

BS EN 12101-7:2011



BSI Standards Publication

# Smoke and heat control systems

Part 7: Smoke duct sections

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**National foreword**

This British Standard is the UK implementation of EN 12101-7:2011.

The UK participation in its preparation was entrusted to Technical Committee FSH/25, Smoke, heat control systems and components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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**Smoke and heat control systems - Part 7: Smoke duct sections**Systèmes pour le contrôle des fumées et de la chaleur -  
Partie 7: Tronçons de conduit de désenfumageRauch- und Wärmefreihaltung - Teil 7:  
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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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists 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.

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## Foreword

This document (EN 12101-7:2011) has been prepared by Technical Committee CEN/TC 191 “Fixed firefighting systems”, 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of an identical text or by endorsement, at the latest by November 2011, and conflicting national standards shall be withdrawn at the latest by November 2011.

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 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: Installed SHEVS systems for smoke and heat ventilation (Technical Report (TR)),

Part 5: Guidelines on functional recommendations and calculation methods for smoke and heat exhaust ventilation systems (TR),

Part 6: Specification for pressure differential systems – Kits,

Part 7: Smoke duct sections (this standard),

Part 8: Smoke control dampers,

Part 9: Control panels,

Part 10: Power supplies.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

This European Standard contains the basic performance and requirements for smoke control duct sections, which are to be used in conjunction with pressure differential systems and smoke and heat control systems. They may also be used to pressurise when gas extinguishing systems are used.

Particular reference is required to EN 1366-8 and EN 1366-9, which define the fire resistance testing associated with these products and EN 13501-4, which provides details on their fire resistance classification.

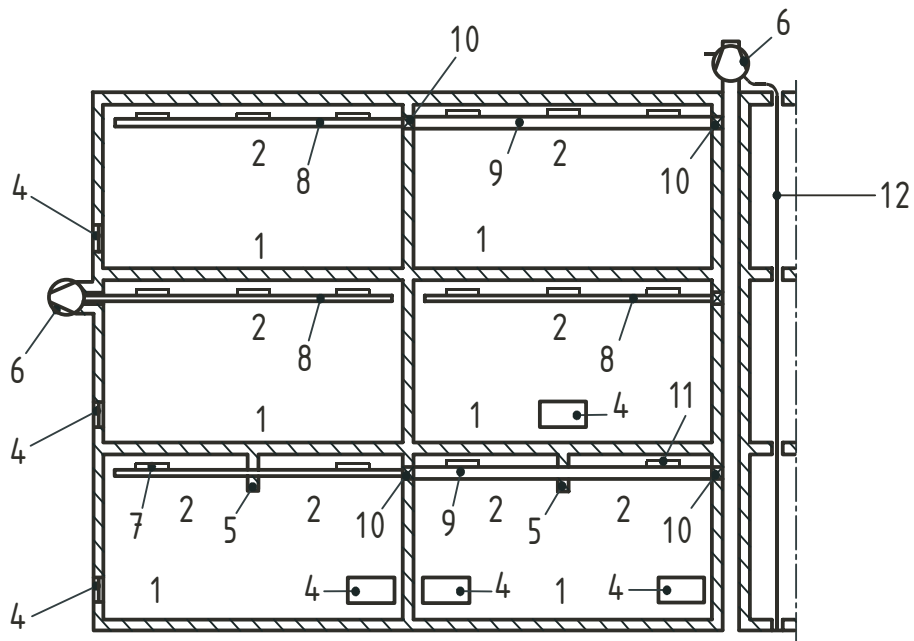
In addition to the prevention of transmission of smoke and combustion products from a fire zone, smoke control duct sections are utilised to contain the spillage of otherwise harmful and toxic extinguishing gases from the affected area, and for the control of pressurising and excess air relief within pressurisation systems.

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 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 ducts are commonly used in smoke and heat control systems. They may serve single compartments or a number of different fire compartments. The systems may be dedicated smoke extraction or possibly a combined environmental ventilation/smoke extraction.

The smoke and heat 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).



**Key**

- 1 Fire compartment
- 2 Smoke reservoir
- 4 Air inlet
- 5 Smoke barrier
- 6 Powered smoke and heat exhaust ventilator (fan)
- 7 Smoke control dampers for single compartments (FprEN 12101-8 and prEN 1366-10)
- 8 Smoke control duct sections for single compartments (FprEN 12101-7 and EN 1366-9)
- 9 Smoke control duct sections for multi compartments (FprEN 12101-7 and EN 1366-8)
- 10 Smoke control dampers for multi compartments (FprEN 12101-8 and prEN 1366-10) mounted inside or outside of wall or floor
- 11 Smoke control dampers for multi compartments (FprEN 12101-8 and prEN 1366-10) mounted on the surface of the duct
- 12 Electrical equipment

**Figure 1 – Example of powered smoke and heat exhaust ventilation**

Further guidance on the application of smoke control ducts may be found within the rest of the EN 12101 series of harmonised standards and technical reports.

