
**Fire resistance tests — Elements
of building construction —
Requirements for active fire curtains**





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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 2, *Fire containment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

As fire-separating elements, active fire curtains are intended to provide two main functions:

- a) to maintain any compartmentation of buildings needed to limit the spread of fire and smoke; and
- b) to allow access to protected escape routes, both vertical and horizontal, without any loss of fire resistance, and to limit smoke entry into these routes, i.e. protected corridors and protected shafts.

They can also be partially deployed to control the deployment of fire effluent within buildings in the event of fire, prior to being fully deployed as active fire curtains.

Recommended positions and ratings for fire-separating elements for means of escape purposes are given in national codes providing either prescriptive or risk-based approaches using the principles of fire safety engineering.

When used as part of a fire-engineered design solution, active fire curtains can become a critical element of design. If active fire curtains do not deploy to their operational position, the fire-engineered design solution is compromised. However, in the event that other fire protection systems or elements do not function (e.g. due to total power failure), active fire curtains in their fire-operational position provide fire separation.

Active fire curtains used in life safety and property protection applications can be vertical, horizontal or angled. Depending on the application, they are at times used to replace fire doors, roller shutters, non-loadbearing walls, non-loadbearing ceilings, glazed elements, etc. At times, they are also used to form fire separation, e.g. forming protected routes or lobbies. They provide some of the functionalities of a fire door, but when used only for fire and smoke leakage, as a fire door, then different requirements apply. These requirements are given in ISO 3008-1 and ISO 5925-1, and further information is given in ISO/TR 5925-2. Active fire curtains enable greater widths and deployments using less space than other traditional methods.

It is essential that any proposed use of active fire curtains be assessed in the context of the building use and perceived occupancy to ensure that it is ultimately suitable and fit for purpose, taking into consideration such factors as:

- a) fire resistance;
- b) reaction to fire;
- c) smoke leakage;
- d) occupancy type and risk profile;
- e) occupancy load;
- f) means of escape for egress;
- g) ingress for fire and rescue service;
- h) life safety and property protection objectives.

Some examples of how active fire curtains are deployed are:

- a) deploy fully upon receipt of a signal from the fire alarm system;
- b) remain retracted when the fire alarm system is activated and only deploy upon receipt of a signal from a local smoke/heat detector. In these circumstances, the only active fire curtains to deploy are those where fire or smoke are in the vicinity;
- c) remain retracted when the fire alarm system is activated for a predetermined time to allow for evacuation before deploying fully;

- d) for vertical installations, move to a given height above finished floor level when the fire alarm system is activated to contain smoke for a predetermined time before closing fully for fire separation;
- e) for vertical installations, move to a given height above finished floor level when a specific fire alarm system signal is provided to contain smoke when the fire location is such that active fire curtains are not required to deploy fully;
- f) deploy upon loss of primary and auxiliary power supply.

In fire safety situations, it is often important to establish the heat transfer from one side of the separating element to the other in order to calculate escape route sizes and safe operating distances. Traditionally this has been established using insulation and radiation measurements.

NOTE National codes apply to life safety. Higher performance levels are sometimes necessary for certain applications if property protection is required.

Fire resistance tests — Elements of building construction — Requirements for active fire curtains

1 Scope

This document specifies requirements for the design, testing and classification of active fire curtains, applicable to any material, that are designed to provide fire and smoke resistance.

This document gives recommendations for the application, installation and maintenance of active fire curtains. It is also intended to provide guidance and recommendations for designers, specifiers (e.g. architects, fire engineers), authorities having jurisdiction (AHJs), installers and maintainers for the following:

- a) creating compartmentation;
- b) creating protected routes for the purpose of means of escape;
- c) providing protection at the location of non-fire resisting elements (e.g. in front of non-fire-resisting glazing and doorsets) where required for compartmentation or protecting means of escape;
- d) providing fire- and smoke-resistant active fire curtains in conjunction with non-smoke rated products protecting openings to reduce leakage of smoke.

This document does not apply to the following, which are intended for a different use:

- barriers made of part of the building's structure;
- theatre/proscenium textile curtains;
- smoke barriers according to ISO 21927-1;
- door and shutter assemblies according to ISO 3008-1.

NOTE 1 Smoke barriers used solely for smoke control are covered by ISO 21927-1. Such smoke barriers are not considered to be active fire curtains.

NOTE 2 Requirements of fire doors are given in ISO 3008-1. Requirements for leakage are given in ISO 5925-1 and further information is given in ISO/TR 5925-2.

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 834-1, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 1182, *Reaction to fire tests for products — Non-combustibility test*

ISO 1716, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value)*

ISO 3009, *Fire-resistance tests — Elements of building construction — Glazed elements*

ISO 5925-1, *Fire tests — Smoke-control door and shutter assemblies — Part 1: Ambient- and medium-temperature leakage tests*

ISO 9705-1, *Reaction to fire tests — Room corner test for wall and ceiling lining products — Part 1: Test method for a small room configuration*

ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test*

ISO 13943, *Fire safety — Vocabulary*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 834-1 and ISO 13943 and the following apply.

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

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

3.1

active fire curtain

curtain, manufactured from flexible materials, not hinged or pivoted, provided for the passage of persons, air and objects, which, together with its frame as installed in a building, is intended (when closed) to resist the passage of fire

3.2

compartmentation

process of separating a building or part of a building into one or more rooms, spaces or storeys, with the intention of preventing the spread of fire to or from another part of the same building or adjoining building

Note 1 to entry: Compartmentation is mainly implemented to assist the fire and rescue services by confining the fire within a fire-resisting enclosure. In some instances, it is employed to assist means of escape in buildings where evacuation might be delayed (e.g. where phased evacuation policy has been applied in premises such as hospitals and care homes) or where a policy of non-evacuation (e.g. “defend in place” or “stay put strategy”) is employed, as in blocks of flats.

Note 2 to entry: Fire enclosures specifically for the purpose of means of escape, such as lobby protection to stairways and enclosure of special risks, are not regarded as compartments and may employ passive smoke separation measures.

3.3

competent person

individual suitably trained and qualified by knowledge and practical experience and provided with the necessary instructions to enable the required task(s) to be carried out correctly

3.4

deployment

movement of an active fire curtain from its retracted position to its fire-operational position

3.5

dwelling

unit of residential accommodation occupied (whether or not as a sole or main residence):

- a) by a single person or by people living together as a family; or
- b) by not more than six residents living together as a single household, including a household where care is provided for residents

3.6**fire effluent**

all gases and aerosols, including suspended particles, created by combustion or pyrolysis and emitted to the environment

[SOURCE: ISO 26367-1:2019, 3.6, modified — Notes to entry removed.]

3.7**fire-operational position**

final configuration of an active fire curtain specified by its designer to achieve and be sustained in the ultimate fire condition of the design

3.8**fire separation**

method of providing an element that is intended for use in maintaining separation between two adjacent areas of a building in the event of a fire to form protected routes and/or compartmentation

3.9**fire strategy**

safety design for a particular building determined by prescriptive codes, fire safety engineering or fire risk assessment

3.10**fit for purpose**

ability of a product, process or service to serve a defined purpose under specific conditions

3.11**gravity fail safe**

ability of an active fire curtain to move to its fire-operational position in a safe and controlled manner to facilitate fire separation when all consumable primary and auxiliary power supplies are removed, in the event of wiring or system corruption, open or short circuit, or any combination thereof

3.12**integrity**

ability of a separating element, when exposed to fire on one side, to prevent the passage of flames and hot gases or occurrence of flames on the unexposed side, for a stated period of time in a standard fire resistance test

[SOURCE: ISO 22899-1:2007, 3.9]

3.13**hold-open device**

element of the hold-open system that allows a gravity fail safe active fire curtain to remain open either at a pre-set or chosen position until released

3.14**life safety**

application of the active fire curtain in its fire-operational position assisting in the protection of the means of escape and access for the fire and rescue service

3.15**material****fabric**

product made from fibres

Note 1 to entry: Within the context of this document, "material" is understood to conform to one of the following tests:

Note 2 to entry: a) Non-combustible test (ISO 1182).

Note 3 to entry: b) Limited combustibility test (ISO 1716).

Note 4 to entry: Within the context of this document, "material" is understood to require the following tests:

Note 5 to entry: a) Room corner test for wall and ceiling linings (ISO/TR 9705-2).

Note 6 to entry: b) Ignitability of products when subjected to direct impingement of flame test (ISO 11925-2).

3.16**means of escape**

means whereby a safe route (or routes) in the event of fire is (or are) provided for persons to travel from any point in a building to a place of ultimate safety

3.17**multi-positional deployment**

staged deployment of active fire curtain to provide initial smoke separation prior to full fire separation

3.18**property protection**

application of the active fire curtain in its fire-operational condition to protect a building's contents and structure

3.19**side retention**

retention device which links the active fire curtain fabric to the building structure to contain fire and smoke

3.20**smoke barrier**

device to channel, control and/or prevent the migration of smoke

Note 1 to entry: Smoke is the visible part of a fire effluent. Smoke barriers can also be referred to as smoke curtains, smoke blinds or smoke screens. These are specified in ISO 21927-1.

