SLOVENSKI STANDARD
SIST ISO 17179:2019

01-julij-2019

Emisije nepremičnih virov - Določevanje masne koncentracije amoniaka v odpadnih plinih - Delovne karakteristike avtomatskih merilnih sistemov

Stationary source emissions - Determination of the mass concentration of ammonia in flue gas - Performance characteristics of automated measuring systems

Émission des sources fixes - Détermination de la concentration massique de l'ammoniac dans les gaz de combustion - Caractéristiques de performance des systèmes de mesure automatisés

Ta slovenski standard je istoveten z: ISO 17179:2016

ICS:

13.040.40	Emisije nepremičnih virov	Stationary source emissions

SIST ISO 17179:2019 **en**

INTERNATIONAL STANDARD

ISO 17179

First edition
2016-07-01

Stationary source emissions — Determination of the mass concentration of ammonia in flue gas — Performance characteristics of automated measuring systems

Émission des sources fixes — Détermination de la concentration massique de l'ammoniac dans les gaz de combustion — Caractéristiques de performance des systèmes de mesure automatisés

Reference number
ISO 17179:2016(E)

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 146, *Air quality*, Subcommittee SC 1, *Stationary source emissions*.

Introduction

Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR) NO_x control systems are used for emission control of NO_x in flue gas from power generation plants, waste incinerators and others. The NO_x reduction technologies require the injection of ammonia (NH_3) and/or urea into flue gas. The SCR system is designed to be operated at unreacted NH_3 in flue gas (or remained NH_3 in flue gas) as small as possible (typically below 2 mg/m^3 to 4 mg/m^3 NH_3 concentration) with more than 90 % NO_x reduction efficiency. The standardization of a measurement method of NH_3 is thus strongly desired for efficient operation and maintenance of the NO_x control systems and for minimization of environmental impacts due to ammonia and NO_x.

Stationary source emissions — Determination of the mass concentration of ammonia in flue gas — Performance characteristics of automated measuring systems

1 Scope

This International Standard specifies the fundamental structure and the most important performance characteristics of automated measuring systems for ammonia (NH_3) to be used on stationary source emissions, for example, combustion plants where SNCR/SCR NO_x control systems (deNO_x systems) are applied. The procedures to determine the performance characteristics are also specified. Furthermore, it describes methods and equipment to determine NH_3 in flue gases including the sampling system and sample gas conditioning system.

This International Standard describes extractive systems, based on direct and indirect measurement methods, and *in situ* systems, based on direct measurement methods, in connection with a range of analysers that operate using, for example, the following principles:

— ammonia conversion to, or reaction with NO, followed by chemiluminescence (CL) NO_x difference measurement for ammonia (differential NO_x);

— ammonia conversion to, or reaction with NO, followed by non-dispersive ultraviolet (NDUV) spectroscopy NO_x difference measurement for ammonia (differential NO_x);

— Fourier transform infrared (FTIR) spectroscopy;

— non-dispersive infrared (NDIR) spectroscopy with gas filter correlation (GFC);

— tuneable laser spectroscopy (TLS).

The method allows continuous monitoring with permanently installed measuring systems of NH_3 emissions, and is applicable to measurements of NH_3 in dry or wet flue gases, for process monitoring, long term monitoring of the performance of deNO_x systems and/or emission monitoring.

Other equivalent instrumental methods can be used, provided they meet the minimum requirements proposed in this International Standard. The measuring system can be calibrated with certified gases, in accordance with this International Standard, or comparable methods.

The differential NO_x technique using CL has been successfully tested on some power plants where the NO_x concentration and NH_3 concentration in flue gas after deNO_x systems are up to 50 mg (NO)/m^3 and 10 mg (NH_3)/m^3, respectively. AMS based on FTIR, NDIR with GFC and TLS has been used successfully in this application for measuring ranges as low as 10 mg (NH_3)/m^3.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9169, *Air quality — Definition and determination of performance characteristics of an automatic measuring system*

ISO 14956, *Air quality — Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty*

ISO 20988, *Air quality — Guidelines for estimating measurement uncertainty*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
analyser
analytical part in an extractive or *in situ AMS* (3.3)

[SOURCE: ISO 12039:2001, 3.3]

3.2
automated measuring system
AMS
measuring system interacting with the flue gas under investigation, returning an output signal proportional to the physical unit of the *measurand* (3.11) in unattended operation

Note 1 to entry: In the sense of this International Standard, an AMS is a system that can be attached to a duct or stack to continuously or intermittently measure the mass concentration of NH_3 passing through the duct.

[SOURCE: ISO 9169:2006, 2.1.2, modified.]

3.3
***in situ* AMS**
non-extractive systems that measure the concentration directly in the duct or stack

Note 1 to entry: *In situ* systems measure either across the stack or duct or at a point within the duct or stack.