The areas for which products supplied to this European Standard are considered applicable include for example:

- a) commercial premises,
- b) shopping and retail centres,
- c) hospitals,
- d) multi-residential buildings.

Smoke control duct sections are intended for use in the following types of systems, including:

- a) pressurisation,



- b) pressure relief,
- c) extraction systems,
- d) ductwork systems,
- e) inerting fire suppression systems.

It is realised that all the above systems do not address smoke directly, but similar properties are required of such smoke control ducts to limit leakage in a fire and smoke control situation.

## 1 Scope

This European Standard applies to smoke control duct sections, placed on the market and intended to operate as part of a pressure differential system or smoke and heat exhaust system. This standard specifies requirements and gives reference to the test methods defined for smoke control duct sections and their associated components (for example, hangers and other items proven at the time of testing), which are intended to be installed in such systems in buildings. It also provides for the evaluation of conformity of the products to the requirements of this standard. Furthermore, marking and information on installation and maintenance of these products are also given in this European Standard.

To avoid duplication, reference is made to a variety of other standards. To this end, this standard is to be read in conjunction with EN 1366-8, EN 1366-9 and EN 1366-1, for details of the fire resistance testing and EN 13501-4 for corresponding classification.

This standard has not considered in detail the detrimental and/or corrosive effects that may be caused by process chemicals present in the atmosphere, which are drawn through the system intentionally or inadvertently.

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

Ducts for use other than in smoke and heat exhaust/control systems are not covered by this standard.

## 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 1366-1, *Fire resistance tests for service installations – Part 1: Ducts*

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

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

EN 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 13943, *Fire safety – Vocabulary (ISO 13943:2008)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 13943, together with the following apply.

### 3.1

#### **air inlet**

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

### 3.2

#### **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

### 3.3

#### **fire compartment**

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

### 3.4

#### **natural smoke and heat control system**

smoke and heat ventilation system which uses natural ventilation

NOTE Natural ventilation is caused by buoyancy forces due to differences in density of the gases because of temperature differences.

### 3.5

#### **penetration seal**

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

### 3.6

#### **powered smoke and heat exhaust system**

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

### 3.7

#### **pressure differential systems**

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 EN 12101-6

### 3.8

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

system consisting of products and/or components jointly selected to exhaust smoke and heat

NOTE The products and/or components form a system in order to establish a buoyant layer of warm gases above cooler cleaner air.

### 3.9

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

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

### 3.10

#### **smoke barrier**

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

### 3.11

#### **smoke control damper**

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

### 3.12

#### **smoke control duct - horizontal**

smoke control duct which passes horizontally through vertical walls

### 3.13

#### **smoke control duct - multi compartment fire resisting**

fire resisting smoke control ducts, built from more than one smoke control duct section, for use in multi compartment applications designed to transport smoke and/or hot gases away from the source of a fire

NOTE May also have a dual function as a normal air conditioning duct.

### 3.14

#### **smoke control duct - single compartment**

smoke control ducts, built from more than one smoke control duct section, for use within single fire compartment application designed to transport smoke and/or hot gases away from the source of a fire

NOTE May also have a dual function as a normal air conditioning duct.

### 3.15

#### **smoke control duct - section**

element of smoke control duct constructed to form part of a smoke control system

### 3.16

#### **smoke control duct - vertical**

smoke control duct which passes vertically through horizontal floors

### 3.17

#### **smoke layer**

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

### 3.18

#### **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

### 3.19 smoke zone

#### **structural supports**

means of retaining the smoke control duct to the building structure

## 4 Smoke control duct section requirements

### 4.1 General

#### 4.1.1 Fire resistance - multi compartment smoke control duct section

The multi compartment smoke control duct section shall demonstrate the following and shall be classified in accordance with EN 13501-4:

- a) integrity: this shall be tested in accordance with test method in 5.2 and the integrity classification (E) declared;
- b) insulation: this shall be tested in accordance with test method in 5.2 and the insulation classification (I) declared;
- c) leakage: this shall be tested in accordance with test method in 5.2 and the leakage classification (S) declared;
- d) mechanical stability: this shall be tested in accordance with test method in 5.2 and forms part of the integrity classification (E) declared;
- e) maintenance of cross section: this shall be tested in accordance with test method in 5.2 and forms part of the integrity classification (E) declared.

#### **4.1.2 Fire resistance - single compartment smoke control duct section**

The single compartment smoke control duct section shall demonstrate the following and shall be classified in accordance with EN 13501-4:

- a) integrity: this shall be tested in accordance with test method in 5.2 and the integrity classification (E) declared;
- b) leakage: this shall be tested in accordance with test method in 5.2 and the leakage classification (S) declared;
- c) mechanical stability: this shall be tested in accordance with test method in 5.2 and forms part of the integrity classification (E) declared;
- d) maintenance of cross section: this shall be tested in accordance with test method in 5.2 and forms part of the integrity classification (E) declared.

