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

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Foreword

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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}	$m^3/m^2/h$	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}	$m^3/m/h$	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}	$m^3/m^2/h$	leakage per metre through the perimeter gaps at the vertical edges
L_{lt}	$m^3/m/h$	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	$W/(m^2K^4)$	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	$(kW/m^2)^{4/3}s$	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;

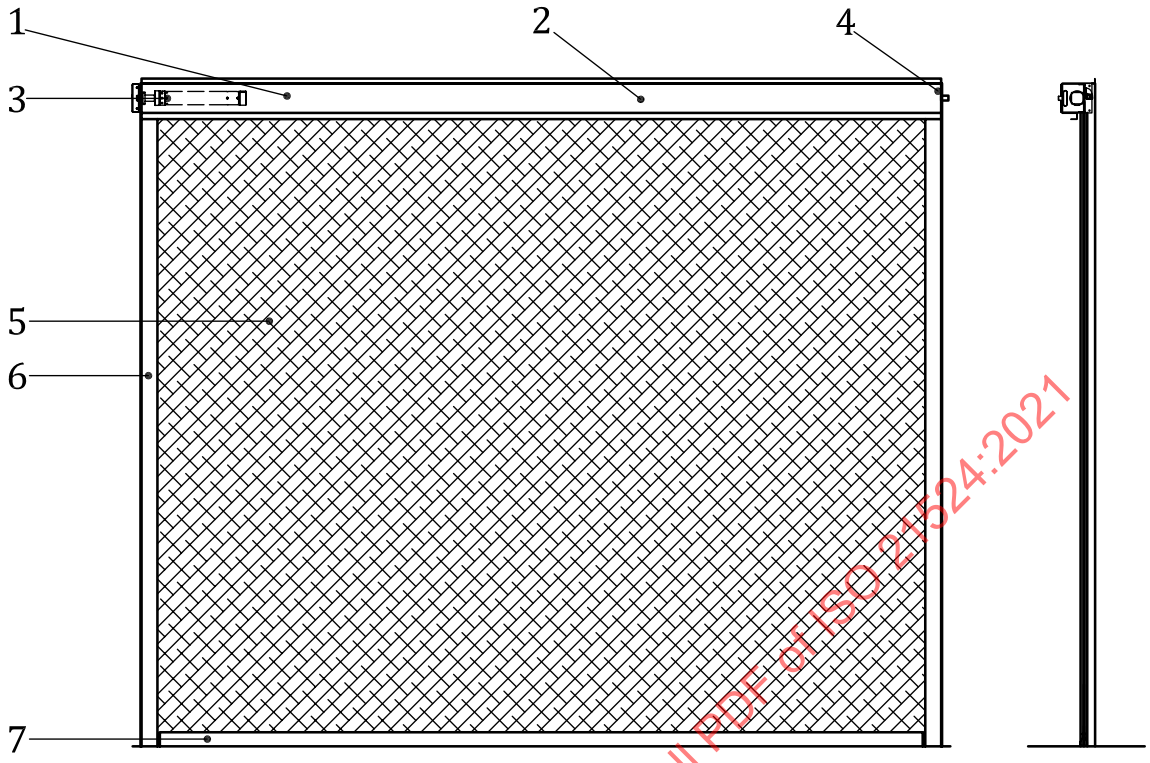
d) meeting the requirements for smoke leakage in conjunction with other non-smoke rated products (e.g. lift door) protecting openings to reduce leakage of smoke.

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.



