



**SLOVENSKI STANDARD**  
**SIST EN 1911-1:1999**  
**01-september-1999**

9a [g]YbYdfYa ] b\ j]fcj '!Fc bUa YrcXUXc`c Yj Ub'U<7`!'%'XY.'AYrcXU  
 j ncf Yb'Ud`]bcj

Stationary source emissions - Manual method of determination of HCl - Part 1: Sampling of gases

Emissionen aus stationären Quellen - Manuelle Methode zur Bestimmung von HCl - Teil 1: Ansaugen des Probegases

Emissions de sources fixes - Méthode manuelle de dosage du HCl - Partie 1: Echantillonnage des gaz

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**Ta slovenski standard je istoveten z: EN 1911-1:1998**

**ICS:**

13.040.40 Stationary source emissions

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English version

## Stationary source emissions - Manual method of determination of HCl - Part 1: Sampling of gases

Emissions de sources fixes - Méthode manuelle de dosage  
du HCl - Partie 1: Echantillonnage des gaz

Emissionen aus stationären Quellen - Manuelle Methode  
zur Bestimmung von HCl - Teil 1: Ansaugen des  
Probegases

This European Standard was approved by CEN on 23 March 1998.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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## Foreword

This European Standard 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 month of October 1998, and conflicting national standards shall be withdrawn at the latest by month of October 1998.

The determination of gaseous hydrogen chloride emissions <sup>1)</sup> from stationary sources by a manual method is divided in three parts described in the following standards :

- |           |   |
|-----------|---|
| EN 1911-1 | Stationary source emissions - Manual method of determination of HCl - Part 1 : Sampling of gases                              |
| EN 1911-2 | Stationary source emissions - Manual method of determination of HCl - Part 2 : Gaseous compounds absorption                   |
| EN 1911-3 | Stationary source emissions - Manual method of determination of HCl - Part 3 : Absorption solutions analysis and calculations |

This standard is an integral part of a complete measurement procedure and the use of the two other parts is necessary for determination of hydrogen chloride.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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<sup>1)</sup> In this standard no distinction is made between hydrogen chloride and hydrochloric acid.

## 1 Scope

This European Standard specifies a method for sampling and filtration of gases, in view of their HCl concentration determination.

Subsequent HCl absorption and analysis are described in EN 1911-2 and EN 1911-3 respectively.

The method applies to ducted gaseous streams emitted by waste incinerators, and more generally to waste gases in which HCl concentration 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).

The method is validated for gaseous streams of dust concentration below  $100 \text{ mg}\cdot\text{m}^{-3}$ , and is not suitable for measurement of molecular chlorine  $\text{Cl}_2$  content.

NOTE : Normal pressure and temperature are 101,325 kPa and  $0 \text{ }^\circ\text{C}$  (273,15 K).

## 2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

|                |   |
|----------------|---|
| EN 1911-2:1998 | Stationary source emissions - Manual method of determination of HCl - Part 2 : Gaseous compounds absorption   |
| EN 1911-3      | Stationary source emissions - Manual method of determination of HCl - Part 3 : Absorption solutions analysis and calculations                             |
| ISO 9096:1992  | Stationary source emissions - Determination of concentration and mass flow rate of particulate material in gas-carrying ducts - Manual gravimetric method |

NOTE : The reference to ISO 9096:1992 will eventually be replaced by the reference to a European Standard, prepared by CEN/TC 264. The title of this future standard is "Stationary source emissions - Determination of low range mass concentration of dust - Manual gravimetric method".

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## 3 Definitions

For the purposes of this standard, the following definitions apply:

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### 3.1 equipment blank

Sample taken at plant site by performing all steps of the sampling procedure, but without drawing exhaust gas through the sampling equipment. Alternatives are to sample exhaust gas during a very short time (1 min), or to sample HCl free gas through the whole sampling equipment for 10 min to 15 min.

The equipment blank value, which provides an estimation of the sampling equipment contamination, is used for the assessment of measurement results.

### 3.2 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 [ISO 9096:1992].

### 3.3 sampling section

Internal cross section of the duct, normal to its centreline, suitable for carrying out sampling.

### 3.4 sampling point

Points spread over the sampling section, in order to be representative of subsections of equal areas.

## 4 Principle

### 4.1 General

Integrated sampling of the gases to be analyzed is carried out by extracting them representatively with a heated probe. Particles and dusts, which can contain solid chlorides, are removed by filtration at a controlled temperature, then gaseous chlorides are collected by dissolving in an absorption reagent (chloride-free water), in accordance with EN 1911-2.

All compounds which are volatile at the filtration temperature and produce chloride ions upon dissolution during sampling are measured by this method, which gives therefore the volatile inorganic chlorides content of gases expressed as HCl. In most cases, this corresponds to the hydrogen chloride content; an indicative distinction between hydrogen chloride and volatile chlorides may be achieved, using additional checks (see EN 1911-3).

### 4.2 Risks of HCl losses

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Attention is drawn to the risks of losses of HCl in the sampling system, due to its high reactivity and solubility: all the parts of the sampling system upstream of the washing bottle have to be made of inert materials, and have to be heated in order to avoid cold points, which can lead to large losses of HCl.

