

Stationary source emissions - Determination of mass concentration of nitrogen oxides - Standard reference method: chemiluminescence

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 14792:2017 sisaldab Euroopa standardi EN 14792:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 14792:2017 consists of the English text of the European standard EN 14792:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 11.01.2017.	Date of Availability of the European standard is 11.01.2017.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.040.40

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Stationary source emissions - Determination of mass
concentration of nitrogen oxides - Standard reference
method: chemiluminescence

Emissions de sources fixes - Détermination de la
concentration massique des oxydes d'azote - Méthode
de référence normalisée : chimiluminescence

Emissionen aus stationären Quellen - Bestimmung der
Massenkonzentration von Stickstoffoxiden -
Standardreferenzverfahren: Chemilumineszenz

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
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	7
4 Symbols and abbreviations	13
4.1 Symbols.....	13
4.2 Abbreviated terms	14
5 Principle	14
5.1 General.....	14
5.2 Measuring principle	14
6 Description of the measuring system	15
6.1 General.....	15
6.2 Sampling and sample gas conditioning system.....	16
6.2.1 Sampling probe	16
6.2.2 Filter.....	17
6.2.3 Sample gas line.....	17
6.2.4 Sample gas conditioning system.....	17
6.2.5 Sample gas pump.....	18
6.2.6 Secondary filter.....	18
6.2.7 Flow controller and flow meter	18
6.3 Analyser equipment.....	18
6.3.1 General.....	18
6.3.2 Converter	19
6.3.3 Ozone generator	19
6.3.4 Reaction chamber	19
6.3.5 Optical filter	19
6.3.6 Photomultiplier tube	20
6.3.7 Ozone removal	20
7 Performance characteristics of the SRM.....	20
8 Suitability of the measuring system to the measurement task	21
9 Field operation.....	22
9.1 Measurement planning	22
9.2 Sampling strategy.....	22
9.2.1 General.....	22
9.2.2 Measurement section and measurement plane.....	22
9.2.3 Minimum number and location of measurement points.....	22
9.2.4 Measurement ports and working platform	22
9.3 Choice of the measuring system	23
9.4 Setting of the measuring system on site	23
9.4.1 General.....	23
9.4.2 Preliminary zero and span check, and adjustments	23
9.4.3 Zero and span checks after measurement	24

10	Ongoing quality control.....	25
10.1	General	25
10.2	Frequency of checks	25
11	Expression of results	26
12	Equivalence of an alternative method	27
13	Measurement report	27
	Annex A (informative) Validation of the method in the field.....	28
A.1	General	28
A.2	Characteristics of installations	28
A.3	Repeatability and reproducibility in the field.....	29
A.3.1	General	29
A.3.2	Repeatability	30
A.3.3	Reproducibility.....	31
	Annex B (informative) Sampling and conditioning configurations.....	32
	Annex C (normative) Determination of conversion efficiency	33
C.1	General	33
C.2	First method: cylinder gases for calibration.....	33
C.3	Second method: gaseous phase titration	33
	Annex D (informative) Examples of different types of converters	35
D.1	Quartz converter.....	35
D.2	Low temperature converter (molybdenum)	35
D.3	Stainless steel converter	35
	Annex E (informative) Calculation of the uncertainty associated with a concentration expressed for dry gas and at an oxygen reference concentration	36
E.1	Uncertainty associated with a concentration expressed on dry gas.....	36
E.2	Uncertainty associated with a concentration expressed at a oxygen reference concentration.....	38
	Annex F (informative) Example of assessment of compliance of chemiluminescence method for NO_x with requirements on emission measurements	40
F.1	General	40
F.2	Elements required for the uncertainty determinations.....	40
F.2.1	Model equation.....	40
F.2.2	Combined uncertainty	41
F.2.3	Expanded uncertainty.....	41
F.2.4	Determination of uncertainty contributions in case of rectangular distributions.....	43
F.2.5	Determination of uncertainty contributions by use of sensitivity coefficients	44
F.3	Example of an uncertainty calculation.....	44
F.3.1	Site specific conditions	44

F.3.2	Performance characteristics of the method.....	45
F.3.3	Calculation of concentration values	46
F.3.4	Determination of the uncertainty contributions.....	47
F.3.5	Result of uncertainty calculation	50
F.3.5.1	Standard uncertainties	50
F.3.5.2	Combined uncertainty.....	51
F.3.5.3	Expanded uncertainty	52
F.3.5.4	Evaluation of the compliance with the required measurement quality	52
Annex G (informative)	Example of correction of data from drift effect	53
Annex H (informative)	Significant technical changes.....	55
Bibliography.....		56

European foreword

This document (EN 14792:2017) has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

This document supersedes EN 14792:2005.

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.

Annex H provides details of significant technical changes between this document and the previous edition.

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.

1 Scope

This European Standard specifies the standard reference method (SRM) based on the chemiluminescence principle for the determination of the nitrogen oxides (NO_x) in flue gases emitted to the atmosphere from ducts and stacks. It includes the sampling and the gas conditioning system, as well as the analyser.

This European Standard specifies the characteristics to be determined and the performance criteria to be fulfilled by portable automated measuring systems (P-AMS) based on this measurement method. It applies for periodic monitoring and for the calibration or control of automated measuring systems (AMS) permanently installed on a stack, for regulatory or other purposes.

This European Standard specifies criteria for demonstration of equivalence of an alternative method to the SRM by application of EN 14793:2017.

This European Standard has been validated during field tests on waste incineration, co-incineration and large combustion installations and on a recognized test-bench. It has been validated for sampling periods of 30 min in the range of 0 mg/m³ to 1 300 mg/m³ of NO_x for large combustion plants and 0 mg/m³ to 400 mg/m³ of NO_x for waste incineration, according to emission limit values (ELV) laid down in the Directive 2010/75/EU.

The ELV for NO_x (NO + NO₂) in EU Directives is expressed in mg/m³ of NO₂ on a dry basis, at a specified value for oxygen and at standard conditions (273 K and 101,3 kPa).

NOTE The characteristics of installations, the conditions during field tests and the values of repeatability and reproducibility in the field are given in Annex A.

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 emission – 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*

EN ISO 14956:2002, *Air quality - Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty (ISO 14956:2002)*

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