
Smoke and heat control systems —
Part 8:
Smoke control dampers

Systèmes pour le contrôle des fumées et de la chaleur —
Partie 8: Volets des désenfumage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 11, *Smoke and heat control systems and components*.

A list of all the parts in the ISO 21927 series can be found on the ISO website.

Introduction

This document contains the basic performance and requirements for smoke control dampers that are to be used in conjunction with pressure differential systems and smoke and heat control systems. They can also be used to pressurize when gas extinguishing systems are used.

Particular reference is made to EN 1366-10, which defines the furnace 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 dampers are utilized to contain the spillage of otherwise harmful and toxic extinguishing gases from the affected area and for the control of pressurizing and excess air relief within pressurization systems.

Smoke control systems are designed to fulfil the following basic functions.

- 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 system duct may or may not pass through other compartments of the building to reach the outside of the building.
- c) The use of pressurization to maintain smoke-free clear areas.

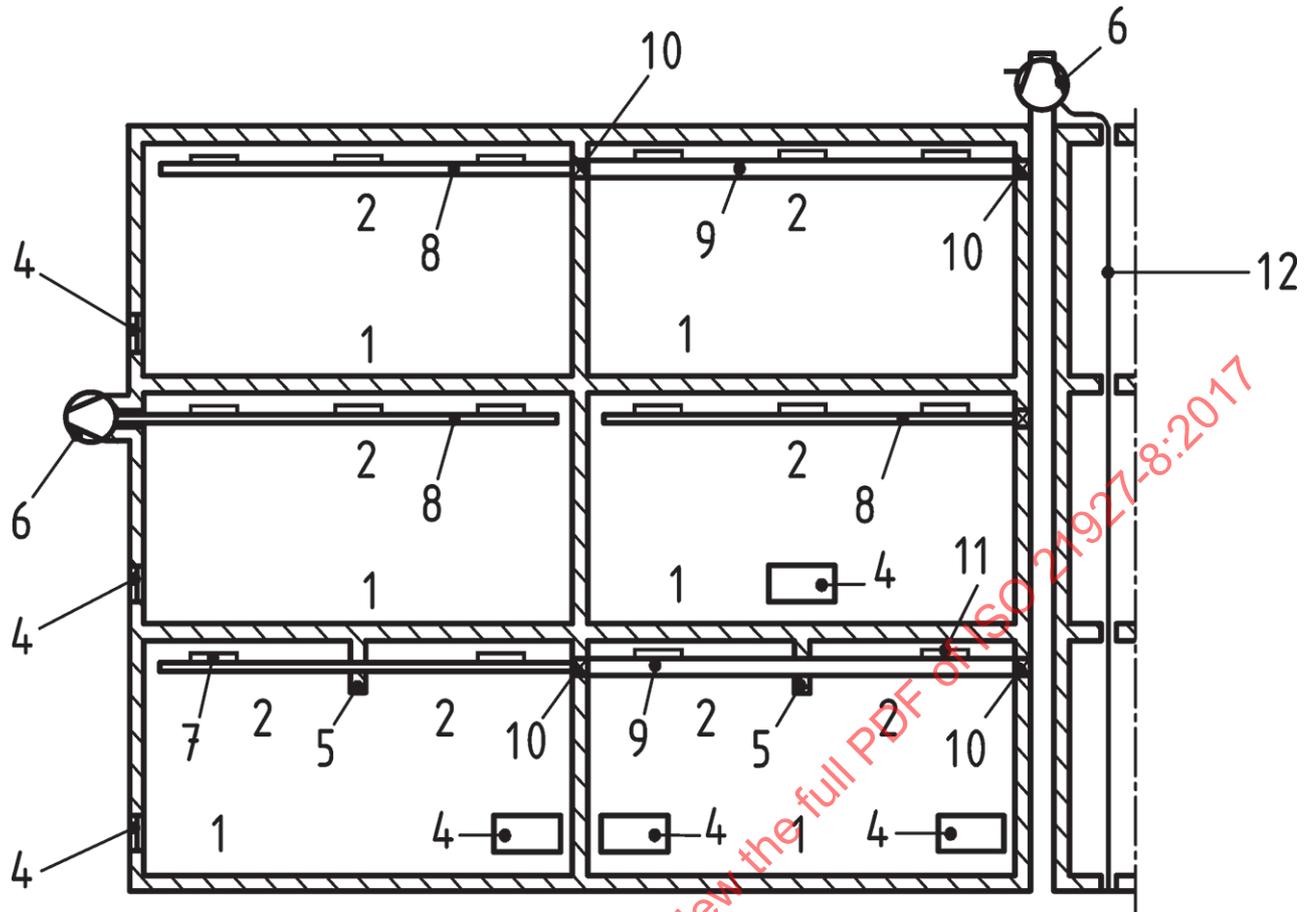
Smoke control dampers are commonly used in smoke and heat control systems as a means of limiting the number of ducts and high temperature fan units. The ducts into which such smoke control dampers are fitted generally serve a number of different fire compartments. The systems can be dedicated smoke extraction or possibly a combined environmental ventilation/smoke extraction.