### **4.2 Construction and components: characteristics**

#### **4.2.1 Construction and operation**

Smoke control ducts are required to maintain a clear path for the extract of smoke and heat. To achieve this, the following shall be considered part of the smoke control duct section assembly and their performance in the tests shown in 5.2 recorded.

#### **4.2.2 Structural supports used for smoke control duct sections**

Structural supports used for smoke control duct sections ensure the mechanical stability and maintenance of cross section. Full details of the structural supports used for the fire test shall be recorded.

#### **4.2.3 Duct sealant materials used in or between smoke control duct sections**

Sealants are often used to reduce the air/gas leakage from smoke and heat exhaust ventilation systems. Failure of these sealants whilst the smoke and heat exhaust ventilation system is operating in its emergency mode may result in the failure of the duct's leakage criteria. Full details of the sealants used for the fire test shall be recorded.

The following general requirements for duct sealants shall apply.

- a) The sealants shall be suitable for the environment to which the smoke control duct is to be subject.
- b) The sealants shall be durable for the proposed life of the smoke control duct section.
- c) The sealants shall be resistant to mechanical damage during the installation of the smoke control duct section.
- d) Any deterioration of the sealant shall not cause the smoke control duct section to fail the leakage criteria for the duct classification.

#### **4.2.4 Penetration seals between fire compartments**

Penetration seals are required to reduce the air/gas leakage between compartments. Failure of these penetration seals, whilst the smoke and heat control system is operating in its emergency mode, may result in the failure of the system to maintain smoke-free areas. Full details of the penetration seals used for the fire test shall be recorded.

The following general requirements for penetration seals shall apply.

- a) Penetration seals shall maintain the integrity and insulation criteria of the smoke control duct.
- b) The gap dimension between the inside edge of the supporting construction and the outer perimeter of the smoke control duct section, and hence the sealing details, shall follow the tested method when the smoke control duct section is installed within a building.

#### 4.2.5 Other components

Smoke control ducts often contain other components than structural supports and sealants. These shall not cause failure of the smoke extraction system whilst exhausting smoke from the building and shall be tested to meet the same requirements as the duct into which they are installed. Full details of any components used for the fire test shall be recorded.

Among these components may be the following equipment:

- access doors/panels,
- silencers or attenuators to limit noise,
- compensators,
- turning vanes,
- air flow/volume indication transponders,
- grilles, to control the direction of air/smoke movement at the terminals of the system.

Components shall be tested according to the principles of EN 1366-8 or EN 1366-9 to prove that they do not reduce the performance of the smoke control duct section already tested and classified. They shall be installed in accordance with the manufacturer's instructions for the component and any associated smoke control duct section.

### 4.3 Fire resistance performance criteria: Multi compartment fire resisting smoke control duct sections

#### 4.3.1 Integrity, insulation, leakage,

The assessment of integrity (E) of multi compartment smoke control duct sections, as one of the fire resistance performance characteristics, shall be made on the basis of:

- a) leakage through the duct section at ambient and after 15 minutes from the start of the fire test;
- b) the ability of the duct section to maintain its cross section when subjected to the fire test;
- c) the assessment of collapse of the duct within the furnace, to confirm mechanical stability;
- d) cracks or openings in excess of given dimensions and ignition of a cotton pad and sustained flaming on the non-exposed side at the perimeter of the duct section junction with the wall or floor or duct (the penetration);
- e) the suitability for use of the duct section at an under pressure, measured at ambient.

When insulation characteristics are proven for multi compartment fire resisting control duct sections, this shall be classified and declared, together with integrity.

A smoke leakage performance requirement is described in EN 13501-4 to allow the (S) classification, and this shall be applied, if the duct section is intended for the end uses where this performance is required (measured continuously after 15 minutes from the start of the fire test).

#### 4.3.2 Fire resistance classification and designation

Having achieved the performance criteria in 4.3.1, the multi compartment smoke control duct section shall be classified and designated in accordance with EN 13501-4.

The following shall be declared for each multi compartment smoke control duct section:

- a) integrity class "E", integrity and insulation class "EI" (in accordance to EN 13501-4);
- b) the additions of the indication(s) of suitability for vertical and/or horizontal use, together with mounting in a floor or in a wall or both, respectively: as  $v_e$  or  $h_o$ ;
- c) the addition of the symbol "S" indicates the satisfaction of an extra restriction on leakage;
- d) the addition of "500", "1000" or "1500" indicates the suitability of use up to these underpressures.

EXAMPLE EI 60 ( $v_e h_o$ ) S 500.

If the multi compartment smoke control duct section requirements defined in this clause are satisfied, this shall be deemed to satisfy also the corresponding single compartment smoke control duct section requirements in 4.4.1.

### 4.4 Fire resistance performance criteria: Single compartment smoke control duct sections

#### 4.4.1 Integrity, leakage

The assessment of integrity (E) of a single compartment smoke control duct section, as one of the fire resistance performance characteristics, shall be made on the basis of:

- a) leakage through the duct section at ambient and after 15 minutes from the start of the elevated temperature test;
- b) the ability of the duct section to maintain its cross section when subjected to the elevated temperature test (i.e. to 600 °C);
- c) the assessment of collapse of the duct within the furnace, to confirm mechanical stability;
- d) the suitability for use of the duct section at an under pressure, measured at ambient.

