



**SLOVENSKI STANDARD**  
**SIST-TP CEN/TR 17078:2017**  
**01-julij-2017**

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**Emisije nepremičnih virov - Navodilo za uporabo standarda EN ISO 16911-1**

Stationary source emissions - Guidance on the application of EN ISO 16911-1

Emissionen aus stationären Quellen - Leitlinien zur Anwendung von EN ISO 16911-1

Émissions de sources fixes - Préconisations concernant l'application de l'EN ISO 16911-1

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**ICS:**

13.040.40      Emisije nepremičnih virov      Stationary source emissions

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## Stationary source emissions - Guidance on the application of EN ISO 16911-1

Émissions de sources fixes - Préconisations concernant  
l'application de l'EN ISO 16911-1

Emissionen aus stationären Quellen - Leitlinien zur  
Anwendung von EN ISO 16911-1

This Technical Report was approved by CEN on 20 February 2017. It has been drawn up by the Technical Committee CEN/TC 264.

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

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

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**CEN/TR 17078:2017 (E)****European foreword**

This document (CEN/TR 17078:2017) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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## Introduction

This CEN Technical Report provides supporting guidance on the application of EN ISO 16911-1:2013. It has been produced in response to the request from Member State mirror committees for clarification on elements of EN ISO 16911-1:2013 and on how certain requirements specified within it should be interpreted. EN ISO 16911-1:2013 has been written to apply to a range of applications with different uncertainty requirements. This CEN Technical Report makes recommendations in regards to which requirements and performance characteristics apply to specified measurement objective(s) and application area(s) in order to achieve a consistent application of EN ISO 16911-1:2013.

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**CEN/TR 17078:2017 (E)****1 Scope**

This CEN Technical Report provides guidance only on the application of the European Standard EN ISO 16911-1:2013.

This CEN Technical Report does not provide guidance on the application of EN ISO 16911-2:2013.

**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 14181, *Stationary source emissions - Quality assurance of automated measuring systems*

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 16911-1:2013, *Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method (ISO 16911-1:2013)*

EN ISO 16911-2:2013, *Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 2: Automated measuring systems (ISO 16911-2:2013)*

ISO 10780, *Stationary source emissions — Measurement of velocity and volume flowrate of gas streams in ducts*

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**3 Terms and definitions**

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For the purposes of this document, the terms and definitions given in EN ISO 16911-1:2013 and the following apply.

**3.1****emission source**

separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted and are regulated under the EU Emissions Trading System

[SOURCE: Commission Regulation (EU) No. 601/2012, Article 3, Definition (5)]

**3.2****tier**

set requirement under the EU Emissions Trading System used for determining activity data, calculation factors, annual emission and annual average hourly emission, as well as for payload

[SOURCE: Commission Regulation (EU) No. 601/2012, Article 3, Definition (8)]



## 4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given in EN ISO 16911-1:2013 and the following apply.

### 4.1 Symbols:

$dl$	change in length (m, inches)
$L_0$	initial length of measuring rod (m, inches)
$\alpha$	linear temperature expansion coefficient (m/m°C)
$t_0$	initial temperature (°C)
$t_1$	final temperature (°C)
$CF_i$	correction factor at position i
$V_{fav}$	average velocity of fixed device measurements
$V_{fi}$	velocity of fixed measurement device at position i
$V_{ticorr}$	corrected velocity at position i
$V_{meas}$	velocity measured
$hs$	corrected height of the indicating fluid to standard temperature
$ht$	height of the indicating fluid at the temperature when read
$ps$	density of the indicating fluid at standard temperature
$pt$	density of the indicating fluid at the temperature when read
$gs$	gravitational acceleration assumed at calibration, ms <sup>-2</sup>
$gt$	gravitational acceleration at test location, ms <sup>-2</sup>
$\theta$	latitude (North/South position with the Equator being zero), °
$H$	height above sea level, m

### 4.2 Abbreviations:

EU ETS	Emissions Trading System
CO <sub>2</sub> (e)	Carbon Dioxide equivalent

## 5 General guidance on manual determination of velocity and flow rate in ducts

### 5.1 General

#### 5.1.1 Role of this CEN Technical Report

The role of this CEN Technical Report is to provide guidance on the application of the European Standard EN ISO 16911-1:2013 on the manual determination of velocity and flow rate in ducts. This Technical Report offers clarification on matters of interpretation of EN ISO 16911-1:2013 and provides recommendations on its application depending on the uncertainty requirements of the measurement objective. The adoption of the full Technical Report or parts of it may be decided by individual Member States' regulatory authorities.

Throughout this Technical Report, reference to the Standard refers to EN ISO 16911-1:2013.