The smoke and heat control system can remove smoke using either high temperature fans (in accordance with ISO 21927-3) or natural ventilators (in accordance with ISO 21927-2).

It may be necessary for a number of reasons (fire growth, smoke release, etc.) that the open smoke control damper(s) is (are) required to close and that the damper(s) previously closed is (are) required to open.

The tests defined in this document are based on the assumption that when smoke is detected within a building, all smoke control dampers other than those serving the fire compartment/smoke reservoir (where the fire has initiated) remain closed or move to the closed position. All smoke control dampers serving the smoke-affected fire compartment/smoke reservoir remain open or move to the open position, and the fan(s) started/natural vents opened.

NOTE [Figure 1](#) gives examples of installation positions, but these are not the only positions where dampers can be fitted.



Key

- 1 fire compartment
- 2 smoke reservoir
- 3 air inlet
- 4 smoke barrier
- 5 powered smoke and heat exhaust ventilator (fan)
- 6 smoke control dampers for single-compartments
- 7 smoke control ducts for single-compartments
- 8 smoke control ducts for multi-compartments
- 9 smoke control dampers for multi-compartments mounted inside or outside of wall or floor
- 10 smoke control dampers for multi-compartments mounted on the surface of the duct
- 11 electrical equipment

Figure 1 — Example of powered smoke and heat exhaust ventilation

Further guidance on the application of smoke control dampers can be found within the rest of the EN 12101 series and technical reports.

The areas for which products supplied to this document are considered applicable including, for example:

- a) commercial premises;
- b) shopping and retail centres;
- c) hospitals;

d) multi-residential buildings.

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

- 1) pressurization;
- 2) pressure relief;
- 3) extraction systems;
- 4) ductwork systems;
- 5) inerting fire suppression systems.

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

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Smoke and heat control systems —

Part 8: Smoke control dampers

1 Scope

This document applies to smoke control dampers, placed on the market and intended to operate as part of a pressure differential system or smoke and heat control system. This document specifies requirements and gives reference to the test methods defined for smoke control dampers and their associated components, such as actuators which are intended to be installed in such systems in buildings. Furthermore, provision on marking and information on installation and maintenance of these products are also given.

This document distinguishes between two categories of smoke control dampers, i.e. single-compartment smoke control dampers and multi-compartment fire-resisting smoke control dampers.

Smoke control dampers covered by this document can be installed into smoke control system ducts or onto the ducts' surface. They can be installed also into a wall, floor or ceiling/roof elements or onto the surface of these elements.

NOTE To avoid duplication, reference is made to a variety of other standards. To this end, this document can be read in conjunction with EN 13501-4, EN 1366-10 and ISO 10294-1 for details of the furnace testing.

This document does not consider in detail the detrimental and/or corrosive effects that can be caused by process chemicals present in the atmosphere, which are drawn through the system intentionally or inadvertently.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5135, *Acoustics — Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room*

ISO 7244, *Air distribution and air diffusion — Aerodynamic testing of dampers and valves*

ISO 10294-1, *Fire resistance tests — Fire dampers for air distribution systems — Part 1: Test method*

ISO 13943, *Fire safety — Vocabulary*

ISO 21927-9, *Smoke and heat control systems — Part 9: Specification for control equipment*

ISO 21927-10, *Smoke and heat control systems — Part 10: Specification for power output devices*

EN 1366-10, *Fire resistance tests for service installations — Part 10: Smoke control dampers*

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*

IEC 60068-2-52:1996, *Environmental testing — Part 2: Tests — Test Kb: Salt mist, cyclic (sodium chloride solution)*

3 Terms and definitions

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

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

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

3.1

air inlet

device connected to outside air to allow the inlet of air from outside the building

3.2

attended control room

room with people, who have the duty to control the smoke exhaust system permanently (24 hours per day, seven days per week), monitor the incoming signals from the smoke control systems and put the smoke control system into operation in case of smoke alarm

Note 1 to entry: This ensures that the smoke control system is running and items such as dampers are in position within the system response time.

