

**Stationary source emissions -
Determination of mass concentration of
nitrogen oxides (NO_x) - Reference
method: Chemiluminescence**

Stationary source emissions - Determination of mass
concentration of nitrogen oxides (NO_x) - Reference
method: Chemiluminescence

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

| | |
|--|---|
| <p>Käesolev Eesti standard EVS-EN 14792:2005 sisaldab Euroopa standardi EN 14792:2005 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 28.12.2005 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p> | <p>This Estonian standard EVS-EN 14792:2005 consists of the English text of the European standard EN 14792:2005.</p> <p>This document is endorsed on 28.12.2005 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p> |
|--|---|

| | |
|---|---|
| <p>Käsitlusala: This European Standard describes the chemiluminescence method, including the sampling and the gas conditioning system, to determine the NO/NO₂/NO_x concentrations in flue gases emitted from ducts and stacks to atmosphere.</p> | <p>Scope: This European Standard describes the chemiluminescence method, including the sampling and the gas conditioning system, to determine the NO/NO₂/NO_x concentrations in flue gases emitted from ducts and stacks to atmosphere.</p> |
|---|---|

ICS 13.040.40

Võtmesõnad: air, air pollution, air purification, analyzers, chimneys

ICS 13.040.40

English Version

Stationary source emissions - Determination of mass
concentration of nitrogen oxides (NO_x) - Reference method:
Chemiluminescence

missions de sources fixes - Détermination de la
concentration massique en oxides d'azote (NO_x) - Méthode
de référence: Chimuluminiscence

Emissionen aus stationären Quellen - Bestimmung der
Massenkonzentration von Stickstoffoxiden (NO_x) -
Referenzverfahren : Chemilumineszenz

This European Standard was approved by CEN on 30 September 2005.

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 Central Secretariat 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 Central Secretariat 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.



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

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

Contents

Page

| | |
|---|----|
| Foreword | 4 |
| 1 Scope | 5 |
| 2 Normative references | 5 |
| 3 Terms and definitions | 6 |
| 4 Principle | 10 |
| 4.1 General | 10 |
| 4.2 Measuring principle | 10 |
| 5 Description of measuring equipment - Sampling and sample gas conditioning systems | 11 |
| 5.1 General | 11 |
| 5.2 Sampling line components | 12 |
| 5.2.1 Sampling line | 12 |
| 5.2.2 Filter | 12 |
| 5.2.3 Sample cooler (configuration 1) | 12 |
| 5.2.4 Permeation drier (configuration 2) | 12 |
| 5.2.5 Dilution system (configuration 3) | 13 |
| 5.2.6 Heated line and heated analyser (configuration 4) | 13 |
| 5.2.7 Sample pump | 13 |
| 5.2.8 Secondary filter | 13 |
| 5.2.9 Flow controller and flow meter | 13 |
| 6 Analyser equipment | 14 |
| 6.1 General | 14 |
| 6.2 Converter | 14 |
| 6.3 Ozone generator | 14 |
| 6.4 Reaction chamber | 15 |
| 6.5 Optical filter | 15 |
| 6.6 Photomultiplier tube | 15 |
| 6.7 Ozone removal | 15 |
| 7 Determination of the characteristics of the SRM: analyser, sampling and conditioning line | 15 |
| 7.1 General | 15 |
| 7.2 Relevant performance characteristics of the SRM and performance criteria | 16 |
| 7.3 Establishment of the uncertainty budget | 17 |
| 8 Field operation | 18 |
| 8.1 Sampling location | 18 |
| 8.2 Sampling point(s) | 18 |
| 8.3 Choice of the measuring system | 19 |
| 8.4 Setting of the SRM on site | 19 |
| 8.4.1 General | 19 |
| 8.4.2 Preliminary zero and span check, and adjustments | 20 |
| 8.4.3 Zero and span checks after measurement | 20 |
| 9 Ongoing quality control | 21 |
| 9.1 General | 21 |
| 9.2 Frequency of checks | 21 |
| 10 Expression of results | 22 |
| 11 Evaluation of the method in the field | 23 |
| 12 Equivalence with an alternative method | 23 |
| 13 Test report | 24 |