4 Symbols

Symbol	Unit	Description
a	m	height of the radiating surface
A	m ²	tested exposed fabric area
A_r	m ²	required exposed fabric area
b	m	width of the radiating surface
c	m	perpendicular distance from the corner of the radiating surface
d_s	m	proximity of the escaping occupants to active fire curtains as the minimum separation distance
δ_a	m	anticipated deflection
H	m	height of the fire tested active fire curtains
H_p	m	proposed height
H_r	m	required height of the exposed fabric
ε	-	emissivity
f	-	factor for scaling the required minimum width of the end curtain and the required minimum width of the overlap
F	-	configuration factor

Symbol	Unit	Description
I	kW/m^2	radiation heat flux (for purposes of TDU)
I_c	m	proposed length/width
L_c	m^3/h	leakage through the complete active fire curtains
L_{fa}	m^3/h	leakage through the fabric only
L_{fb}	$\text{m}^3/\text{m}^2/\text{h}$	leakage per square metre of fabric
L_{fh}	m^3/h	leakage through the fabric and the horizontal edge
L_{ph}	m^3/h	leakage through the perimeter gap at the horizontal edge
L_{phb}	$\text{m}^3/\text{m}/\text{h}$	leakage per metre through the perimeter gap at the horizontal edge
L_{pv}	m^3/h	leakage through the perimeter gap at the two vertical edges
L_{de}	$\text{m}^3/\text{m}^2/\text{h}$	leakage per metre through the perimeter gaps at the vertical edges
L_{lt}	$\text{m}^3/\text{m}/\text{h}$	effective linear perimeter leakage
O	m	width of the tested overlap
O_m	m	required minimum width of the overlap
Q	W/m^2	heat flux
Σ	$\text{W}/(\text{m}^2\text{K}^4)$	Stefan Boltzmann's constant
$R_{\max}$	kW/m^2	maximum permitted radiation heat flux at the tested size
R_{RSET}	kW/m^2	radiation heat flux from the fire curtain at the tested size at the Required Safe Evacuation/Egress Time
t	s	exposure time
T	K	surface temperature of the radiator
τ	$(\text{kW/m}^2)^{4/3}\text{s}$	thermal dose unit (TDU)
v_o	m/s	speed of escaping occupants
w_c	m	width of the corridor
w_p	m	width of the person
W	m	width of the tested end curtain
W_m	m	required minimum width of the end curtain
W	m	tested width of the exposed fabric
W_r	m	required width of the exposed fabric

5 Requirements

5.1 General

Active fire curtains shall be designed according to [Annex L](#) and manufactured to create a fire-separating element in a horizontal, vertical or angled orientation.

Typical uses of the active fire curtains include:

- a) compartmentation;
- b) creating protected routes for the purpose of means of escape where using standard fire doors/shutters and non-loadbearing walls and ceilings would be prohibitive to the design;
- c) providing protection at the location of non-fire resisting elements, e.g. in front of non-fire resisting glazing and doorsets, where required for compartmentation or protecting means of escape;
- d) meeting the requirements for smoke leakage in conjunction with other non-smoke rated products (e.g. lift door) protecting openings to reduce leakage of smoke.

5.2 Side retention

Where active fire curtains, whether single or multiple units, are reliant on side retention as part of their integral design, there shall be no gaps between the fabric edge and the leading edge of the retention guide that can impede integrity (see [C.3](#)).

[Figure 1](#) illustrates an example of a typical single active fire curtain.

Active fire curtains with side retention (see [3.19](#)) have been found in some circumstances to produce edge gaps in end-use applications. Care should be taken during installation to use side retention that is identical to the tested samples.

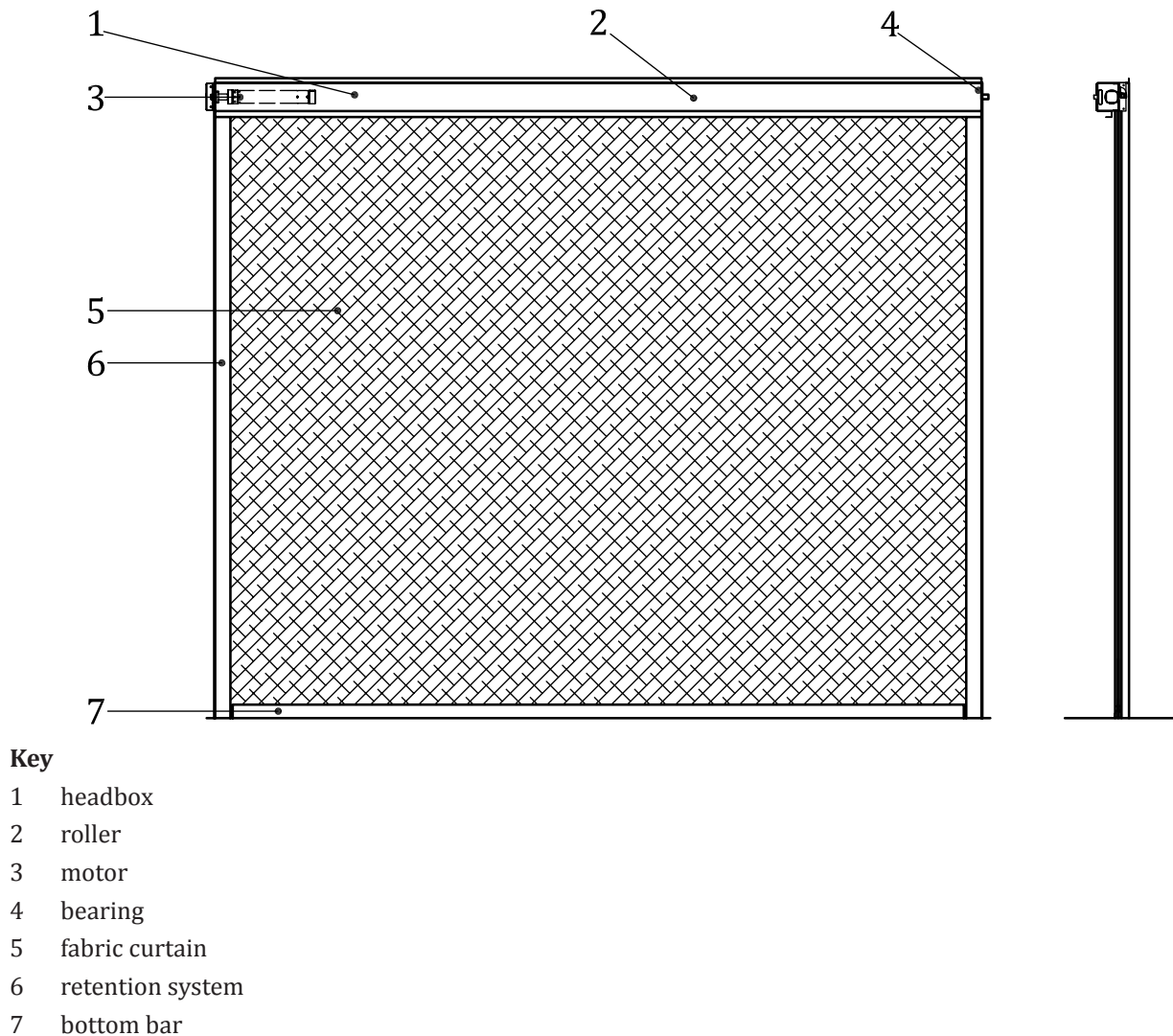


Figure 1 — Example of a typical single active fire curtain

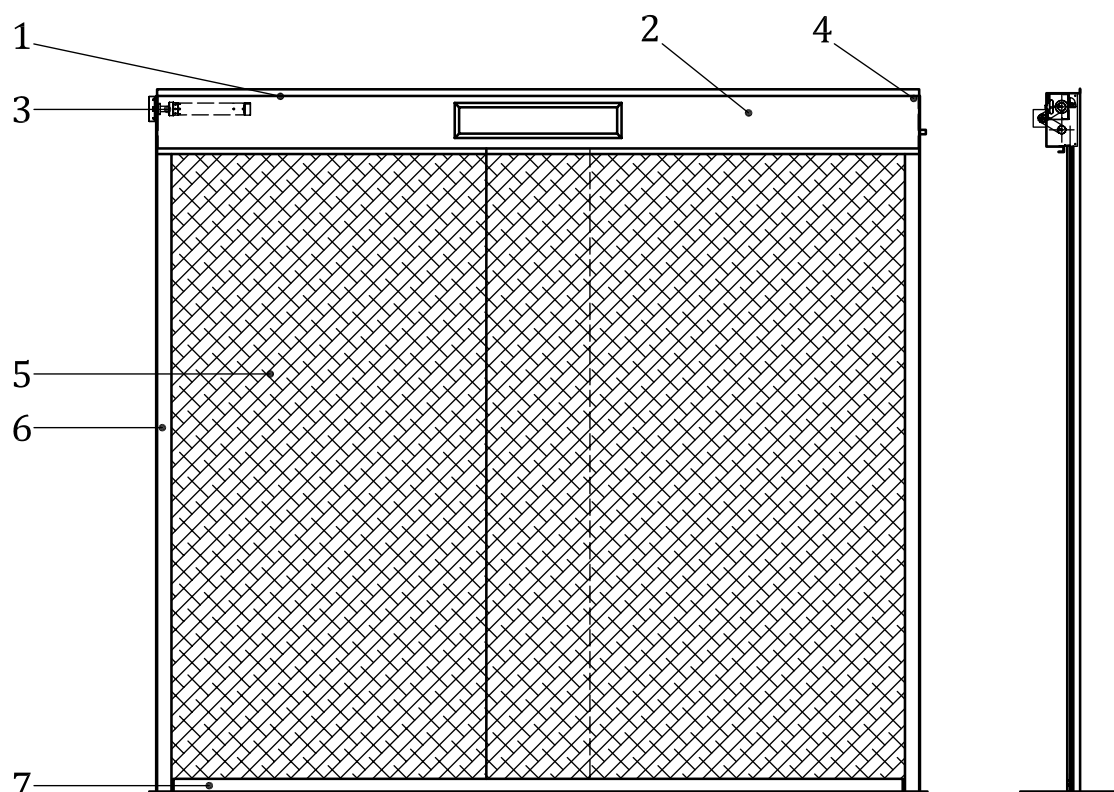
5.3 Additional requirements for multiple active fire curtains

5.3.1 Multiple active fire curtains

Where multiple active fire curtains are used to create a larger active fire curtain, they shall be tested with the minimal overlap and shall be continuously conjoined at the bottom edge ([A.1](#) applies).

