
Kakovost zraka - Certificiranje avtomatskih merilnih sistemov (AMS) - 4. del: Merila za delovanje in postopki preskušanja prenosnih avtomatskih merilnih sistemov (P-AMS) za periodične meritve emisij nepremičnih virov

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

Luftbeschaffenheit - Zertifizierung von automatischen Messeinrichtungen - Teil 4: Mindestanforderungen und Prüfprozeduren für automatische Messeinrichtungen für wiederkehrende Messungen von Emissionen aus stationären Quellen

[SIST EN 15267-4:2017](https://standards.itih.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-100000000000/sist-en-15267-4-2017)

Qualité de l'air - Certification des systèmes de mesurage automatisés - Partie 4 : Spécifications de performance et procédures d'essai pour systèmes de mesurage automatisés

Ta slovenski standard je istoveten z: EN 15267-4:2017

ICS:

13.040.40 Emisije nepremičnih virov Stationary source emissions

SIST EN 15267-4:2017

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 15267-4:2017

<https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/sist-en-15267-4-2017>

EUROPEAN STANDARD

EN 15267-4

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2017

ICS 13.040.99

English Version

**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**

Qualité de l'air - Certification des systèmes de
mesurage automatisés - Partie 4 : Spécifications de
performance et modes opératoires d'essai des
systèmes de mesurage automatisés pour le mesurage
périodique des émissions de sources fixes

Luftbeschaffenheit - Zertifizierung von automatischen
Messeinrichtungen - Teil 4: Mindestanforderungen und
Prüfprozeduren für automatische Messeinrichtungen
für wiederkehrende Messungen von Emissionen aus
stationären Quellen

This European Standard was approved by CEN on 26 September 2016.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists 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 CEN-CENELEC Management Centre has the same status as the official versions.

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



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword.....	5
0 Introduction	6
0.1 General.....	6
0.2 Legal drivers	6
0.3 Periodic measurements.....	6
0.4 Relationship to EN 14181.....	6
0.5 Processes.....	7
0.6 Performance characteristics.....	7
0.7 Relationship to EN 15267-3.....	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	9
4 Symbols and abbreviations	15
4.1 Symbols.....	15
4.2 Abbreviations	17
5 General requirements	17
5.1 Application of performance criteria	17
5.2 Ranges to be tested.....	17
5.2.1 Certification range	17
5.2.2 Supplementary ranges	18
5.2.3 Lower limit of ranges.....	18
5.2.4 Expression of performance criteria with respect to ranges.....	18
5.2.5 Ranges of optical insitu P-AMS with variable optical length.....	18
5.3 Performance testing of P-AMS based on certified AMS previously tested according to EN 15267-3	18
5.4 Equivalence with the SRM	18
5.5 Manufacturing consistency and changes to P-AMS design.....	19
5.6 Qualifications of test laboratories	19
6 Performance criteria common to all P-AMS for laboratory testing	19
6.1 P-AMS for testing	19
6.2 CE labelling.....	19
6.3 Output ranges and zero-point	19
6.4 Display of operational status signals	20
6.5 Degrees of protection provided by enclosures	20
6.6 Response time	20
6.7 Repeatability standard deviation at zero point.....	20
6.8 Repeatability standard deviation at span point	20
6.9 Lack of fit.....	20
6.10 Short-term zero and span drift	20
6.11 Set-up time after transport and influence of ambient temperature	20
6.12 Influence of voltage variations.....	21
6.13 Influence of vibration	21

