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**Environmental Protection Industry Standard
of the People's Republic of China**

HJ/T 76-2007

Replacing HJ/T 76-2001

**Specifications and Test Procedures for Continuous Emission
Monitoring Systems of Flue Gas Emitted from Stationary Sources
(on trial)**

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Foreword

In order to implement Environmental Protection Law of the People's Republic of China and Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, and monitor pollutants emitted from stationary sources of air, this Standard is herein stipulated.

This Standard specifies the main technical indices, test items, test procedures and quality assurance measures taken in test for continuous emission monitoring system of flue gas from stationary sources. The continuous emission monitoring system of flue gas within the national environmental monitoring network shall meet the requirements of this Standard.

The following revisions for “Specifications and Test Procedures for Continuous Emission Monitoring Systems of Flue Gas Emitted from Stationary Sources” (HJ/T 76-2001) have been made in this Standard: modification of partial technical indices of continuous monitoring system for particulates and continuous measuring system for flow rates; further definition of test procedures of correlation coefficient in continuous monitoring system for particulates; supplement of technical indices of flue gas parameters and technical requirements for continuous emission monitoring system of flue gas during its running period of 90 days.

During the drafting course, this Standard has referred to the overseas technical standards, and technical indices and enterprise standards of continuous monitoring systems manufactured by some domestic and abroad manufacturers.

This Standard shall come into effect from the date of implementation. And the “Specifications and Test Procedures for Continuous Emission Monitoring Systems of Flue Gas Emitted from Stationary Sources” (HJ/T 76-2001) shall be abandoned.

This Standard is a guidance-standard.

This Standard was put forward by Department of Science, Technology and Standards of State Environmental Protection Administration.

The main drafters of this Standard: General Environmental Monitoring Station of China, Shanghai Environmental Monitoring Centre, and Information Center of State Environmental Protection Administration.

This Standard was approved by State Environmental Protection Administration on July 12, 2007.

This Standard shall be implemented from August 1st, 2007.

This Standard shall be explained by State Environmental Protection Administration.

Specifications and Test Procedures for Continuous Emission Monitoring Systems of Flue Gas Emitted from Stationary Sources (on trial)

1. Applicable Scope

1.1 This standard specifies CEMS's main technical indices, test items, test procedures, and quality assurance measures taken in test.

1.2 This standard is applicable to monitor the flue gas parameters of stationary sources, particulates in flue gas, concentrations of SO₂ and NO_x, and CEMS of total emission.

2. Normative References

The provisions in the following documents are referred to by this Standard. All editions without any date indication are valid and applicable for this Standard.

GB/T 16157-1996 Measurements of particulates in flue gas emitted from stationary sources and sampling method for gaseous pollutants

HJ/T 212-2005 Transmission Standard of on-line auto-monitoring system for pollution sources

HJ/T 75-2007 Code for continuous emission monitoring techniques of flue gas emitted from stationary sources (on trial)

3. Terms and Definitions

3.1 Particulates

Particulates denote solid and liquid granular substances suspended in liquids and flue gas generated in burning, synthesis, decomposition of fuels and other substances and in treatment of various materials.

3.2 Gaseous Pollutants

Gaseous pollutants denote various pollutants dispersed in flue gases in a gaseous form.

3.3 Dry Flue Gas in Standard Conditions

Dry flue gas in standard conditions denotes the flue gas, free of moisture at 273K and under the pressure of 101325Pa.

3.4 Continuous Emission Monitoring, CEM

Pollutants emitted from stationary sources are continuously measured by real-time tracing with total measuring hours for each stationary source not less than 75% of total running hours of boilers and kilns and furnaces; measuring time each hour is not less than 45min.

3.5 Continuous Emission Monitoring System, CEMS

It includes all the equipment and devices required for continuous measurements of

concentrations of particulates and gaseous pollutants and their emission rates; it is generally composed of three sub-systems of sampling, testing and data collection and processing.

Sampling system: collection and transportation of flue gas or isolation of flue gas from the testing system.

Testing system: measuring pollutants, and displaying physical quantity or concentrations of pollutants.

Data collection and processing system: data collection and processing, generating charts or report forms, and having controlling and auto operation functions.

3.6 Point CEMS

It denotes a CEMS for measurement at a point on cross section of gas flue or duct, or along the path equal to or less than 10% of diameter of cross section.

