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Preskusi požarne odpornosti servisnih napeljav - 9. del: Kanali za odvod dima iz enega požarnega sektorja

Fire resistance tests for service installations - Part 9: Single compartment smoke extraction ducts

Feuerwiderstandsprüfungen für Installationen - Teil 9: Entrauchungsleitungen für einen Einzelabschnitt

Essai de résistance au feu des installations de service - Partie 9 : Conduits d'extraction de fumées relatifs à un seul compartiment

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Fire resistance tests for service installations - Part 9: Single compartment smoke extraction ducts

Essai de résistance au feu des installations de service -
Partie 9 : Conduits d'extraction de fumées relatifs à un seul
compartiment

Feuerwiderstandsprüfungen für Installationen - Teil 9:
Entrauchungsleitungen für einen Einzelabschnitt

This European Standard was approved by CEN on 21 January 2008.

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Contents

Page

Foreword	4
Introduction	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions.....	7
4 Test equipment.....	7
4.1 General	7
4.2 Furnace	7
4.3 Perforated plate.....	8
4.4 Inlet nozzles (fire test)	10
4.5 Ambient leakage measuring device	10
4.6 Pressure sensors for differential pressure control	10
4.7 Welded connecting tube.....	10
4.8 Extract fan connecting duct.....	10
4.9 Extraction fan	10
4.10 Thermocouples	10
4.11 Oxygen measuring equipment	10
4.12 Restraint equipment	11
4.13 Observation window	11
5 Test conditions.....	11
5.1 Differential pressure conditions.....	11
5.2 Heating conditions	11
6 Test specimen	11
6.1 Size	11
6.1.1 Length	11
6.1.2 Cross-section	11
6.2 Number.....	12
6.3 Design	12
7 Installation of test specimen.....	12
7.1 General	12
7.2 Standard supporting construction.....	12
7.3 Duct arrangement	12
7.4 Restraint of ducts.....	13
7.5 Perforated plate.....	13
8 Conditioning	13
8.1 General.....	13
9 Application of instrumentation.....	13
9.1 Thermocouples	13
9.1.1 Furnace thermocouples (plate thermometers)	13
9.1.2 Gas temperature within flow nozzles	14
9.2 Pressure	14
9.3 Oxygen measurements.....	14
9.4 Observations of reduction of cross-section	14
10 Test procedure	14
10.1 Pre-test calibration.....	14
10.1.1 Oxygen-measuring instrument.....	14

10.1.2	Perforated plate	14
10.2	Leakage measurement at ambient temperature	14
10.3	Fire test	15
10.3.1	Extraction fan	15
10.3.2	Ignition of furnace	15
10.3.3	Furnace conditions	15
10.3.4	Temperatures and pressures	15
10.3.5	Oxygen measurements	15
10.3.6	General observations	15
10.3.7	Reduction of cross-section	15
10.3.8	Leakage calculations	16
10.3.9	Termination of test	16
11	Performance criteria	17
11.1	General requirements	17
11.2	Criteria at ambient temperature	17
11.3	Criteria under fire conditions	17
11.3.1	General	17
11.3.2	Leakage	17
11.3.3	Reduction in cross-section	17
11.3.4	Mechanical stability	17
12	Test report	17
13	Direct field of application of test results	18
13.1	General	18
13.2	Duct sizes	18
13.3	Hangers	19
13.4	Pressure difference	19
13.5	Number of sides of duct	19
Annex A	(informative) Measurement of volume/mass flow	30
A.1	Hints on measuring volume flow or mass flow with differential pressure devices	30
A.2	Density	30
A.3	Absolute Pressure (barometric pressure)	30
A.4	Viscosity	31
A.5	Characteristic data of the inlet nozzles according to Figure 10	31
Annex B	(informative) Measurement of oxygen content	35
Annex C	(informative) The usage of correction factors for the consideration of different parameters	39

EN 1366-9:2008 (E)**Foreword**

This document (EN 1366-9:2008) has been prepared by Technical Committee CEN/TC 127 "Fire safety in 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 September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] 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, and supports essential requirements of 89/106/EEC Directive.

EN 1366 "*Fire resistance tests for service installations*" consists of the following Parts:

Part 1: Ducts

Part 2: Fire dampers

Part 3: Penetration seals

Part 4: Linear joint seals

Part 5: Service ducts and shafts

Part 6: Raised access and hollow core floors (in course of preparation)

Part 7: Conveyor systems and their closures

Part 8: Smoke extraction ducts

Part 9: Single compartment smoke extraction ducts

Part 10: Smoke control dampers (in course of preparation)

Part 11: Protective systems for essential services (in course of preparation)

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Introduction

This part of this European Standard has been prepared because a method of test for smoke extraction ducts used in single compartment applications has become necessary. This test exposes a smoke extraction duct to conditions intended to represent the pre-flashover stage of a fire.

Leakage is measured at both ambient temperature and exposure at 600 °C. During the tests, air/gases are drawn through the duct at a differential pressure between the inside and outside of the duct. Leakage is determined at ambient temperature by sealing the openings in the duct located in the furnace and taking flow measurements through a flow measuring device located just before the extraction fan. With respect to determining leakage at 600 °C, oxygen-measuring techniques are used.

