SLOVENSKI STANDARD
oSIST prEN 1366-8:2019

01-maj-2019

Preskusi požarne odpornosti servisnih inštalacij - 8. del: Kanali za odvod dima

Fire resistance tests for service installations - Part 8: Smoke extraction ducts

Feuerwiderstandsprüfungen für Installationen - Teil 8: Entrauchungsleitungen

Essais de résistance au feu des installations de service - Partie 8 : Conduits d'extraction de fumées

Ta slovenski standard je istoveten z: **prEN 1366-8**

ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
91.060.40	Dimniki, jaški, kanali	Chimneys, shafts, ducts

oSIST prEN 1366-8:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1366-8

March 2019

ICS 13.220.20; 13.220.50

Will supersede EN 1366-8:2004

English Version

Fire resistance tests for service installations - Part 8: Smoke extraction ducts

Essais de résistance au feu des installations de service - Partie 8 : Conduits d'extraction de fumées

Feuerwiderstandsprüfungen für Installationen - Teil 8: Entrauchungsleitungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 127.

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.

This draft European Standard was established by CEN 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

Page

European foreword

This document (prEN 1366-8:2019) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1366-8:2004.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 1366 “Fire resistance tests for service installations” consists of the following:

— Part 1: Ventilation ducts;

— Part 2: Fire dampers;

— Part 3: Penetration seals;

— Part 4: Linear joint seals;

— Part 5: Service ducts and shafts;

— Part 6: Raised floors;

— Part 7: Closures for conveyors and trackbound transportation systems;

— 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);

— Part 12: Non-mechanical fire barrier for ventilation ductwork;

— Part 13: Chimneys.

Introduction

This document has been prepared because a method of test for fire resisting smoke extraction ducts has become necessary to evaluate the ability of fire resisting ducts already tested to EN 1366-1 to function adequately as smoke extraction ducts.

Leakage is measured at both ambient and elevated temperatures. 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 elevated temperatures, oxygen measuring techniques are used.

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

1 Scope

This document specifies a test method for determining the fire resistance of smoke extraction ducts. It is applicable only to smoke extraction ducts that pass through another fire compartment from the fire compartment to be extracted in case of fire. It represents fire exposure of a fully developed fire.

This method of test is only applicable to ventilation ducts with the following classification according to EN 13501-3:

— fire from inside and outside i ↔ o;

— applicable to a pressure difference up to 500 Pa;

NOTE 1 Requires that the duct A test(s) has been preformed with an under-pressure of minimum 500 Pa.

— with integrity (E) and insulation (I) criteria equal to or higher than the intended classification for the smoke extraction duct.

NOTE 2 According to: EN 13501–4:2009/A1:2009 Multi-compartment smoke extraction duct can only be classified as EI.

For the purposes of the test described in this document, the duct is referred to as duct C.

This test method has been designed to cover both vertical and horizontal smoke extraction ducts. A vertical system need not be evaluated to this method provided that:

— both horizontal (ho) and vertical (ve) classification according to EN 13501-3 has been obtained for the ventilation duct, and

— it has been tested in a horizontal orientation to this method.

If the ventilation duct in practice is only used for vertical applications in smoke extraction systems, only vertical (ve) classification is bound to be used and tested in a vertical orientation to this method according to EN 13501-3.

This test method is suitable for ducts constructed from non-combustible materials (Euroclass A1 and A2).