3.7 Path CEMS

CEMS for measurements along the path equal to or greater than 10% of diameter of cross section of the gas flue or duct.

3.8 Span, Full Scale

The maximum measurement value is set for CEMS based on the practical requirements, usually 1-2 times higher than the maximum emission concentration from the emission sources.

3.9 Zero Drift

Deviation between the readings of instrument and zero input after CEMS runs for a specified time under the premise of maintenance, repair or adjustment scheduled.

3.10 Span Drift

Deviation between the readings of instrument and known reference value after CEMS runs for a specified time under the premise of regular maintenance, repair or adjustment.

3.11 Response Time

The time required when the value displayed reaches the 90% of stabilized value.

3.12 Centroidal Area

Geometrically central area in cross section of the gas flue or duct with its area not greater than 1% of area of the cross section of the gas flue or duct.

3.13 Pretest Preparation Period

The normal running time of CEMS required (not less than 168h) under the premise of maintenance, repair or adjustment scheduled, before testing the CEMS technical indices.

3.14 Test Period

The running time required for testing CEMS technical indices under the premise of maintenance, repair or adjustment scheduled (initial test not less than 168h).

3.15 Retest Period

② Confidence interval: 95% confidence level shall be within the interval composed of two straight lines in the calibration curve corresponding to $\pm 10\%$ of concentration limits of emitted particulates.

③ Permissible interval: shall have 95% confidence level, namely 75% of measured values shall be within the interval composed on two straight lines in the calibration curve corresponding to $\pm 25\%$ of concentration limits of emitted particulates.

5.8.1.5 Accuracy

Retest shall meet the following requirement:

When emission concentration of particulates measured with a reference method (ρ_{PM})

a. When $\rho_{PM} \leq 50 \text{ mg/m}^3$, the absolute error of average of the measured results by CEMS method and reference method shall not exceed 15 mg/m^3 ;

b. When $\rho_{PM} > 50 \text{ mg/m}^3 < \rho_{PM} \leq 100 \text{ mg/m}^3$, the relative error of average of the measured results by

CEMS method and reference method shall not exceed $\pm 25\%$;

c. When $100 \text{ mg/m}^3 < \rho_{PM} \leq 200 \text{ mg/m}^3$, the relative error of average of the measured results by CEMS method and reference method shall not exceed $\pm 20\%$;

d. When $\rho_{PM} > 200 \text{ mg/m}^3$, the relative error of average of the measured results by CEMS method and reference method shall not exceed $\pm 15\%$.

5.8.2 Main technical indices of CEMS for gaseous pollutants (including O₂ or CO₂)

5.8.2.1 Linear error: the relative error of measured values by CEMS and reference method shall not exceed $\pm 5\%$ if checked with a low, medium and high concentration of standard gases.

5.8.2.2 Response time: $\leq 200 \text{ s}$.

5.8.2.3 Zero drift: zero drift does not exceed $\pm 2.5\%$ of full range within 24h.

5.8.2.4 Span drift: span drift does not exceed $\pm 2.5\%$ of full range within 24h.

5.8.2.5 Relative accuracy: When average concentration of SO₂ and NO_x in flue gas measured with a reference method:

a. $\geq 250 \mu \text{ mol/mol}$ (the concentrations of SO₂, NO and NO₂ are 715 mg/m^3 , 335 mg/m^3 and 513 mg/m^3 respectively), the relative accuracy does not exceed 15%.

b. $< 250 \mu \text{ mol/mol}$ (the concentrations of SO₂, NO and NO₂ are 715 mg/m^3 , 335 mg/m^3 and 513 mg/m^3 respectively), the absolute value of difference of the averaged results measured by reference method and CEMS shall be not greater than $20 \mu \text{ mol/mol}$ (the concentrations of SO₂, NO and NO₂ are 57 mg/m^3 , 27 mg/m^3 and 41 mg/m^3 respectively);

c. $< 50 \mu \text{ mol/mol}$ (the concentrations of SO₂, NO and NO₂ are 143 mg/m^3 , 67 mg/m^3 and

used as the emission results are not proposed. However, the identical sensors installed at each of gas flue or duct are permitted which each sensor shall meet the requirement of 3.4 in terms of monitoring time per hour.

