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Smoke and heat control systems - Part 7: Smoke control ducts

Rauch- und Wärmefreihaltung - Teil 7: Entrauchungsleitungen

Systemes pour le contrôle des fumées et de la chaleur - Partie 7 - Conduits de désenfumage

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Smoke and heat control systems - Part 7: Smoke control ducts

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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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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prEN 12101-7:2004 (E)**Foreword**

This document (prEN 12101-7:2004) has been prepared by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

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 has the general title “*Smoke and heat control systems*” and consists of the following separate parts:

- Part 1: Specification for smoke barriers,
- Part 2: Specification for natural smoke and heat exhaust ventilators,
- Part 3: Specification for powered smoke and heat exhaust ventilators,
- Part 4: Fire and smoke control installations – Kits,
- Part 6: Pressure differential – Kits,
- Part 7: Smoke control ducts,
- Part 8: Smoke control dampers,
- Part 9: Control panels and emergency control panels,
- Part 10: Power supplies.

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

- a) Gas extinguishing systems (EN 12094 and EN ISO 14520),
- b) Sprinkler systems (EN 12259),
- c) Powder systems (EN 12416),
- d) Explosion protection systems (EN 26184),
- e) Foam systems (EN 13565),
- f) Hose reel systems (EN 671),
- g) Water spray systems (EN BKWX).

Introduction

Smoke and heat exhaust ventilation systems (SHEVS) create a smoke free layer above the floor by removing smoke and thus improve the conditions for the safe escape and/or rescue of people and animals and the protection of property and permit the fire to be fought while still in its early stages. They also exhaust hot gases released by a fire in the developing stage.

The use of smoke and heat exhaust ventilation systems (SHEVS) to create smoke free areas beneath a buoyant smoke layer has become widespread. Their value in assisting in the evacuation of people from construction works, reducing fire damage and financial loss by preventing smoke logging, facilitating fire fighting, reducing roof temperatures and retarding the lateral spread of fire is firmly established.

Pressure differential systems are also available to assist in the evacuation of people, fire fighting and the reduction of smoke migration.

For these benefits to be obtained it is essential that smoke and heat control systems operate fully and reliably whenever called upon to do so during their installed life. A heat and smoke control system is a scheme of safety equipment intended to perform a positive role in a fire emergency.

Components for smoke and heat control systems should be installed as part of a properly designed smoke and heat control system.

Smoke and heat exhaust ventilation systems help to:

- keep the escape and access routes free from smoke,
- facilitate fire fighting operations by creating a smoke free layer,
- delay and/or prevent flashover and thus full development of the fire,
- protect equipment and furnishings,
- reduce thermal effects on structural components during a fire,
- reduce damage caused by thermal decomposition products and hot gases.

Powered SHEVS should operate based on powered ventilators. The performance of the powered smoke and heat exhaust system depends on:

- the temperature of the smoke,
- the size, number and location of the exhaust openings,
- the wind influence,
- the size, geometry and location of the inlet air openings,
- the time of actuation,
- the location and conditions of the system (for example arrangements and dimensions of the building).

SHEVS are used in buildings or construction works where the particular (large) dimensions, shape or configuration make smoke control necessary. Typical examples are:

- single and multi-storey shopping malls,

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- single and multi-storey industrial buildings and warehouses; atria and complex buildings,
- enclosed car parks,
- stairways,
- tunnels,
- theatres.

Depending on differing circumstances and the situation of the building or construction works that can affect their performance, powered or natural smoke and heat control systems or pressure differential systems may be used.

It is specified in Parts 4 and 6 of this European Standard that powered and natural exhaust ventilators shall not be used to extract smoke and hot gases from the same smoke reservoir.

Special conditions apply where gas extinguishing systems (e.g. according to EN 12094 or EN ISO 14520) are used (see prEN 12101-4 and 6). It is the purpose of this standard to provide the additional requirements for smoke control system ducts to operate in these hostile conditions.

A number of different system designs are commonly in use to fulfil this function and separate into three distinct groups. These are:

- i) natural dedicated smoke and/or heat control systems,
- ii) powered dedicated smoke and/or heat control systems,
- iii) powered smoke and/or heat control systems that are used during the day to day running of the building or construction works and otherwise provide an environmental air provision function.

