

# **SLOVENSKI STANDARD**

## **SIST EN 1911:2011**

**01-februar-2011**

**Nadomešča:**

**SIST EN 1911-1:1999**

**SIST EN 1911-2:1999**

**SIST EN 1911-3:1999**

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**Emisije nepremičnih virov - Določevanje masne koncentracije plinastih kloridov, izraženih kot HCl - Standardna referenčna metoda**

Stationary source emissions - Determination of mass concentration of gaseous chlorides expressed as HCl - Standard reference method

Emissionen aus stationären Quellen - Bestimmung der Massenkonzentration von gasförmigen Chloriden, angegeben als HCl - Standardreferenzverfahren

Emissions de sources fixes - Détermination de la concentration massique en chlorures gazeux, exprimée en HCl - Méthode de référence normalisée

**Ta slovenski standard je istoveten z: EN 1911:2010**

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**ICS:**

13.040.40      Emisije nepremičnih virov      Stationary source emissions

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**EN 1911**

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English Version

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

Emissions de sources fixes - Détermination de la concentration massique en chlorures gazeux, exprimée en HCl - Méthode de référence normalisée

Emissionen aus stationären Quellen - Bestimmung der Massenkonzentration von gasförmigen Chloriden, angegeben als HCl - Standardreferenzverfahren

This European Standard was approved by CEN on 26 June 2010.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: Avenue Marnix 17, B-1000 Brussels**

# Contents

Page

Foreword.....	4
Introduction .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms, definitions and abbreviations.....	6
3.1 Terms and definitions .....	6
3.2 Abbreviations .....	9
4 Principle.....	11
5 Sampling .....	11
5.1 Sampling strategy .....	11
5.1.1 General.....	11
5.1.2 Non isokinetic sampling .....	12
5.1.3 Isokinetic sampling.....	13
5.1.4 Losses of gaseous chlorides and side reactions during sampling .....	14
5.2 Sampling equipment .....	14
5.3 Sampling procedure.....	18
5.3.1 Preparation and installation of equipment.....	18
5.3.2 Sampling procedure .....	19
5.3.3 Validation of results .....	20
6 Analysis .....	21
6.1 Introduction .....	21
6.2 Reagents and samples to be analysed.....	22
6.2.1 Reagents for analysis.....	22
6.2.2 Samples to be analysed .....	22
6.3 Silver titration: potentiometric method .....	22
6.3.1 Apparatus .....	22
6.3.2 Reagents and solutions .....	23
6.3.3 Procedure .....	23
6.3.4 Interferences .....	23
6.3.5 Calculations.....	24
6.4 Mercuric-thiocyanate spectrophotometry.....	24
6.4.1 Warning.....	24
6.4.2 Apparatus .....	24
6.4.3 Reagents .....	24
6.4.4 Procedure .....	25
6.4.5 Interferences .....	25
6.4.6 Calculations.....	26
6.5 Ion-exchange chromatography .....	26
7 Expression of results .....	27
8 Determination of the characteristics of the method: sampling and analysis.....	28
8.1 General.....	28
8.2 Relevant performance characteristics of the method and performance criteria .....	28
8.2.1 General.....	28
8.2.2 Sampling procedure .....	28
8.2.3 Analyse procedure.....	29
8.3 Establishment of the uncertainty budget.....	30
9 Measurement report .....	31

