SLOVENSKI STANDARD
SIST EN 13182:2004

01-februar-2004

Prezraļ evanje stavb - Zahtevana merilna opremljenost za merjenje hitrosti zraka v prezraļ evanih prostorih

Ventilation for buildings - Instrumentation requirements for air velocity measurements in ventilated spaces

Lüftung von Gebäuden - Gerätetechnische Anforderungen für Messungen der Luftgeschwindigkeit in belüfteten Räumen

Ventilation des bâtiments - Prescription d'instrumentation pour les mesures de vitesses d'air dans des espaces ventilés

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Ventilation for buildings - Instrumentation requirements for air velocity measurements in ventilated spaces

Ventilation des bâtiments - Prescription d'instrumentation pour les mesures de vitesses d'air dans des espaces ventilés

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This document EN 13182 has been prepared by Technical Committee CEN/TC 156 "Ventilation for buildings", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by October 2002, and conflicting national standards shall be withdrawn at the latest by October 2002.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

European Standards exist which deal with the evaluation of local air velocity in ventilated spaces. This parameter is important in the assessment of comfort[1)]. It is determined in the assessment of air terminal device performance in the laboratory[1)] and in the site situation (in a building) where comparisons are required in relation to specified values[1)].

This standard provides a common basis for the instrumentation requirements for all the above applications.

The characteristics of instruments can vary according to their measuring and signal processing principles, their construction, and the way in which they are used. It is important that the users compare the quality of the instruments available in the market at any given time and a check is made that they conform to the requirements of this European Standard.

1 Scope

This European Standard specifies the main characteristics of air velocity measuring devices. This includes requirements for thermal velocity probes, recalibration and the signal processing of measurements in a ventilated space, including those in the air jet and in the occupied zone. Other types of velocity measuring devices should fulfil the performance parameters stated but appropriate calibration techniques should not necessarily be used which are described in this standard.

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 amendment to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

CR 12792, *Ventilation for buildings – Symbols and terminology.*

EN 27726, *Thermal environments - Instruments and methods for measuring physical quantities (ISO 7726:1985).*

3 Terms, definitions and symbols

For the purposes of this European Standard the terms, definitions and symbols in CR 12792 apply together with those given in Table 1.

1) See Bibliography.

Table 1 – Symbols

Symbol	Quantity	Unit
f	Frequency	Hz
f_{up}	Upper frequency	Hz
N	Total number of samples	
n	Speed of rotation	$rad \cdot s^{-1}$
n_r	Sampling rate	s^{-1}
Δp	Pressure drop	Pa
R	Radius	m
s_v	Standard deviation of velocity	$m \cdot s^{-1}$
T_u	Turbulence intensity	%
θ	Air temperature	°C
U	Output signal	V
U_v	Output signal of velocity	V
U_t	Output signal of temperature	V
v	Air velocity	$m \cdot s^{-1}$
$\overline{v}$	mean air velocity	$m \cdot s^{-1}$
v_i	Instantaneous air velocity	$m \cdot s^{-1}$
v_o	Reference air velocity	$m \cdot s^{-1}$
v_α	Air velocity reading at yaw angle	$m \cdot s^{-1}$
v_β	Air velocity reading at roll angle	$m \cdot s^{-1}$
v_{true}	True air velocity	$m \cdot s^{-1}$
Δv	Deviation of air velocity	$m \cdot s^{-1}$
α	Angle of yaw	°
β	Rotational angle (roll angle)	°
τ	Time	s

4 Main characteristics of air flow patterns

4.1 General

In ventilated spaces, there are three main zones of interest (see Figure 1), depending on the air flow distribution. Table 2 shows the range of flow characteristics, which can occur in the zones as specified in 4.2, 4.3, and 4.4.

Table 2 – Main characteristics of air flow patterns

Zone	Range of mean air Velocity $\bar{v}$ $m \cdot s^{-1}$	Turbulence intensity T_u %	Frequency f Hz	Temperature range θ °C	Main flow direction
A (jet)	0,3 to 10,0	10 to 50	≤ 3	10 to 50	unidirectional
B (jet)	0,1 to 0,5	5 to 50	≤ 1	15 to 25	unidirectional
C (occupied zone)	0,1 to 0,5	20 to 80	≤ 1	18 to 35	omnidirectional

4.2 Zone A

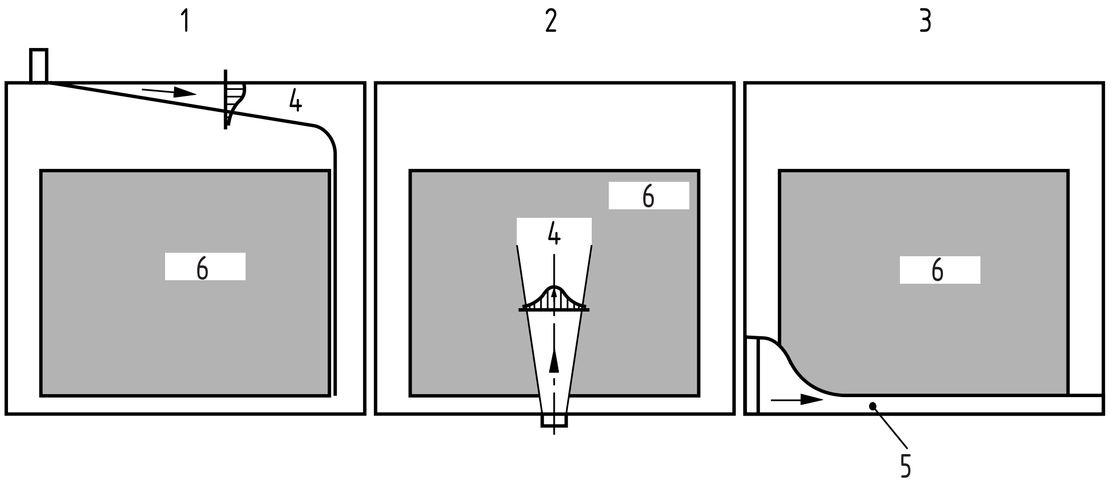
The area within the supply air jet in a mixed air flow application.