A smoke leakage performance requirement is described in EN 13501-4 to allow the (S) classification, and this shall be applied, if the duct section is intended for the end uses where this performance is required.

#### 4.4.2 Fire resistance classification and designation

Having achieved the performance criteria in 4.4.1, the single compartment smoke control duct section shall be classified and designated in accordance with EN 13501-4.

The following shall be declared for each single compartment smoke control duct section:

- a) integrity class "E<sub>600</sub>", (in accordance to EN 13501-4);
- b) The additions of the indication(s) of suitability for vertical and/or horizontal use, respectively: as  $v_e$ , or  $h_o$ ;
- c) The addition of the symbol "S" indicates the satisfaction of an extra restriction on leakage;

d) The addition of "500", "1000" or "1500" indicates the suitability of use up to these underpressures.

EXAMPLE E<sub>600</sub> 60 (v<sub>e</sub>, h<sub>0</sub>) S 1500.

## 5 Test methods

### 5.1 Ambient leakage tests

The openings in the duct inside the furnace shall be sealed and the test method shall be in accordance with EN 1366-8 or EN 1366-9.

### 5.2 Fire resistance tests

#### 5.2.1 General

In addition to other requirements in this standard, the smoke control duct section shall be subjected to a furnace based fire resistance test. The purpose of the test is to evaluate the ability of a smoke control duct section to prevent fire and smoke spreading from one fire compartment to another through the ductwork system which may penetrate fire separating walls and floors.

In addition the test assesses the tightness of the ductwork while hot gases are drawn through the extraction system, ensuring that only small quantities of clean air could be sucked into the duct from areas not affected by a fire, and demonstrating low leakage out in positive pressure situations.

Single compartment smoke control duct sections will be subjected to an elevated temperature test matching the standard time temperature heating curve but levelling out to a flat maximum of 600 °C. Multi-compartment smoke control duct sections will be subjected to a fire test to the standard time temperature test curve.

Hot gases from inside the furnace are drawn through the smoke control duct section to the outside. The provision of a perforated plate allows the smoke control duct section outside the furnace to be subjected to pressure differential of 500Pa. The leakage of the smoke control duct section outside the furnace is recorded. The leakage rate of duct sections requiring an S classification shall be measured both at ambient temperature and during the fire test.

Temperature and integrity measurements shall be carried out in various parts of the test construction during the test. Observations on the duct hangers and the penetration seal will be made to confirm maintenance of stability and the maximum allowable reduction in cross section.

#### 5.2.2 Smoke control duct section: integrity and insulation

##### 5.2.2.1 Multi compartment smoke control duct section

Equipment, method and section size as fully described in EN 1366-8, shall be subjected to the fire resistance test. Sections shall be fire tested in the plane of proposed installation, noting the direct field of application of fire test results.

##### 5.2.2.2 Single compartment smoke control duct section

Equipment, method and section size as fully described in EN 1366-9, shall be subjected to the fire resistance test. Sections shall be fire tested in the plane of proposed installation, noting the direct field of application of fire test results. An insulation classification is not available.



### **5.2.3 Leakage rated smoke control duct section**

#### **5.2.3.1 Multi compartment smoke control duct section**

Equipment, method and section size as fully described in EN 1366-8, shall be subjected to the fire resistance test. Sections shall be fire tested in the plane of proposed installation, noting the direct field of application of fire test results.

#### **5.2.3.2 Single compartment smoke control duct section**

Equipment, method and section size as fully described in EN 1366-9, shall be subjected to the fire resistance test. Sections shall be fire tested in the plane of proposed installation, noting the direct field of application of fire test results.

## **6 Evaluation of conformity**

### **6.1 General**

The compliance of a smoke control duct section with the requirements of this standard shall be demonstrated by:

- initial type testing (ITT),
- factory production control (FPC).

For smoke control duct sections produced as one-offs, pre-production smoke control duct sections (e.g. prototypes) and smoke control duct sections produced in very low quantities, 6.4 shall apply.

### **6.2 Initial type testing (ITT)**

#### **6.2.1 General**

Initial type testing (ITT) shall be performed to demonstrate compliance of smoke control duct sections with this European Standard.

All essential characteristics for which the manufacturer declares performances are subject to initial type testing. Tests shall be carried out in accordance with Clause 5. No smoke control duct section needs to be re-tested for the sake of proving repeatability, but more than one smoke control duct section shall be required to be tested to cover different applications.

Because the objective of the general testing procedures is to establish the ability of the smoke control duct section to achieve the product design and performance requirements and classification in its operational position (i.e. end use conditions), and to continue to act as a barrier/opening for a designated period of time, the complete product to be installed shall be tested.