6.14	Influence of sample gas flow for extractive P-AMS.....	21
6.15	Influence of sample gas pressure.....	21
6.16	Cross-sensitivity.....	21
6.17	Converter efficiency for P-AMS measuring NO _x	21
6.18	Response factors for TOC measuring P-AMS.....	21
6.19	Influences on P-AMS with in-stack sampling chamber	22
6.20	Influences related to storage and transportation.....	22
7	Performance criteria common to all P-AMS for field testing.....	22
7.1	Response time.....	22
7.2	Short-term zero and span drift.....	23
7.3	Reproducibility.....	23
8	Performance criteria specific to measured components.....	23
8.1	General	23
8.2	Gas monitoring P-AMS	23
8.2.1	Performance criteria.....	23
8.2.2	P-AMS for total organic carbon.....	25
8.3	Particulate matter monitoring P-AMS.....	26
9	General test requirements.....	27
10	Test procedures for laboratory tests.....	28
10.1	P-AMS for testing.....	28
10.2	CE labelling.....	28
10.3	Output ranges and zero point	28
10.4	Display of operational status signals.....	29
10.5	Degrees of protection provided by enclosures.....	29
10.6	Response time.....	29
10.7	Repeatability standard deviation at zero point.....	31
10.8	Repeatability standard deviation at span point.....	31
10.9	Lack of fit.....	32
10.10	Short-term zero and span drift.....	33
10.11	Set-up time after transportation and influence of ambient temperature.....	33
10.12	Influence of voltage variations	34
10.13	Influence of vibration.....	35
10.14	Influence of sample gas pressure.....	36
10.15	Influence of the sample gas flow for extractive P-AMS	36
10.16	Cross-sensitivity.....	37
10.17	Converter efficiency for P-AMS measuring NO _x	38
10.18	Response factors.....	39
10.19	Influences on P-AMS with in-stack sampling chamber	40
10.20	Influences related to storage and transportation.....	40
11	Requirements for the field test.....	41
12	Test procedures common to all P-AMS for field tests.....	41
12.1	Response time.....	41
12.2	Short-term zero and span drift.....	41
12.3	Reproducibility.....	42
13	Equivalence with the SRM	43
14	Measurement uncertainty.....	43
15	Test report	43
	Annex A (normative) Minimum requirements for a test bench.....	44

EN 15267-4:2017 (E)

Annex B (normative) Interferents.....	45
Annex C (normative) Test of linearity	46
C.1 Description of the test procedure	46
C.2 Establishment of the regression line	46
C.3 Calculation of the residuals of the average concentrations.....	47
Annex D (normative) Determination of the total uncertainty	48
D.1 Determination of uncertainty contributions	48
D.2 Elements required for the uncertainty determinations	48
D.3 Example of an uncertainty calculation for a CO measuring P-AMS.....	50
D.4 Determination of uncertainty contributions by use of sensitivity coefficients.....	52
Annex E (informative) Elements of performance testing report.....	53
Annex F (informative) European standard reference methods	56
Bibliography.....	57

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 15267-4:2017

<https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/sist-en-15267-4-2017>

European foreword

This document (EN 15267-4:2017) has been prepared by 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 July 2017, and conflicting national standards shall be withdrawn at the latest by July 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document is Part 4 of a series of European Standards:

- EN 15267-1, *Air quality — Certification of automated measuring systems — Part 1: General principles*
- EN 15267-2, *Air quality — Certification of automated measuring systems — Part 2: Initial assessment of the AMS manufacturer's quality management system and post certification surveillance for the manufacturing process*
- EN 15267-3, *Air quality — Certification of automated measuring systems — Part 3: Performance criteria and test procedures for automated measuring systems for monitoring emissions from stationary sources*
- EN 15267-4, *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*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

EN 15267-4:2017 (E)**0 Introduction****0.1 General**

CEN has established standards for the certification of automated measuring systems (AMS) used for monitoring emissions from stationary sources and ambient air quality. This product certification is based on the following four sequential stages:

- a) performance testing of the AMS;
- b) initial assessment of the AMS manufacturer's quality management system;
- c) certification of the AMS;
- d) post certification surveillance.

This European Standard specifies the performance criteria and test procedures for performance testing of portable automated measuring systems (P-AMS) used for periodic measurements of stationary source emissions. Testing applies to complete measuring systems.

NOTE 1 Portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances are specified in EN 50379-1 to EN 50379-3.

The application of P-AMS for periodic measurements of stationary source emissions is based on

- specification of the standard reference method (SRM) and validation of the SRM;
- specification of the alternative method (AM) if the P-AMS is based on an AM;
- certification of the P-AMS in accordance with EN 15267-1, EN 15267-2 and EN 15267-4 including demonstration of equivalence with the SRM in the field if the P-AMS is based on an AM;
- on-going quality management by the user of the P-AMS in line with EN ISO/IEC 17025.

NOTE 2 Examples for standard reference methods for different measured components are listed in Annex F.