[Figure 2](#) illustrates a typical example of the overlapped and conjoined active fire curtains. This configuration is not suitable for use on an escape route.

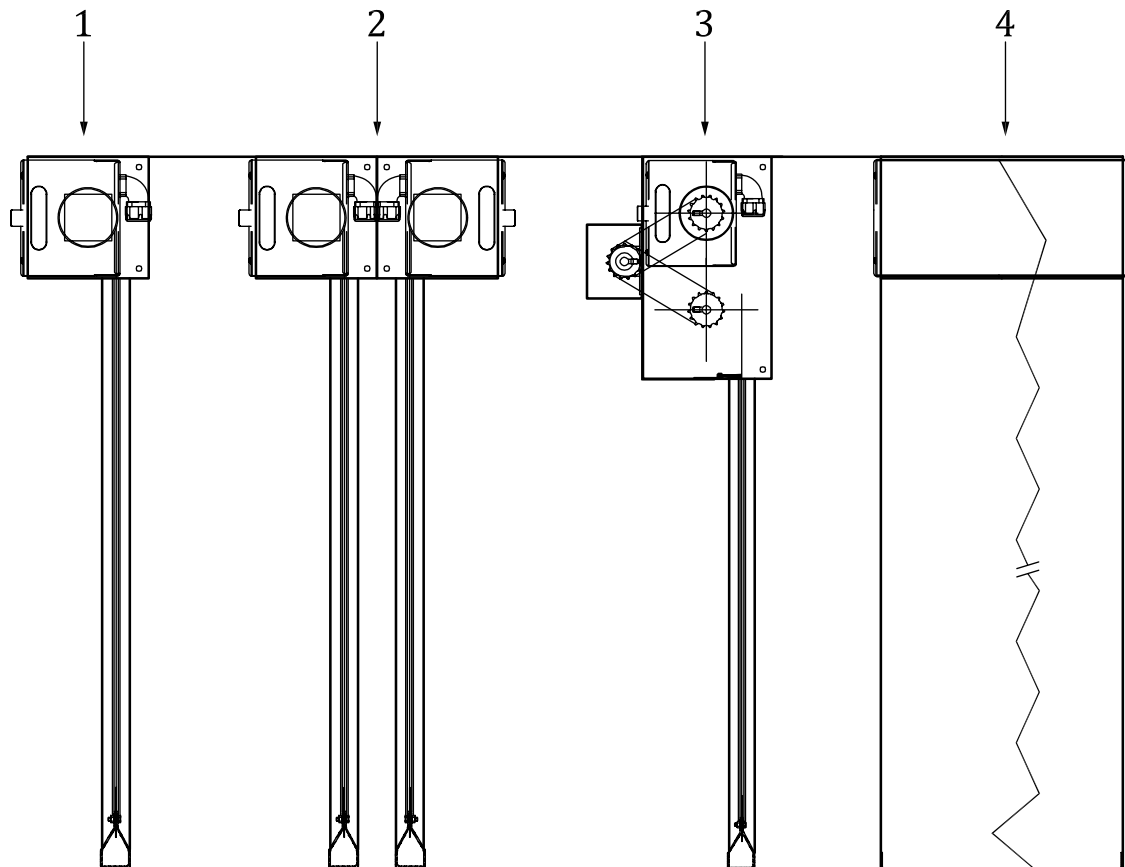
[Figure 3](#) illustrates examples of typical active fire curtains arrangements.



Key

- 1 headbox
- 2 roller
- 3 motor
- 4 bearing
- 5 fabric curtain
- 6 retention system
- 7 bottom bar

Figure 2 — Example of typical overlapped and conjoined active fire curtains



Key

- 1 single roller
- 2 side-by-side rollers (horizontal)
- 3 over and under rollers (vertical)
- 4 folding/pleating

Figure 3 — Examples of typical arrangements for active fire curtains

5.3.2 Required overlap

The amount of overlap required in addition to the tested size shall be determined in accordance with [Annex D](#).

5.3.3 Larger than tested

For active fire curtains larger than those tested, supporting evidence shall be provided where an independent assessment body can provide a technical appraisal of the necessary overlap dimensions in accordance with [Annex D](#).

NOTE 1 The necessary overlap generally increases as the span of the curtain increases.

NOTE 2 Further guidance is available in EN 15269-11:2018, Annex C.

5.4 Horizontal or angled

This subclause specifies the test method for determining the fire resistance of horizontally or angled oriented active fire curtains which can be exposed to a fire from the underside. It is applicable to all types of active fire curtains that may be installed in a horizontal orientation within floor or roof assemblies requiring fire-resistance ratings in buildings (see [Figure 4](#)).

The test method allows for the measurement of integrity and, if required, the measurement of radiation and thermal insulation when subjected to a standard temperature/time curve as stipulated in ISO 834-1.

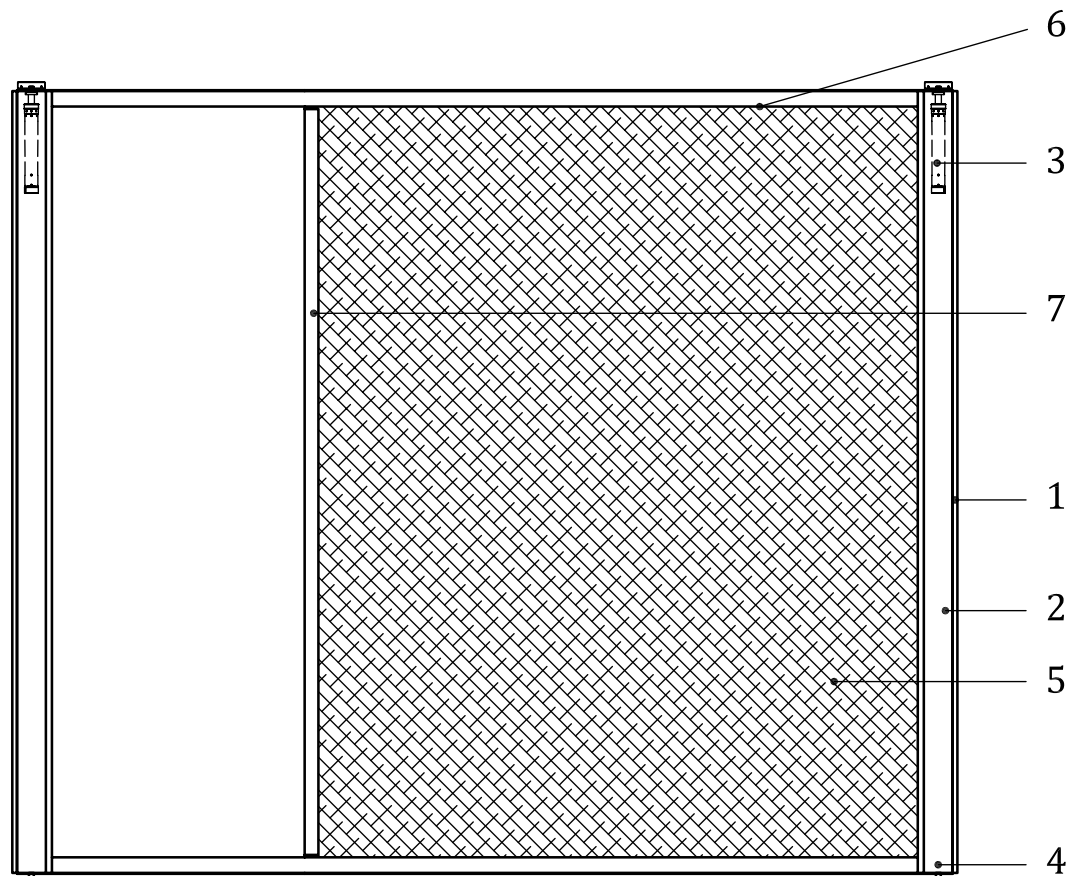
The test specimen and all its components shall be full size. When this is restricted by the size of the opening of the furnace (which is normally 3,0 m × 4,0 m), active fire curtains shall be tested at the maximum size possible and the fire resistance of the full-sized assembly shall be derived by an extended application analysis.

The test specimen shall be fully representative of the active fire curtain as intended for use in practice, including any appropriate surface finishes and fittings which are an essential part of the specimen and which can influence its behaviour in a test construction.

If the test specimen is intended for use at an incline other than horizontal, i.e. angled, then the guidance for inclined specimens in ISO 3009 shall be followed.

The design of the connection between the test specimen and the supporting construction, including any fixings and materials used to make the connection shall be as intended for use in practice and shall be regarded as part of the test specimen.

There shall be a minimum zone of supporting construction of 200 mm wide exposed within the furnace, each side and over the top of the aperture into which the test specimen is to be fixed. The thickness of the supporting construction may be increased outside of the 200 mm zone. The test construction may incorporate more than one test specimen providing that there is minimum separation of 200 mm between each specimen and between the specimens and the edge of the furnace.



Key

- 1 headbox
- 2 roller
- 3 motor
- 4 bearing
- 5 fabric curtain
- 6 retention system
- 7 bottom bar

Figure 4 — Example of a typical active fire curtain in the horizontal orientation

5.5 Pass door(s)

Pass door(s) shall be tested with the minimum of a single pass door located central to the furnace opening. See [Figure 5](#).

