
**Kakovost okoljskega zraka – - Referenčna gravimetrijska metoda za
določevanje
masne frakcije suspendiranih trdnih delcev z velikostjo PM_{2,5}**

Ambient air quality - Reference gravimetric measurement method for the
determination of the PM_{2,5} mass fraction of suspended particulate matter

**iTeh Standards
(<https://standards.itih.ai>)
Document Preview**

[SIST EN 14907:2005](https://standards.itih.ai/catalog/standards/sist/b8aaa9d1-19ff-4d4c-9276-6817a6ea2a64/sist-en-14907-2005)

<https://standards.itih.ai/catalog/standards/sist/b8aaa9d1-19ff-4d4c-9276-6817a6ea2a64/sist-en-14907-2005>

March 2004

ICS

English version

**Ambient air quality - - Reference gravimetric measurement
method for the determination of the PM_{2,5} mass fraction of
suspended particulate matter**

Qualité de l'air ambiant - Méthode de mesurage
gravimétrique de référence pour la détermination de la
fraction massique MP_{2,5} de matière particulaire en
suspension

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 264.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

Page

Foreword.....	3
Introduction	4
1 Scope	4
2 Normative references	5
3 Terms, definitions and abbreviations	5
3.1 Terms and definitions.....	5
3.2 Abbreviations	6
4 Principle	6
4.1 Description of the reference measuring principle.....	6
4.2 Description of QA/QC procedure	6
5 Equipment and facilities.....	7
5.1 Sampling system components	7
5.2 Weighing facilities	11
5.3 Transport and storage facilities	11
6 Sampling and weighing procedure	11
6.1 Weighing room procedures	11
6.2 Unloaded filter weighing	12
6.3 Sampling period	12
6.4 Sample storage and transport procedures	12
6.5 Loaded filter weighing	12
7 Additional quality assurance and quality control.....	12
7.1 Maintenance of the sampling system	12
7.2 Calibration	13
7.3 Field blanks	13
8 Expression of results	13
9 Performance characteristics of the method.....	14
9.1 GUM concept.....	14
9.2 Individual uncertainty sources	15
9.3 Expanded uncertainty vs EU Data Quality Objectives	19
Annex A (normative) Equivalence test procedure for manual measurement methods.....	21
A.1 General	21
A.2 Formal procedures	21
A.3 Overview of test procedure.....	22
A.4 Laboratory test procedure	22
A.5 Field test procedure.....	24
A.6 Evaluation of equivalence of candidate methods	26
A.7 Application of correction factors or terms.....	29
Annex ZA (informative) Relationship with EU Directives	31
Bibliography	32

Foreword

This document (prEN 14907:2004) has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[SIST EN 14907:2005](https://standards.iteh.ai/catalog/standards/sist/b8aaa9d1-19ff-4d4c-9276-6817a6ea2a64/sist-en-14907-2005)

<https://standards.iteh.ai/catalog/standards/sist/b8aaa9d1-19ff-4d4c-9276-6817a6ea2a64/sist-en-14907-2005>

Introduction

For air quality across the European Union to be assessed on a consistent basis, Member States need to employ standard measurement techniques and procedures. The aim of this European standard is to present a harmonised and practical methodology for monitoring PM_{2,5} mass concentration in ambient air, following Community Directive 96/62/EC on ambient air quality assessment and management, and Council Directive 1999/30/EC [1], which sets the parameters specific to the assessment of particulate matter (and also of sulphur dioxide, nitrogen dioxide and lead).

There are no traceable reference standards for PM_{2,5} measurements. Therefore, the reference method set out in this standard effectively defines the measured quantity by convention, specifically by the sampling inlet design and associated operational parameters covering the whole measurement process. The standard contains:

- a manual gravimetric reference measurement method for PM_{2,5}
- a summary of performance characteristics of the method, including measurement uncertainty
- a procedure for determining whether other measurement methods (like other manual gravimetric or automatic monitoring methods) are equivalent to this reference method (Annex A).