| | |
|---|-----------|
| Annex A (informative) Four different sampling and conditioning configurations | 25 |
| Annex B (normative) Determination of converter efficiency | 26 |
| B.1 General | 26 |
| B.2 First method : cylinder gases for calibration | 26 |
| B.3 Second method : gaseous phase titration | 26 |
| Annex C (informative) Examples of different types of converters | 28 |
| C.1 Quartz converter | 28 |
| C.2 Low temperature converter (molybdenum) | 28 |
| C.3 Stainless steel converter | 28 |
| Annex D (informative) Example of assessment of compliance of chemiluminescence method for NO_x with requirements on emission measurements | 29 |
| D.1 General | 29 |
| D.2 Process of uncertainty estimation | 29 |
| D.2.1 Determination of the model equation | 29 |
| D.2.2 Quantification of uncertainty components | 29 |
| D.2.3 Calculation of the combined uncertainty | 29 |
| D.3 Specific conditions in the field | 30 |
| D.4 Performance characteristics of the method | 31 |
| D.4.1 NO measurement | 32 |
| D.4.2 NO_x measurement | 38 |
| D.4.3 Results of standard uncertainties calculation | 40 |
| D.4.4 Calculation of combined uncertainties | 42 |
| D.5 Conversion of the concentrations in mg/m³ | 42 |
| D.5.1 No measurement | 43 |
| D.5.2 NO₂ measurement | 43 |
| D.5.3 NO_x measurement | 43 |
| D.5.4 Combined uncertainty | 43 |
| D.5.5 Overall uncertainty | 43 |
| D.6 Evaluation of the compliance with the required measurement quality | 43 |
| Annex E (informative) Procedure of correction of data from drift effect | 45 |
| Annex F (informative) Evaluation of the method in the field | 46 |
| F.1 General | 46 |
| F.2 Characteristics of installations | 46 |
| F.3 Repeatability and reproducibility in the field | 47 |
| F.3.1 General | 47 |
| F.3.2 Repeatability | 48 |
| F.3.3 Reproducibility | 49 |
| Annex ZA (informative) Relationship with EU Directives | 50 |
| Bibliography | 51 |

Foreword

This European Standard (EN 14792:2005) 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 May 2006, and conflicting national standards shall be withdrawn at the latest by May 2006.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this European Standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: 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.

1 Scope

This European Standard describes the chemiluminescence method, including the sampling and the gas conditioning system, to determine the NO/NO₂/NO_x concentrations in flue gases emitted from ducts and stacks to atmosphere. This European Standard is the Standard Reference Method (SRM) for periodic monitoring and for calibration or control of Automatic Measuring Systems (AMS) permanently installed on a stack, for regulatory or other purposes such as calibration. To be used as the SRM, the user shall demonstrate that the performance characteristics of the method are better than the performance criteria defined in this European Standard and that the overall uncertainty of the method is less than $\pm 10\%$ relative at the daily Emission Limit Value (ELV).

NOTE When the chemiluminescence method is the measurement principle used for AMS, reference should be made to EN 14181 and other relevant standards provided by CEN TC 264.

An Alternative Method to this SRM may be used provided that the user can demonstrate equivalence according to the Technical Specification CEN TS 14793, to the satisfaction of his national accreditation body or law.

This SRM has been evaluated during field tests on waste incineration, co-incineration and large combustion installations. It has been validated for sampling periods of 30 min in the range of 0 mg NO₂/m³ to 1 300 mg NO₂/m³ for large combustion plants and 0 mg NO₂/m³ to 400 mg NO₂/m³ for waste incineration, according to emission limit values (ELVs) laid down in the following Council Directives:

- Council Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants;
- Council Directive 2000/76/EC on waste incineration plants.

The ELVs for NO_x (NO + NO₂) in EU directives are expressed in mg NO₂/m³, on dry basis, at a reference value for O₂ and at the reference conditions (273 K and 101,3 kPa).

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ENV 13005, *Guide to the expression of uncertainty in measurement*.

EN 14790:2003, *Stationary source emissions - Determination of the water vapour in ducts*.

CEN/TS 14793, *Stationary source emissions - Intralaboratory validation procedure for an alternative method compared to a reference method*.

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