**CEN/TR 17078:2017 (E)****5.1.2 How to use this Technical Report**

This Technical Report does not follow the numbering of EN ISO 16911-1:2013; however for easier handling it uses the same headings and sub-headings as EN ISO 16911-1:2013. It does not repeat text, tables or diagrams from EN ISO 16911-1:2013, instead it refers to the relevant sections of the Standard. It is therefore essential that the reader has a copy of the Standard to refer to. For sections of the Standard where this Technical Report does not provide any text or guidance it is deemed that the relevant section does not require any additional clarification.

An error has been identified in Formula (F.10) of the uncertainty example in EN ISO 16911-1:2013, Annex F. It is recommended that the uncertainty example provided in this CEN Technical Report (see Clause 8) replaces the existing one in the Standard.

**5.2 Scope and structure of EN ISO 16911-1****5.2.1 Scope of EN ISO 16911-1**

EN ISO 16911-1:2013 is applicable to industrial plants falling under the European Industrial Emission Directive (2010/75/EU). It is also applicable to industrial plants falling under the EU Emissions Trading System Directive (EU ETS) (2003/87/EC) that are required or have opted to use the measurement-based methodology as specified in Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions (MRR).

**5.2.2 Concept of EN ISO 16911-1**

EN ISO 16911-1 has been written to apply to different measurement objectives with different uncertainty requirements ranging from very stringent (EU ETS Tier 4 -  $\pm 2,5\%$ ) to less demanding (support of isokinetic sampling). The performance characteristics and requirements within the Standard have been specified as a means of achieving the most stringent uncertainty requirements. Although not explicitly specified within the Standard, it is implied that the level of quality control should be determined by the uncertainty requirements of the measurement objective. Therefore for measurement objectives with lesser uncertainty requirements the level of quality assurance and control can be reduced. It is the role of this Technical Report to make these distinctions and provide guidance as to the level of quality control that may be applied.

**5.2.3 Relationship to other international standards**

EN ISO 16911-1 does not replace existing standards. This Technical Report does not reproduce any detailed procedures; therefore users will have access to the documents referenced in Clause 2 and in the final Bibliography.

**5.3 Summary of different requirements for determination of velocity and flow rate****5.3.1 Velocity and flow rate monitoring requirements under the Industrial Emissions Directive**

The measurement of velocity and flow rate is required under the Industrial Emissions Directive as part of periodic monitoring for compliance purposes or pollution inventory reporting which involves the determination of mass emissions. It is also required for the control of isokinetic conditions during the manual sampling of atmospheric pollutants.

**5.3.2 Velocity and flow rate monitoring requirements under the EU ETS Directive**

The MRR specify that all flow automated measuring systems (AMS) used for the monitoring and reporting of GHG under the EU ETS, shall follow the quality assurance procedures specified within EN 14181 and other corresponding EN standards and therefore by deduction require the flow AMS to adhere to EN ISO 16911-2:2013 and its calibration (procedure specified in EN ISO 16911-2) to be carried out using one of the techniques specified within EN ISO 16911-1:2013.

The MRR prescribe Tiers and corresponding maximum permissible uncertainties (Table 1) for emission sources regulated under the EU ETS. An emission source is considered tier 4 if it emits more than 5,000 tonnes of CO<sub>2</sub>(e) per year or contributes more than 10 % of the total annual emissions of the installation (Commission Decision [EU] No. 601/2012 – 2012). The maximum permissible uncertainty specified for each tier is the combined uncertainty of the concentration AMS and flow AMS expanded to a 95 % confidence interval. Under tier 4 – assuming an equal value on both uncertainty components (concentration and flow) – the target value for each uncertainty component is approximately  $\pm 1,8$  %. The requirement to achieve such a low uncertainty value has dictated the selection and associated values of certain performance characteristics and requirements specified within EN ISO 16911-1.

**Table 1 — Maximum permissible uncertainty for measurement-based methods**

	<b>Tier 1</b>	<b>Tier 2</b>	<b>Tier 3</b>	<b>Tier 4</b>
<b>CO<sub>2</sub> emission sources</b>	$\pm 10$ %	$\pm 7,5$ %	$\pm 5$ %	$\pm 2,5$ %
<b>N<sub>2</sub>O emission sources</b>	$\pm 10$ %	$\pm 7,5$ %	$\pm 5$ %	N/A

Source: Commission Regulation (EU) No. 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

### 5.3.3 Other requirements for monitoring velocity and flow rate in ducts and stacks

A flow profile characterization at the measurement plane may be required. This may be part of the pre-installation work carried out before a new flow AMS is commissioned and installed or for any other measurement objective that may require information on the uniformity of flow at the measurement plane.

