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SIST-TS CEN/TS 17337:2019

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Emisije nepremičnih virov - Določevanje masne koncentracije posameznih plinov v zmesi - Infrardeča spektroskopija s Fourierjevo transformacijo (FTIR)

Stationary source emissions - Determination of mass concentration of multiple gaseous species - Fourier transform infrared spectroscopy

Emissionen aus stationären Quellen - Messung von Emissionen im Abgas mit FTIR-Geräten

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Émissions de sources fixes - Détermination de la concentration en masse de multiples substances gazeuses - Spectroscopie infrarouge à transformée de Fourier

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ICS:

13.040.40	Emisije nepremičnih virov	Stationary source emissions

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Stationary source emissions - Determination of mass concentration of multiple gaseous species - Fourier transform infrared spectroscopy

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Emissionen aus stationären Quellen - Messung von Emissionen im Abgas mit FTIR-Geräten

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (CEN/TS 17337:2019) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

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1 Scope

This document describes a method for sampling and determining the concentration of gaseous emissions to atmosphere of multiple species from ducts and stacks by extractive Fourier transform infrared (FTIR) spectroscopy.

This method is applicable to periodic monitoring and to the calibration or control of automated measuring systems (AMS) permanently installed on a stack, for regulatory or other purposes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14793:2017, *Stationary source emissions - Demonstration of equivalence of an alternative method with a reference method*

EN 15259:2007, *Air quality - Measurement of stationary source emissions - Requirements for measurement sections and sites and for the measurement objective, plan and report*

EN 15267-4:2017, *Air quality - Certification of automated measuring systems - Part 4: Performance criteria and test procedures for automated measuring systems for periodic measurements of emissions from stationary sources*

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EN ISO 14956, *Air quality - Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty (ISO 14956)*

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ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

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3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
FTIR spectrometer
interferometer that uses infrared wavelengths of the electromagnetic spectrum for measurements and normally includes a sample cell and detector

Note 1 to entry: The interferometer records an interferogram which represents the detection systems response as a function of time. The Fourier-transform function is applied to produce optical intensity as a function of frequency or wavelength.

3.2
sample cell
part of the FTIR instrument where the infrared beam is transmitted through the sample

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3.3
standard reference method
SRM
reference method prescribed by European or national legislation

[SOURCE: EN 15259:2007]

3.4
reference method
RM
measurement method taken as a reference by convention, which gives the accepted reference value of the measurand

Note 1 to entry: A reference method is fully described

Note 2 to entry: A reference method can be a manual or an automated method

Note 3 to entry: Alternative methods can be used if equivalence to the reference method has been demonstrated

[SOURCE: EN 15259:2007]

3.5
alternative method
AM
measurement method which complies with the criteria given by EN 14793 with respect to the reference method

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Note 1 to entry: An alternative method can consist of a simplification of the reference method.

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[SOURCE: EN 14793:2017]

3.6
measuring system
set of one or more measuring instruments and often other devices, including any reagent and supply, assembled and adapted to give information used to generate measured quantity values within specified intervals for quantities of specified kinds

[SOURCE: JCGM 200:2012]

3.7
automated measuring system
AMS
entirety of all measuring instruments and additional devices for obtaining a result of measurement

Note 1 to entry: Apart from the actual measuring device (the analyser), an AMS includes facilities for taking samples (e.g. probe, sample gas lines, flow meters and regulator, delivery pump) and for sample conditioning (e.g. dust filter, pre-separator for interferents, cooler, converter). This definition also includes testing and adjusting devices that are required for functional checks and, if applicable, for commissioning.

Note 2 to entry: The term “automated measuring system” (AMS) is typically used in Europe. The term “continuous emission monitoring system” (CEMS) is also typically used in the UK and USA.

[SOURCE: EN 15267-4:2017]

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3.8
portable automated measuring system
P-AMS
automated measuring system which is in a condition or application to be moved from one to another measurement site to obtain measurement results for a short measurement period

Note 1 to entry: The measurement period is typically 8 h for a day.