Pass door(s) shall be so designed and positioned that they cannot unintentionally leave their safe position when the main door, in which they are installed, is operated in normal use.

The parts of the door(s) shall not cause any tripping hazard. Height differences up to 5 mm which occur in the traffic area are not considered dangerous.

When height differences greater than 5 mm are necessary due to technical reasons (e.g. thresholds of pass doors) the raised parts shall be clearly visible themselves or shall be made so by warning signs, e.g. yellow-black stripes.

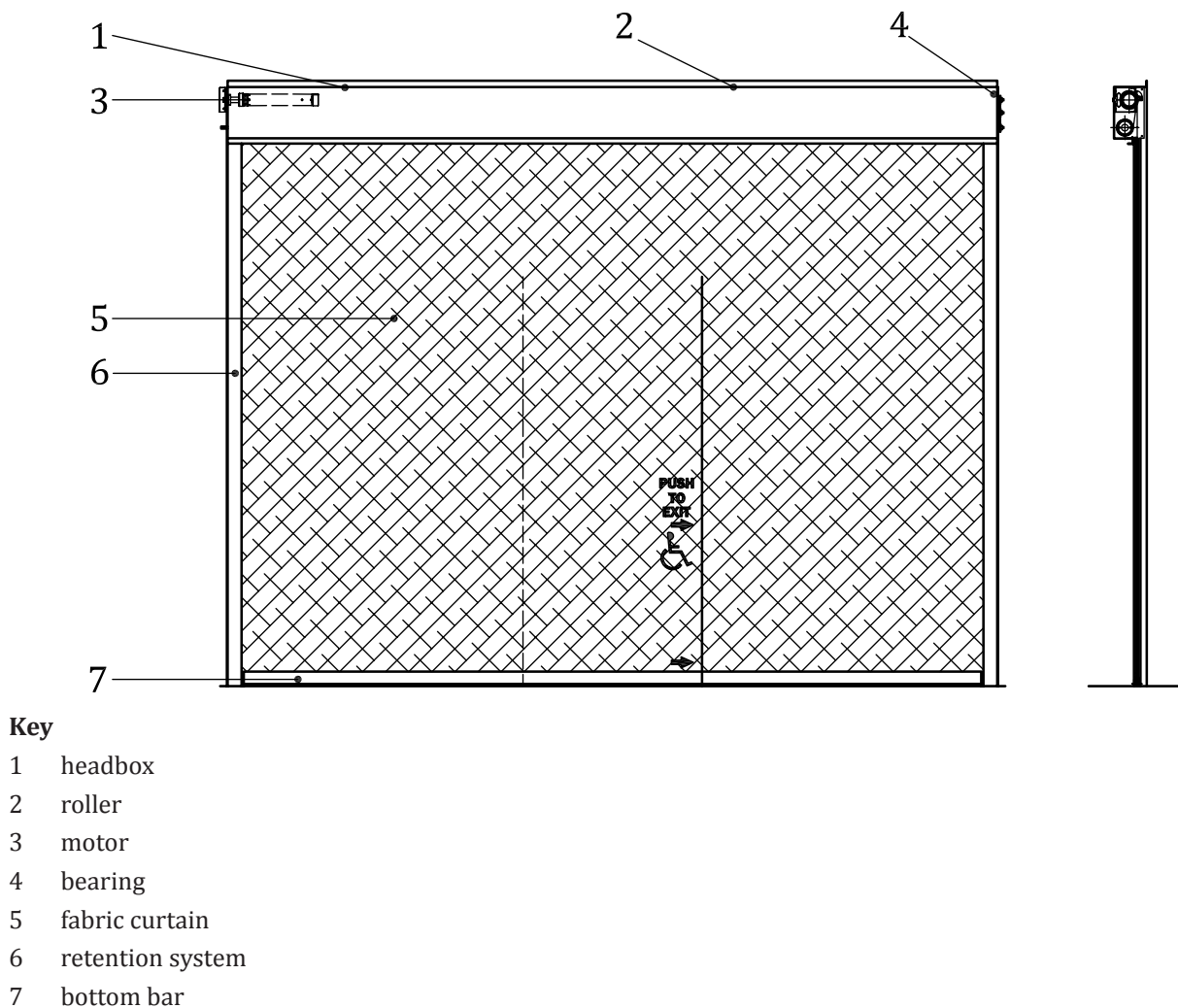


Figure 5 — Example of a typical active fire curtain with pass door(s)

5.6 Vision panels

The type of vision panels and the edge fixing technique (e.g. stitching per metre of perimeter) shall not be changed from those tested.

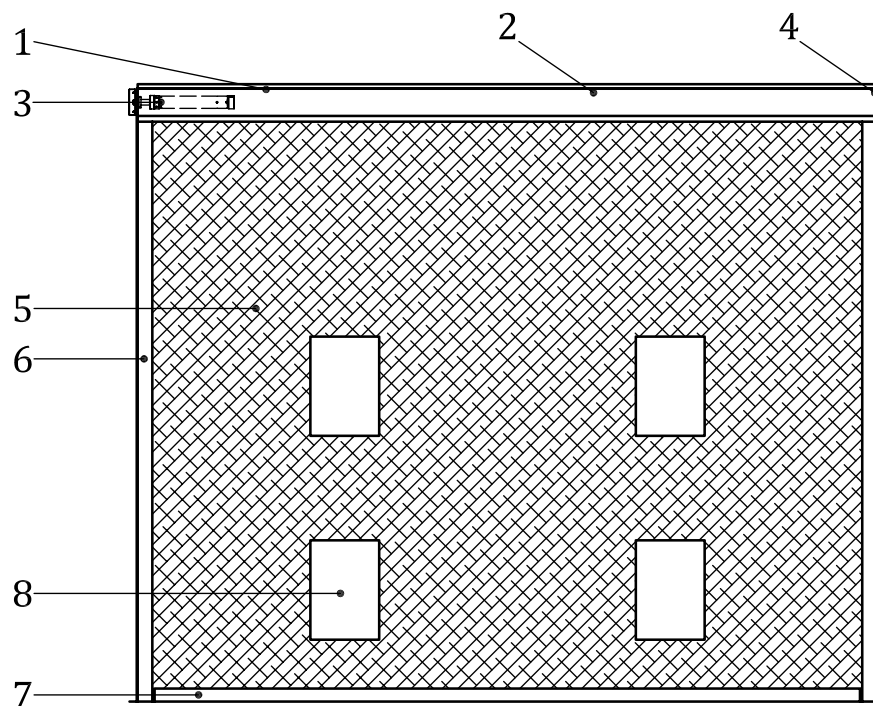
The number of vision panels and each of the dimensions (width and height) of vision panels in active fire curtains included within a test specimen may be:

- decreased in proportion with size reductions; or
- decreased by a maximum of 25 % for integrity only and/or radiation control constructions and for insulation specimens where the unexposed surface temperature for both the construction and the vision panels have been maintained for the classification period; or
- reduced for active fire curtains, without restriction, providing that the total area of the tested vision panels is less than 15 % of the active fire curtains.

The number of vision panels and each of the dimensions of vision panels included within a test specimen shall not be increased.

The distance between the edge of vision panels and the perimeter of the active fire curtains, or the distance between vision panels shall not be reduced from those incorporated in test specimens.

Other positioning within the active fire curtains can only be modified if this does not involve the removal or re-positioning of vision panels. [Figure 6](#) provides an example of typical active fire curtains with vision panel(s).



Key

- 1 headbox
- 2 roller
- 3 motor
- 4 bearing
- 5 vision panel(s) in fabric curtain
- 6 retention system
- 7 bottom bar
- 8 vision panel

Figure 6 — Example of typical active fire curtains with vision panel(s)

6 Sampling

6.1 Test samples, testing and conformance criteria

The requirements for each test specimen are provided in [Annex A](#).

The order of testing shall be as shown in [Annex B](#).

The number of samples of active fire curtains to be tested/assessed shall be in accordance with [Table 1](#).

Table 1 — Number of samples to be tested and conformance criteria

Characteristic	No. of samples	Conformance criteria
Ancillary devices	Specimens 1, 2, 3 and 5	7.8
Durability and force gauge	Specimens 1, 2 and 3	7.2
Reliability and durability	Specimens 1, 2, 3 and 5	7.3

Table 1 (continued)

Characteristic	No. of samples	Conformance criteria
Deployment, response delay, response time and velocity	Specimens 1, 2, 3 and 5	7.4
Resistance to fire	Specimens 3, 4, 7 and 8	7.6.2 , 7.6.3 , 7.6.4 , C.6.5 , Figure C.9, Figure C.10, Annex F
Smoke leakage	Specimen 5	7.5
Reaction to fire	Specimen 6	7.7

7 Test methods

7.1 General

The number of samples to be tested and the conformance criteria are summarized in [Table 1](#).

The fabric used with the construction of the active fire curtains is critical to its performance (see [Table 2](#)).

Table 2 — Summary of performance characteristics

Performance measure	Related sub-clause	Test method(s)	Performance level
Durability and force gauge [including pass door(s)]	7.2	Annex J	(400 ± 10) N 35 N $\pm$ 1 N on pass door(s)
Reliability and durability [including pass door(s)]	7.3	Annex E	B1 and C1–C5
Reliability of alternative or additional motor(s)	7.3	Annex H	C1–C5
Response time and velocity	7.4	Annex E	Vertical: $\geq 0,03$ m/s at any height; $\leq 0,15$ m/s below 2,0 m Horizontal: $\geq 0,03$ m/s at any length
Smoke leakage: - smoke leakage, where applicable	7.5	ISO 5925-1	S_a or S_{200}^1
Fire resistance: - integrity - insulation, where applicable - radiation, where applicable	7.6 7.6.2 7.6.3 7.6.4	ISO 834-1, Table 5	Plus time (min) for integrity, insulation and/or radiation
Deflection zone	7.6.5	Annex C	Distance (mm)
- Motor operation, where applicable	7.6.6	Annex F	Pass/fail
Reaction to fire	7.6.7	ISO 1182, or ISO 1716	Non-combustible, or limited combustibility
Ancillary devices, where applicable	7.6.8	Annex I	Pass/fail

NOTE Classifications are based upon EN 13501-2.

