

Fire resistance tests for service installations — Ducts

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National foreword

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- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Summary of pages

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Foreword

This European Standard 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of an identical text or by endorsement, at the latest by September 2001, and conflicting national standards shall be withdrawn at the latest by September 2001.

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

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the Construction Product Directive.

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

Part 1: Ducts

Part 2: Fire dampers

Part 3: Penetration seals (in course of preparation)

Part 4: Linear joint seals (in course of preparation)

Part 5: Service ducts and shafts (in course of preparation)

Part 6: Raised floors (in course of preparation)

Part 7: Closures for conveyors and trackbound transportation systems (in course of preparation)

Part 8: Smoke extraction ducts (in course of preparation)

Part 9: Single compartment smoke extraction ducts (in course of preparation)

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

Introduction

The purpose of this test is to measure the ability of a representative duct or duct assembly that is part of an air distribution system to resist the spread of fire from one fire compartment to another with fire attack from inside or outside the duct. It is applicable to vertical and horizontal ducts, with or without branches, taking into account joints and exhaust openings, as well as suspension devices and penetration points.

The test measures the length of time for which ducts, of specified dimensions, suspended as they would be in practice, satisfy defined criteria when exposed to fire from (separately) both inside and outside the duct.

All ducts are fully restrained in all directions where they are inside the furnace. Outside the furnace, ducts exposed to fire from the outside are tested unrestrained, while ducts exposed to fire from the inside (horizontal only) are tested restrained.

The test takes into account the effect of fire exposure from the outside where a 300 Pa underpressure is maintained in the duct as well as the effect of fire entering the ducts in conditions where forced air movement may or may not be present by maintaining a velocity of 3 m/s.

Ducts exposed to fire from the inside are supplied with air in a manner which is indicative of the "fan off" and "fan on" situations which could arise in practice.

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 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.

1 Scope

This Part of EN 1366 specifies a method for determining the fire resistance of vertical and horizontal ventilation ducts under standardized fire conditions. The test examines the behaviour of ducts exposed to fire from the outside (duct A) and fire inside the duct (duct B). This Standard is used in conjunction with EN1363-1.

Annex A provides general guidance and gives background information.
This European Standard is not applicable to:

- a) ducts whose fire resistance depends on the fire resistance performance of a ceiling;
- b) ducts containing fire dampers at points where they pass through fire separations;
- c) doors of inspection openings, unless included in the duct to be tested;
- d) two or three sided ducts;
- e) fixing of suspension devices to floors or walls.

For evaluation of fire dampers see EN 1366-2.

For evaluation of smoke extraction ducts see prEN 1366-8.

For evaluation of service ducts and shafts see prEN 1366-5.

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.

prEN 520	Gypsum plasterboards -Specification - Test method (ISO 6308:1980 modified)
EN 1363-1	Fire resistance tests - Part 1: General requirements
EN 1363-2	Fire resistance tests - Part 2: Alternative and additional procedures
EN 1366-2	Fire resistance tests for service installations Part 2: Dampers
prEN 1366-5	Fire resistance tests for service installations Part 5: Service ducts and shafts
prEN 1366-8	Fire resistance tests for service installations Part 8: Smoke extraction ducts
prEN 1507	Ventilation for buildings - Ductwork - Rectangular sheet metal air ducts - Strength and leakage - Requirements and testing
prEN ISO 13943	Fire safety - Vocabulary (ISO/DIS 13943:1998)
EN 20898-1	Mechanical Properties of fasteners Part 1: Bolts, screws and studs (ISO 898:1980)
EN ISO 5167-1	Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and venturi tubes inserted in circular cross-section conduits (ISO 5167-1:1991)
ISO 5221	Air distribution and air diffusion - Rules to methods of measuring air flow rate in an air handling duct

3 Definitions

For the purposes of this Part of EN 1366, the definitions given in EN 1363-1 and prEN ISO 13943, together with the following, apply:

3.1 fire resisting duct: A duct used for the distribution or extraction of air and designed to provide a degree of fire resistance.

3.2 suspension devices: The components used for suspending and fixing a duct from a floor 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 compensator: A device that is used to prevent damage from the forces generated by expansion.

4 Test equipment

4.1 General

In addition to the test equipment specified in EN 1363-1, and if applicable EN 1363-2, the following is required:

4.2 Furnace

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

4.3 Fan A

This shall be able to produce at the start and throughout the test an underpressure of (300 ± 15) Pa within duct A (see figure 3) and shall be connected either directly, or by a suitable length of flexible ducting, to the measuring station described in 4.5.

4.4 Fan B

This shall be able to produce an air velocity when extracting gas from duct B (see figure 4), of at least 3 m/s measured at ambient temperature in the duct before the test. It shall be connected either directly, or by a suitable length of flexible ducting, to the velocity measuring station described in 4.8. The fan shall be provided with a by-pass vent that can be opened prior to the damper described in 4.7 being shut.

4.5 Volume flow measuring station

This shall consist of a venturi, orifice plate, or other suitable device and (where necessary) an air flow straightener, installed in straight lengths of pipe, all sized to EN ISO 5167-1 and ISO 5221. It shall be connected to the end of duct A outside the furnace to determine the volume flow rate of gas passing through duct A during the test. The measuring device shall be capable of measuring to an accuracy of $\pm 5\%$. Regardless of whether vertical or horizontal ducts are being tested, the volume flow measuring station shall always be used in a horizontal orientation.