<b>Annex A</b> (informative) <b>Examples of absorbers</b> .....	<b>32</b>
<b>Annex B</b> (informative) <b>Comparison between mercuric-thiocyanate spectrophotometry and ion exchange chromatography method (methods B and C)</b> .....	<b>34</b>
<b>Annex C</b> (informative) <b>Example of assessment of compliance of the reference method for chlorides</b> .....	<b>35</b>
<b>C.1</b> <b>General</b> .....	<b>35</b>
<b>C.2</b> <b>Process of uncertainty estimation</b> .....	<b>35</b>
<b>C.3</b> <b>Specific conditions in the field</b> .....	<b>36</b>
<b>C.4</b> <b>Performance characteristics of the method</b> .....	<b>37</b>
<b>C.5</b> <b>Calculation of standard uncertainty of concentration measured</b> .....	<b>38</b>
<b>C.6</b> <b>Calculation of the overall (or expanded) uncertainty</b> .....	<b>41</b>
<b>C.7</b> <b>Uncertainty associated to the mass concentration of gaseous chlorides at O<sub>2</sub> reference concentration</b> .....	<b>41</b>
<b>Annex D</b> (informative) <b>Performance characteristics of the whole measurement method</b> .....	<b>43</b>
<b>D.1</b> <b>Analytical detection limit of the method</b> .....	<b>43</b>
<b>D.2</b> <b>Repeatability and reproducibility of the method in the field</b> .....	<b>43</b>
<b>Annex E</b> (informative) <b>Significant technical changes</b> .....	<b>45</b>
<b>Bibliography</b> .....	<b>46</b>

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**EN 1911:2010 (E)****Foreword**

This document (EN 1911:2010) 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 February 2011, and conflicting national standards shall be withdrawn at the latest by February 2011.

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 supersedes EN 1911-1:1998, EN 1911-2:1998 and EN 1911-3:1998.

Annex E provides details of significant technical changes between this European Standard 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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## Introduction

This European Standard describes the Standard Reference Method (SRM) with three alternative analytical techniques for determining gaseous chlorides content emitting to atmosphere from ducts and stacks. The specific components and the requirements for the measuring system are described. A number of performance characteristics with associated minimum performance criteria are specified for the measuring system (see Tables 1 and 2 in 8.2). This European Standard can be used as an SRM provided the overall uncertainty of the method is less than 30,0 % relative at the daily Emission Limit Value (ELV) for incineration and large combustion plants or at the ELV prescribed by the specific regulations for other plants.

An Alternative Method to this SRM may be used provided that the user can demonstrate equivalence according to CEN/TS 14793.

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## 1 Scope

The method described in this European Standard determines the concentration of chlorinated compounds in a flue gas that – after passage of the sampling system including a particle filter – give  $\text{Cl}^-$  ions in the absorption solution. This Standard Reference Method has been evaluated during field tests on waste incineration. The method applies to waste gases in which chlorides concentration expressed as HCl may vary between  $1 \text{ mg}\cdot\text{m}^{-3}$  and  $5\,000 \text{ mg}\cdot\text{m}^{-3}$  under normal pressure and temperature conditions (see Note 1), and according to emission limit values laid down, for example, in the Council Directive 2000/76/EC on waste incineration plants.

NOTE 1 The limit values of this European Standard are expressed in  $\text{mg HCl/m}^3$ , on dry basis, at the reference conditions of 273 K and 101,3 kPa and at the reference  $\text{O}_2$  concentration.

NOTE 2 The required uncertainty results from the capacity of the method tested in the field (Annex D) and in the laboratory (see performance characteristics in Tables 1 and 2 and Annex C).

## 2 Normative references

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

EN 13284-1:2001, *Stationary source emissions — Determination of low range mass concentration of dust — Part 1: Manual gravimetric method*

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

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 ISO 3696:1995, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

EN ISO 10304-1, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (ISO 10304-1:2007)*

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

## 3 Terms, definitions and abbreviations

### 3.1 Terms and definitions

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

#### 3.1.1

##### **absorber**

device in which gaseous chloride is absorbed into an absorption solution

#### 3.1.2

##### **chemical blank**

chloride ion content of an unexposed sample of the absorption solution, plus reagents that are added to the solution before analysis if necessary



**3.1.3****analytical detection limit****D<sub>L</sub>**

concentration value of the measurand below which there is at least 95 % level of confidence that the measured value corresponds to a sample free of that measurand

**3.1.4****field blank**

value determined by a specific procedure used to ensure that no significant contamination has occurred during all steps of the measurement and to check that the operator can achieve a quantification level adapted to the task

**3.1.5****isokinetic sampling**

sampling at a rate such that the velocity and direction of the gas entering the sampling nozzle is the same as that of the gas in the duct at the sampling point