Note 2 to entry: The P-AMS can be configured at the measurement site for the special application but can be also set-up in a van or mobile container. The probe and the sample gas lines are installed often just before the measurement task is started.

[SOURCE: EN 15267-4:2017]

3.9
calibration
set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring method or measuring system, and the corresponding values given by the applicable reference

Note 1 to entry: In case of automated measuring system (AMS) permanently installed on a stack the applicable reference is the standard reference method (SRM) used to establish the calibration function of the AMS.

Note 2 to entry: Calibration should not be confused with adjustment of a measuring system.

[SOURCE: EN 15058:2017]

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3.10
adjustment
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

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Note 1 to entry: The adjustment can be made directly on the instrument or using a suitable calculation procedure.

[SOURCE: EN 15058:2017]

3.11
span gas
test gas used to adjust and check a specific point on the response line of the measuring system

[SOURCE: EN 15058:2017]

3.12
measurand
particular quantity subject to measurement

Note 1 to entry: The measurand is a quantifiable property of the waste gas under test, for example mass concentration of a measured component, temperature, velocity, mass flow, oxygen content and water vapour content.

[SOURCE: EN 15259:2007]

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3.13
interference
negative or positive effect upon the response of the measuring system, due to a component of the sample that is not the measurand

[SOURCE: EN 15058:2017]

3.14
influence quantity
quantity that is not the measurand but that affects the result of the measurement

Note 1 to entry: Influence quantities are e.g. presence of interfering gases, ambient temperature, pressure of the gas sample.

[SOURCE: EN 15058:2017]

3.15
ambient temperature
temperature of the air around the measuring system

[SOURCE: EN 15058:2017]

3.16
emission limit value
ELV
limit value given in regulations such as EU Directives, ordinances, administrative regulations, permits, licences, authorisations or consents

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Note 1 to entry: ELV can be stated as concentration limits expressed as half-hourly, hourly and daily averaged values, or mass flow limits expressed as hourly, daily, weekly, monthly or annually aggregated values.

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[SOURCE: EN 15058:2017]

3.17
measuring campaign
given by the measurement task described in the measurement plan in accordance with EN 15259

3.18
measuring period
period encompassed by the drift test

3.19
measurement site
place on the waste gas duct in the area of the measurement plane(s) consisting of structures and technical equipment, for example working platforms, measurement ports, energy supply

Note 1 to entry: Measurement site is also known as sampling site.

[SOURCE: EN 15259:2007]

3.20
measurement plane
plane normal to the centreline of the duct at the sampling position

Note 1 to entry: Measurement plane is also known as sampling plane.

[SOURCE: EN 15259:2007]

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3.21
measurement port
opening in the waste gas duct along the measurement line, through which access to the waste gas is gained

Note 1 to entry: Measurement port is also known as sampling port or access port.

[SOURCE: EN 15259:2007]

3.22
measurement line
line in the measurement plane along which the measurement points are located, bounded by the inner duct wall

Note 1 to entry: Measurement line is also known as sampling line.

[SOURCE: EN 15259:2007]

3.23
measurement point
position in the measurement plane at which the sample stream is extracted or the measurement data are obtained directly

Note 1 to entry: Measurement point is also known as sampling point.

[SOURCE: EN 15259:2007]

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3.24
absorbance spectrum
negative logarithm of the transmission spectrum

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3.25
transmittance spectrum
ratio of a single channel spectrum where the component(s) is present to a single channel spectrum where it is not (the background), both spectra being acquired under the same conditions

3.26
background spectrum
single channel spectrum recorded in the absence of component (usually zero gas) used for deriving the transmission spectrum

3.27
single channel spectrum
response of the FTIR instrument as a function of wavenumber to a sample of either the component(s) or background

3.28
spectral feature
referring to one or more absorbance peaks in a spectrum

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3.29
resolution
minimum separation that two spectral features can have and still be distinguished from one another

Note 1 to entry: Defined as the reciprocal of the optical path difference of the interferometer.

