

Stationary source emissions - Determination of the
water vapour in ducts - Standard reference method

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 14790:2017 sisaldab Euroopa standardi EN 14790:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 14790:2017 consists of the English text of the European standard EN 14790:2017.
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 the water vapour in ducts - Standard reference method

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

Emissionen aus stationären Quellen - Bestimmung von
Wasserdampf in Kanälen - Standardreferenzverfahren

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.....	4
1 Scope.....	5
2 Normative references.....	5
3 Terms and definitions	6
4 Symbols and abbreviations	11
4.1 Symbols.....	11
4.2 Abbreviated terms	12
5 Principle	12
5.1 General.....	12
5.2 Adsorption or condensation/adsorption method.....	12
5.3 Temperature method	12
6 Description of the measuring system	13
6.1 General.....	13
6.2 Sampling probe	13
6.3 Filter housing.....	13
6.4 Particle filter.....	14
6.5 Trapping system.....	14
6.6 Cooling system (optional)	14
6.7 Sample gas pump.....	14
6.8 Gas volume meter	14
6.9 Barometer.....	15
6.10 Balance.....	15
6.11 Temperature measurement.....	15
7 Performance characteristics of the SRM.....	15
8 Field operation.....	16
8.1 Measurement planning.....	16
8.2 Sampling strategy.....	17
8.2.1 General.....	17
8.2.2 Measurement section and measurement plane.....	17
8.2.3 Minimum number and location of measurement points.....	17
8.2.4 Measurement ports and working platform	17
8.3 Assembling the equipment	17
8.4 Leak test.....	18
8.5 Performing sampling.....	18
8.5.1 Introduction of the sampling probe in the duct.....	18
8.5.2 Sampling.....	18
8.6 Repeatability of the weighing.....	19
8.7 Procedure for gas streams saturated with water (droplets present).....	19
9 Water vapour determination.....	19
10 Equivalence of an alternative method.....	21
11 Measurement report.....	21

Annex A (informative) Validation of the method in the field.....	22
A.1 General	22
A.2 Characteristics of installations	22
A.3 Repeatability and reproducibility in the field.....	23
A.3.1 General	23
A.3.2 Repeatability	24
A.3.3 Reproducibility.....	25
Annex B (normative) Determination of water vapour concentration for water saturated gas, at $p_{ref} = 101,325$ kPa	26
Annex C (informative) Type of sampling equipment.....	30
Annex D (informative) Example of assessment of compliance of standard reference method for water vapour with given uncertainty requirements	31
D.1 General	31
D.2 Elements required for the uncertainty determinations.....	31
D.3 Example of an uncertainty calculation.....	31
D.3.1 Specific conditions in the field.....	31
D.3.2 Performance characteristics	32
D.3.3 Model equation and application of the rule of the uncertainty propagation	34
D.3.3.1 Water vapour content.....	34
D.3.3.2 Effect of the collection efficiency.....	35
D.3.3.3 Calculation of the combined uncertainty of the water vapour content taking into account the collection efficiency	35
D.3.3.4 Calculation of sensitivity coefficients.....	36
D.3.3.5 Calculation of the standard uncertainty of the collection efficiency	36
D.3.3.6 Calculation of the standard uncertainty of measured dry gas volume corrected to standard conditions.....	37
D.3.3.7 Calculation of the combined uncertainty of the water vapour content	38
D.3.3.8 Results of standard uncertainties calculations.....	38
D.3.4 Estimation of the combined uncertainty.....	41
Annex E (informative) Significant technical changes	42
Bibliography	43

European foreword

This document (EN 14790:2017) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This document supersedes EN 14790:2005.

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 E 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 a sampling system with a condensation/adsorption technique to determine the water vapour concentration in the flue gases emitted to atmosphere from ducts and stacks.

This European Standard specifies the performance characteristics to be determined and performance criteria to be fulfilled by measuring systems based on the measurement method. It applies to periodic monitoring and to 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 is applicable in the range of water vapour content from 4 % to 40 % as volume concentrations and of water vapour mass 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.

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

NOTE 1 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.

This European Standard has been validated during field tests on waste incineration, co-incineration and large combustion plants. It has been validated for sampling periods of 30 min in the volume concentration range of 7 % to 26 %.

NOTE 2 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 1911, *Stationary source emissions - Determination of mass concentration of gaseous chlorides expressed as HCl - Standard reference method*

EN 14791:2017, *Stationary source emissions — Determination of mass concentration of sulphur oxides — Standard reference method*

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*

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