3.3

elevated temperature

temperature 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, to gain classification

3.4

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

3.5

interface control unit

device which controls the operation of the actuator located at the damper or within the same fire zone as the damper

3.6

multi-compartment smoke control damper

smoke control dampers, which are fire-resisting, for use in multi-compartment areas, which may be associated with multi- or single-compartment smoke control ductwork and/or may be installed in a fire compartment structure

3.7

multi-compartment fire-resisting smoke control duct

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 1 to entry: May also have a dual function as a normal air conditioning duct.

Note 2 to entry: For more details, see ISO 21927-7.

3.8

natural smoke and heat control system

smoke and heat ventilation system which uses natural ventilation

Note 1 to entry: Natural ventilation is caused by buoyancy forces due to differences in density of the gases because of temperature differences.

3.9**penetration seal**

product tested for use between the smoke control duct/damper and the fire compartment structure to maintain the fire resistance, at the position where a smoke control system duct passes through the element, or a damper is mounted in the element

3.10**powered smoke and heat exhaust system**

smoke and heat ventilation system, which utilizes 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

3.11**pressure differential system**

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

3.12**remote signalling**

device located away from the damper which will indicate the damper position, open or closed

3.13**safety position**

position (open or closed) into which specific projects may require certain dampers to move, depending upon the fire location within the building

3.14**single-compartment smoke control damper**

smoke control damper for use in single-compartment areas, which may be associated with single-compartment smoke control ductwork and/or may be installed in an external wall or roof

3.15**single-compartment smoke control duct**

smoke control duct, 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 1 to entry: May also have a dual function as a normal air conditioning duct.

Note 2 to entry: For more details, see ISO 21927-7.

3.16**smoke and heat exhaust ventilation system****SHEVS**

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

Note 1 to entry: The products and/or components form a system in order to establish a buoyant layer of warm gases above cooler cleaner air.

3.17**smoke and heat exhaust ventilator****SHEV**

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

3.18**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

3.19

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

3.20

smoke control damper

<horizontal installation> *smoke control damper* (3.19) fitted in-line across a vertical duct, or on the top and bottom surface of a horizontal duct

3.21

smoke control damper

<vertical installation> *smoke control damper* (3.19) fitted in-line across a horizontal duct, or on the sides of a horizontal duct, or on any surface of a vertical duct

3.22

smoke control duct

<section> element of smoke control duct constructed to form part of a smoke control system

Note 1 to entry: For more details, see ISO 21927-7.

3.23

smoke control system with automatic activation

smoke control system that operates automatically on receipt of a smoke or fire alarm without any manual action/intervention

Note 1 to entry: A system with an attended control room can also be accepted as an automatic system. Once initiated, the system will not cause the damper position to be changed.

Note 2 to entry: This system can be smoke and heat exhaust ventilation type or pressure differential type.

3.24

smoke control system with automatic activation and with manual override

smoke control system that can be put into operation as 3.23 on receipt of a smoke or fire alarm, but once initiated, the system will allow the damper position to be changed by external input or fireman's override

Note 1 to entry: This system can be smoke and heat exhaust ventilation type or pressure differential type.

3.25

smoke control system with manual initiation

smoke control system that has to be put into operation, on detection of 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

Note 1 to entry: Once initiated, the system may allow the damper position to be changed by external input or fireman's override.

Note 2 to entry: This system can be smoke and heat exhaust ventilation type or pressurization type.

3.26

smoke-free clear area

volume of air which is unpolluted by smoke

3.27

smoke layer

layer of smoke that stabilizes underneath the roof due to the effect of temperature gradient

3.28

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

3.29**system response time**

time from the initiation of the smoke control system to it being fully operational

3.30**triggering device**

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

4 Smoke control damper requirements**4.1 General****4.1.1 Fire resistance**

The smoke control damper shall demonstrate the following and shall be classified in accordance with EN 13501-4:

- a) integrity: this shall be tested in accordance with the test method in [5.2](#) and the integrity classification (E) declared;
- b) insulation: this shall be tested in accordance with the test method in [5.2](#) and the insulation classification (I) declared;
- c) leakage: this shall be tested in accordance with the test method in [5.2](#) and the leakage classification (S) declared;
- d) mechanical stability: this shall be tested in accordance with the 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 the test method in [5.2](#) and forms part of the integrity classification (E) declared;
- f) high operational temperature: this shall be tested in accordance with the test method in [5.2](#) and the classification (HOT400/30) declared.

