SLOVENSKI STANDARD
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Sistemi za nadzor dima in toplote – 2. del: Določila za odvod dima in toplote z naravnim prezračevanjem

Smoke and heat control systems - Part 2: Specification for natural smoke and heat exhaust ventilators

Rauch- und Wärmefreihaltung - Teil 2: Festlegungen für natürliche Rauch- und Wärmeabzugsgeräte

Systemes pour le contrôle des fumées et de la chaleur - Partie 2: Spécifications relatives aux dispositifs d'évacuation naturelle de fumées et de chaleur

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Smoke and heat control systems - Part 2: Specification for natural smoke and heat exhaust ventilators

Systèmes pour le contrôle des fumées et de la chaleur - Partie 2: Spécifications pour les dispositifs d'évacuation de fumées et de chaleur

Rauch- und Wärmefreihaltung - Teil 2: Festlegungen für natürliche Rauch- und Wärmeabzugsgeräte

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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 Management Centre 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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Foreword

This document EN 12101-2:2003 has been prepared by CEN /TC 191, "Smoke and heat control systems", 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of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

This European Standard is one of ten parts of the European Standard EN 12101 covering smoke and heat control systems.

This European Standard has the general title *Smoke and heat control systems* and consists of the following six parts:

Part 1: *Specification for smoke barriers — Requirements and test methods*

Part 2: *Specification for natural smoke and heat exhaust ventilators*

Part 3: *Specification for powered smoke and heat exhaust ventilators*

Part 4: *Natural smoke and heat exhaust ventilation systems — Installation and test methods*

Part 5: *Design and calculation for smoke and exhaust ventilation systems (published as CR 12101-5)*

Part 6: *Design and calculation methods and installation procedure for pressure differential smoke control systems*

Part 7: *Specification for smoke ducts*

Part 8: *Specification for smoke dampers*

Part 9*: Specification for control panels and emergency control panels*

Part 10*: Specification for power supplies*

EN 12101 is included in a series of European Standards planned to cover also:

- Gas extinguishing systems (EN 12094 and ISO 14520-1)
- Sprinkler systems (EN 12259)
- Powder systems (EN 12416)
- Explosion protection systems (EN 26184)
- Foam systems (EN 13565)
- Hose systems (EN 671)
- Water spray systems

Annexes A, B, C, D, E, F and G are normative.

This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

In a fire situation, smoke and heat exhaust ventilation systems create and maintain a smoke free layer above the floor by removing smoke. They also serve simultaneously to exhaust hot gases released by a fire in the developing stages. The use of such systems to create smoke-free areas beneath a buoyant layer has become widespread. Their value in assisting in the evacuation of people from buildings and other construction works, reducing fire damage and financial loss by preventing smoke damage, facilitating access for firefighting by improving visibility, reducing roof temperatures and retarding the lateral spread of fire is firmly established. For these benefits to be obtained it is essential that smoke and heat exhaust ventilators operate fully and reliably whenever called upon to do so during their installed life. A smoke and heat exhaust ventilation system (referred to in this standard as a SHEVS) is a system of safety equipment intended to perform a positive role in a fire emergency.

1 Scope

This part of this European Standard specifies requirements and gives test methods for natural smoke and heat exhaust ventilators which are intended to be installed as a component of a natural smoke and heat exhaust system.

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 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).

EN 54-7, *Fire detection and fire alarm systems - Part 7: Smoke detectors - Point detectors using scattered light, transmitted light or ionization*.

EN 1363-1, *Fire resistance tests - Part 1: General requirements*.

EN 12259-1, *Fixed firefighting systems - Components for sprinkler and water spray systems - Part 1: Sprinklers*.

EN 13501-1, *Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests*.

EN 60584-1, *Thermocouples - Part 1: Reference tables (IEC 60584-1:1995)*.

3 Terms and definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1
aerodynamic efficiency
another term for coefficient of discharge (see 3.1.8)

3.1.2
aerodynamic free area
product of the geometric area multiplied by the coefficient of discharge

3.1.3
ambient
word used to describe properties of the surroundings

3.1.4
automatic activation
initiation of operation without direct human intervention

3.1.5
aspect ratio
ratio of length to width

3.1.6
automatic natural smoke and heat exhaust ventilator
smoke and heat exhaust ventilator which is designed to open automatically after the outbreak of fire if called upon to do so

NOTE Automatic natural smoke and heat exhaust ventilators can also be fitted with a manual control or release device.

3.1.7
coefficient of discharge
ratio of actual flow rate, measured under specified conditions, to the theoretical flow rate through the ventilator (c_V), as defined in annex B

NOTE The coefficient takes into account any obstructions in the ventilator such as controls, louvers and vanes and the effect of external side winds.

