

SVENSK STANDARD

SS-ISO 20264:2020

Utsläpp från stationära källor – Bestämning av masskoncentrationen av enskilda flyktiga organiska föreningar (VOC) i avgaser från icke-förbränningsprocesser (ISO 20264:2019, IDT)

Stationary source emissions – Determination of the mass concentration of individual volatile organic compounds (VOCs) in waste gases from non-combustion processes (ISO 20264:2019, IDT)



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Den internationella standarden ISO 20264:2019 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 20264:2019.

The International Standard ISO 20264:2019 has the status of a Swedish Standard. This document contains the official English version of ISO 20264:2019.

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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).

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This document was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 1, *Stationary source emissions*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

There are various volatile organic compounds (VOCs) emitted from stationary sources where organic solvents are used for painting, printing, cleaning, degreasing and chemicals production. In order to understand how to reduce the environmental risk due to VOCs, it is necessary to measure not only the concentration of total VOCs but also the concentration of individual VOCs in waste gases. This is because individual VOCs have different potentials to form O₃ and suspended particulate matter (SPM). Also, there are VOCs of high toxicity (e.g. benzene, toluene, propyl acetate, propanol, formaldehyde, some chlorinated organic compounds) of concern.

Fourier Transform Infrared (FTIR) spectrometry is proposed to provide these measurements as it provides a measurement in the infrared (IR) region over a wide spectral band. Analysis of the recorded spectra enables the concentration of a wide number of compounds to be quantified simultaneously. Overlap of IR absorption features with each VOC can affect the quantification of each compound. However, by using appropriate chemometric procedures for the overlapping IR spectra of VOCs, the concentrations are quantified for the individual compounds of interest.

This document specifies the measurement method for determining concentrations of individual VOCs in waste gases from non-combustion processes by using FTIR spectroscopy.

Stationary source emissions — Determination of the mass concentration of individual volatile organic compounds (VOCs) in waste gases from non-combustion processes

1 Scope

This document specifies the use of FTIR spectrometry for determining the concentrations of individual volatile organic compounds (VOCs) in waste gases from non-combustion processes. The method can be employed to continuously analyse sample gas which is extracted from ducts and other sources. A bag sampling method can also be applied, if the compounds do not adsorb on the bag material, and is appropriate in cases where it is difficult or impossible to obtain a direct extractive sample.

The principle, sampling procedure, IR spectral measurement and analysis, calibration, handling interference, QA/QC procedures and some essential performance criteria for measurement of individual VOCs are described in this document.

NOTE 1 The practical minimum detectable concentration of this method depends on the FTIR instrument (i.e. gas cell path length, resolution, instrumental noise and analytical algorithm) used, compounds, and interference specific (e.g. water and CO₂).

2 Normative references

There are no normative references in this document.

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:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 Terms related to FTIR

3.1.1

absorbance

negative logarithm of the transmission, $A = -\log(I/I_0)$, where I is the transmitted intensity of the light and I_0 is the incident intensity

3.1.2

resolution

minimum separation that two spectral features can have and still, in some manner, be distinguished from one another

3.2 Terms related to performance characteristics

3.2.1

reference spectrum

plot of absorbance versus wavenumber for a known gas or known mixture of gases, which are obtained under controlled conditions of pressure and temperature, path length, and known concentration

Note 1 to entry: The reference spectra are used to prepare the chemometric model used to obtain the unknown concentrations of analytes in sample spectra.

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Note 2 to entry: See [10.3.1](#).

3.2.2

validation spectrum

plot of absorbance versus wavenumber for *calibration verification gas* ([3.2.6](#))

Note 1 to entry: See [10.3.4](#).

3.2.3

background spectrum

plot of absorbance versus wavenumber for *zero gas* ([3.2.5](#))

3.2.4

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

[SOURCE: ISO 9169:2006, 2.2.4]

3.2.5

zero gas

high purity nitrogen (99,999 %) or synthetic air (99,999 %) is used to measure a *background spectrum* ([3.2.3](#)) and to determine the limit of detection, as well as to purge sample lines and sampling system components, to dilute sample and *calibration verification gas* ([3.2.6](#)), and to conduct blank measurements

3.2.6

calibration verification gas

gas or gas mixture where the concentration(s) and uncertainty(ies) are known, used to check the high level concentration point of the measuring system

Note 1 to entry: The gas or gases used is included in the analytical algorithm used to quantify the concentration of target analyte, and have absorption lines distinguishable from baseline noise at wavenumbers that are within the upper and lower wavenumber limits where the target analyte displays absorption lines distinguishable from baseline noise. An absorption feature is considered distinguishable from baseline noise if it is greater than three times the standard deviation of the baseline noise.

Note 2 to entry: This concentration is often chosen around 70 % to 80 % of full scale.

3.2.7

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 and the corresponding accepted value of such reference materials

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

[SOURCE: ISO 9169:2006, 2.2.9]

3.2.8

analytical interference

situation that arises when two or more compounds have overlapping absorbance bands in their infrared spectra

3.2.9

limit of detection

LOD

minimum concentration of a compound that can be detected by an instrument with a given statistical probability

Note 1 to entry: Usually the detection limit is given as three times the standard deviation of noise in the system.

3.2.10

analytical algorithm

method used to quantify the concentration of the target analytes and interferences in each FTIR spectrum

Note 1 to entry: The analytical algorithm should be used to account for the *analytical interferences* (3.2.8) by conducting the analysis in a portion of the infrared spectrum that is the most unique for that particular compound.

3.2.11

chemometrics

chemical discipline that uses mathematical and statistical methods, (a) to design or select optimal measurement procedures and experiments, and (b) to provide maximum chemical information by analysing chemical data

3.2.12

independent reading

reading that is not influenced by a previous individual reading as the two individual readings are separated by at least four response times

4 Symbols and abbreviated terms

I_0	intensity of incident radiation
I	intensity of transmitted radiation
A	absorbance
T	transmittance
α	absorptivity
l	optical path length
c	sample concentration
C_{CLS}	the known concentration from the reference spectra
C_{VAL}	the predicted concentrations from the validation spectra
FTIR	Fourier transform infrared
CLS	classical least squares
PLS	partial least squares
ILS	inverse least squares
SEV	standard error of validation

5 Measurement principle

5.1 General

A sample gas is extracted from ducts and other sources via a sampling system and continually introduced into a gas cell of an FTIR system. The IR spectra of the sample gas is measured using an FTIR spectrometer. When a sampling bag is used, the gas sampled in the bag is transferred to the gas cell. IR spectra obtained are analysed by using analytical algorithm. Some VOCs might adsorb onto the sampling bag surface, reducing measured VOC concentration. Losses by absorption shall be tested and documented before sampling.