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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (prEN 1366-10:2004) 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.

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: Smoke compartment smoke extraction ducts (in course of preparation)

Part 10: Smoke control dampers

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

Introduction

The purpose of this standard is to define test methods to evaluate the abilities of smoke control dampers to

1) be applicable to single compartment and/or multi compartment fire resisting applications;

2) be applicable to automatic systems or systems with manual intervention;

3) change state from closed to open at elevated temperatures;

4) once opened maintain a defined cross sectional area at elevated temperature;

5) maintain a satisfactory leakage performance when subjected to positive pressure at elevated temperatures.

The units will be mounted for the tests in a manner representative of practice.

Temperature and integrity measurements will be carried out in various parts of the test construction during the test. Impermeability measurements required will be measured by direct flow measurement at the prescribed pressure differentials. Ambient leakage of the units will also be recorded.

Performance of these tests will allow products to conform to and be classified to prEN 12101-8. The required temperatures, pressure differentials etc. are stated in prEN 12101-8.

Completing the tests within this standard does not ensure full compliance with prEN 12101-8, as other, additional, requirements are defined in that standard.

Caution

The attention of all persons concerned with managing and carrying out this furnace testing 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 this European Standard specifies test methods for smoke control dampers. These tests are required to confirm that the dampers meet the furnace testing requirements of prEN 12101-8. It should be noted that the damper to be tested might require testing to EN 1366-2 and that this should be considered before carrying out these tests.

To this end this standard must be read in conjunction with prEN 12101-8, EN 1366-2 and EN 1363, the latter giving the details for fire resistance testing.

For installation details the requirements for smoke extraction ducts must be considered and these are defined in EN 1366-8 and EN 1366-9

2 Normative references

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.

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

EN 1366-2, *Fire resistance tests for service installations — Part 2: Fire dampers*

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

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

EN 1751, *The aerodynamic testing of dampers and valves*

prEN ISO 13943, *Fire safety vocabulary*

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*

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

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

prEN 12101-7, *Smoke and heat control systems — Part 7: Smoke ducts*

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

prEN13501-4, *Fire Classification of Construction products and building elements — Part 4: Classification using data from fire resistance tests on components of smoke control systems*

3 Terms and definitions

Where not covered by EN ISO 13943 — Fire Safety Vocabulary, 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
attended control room
a room with people, who have the duty to control the smoke exhaust system, permanently (24 hours, seven days per week) monitor the incoming signals from the smoke control system and put the smoke control system into operation in case of smoke alarm. This ensures that the smoke control system is running and items such as dampers are in position within the system response time

3.3
back-up power supply
a power supply to operate the system when the normal power supply has failed

3.4
commissioning
the act of ensuring that all components and the system are installed and operating in accordance with this standard

3.5
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

3.6
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".

3.7
interface control unit
a device with control the operation of the actuator located at the damper or within the same fire zone as the damper

3.8
modulating actuators
a damper control mechanism which can control the damper to be in a position or number of positions between fully open and fully closed

3.9
muti compartment fire resisting smoke control damets
smoke control dampers for use in multi compartment areas, which may be associated with smoke control duct tested to prEN 1366-8 and/or may be installed in a fire compartment structure

3.10
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

3.11
natural smoke and heat control system
a smoke and heat ventilation system which uses natural ventilation. Natural ventilation is caused by bouyancy forces due to differences in density of the gases because of temperature differences

3.12
penetration seal
the product used between the smoke control system duct/damper and the fire compartment structure to maintain the fire resistance, when tested and having met the requirements of EN 1366-8, at the position where a smoke Control System Duct passes through the element, or a damper is mounted in the element

3.13
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

3.14
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)

3.15
remote signalling
a device located away from the damper which will indicate the damper position, open or closed

3.16
safety position
smoke control dampers do not have a designated safety postion, unlike fire dampers which are closed in their safety position. Specific projects may require certain dampers to move to an open or closed position, depending upon the fire location within the building

3.17
single compartment smoke control dampers
smoke control dampers for use in single compartment areas, which may be associated with smoke control duct tested to prEN 1366-9, and/or may be installed in an external wall, floor or roof

3.18
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

3.19
smoke and heat exhaust ventilation system (SHEVS)
a smoke and heat exhaust ventilation system consists 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

3.20
smoke and heat exhaust ventilator (SHEV)
device specially designed to move smoke and hot gases out of a construction work under conditions of fire

3.21
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

3.22
smoke control damper for systems with automatic activation
a smoke control damper that is applicable to the systems defined in 3.26

3.23
smoke control damper for systems with manual intervention
a smoke control damper that is applicable to the systems defined in 3.27 and 3.28

3.24
smoke control system damper
a device automatically or manually activated, which maybe open or closed in its operational position, to control the flow of smoke and hot gases into, from or within a duct

3.25
smoke control system duct
a duct used in a system to control the movement and /or containment of smoke and heat

3.26
smoke control system with automatic activation
a smoke control system (smoke and heat exhaust ventilation type or pressure differential type), that operates automatically on receipt of a smoke or fire alarm without any manual action/intervention. A system with an attended control room can also be accepted as an automatic system. Once initiated the system will not allow the damper position to be changed