#### **6.2.2 Modifications**

In the case of modification of the smoke control duct section or of the method of production (where these may affect the stated performance characteristics), the initial type testing shall also be performed. All characteristics given in Clause 4, which may be changed by the modification, shall be subject to this initial type testing, except those tests described in 6.2.3.

### 6.2.3 Previous tests and product families

Tests previously performed in accordance with the provisions of this standard may be taken into account for the ITT purpose providing that the tests:

- were equivalent or more rigorous;
- were carried out by a third party in the frame of a national/voluntary certification scheme;
- were carried out on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

Products may be grouped into families where the results for one or more characteristics from any one product in the family are representative for all other products within that family.

NOTE 1 Products may be in different families for different characteristics.

NOTE 2 Reference to the test methods standards should be made to allow the selection of a suitable representative sample.

In addition, type tests or initial type testing shall be performed for all characteristics included in the standard for which the manufacturer declares performances:

- at the beginning of the production of a new or modified smoke control duct section design, the raw material or supplier of the components;
- at the beginning of a new or modified method of production (where this may affect the stated properties);  
or
- they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the smoke control duct section design, in the raw material or in the supplier of the components, or in the production process (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where kit components are used whose characteristics have already been determined, by the component manufacturer, on the basis of compliance with other technical specifications, these characteristics need not be reassessed. The specifications of these components shall be documented, as shall the inspection scheme for ensuring their compliance.

Products CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated with the CE marking, although this does not replace the responsibility of the smoke control duct section designer to ensure that the smoke control duct section as a whole is correctly designed and its components have the necessary performance values to meet the design.

### 6.2.4 Test samples

Test samples of smoke control duct sections shall be representative of the normal production.

If the technical documentation (see 8.1) of the test samples does not give a sufficient basis for later compliance checks, a reference test sample (identified and marked) shall remain available for this purpose.

### 6.2.5 Test report

All initial type testing and its results shall be documented in a test report.

## **6.3 Factory product control (FPC)**

### **6.3.1 General**

The manufacturer shall establish, document and maintain an FPC system in a form of permanent internal control of production to ensure that the smoke control duct section placed on the market continuously complies with the ITT sample, for which compliance with this European Standard has been verified and expressed by the smoke control duct section's stated performance characteristics.

If the manufacturer has the product designed, manufactured, assembled, packed, processed and labelled by subcontracting, FPC of the original manufacturer may be taken into account. However, where subcontracting takes place, the manufacturer shall retain the overall control of the products and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard. The manufacturer who subcontracts all of his activities may in no circumstances pass his responsibilities on to a subcontractor.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required smoke control duct section characteristics and the effective operation of the production control system to be checked.

FPC therefore brings together operational techniques and all measures allowing maintenance and control of the conformity of the product with its technical specifications. Its implementation may be achieved by controls and tests on measuring equipment, raw materials and constituents, processes, machines and manufacturing equipment and finished products, including material properties in products, and by making use of the results thus obtained.

### **6.3.2 General requirements**

Manufacturers having an FPC system which complies with EN ISO 9001 and which addresses the requirements of this harmonised standard are recognised as satisfying the FPC requirements of the Council Directive 89/106/EEC.

Where a manufacturer operates different production lines or units in the same factory, or production lines or units in different factories, and these are covered by a single, overall FPC system, the manufacturer still has to keep control records for each separate production line or unit (and this shall be made a requirement of the technical specification). However, when performing FPC inspections, although the product specific aspects always need to be evaluated, the Notified Body does not have to repeat systematically the assessment of "general" FPC provisions which apply to all lines/units.

### **6.3.3 FPC specific requirements**

#### **6.3.3.1 General**

The FPC system shall:

- address this European Standard, and
- ensure that the products placed on the market conform with the stated performance characteristics.

This involves:

- a) the preparation of documented procedures and instructions relating to factory production control operations;
- b) the effective implementation of these procedures and instructions;

- c) the recording of these operations and their results;
- d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-conformity.

Production control operations include some or all of the following operations:

- a) the specification and verification of raw materials and constituents;
- b) the controls and tests to be carried out during manufacture according to a frequency laid down in the prescribed test plan;
- c) the verifications and tests to be carried out on finished products according to a frequency in accordance with Annex B and adapted to the product and its conditions of manufacture.

NOTE Depending on the specific case, it may be necessary to carry out i) the operations referred to under b) and c), ii) only the operations under b) or iii) only those under c).

The operations under b) centre as much on the intermediate states of the product as on manufacturing machines and their adjustment, and equipment etc. These controls and tests and their frequency are chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

With regard to operations under c), where there is no control of finished products at the time that they are placed on the market, the manufacturer shall ensure that packaging, and reasonable conditions of handling and storage, do not damage products and that the product remains in conformity with the technical specification.

The appropriate calibrations shall be carried out on defined measuring and test instruments.

### **6.3.3.2 Verification and tests**

#### **6.3.3.2.1 General**

The manufacturer shall have or have available the installations, equipment and personnel which enable him to carry out the necessary verifications and tests. He may, as may his agent, meet this requirement by concluding a sub-contracting agreement with one or more organisations or persons having the necessary skills and equipment.