[EN 13284-1:2001]

**3.1.6****measurand**

particular quantity subject to measurement

[ISO/IEC Guide 99:2007, 2.6]

**3.1.7****measurement series**

several successive measurements carried out on the same sampling plane and at the same process operating conditions

[EN 13284-1:2001]

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**3.1.8****performance characteristic**

one of the quantities (described by values, tolerances, range, etc.) assigned to equipment in order to define its performance

**3.1.9****analytical repeatability**

closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement

NOTE 1 Analytical repeatability conditions include:

- the same measurement procedure;
- the same laboratory;
- the same sampling equipment, used under the same conditions and at the same location;
- repetition over a short period of time.

NOTE 2 Analytical repeatability may be expressed quantitatively in terms of the dispersion characteristics of the results.

[ISO/IEC Guide 99:2007, 3.6]

NOTE 3 In this European Standard the analytical repeatability is expressed as a value with a level of confidence of 95 %.

**EN 1911:2010 (E)****3.1.10****repeatability in the field**

closeness of the agreement between the results of simultaneous measurements of the same measurand carried out with two sets of equipment under the same conditions of measurement

NOTE 1 These conditions include:

- the same measurement procedure;
- two sets of equipment, the performances of which are fulfilling the requirements of the reference method, used under the same conditions;
- the same location;
- implemented by the same laboratory;
- typically calculated over short periods of time in order to avoid the effect of changes of influence parameters (e.g. 30 min).

NOTE 2 Repeatability may be expressed quantitatively in terms of the dispersion characteristics of the results.

NOTE 3 In this European Standard the repeatability under field conditions is expressed as a value with a level of confidence of 95 %.

**3.1.11****reproducibility in the field**

closeness of the agreement between the results of simultaneous measurements of the same measurand carried out with several sets of equipment under the same conditions of measurement

NOTE 1 These conditions are called field reproducibility conditions and include:

- the same measurement procedure;
- several sets of equipment, the performance of which fulfils the requirements of the reference method, used under the same conditions;
- the same location;
- implemented by several laboratories.

NOTE 2 Reproducibility may be expressed quantitatively in terms of the dispersion characteristics of the results.

NOTE 3 In this European Standard the reproducibility under field conditions is expressed as a value with a level of confidence of 95 %.

**3.1.12****sampling location**

specific area close to the sampling plane where the measurement devices are set up

**3.1.13****sampling plane**

plane normal to the centreline of the duct at the sampling position

[EN 13284-1:2001]

**3.1.14****sampling point**

specific position on a sampling plane at which a sample is extracted

[EN 13284-1:2001]

**3.1.15****standard reference method****SRM**

measurement method recognised by experts and taken as a reference by convention, which gives, or is presumed to give, the accepted reference value of the concentration of the measurand to be measured

**3.1.16****uncertainty**

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

**3.1.17****standard uncertainty** $u$ 

uncertainty of the result of a measurement expressed as a standard deviation

**3.1.18****expanded uncertainty** $U$ 

quantity defining a level of confidence about the result of a measurement that may be expected to encompass a specific fraction of the distribution of values that could reasonably be attributed to a measurand

NOTE 1  $U = k \cdot u$ NOTE 2 In this European Standard, the expanded uncertainty is calculated with a coverage factor of  $k = 2$ , and with a level of confidence of 95 %.**3.1.19****combined uncertainty** $u_c$ 

standard uncertainty  $u$  attached to the measurement result calculated by combination of several standard uncertainties according to GUM

$$\text{NOTE} \quad u_c = \sqrt{\sum_{i=1}^N u_i^2}$$

**3.1.20****overall uncertainty** $U_c$ 

expanded combined standard uncertainty attached to the measurement result calculated according to GUM

NOTE  $U_c = k \times u_c$ **3.2 Abbreviations**

$C_{Ag}$  concentration of silver nitrate solution, in moles per litre (mol/l)