When tested in accordance with [7.2](#), [7.3](#), [7.7](#) and the relevant parts of [7.4](#), [7.5](#), [7.6](#) and [7.8](#), the active fire curtains shall meet the pass criteria specified in those subclauses.

Tests shall be undertaken in the order specified in [Annex B](#).

7.2 Durability and force gauge

When a specimen conforming to [A.2](#) is tested with a force gauge in accordance with [Annex J](#), active fire curtains shall remain operable afterwards, and gaps, cracks or tears shall not develop between the fabric and beyond the retention device (retention system) shall be recorded.

Following the initial force gauge test, the active fire curtains shall undergo testing for reliability and durability in accordance with [7.3](#), and deployment in accordance with [7.4](#). A second force gauge test shall then be undertaken on the same specimens and they shall remain operable afterwards.

The deflection criteria shall not be used to determine failure of the active fire curtains following each force gauge test.

7.3 Reliability and durability

When tested in accordance with [Annex E](#), the active fire curtains shall complete without failure the number of cycles that are relevant to the intended classification in [Table 3](#) and [Table 4](#) (see [E.5](#)). The active fire curtains shall subsequently be classified in accordance with [Table 4](#) according to the test result obtained.

NOTE A successful test for a given number of cycles also covers all classifications for lower numbers of cycles, e.g. Class C3 also covers classes C1 and C2.

Table 3 — Mechanical pre-test conditioning for pass door(s)

Frequency of intended use	Number of opens	Class
Retained in the closed position	10	B1

Table 4 — Mechanical pre-test conditioning

Frequency of intended use	Minimum number of cycles	Class
Retained position in the open	1 000	C1
Low frequency of use by those with high incentive to exercise care	10 000	C2
Medium frequency of use primarily by those with some incentive to exercise care	50 000	C3
High frequency of use by public with little incentive to exercise care	100 000	C4
Subject usage to very frequent	200 000	C5

When tested in accordance with [Annex E](#), alternative or additional motors to those tested as part of the active fire curtains shall complete without failure the number of cycles that are relevant to the intended classification in [Table 4](#). They shall subsequently be classified in accordance with [Table 4](#), according to the test result obtained.

7.4 Deployment

7.4.1 Response time and velocity

The active fire curtain shall be tested in accordance with [Annex E](#).

The active fire curtain shall commence deployment within 10 s of receipt of an initiation signal and move to its fire-operational position in all operating modes.

The active fire curtains shall have a velocity of not less than 0,03 m/s. Within 2,0 m of floor level, the velocity shall be not more than 0,15 m/s for vertical deployment or 0,3 m/s for horizontal deployment.

NOTE It is possible that national codes dictate increased velocities, e.g. up to 0,6 m/s.

All vertical active fire curtains shall be gravity fail safe.

For non-vertical (e.g. horizontal or low-angle) active fire curtains that do not permit fail safe by gravity, a power supply for life safety equipment for fire protection shall be provided in accordance with ISO 21927-10.

7.4.2 Delayed and/or multi-positional deployment

Where an active fire curtain is used with delayed and/or multi-positional deployment, its full range of positions and delay times shall be specified.

The operation of multi-positional deployment shall be tested in accordance with [I.6.6](#).

NOTE An example of multi-positional deployment is where, upon fire/smoke detection, active fire curtains deploy partially to limit smoke prior to full deployment.

7.4.3 Emergency egress control

Where active fire curtains include an emergency egress control to open (e.g. crossing egress routes), when tested in accordance with [I.7](#), the retract button shall be capable of opening and re-closing with an adjustable pause of up to 30 s before re-closing. It shall be possible to interrupt the descent at any stage by pressing the retract button again.

The length of the pause depends upon the occupancy level and type, taking into consideration national codes. This does not apply to active fire curtains with pass door(s).

7.4.4 Emergency access control

Where the active fire curtains include a retract control for fire and rescue service use, when tested in accordance with [I.8](#), the control shall retract the active fire curtains when pressed and shall redeploy once pressure is released.

7.5 Smoke leakage

7.5.1 General

Where smoke containment is required, the active fire curtains shall conform to the smoke leakage requirements specified in [7.5.2](#).

7.5.2 Total smoke leakage of active fire curtains with smoke-resistance

Active fire curtains shall be tested in accordance with [Table 1](#) and shall complete a test for smoke leakage in accordance with ISO 5925-1 and with the additional measurements required in [Annex G](#). The test shall be carried out on a specimen that conforms to [Annex A](#).

The leakage rates shall be declared in accordance with the relevant test standard. For active fire curtains of different dimensions to those tested, the leakage rate shall be calculated in accordance with [Annex G](#).

NOTE In certain circumstances, the total leakage rate for the installed active fire curtains can be limited, regardless of size.

7.6 Fire resistance

7.6.1 General

The fire resistance of the active fire curtains shall be determined in accordance with the standards specified in [Table 5](#), as appropriate to the end use application.

Table 5 — Fire resistance test standards for active fire curtains

Application	Standard
Vertical	ISO 834-1
Horizontal and angled	ISO 834-1 and guidance in ISO 3009

7.6.2 Integrity

The active fire curtains shall be evaluated against the integrity performance criteria specified in the relevant test method (see [Table 5](#)), using test specimens as specified in [Annex A](#).

Note that during the fire test the active fire curtain bottom bar has been in contact with a floor surface area with reaction to fire properties as defined in ISO 1182, i.e. non-combustible.

When the active fire curtain is installed in practice, the floor surface area should be checked with respect to reaction to fire properties with a view to preventing non-piloted autoignition of the floor covering on the unexposed side of the active fire curtain.

It is recommended to perform this check by subjecting the floor covering to a reduced scale fire test where the bottom bar is in direct contact with the floor covering intended to be installed in practice. Non-piloted autoignition shall not occur during the full heating period of the fire resistance of the active fire curtain proposed.

7.6.3 Insulation

Where an insulation classification is required, the active fire curtains shall be evaluated against the insulation performance criteria specified in the relevant test method (see [Table 5](#)), using test specimens conforming to [Annex A](#).

NOTE Insulation is not needed in all cases. For further information on the use of non-insulated elements on escape routes, refer to national codes.

7.6.4 Radiation (heat flux)

Where radiation criteria and/or radiation measurements are required, the active fire curtains shall be evaluated against the radiation performance criteria specified in the relevant test method (see [Table 5](#)), using test specimens as specified in [Annex A](#).

NOTE 1 Radiation (heat flux) measurement can be used as part of a fire engineering analysis.

NOTE 2 The distance at which radiation measurements are recorded is set in the relevant test standard. [Annex Q](#) provides guidance for the use of radiation data.

Readings shall be recorded in accordance with ISO 3009, and reported at intervals of no longer than 1 min. The readings shall be recorded in tabular format for ease of reference.

Note that during the fire test the active fire curtain bottom bar has been in contact with the floor surface area with reaction to fire properties as defined in ISO 1182, i.e. non-combustible.

When the active fire curtain is installed, in practice, the floor surface area should be checked with respect to reaction to fire properties with a view to preventing non-piloted autoignition of the floor covering on the unexposed side of the active fire curtain.

It is recommended to perform this check by subjecting the floor covering to a reduced scale fire test where the bottom bar is in direct contact with the floor covering intended to be installed in practice. Non-piloted autoignition shall not occur during the full heating period of the fire resistance of the active fire curtain proposed.

7.6.5 Deflection zone

The deflection of the active fire curtains shall be measured in accordance with ISO 834-1 (see [C.3.1.7](#)). The maximum recorded deflection (in mm) shall be taken as the deflection zone which runs parallel to the active fire curtains. A separate assessment made by an independent assessment body shall be made to determine the deflection zone for smaller sizes.

7.6.6 Initial deployment

When tested in accordance with [Annex F](#), Specimen 4 shall complete motor operations 1 and 2 (see [Table F.1](#)).

7.6.7 Operation following initial deployment — emergency egress

Where the active fire curtains are designed to operate following initial deployment, i.e. where an emergency egress control is fitted:

- a) when the operation of the emergency egress control is tested in accordance with [L.7](#), it shall not fail (see [L.9](#));
- b) when Specimen 4 is tested in accordance with [Annex F](#), it shall complete motor operations 1 to 11 (see [Table F.1](#)).

7.6.8 Operation following initial deployment — emergency access

Where the active fire curtains are designed to operate for fire service access, i.e. where an emergency access control is fitted:

- a) when the operation of the emergency access control is tested in accordance with [L.8](#), it shall not fail (see [L.9](#));
- b) when Specimen 4 is tested in accordance with [Annex F](#), it shall complete motor operations 1 to 12 (see [Table F.1](#)).

7.6.9 Delayed and/or multi-positional deployment

Where the active fire curtains are designed for delayed and/or multi-positional deployment, when Specimen 4 is tested in accordance with [Annex F](#), it shall complete motor operations 1 to 12 (see [Table F.1](#)).