The precision and performance characteristics described in this document were determined in 9 different comparative and validation trials. The trials were performed at 9 different sites in northern, middle and southern European countries in order to cover a wide range of relevant ambient air conditions. The trials were sponsored by the European Commission and the European Free Trade Association.

Besides the measurement procedure of the 2,5 µm mass fraction of suspended particulate matter (PM_{2,5}) described in this document there is EN 12341 [2] dealing with the measurement of PM₁₀.

SIST EN 14907:2005

<http://standards.iteh.ai/catalog/standards/sist/b8aaa9d1-19ff-4d4c-9276-6817a6ea2a64/sist-en-14907-2005>

1 Scope

This standard describes a reference method for determining the PM_{2,5} mass concentration of suspended particulate matter in ambient air by sampling and weighing the particulate matter on filters.

Measurements are made over a sampling period of about 24 hours, and, in line with the Directive, are expressed as µg/m³, where the volume of air is the volume at ambient conditions near the inlet at the time of sampling, ie not corrected to standard temperature and pressure.

The range of application of the standard is from 1 µg/m³ (i.e. the lower detection limit of the reference measurement method expressed as its uncertainty) up to at least 120 µg/m³ (i.e. the maximum concentration level observed during the field study undertaken by CEN/TC 264/WG 15 to validate the standard).

NOTE Although the standard is not validated for concentrations over 120 µg/m³, its range of application could well be extended to commonly encountered ambient concentrations upto circa 200 µg/m³. At these high concentrations, hence high particulate mass load on the filter, in practice still no filter clogging is to be expected. Also the flow rate can be easily maintained at the nominal setting.

The equivalence procedure in Annex A specifies two approaches, depending on whether the candidate method differs slightly or fundamentally from the standard method.

In the former case, involving only slight differences from the standard method ("variations on a theme") Annex A provides a restricted procedure to compare only the pertinent differences, instead of a full field test. This part of the Annex serves to give practical guidance for determining equivalence for measurement methods commonly used in monitoring networks, and includes examples of common variations to the standard method, such as different filter storing procedures.

In the latter case, involving a full set of field tests, the procedure serves to determine equivalence only within the range of conditions under which the field tests are carried out. The equivalence can be shown to hold for conditions prevailing within European countries by carrying out the field test in situations covering a suitable range of relevant ambient parameters (such as concentration and composition of the suspended particulate matter, temperature, and humidity).

NOTE Although this standard does not explicitly address automatic monitoring methods for the measurement of the PM_{2,5} mass fraction in ambient air, the equivalence test procedure given in Annex A could still be applied.

2 Normative references

This standard incorporates provisions from other publications by dated or undated reference. These normative references are cited at the appropriate places in the text, and the publications are listed below. For dated references, subsequent amendments or revisions apply only when they are formally incorporated by the issuing body. For undated references the latest edition of the publication referred to applies.

ENV 13005:1999, *Guide to the expression of uncertainty in measurements*.

CR 14377:2002, *Air quality – Approach to uncertainty estimation for ambient air reference measurement methods*.

ISO/IEC 17025:1999, *General requirements for the competence of testing and calibration laboratories*

3 Terms, definitions and abbreviations

For the purposes of this European Standard, the following terms and definitions apply:

3.1 Terms and definitions

3.1.1

ambient air

outdoor air in the lower troposphere excluding workplace air.

3.1.2

automatic monitoring method

method intended for the automatic on-line determination of the PM_{2,5} mass concentration of suspended particulate matter in ambient air.

3.1.3

high volume sampling method HVS

method for sampling particulate matter with a flow rate of several 10's of m³/h.

3.1.4

low volume sampling method LVS

method for sampling particulate matter with a flow rate of a few m³/h.

3.1.5

PM_{2,5}

fraction of suspended particulate matter which passes through a size-selective inlet with a 50 % efficiency cut-off at 2,5 µm aerodynamic diameter. By convention, the size-selective reference inlet design prescribed in 5.1.1, used at the flow rate given in 5.1.4, possesses the required characteristics in order to sample the PM_{2,5} fraction in ambient air.