$CI_r$  repeatability confidence interval

$CI_R$  reproducibility confidence interval

## EN 1911:2010 (E)

$C_{corr}$	corrected concentration of measurand
$C_{actual}$	concentration of measurand at actual O <sub>2</sub> concentration
$C_{chlorides(Cl)}$	chlorides content expressed in milligrams Cl <sup>-</sup> per cubic metre
$C_{chlorides(HCl)}$	chlorides content expressed in milligrams HCl per cubic metre
$D_L$	analytical detection limit
$M_{Cl}$	molar mass of chloride
$M_{HCl}$	molar mass of hydrogen chloride
$m_{chlorides}$	quantity of gaseous chlorides collected in the sampling device, , in milligrams Cl
$O_{2,meas}$	dry oxygen content
$O_{2,ref}$	oxygen reference concentration
$P$	absolute pressure in kilopascals (kPa) at the gas volume meter; $P$ is equal to the sum of relative pressure measured at the gas volume meter $P_{rel}$ plus atmospheric pressure $P_{atm}$
$P_{rel}$	relative pressure measured at the gas volume meter in kilopascals (kPa)
$P_{atm}$	atmospheric pressure in kilopascals (kPa)
$p_s(H_2O)$	saturated vapour pressure at the temperature of the gas meter, in kilopascals (kPa)
$p_{res}$	residual vapour pressure, in kilopascals (kPa)
$S_r$	repeatability standard deviation
$S_R$	reproducibility standard deviation
$t_{0,95,np-1}$	student factor for a level of confidence of 95 % and a degree of freedom of np-1
$T$	actual temperature, in Kelvins (K)
$u$	standard uncertainty
$u_c$	combined uncertainty
$U$	expanded uncertainty
$U_c$	overall uncertainty
$V_{std}$	volume of gas sampled under standard conditions and dry basis, in cubic metres (m <sup>3</sup> )

$V_s$	volume of absorption solution $S_e$ , in millilitres (ml)
$V_{s,a}$	aliquot portion of $S_e$ used for analysis, in millilitres (ml)
$V_{AgNO_3}$	volume of the Ag NO <sub>3</sub> solution used for dosing the solution $S_e$ , in millilitres (ml)
$V_{o,AgNO_3}$	volume of the Ag NO <sub>3</sub> solution used for taking into account the chemical blank value, in millilitres (ml)
$V_{T,p}$	volume under actual conditions of temperature and pressure, on dry basis with "dry" gas meter or wet basis with "wet" gas meter, in cubic metres (m <sup>3</sup> )

## 4 Principle

This European Standard describes the Standard Reference Method (SRM) for determining chloride ions content, expressed as HCl, emitting to atmosphere from ducts and stacks. The specific components and the requirements for the measuring system are described. A number of performance characteristics with associated minimum performance criteria are specified for the measuring system (see Tables 1 and 2 in 8.2). These performance characteristics and the overall uncertainty of the method shall meet the specifications given in this European Standard.

A known volume of flue gas is extracted representatively from a duct or a chimney during a certain period of time at a controlled flow rate with a heated probe. A heated filter removes the dust in the sampled volume, thereafter the gas stream containing gaseous chlorides is passed through a series of absorbers containing an absorption solution (chloride-free water).

All compounds which are volatile at the temperature of filtration and produce chloride ions upon dissolution during sampling are measured by this method, which gives therefore the volatile inorganic chlorides content of the waste gas. The results shall be expressed as HCl.

After sampling the solutions are analysed by one of the following methods:

- silver titration: potentiometric method (Method A);
- mercuric-thiocyanate spectrophotometry (Method B);
- ion-exchange chromatography (Method C).

## 5 Sampling

### 5.1 Sampling strategy

#### 5.1.1 General

The test programme shall be established following the advice and requirements described in EN 15259:2007 (5.4, Clauses 6, 7 and 8).

- a) Quantification of several compounds simultaneously, if relevant.

NOTE 1 Compounds such as gaseous chlorides, HF, SO<sub>2</sub>, NH<sub>3</sub> and water vapour, can be sampled simultaneously in parallel side stream lines.

NOTE 2 When performing isokinetic sampling the presence of water droplets means water vapour cannot be measured simultaneously in the same equipment.