9.1.3 Constant rate sampling can be realized with measuring flue gas by S type Pitot tube when measuring particulates with reference method. When a flow rate is lower than 5m/s, it is difficult to measure flow rate with a Pitot tube with poor accuracy of measuring results. Therefore, the sampling point for reference method shall be at a position selected with a flow rate > 5m/s as much as possible.

9.1.4 Maximum permissible emission concentration in smoke dust of boilers denotes the concentration of smoke dust when excessive air factor at outlet of a duster reaches the specified value, thus, the CEMS sensor for particulates shall be installed a position close to outlet of the purifier as much as possible, satisfied with requirement of Clause 6.

9.1.5 The sampling platform set-up must be accessible and have enough space and ease to operate; it is firm and satisfied with requirement for safety measures; when the sampling platform is set up at height a spiral ladder or elevator shall be provided to access to the platform.

9.1.6 In order to calibrate accurately the CEMS for particulates and continuous measurement system for flue gas flow rate, the CEMS for particulates and continuous measurement system for flue gas flow rate must be installed at a position with flow rate over 5m/s.

9.1.7 Slope of whole pipeline from the sensor to dehumidifier or analyzer by a fully abstraction sampling method must not be smaller than 5 degrees.

9.1.8 If relative accuracy of CEMS for gaseous pollutants can not meet the requirement, it shall be solved upon the investigation of causes. In case the cause remains unclear the measured data of CEMS can be adjusted according to formulas (28) and (29); if measurement cannot be conducted accurately after adjustment the CEMS shall be installed at a more representative position for retesting.

$$CEMS_{adi} = CEMS_i \times E_{ac} \dots\dots\dots (28)$$

wherein: $CEMS_{adi}$ — adjusted data of CEMS at the i time;

$CEMS_i$ — measured data of CEMS at the i time;

E_{ac} — bias of adjusted factor.

$$E_{ac} = 1 + \overline{d_i} / CEMS_i \dots\dots\dots (29)$$

wherein: $\overline{d_i}$ — average of differences calculated according to Formula (21);

$CEMS_i$ — average of measured data of CEMS at the i data pair.

(Note: Place the analyzer in a clean, constant-temperature and anti-corrosive environment to reduce the drift after calibrating analyzer.)

D.5.1.11 Data recorder

Strip-chart recorder, analog computer or digital recorder can be used in recording measured data. Resolution of data shall be 0.5% of span. Digital or analog head, whose resolution is 0.5% of span, can be used in manual record of reading.

D.6. Performance Test Procedures of Measurement System

Finish following procedures before measuring emission concentration.

D.6.1 Preparation of Measurement System

Prepare and test analyzer and other systematic components according to user's manual provided by manufacturer.

D.6.2 Calibration Error of Analyzer

D.6.2.1 Select standard gas, complying with 8.3.1 in this technical specification, and infuse Blank gas, medium-concentration and high-concentration standard gas into the analyzer. During inspection period, adjustment isn't required except for ensuring correctly calibrated gas flow, and record response value of each kind of standard gas on the analyzer (Table D1).

D.6.2.2 If concentration of any kind of standard gas, indicated by analyzer, exceeds $\pm 2\%$ of span, inspection for calibration error of analyzer will be invalid. To handle with invalid inspection, take corrective measures and re-inspect calibration error of analyzer to reach acceptable indices of performance.

D.6.3 Inspect Deviation of Sampling System

Inspect deviation of sampling system by infusing standard gas through calibration valve installed at the outlet of sampling probe. From medium and high-concentration standard gases, select standard gas, nearest to emission concentration, and Blank gas.

Then, conduct inspection according to following methods.

D.6.3.1 Infuse standard gas, nearest to emission concentration, and record response value of analyzer in Table D2. Then, infuse Blank gas and record

References and Original Chinese Documents

[1] HJ/T 76-2007 Specifications and test procedures for continuous emission monitoring systems of flue gas emitted from stationary sources (on trial).

<http://www.chinesestandard.net/Default.aspx?PDF-English-ID=HJ/T%2076-2007>

[2] HJ/T 212 Transmission Standard of on-line auto-monitoring system for pollution sources.

<http://www.chinesestandard.net/Default.aspx?StdID=HJ/T%20212>

[3] HJ/T 75-2007 Code for continuous emission monitoring techniques of flue gas emitted from stationary sources (on trial).

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