4.1.2 General application

Where the manufacturer intends to provide information regarding aerodynamic characteristics, this shall be done according to ISO 7244; see [5.5](#).

4.2 Construction and components: Characteristics**4.2.1 Construction and operation****4.2.1.1 General**

Smoke control dampers shall be required to have two safety positions, i.e. fully open and fully closed. In the case of a single fire compartment, this safety position shall generally be open, unless separate smoke reservoirs are designated along a duct run. For multi-compartment fire-resisting smoke control dampers, the safety position shall be either open or closed, depending on the source and path of the smoke and heat to be extracted.

The purpose of this is to maintain a fixed extraction path through the ductwork (open dampers), whilst also maintaining the fire compartmentation to the compartment and the duct (closed dampers). Depending on the position of the fire source, any smoke control damper shall be required to perform both functions.

Where a smoke control damper is required to maintain fire compartmentation, it shall be fire-resisting (i.e. a multi-compartment fire-resisting smoke control damper).

Smoke control dampers that are designed to function automatically on smoke detection shall travel to, or remain in, the correct position to exhaust smoke from the fire compartment.

Smoke control dampers that are initiated manually by switches, or actuated automatically at higher temperatures, shall be capable of operating at the appropriate higher temperatures.

Smoke control damper construction shall contain no device that is able to change the position of the damper once the safety position has been reached, i.e. it shall not change position unless required by direct instruction from a triggering device.

It is assumed that, as specified, power should be maintained throughout a building where a smoke control damper referred to in this document is installed.

Consequently, smoke control damper assemblies shall have no thermal devices to cause uncontrolled operation and no automatic return mechanisms that can, for instance, operate on loss of power.

The smoke control damper construction shall contain a method for the remote signalling of both open and closed positions.

The smoke control damper shall move from one end position to the other within 60 s of the receipt of a signal.

4.2.1.2 Actuators

Actuators shall be constructed and assembled to have the strength and rigidity necessary to perform the design operations to which they may be subjected, without loosening or displacement of parts, or other serious defects, when subjected to the test in EN 1366-10.

Actuator construction shall contain no device that is able to change the position of the damper once the safety position has been reached, i.e. it shall not change position unless required by direct instruction from a triggering device.

It is assumed that, as specified, power shall be maintained throughout a building where a smoke control damper referred to in this document is installed.

Consequently, actuators shall have no thermal devices to cause uncontrolled operation and no automatic return mechanisms that can, for instance, operate on loss of power.

The actuator shall be designed to operate the damper within the time period described in [4.2.1.5](#).

4.2.1.3 Interface control units

Any interface control unit that governs the movement of the actuator shall be tested and operate to the same time/temperature criteria as the actuator it controls. The interfacing unit shall be designed to be suitable for connection to control panels in accordance with ISO 21927-9 and power supplies in accordance with ISO 21927-10.

4.2.1.4 Nominal activation conditions/sensitivity

The units may be open or closed as part of a heating and ventilating system or a smoke and heat ventilation system and shall only open or close only on the receipt of an external input.

Consequently, smoke control dampers shall

- a) move to and maintain either their closed position, or open position, in the specified time of receiving an alarm,
- b) have known leakage characteristics,

- c) if multi-compartment, be fire-resisting to maintain compartmentation in closed position, and
- d) maintain their free area when fully open, at elevated or standard fire temperatures.

4.2.1.5 Response delay/closure time

The smoke control dampers' response delay is such that closure/opening starts within the time period of 30 s or 25 min in accordance with the test method in 5.2. The unit shall then open/close within 60 s in accordance with the test method in 5.2.

4.2.2 Protection against corrosion

Where a manufacturer intends to demonstrate an enhanced salt spray corrosion resistant performance of a smoke control damper to give a guide on its durability, the tests detailed in Annex B shall be performed and the result of these tests declared (i.e. pass/fail). Alternatively, this performance may be made by using of known-corrosion-resistance products, components and treatments and this shall be declared.

NOTE Except for products used in a corrosive/contaminated environment, there are no corrosion resistance requirements on products for other uses.