4.3 Zone B

The area within the supply air stream in an application using low velocity air terminal devices (for example; displacement ventilation).

4.4 Zone C

The occupied zone area within ventilated spaces (see prEN 13779).



Key

1 Mixed air flow – Ceiling air terminal device

2 Mixed air flow – Floor air terminal device

3 Displacement air flow

4 Zone A

5 Zone B

6 Zone C

	Main characteristics of air flow pattern					**Parameter of interest**		**Requirements for velocity probe**				**Signal processing requirements**	
Zone	Velocity range	Turbulence intensity	Frequency	Temperature range	Main flow direction	Mean velocity	Turbulence intensity	Instantaneous velocity range	Temperature range	Upper response frequency	Direction sensitivity minimum requirements[a]	Measuring period	Sampling Rate
		T_u	f	θ		$\bar{v}$	T_u	v	θ	f_{up}			n_r
	$m \cdot s^{-1}$	%	Hz	°C		$m \cdot s^{-1}$	%	$m \cdot s^{-1}$	°C	Hz		s	$l \cdot s^{-1}$
A (Jet)	0,3 to 10	10 to 50	≤3,0	10 to 50	uni-directional	yes	no	0,25 to 12	10 to 50	N/A[b]	uni-directional	≥ 60	≥ 1
B (Jet)	0,1 to 0,5	5 to 50	≤1,0	15 to 25	uni-directional	yes	yes	0,05 to 1,0	15 to 25	≤ 1,0	uni-directional	≥ 180	≥ 5
C (Occupied zone)	0,1 to 0,5	20 to 80	≤1,0	18 to 35	omni-directional	yes	yes	0,05 to 1,0	18 to 35	1,0	omni-directional	≥ 180	≥ 5

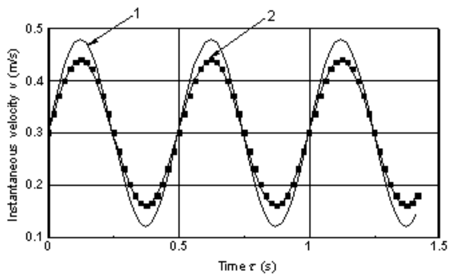
[a] Using flow visualisation to establish flow direction in all zones, two- dimensional or response sensors can be used.

[b] N/A - Not applicable because in Zone A only the mean velocity is of interest - not turbulence intensity

Figure 1 – Main characteristics of air flow and requirements of low velocity measuring instruments

5 Relevant parameters

The main relevant parameters applicable to ventilated spaces are given in Table 3.

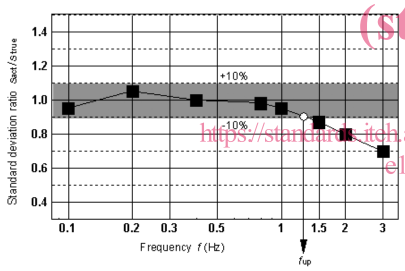


Key

1 True velocity

2 Actual velocity

Figure 2 – Example of velocity records at *f* = 2 Hz used to define the upper frequency



Key

S_{act} is the actual standard deviation of the velocity measured by the tested probe
S_{true} is the standard deviation of the velocity measured by the reference instrument

Figure 3 – Example of dynamic response curve to define the upper frequency f_{up}

Table 3 – Parameters

Zone	Mean velocity $\bar{v}$	Turbulence intensity T_u
A (Jet)	yes	no
B (Jet)	yes	yes
C (Occupied zone)	yes	yes

6 Requirements for velocity probe

6.1 Velocity and temperature range

The values for the instrument velocity range and temperature are given in Table 4.

6.2 Upper response frequency limit

The upper response frequency limit is defined as the highest frequency of sinusoidal velocity fluctuations up to which the anemometer shall be able to measure the standard deviation of the air velocity with an accuracy of ± 10 % (see 7.4 for turbulence intensity in the range of 40 % to 60 %, see also 7.5 and Figure 2).

Alternatively, the standard deviation ratio, which is the standard deviation of the velocity measured by the tested anemometer divided by the actual standard deviation of the velocity calculated or measured by a reference instrument under identical flow conditions, can be used. The standard deviation ratio can be higher or lower than 1 depending on the electrical design of the tested anemometer. The achievement of an accuracy of ± 10 % implies a standard deviation ratio of between 0,9 and 1,1 (see Figure 3).

6.3 Directional sensitivity

The extremes of instrument directional sensitivity are described as follows:

A uni-directional probe has a sensor which has a strong directional sensitivity and does not respond to flows in all directions.

An omni-directional probe will respond to flow from virtually any direction.

The directional sensitivity is investigated by measuring the velocity as a function of angle of attack and the investigation is carried out as described below.

The roll characteristics are obtained by rotation of the probe about the stem axis (see Figure 4).

The yaw characteristics are obtained by tilting the stem axis of the probe about its centre (see Figure 5).

Both the roll and yaw characteristics of the probes shall be specified.