7.7 Reaction to fire

The tested curtain fabric material used in the construction of active fire curtains shall be tested in accordance with and meet the requirements of ISO 1182 for combustibility and/or ISO 1716 and ISO 9705-1 for limited combustibility and ISO 11925-2 or other national codes.

NOTE 1 In the European Union, the Euroclass system under the Commission Delegated Regulation (EU) 2016/364 is used to determine combustibility and contribution to fire of construction products: A1 and A2 are non-combustible, B to D run from very limited to medium contribution to fire and E and F run from high contribution to easily flammable. The 's' part relates to the total smoke propagation/emission level. The values range from 1 (absent/weak) to 3 (high): s1 = a little or no smoke, s2 = quite a lot of smoke, and s3 = substantial smoke. The 'd' part indicates the 'flaming droplets and particles' during the first 10 minutes of exposure. The index is: d0 = none, d1 = some and d2 = quite a lot.

NOTE 2 Where the control of toxicity levels is required, the toxicity and smoke production of materials needs to conform to the requirements of the end-use application, such as transport, sub-surface and marine applications. IMO Resolution MSC.61(67): Annex 1, Part 2 covers smoke and toxicity testing for marine applications but can be used for other applications where toxicity levels need to be controlled. For under ventilated fires other tests can apply.

NOTE 3 It is recommended that care be given to reaction to fire tests. The results can not conform with fire-resistance performance of the complete product specimen.

7.8 Ancillary devices

7.8.1 General

Where a manufacturer's range includes any of the ancillary items listed in 7.8.2 to 7.8.7, they shall be included in all test specimens and their function shall be tested in accordance with the relevant parts of [Annex I](#).

7.8.2 Ancillary devices activation

All ancillary devices, when tested using the manufacturer's control panel(s), shall activate in the manner and to the standard specified by the manufacturer.

7.8.3 Hold-open devices

Hold-open devices, which may incorporate local smoke/heat detectors, or alternative release techniques or linkages, which are part of the manufacturer's range and which are used to retract active fire curtains, shall be incorporated into the specimen prepared for testing according to [Annex I](#).

NOTE This does not imply that active fire curtains need to be retracted during any part of the fire test.

7.8.4 Fire detection and alarm systems

Where fire detection and/or fire alarm systems are provided, they shall take into consideration national codes.

7.8.5 Sensory equipment for obstruction warning

Where sensory equipment for detecting obstructions to active fire curtain deployment is used for day-to-day use, then provide a single or multi-beam detection system, that is tested in accordance with [Annex I](#) to provide a warning.

A multi-beam detection system is required when the active fire curtains are intended to protect a means of escape route.

The frequency of warning time should be determined in relation to risk using an audible alert, visual alert or both, as appropriate for the application. It should not be possible to manually reset the alarm while the obstruction is still in place.

7.8.6 Pressure-sensitive protective equipment (PSPE)

Where PSPE is provided, such as a safety edge, it shall take into consideration national codes, and shall stop deployment of the active fire curtains and not retract.

7.8.7 Self-test facility for dwellings

When the active fire curtains are intended to be installed in a dwelling, it shall have a self-test facility within the control panel capable of deploying the active fire curtains at regular intervals and recording the date and time of the test, at a minimum frequency of once per month.

8 Marking, labelling and packaging

Active fire curtains shall be permanently marked where the marking can be easily seen when the active fire curtains are deployed (e.g. on the bottom bar or lower edge of the curtain above the bottom bar), with the following:

- a) the number and date of this document, i.e. ISO 21524:2021;
- b) the product (i.e. active fire curtain) and its performance characteristics as given in [Table 2](#);
- c) the name of the manufacturer and/or certification body;
- d) identification number or serial number if labelling by certification body;
- e) the date of manufacture of the system;
- f) for installation, see [Annexes S, T and U](#);
- g) for commissioning, see [Annexes N and V](#);
- h) for completion, see [Annex W](#);
- i) for inspection, testing and maintenance, see [Annexes O, U and X](#).

Where the active fire curtains are certified by a third party, the name of the certification body and the certificate reference shall also be included.

A suggested label format is given in [Figure 7](#).

Manufacturer:	A N Other
Address:	221B Baker Street London UK
Model:	XYZ Active Fire Curtain
Performance:	
- Force Gauge (pass/fail):	Pass
- Reliability:	B1 and C1
- Velocity (pass/fail):	Pass
- Smoke Leakage:	2,6 m ³ /m/h
- Integrity:	126 mins
- Insulation:	2 mins
- Radiation:	15 kW/m ² at 36 mins
- Deflection:	200 mm
Reaction to fire:	
- ISO 1716	18.73543 MJ/kg
Motor operation:	Pass

Figure 7 — Typical example of active fire curtains label

Annex A (normative)

General requirements for testing

A.1 General

Engineering drawings, calculations and parameters (e.g. equivalent active fire curtains dimensions and joints) shall be examined to confirm that all sizes in the range are represented by the specimen under test.

Technical drawings showing the standard fixing method shall be examined by the laboratory. This fixing method shall be used during the test. If this passes testing, other fixing methods can be considered subject to further technical appraisal by an independent assessment body.

Any deviation from the tested specimen could influence its fire performance and it should therefore be subjected to a full technical appraisal. It is therefore recommended that the specimen of active fire curtain to be tested (including joint details, curtain dimensions, fixing details, etc.) be considered carefully to maximize the scope for further assessment.

NOTE Further guidance is available in EN 15269-11:2018, Table A.2.

Overlapped and non-overlapped active fire curtains shall be tested separately.

A.2 Test specimens

A.2.1 General

With the exception of Specimen 4, Specimen 6, Specimen 7 and Specimen 8, all test specimens shall be tested as complete installed active fire curtains including side retention devices, motors, head boxes, bottom bars or tensioning devices. All ancillary devices required for the active fire curtains to function shall be included.

Where the active fire curtains are intended to limit the spread of fire effluent, smoke seals, if required, shall be included as part of all test specimens.

Where fabric materials in normal use have hems or joints (e.g. seams, welds or overlaps) the following shall be incorporated into all test specimens:

- a) Active fire curtains with horizontal joints shall be tested with a horizontal joint within 1,0 m of the top of the fabric curtain, exposed to view when active fire curtains are deployed.
- b) Active fire curtains with vertical joints shall be tested with at least one joint located 0,75 m to 1,25 m from a vertical side of active fire curtains.
- c) Active fire curtains with side hems shall be tested with at least one side hem.
- d) Active fire curtains shall have intentional tears located in the fabric curtain material (see [Figure C.7](#)) which shall be patched using the same materials as the main fabric curtain. These tears are intended to simulate potential integrity failures caused by creasing or folding during reliability testing. Patches shall be tested on the unexposed side. Patches shall thereby be subjected to reliability, durability and fire- and smoke-resistance testing where applicable.

A.2.2 Specimen 1 and Specimen 2

Where the manufacturer produces only one size and type of active fire curtains, this shall be tested as Specimen 1 only.

Where the manufacturer produces a range of active fire curtains and variety of sizes, at least two differing specimens shall be tested separately as follows:

- a) Specimen 1 shall have a width of 1,0 m and a deployment of 2,0 m, or else be the largest active fire curtains size in the range if this is smaller, or the smallest active fire curtains in the range if this is larger.
- b) Specimen 2 shall have a minimum width of 10,0 m (or the largest width in the range if smaller than 10,0 m). Active fire curtains which overlap, physically interact or are mechanically connected shall include such details in the specimen and be assembled in the manufacturer's intended manner. The height (vertical) or length (horizontal/angled) shall be 10,0 m or the largest in the range.

A.2.3 Specimen 3

The specimen shall be a complete assembly having maximum width dimensions to suit the furnace opening as specified in [C.2.1](#) (vertical) or [5.4](#) (horizontal/angled), or the largest width of an active fire curtain width in the range, if smaller. The height (vertical) or length (horizontal/angled) shall be 10,0 m or the largest in the range. Following the reliability test (see [Annex E](#)) the specimen shall be reduced in height or length to suit the furnace opening dimensions i.e. only the upper (top) portion. This shall include the headbox. The bottom bar or tensioning device will need to be re-attached to the bottom edge of the specimen. The remaining lower (bottom) portion of the fabric curtain will not be used for the fire-resistance test.

As the bottom bar sits on the furnace threshold, the sub-contraction of the lower (bottom) portion of the fabric curtains weight and/or any additional weight shall be applied to the bottom edge i.e. directly above bottom bar horizontally across its full width. Any additional load applied across the bottom edge does not form part of the finished product.

NOTE See [Figure C.7](#) for the location of tears and fabric material patches.

A.2.4 Specimen 4

The specimen shall be a complete motor drive assembly, mounted in its end-use configuration. Where the specimen is tested without any additional materials it shall be deemed suitable in all applications. Where a manufacturer supplies more than one type of motor, they shall all be subjected to testing (see [Annex F](#) and [Annex H](#)).

A.2.5 Specimen 5

The specimen shall be a complete active fire curtain with minimum dimensions of 2,0 m wide × 2,0 m high, or the largest active fire curtain in the range, if smaller.

The sill (gap below the bottom bar) shall be sealed during the tests (see [Annex G](#)).

A.2.6 Specimen 6

The specimen shall be samples of the same fabric used in all specimens, except Specimen 4.

A.2.7 Specimen 7

The specimen shall be samples of the same fabric used in all specimens, except Specimen 4, for the reduced scale test for the vertical seam direction and loads on retention system (see [Figure C.9](#)).

A.2.8 Specimen 8

The specimen shall be samples of the same fabric used in all specimens, except Specimen 4, for the reduced scale test for the horizontal seam direction and loads on barrel/barrel to tube fixing (see [Figure C.10](#)).