NOTE 3 Using combustible material could lead to an incorrect calculation of the leakage based on the oxygen measurement. E.g. galvanisation could lead to some negative effects for the measurements.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

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

EN 1507, *Ventilation for buildings - Sheet metal air ducts with rectangular section - Requirements for strength and leakage*

EN 60584-1, *Thermocouples - Part 1: EMF specifications and tolerances (IEC 60584 1)*

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

3 Terms and Definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
smoke extraction duct
duct used for the extraction of smoke in case of fire and designed to provide a degree of fire resistance

3.2
fire-resistant ventilation duct
duct used for the distribution or extraction of air and designed to provide a degree of fire resistance

3.3
self-supporting duct
duct constructed, e.g., from fire-protective boards, without encasing a steel duct

3.4
suspension devices
components used for suspending and fixing a duct from a floor or supporting a duct from a wall

3.5
supporting construction
wall, partition or floor through which the duct passes in the test

3.7
compensator
device used to prevent damage from the forces generated by expansion

3.8
access panel
cover for an inspection opening within the duct

3.9
fire protected steel duct
steel duct with an external insulation to provide fire resistance

3.10
internal surface area with under-pressure
surface area of the duct from the perforated plate to the end of the duct by the inlet nozzles including the endplate where the nozzles is positioned and excluding the surface of the perforated plate

3.11
total internal surface area
full internal area of the duct including both end plates

4 Caution

The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing can be hazardous and that there is a possibility that toxic and/or harmful smoke and gases might be evolved during the test. Mechanical and operational hazards might 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 shall be made and safety precautions shall be identified and provided. Written safety instructions shall be issued. Appropriate training shall be given to relevant personnel. Laboratory personnel shall ensure that they follow written safety instructions at all times.

5 Test equipment

5.1 General

In addition to the test equipment specified in EN 1363-1 the following is required:

5.2 Furnace

This shall be capable of subjecting smoke extraction ducts to the standard heating and pressure conditions specified in EN 1363-1 and be suitable for testing ducts in the horizontal (see Figure 1) or vertical (see Figure 2) orientation.

It is required that the construction of furnace shall allow observation of at least 75 % of the test specimen.

5.3 Perforated plate

The perforated plate controls the flow through the duct so 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 or roof, see Figures 1 and 2.

The plate shall be made from austenitic heat-resisting steel (grade number 1.4835) in accordance with EN 10095 Heat resisting steels and nickel alloys. The number of holes and dimensions are given in Tables 2 and 3. The thickness of the plates shall be 2,5 ± 0,5 mm.

NOTE 1 Table 2 gives details of perforated plates for standard rectangular ducts of size 1000 mm x 250 mm. For smaller sizes the number of holes will be reduced proportional to the smaller cross section.

NOTE 2 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 permitted; see 7.1.2 and Table 5).

Further details of the plate are shown in Figures 3, 4 and 5.

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

Pressure level	Operating differential pressure at ambient temperature Pa	Differential pressure for fire test and pre-test calibration Pa
1	−500	−150
2	−1000	−300
3	−1500	−500

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

Specification for perforations	Pressure level		
	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 e (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

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

Specification for perforations	Pressure level		
	1	2	3
Total number of holes	541	403	319
Diameter of hole (mm)	10	10	10
Distance from rim e (mm)	30	35	35
Mounting hole separation a (mm)	20,8	22,2	27,5
Mounting hole separation b (mm)	20,8	22,2	27,5

5.4 Inlet nozzles

The measuring device shall be capable of measuring to an accuracy of + 5 % when used in cold conditions and shall be suitably mounted to the end of the duct with its piezometric ring connected to appropriate differential pressure measuring equipment

NOTE 1 For the standard size standard sizes of ducts specified in 7.1, an internal dimension of diameter = 160 mm of each nozzle is suitable (cf. Figure 7). Descriptions of similar nozzles are given in EN ISO 5167-3, EN ISO 5167-4 and ISO 5221.

NOTE 2 Suggestion to an inlet nozzles system for standard size ducts is shown on Figure 6 and 7. The calculation procedure is given in Annex A.

5.5 Ambient temperature leakage measuring device

The measuring device shall be capable of measuring to an accuracy of + 5 % and suitably mounted at the end of the duct, connected to appropriate differential pressure measuring equipment. Descriptions of possible measuring device are given in EN ISO 5167 series and ISO 5221.