4.3 Fire resistance performance criteria: Single-compartment smoke control dampers

4.3.1 Integrity, leakage, HOT400/30

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

- a) leakage through the damper at ambient and when closed after 5 min (automatic operation) or 30 min (systems with manual intervention) from the start of the elevated temperature test,
- b) the ability of the damper to maintain its opening when subjected to the elevated temperature test (i.e. to 600 °C), and
- c) the suitability for use of the damper at an under pressure, measured at ambient.

A smoke leakage performance requirement is described in EN 1366-10 to allow the (S) classification, and this shall be applied if the damper is intended for the end uses where this performance is required [largest and smallest sizes at ambient and largest size (measured continuously) after 5 min (automatic operation) or 30 min (systems with manual intervention) from the start of the fire test].

The HOT400/30 (High Operating Temperature) performance requirement (operating at 400 °C for 30 min) is described in EN 1366-10 and this shall be applied if the damper is intended for the end uses where this performance is required.

4.3.2 Durability

4.3.2.1 Durability of response delay

Following the test described in 5.2.4, it demonstrates the durability of response delay by proving that the single-compartment smoke control damper closes at the prescribed time and in the required time period.

4.3.2.2 Durability of operational reliability

The ability of the single-compartment smoke control damper to demonstrate its operational reliability over the life of the system shall be determined by the open and closing cycle tests shown in 5.4.

The number of cycles to be performed reflects the proposed use of the single-compartment smoke control damper in smoke control only systems, combined smoke control and environmental systems, or modulating use in combined smoke control and environmental systems.

A cycle is defined as the damper moving from the open position to the closed and back to the open position or between the upper position to the lower position and back to the upper position for modulating dampers.

The single-compartment smoke control damper passes the open and closing cycle test when

- the cycles required are fully completed with the average time of each cycle less than 120 s, and
- the average time of the last cycle is less than 120 s.

In the case of smoke exhaust, the control system should ensure modulating actuators to move the smoke control damper only into fully open or fully closed position, i.e. the modulating signal should be overridden.

4.3.3 Fire resistance classification and designation

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

The following shall be declared for each single-compartment smoke control damper:

- a) integrity class “E₆₀₀” (in accordance to EN 13501-4);
- b) the addition of H0T400/30 indicates the satisfaction of the high operational temperature requirements;
- c) the additions of the indication(s) of suitability for vertical and/or horizontal installation, together with mounting in a duct or in a wall or both, respectively: as v_{ed} , v_{ew} or v_{edw} and/or h_{od} , h_{ow} or h_{odw} ; v_e or h_o should not be taken to imply the direction of operation, nor the orientation of the axis of the damper blade;
- d) the addition of the symbol “S” indicates the satisfaction of an extra restriction on leakage;
- e) the addition of “500”, “1 000” or “1 500” indicates the suitability of use up to these under-pressures;
- f) the addition of “AA” or “MA” indicates automatic activation or manual intervention;
- g) the addition of the symbols “(i → o)”, “(o → i)”, or “(i ↔ o)” to indicate whether the element has been tested and fulfils the requirements from the inside or outside only or both;
- h) the addition of “C₃₀₀”, “C_{10 000}”, “C_{mod}” indicates the suitability for use in smoke control only systems, combined smoke control and environmental systems, or modulating use in combined smoke control and environmental systems;
- i) the addition of the suffix “single” to indicate suitability.

EXAMPLE E600 60 (v_e -i↔o) S 1500 C_{10 000} MA single.

4.3.4 Other performance criteria

Where the manufacturer intends to provide information regarding aerodynamic performance, it shall do so in accordance with ISO 7244; see 5.5.

4.4 Fire resistance performance criteria: Multi-compartment fire-resisting smoke control dampers

4.4.1 Integrity, insulation, leakage, HOT400/30

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

- a) leakage through the damper at ambient and when closed after 5 min (automatic operation) or 30 min (systems with manual intervention) from the start of the fire test,
- b) the ability of the damper to maintain its opening when subjected to the fire test,
- c) 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 damper junction with the wall or floor or duct (the penetration), and
- d) the suitability for use of the damper at an under pressure, measured at ambient.

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

A smoke leakage performance requirement is described in EN 1366-10 to allow the (S) classification, and this shall be applied if the damper is intended for the end uses where this performance is required [largest and smallest sizes at ambient and largest size (measured continuously) after 5 min (automatic operation) or 30 min (systems with manual intervention) from the start of the fire test].