3.1.6

suspended particulate matter (SPM)

notion of all particles surrounded by air in a given, undisturbed volume of air.

3.1.7

uncertainty (of measurement)

parameter, associated with the result of a measurement, that characterizes the dispersion of the values that would reasonably be attributed to the measurand.

NOTE The consistent determination of measurement uncertainties for different types of air quality measurements is described in detail in CR 14377.

3.2 Abbreviations

3.2.1

CM

candidate method (non-reference measurement method).

3.2.2

RM

reference measurement method.

4 Principle

4.1 Description of the reference measuring principle

Ambient air is passed through a size-selective inlet, specifically designed to allow the $PM_{2,5}$ fraction of suspended particulate matter to pass through, at a known, constant flow rate. The $PM_{2,5}$ fraction is collected on a filter for a known period of about 24 hours. The mass of the $PM_{2,5}$ material is determined by weighing the filter at constant conditions before and after collection of the particulate matter.

Key factors which can affect the result of the measurement, and which are addressed by the procedures prescribed within this standard, include:

- deposition losses of non-volatile $PM_{2,5}$ fraction within the pipework between the inlet and the filter;
- uncontrolled losses due to volatilisation of semi-volatile $PM_{2,5}$, both within the pipework between the inlet and the filter, and on the filter at any time between collection and weighing;
- changes in weight of the filters or $PM_{2,5}$ fraction due to absorbed water, spurious addition or loss of material, buoyancy, or static electricity;
- control of flow rate.

4.2 Description of QA/QC procedure

The QA/QC procedures within this standard are separated into those activities typically carried out with each measurement, and those carried out less frequently.

QA/QC procedures which are used for each measurement, including filter handling and conditioning, weighing room conditions, proper functioning of the weighing instrument, and the use of blank filters, are described in Clause 6.

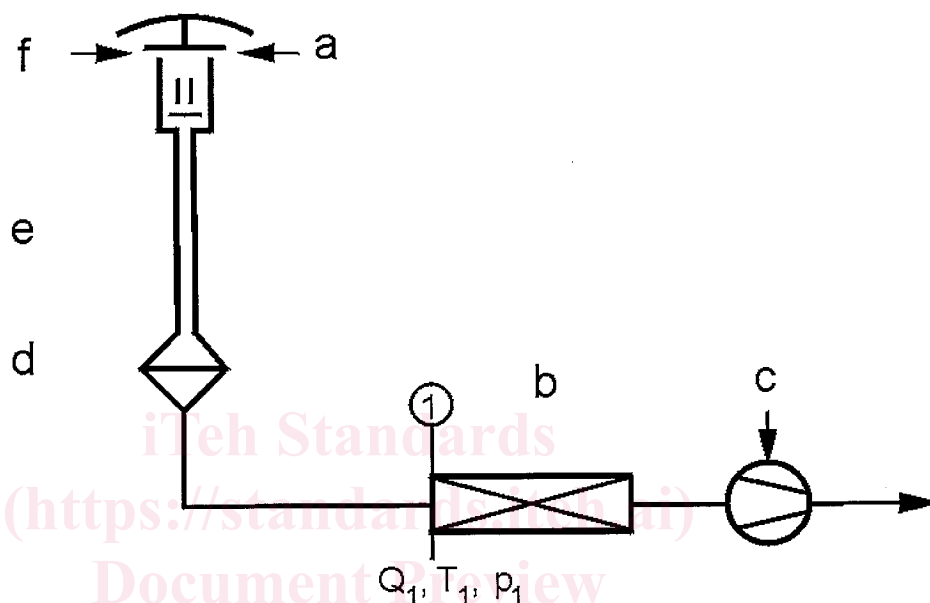
Additional QA/QC procedures which are used on a less frequent basis, including flow calibration, calibration of the weighing instrument, and maintenance and leak testing of the sampling system, are described in Clause 7.