5.6 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. This is shown on Figure 6 and 7 as probe D1.

5.7 Welded connecting duct

A duct tightly welded, which is designed to provide a suitable gas tight connection between the inlet nozzles and the oxygen measuring probes, shall be provided.

One end of the duct is 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 5.6). This is shown on Figure 7, item 7.

5.8 Extraction fan

A fan for extracting gas under the fire test with a suggested capacity of at least 2 x Vn where Vn is the required capacity calculated by multiplying the air speed (2 m/s) by the height and width of the duct, e.g. for the rectangular duct described in 7.1.2 with cross section of 1 m x 0,25 m:

Vn = 2 m/s x 1,0 m x 0,25 m = 0,5 m^3/s

The characteristic curves of the fan shall be horizontal for the actual air flow. 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.

5.9 Thermocouples

Sheathed thermocouples shall be provided for measuring the gas temperature adjacent to the nozzles of nickel chromium/nickel aluminium type K wire as defined in EN 60584-1, with a nominal diameter of 1,5 mm to 3 mm. The thermocouples shall measure with an accuracy of ± 15 K. The position is shown on Figure 6 and 7, item 6.

5.10 Surface thermocouples

Surface thermocouples for measuring surface temperature of the type specified in EN 1363-1 and at the locations specified in EN 1366-1 shall be used.

5.11 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 equal to or better than + 0,1 %.

5.12 Oxygen measurement probes

Steel probes shall be provided for extracting the furnace gas from the inside of the duct at the locations G1 and G2 on Figure 6. The end of the probe shall be located in the centre point of the duct cross section.

5.13 Restraining equipment

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

5.14 Deflection measurements

Deflection measurements shall be taken for determining the reduction of internal cross-section area at ambient temperature and during the fire test. The measurement shall be done with an accuracy of ± 1mm.

The interval between a complete set of measurements shall not exceed 15 min, in any case near prior to any classification time period.

6 Test conditions

The heating conditions and the furnace atmosphere shall conform to those given in EN 1363-1.

The furnace pressure shall be controlled to $\Delta P = 15$ Pa throughout the test at the mid-height position of the horizontal ducts. For vertical ducts the furnace pressure shall be controlled to $\Delta P = 20$ Pa at a distance of 100 mm below the ceiling. The tolerance of the pressure differential is given in EN 1363-1.

Details of test conditions within the ducts during the test are given in Clause 11.

7 Test specimen

7.1 Size

7.1.1 General

For duct specimens of sizes other than those given in Table 5, the field of direct application is restricted (see Clause 14).

7.1.2 Length

The minimum lengths of the parts of the test specimen inside and outside the furnace shall be as given in Table 4 (see also Figures 3 and 9).

Table 4 — Minimum length of test specimen

Orientation	Minimum length (m)	
	Inside furnace	Outside furnace
Horizontal	3,0	4,2
Vertical	2,0	4,25

7.1.3 Cross-section

The standard sizes of ducts given in Table 5 shall be tested unless only smaller cross-sections are used:

Table 5 — Internal cross-section of test specimen (dimension of the open cross-section)

Rectangular		Circular
Width (mm)	Height (mm)	Diameter (mm)
1000 ± 10	250 ± 10	560 ± 10

7.2 Number

A minimum of one test specimen shall be tested. For horizontal and vertical installation see 14.2.

7.3 Design

7.3.1 General

The test shall be made on a test specimen representative of the complete duct assembly, including integral or intended insulation on which information is required. Each type of duct requires a different approach and the laboratory shall as far as practical reproduce the edge conditions and the method of fixing or support inside and outside the furnace to that representative of that used in practice. The distance between hangers or supports shall also be representative.

7.3.2 Openings in duct

Two openings equal in size shall be provided, one on each vertical side of the duct inside the furnace. For horizontal ducts the openings shall be positioned (500 ± 25) mm from the end of the duct inside the furnace (see Figures 1). For vertical ducts the openings shall be positioned (200 ± 10) mm below the furnace roof (see Figure 2).