Each can then be separated further into smoke and/or heat control systems that serve a single fire compartment and those that, by the provision of smoke ducts, serve or pass through a number of fire compartments.

When a system is to be provided, it is necessary to ensure that any components do not fail and cause failure of the smoke and/or heat control system whilst working to control heat and/or smoke. Thus all components are tested to meet the performance requirements of the smoke control system duct into which they are to be installed following the principles described in this standard.

The components installed within a system are generally to:

- allow access to the duct for cleaning and inspection of ancillaries (e.g. access doors/panels),
- limit noise (silencers, attenuators),
- control air distribution within parts of the smoke control system duct (turning vanes at bends, volume control system ducts, etc.),
- give air flow/volume indication, and
- provide structural support to the system and control the direction of air/smoke movement at the terminals of the system (grilles).

1 Scope

This European Standard applies to smoke control system ducts operating as part of smoke and heat control systems, placed on the market. This standard specifies requirements and refers to test methods for smoke control system ducts which are intended to be installed in smoke and heat control systems in buildings.

This European Standard also governs components used within such duct systems, such as turning vanes and silencers, with the exception of natural and powered smoke ventilators and smoke control system dampers, which are covered by separate standards.

Ducts for use other than in smoke and heat control systems are not covered by 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 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 1363-1, *Fire resistance tests — Part 1: General requirements*

EN 1363-2, *Fire resistance tests — Part 2: Alternative and additional procedures*

EN 1366-1, *Fire resistance tests for service installations — Part 1: Fire resistant ducts*

prEN 1366-8, *Fire resistance tests for service installations — Part 8: Smoke extraction ducts*

prEN 1366-9, *Fire resistance tests for service installations — Part 9: Single compartment smoke extraction ducts*

prEN 1366-10, *Fire resistance tests for service installations — Part 10: Smoke control dampers*

EN 12101-2, *Smoke and heat control systems — Part 2: Specification for natural smoke and heat exhaust ventilators*

EN 12101-3, *Smoke and heat control systems — Part 3: Specification for powered smoke and heat exhaust ventilators*

prEN 12101-4, *Smoke and heat control systems — Part 4: Fire and smoke installations – Kits*

prEN 12101-6, *Smoke and heat control systems — Part 6: Pressure differential systems – Kits*

prEN 12101-8, *Smoke and heat control systems — Part 8: Smoke control dampers*

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

EN ISO 5167-1, *Measurement of fluid flow by means of orifice plates, nozzles and venturi tubes inserted in circular cross section conduits running full*

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

EN ISO 13943, *Fire safety – Vocabulary*

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ISO 5221, *Air distribution and air diffusion – Rules to methods of measuring airflow rate in an air handling duct*

3 Terms and definitions

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

3.1**air inlet**

device connected to outside air to allow the inlet of air from outside the construction work

3.2**back-up power supply**

a power supply to operate the system when the normal power supply has failed

3.3**commissioning**

the act of ensuring that all components and the system are installed and operating in accordance with this standard

3.4**elevated temperature**

temperatures in excess of normal ambient air, below those necessary for fire resistance testing, to which smoke and heat exhaust ducts for single compartments are tested

3.5**fire compartment**

an enclosed space, comprising one or more separate spaces, bounded by elements of construction having a specified fire resistance and intended to prevent the spread of fire (in either direction) for a given period of time

NOTE

Fire compartment often has regulatory connotations. The term should not be confused with "room of origin" or "fire cell".

