SLOVENSKI STANDARD
SIST EN ISO 23210:2010

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Emisije nepremiļnih virov - Doloļevanje masne koncentracije PM10/PM2,5 v odpadnih plinih - Meritve pri nizkih koncentracijah z uporabo impaktorjev (ISO 23210:2009)

Stationary source emissions - Determination of PM10/PM2,5 mass concentration in flue gas - Measurement at low concentrations by use of impactors (ISO 23210:2009)

Emissionen aus stationären Quellen - Ermittlung der Massenkonzentration von PM10/PM2,5 im Abgas - Messung bei niedrigen Konzentrationen mit Impaktoren (ISO 23210:2009)

Émissions de sources fixes - Détermination de la concentration en masse de PM10/PM2,5 dans les effluents gazeux - Mesurage à des faibles concentrations au moyen d'impacteurs (ISO 23210:2009)

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Stationary source emissions - Determination of PM10/PM2,5 mass concentration in flue gas - Measurement at low concentrations by use of impactors (ISO 23210:2009)

Émissions de sources fixes - Détermination de la concentration en masse de PM10/PM2,5 dans les effluents gazeux - Mesurage à des faibles concentrations au moyen d'impacteurs (ISO 23210:2009)

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Contents

Page

Foreword.....3

Foreword

This document (EN ISO 23210:2009) has been prepared by Technical Committee ISO/TC 146 "Air quality" in collaboration with Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.

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Endorsement notice

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INTERNATIONAL STANDARD

ISO 23210

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Stationary source emissions — Determination of $PM_{10}/PM_{2,5}$ mass concentration in flue gas — Measurement at low concentrations by use of impactors

Émissions de sources fixes — Détermination de la concentration en masse de $PM_{10}/PM_{2,5}$ dans les effluents gazeux — Mesurage à des faibles concentrations au moyen d'impacteurs

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Contents

Page

Foreword ... iv
Introduction ... v
1 Scope ... 1
2 Normative references ... 1
3 Terms and definitions ... 2
4 Symbols and abbreviated terms ... 3
5 Principle of the method ... 5
6 Specification of the two-stage impactor ... 8
7 Sampling train ... 11
8 Preparation, measurement procedure and post-treatment ... 13
9 Calculation of the results ... 17
10 Performance characteristics ... 17
11 Reporting ... 20
Annex A (normative) **Calculation of the sample volumetric flow rate of the impactor** ... 21
Annex B (informative) **General equations concerning impaction theory** ... 28
Annex C (informative) **Results of method validation** ... 30
Annex D (informative) **Influence of variations in the flue gas temperature and flue gas composition on the Reynolds number** ... 36
Annex E (informative) **Entry nozzle** ... 38
Annex F (informative) **Equipment list** ... 39
Annex G (normative) **Determination of a representative sampling point** ... 41
Bibliography ... 42

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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ISO 23210 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 1, *Stationary source emissions*.

Introduction

In order to quantify the amount of PM_{10} and $PM_{2,5}$ particles in stationary source emissions or to identify the contribution sources of PM_{10} and $PM_{2,5}$ in ambient air, it is necessary to measure fine particulate matter in the flue gas of industrial sources.

This International Standard describes a measurement method for the determination of mass concentrations of PM_{10} and $PM_{2,5}$ emissions, which realizes the same separation curves as those specified in ISO 7708:1995 for PM_{10} and $PM_{2,5}$ in ambient air. The method is based on the principle of impaction. During sampling, the particle fraction is divided into three groups with aerodynamic diameters greater than 10 µm, between 10 µm and 2,5 µm and smaller than 2,5 µm.

The measurement method allows the simultaneous determination of concentrations of PM_{10} and $PM_{2,5}$ emissions. The method is designed for stack measurements at stationary emission sources.

The contribution of stationary source emissions to PM_{10} and $PM_{2,5}$ concentrations in ambient air can be classified as primary and secondary. Those emissions that exist as particulate matter within the stack gas and that are emitted directly to air can be considered “primary”. Secondary particulate consists of those emissions that form in ambient air due to atmospheric chemical reactions. The measurement technique in this International Standard does not measure the contribution of stack emissions to the formation of secondary particulate matter in ambient air.

This International Standard includes normative references to ISO 12141:2002. The corresponding requirements in ISO 12141:2002 are identical to those in European Standards EN 13284-1:2001 and EN 15259:2007.