The majority of times the calibration of a flow AMS is carried out for reasons of compliance with the EU ETS Directive. However the calibration of a flow AMS for any other regulatory reasons is not excluded from the scope of EN ISO 16911-1. The user should adopt those elements required to achieve the specified uncertainty requirement for their application.

## 6 Specific guidance on the application of EN ISO 16911-1

### 6.1 Scope

No guidance required.

### 6.2 Normative references

No guidance required.

### 6.3 Terms, definitions

No guidance required.

### 6.4 Symbols and abbreviated terms

#### 6.4.1 Symbols

No guidance required.

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## 6.4.2 Abbreviated terms

No guidance required.

## 6.5 Principle

## 6.5.1 General

No guidance required.

## 6.5.2 Principle of flow velocity determination at a point the duct

EN ISO 16911-1 specifies the use of 2D Pitot tubes as one of the techniques for the determination of flow velocity at a measurement point within a duct or stack. In regard with quality assurance and control of 2D Pitot tubes it refers users to US EPA Method 2G. Table 2 of this Technical Report reproduces the main performance characteristics and requirements for 2D Pitot tubes as specified in US EPA Method 2G. For test laboratories wishing to use 2D Pitot tubes the full set of specifications and requirements of US EPA Method 2G should be adhered to. These requirements only apply to 2D Pitot tubes that are not covered in detail in EN ISO 16911-1. For example they do not apply for manual S-type Pitot tubes as the performance characteristics for these are specified within the main text of the Standard.

**Table 2 —Performance characteristics and requirements for 2D Pitot tubes as specified in US EPA Method 2G**

Performance characteristic	Criterion	Frequency
Calibration acceptance criterion for 2D-Probe (yaw and pitch angles)	$\pm 3^\circ$ at $0^\circ$	Prior to use
Width of reference scribe line (to determine yaw angles of flow)	$\leq 1,6 \text{ mm}$	Prior to use
Diameter of tubing used to connect the probe and pressure readout device	$\geq 3,2 \text{ mm}$	Prior to use
Uncertainty of yaw angle-measuring device	$\leq \pm 1^\circ$	Prior to use
Horizontal straightness check	$< 5^\circ$	Before field measurement
Rotational positional check of angle measuring device	$\pm 1^\circ$	Before field measurement
Rotational positional check of angle measuring device	$\pm 2^\circ$	Post field measurement check
Calibration acceptance criterion for yaw-angle measuring device	$\pm 2^\circ$ of a known angle $\theta$ of the triangular block used for calibration	Prior to use

## 6.6 Principle of measurement of flow rate

## 6.6.1 General

No guidance required

## 6.6.2 Principle of volume flow rate determination from point velocity measurements

EN ISO 16911-1 specifies the use of S-type, 3D or 2D Pitot tubes for the determination of swirl at a measurement plane. This Technical Report recommends the use of L-type Pitot tubes as another viable technique for this type of measurement. For more information on the procedure for measuring the degree of swirl at the measurement plane see 6.12.5.

## 6.6.3 Determination of volume flow rate using tracer dilution measurements

No guidance required.

## 6.6.4 Determination of volume flow rate using transit time tracer measurements

No guidance required.

## 6.6.5 Determination of volume flow rate from plant thermal input

No guidance required.

## 6.7 Selection of a monitoring approach

### 6.7.1 Measurement objective

This Technical Report adopts a slightly different grouping for measurement objectives than EN ISO 16911-1. This is in order that objectives are grouped based on the proposed quality control that will be recommended throughout this Technical Report. The grouping of measurement objectives is as follows:

- a) periodic monitoring for compliance purposes according to EN 15259 or pollution inventory reporting which involves the determination of mass emissions and for the control of isokinetic conditions during manual sampling;
- b) calibration of flow AMS under EN 14181 and EN ISO 16911-2 and/or flow profile characterization either to meet the requirements of the EU ETS Directive or any other regulatory requirements;
- c) any other periodic measurements under the requirements of the EU ETS Directive.

For simplicity any reference throughout this Technical Report to measurement objective 1, 2 or 3 refers to the above list.

On the selection of techniques for different measurement objectives as aforementioned in 6.2.2 of this document the inclusion of L-Type Pitot tubes as another technique for the determination of swirl at the measurement plane is recommended by this Technical Report.

### 6.7.2 Choice of technique to determine point flow velocity

No guidance required.

### 6.7.3 Choice of technique for volume flow rate and average flow determination

No guidance required.

## 6.8 Measuring equipment

### 6.8.1 General

No guidance required.