3.6**multi compartment fire resisting smoke control system ducts**

fire resisting ducts for use in multi compartment application and that have been tested and met the requirements of prEN 1366-8

3.7**natural smoke and heat control system**

a smoke and heat ventilation system which uses natural ventilation. Natural ventilation is caused by buoyancy forces due to differences in density of the gases because of temperature differences

3.8**penetration seal**

the product used between the smoke control system duct and the fire compartment structure to maintain the fire resistance, when tested and having met the requirements of prEN 1366-8, at the position where a smoke control system duct passes through the element

3.9**powered smoke and heat exhaust system**

a smoke and heat ventilation system which utilises a number of hot gas fans that are suitable for handling hot gases for a limited period of time which causes the positive displacement of gases

3.10**pressure differential systems**

a system of fans, ducts, vents and other features provided for the purposes of creating a lower pressure in the fire zone than in the protected space – see prEN 12101-6

3.11**single compartment smoke control system ducts**

ducts for use within single fire compartment application and that have been tested and met the requirements of prEN 1366-9

3.12**smoke and heat exhaust ventilation system (SHEVS)**

system consisting of components jointly selected to exhaust smoke and heat. The components form a system which complies with the requirements of prEN 12101-4 in order to establish a buoyant layer of warm gases above cooler cleaner air

3.13**smoke and heat exhaust ventilator (SHEV)**

device specially designed to move smoke and hot gases out of a construction work under conditions of fire

3.14**smoke barrier**

a barrier to restrict the spread of smoke and hot gases from a fire, forming part of the boundary of a smoke reservoir or used as a channelling screen, or used as a void edge boundary

3.15**smoke control system damper** (standards.iteh.ai)

a device automatically or manually activated, which may be open or closed in its operational position, to control the flow of smoke and hot gases into, from or within a duct

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3.16**smoke control system duct**

a duct used in a system to control the movement and/or containment of smoke and heat

3.17**smoke layer**

layer of smoke that stabilises underneath the roof due to the affect of temperature gradient

3.18**smoke logging**

a condition within a building when the hot gases from a fire descend within it to a level whereby the safe escape of the occupants is hampered and the ingress of firefighters is prevented

3.19**smoke reservoir**

region within a building limited or bordered by smoke barriers or structural elements and which will, in the event of a fire, retain a thermally buoyant smoke layer

3.20**smoke zone (zones)**

areas into which a construction works is divided for the extraction of smoke and hot gases. Each zone is served by a SHEV, (or sub-system of a SHEV), which is initiated by a signal from a single or group of initiation devices associated with the zone

3.21**structural supports**

the means of retaining the smoke control system duct to the building structure

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4 Applications

4.1 General

4.1.1 Functions and installation

Smoke control systems are designed to fulfil three basic functions. These are:

- a) the extraction of smoke from a single fire compartment to the outside of the building,
- b) the extraction of smoke from fire compartments of a building, using a SHEVS connected to one or more fire compartments. The smoke control system duct may or may not pass through other compartments of the building to reach the outside of the building,
- c) the use of pressurisation to maintain smoke free clear areas.

Smoke control system ducts are commonly used in smoke and heat control systems as a means of limiting the number of high temperature fan units. The ducts may serve single compartments or a number of different fire compartments. The systems may be dedicated smoke extract or possibly a combined environmental ventilation/smoke extract.

The smoke control system may remove smoke using either high temperature fans (in accordance with EN 12101-3) or natural ventilators (in accordance with EN 12101-2).

Smoke control system ducts shall maintain their cross sectional area within defined limits.

NOTE It is not unusual for the velocity in this type of system to be from 10 to 20 m/s. It is recommended that a velocity of 20 m/s should be the maximum considered.

4.1.2 Specific fire resistant duct types

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4.1.2.1 Duct A

Vertical duct, which is able to resist the fire from outside as fully described in EN 1366-1.

4.1.2.2 Duct B

Horizontal duct, which is able to resist the fire from inside and outside as fully described in EN 1366-1.

4.1.2.3 Duct C

Horizontal duct, which is able to resist the fire from inside and outside as fully described in prEN 1366-8.

4.1.3 Single compartment smoke control system ducts

A smoke control system duct that is used for the extraction of smoke from a single fire compartment to the outside of the building without passing through another fire compartment (see Figure 1).

4.1.4 Multi compartment fire resisting smoke control system ducts

A smoke control system duct that is used for the extraction of smoke from one or more compartments of a building to reach the outside of the building (see Figure 2).

NOTE The following figures give examples of installation positions, but these are not the only positions where ducts may be located.