Stationary source emissions — Determination of $PM_{10}/PM_{2,5}$ mass concentration in flue gas — Measurement at low concentrations by use of impactors

1 Scope

This International Standard specifies a standard reference method for the determination of PM_{10} and $PM_{2,5}$ mass concentrations at stationary emission sources by use of two-stage impactors. The measurement method is especially suitable for measurements of mass concentrations below 40 mg/m^3 as half-hourly averages in standard conditions (273 K, 1 013 hPa, dry gas). It is an acceptable method for the measurement in the flue gas of different installations, such as cement and steel production plants, as well as combustion processes.

This International Standard is not applicable to the sampling of flue gases that are saturated with water vapour.

This International Standard is not applicable where the majority of the particles are likely to exceed PM_{10}, for example, in the case of raw gases or plant operating failures.

NOTE 1 Measurements of particulate concentrations higher than 40 mg/m^3, as a half-hourly average in standard conditions (273 K, 1 013 hPa, dry gas), can lead to overloading of the collecting plates and backup filters and also could result in shorter sampling times.

NOTE 2 The collecting plates and backup filters can be used for further chemical analysis.

This International Standard cannot be used for the determination of the total mass concentration of dust.

NOTE 3 For data assessment purposes, it can be useful to perform measurements of total particulate matter in parallel to the PM_{10} and $PM_{2,5}$ measurements.

This International Standard describes the design, use and theory of round-nozzle impactors. It does not exclude other types of impactors, provided these systems meet the performance criteria specified in this International Standard in a validation of the impactor performed by an independent testing laboratory.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 7708:1995, *Air quality — Particle size fraction definitions for health-related sampling*

ISO 12141:2002, *Stationary source emissions — Determination of mass concentration of particulate matter (dust) at low concentrations — Manual gravimetric method*

ISO 20988:2007, *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 Flow-related terms

3.1.1
aerodynamic diameter
diameter of a sphere of density 1 g/cm^3 with the same terminal velocity due to gravitational force in calm air as the particle, under prevailing conditions of temperature, pressure and relative humidity

NOTE Adapted from ISO 7708:1995, 2.2.

3.1.2
cut-off diameter
aerodynamic diameter where the separation efficiency of the impactor stage is 50 %

3.1.3
PM_{10}
particles which pass through a size-selective inlet with a 50 % efficiency cut-off at 10 µm aerodynamic diameter

NOTE PM_{10} corresponds to the “thoracic convention” as defined in ISO 7708:1995, Clause 6.

3.1.4
$PM_{2,5}$
particles which pass through a size-selective inlet with a 50 % efficiency cut-off at 2,5 µm aerodynamic diameter

NOTE $PM_{2,5}$ corresponds to the “high-risk respirable convention” as defined in ISO 7708:1995, 7.1.

3.1.5
Reynolds number
dimensionless parameter describing a flow

3.1.6
Stokes's number
dimensionless instrument-specific quantity

NOTE See B.2.

3.1.7
Cunningham factor
correction factor taking into account the change in the interaction between particles and the gas phase

NOTE Stokes's law is based on the assumption that the relative gas velocity at the particle edge equals zero. This assumption is not valid for particle sizes close to the mean free path length. Such particles cannot move continuously due to collisions with particles and gas atoms. In this case, Stokes's law has to be amended by a correction factor, i.e. the Cunningham factor. This factor only depends on the mean free path length and the particle diameter.

3.1.8
Sutherland constant
constant characteristic of a gas used for calculating the dependence of the viscosity of a gas on its temperature

3.1.9
aerosol
suspension in a gaseous medium of solid particles, liquid particles or solid and liquid particles having a negligible falling velocity

[ISO 4225:1994, 3.2]

3.2 Instrument-related terms

3.2.1
filter set
separator consisting of two collecting plates and a backup filter

3.2.2
collecting plate
plane filter used for particle collection by impaction

3.2.3
backup filter
plane filter used for collection of the $PM_{2,5}$ particle fraction

3.2.4
collecting plate holder
support of the collecting plate

3.2.5
backup filter holder
punched plate as support of the backup filter

3.2.6
diffuser
conical part in front of the nozzle plates to avoid stall

3.3 Sampling-related terms

3.3.1
measurement site
sampling site
place on the waste gas duct in the area of the measurement plane(s) consisting of structures and technical equipment

NOTE The measurement site consists, for example, of working platforms, measurement ports and energy supply.

3.3.2
measurement section
region of the waste gas duct which includes the measurement plane(s) and the inlet and outlet sections

3.3.3
measurement plane
sampling plane
plane normal to the centreline of the duct at the sampling position

4 Symbols and abbreviated terms

A	separation efficiency
BF	backup filter
$c_{1,i}$	ith concentration value of the first measuring system
$c_{2,i}$	ith concentration value of the second measuring system
C	Cunningham factor