The manufacturer shall calibrate or verify and maintain the control, measuring or test equipment in good operating condition, whether or not it belongs to him, with a view to demonstrating conformity of the product with its technical specification.

The equipment shall be used in conformity with the specification or the test reference system to which the specification refers.

#### **6.3.3.2.2 Monitoring of conformity**

If necessary, monitoring shall be carried out of the conformity of intermediate states of the product and at the main stages of its production.

NOTE This monitoring of conformity focuses where necessary on the product throughout the process of manufacture, so that only products having passed the scheduled intermediate controls and tests are dispatched.

#### **6.3.3.2.3 Prescribed test plan**

Tests shall be in accordance with the test plan in Annex B.

#### **6.3.3.2.4 Test records**

The manufacturer should establish and maintain records which provide evidence that the product has been tested. These records should show clearly whether the product has satisfied the defined acceptance criteria. Where the product fails to satisfy the acceptance measures, the provisions for non-conforming products should apply.

#### **6.3.3.2.5 Treatment of products which do not conform**

If control or test results show that the product does not meet the requirements, for example if the statistical variation of test results exceeds the limits allowed by the technical specification (see Annex B), the necessary corrective action shall immediately be taken.

Products or batches not conforming shall be isolated and properly identified. Once the fault has been corrected, the test or verification in question shall be repeated.

If products have been delivered before the results are available, a procedure and record should be maintained for notifying customers.

#### **6.3.3.2.6 Recording of verifications and tests (manufacturer's register)**

The results of factory production controls shall be properly recorded in the manufacturer's register. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the register under the signature of the person responsible for control who carried out the verification.

With regard to any control result not meeting the requirements of the technical specification, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the register.

#### **6.3.3.2.7 Traceability**

It is the manufacturer's, or his agent's, responsibility to keep full records of individual products or product batches, including their related manufacturing details and characteristics, and to keep records of to whom these products or batches were first sold. Individual products or batches of products and the related manufacturing details shall be completely identifiable and retraceable. In certain cases, for example for bulk products, a rigorous traceability is not possible. The expression of the requirement in the relevant technical specifications should be realistically adapted keeping in view a traceability as complete as possible.

### **6.3.4 Initial inspection of factory and FPC**

**6.3.4.1** Initial inspection of factory and FPC shall be carried out when the production is already running and the FPC is already in practice.

**6.3.4.2** The following shall be assessed:

- the FPC-documentation, and
- the factory.

In the initial assessment of the factory and FPC, the following shall be verified:

- a) that all resources necessary for the achievement of the product characteristics required by this European Standard are (see 6.3.4.1) available, and

- b) that the FPC-procedures in accordance with the FPC-documentation are (see 6.3.4.1) implemented and followed in practice, and
- c) that the product complies (see 6.3.4.1) with the initial type testing samples, for which compliance with this European Standard has been verified.

**6.3.4.3** All assessments and their results shall be documented in a report.

### **6.3.5 Continuous surveillance of FPC**

**6.3.5.1** The factory, which has been assessed according to 6.3.4, shall be re-assessed annually.

**6.3.5.2** All assessments and their results shall be documented in a report.

### **6.3.6 Procedure for modifications**

In the case of modification of the smoke control duct section, the method of production or the FPC system (where these may affect the smoke control duct section's declared performance characteristics), a re-assessment of the factory and of the FPC system shall be performed for those aspects (including the relevant ITT), which may be affected by the modification.

All assessments and their results shall be documented in a report.

## **6.4 One-off smoke control duct sections, pre-production smoke control duct sections (e.g. prototypes) and smoke control duct sections produced in very low quantities**

Smoke control duct sections produced as a one-off, prototypes assessed before full production is established, and smoke control duct sections produced in very low quantities (less than 30 per year) shall be assessed as follows.

For initial type assessment, the provisions of 6.2 shall apply, with the following exceptions:

- all smoke control duct sections presented for test shall be supported by full design documentation,
- a sampling process is not required as no "production" batch will be available.

The FPC system of one-off smoke control duct sections and those produced in very low quantities shall ensure that raw materials and/or components are sufficient for their production. The provisions of 6.3 shall apply, only where appropriate. The records allowing traceability of the smoke control duct sections shall be maintained.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

- the FPC-documentation; and
- the factory.

In the initial assessment of the factory and FPC it shall be verified:

- a) that all resources necessary for the achievement of smoke control duct sections characteristics required by this European Standard will be available, and
- b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a smoke control duct section complying with the requirements of this European Standard and that smoke control duct sections will be the same as the initial type testing samples, for which compliance with this European Standard has been verified.

Once series production is fully established, the provisions of FPC in 6.3 shall apply.