The overall assessment for the purposes of certification is *conformity testing*, while the evaluation of performance against specified performance criteria is *performance testing*.

0.2 Legal drivers

This European Standard supports the requirements of the following EU Directives:

- Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)
- Directive 2003/87/EC on processes emitting greenhouse gases.

However, this European Standard can also be applied to the monitoring requirements specified in other EU Directives.

0.3 Periodic measurements

Certified P-AMS can be used as SRM or AM for periodic measurements of stationary source emissions.

0.4 Relationship to EN 14181

Certified P-AMS can be used as SRM or AM for the calibration and validation of stationary AMS for QAL2 and AST purposes.

0.5 Processes

Field testing of P-AMS is ordinarily carried out on industrial processes representative of the range of application of the SRM or AM. The premise is that if the P-AMS performs acceptably on these processes, then experience has shown that the P-AMS generally performs well on the majority of other processes. However, there are always exceptions and it is the responsibility of the user to ensure that the P-AMS performs adequately on a specific process.

The necessary field test of P-AMS is specified in this European Standard.

0.6 Performance characteristics

A combination of laboratory and field tests is detailed within this European Standard. Laboratory testing is designed to assess whether a P-AMS can meet, under controlled conditions, the relevant performance criteria. Field testing, is designed to assess whether a P-AMS can continue to work and meet the relevant performance criteria in real applications including transportation to the measurement site, set-up of the P-AMS and measurement.

The main P-AMS performance characteristics are:

- response time;
- repeatability standard deviation;
- lack of fit (linearity);
- short-term drift;
- influence of ambient temperature;
- influence of voltage variations;
- influence of vibration;
- influence of sample gas pressure;
- influence of sample gas flow for extractive P-AMS;
- cross-sensitivity to likely interferents contained in the stack gas other than the measured component;
- converter efficiency for NO_x P-AMS;
- response factors for P-AMS measuring TOC;
- reproducibility under field conditions;
- trueness and precision of the P-AMS against the SRM under field conditions if the P-AMS is based on an AM.

Additional performance characteristics specific to the SRM or AM are included in the performance test.

The quality assurance and quality control (QA/QC) procedures to be applied by the user of the P-AMS are also assessed in the performance test.

EN 15267-4:2017 (E)

This European Standard is an application and elaboration of EN ISO 9169 with additional and alternative provisions for the performance test of P-AMS. Where this European Standard appears to differ from EN ISO 9169, it either elaborates upon the requirements of EN ISO 9169 or differs in minor ways owing to the necessity to conduct the performance test of P-AMS.

0.7 Relationship to EN 15267-3

This European Standard is based on EN 15267-3, which specifies the performance testing of stationary AMS for the continuous monitoring of emissions from stationary sources. Many requirements of this European Standard are identical to those of EN 15267-3. This European Standard deviates from EN 15267-3 only where the portable use and the use as SRM or AM require different or additional requirements. Therefore, this European Standard allows a combined testing where an AMS is designed for stationary and portable use. It also allows a reduced performance testing of P-AMS, which have been already certified according to EN 15267-3 for stationary use.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 15267-4:2017

<https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/sist-en-15267-4-2017>

1 Scope

This European Standard specifies the general performance criteria and test procedures for portable automated measuring systems (P-AMS) used for periodic measurements of stationary source emissions. It applies to the performance testing of P-AMS based on measurement techniques specified by the standard reference method (SRM) or an alternative method (AM).

Performance testing is based on the general performance criteria and test procedures specified in this European Standard and on the specific requirements specified for the SRM or AM. This includes testing of the applicability and correct implementation of the QA/QC procedures specified for the SRM or AM.

This European Standard supports the requirements of particular EU Directives.

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.

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 60068-2-6, *Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal) (IEC 60068-2-6)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

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

3 Terms and definitions

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

3.1

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 interferences, 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.

EN 15267-4:2017 (E)**3.2
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.

**3.3
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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SOURCE: EN 15259:2007]

**3.4
standard reference method
SRM**

reference method prescribed by European or national legislation

[SIST EN 15267-4:2017](https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/it-en-15267-4-2017)

[https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-](https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/it-en-15267-4-2017)

[493777a808d8/it-en-15267-4-2017](https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/it-en-15267-4-2017)

Note 1 to entry: Standard reference methods are used e.g. to calibrate and validate AMS and for periodic measurements to check compliance with limit values.