3.27
smoke control system with automatic activation and with manual override
a smoke control system (smoke and heat exhaust ventilation type or pressure differential type), that can be put into operation as 3.26 on receipt of a smoke or fire alarm, but once initiated the system will allow the damper position to be changed by external input/firemans' override

3.28
smoke control system with manual Initiation
a smoke control system (smoke and heat exhaust ventilation type or pressurization type), that must be put into operation, on detection smoke or fire, by human intervention. (e.g. by pressing a button, or pulling a handle) leading to a sequence of automatic actions in the operation of the smoke control system. Once initiated the system may allow the damper position to be changed by external input/firemans' override

3.29
smoke layer
layer of smoke that stabilises underneath the roof due to the affect of temperature gradient

3.30
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

3.31
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

3.32
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

3.33
structural supports
the means of retaining the smoke control system duct to the building structure

3.34
system response time
the time from the initiation of the smoke control system to it being fully operational [This definition needs to be agreed with 12101-6 group since SC1 decided they have responsibility for this definition]

3.35
thermal operating device
temperature sensitive device which responds to initiate a subsequent action

3.36
triggering device
a device such as a fire detector system, smoke detector or pushbutton which sends an activating signal to the initiation device(s)

4 Test Equipment

4.1 General

In addition to the test equipment specified in prEN 1363-1, and if applicable, prEN 1363-2, the following is required: Examples of test configurations are shown in figures 1 and 2.

4.2 Connecting duct for multi compartment fire resisting smoke control damper maintenance of opening test and 1366-2 test

The connecting duct shall be of all welded construction fabricated from (1.5 ± 0.1) mm thick steel with a width and height appropriate to the size of fire damper being tested. The duct shall have a length of two times the diagonal dimension of the damper up to a maximum of 2m. The connecting duct shall be provided with a gas tight observation window.

4.3 Volume flow measuring station for multi compartment fire resisting smoke control damper maintenance of opening test and 1366-2 test

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 installed between the connecting duct and the exhaust fan to determine the volume flow rate of gases passing through the fire damper under test. The measuring device shall be capable of measuring to an accuracy of ± 5 %. Regardless of whether vertical or horizontal fire dampers are being tested, the volume flow measuring station shall always be used in a horizontal direction.

4.4 Cycling Equipment

Full information on the equipment needed to perform the cycling tests is shown in annex B. In addition the following must be considered.

Equipment will be required to control a supply to allow the damper actuator to be cycled. This equipment will be able to provide the nominal operating power less 10%, plus 15%, and be variable between these values to confirm that the damper will operate at the extremes. If the unit to be tested requires a control signal of any type this needs to be provide in addition and will be able to give the device a signal at each extreme and any in between these.

Methods of loading the smoke control damper will be required

NOTE A device that allows the damper to be cycled automatically, together with a method of recording completed cycles, would be useful, so that a test could be set to run without attendance, noting that each cycle could potentially take 120 seconds

4.5 Condensing unit

Where materials used in the construction of the test duct or the smoke control damper may generate quantities of steam during the fire test, a condensing unit having provisions for drainage shall be installed between the fire damper and the flow measuring device. When using the condensing device, the temperature recorded by the thermocouple positioned downstream of the flow measuring device described in 4.3 shall not exceed 40 °C.

A suitable condensing device may be considered to be a water tank fed with water at ambient temperature with [approximately 9 metres] of measuring duct immersed in the tank prior to reaching the measuring device providing that there is a means for removal of the condensate. Custom devices designed by individual laboratories that meet the 40°C condition and allow condensate removal are allowable.

4.6 Gas temperature measuring devices

These shall be positioned adjacent to the flow measuring device. A suitable device is a 1.5 mm diameter sheathed thermocouple orientated vertically with its measuring junction 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. A similar thermocouple shall be located at the exit from the connecting duct plenum (see Ffigure 1).

4.7 Exhaust fan system

This shall be capable of controlling the flow rates and maintaining the specified pressure differential between the connecting duct and the furnace when the fire damper is closed.

The pressure differential shall be regulated by means of a dilution damper installed just before the fan inlet. The pressure shall be controlled to within ± 5 % of the specified value. A balancing damper shall be fitted at the outlet of the fan to adjust the pressure range of the systems to suit the fire damper under test. A variable speed fan may be used instead of the dilution damper.

4.8 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.

NOTE 1 Table 2 gives details of perforated plates for standard rectangular ducts of size 1000 mm × 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 accepted; see 6.1.2 and Table 5).

Further details of the plate are shown in Figures n1,n2 and n3.

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 the fire test and pre-test calibration Pa
1	-500	-150
2	-1000	-300
3	-1500	-500
*) See clause 5.		

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 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
*) See clause 5.			

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
Horizontal 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
*) See clause 5.			

4.9 Inlet nozzles (fire test)

Each nozzle shall have an internal dimension of 160 mm (see Figure 10, suitable for the standard size of duct specified in 6.1) in accordance with ISO 5167/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 ± 5 %.