, until the end of the test by the reference method.

d) Take the reference method, within the same time interval (usually 2 ~ 3 times the analysis cycle), to form a data pair, with the NMHC-CEMS measurement results, to ensure that the reference method and the NMHC-CEMS measurement data are under the same conditions (exhaust gas temperature, pressure, humidity, etc., which generally take the standard dry basis concentration).

e) Obtain at least 9 sets of data pairs every day, for accuracy calculation.

f) When the average value of the non-methane hydrocarbon concentration, which is measured by the reference method, is less than 50 mg/m^3, calculate the absolute value of the absolute error of the average value of all data pair, which is measured by NMHC-CEMS and the reference method; the results shall meet the requirements of Table 4.

g) When the average concentration of non-methane hydrocarbons, which is measured by the reference method, is ≥ 50 mg/m^3, calculate the relative accuracy, according to formulas (16) ~ (21). The results shall meet the

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