5 Equipment and facilities

5.1 Sampling system components

This standard contains two different designs for the sampling system to be used within the reference method. These designs operate at significantly different flow rates, and will be described throughout the text as the "low volume" or LVS and "high volume" or HVS designs.

The sampling system for the reference measurement method consists of the following elements, illustrated schematically in Figure 1:



$$Q_{\text{ambient}} [\text{m}^3/\text{h}] = \frac{T_a \cdot P_1}{T_1 \cdot P_a} \cdot Q_1$$

Key

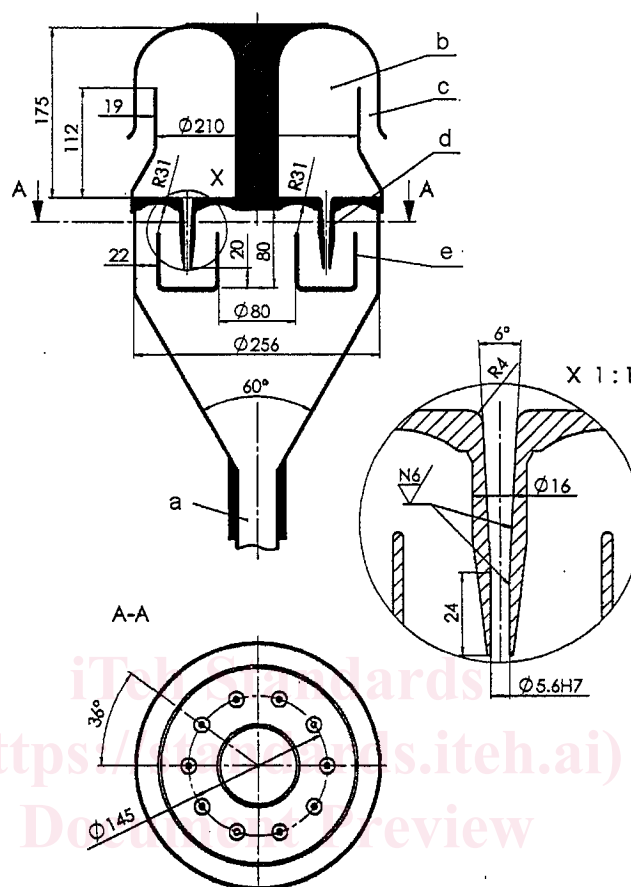
- a Air sample (T_{ambient} , P_{ambient})
- b Flow measuring device
- c Flow controlled pump
- d Sampling position with filter
- e Connecting pipework
- f Impactor inlet

Figure 1 – Scheme of $\text{PM}_{2.5}$ reference sampler

- the size-selective inlet, whose design is prescribed in 5.1.1;
- connecting pipework between the inlet and the filter holder, described in 5.1.2;
- filter holder and filter, described in 5.1.3;
- flow and volume control system, given by performance specifications in 5.1.4.

Correct operation of the sampling system also requires calibration devices regarding flow rate, and ambient temperature and pressure sensors, with specifications given in Clause 7.

5.1.1.2 HVS reference design inlet



SIST EN 14907:2005

<https://standards.iteh.ai/catalog/standards/sist/b8aaa9d1-19ff-4d4c-9276-6817a6ea2a64/sist-en-14907-2005>

Material: aluminium ematal coated

Tolerance of all free measures: ± 0.1 mmDesign of 30 m³/h PM2,5-HVS inlet system**Key**

- a air outlet
- b air calm camt 6750 cm³
- c air inlet
- d 10 nozzles
- e baffle pot

Figure 3 – Construction design with specific dimensions**5.1.2 Connecting pipework**

The requirements for the connecting pipework between the inlet and the filter holder are to minimise deposition losses of particulate matter by kinetic processes, as well as losses due to thermal, chemical or electrostatic processes. Contact of the sampling air with cold surfaces which could cause condensation shall be avoided.

Also, the pipework shall be designed to minimise the effect of solar heating so that the air sample is kept as close as possible to ambient temperature.