A.2.9 Specimen 9

The specimen shall be samples of the same fabric used in all specimens, except Specimen 4, for the shrinkage of curtain test (see [Figure C.1](#)).

A.3 Test report

A test report shall be prepared to include the following:

- a) name or trademark, and address of the manufacturer and/or supplier;
- b) name of the product (type and model);
- c) date(s) of the test(s);
- d) name(s) and address(es) of the testing organization;
- e) reference to this document, i.e. ISO 21524:2021;
- f) full and detailed description of the test specimen, including but not limited to:
 - 1) any relevant information regarding the range, the material integrity, weight and tensioning, where appropriate;
 - 2) the original manufacturer and model of the motor;
 - 3) key components of the motor, including type, drive, gear box, limits, brake, cable, voltage etc.;
 - 4) smoke seals (where provided);
 - 5) overlaps (where used);
 - 6) the original manufacturer of the fabric material of the fire curtain;
 - 7) key components used within the construction of the curtain material, including woven yarns and the compounds used within the coatings of such materials;

NOTE Fingerprinting as required in UL 10D, ETAG 026/5, EOTA TR 024 using Infrared Spectroscopy (general principles of EN 1767).

 - 8) control panel (where provided);
 - 9) ancillary devices (where provided);
- g) reference to the test method(s);
- h) observations during the test(s), including any deviations from the procedure and any unusual features observed;
- i) fixing and installation methods;
- j) test results and classifications achieved.

The observations outlined in [A.3](#) shall include any comments regarding the suitability of the active fire curtains to fulfil its function.

Annex B (normative)

Order of testing

The active fire curtains shall be subjected to relevant tests (see [Clause 7](#)) as specified in [Table B.1](#). Specimens 1 to 9 may be tested in any order, but tests carried out on each specimen shall follow the order given in [Table B.1](#).

Table B.1 — Test order

Specimen	Test	Test method
Specimen 1 (see A.2)	Ancillary devices	Annex I
	Initial force gauge deflection	Annex J
	Reliability and durability	Annex E
	Deployment	Annex E
	Response time and velocity	Annex E
	Multi-position deployment	Annex E
	Second force gauge deflection	Annex J
Specimen 2 (see A.2)	Initial force gauge deflection	Annex J
	Reliability and durability	Annex E
	Deployment	Annex E
	Response time and velocity	Annex E
	Multi-position deployment	Annex E
	Second force gauge deflection	Annex J
Specimen 3 (see A.2.3)	Initial force gauge deflection	Annex J
	Reliability and durability	Annex E
	Deployment	Annex E
	Response time and velocity	Annex E
	Multi-position deployment	Annex E
	Second force gauge deflection	Annex J
	Fire resistance	Table 3 , Table 4 and Table 5
	- integrity	
	- insulation, if applicable	
	- radiation, if applicable	
	- deflection	
Specimen 4 (see A.2.4)	Motor operation	Annex F
Specimen 5 (see A.2.5)	Smoke leakage, if required	Annex G
Specimen 6 (see A.2.6)	Reaction to fire	7.7
Specimen 7 (see A.2.7)	Fire resistance - integrity	Table 5

NOTE If toxicity testing is required (see [7.7](#)). It is possible to use additional specimens

Table B.1 *(continued)*

Specimen	Test	Test method
Specimen 8 (see A.2.8)	Fire resistance - integrity	Table 5
Specimen 9 (see A.2.9)	Fire resistance - integrity	Table 5
NOTE If toxicity testing is required (see 7.7). It is possible to use additional specimens		

Annex C (normative)

Fire-resistance test method

WARNING — The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing can be hazardous and that there is a possibility that toxic and/or harmful smoke and gases can be evolved during the test. Mechanical and operational hazards can also arise during the construction of the test elements or structures, their testing and disposal of test residues.

It is imperative that an assessment of all potential hazards and risks to health is made and that safety precautions are identified and provided. Written safety instructions need to be issued. Appropriate training shall be given to relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

C.1 Test equipment — Test conditions

Appropriate mechanical pre-test conditioning shall be completed in accordance with the requirements in [Table 3](#) and [Table 4](#).

C.2 Test specimen

C.2.1 Size

The test specimen and all its components shall be full size unless limited by the size of the front opening of the furnace which will normally be 3,0 m × 3,0 m.

C.2.2 Number

The number of test specimens required to determine the fire resistance of active fire curtains shall be based upon all orientations and constructions:

Insulation and/or Radiation	2
Integrity	1

This applies to all types of construction, i.e. single or overlapped in either the vertical, horizontal or angled orientation. Refer to [C.2.5](#).

C.2.3 Design

The design of the test specimen and the choice of supporting construction shall take into account the requirements for direct field of application or extended application.

C.2.4 Installation of test specimen

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

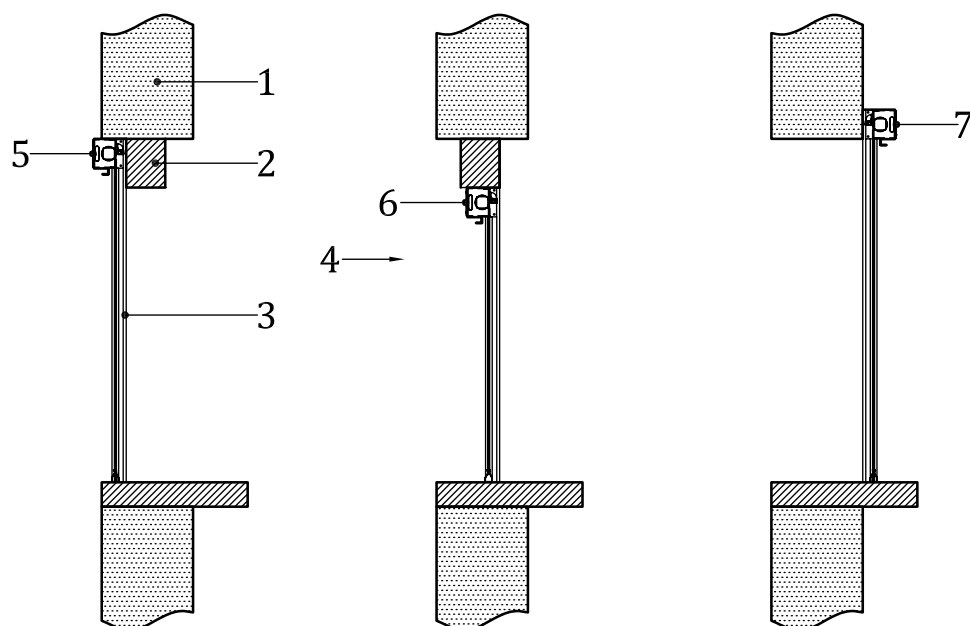
The test specimen shall be mounted in a supporting construction which covers the type in which it is intended to be used. The design of the connection between the active fire curtains and the supporting construction, including any fixings and materials used to make the junction, shall be as used in practice and shall be regarded as part of the test specimen. The test specimen shall be mounted within the

supporting construction so that it is flush with the exposed face of the supporting construction, unless the normal mounting procedure provided does not allow this.

The whole area of the test specimen, together with at least the minimum dimensions of the supporting construction, shall be exposed to the heating conditions.

C.2.5 Asymmetrical active fire curtains

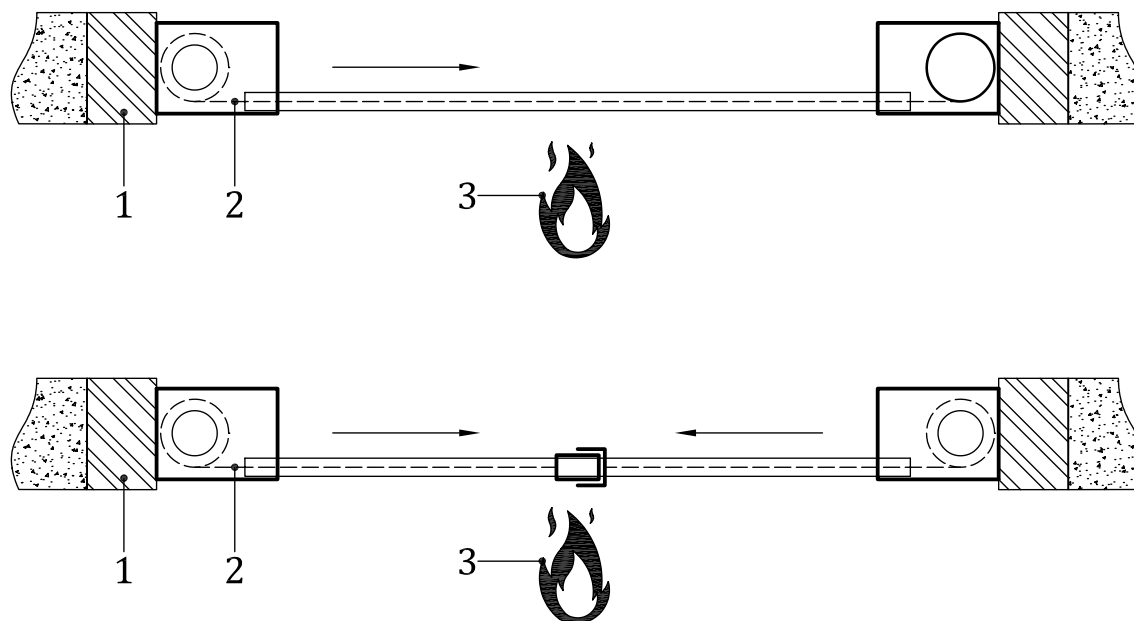
For active fire curtains required to be fire resisting for insulation or radiation from both sides, two test specimens shall be tested (one from each direction) unless the element is fully symmetrical, i.e. the construction of the active fire curtain is identical on both sides of a centre line through the thickness of the head section when viewed in plan (from above). However, in some cases it is possible to develop rules whereby the fire resistance of an asymmetrical active fire curtain tested in one direction can apply when the fire exposure is from the other direction. The possibility of developing such rules increases if the consideration is limited to certain types of active fire curtains and on the criteria being applicable, e.g. integrity only active fire curtains (see [Figures C.1, C.2, C.3, C.4 and C.5](#)).