CAUTION — The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing may be hazardous and that there is a possibility that toxic and/or harmful smoke and gases may be evolved during the test. Mechanical and operational hazards may also arise during the construction of the test elements or structures, their testing and disposal of test residues.

An assessment of all potential hazards and risks to health should be made and safety precautions should be identified and provided. Written safety instructions should be issued. Appropriate training should be given to relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

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EN 1366-9:2008 (E)**1 Scope**

This part of EN 1366 specifies a test method for determining the fire resistance of smoke extraction ducts that are used for single compartment applications only. In such applications, the smoke extraction system is only intended to function up to flashover (typically 600 °C).

This method of test is only suitable for ducts constructed from non-combustible materials (euro class A1 and A2-s1, d0).

It is applicable only to four sided and circular ducts. One, two and three sided ducts are not covered.

This test has been designed to cover horizontal smoke extraction ducts intended for single compartment applications only.

This test method of part 9 is applicable only to smoke extraction ducts that do not pass through into other fire compartments. It represents fire exposure of a developing fire (pre-flashover). For smoke extraction ducts that pass through into other compartments, the method of test described in EN 1366-8 should be used.

The smoke extraction duct is part of the smoke extraction system which also includes smoke control dampers and smoke extract fans.

The method described in this test standard is complex and requires sophisticated instrumentation. It is not recommended therefore to try to test multiple assemblies in this test.

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2 Normative references (standards.iteh.ai)

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. standards.iteh.ai/sist-en-1366-9-2008

EN 1363-1:1999, *Fire resistance tests - Part 1: General requirements*

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

EN 1366-1:1999, *Fire resistance tests for service installations - Part 1: Ducts*

EN 1751, *Ventilation for buildings - Air terminal devices - Aerodynamic testing of dampers and valves*

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

EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements (ISO 5167-1:2003)*

EN ISO 13943:2000, *Fire safety - Vocabulary (ISO 13943:2000)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1:1999 and EN ISO 13943:2000 and the following apply.

3.1

single compartment smoke control system ducts

ducts for use within single fire compartment application

3.2

suspension devices

the components used for suspending and fixing a duct from a floor soffit or supporting a duct from a wall

3.3

supporting construction

the wall, partition or floor which the duct passes through in the test

3.4

single fire compartment

fire area of a single compartment building bounded by fire-resistant walls

3.5

smoke zone (zones)

areas into which a construction work 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

3.6

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

3.7

compensator

a device that is used to prevent damage from the forces generated by expansion

3.8

smoke and heat exhaust ventilation system (SHEVS)

system consisting of products and/or components jointly selected to exhaust smoke and heat. The products and/or components form a system in order to establish a buoyant layer of warm gases above cooler cleaner air

4 Test equipment

4.1 General

In addition to the test equipment specified in EN 1363-1, the equipment in 4.2 and 4.3 is required. The overall test arrangement is shown in Figure 1. Details of instrumentation and other details are shown in Figures 2 to 10.

4.2 Furnace

The furnace shall be capable of subjecting fire resisting smoke extraction ducts to the standard heating and pressure conditions specified in EN 1363-1 and be suitable for testing ducts in the horizontal orientation (see Figure 1).

EN 1366-9:2008 (E)

4.3 Perforated plate

The perforated plate controls the flow through the duct so that the required differential pressure, see Table 1, can be achieved. Depending on the end-use conditions, a pressure level from Table 1 shall be selected. These levels correspond to typical values used in smoke extraction design.

The plate shall be positioned (250 ± 50) mm from where the duct passes through the furnace wall (see Figures 1 and 2).

These plates shall be made from heat resisting steel, 19 % min. Cr content and 11 % min. Ni content. The number of holes and dimensions are given in Tables 2 and 3. The thickness of the plates shall be 2,5 mm.

Table 2 gives details of perforated plates for standard rectangular ducts of size 1 000 mm x 250 mm. For smaller sizes, the number of holes will be reduced proportional to the smaller cross-section.

Table 3 gives details of perforated plates for standard circular ducts of diameter 560 mm. For smaller sizes, the number of holes will be reduced proportional to the cross-section (a change to larger sizes is not accepted; see 6.1.2 and Table 5).

Further details of the plate are shown in Figures 2, 3 and 4.

Table 1 — Differential pressures between inside and outside the duct for smoke extraction ductwork

Pressure Level ¹⁾	Operating differential pressure at ambient temperature Pa	Differential pressure for the fire test and pre-test calibration Pa
1	-500	-150
2	-1 000	-300
3	-1 500	-500

Table 2 — Details of perforated plates for testing rectangular ducts (see Figure 3)

Specification for perforations	Pressure level ¹⁾		
	1	2	3
Total number of holes	550	407	324
Number of holes - horizontally	50	37	36
Number of holes - vertically	11	11	9
Diameter of hole (mm)	10	10	10
Horizontal distance from rim e (mm)	15	15	20
Vertical distance from rim c (mm)	15	15	20
Mounting hole separation a (mm)	19,8	26,9	27,4
Mounting hole separation b (mm)	21,8	22	26,3

1) see Clause 5.