## 7 Marking and documentation

Each smoke control duct section shall be marked as follows:

- the name or identifying mark of the manufacturer,
- the model/type,
- the number of this standard and the year of its publication (i.e. EN 12101-7:2011), followed by the generic name of the product "Smoke Control Duct Section",
- the classification for resistance to fire and other related information according to EN 13501-4,
- if the smoke control duct section has an S classification (EN 13501-4), the words "leakage rated" shall be added,
- the date of manufacture (month and year).

NOTE Where ZA.3 covers the same information as this clause, the requirements of this clause are met

## 8 Product, installation and maintenance information (documentation)

### 8.1 Product specification

The manufacturer shall provide, and retain a detailed description of the product including all the relevant components. This shall include a description of the materials used (e.g. densities, thickness) in the construction of the smoke control duct.

Full details of the hanging system and any protection used shall be described

It shall include details of the supporting construction (wall/floor etc) and the method of installation, including the penetration sealing product and fixing details.

Full details and specifications of any components used shall be described.

### 8.2 Installation information

The manufacturer shall provide appropriate installation details that shall include at least information for:

- a) fixing and installation: hangers and positions, penetration seals to be used;
- b) health and safety information to allow safe installation.

### 8.3 Maintenance information

The manufacturer shall provide appropriate maintenance information for the smoke control duct section that shall include at least:

- a) inspection and maintenance procedures;

NOTE Regular testing/inspection should be undertaken to meet regulatory requirements, or at intervals not exceeding 12 months. A comprehensive example of the above procedure is given in Annex A.

- b) the recommended frequency of operational checks;
- c) recommended checks to establish the effects of corrosion.



## Annex A (informative)

### Example of inspection and maintenance procedure

After installation, when the system is running, it is recommended that the following is carried out and recorded. An example of the inspection procedure is shown in Table A.1. These inspections should be undertaken at the time intervals stated in the manufacturer's maintenance information (refer to Clause 6 of this standard), but at least once per year.

**NOTE** This is a guide to a minimum level, there may be regulatory requirements that require more frequent checking and maintenance and these shall be followed where required.

**Table A.1 – Example of inspection record**

Duct section reference	
Date of inspection	
Check ducting for damage	
Check connections between duct sections and ancillary components	
Check penetration seals at compartment boundaries	
Check duct cleanliness and clean where necessary	
Check the condition of seals, rectify and report where necessary	
Confirm that the duct fulfils its function as part of the smoke control system	
<p><b>NOTE</b> A smoke control duct section is inherently part of a smoke control system. As this is the case the whole system should be checked as governed by the operation and maintenance requirements for the system.</p>	

**Annex B**  
 (normative)

**Factory production control – test plan**

One smoke control duct section per product family, shall be submitted to the checks indicated in Table B.1, according to the foreseen frequency. The results of the checks shall be recorded.

**Table B.1 — Checks frequency and workmanship**

<b>Annually</b>	<b>Daily</b>	<b>General</b>
Carry out a third party certification product audit by notified body	<p>A leakage test shall be carried out daily on one smoke control duct section and one fitting (if applicable). The leakage test shall be carried out at the applicable under-pressure and the leakage shall not exceed the classification defined value +10 %</p> <p>The leakage test results shall be documented and retained for 5 years</p>	<p>The construction of both smoke control duct sections and fittings shall conform to ITT.</p> <p>Tolerances for the manufacture of any smoke control duct sections shall meet the general tolerances applying to the materials used, such that the product specification (see 8.1) and the ITT are reflected in standard manufacture. These tolerances shall be recorded, together with the method of demonstrating that they are maintained.</p>

## Annex ZA (informative)

### Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

#### ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/109, Fire alarm/detection, fixed firefighting, fire and smoke control and explosion suppression products, given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the smoke control duct sections covered by this annex for the intended uses indicated herein; reference shall be made to the information given with the CE marking.

**WARNING** — Other requirements and other EU Directives, not affecting the fitness for intended use may be applicable to the smoke control duct sections falling within the scope of this standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through <http://ec.europa.eu/enterprise/construction/cpd-ds>).

This annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1. It establishes the conditions for the CE marking of the smoke control duct sections intended for the uses indicated below and shows the relevant clauses applicable (see Table ZA.1).

**Construction products:** Smoke control duct sections.

**Intended use:** Smoke control duct sections that are to be used in smoke control systems, either at 600 °C or under fire conditions.

**Table ZA.1a – Relevant clauses for multi-compartment smoke control duct sections**

<b>Construction products:</b> Smoke control duct sections			
<b>Intended use:</b> Smoke control duct sections that are to be used in smoke control systems, either at 600 °C or under fire conditions			
<b>Essential characteristics</b>	<b>Requirement clauses in this European Standard</b>	<b>Mandated levels and/or classes</b>	<b>Notes</b>
Fire resistance			
– integrity	4.1.1 a), 4.3.1	E	
– insulation,	4.1.1 b), 4.3.1	EI	
– smoke leakage,	4.1.1 c), 4.3.1	ES EIS	
– mechanical stability (under E)	4.1.1 d)	-	
– maintenance of cross-section (under E)	4.1.1 e)	-	