Key

- 1 test frame
- 2 lintel
- 3 active fire curtain
- 4 fire
- 5 exposed
- 6 aperture
- 7 unexposed

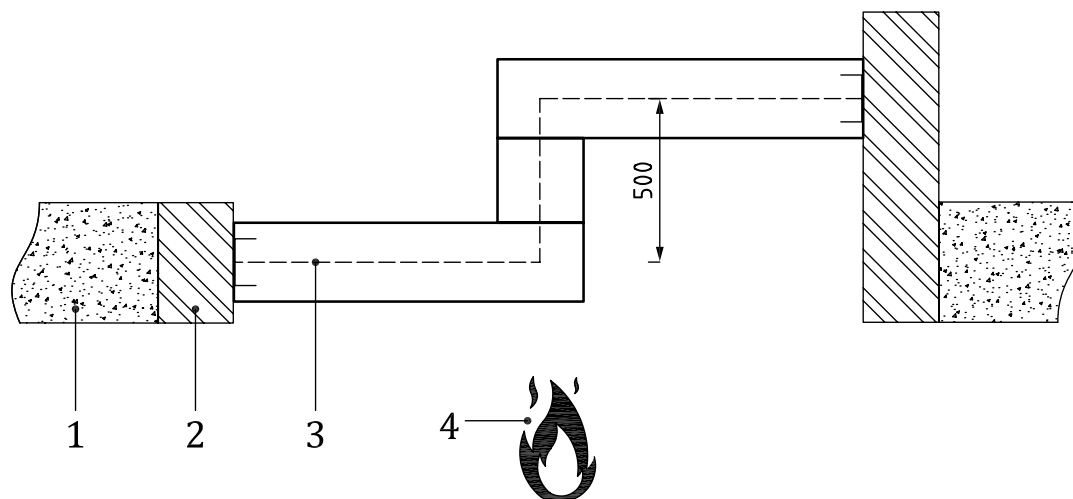
Figure C.1 — Typical example of asymmetrical vertical active fire curtains



Key

- 1 test frame
- 2 active fire curtain
- 3 fire

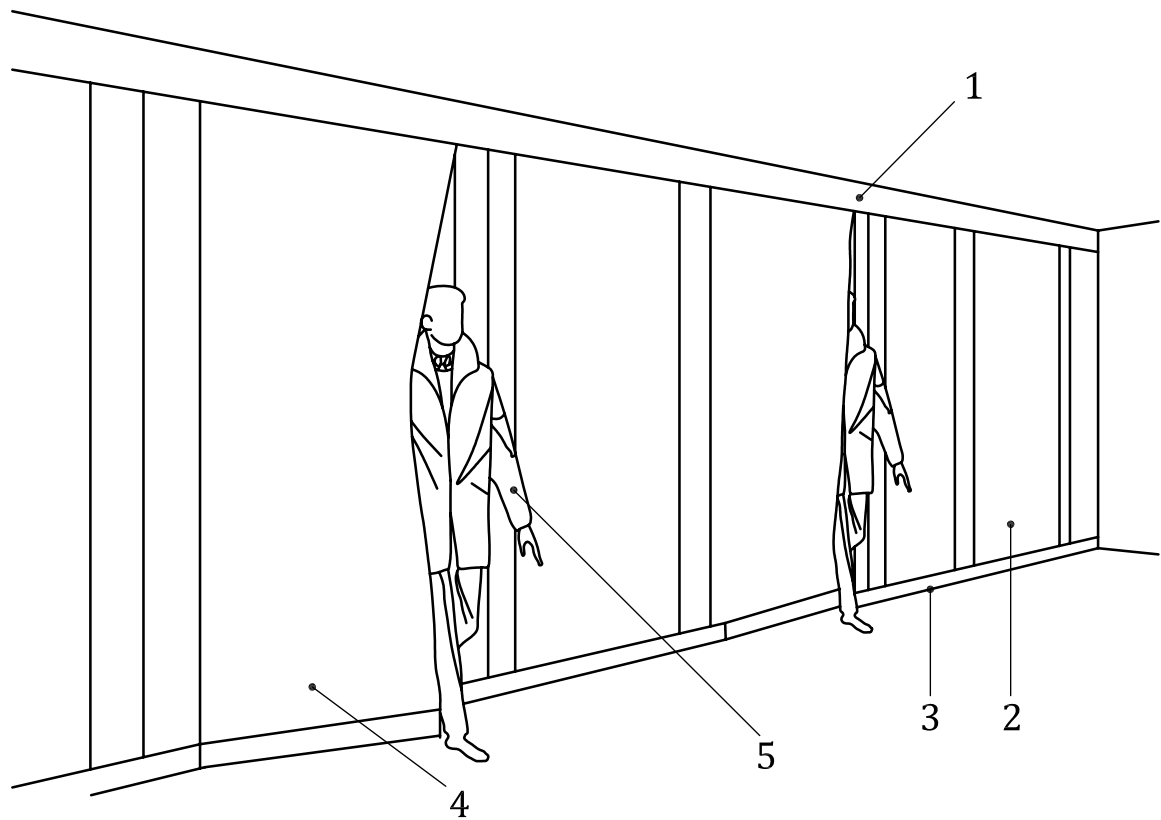
Figure C.2 — Example of a typical asymmetrical horizontal active fire curtains



Key

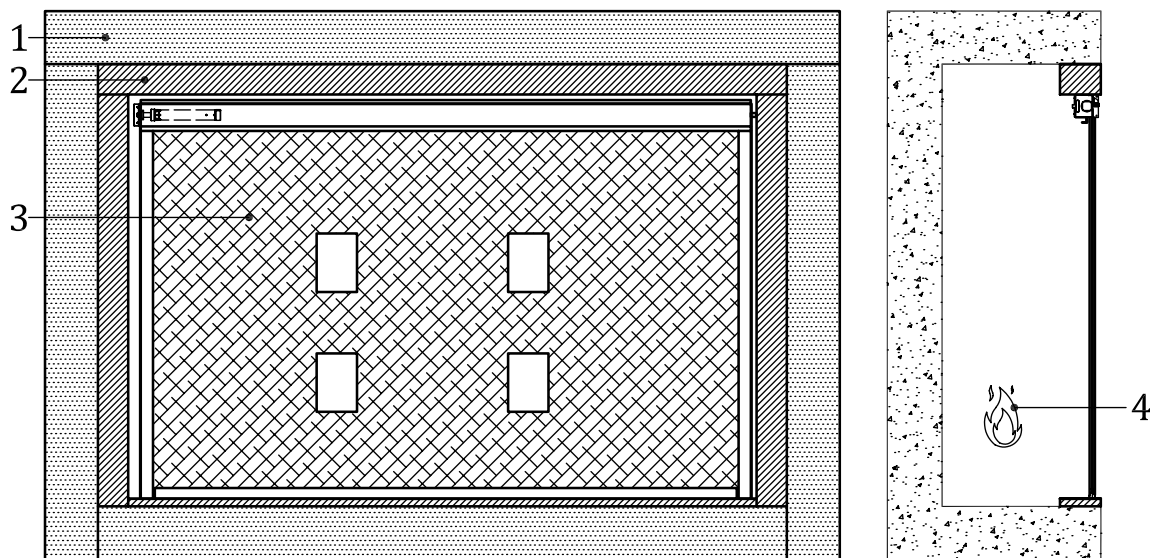
- 1 test frame
- 2 supporting construction
- 3 active fire curtain
- 4 fire

Figure C.3 — Example of typical asymmetrical pleated/folding active fire curtains

**Key**

- 1 headbox
- 2 active fire curtain
- 3 bottom bar
- 4 pass door(s) fabric curtain
- 5 occupant

Figure C.4 — Example of typical asymmetrical active fire curtains with pass door(s)

**Key**

- 1 test frame
- 2 supporting construction
- 3 active fire curtain
- 4 fire

Figure C.5 — Example of typical asymmetrical active fire curtains with vision panel(s)

C.2.6 Supporting construction

C.2.6.1 General

The fire resistance of any supporting construction shall not be determined from a test in conjunction with an active fire curtain and shall be at least commensurate with that anticipated for the product.

C.2.6.2 Standard supporting construction

The choice of standard supporting construction shall reflect the intended normal use of the active fire curtain. The rules governing the applicability of the chosen standard supporting construction to other end use situations are given in rigid standard supporting constructions (high or low density) and flexible standard supporting constructions.

The fire resistance of active fire curtains tested in one form of standard supporting construction can or can not apply when it is mounted in other types of construction. Generally, the rigid and flexible types are not interchangeable.

C.2.6.3 Rigid standard supporting constructions (high or low density)

The fire resistance of an active fire curtain tested in a high- or low-density rigid standard supporting construction as specified in ISO 834-1 can be applied to active fire curtains mounted in the same manner in a wall provided the density and the thickness of the wall are equal to or greater than that in which the active fire curtains was tested.

C.2.6.4 Flexible standard supporting constructions

The fire resistance of active fire curtains tested in one of the flexible standard supporting constructions specified in ISO 834-1 can be applied to active fire curtains mounted in the same manner in a wall or partition which is of the board-covered type with studs made from metal or timber.