

**Stationary source emissions -
Determination of the water vapour in
ducts**

Stationary source emissions - Determination of the
water vapour in ducts

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 14790:2005 sisaldab Euroopa standardi EN 14790:2005 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 14790:2005 consists of the English text of the European standard EN 14790:2005.</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 condensation/adsorption technique, including the sampling system, to determine the water vapour concentration in the flue gases emitting to atmosphere from ducts and stacks.</p>	<p>Scope: This European Standard describes the condensation/adsorption technique, including the sampling system, to determine the water vapour concentration in the flue gases emitting to atmosphere from ducts and stacks.</p>
---	---

ICS 11.040.40

Võtmesõnad: air pollution, air quality, chimneys, concentration, ducts

ICS 11.040.40

English Version

Stationary source emissions - Determination of the water vapour in ducts

Emissions de sources fixes - Détermination de la vapeur
d'eau dans les conduits

Emissionen aus stationären Quellen - Bestimmung von
Wasserdampf in Leitungen

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	9
4.1 General	9
4.2 Adsorption or condensation/adsorption method	9
4.3 Temperature method	9
5 Apparatus	10
5.1 General	10
5.2 Sampling probe	10
5.3 Filter housing	10
5.4 Particle filter	11
5.5 Trapping unit	11
5.6 Cooling System (optional)	11
5.7 Sampling pump	11
5.8 Gas volume meter	11
5.9 Barometer	12
5.10 Balance	12
5.11 Temperature measurement	12
6 Measurement procedure	12
6.1 General requirements	12
6.2 Preparation and installation of equipment	12
6.2.1 Sampling location	12
6.2.2 Sampling point	13
6.2.3 Assembling the equipment	13
6.3 Leak test	13
6.4 Performing of the sampling	14
6.4.1 Introduction of the probe in the duct	14
6.4.2 Sampling	14
6.5 Repeatability of the weighing	14
6.6 Procedure for gas streams saturated with water (droplets present)	15
7 Determination of the characteristics of the method: sampling and analysis	15
7.1 Introduction	15
7.2 Relevant performance characteristics of the method and performance criteria	15
7.3 Establishment of the uncertainty budget	16
7.4 Equivalency with an alternative method	17
8 Evaluation of the method in the field	17
9 Water vapour determination	18
10 Report	20
Annex A (normative) Determination of water vapour concentration for water saturated gas, at P_{std} = 101,325 kPa	21
Annex B (informative) Type of sampling equipments	25
Annex C (informative) Example of assessment of compliance of reference method for water vapour with requirements on emission measurements	26
C.1 General	26
C.2 Process of uncertainty estimation	26

C.2.1	Determination of the model equation	26
C.2.2	Quantification of uncertainty components	26
C.2.3	Calculation of the combined uncertainty	26
C.3	Specific conditions in the field	27
C.4	Performance characteristics of the method	28
C.5	Calculation of standard uncertainty of the concentration	28
C.5.1	Model equation and application of the rule of the uncertainty propagation	29
C.5.2	Results of standard uncertainties calculations	33
C.5.3	Estimation of the combined uncertainty	36
Annex D	(informative) Evaluation of the method in the field	37
D.1	General	37
D.2	Characteristics of installations	37
D.3	Repeatability and reproducibility in the field	38
D.3.1	Repeatability	39
D.3.2	Reproducibility	40
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive	41
Bibliography	42

Foreword

This European Standard (EN 14790:2005) 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 condensation/adsorption technique, including the sampling system, to determine the water vapour concentration in the flue gases emitting to atmosphere from ducts and stacks.

This technique is usually used all over Europe for water vapour monitoring. However to be implemented as the Standard Reference Method (SRM), the user has to 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 $\pm 20\%$ of the measured value. This European Standard as the Standard Reference Method (SRM) is used for periodic monitoring and for calibration or control of Automatic Measuring Systems (AMS) permanently installed on a stack, for regulatory purposes or other purposes.

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.

The determination of water vapour is mainly necessary for:

- regulatory purposes, to express the concentration at standard conditions (on dry gas);
- adjust the flow rate for isokinetic sampling, when a dry gas flow rate metering device is used.

For both applications, the quantity to be measured is the amount of water present in the gas phase (vapour), which does not include water droplets.

This European Standard is applicable in the range from 4 % to 40 % relative humidity and for water vapour concentration from 29 g/m³ to 250 g/m³ as a wet gas, although for a given temperature the upper limit of the method is related to the maximum pressure of water in air or in the gas.

This European Standard 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 concentration range of 7 % to 26 % volume.

In this European Standard all the concentrations are expressed in normal conditions (273 K and 101,3 kPa).

NOTE For saturated conditions the condensation/adsorption method is not applicable. Some guidance is given in this European Standard to deal with flue gas when droplets are present.

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*.

CEN/TS 14793, *Stationary source emission - 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)*.