SLOVENSKI STANDARD

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Sistemi za nadzor dima in toplote - 2. del: Dolo̧ila za odvod dima in toplote z naravnim prezra̧evanjem

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 relatives aux dispositifs d'évacuation naturelle de fumées et de chaleur

Anlagen zur Ableitung von Rauch und Wärme - Teil 2: Bestimmungen für natürliche Rauch- und Wärmeabzugsgeräte

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 191.

If this draft becomes a European Standard, 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.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 12101-2:2006) has been prepared by CEN /TC 191, "Smoke and heat control systems", the secretariat is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12101-2:2003.

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 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 (should be published as CR 12101-4)*

Part 5: *Design and calculation for smoke and heat 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: *Smoke ducts*

Part 8: *Smoke dampers*

Part 9: *Control panels*

Part 10: *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, G, and H are normative.

This document includes a Bibliography.

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 in roofs and/or walls.

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 1187, *Test methods for external fire exposure to roofs*

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 13501-4, *Fire classification of construction products and building elements - Part 4: Classification using test data from resistance tests on smoke control systems*

EN 13501-5, *Fire classification of construction products and building elements - Part 5: Classification using data from external fire exposure to roofs tests*

EN 1382 *Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item*

EN ISO 9001:2000, *Quality management systems - Requirements*

EN ISO 11925-2, *Reaction to fire tests - Ignitability of building products subjected to direct impingement of flame - Part 2: Single-flame source test*

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 3.1.7)

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
NSHEV 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 NSHEV such as controls, louvres and vanes and the effect of external side wind.

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

3.1.9
fire open position
configuration of the NSHEV specified by its designer to be achieved and sustained while venting smoke and heat

3.1.10
gas container
vessel containing gas in a compressed form, the energy of which, when the gas is released from the vessel, will open the NSHEV

3.1.11
geometric area (A_v)
area of the opening through a NSHEV, measured in the plane defined by the surface of the construction works, where it contacts the structure of the NSHEV. No reduction will be made for controls, louvres or other obstructions. Specific configurations are given in Figures B.1 and B.4.

3.1.12
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

3.1.13
manually opened natural smoke and heat exhaust ventilator
NSHEV that can only be opened by a manual control or release device

3.1.14
mass flux
the total mass of gases crossing a specified boundary per unit time

3.1.15
natural ventilation
ventilation caused by buoyancy forces due to differences in density of the gases because of temperature differences

3.1.16
opening mechanism
mechanical device which operates the NSHEV to the fire open position

3.1.17
opening time
period between the information to open being received by the NSHEV and achieving the fire open position of the ventilator

3.1.18
projection area
cross sectional area of the NSHEV in its fire open position above the plane of the roof, at a right angle to the side wind flow

3.1.19
range of natural smoke and heat exhaust ventilators
NSHEV of various sizes having the same method of construction and the identical number and type of opening devices

3.1.20
smoke and heat control system
arrangement of components installed in a construction works to limit the effects of smoke and heat from a fire

3.1.21
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

3.1.22
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

3.1.23
Natural smoke and heat exhaust ventilator (NSHEV)
device specially designed to move smoke and hot gases out of a construction works under conditions of fire; a NSHEV is a complete product assembled in the factory or assembled at site (where its parts are possibly delivered from different manufacturers) but for which the initial type testing has been conducted as a complete product including frame systems, glazing, opening mechanisms etc.

3.1.24
thermal device
temperature sensitive device which responds to initiate a subsequent action

3.1.25
throat area
smallest cross sectional area of the flow path through the NSHEV

3.1.26
ventilator
device for enabling the movement of gases into or out of the construction works

3.1.27
wind sensitive control system
control system designed to control two or more banks of NSHEV on separate elevations so that only the NSHEV not subject to positive wind pressures open in case of fire

3.1.28
walls
external building surfaces with an inclination of more than 60° relative to the horizontal

3.1.29
roofs
external building surfaces with inclination of 60° or less relative to the horizontal; shed roofs, independent of inclination angle, are considered to be part of roofs.

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 NSHEV 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 NSHEV, 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 NSHEV 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 NSHEV in the fire open position above the upper surface of the settling chamber, expressed in metres	(m)
h_{US}	height of the NSHEV upstand, expressed in metres	(m)
$I_{u,\,hUS}$	turbulence intensity in flow direction at height h_{US}, dimensionless	-
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 NSHEV, expressed in degrees	(°)
ß	angle of attack, expressed in degrees	(°)
$ß_{crit}$	incidence angle at which the smallest value of C_{vw} obtained with side wind, occurs, expressed in degrees	(°)
θ	angle of installation of NSHEV on a roof or in a wall, 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

To ensure the natural smoke and heat ventilator opens in the event of a fire each NSHEV shall be fitted with one or more of the following automatic initiation devices.

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.

In addition, a manually operated initiation device according to EN 12101-9 may be fitted.

A pneumatic Non Fail Safe NSHEV, which does not open automatically on loss of power, shall have at least a thermal device and one power source in accordance to EN 12101-10, which is mounted directly in the NSHEV, unless the required control panel monitors the lines to the NSHEV and indicates a failure in accordance to EN 12101-9.

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

4.1.2 Thermal initiation or release device

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

There are two exceptions to this requirement, where an automatic thermal initiation or release device shall not be fitted to the NSHEV.

1. If the NSHEV are to be installed as wall mounted ventilators.

NOTE: Adverse wind conditions may cause a NSHEV which has been opened by the automatic initiation device to inlet and not remove heat and smoke.

2. In specific design cases where it is suitable that the NSHEV shall only be manually initiated.

The response behaviour of thermal automatic initiation devices shall be according to EN 12101-9. Smoke detectors shall comply with the requirements of EN 54-7.

4.2 Opening mechanism

4.2.1 General

The NSHEV shall be provided with an opening mechanism with energy within the NSHEV, 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.

4.2.2 Integral gas containers

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

4.3 Opening of NSHEV

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

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 NSHEV larger than the largest NSHEV 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.

NOTE: The geometric area should not be smaller than 1,0 m² and not larger than 6,0 m². The aspect ratio should not be larger than 5:1.

4.5 Inputs and Outputs

The NSHEV shall be equipped with inputs and/or outputs to allow connection of the NSHEV to the control panel in accordance with EN 12101-9, and power supplies in accordance with EN 12101-10.

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 the consequences of the changes shall be evaluated in accordance with Annex H.

6 Aerodynamic free area of the NSHEV

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

For roof mounted ventilators, the aerodynamic free area is written $A_{a\ Roof}$.

For wall mounted ventilators, the aerodynamic free area is written $A_{a\ Wall}$.

7 Performance requirements and classification

7.1 Reliability

7.1.1 Reliability classification

The NSHEV 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.