**Table ZA.1b – Relevant clauses for single compartment smoke control duct sections**

<b>Construction products:</b> Smoke control duct sections			
<b>Intended use:</b> Smoke control duct sections that are to be used in smoke control systems, either at 600 °C or under fire conditions			
<b>Essential characteristics</b>	<b>Requirement clauses in this European Standard</b>	<b>Mandated levels and/or classes</b>	<b>Notes</b>
Fire resistance			
– integrity	4.1.2 a), 4.4.1	E <sub>600</sub>	An insulation classification is not required for single compartment smoke control duct sections
– insulation,	-	-	
– smoke leakage,	4.1.2 b), 4.4.1	E <sub>600</sub> S	
– mechanical stability (under E)	4.1.2 c)	-	
– maintenance of cross-section (under E)	4.1.2 d)	-	

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

## ZA.2 Procedure for the attestation of conformity of smoke control duct sections

The system of attestation of conformity of smoke control duct sections indicated in Table ZA.1 in accordance with the EC Decision 1996/577/EC (*OJEU L254 of 1996-10-08*), as amended by EC Decision 2002/592/EC (*OJEU L192, 2002-07-20*), as given in Annex III of the Mandate for Fire alarm/detection, fixed fire-fighting, fire and smoke control and explosion suppression products, is shown in Table ZA.2 for the indicated intended use and relevant level or class.

**Table ZA.2 – Attestation of conformity system**

Product	Intended use	Level(s) or class(es)	Attestation of conformity system
Smoke control duct sections	Smoke control and Fire safety		1
System 1: See Directive 89/106/EEC CPD Annex III.2(i), without audit testing of samples.			

The attestation of conformity of the smoke control duct sections in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Table ZA.3 resulting from application of the clauses of this or other European Standard indicated therein.

**Table ZA.3 – Assignment of evaluation of conformity tasks for smoke control duct sections under system 1**

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Tables ZA.1a and ZA.1b relevant for the intended use which are declared	6.3.3
	Further testing of samples taken at factory according to the prescribed test plan	All characteristics of Tables ZA.1a and ZA.1b relevant for the intended use which are declared	6.3.3
Tasks under the responsibility of the notified product certification body	Initial type testing (ITT)	All characteristics of Tables ZA.1a and ZA.1b relevant for the intended use which are declared	6.2
	Initial inspection of factory and of FPC	Parameters related to all characteristics of Tables ZA.1a and ZA.1b relevant for the intended use which are declared	6.3.4
	Continuous surveillance, assessment and approval of FPC	Parameters related to all characteristics of Tables ZA.1a and ZA.1b relevant for the intended use which are declared	6.3.5

### **ZA.2.2 EC certificate of conformity and EC declaration of conformity**

When compliance with the conditions of this annex is achieved, the notified product certification body shall draw up an EC certificate of conformity, which entitles the manufacturer to affix the CE marking. This certificate shall include:

- name, address and identification number of the notified product certification body,
- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production,

NOTE The manufacturer may also be the person responsible for placing the product on to the EEA market, if he takes responsibility for the CE marking.


- description of the product (type, identification, use,...),
- provisions to which the product comply (i.e. Annex ZA of this European Standard),
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions),
- the number of the EC certificate of conformity,
- name of, and position held by, the person empowered to sign the certificate.

### ZA.3 CE Marking

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on a label on each smoke control duct section and on the accompanying commercial documents (e.g. a delivery note). The following information shall accompany the CE marking symbol:

- a) identification number of the certification body;
- b) name or identifying mark and registered address of the manufacturer (see NOTE in ZA.2.2);
- c) the last two digits of the year in which the marking is affixed;
- d) number of the EC certificate of conformity or factory production control certificate ;
- e) reference to this European Standard;
- f) description of the product: generic name, model/type, material, dimensions,... and intended use;
- g) information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as a classification to EN13501-4.

Figure ZA.1 gives an example of the CE marking information to appear on the smoke control duct sections.

 01234	<i>CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC</i>  <i>Identification number of the notified product certification body</i>
<b>AnyCo Ltd, PO Box 21, B-1050</b>  <b>10</b>  01234-CPD-00234	<i>Name or identifying mark and registered address of the manufacturer</i>  <i>Last two digits of the year in which the marking was affixed</i>  <i>Number of the EC certificate of conformity</i>
<b>EN 12101-7</b>  Smoke control duct section  Model: DUCT X	<i>No. of European Standard</i> <i>Description of product</i>  <i>Manufacturer's Type/Model number</i>
<b>Classification</b>  E <sub>600</sub> 60 v <sub>e</sub> S 1000	<i>Classification to EN 13501-4</i>

**Figure ZA.1 – Example of CE marking information to be shown on the smoke control duct sections**

In addition to any specific information relating to dangerous substances shown above, the product shall also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE 1 European legislation without national derogations need not be mentioned.

NOTE 2 Affixing the CE marking symbol means, if a product is subject to more than one directive, that it complies with all applicable directives.

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