3.4
calibration of an automated measuring system
procedure for establishing the statistical relationship between values of the *measurand* (3.11) indicated by the *automated measuring system* (3.2) and the corresponding values given by an independent method of measurement implemented simultaneously at the same measuring point

3.5
efficiency of NH_3/NO
efficiency of a converter which oxidizes NH_3 to NO

3.6
efficiency of NH_3/N_2
efficiency of a converter which reduces NH_3 to N_2

3.7
influence quantity
quantity that is not the *measurand* (3.11) but that affects the result of the measurement

[SOURCE: ISO/IEC Guide 98-3:2008, B.2.10]

3.8
interference
cross-sensitivity
negative or positive effect upon the response of the measuring system, due to a component of the sample that is not the *measurand* (3.11)

3.9
interferent
interfering substance
substance present in the air mass under investigation, other than the *measurand* (3.11), that affects the response

[SOURCE: ISO 9169:2006, 2.1.12]

3.10
lack-of-fit
systematic deviation within the range of application between the measurement results obtained by applying the calibration function to the observed response of the measuring system, measuring *reference materials* (3.16) and the corresponding accepted value of such reference materials

Note 1 to entry: Lack of-fit may be a function of the measurement result.

Note 2 to entry: The expression “lack-of-fit” is often replaced in everyday language for linear relations by “linearity” or “deviation from linearity”.

[SOURCE: ISO 9169:2006, 2.2.9, modified.]

3.11
measurand
particular quantity subject to measurement

[SOURCE: ISO/IEC Guide 98-3:2008, B.2.9, modified.]

3.12
NO_2/NO converter efficiency
efficiency with which the converter unit of a NO_x analyser reduces NO_2 to NO

3.13
performance characteristic
one of the quantities assigned to equipment in order to define its performance

Note 1 to entry: Performance characteristics can be described by values, tolerances, or ranges.

3.14
period of unattended operation
maximum interval of time for which the *performance characteristics* (3.13) remain within a predefined range without external servicing, e.g. refill, adjustment

Note 1 to entry: The period of unattended operation is often called maintenance interval.

[SOURCE: ISO 9169:2006, 2.2.11]

3.15
reference gas
gaseous mixture of stable composition used to calibrate the measuring system and which is traceable to national or international standards

3.16
reference material
RM
substance or mixture of substances with a known concentration within specified limits, or a device of known characteristics

Note 1 to entry: Normally used are calibration gases, gas cells, gratings, or filters.

[SOURCE: ISO 14385-1:2014, 3.20]

3.17
reference method
measurement method taken as a reference by convention, which gives the accepted reference value of the *measurand* (3.11)

3.18
transport time in the measuring system
time period for transportation of the sampled gas from the inlet of the probe to the inlet of the measurement instrument

3.19
response time
time interval between the instant when a stimulus is subjected to a specified abrupt change and the instant when the response reaches and remains within specified limits around its final stable value, determined as the sum of the lag time and the rise time in the rising mode, and the sum of the lag time and the fall time in the falling mode

Note 1 to entry: Lag time, rise time and fall time are defined in ISO 9169:2006.

[SOURCE: ISO 9169:2006, 2.2.4]

3.20
span gas
gas or gas mixture used to adjust and check the *span point* (3.21) on the response line of the measuring system

Note 1 to entry: This concentration is often chosen around 70 % to 80 % of full scale.

3.21
span point
value of the output quantity (measured signal) of the *automated measuring system* (3.2) for the purpose of calibration, adjustment, etc. that represents a correct measured value generated by *reference material* (3.16)

3.22
standard uncertainty
uncertainty (3.23) of the result of a measurement expressed as a standard deviation

[SOURCE: ISO/IEC Guide 98-3:2008, 2.3.1]

3.23
uncertainty (of measurement)
parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the *measurand* (3.11)

[SOURCE: ISO/IEC Guide 98-3:2008, 2.2.3]

3.24
validation of an automated measuring system
procedure to check the statistical relationship between values of the *measurand* (3.11) indicated by the *automated measuring system* (3.2) and the corresponding values given by an independent method of measurement implemented simultaneously at the same measuring point

3.25
zero gas
gas or gas mixture used to establish the *zero point* (3.26) on a calibration curve within a given concentration range

[SOURCE: ISO 12039:2001, 3.4.2]

3.26
zero point
specified value of the output quantity (measured signal) of the *AMS* (3.2) and which, in the absence of the measured component, represents the zero crossing of the calibration line

4 Symbols and abbreviated terms

e_i	Residual (lack-of-fit) at level *i*
k	Coverage factor
n	Number of measurements
s_r	Standard deviation of repeatability
$u(\gamma_{NH_3})$	Combined uncertainty of NH_3 mass concentration
$U(\gamma_{NH_3})$	Expanded uncertainty of NH_3 mass concentration
M_c	Molar mass of NH_3 (=17,031 g/mol)
V_M	Molar volume (22,4 l/mol)
ϕ_{NH_3}	Volume fraction of NH_3
γ_{NH_3}	NH_3 mass concentration in mg/m^3
γ_S	NH_3 mass concentration at standard conditions in mg/m^3 (273,15 K; 101,325 kPa)
γ_R	NH_3 mass concentration at reference conditions in mg/m^3 (273,15 K; 101,325 kPa; O_2 and H_2O corrected)
$\bar{x}$	Average of the measured values x_i
x_i	*i*th measured value
$\bar{x}_i$	Average of the measured value at level *i*
$\hat{x}_i$	Value estimated by the regression line at level *i*
AMS	Automated measuring system
CL	Chemiluminescence
FTIR	Fourier transform infrared
GFC	Gas filter correlation
NDIR	Non-dispersive infrared
NDUV	Non-dispersive ultraviolet
QA	Quality assurance
QC	Quality control
SCR	Selective catalytic reduction
SNCR	Selective non-catalytic reduction
TLS	Tuneable laser spectroscopy