The HOT400/30 (High Operating Temperature) performance requirement (operating at 400 °C for 30 min) is described in EN 1366-10 and this shall be applied if the damper is intended for the end uses where this performance is required.

4.4.2 Durability

4.4.2.1 Durability of response delay

Following the test described in 5.2.4 demonstrates the durability of response delay by proving that the multi-compartment smoke control damper closes at the prescribed time and in the required time period.

4.4.2.2 Durability of operational reliability

The ability of the multi-compartment smoke control damper to demonstrate its operational reliability over the life of the system shall be determined by the open and closing cycle tests shown in 5.4.

The number of cycles to be performed reflects the proposed use of the multi-compartment smoke control damper in smoke control only systems, combined smoke control and environmental systems, or modulating use in combined smoke control and environmental systems.

A cycle is defined as the damper moving from the open position to the closed and back to the open position or between the upper position to the lower position and back to the upper position for modulating dampers.

The multi-compartment smoke control damper passes the open and closing cycle test when

- the cycles required are fully completed with the average time of each cycle less than 120 s, and
- the average time of the last cycle is less than 120 s.

In the case of smoke exhaust, the control system should ensure modulating actuators to move the smoke control damper only into fully open or fully closed position, i.e. the modulating signal should be overridden.

4.4.3 Fire resistance classification and designation

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

The following shall be declared for each multi-compartment smoke control damper:

- a) integrity class “E”, integrity and insulation class “EI” (in accordance to EN 13501-4);
- b) the addition of H0T400/30 indicates the satisfaction of the high operational temperature requirements;
- c) the additions of the indication(s) of suitability for vertical and/or horizontal installation, together with mounting in a duct or in a wall or both, respectively: as v_{ed} , v_{ew} or v_{edw} and/or h_{od} , h_{ow} or h_{odw} ; v_e or h_o should not be taken to imply the direction of operation, nor the orientation of the axis of the damper blade;
- d) the addition of the symbol “S” indicates the satisfaction of an extra restriction on leakage;
- e) the addition of “500”, “1 000” or “1 500” indicates the suitability of use up to these under-pressures;
- f) the addition of “AA” or “MA” indicates automatic activation or manual intervention;
- g) the addition of the symbols “(i → o)”, “(o → i)”, or “(i ↔ o)” to indicate whether the element has been tested and fulfils the requirements from the inside or outside only or both;
- h) the addition of “C₃₀₀”, “C_{10 000}”, “C_{mod}” indicates the suitability for use in smoke control only systems, combined smoke control and environmental systems, or modulating use in combined smoke control and environmental systems;
- i) the addition of the suffix “multi” to indicate suitability.

EXAMPLE EI 60 ($v_{edw-i \rightarrow o}$) S 500 C_{10 000} AA multi.

If the multi-compartment smoke control damper requirements defined in this clause are satisfied, this shall be deemed to satisfy also the corresponding single-compartment smoke control damper requirements in 4.3.1.

4.4.4 Other performance criteria

Where the manufacturer intends to provide information regarding aerodynamic performance, it shall do so in accordance with ISO 7244; see 5.5.

5 Test methods

5.1 Ambient leakage tests

The test method shall be in accordance with ISO 10294-1 and ISO 7244.

5.2 Fire resistance tests

5.2.1 General

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

The smoke control damper in the furnace (e.g. fire compartment) is tested on its ability to open, and stay open, to allow smoke to be extracted. The smoke control damper on the non-exposed position

(neighbouring compartment) is tested upon its ability to stay closed and have known maximum leakage to allow sensible fan selection and give a guide to smoke not leaking back through.

Single-compartment smoke control dampers 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 dampers will be subjected to a fire test to the standard time temperature test curve.

Two smoke control dampers are attached to a single-compartment smoke control duct (methods are described in EN 1366-10 for both horizontal and vertical ductwork) in a manner generally representative of practice. One smoke control damper will be mounted on the duct inside the furnace and one outside the furnace as described in EN 1366-10.

Test results are only valid for the tested method of mounting, together with any direct or extended field of application that may be applicable.

Tests shall be performed starting with the smoke control damper inside the furnace in the closed position and the smoke control damper outside the furnace in the open position (unless in its application it will never be open at the commencement of a smoke situation, in which case it will remain closed). This is to demonstrate the abilities of the smoke control damper both inside and outside the fire compartment. The damper inside the furnace will be required to open during the test and the smoke control damper outside the furnace will be required to close. The time at which these changeovers occur is determined by the requirement for automatic activation or for manual intervention.