3.1.8
dual purpose ventilator
smoke and heat exhaust ventilator which has provision to allow its use for comfort (i.e. day to day) ventilation

3.1.9
exhaust ventilator
device for the movement of gases out of the construction works

3.1.10
fire open position
configuration of the ventilator specified by its designer to be achieved and sustained while venting smoke and heat

3.1.11
gas container
vessel containing gas in a compressed form, the energy of which, when released, will open the ventilator

3.1.12
geometric area (A_v)
area of the opening through a ventilator, measured in the plane defined by the surface of the construction works, where it contacts the structure of the ventilator. No reduction will be made for controls, louvers or other obstructions

3.1.13
initiation device
device which activates the operating mechanism of the component (e.g. of a damper or a ventilator) on receipt of information from a fire detection system or thermal device

3.1.14
manual operation
initiation of the operation of a smoke and heat exhaust ventilator by a human action (e.g. pressing a button, or pulling a handle). A sequence of automatic actions in the operation of a smoke and heat exhaust ventilator started by the initial human action is regarded as manual operation for the purposes of this standard

3.1.15
manually opened natural smoke and heat exhaust ventilator
natural smoke and heat exhaust ventilator that can only be opened by a manual control or release device

3.1.16
mass flux
the total mass of gases crossing a specified boundary per unit time

3.1.17
natural ventilation
ventilation caused by buoyancy forces due to differences in density of the gases because of temperature differences

3.1.18
opening mechanism
mechanical device which operates the ventilator to the fire open position

3.1.19
opening time
period between the information to open being received by the ventilators and achieving the fire open position of the ventilator

3.1.20
projection area
cross sectional area of the natural smoke and heat exhaust ventilator in its fire open position above the plane of the roof, at a right angle to the side wind flow

3.1.21
range of natural smoke and heat exhaust ventilators
ventilators of various sizes having the same method of construction (identical number of hinges on a louver blade or flap, identical materials and thickness, etc.) and the identical number and type of opening devices

3.1.22
smoke and heat control system
arrangement of components installed in a construction works to limit the effects of smoke and heat from a fire

3.1.23
smoke and heat exhaust system
smoke and heat control system which exhausts smoke and heat from a fire in a construction works or part of a construction works

3.1.24
smoke and heat exhaust ventilation system (shevs)
components jointly selected to exhaust smoke and heat in order to establish a buoyant layer of warm gases above cooler and cleaner air

3.1.25
smoke and heat exhaust ventilator
device specially designed to move smoke and hot gases out of a construction works under conditions of fire

3.1.26
thermal device
temperature sensitive device which responds to initiate a subsequent action

3.1.27
throat area
smallest cross sectional area of the flow path through the ventilator

3.1.28
ventilator
device for enabling the movement of gases into or out of the construction works

3.1.29
wind sensitive control system
control system designed to control two or more banks of ventilators on separate elevations so that only the ventilators not subject to positive wind pressures open in case of fire

3.2 Symbols and abbreviations

For the purposes of this standard, mathematical and physical quantities are represented by symbols, and expressed in units as follows.

Symbol	Quantity	
A_a	aerodynamic free area, expressed in square metres	(m^2)
A_n	nozzle exit area (for open jet facilities); test section entrance area (for closed test section facilities), expressed in square metres	(m^2)
A_{pr}	projection area of the ventilator for the side wind flow, expressed in square metres	(m^2)
A_{sc}	horizontal cross section area of the settling chamber, expressed in square metres	(m^2)
A_v	geometric area of the ventilator, expressed in square metres	(m^2)
B	width of the open hole of the settling chamber, expressed in metres	(m)
B_n	width of nozzle exit area in open jet facilities, width of the test section in closed test section facilities, expressed in metres	(m)
B_v	maximum width of the ventilator in the fire open position, expressed in metres above the upper surface of the settling chamber	(m)
C_v	coefficient of discharge, dimensionless	
C_{v0}	coefficient of discharge without side wind influence, dimensionless	
C_{vw}	coefficient of discharge with side wind influence, dimensionless	
H_n	height of nozzle exit area in open jet facilities, height of the test section in closed test section facilities, expressed in metres	(m)
H_v	maximum height of the ventilator in the fire open position above the upper surface of the settling chamber, expressed in metres	(m)
L	length of the open hole of the settling chamber, expressed in metres	(m)
$\dot{m}_{ing}$	mass flow rate entering the settling chamber, expressed in kilograms per second	(kg/s)
p_{amb}	ambient pressure, expressed in pascals	(Pa)