Losses may also occur by side reactions during the filtration of sampled gases at temperature less than 130 °C. Therefore the temperature of the probe and of gases during filtration shall be at least 150 °C, and 20 °C higher than the acid dew point of gases (see 9.2).

### 4.3 Representative sampling

#### 4.3.1 General

In some cases, the waste gases to be analysed may be water vapor saturated or slightly supersaturated, thus containing droplets which may have a high chloride content (dissolved HCl and/or dissolved chlorides).

For example, this may occur when sampling gases downstream a humid scrubber without subsequent reheating.

These droplets will be sampled with the gas to some extent and will influence the results. It has been shown that, in such cases, the reproducibility of measurement is better using an isokinetic sampling than using classical gas sampling by a straight probe. Therefore, when the occurrence of droplets is suspected or known in the gas to be analyzed, isokinetic sampling is required. If it can be shown that droplets are absent then non-isokinetic sampling may be used.

NOTE : Using isokinetic sampling in accordance with this standard and with ISO 9096:1992 in the specified field of application, it is possible to determine both HCl and dust content of waste gases.

#### 4.3.2 Isokinetic sampling

If isokinetic sampling is required, the principle is quite similar to that of dust content measurement (see ISO 9096:1992), which are briefly summarized as follows :

- select a suitable location in the duct, situated in a straight duct with constant shape of sufficient length, in order to ensure a homogeneous gas velocity distribution at the sampling section (see 6.1.1) ;
- measure the velocity of gas at the sampling points and, taking into account the probe nozzle diameter, calculate the volume flow rate which is necessary for isokinetic sampling ;
- carry out sampling isokinetically, using sharp edged nozzle facing into the moving gas stream, a heated probe tube and a high efficiency filter in a heated housing.

Because probe nozzle diameters shall comply with ISO 9096:1992 requirement (at least 4 mm), isokinetic sampling requires usually volume flow rates much higher than those which can be admitted by the washing bottles used for HCl collection (see EN 1911-2).

Therefore, downstream of the filter, only a part of the gases is drawn through the washing bottle(s) through a secondary line, the main line and the secondary line having their own gas metering systems and suction devices. The ratio between the main and the secondary line volume flow rates shall be kept constant.

#### 4.3.3 Non isokinetic sampling

Even in the case of non-isokinetic sampling, the gas velocity distribution at the sampling section should be homogeneous.



Generally, sampling has to be carried out at several points in the duct section, adjusting volume flow rate (on sampling time) to the gas velocity at each point (see 6.1.2 and 6.1.3).

Sampling may be carried out using a straight heated probe, without special requirement for the nozzle. Dusts are removed by a high efficiency heated filter, then gaseous chlorides are collected in washing bottles.

## 5 Sampling equipment

### 5.1 Isokinetic sampling equipment

**5.1.1** An example of the whole sampling equipment for isokinetic sampling is shown in figure 1. Sampling equipment should be designed in order to minimize the gas residence time between the probe nozzle and the washing bottles (less than 5 s).

**5.1.2** The heated probe and entry nozzle shall be designed in accordance with ISO 9096:1992. However, since these parts are often made of borosilicate glass (see 5.3), which is difficult to manufacture to close tolerances, requirements may be less stringent concerning the edge of the entry nozzle.

The probe shall be temperature controlled at least at 150 °C and 20 °C higher than the acid dew point of gases (see 9.2). The heating device shall be designed in order to minimize unheated zone near the connection to the particle separator housing.

**5.1.3** The particle separator shall contain a filter material, whose efficiency shall be better than 99,5 % on a test aerosol of 0,3 µm mean diameter (or 99,9 % on a test aerosol of 0,6 µm mean diameter), for the maximal actual volume flow rate of the filter, to avoid measurement errors due to fine particles of chloride salts which could be collected in the washing bottles and analysed as HCl.

Filters with the most suitable properties for this purpose are plane filters : convenient glass and quartz fibres filters of different diameters and certified efficiency are commercially available.

Diameters of about 50 mm to 150 mm are generally convenient.

Fibre-packed filters are less well defined in their particle retention efficiency which depends on the method of packing, and their efficiency has to be checked. Compared with plane filters, they also have a larger contact surface, which may enhance side reactions between HCl and particles.

The filter housing shall be heated in order to control the filtered gas temperature at the same level as indicated in 5.1.2.

**5.1.4** A tee piece ensures the division of the sample between the secondary line which allows a gas volume flow rate of about 2 l·min<sup>-1</sup> to 3 l·min<sup>-1</sup> to the washing bottles (see EN 1911-2) for HCl collection, and the main line, in which the volume flow rate, depending on the isokinetic criteria, is usually higher, about 30 l·min<sup>-1</sup> to 150 l·min<sup>-1</sup>.

Care shall be taken to design the sampling system in such a way that no condensation shall occur between the filter and the tee connection, and up to the part of the secondary line which will be rinsed after each sampling.