Temperature and integrity measurements shall be carried out in various parts of the test construction during the test.

When the dampers have changed position, hot gases from inside the furnace are drawn through the now open smoke control damper inside the furnace, past the now closed smoke control damper outside the furnace. The provision of a perforated plate (described in EN 1366-10) allows the smoke control damper outside the furnace to be subjected to pressure differential of 500 Pa. The leakage of the smoke control damper outside the furnace is recorded when it is closed. The leakage rate of dampers requiring an S classification shall be measured both at ambient temperature, as well as during the fire test.

Similar information is given in EN 1366-10 for the testing of dampers in compartment barriers to demonstrate maintenance of fire resistance when closed and maintenance of opening to allow smoke and hot gases to be moved through them.

If the smoke control damper is intended for the end uses where HOT400/30 is required, a sample of the smoke control damper and the associated actuator shall be first subjected to a furnace based fire test to prove maintenance of closure.

The smoke control damper is attached (directly or remotely via a section of ducting), in/to a supporting construction using a method described in the test standard (ISO 10294-1, referenced by EN 1366-10) in a manner generally representative of practice. Smoke control dampers may be situated within the construction of the wall/floor, attached to the face of the wall/floor, or mounted remotely from it via a section of fire-resistant ducting.

Test results are only valid for the tested method of mounting, together with any direct or extended field of application that may be applicable.

Tests shall be performed starting with the smoke control damper in the open position. It will be driven closed at the start of the test to meet the two-minute requirement.

Temperature and integrity measurements shall be carried out in various parts of the test construction during the test. The impermeability of the smoke control damper system shall be measured by direct flow measurements whilst maintaining a constant pressure differential across the closed smoke control damper of 300 Pa. The leakage rate of dampers requiring an S classification shall be measured at ambient temperature.

It may be necessary to test smoke control dampers not mounted directly within the centre of the supporting construction, both inside and outside the supporting construction for it to be universally acceptable for that method of installation.

A further smoke control damper sample shall be subjected to a furnace based fire test to prove operation and maintenance of opening. The smoke control damper is attached (directly or remotely via a section of ducting), in/to a supporting construction using a method described in the test standard (EN 1366-10) in a manner generally representative of practice. Smoke control dampers may be situated within the construction of the wall/floor, attached to the face of the wall/floor, or mounted remotely from it via a section of fire-resistant ducting.

Tests shall be performed starting with the smoke control damper in the open position. It will be cycled and observed (EN 1366-10).

5.2.2 Smoke control damper: Integrity and insulation

Equipment and method as fully described in EN 1366-10, the largest size to be manufactured shall be subjected to the selected cycling test, followed by the fire resistance test (EN 1366-10). Units shall be fire tested in the plane of proposed installation, noting the direct field of application of fire test results.

For information purposes only, the unit may be ambient leakage tested prior to the fire test.

5.2.3 Leakage rated smoke control damper

Equipment and method as fully described in EN 1366-10, the largest size to be manufactured shall be subjected to the selected cycling test, followed by the ambient leakage test, followed by the fire resistance test (see EN 1366-10). Units need to be fire tested in the plane of proposed installation, noting the direct field of application of fire test results.

In addition, the smallest size to be manufactured shall be subjected to an ambient leakage test (see ISO 7244) to provide the information necessary to gain this classification.

5.2.4 Response delay of a smoke control damper

The response delay is proven, provided that the smoke control dampers achieve the opening and closing requirements defined in EN 1366-10:2010, 6.2.

For HOT400/30, a second smoke control damper sample shall be subjected to a standby temperature test to prove the longevity of any electrical items. This shall be as described in EN 1366-10.

5.3 Salt spray exposure test

The equipment and test method referenced in [Annex A](#) and IEC 60068-2-52 shall be used.

5.4 Cycling tests

For damper durability cycling, the equipment and test method referenced in EN 1366-10.

5.5 Damper aerodynamic performance

The following performance and rating test methods for dampers and valves specified in ISO 7244 and ISO 5135 shall be used:

a) Damper blade leakage

Leakage past a closed damper or valve may be classified using the data published in ISO 7244. Classes then increase 1 to 4 with class 4 being the most leak tight.