Table 3 — Details of perforated plate for testing circular ducts (see Figure 4)

Specification for perforations	Pressure level ¹⁾		
	1	2	3
Total number of holes	541	403	319
Diameter of hole (mm)	10	10	10
Horizontal distance from rim e (mm)	30	35	35
Mounting hole separation a (mm)		23	25,5

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EN 1366-9:2008 (E)**4.4 Inlet nozzles (fire test)**

Each nozzle shall have an internal dimension of 160 mm (see Figure 10, suitable for the standard sizes of ducts specified in 6.1) in accordance with EN ISO 5167-1 and ISO 5221, and shall be suitably mounted to the end of the duct with its piezometric ring connected to appropriate differential pressure measuring equipment. The measuring device shall be capable of measuring to an accuracy of $\pm 5\%$.

4.5 Ambient leakage measuring device

Ambient leakage measuring shall be in accordance with EN ISO 5167-1 and ISO 5221 and suitably mounted to the end of the duct, connected to appropriate differential pressure measuring equipment. The measuring device shall be capable of measuring to an accuracy of $\pm 5\%$.

4.6 Pressure sensors for differential pressure control

A tube sensor as specified in EN 1363-1 shall be located at the end of the duct, inside the duct, at the level of its centre line. A second sensor (e.g. an open end of a measuring tube) shall be located on the same level outside the duct.

A flow control damper shall be provided for a fine control for maintaining the required differential pressure. Alternatively, another suitable device such as a variable speed fan may be used. Any flow control damper shall be attached to the extract fan connecting duct (see 4.8).

4.7 Welded connecting tube

A welded connecting tube is a tube designed to provide a suitable gas tight connection between the inlet nozzles and the oxygen measuring probes shall be provided (for details see Figure 6).

4.8 Extract fan connecting duct [SIST EN 1366-9:2008](https://standards.iteh.ai/catalog/standards/sist/cc793bdf-6b1b-4602-88d7-9c6b8e895738/standards/en-1366-9-2008)

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An extract fan connecting duct is a duct designed to connect between the test specimen and the extraction fan. An inlet opening may be provided if a flow control damper is used for fine control of the differential pressure (see 4.6).

4.9 Extraction fan

An extraction fan is a fan for extracting gas under test with a suction capacity of at least $2 \times V_n$ where V_n is the required capacity e.g. for a stated cross-section of $V_n = 0,25 \text{ m} \times 1 \text{ m}$, $2 \times V_n = 0,5 \text{ m}^3/\text{s}$.

The characteristic curves of the fan shall be horizontal for the actual airflow. The capacity of the fan shall not change by more than 10 % in the event of a drop in the pressure of up to 50 Pa.

4.10 Thermocouples

1,5 mm sheathed thermocouples shall be provided for measuring the gas temperature adjacent to the nozzles. An alternative thermocouple may be used, provided it can be shown to have equivalent response time.

4.11 Oxygen measuring equipment

Equipment for measuring the oxygen content of gases shall be provided. This system shall consist of paramagnetic cell oxygen analysers together with appropriate equipment for cooling, filtering and drying the gases. Appropriate connecting tubes and probes shall be provided. The 90 % response time of the complete system shall be 20 s maximum. The accuracy shall be better than $\pm 0,1 \text{ vol } \%$.

4.12 Restraint equipment

Restraining equipment shall be applied as for duct B in EN 1366-1:1999.

4.13 Observation window

An observation window shall be provided between the two nozzles and a suitable method of viewing from a safe distance shall be provided (a mirror arrangement may be found suitable). If the reduction in cross-section of the duct can be assessed sufficiently from the outside (see 9.4), then the observation window may be omitted.

5 Test conditions

5.1 Differential pressure conditions

Depending on the end-use conditions, a pressure selected from Table 1 shall be selected. These levels correspond to typical values used in smoke extraction design.

5.2 Heating conditions

The heating conditions and the furnace atmosphere shall conform to those specified in EN 1363-1 (or, if applicable, EN 1363-2) until 600 °C is reached. The mean temperature of the six furnace thermocouples shall reach 600 °C between 5 min to 10 min from igniting the first furnace burner. After 10 min this temperature shall be maintained between +70 °C, -0 °C for the rest of the test.

The furnace pressure shall be controlled to (15 ± 3) Pa throughout the test at the mid-height position of the ducts in the furnace.

Details of test conditions within the duct during the test are given in Clause 10.

6 Test specimen

6.1 Size

6.1.1 Length

The minimum lengths of the parts of the test specimen inside and outside the furnace shall be as given in Table 5 (see also Figure 1).

Table 4 — Minimum length of test specimen

Orientation	Minimum length (m)	
	Inside furnace	Outside furnace
Horizontal	3,0	4,2

6.1.2 Cross-section

The sizes of duct given in Table 6 shall be tested unless smaller cross-sections are required for specific applications.