p_d	wind stagnation pressure, expressed in pascals	(Pa)
p_{int}	internal static pressure, expressed in pascals	(Pa)
$p_{int, vo}$	internal static pressure without side wind, expressed in pascals	(Pa)
$p_{int, vw}$	internal static pressure with side wind, expressed in pascals	(Pa)
T	temperature, expressed in degrees C	(°C)
ΔT	temperature difference, expressed in Kelvin	(K)
V_∞	side wind velocity, expressed in metres per second	(m/s)
$V_{m, sc}$	mean velocity of the settling chamber, expressed in metres per second	(m/s)
V_n	mean nozzle velocity, expressed in metres per second	(m/s)
V_{sc}	local velocities in plane above settling chamber, see Figure B6, expressed in metres per second	(m/s)
W_s	snow load, expressed in pascals	(Pa)
W_w	wind load, expressed in pascals	(Pa)
W_{wd}	design wind load, expressed in pascals	(Pa)
α	opening angle of the ventilator, expressed in degrees	
β	angle of attack, expressed in degrees	
β_{crit}	incidence angle at which the smallest value of C_{vw} obtained with side wind, occurs, expressed in degrees	
θ	angle of installation of ventilators on a roof, expressed in degrees	
Δp	pressure difference, expressed in pascals	(Pa)
Δp_{v0}	reference pressure difference between the static pressure in the settling chamber and the ambient pressure without side wind, expressed in pascals	(Pa)
Δp_{vw}	reference pressure difference between the static pressure in the settling chamber and the ambient pressure with side wind, expressed in pascals	(Pa)
Δp_{int}	pressure difference between the static pressure in the settling chamber and the ambient pressure, expressed in pascals	(Pa)
ρ_{air}	density of air, expressed in kilograms per cubic metre	(kg/m^3)

4 Design requirements

4.1 Initiation device

4.1.1 General

Each ventilator shall be fitted with one or more of the following automatic initiation devices:

a) a thermal initiation device;

b) an initiation device activated by an electrical signal from a remote source, e.g. a smoke and heat detector system, the interruption of electrical supply or a manually actuated "fire override“ switch;

c) a pneumatic initiation device, e. g. a pneumatic signal or a loss of compressed air;

d) an initiation device able to respond to other types of release signal.

The response behaviour of thermal automatic initiation devices shall comply with the requirements of EN 12259-1. Smoke detectors shall comply with the requirements of EN 54-7. In addition, a manually operated initiation device may be fitted.

In some specific design cases where it is suitable that the ventilator shall only be manually initiated, the ventilator may be installed without an automatic initiation device.

4.1.2 Thermal initiation device

Any thermal initiation device shall be within the ventilator and shall be exposed to the hot gas entering the closed ventilator.

4.2 Opening mechanism

4.2.1 General

The ventilator shall be provided with an opening mechanism with energy within the ventilator, e.g. gas containers, spring systems, electrical power supply and/or with an external energy source. For the external links the manufacturer shall specify the operating requirements for the initiation device and the opening mechanism, e.g. voltage, energy.

NOTE The availability of the energy source should be ensured.

4.2.2 Integral gas containers

Any gas container forming an integral part of the ventilator shall be equipped with a pressure release device to prevent an explosion if the container overheats.

4.3 Opening of ventilator

For on site testing purposes there are two types of ventilators:

Type A which are able to be opened into their fire open position;

Type B which are able to be opened into their fire open position and closed remotely.

4.4 Size of the geometric area

The size and form of the geometric area shall be such that it will comply to the limitation set by the test apparatus available for the heat exposure test.

The side length shall not exceed 2,5 m and the aspect ratio of the geometric area shall not exceed 5:1 when using the simple assessment procedure to determine the aerodynamic free area, see B.1.

NOTE At present, maximum dimensions of the test apparatus for the heat exposure test are in the range of 3 m.

For ventilators larger than the largest ventilator tested according to annex G an assessment of the heat exposure effect shall be made by the testing station, to ensure that the performance is not negatively affected.

5 General testing procedures

For type approval testing, tests shall be carried out in the sequence specified in A.1.

For each test, a test report shall be prepared in accordance with A.2.

If detail changes are made to the product range which has been tested then some of the tests mentioned may be omitted, when type testing the new product in the range.

6 Aerodynamic free area of the ventilator

The aerodynamic free area of the ventilator shall be determined in accordance with annex B.

7 Performance requirements and classification

7.1 Reliability

7.1.1 Reliability classification

The ventilator shall be classified as one of the following:

Re A

Re 50

Re 1000

The designation A, 50, 1000 will represent the number of openings into the fire open position and closing under no applied load in accordance with annex C.

7.1.2 Reliability performance

The ventilator shall open, reach its fire open position not more than 60 s after actuation without damage and remain in position without an external energy supply (until reset).

7.1.3 Dual purpose ventilator

If the ventilator is a dual purpose ventilator, it shall open to its normal comfort position when tested under no load 10 000 times in accordance with annex C prior to testing the same ventilator under 7.1.1 and 7.1.2.