In both vertical and horizontal ducts, clear openings shall have the same width/height ratio as the cross-section of the duct. For circular ducts, the openings shall be rectangular with a width/height ration of 4:1. The total area of the openings shall be 50 % ± 10 % of the internal cross sectional area of the duct. Framing of the openings shall be as in practise (to avoid weakening the duct walls in the area around the openings).

7.3.3 Joints in horizontal ducts

The test configuration shall include at least one joint inside the furnace and at least one joint outside it. There shall be at least one joint in every layer of fire protection material (if applicable), both inside and outside the furnace and in any steel duct.

Outside the furnace, the joint in the outer layer of the fire protection material shall be no further than 700 mm from the supporting construction and no nearer than 100 mm to thermocouples T2. Inside the furnace, the joint in the outer layer of fire protection material shall be located at approximately mid-span.

The distance between joints and suspension devices shall not be less than that used in practice. If the minimum distance has not been specified, suspension devices shall be arranged so that the joint of the outermost layer at the bottom of the insulation material (if no insulation material is present: joint of the steel duct) lies midway between them. Centres of the suspension devices shall be specified by the manufacturer and shall be representative of practice.

7.3.4 Joints in vertical ducts

The test configuration shall include at least one joint inside and one joint outside it.

There shall be at least one joint for every layer of fire protection material, both inside and outside the furnace and in any steel duct.

Outside the furnace, the joint in the outer layer of the fire protection material shall be no further than 700 mm from the supporting construction and no nearer than 100 mm to thermocouples T2. Inside the furnace, the joint in the outer layer of fire protection material shall be located at approximately mid-span.

7.3.5 Support for vertical ducts

Vertical ducts shall be supported on the furnace floor and penetrate through the supporting construction (see Figure 2); the ducts shall be fixed at the level of the supporting construction as they would be fixed in practice when penetrating a floor. This shall be as specified by the sponsor.

7.3.6 Compensators

Where compensators are used in practice then they shall be incorporated in the test specimen. In this case the compensator shall be located outside the furnace approximately 500 mm from the perforated plate.

7.3.7 Access panels

Where access panels are used in practice then they shall be incorporated in the test specimen. In this case the access panels shall be located outside the furnace approximately 500 mm downstream from the perforated plate. In cases where compensator and access panel are included in one test specimen, the placement of the compensator takes precedence (access panel shall be located (300 ± 50) mm from the end of the compensator or in the next section downstream).

In cases where access panel are included in the test specimen causing conflicts with the joints in the different layers of the duct, the placement of the joints takes precedence. In that case move the access panel further downstream.

8 Installation of test specimen

8.1 General

The test specimen shall be installed, as far as possible, in a manner representative of its use in practice.

The supporting construction selected shall be a wall, partition or floor either selected from the standard supporting constructions in chapter 8.2 or of the type to be used in practice which shall have a classified fire resistance equal or greater than the intended fire resistance of the duct being tested.

Where the duct passes through an opening in the furnace wall or roof, then the opening shall be of sufficient dimensions to allow for the supporting construction to surround all faces of the duct by at least 200 mm in case of rigid supporting constructions.

In case of flexible supporting walls, the flexible walls shall have minimum dimensions of 2500 mm x 2500 mm and have one fixed and one free vertical edge (for free edge cf. EN 1364-1:2015, 6.3.2). The horizontal clear spacing between the outer edge of the penetration and the free edge of the flexible supporting construction shall be (500 ± 50) mm. The clear vertical spacing between the top of the flexible supporting construction and the top of the outer edge of the penetration shall be at least 500 mm.

Ducts shall be arranged as shown in Figures 1 and 2. The end of the duct within the furnace shall be closed independently of any furnace enclosure by materials and construction similar to the remainder of the duct.