3.30
analytical window
upper and lower wavenumber range (or set of ranges) between which the measurand is interpreted the instruments analytical model

3.31
analytical model
algorithm used to interpret a spectrum and output quantitative (or qualitative) information

Note 1 to entry: The analytical model will usually fit (in a least squares sense) reference spectra to a spectrum of the sample in order to identify which compounds are present and derive concentration data.

3.32
performance characteristic
quantity assigned to the P-AMS in order to define its performance

Note 1 to entry: The values of relevant performance characteristics are determined in the performance testing and compared to the applicable performance criteria.

[SOURCE: EN 15267-4:2017]

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3.33
response time

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duration between the instant when an input quantity value of a measuring instrument or measuring system is subjected to an abrupt change between two specified constant quantity values and the instant when a corresponding indication settles within specified limits around its final steady value

Note 1 to entry: By convention time taken for the output signal to pass from 0 % to 90 % of the final variation of indication.

[SOURCE: EN 15058:2017]

3.34
drift
difference between two readings of a reference material at the beginning and at the end of a measuring period

3.35
lack of fit
systematic deviation, within the measurement range, between the accepted value of a reference material applied to the measuring system and the corresponding result of measurement produced by the calibrated measuring system

Note 1 to entry: In common language lack of fit is often called “linearity” or “deviation from linearity”. Lack of fit test is often called “linearity test”.

[SOURCE: EN 15267-4:2017]

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3.36
repeatability in the laboratory
closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement

Note 1 to entry: Repeatability conditions include:

— same measurement method;

— same laboratory;

— same measuring system, used under the same conditions;

— same location;

— repetition over a short period of time.

Note 2 to entry: Repeatability can be expressed quantitatively in terms of the dispersion characteristics of the results.

Note 3 to entry: In this document the repeatability is expressed as a value with a level of confidence of 95 %.

[SOURCE: EN 15058:2017]

3.37
repeatability in the field
closeness of the agreement between the results of simultaneous measurements of the same measurand carried out with two sets of equipment under the same conditions of measurement

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Note 1 to entry: These conditions include:

— same measurement method;

— two sets of equipment, the performances of which are fulfilling the requirements of the reference method, used under the same conditions;

— same location;

— implemented by the same laboratory;

— typically calculated on short periods of time in order to avoid the effect of changes of influence parameters (e.g. 30 min).

Note 2 to entry: Repeatability may be expressed quantitatively in terms of the dispersion characteristics of the results.

Note 3 to entry: In this document, the repeatability under field conditions is expressed as a value with a level of confidence of 95 %.

[SOURCE: EN 15058:2017]

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3.38
reproducibility in the field
closeness of the agreement between the results of simultaneous measurements of the same measurand carried out using several sets of equipment under the same conditions of measurement

Note 1 to entry: These conditions are called field reproducibility conditions and include:

— same measurement method;

— several sets of equipment, the performances of which are fulfilling the requirements of the measurement method, used under the same conditions;

— same location;

— implemented by several laboratories.

Note 2 to entry: Reproducibility can be expressed quantitatively in terms of the dispersion characteristics of the results.

Note 3 to entry: In this document, the reproducibility under field conditions is expressed as a value with a level of confidence of 95 %.

[SOURCE: EN 15058:2017]

3.39
uncertainty
parameter associated with the result of a measurement, that characterises the dispersion of the values that could reasonably be attributed to the measurand

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

3.40
standard uncertainty
u
uncertainty of the result of a measurement expressed as a standard deviation

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

3.41
combined uncertainty
u_c
standard uncertainty attached to the measurement result calculated by combination of several standard uncertainties according to the principles laid down in ISO/IEC Guide 98-3 (GUM)

[SOURCE: EN 15058:2017]

3.42
expanded uncertainty
U
quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand

$$U = k \times u_c$$

Note 1 to entry: In this document, the expanded uncertainty is calculated with a coverage factor of $k = 2$, and with a level of confidence of 95 %.

Note 2 to entry: The expression overall uncertainty is sometimes used to express the expanded uncertainty.

[SOURCE: EN 15058:2017]