4.6 Condensing unit

This shall be installed between the end of duct A and the flow measuring device and shall allow for drainage. The gas temperature adjacent to the flow measuring device shall be measured by a 2 mm sheathed thermocouple with an insulated hot junction, arranged pointing downwards to allow for draining moisture. Its measuring junction shall be located at the centre line of the measuring duct and at a distance equal to twice the diameter of the measuring duct downstream from the flow measuring device. The temperature measured by this thermocouple shall not exceed 40 °C.

4.7 Damper

This shall be installed between the fan and the velocity measuring station to shut off the air flow in duct B during evaluation of integrity in the "fan-off" condition.

4.8 Velocity measuring station

This shall determine air velocity in duct B and shall consist of one or two inlet nozzle(s), or other suitable device, installed in a straight length of pipe sized to EN ISO 5167-1 and ISO 5221, connected to the end of both the vertical and horizontal duct B outside the furnace.

4.9 Equipment for measuring gas pressure

This shall be provided in the furnace and inside duct A.

4.10 Thermal movement measuring device

This shall be provided for measuring expansion/contraction of duct A and shall have an accuracy of $\pm 1\text{mm}$.

4.11 Force measuring device

This shall be provided for measuring forces at the point of applying restraint in duct B (see figure 5).

5 Test conditions

The heating conditions and the furnace atmosphere shall conform to those given in EN 1363-1, or if applicable, EN 1363-2.

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

Details of test conditions within the ducts during the test are given in clause 10.

6 Test specimen

6.1 Size

6.1.1 General

Ducts of sizes other than those given in tables 1 and 2 have restricted the direct field of application (see clause 13).

6.1.2 Length

The minimum lengths of the parts of the test specimen inside and outside the furnace shall be as given in table 1. (see also figures 1 and 2):

Table 1 - Minimum length of test specimen

Orientation	Minimum length (m)	
	Inside furnace	Outside furnace
Horizontal	4,0	2,5
Vertical	2,0	2,0

6.1.3 Cross section

The standard sizes of ducts given in table 2 shall be tested unless only smaller cross sections are used:

Table 2 – Cross section of test specimen

Duct	Rectangular		Circular
	width (mm)	height (mm)	diameter (mm)
A	1000 ± 10	500 ± 10	800 ± 10
B	1000 ± 10	250 ± 10	630 ± 10

6.2 Number

One test specimen shall be tested for each type of installation to be evaluated.

6.3 Design

6.3.1 General

The test shall be made on a test specimen representative of the complete duct assembly on which information is required. The edge conditions and the method of fixing or support inside and outside the furnace shall be representative of that used in practice.

Ducts shall be arranged as shown in figures 1 and 2.

6.3.2 Minimum separation

There is no limit to the number of ducts that may be tested simultaneously in the same furnace, provided that there is sufficient space to do so, in accordance with the dimensions shown in figures 1 and 2.

There shall be a separation of (500 ± 50) mm between the top of a horizontal duct and the ceiling. A minimum separation of 500 mm shall be provided between the underside of a horizontal duct and the floor. Similarly, there shall be a minimum separation of at least 500 mm between the sides of ducts and furnace walls.

6.3.3 Configuration of duct A (horizontal only)

The horizontal duct A shall include one sharp bend, a T-piece and a 500 mm long length of duct to form a short branch duct having a cross-section of $250 \text{ mm} \times 250 \text{ mm}$, and shall be arranged as shown in figure 2. All specimens including this branch shall be mounted with the suspension or fixing devices as would be intended in practice.

6.3.4 Openings in duct B

Two openings 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 furnace wall. For vertical ducts the openings shall be positioned (200 ± 10) mm below the furnace roof (see figures 1 and 2).

In both vertical and horizontal ducts the openings shall have the same breadth:height ratio as the cross-section of the duct and have a total opening area of $(50 \pm 10)\%$ of the cross-sectional area of the duct, i.e. each opening shall have an area of $(25 \pm 5)\%$ of the cross sectional area of the duct.

6.3.5 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 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 T_2 . 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 at mid-span lies midway between them. Centres of the suspension devices shall be specified by the manufacturer and shall be representative of practice.

6.3.6 Joints in vertical ducts

The test configuration shall include at least one joint inside and one joint outside it (see figure 1).

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 T_2 . Inside the furnace, the joint in the outer layer of fire protection material shall be located at approximately mid-span.

6.3.7 Support for vertical ducts

These shall be supported on the furnace floor and penetrate through the furnace roof slab/supporting construction (see figure 1); the ducts shall be fixed at the furnace roof level as they would be fixed in practice when penetrating a floor. This shall be as specified by the sponsor.

6.3.8 Compensators

Only where compensators are used in practice shall they be incorporated in the test specimen. Where a compensator is to be tested it shall be located within the furnace for duct A, and for duct B outside the furnace approximately 500 mm from the wall or floor.

6.3.9 Steel ducts

Where steel ducts are used, these shall have class A leakage in accordance with prEN 1507.

7 Installation of test specimen

7.1 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 of the type to be used in practice and shall have a fire resistance greater than the required 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.

7.2 Standard supporting construction

Where the type of supporting construction to be used in practice is not known then one of the standard supporting constructions in tables 3 to 5 shall be used.