[SOURCE: EN 15259:2007]

**3.5
alternative method
AM**

measurement method which complies with the criteria given by EN 14793:2017 with respect to the reference method

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

[SOURCE: Adapted from EN 14793:2017]

**3.6
measurement method**

method described in a written procedure containing all the means and procedures required to sample and analyse, namely: field of application, principle and/or reactions, definitions, equipment, procedures, presentation of results, other requirements and measurement report

[SOURCE: EN 14793:2017]

3.7**measurement**

set of operations having the object of determining a value of a quantity

3.8**paired measurement**

simultaneous recording of results of measurement at the same measurement point using two P-AMS of identical design

3.9**measurand**

particular quantity subject to measurement

Note 1 to entry: The measurand is a quantifiable property of the stack 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]

3.10**measured component**

constituent of the waste gas for which a defined measurand is to be determined by measurement

Note 1 to entry: Measured component is also called determinand.

[SOURCE: EN 15259:2007]

3.11**interferent**

substance present in the stack gas under investigation, other than the measured component, that affects the output

3.12**reference material**

substance or mixture of substances, with a known concentration within specified limits, or a device of known characteristics

3.13**zero gas**

gas mixture used to establish the zero point of a calibration curve when used with a given analytical procedure within a given calibration range

3.14**zero point**

specified value of the output of the P-AMS which, in the absence of the measured component, represents the zero crossing of the P-AMS characteristic

Note 1 to entry: In case of oxygen and some flow monitoring AMS, the zero point is interpreted as the lowest measurable value.

3.15**span point**

value of the output of the P-AMS for the purpose of calibrating, adjusting, etc. that represents a correct measured value generated by reference material between 70 % and 90 % of the range tested

EN 15267-4:2017 (E)**3.16****measured signal**

output of the P-AMS in analogue or digital form which is converted into the measured value with the aid of the analysis function of the analyzer

3.17**output**

reading, or digital or analogue electrical signal, generated by the P-AMS in response to a measured object

3.18**independent reading**

reading that is not influenced by a previous individual reading by separating two individual readings by at least four response times

3.19**individual reading**

reading averaged over a time period equal to the response time of the P-AMS

3.20**averaging time**

period of time over which an arithmetic or time-weighted average of concentrations is calculated

3.21**performance characteristic**

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

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

<https://standards.iteh.ai/catalog/standards/sist/61877a47-7066-4b9f-a1bf-493777a808d8/sist-en-15267-4-2017>

3.22**response time**

t_{90}

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: The response time is also referred to as the 90 % time.

Note 2 to entry: The response time is by convention the time taken for the output signal to pass from 0 % to 90 % of the final variation of indication.

Note 3 to entry: Beside the different wording, this definition does not technically deviate from the definition of response time in EN 15267-3.

3.23**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".

3.24**converter efficiency**

efficiency with which the converter unit of a NO_x analyser reduces NO₂ to NO

3.25**interference**

negative or positive effect that a substance has upon the output of the P-AMS, when that substance is not the measured component

3.26**cross-sensitivity**

response of the P-AMS to interferents

Note 1 to entry: See interference.

3.27**short-term zero drift**

difference between two zero readings at the beginning and at the end of the measurement period

3.28**short-term span drift**

difference between two span readings at the beginning and at the end of the measurement period

Note 1 to entry: The measurement period is typically 8 h for a day. Measurement periods of several days need a drift control on each day.

(standards.iteh.ai)

3.29**repeatability**

ability of the P-AMS to provide closely similar indications for repeated applications of the same measurand under the same conditions of measurement

3.30**reproducibility** **R_r**

measure of the agreement between two identical measuring systems applied in parallel in field tests at a level of confidence of 95 % using the standard deviation of the difference of the paired measurements

Note 1 to entry: Reproducibility is determined by means of two identical P-AMS operated side by side. It is an P-AMS performance characteristic for describing the production tolerance specific to that P-AMS. The reproducibility is calculated from the short-term averages of the output signals (raw values as analogue or digital outputs) obtained during the field test.

Note 2 to entry: The term “field repeatability” is sometimes used instead of reproducibility.

3.31**uncertainty**

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

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