Key

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

Figure 1 — Example of a typical single active fire curtain

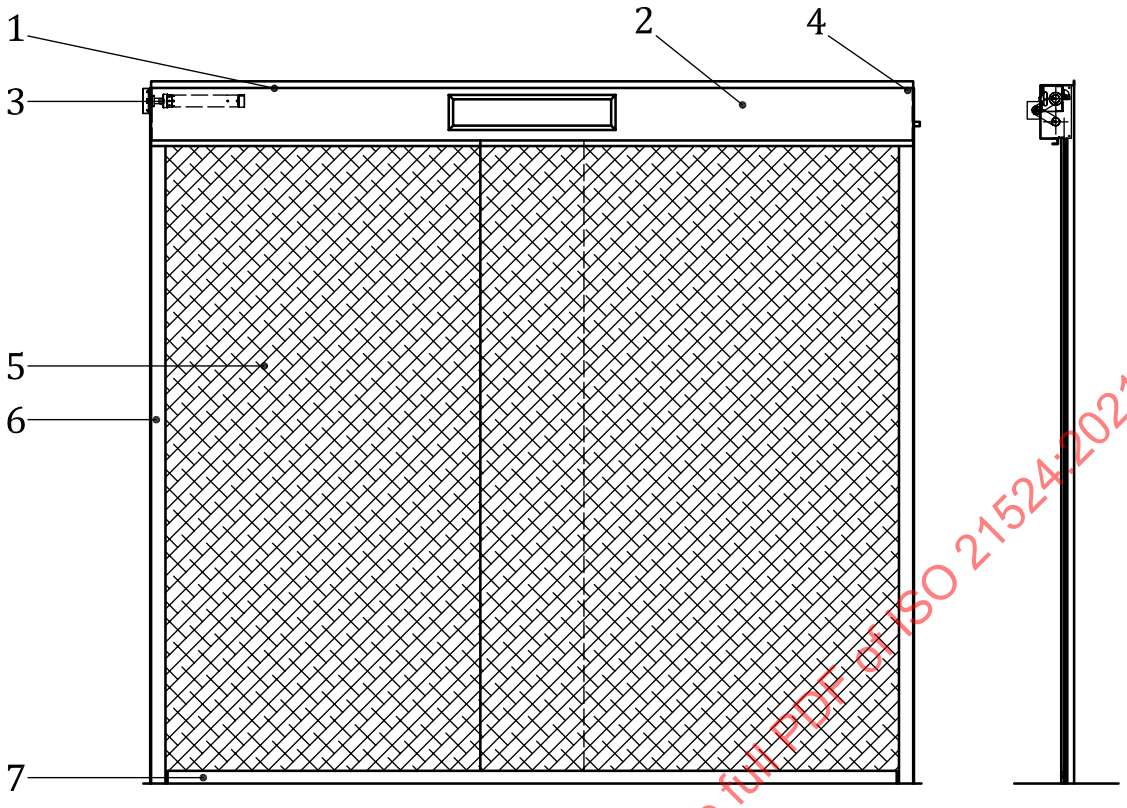
5.3 Additional requirements for multiple active fire curtains

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.

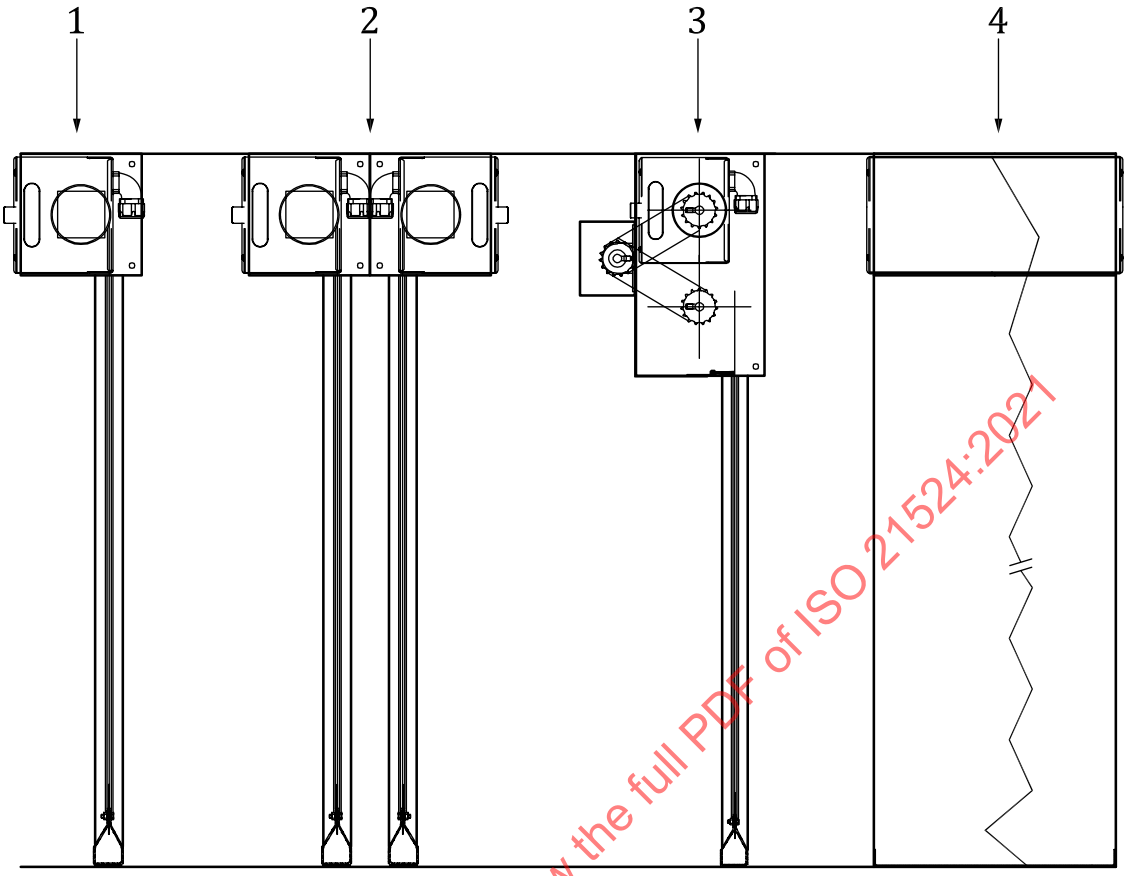
Figure 3 illustrates examples of typical active fire curtains arrangements.



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.

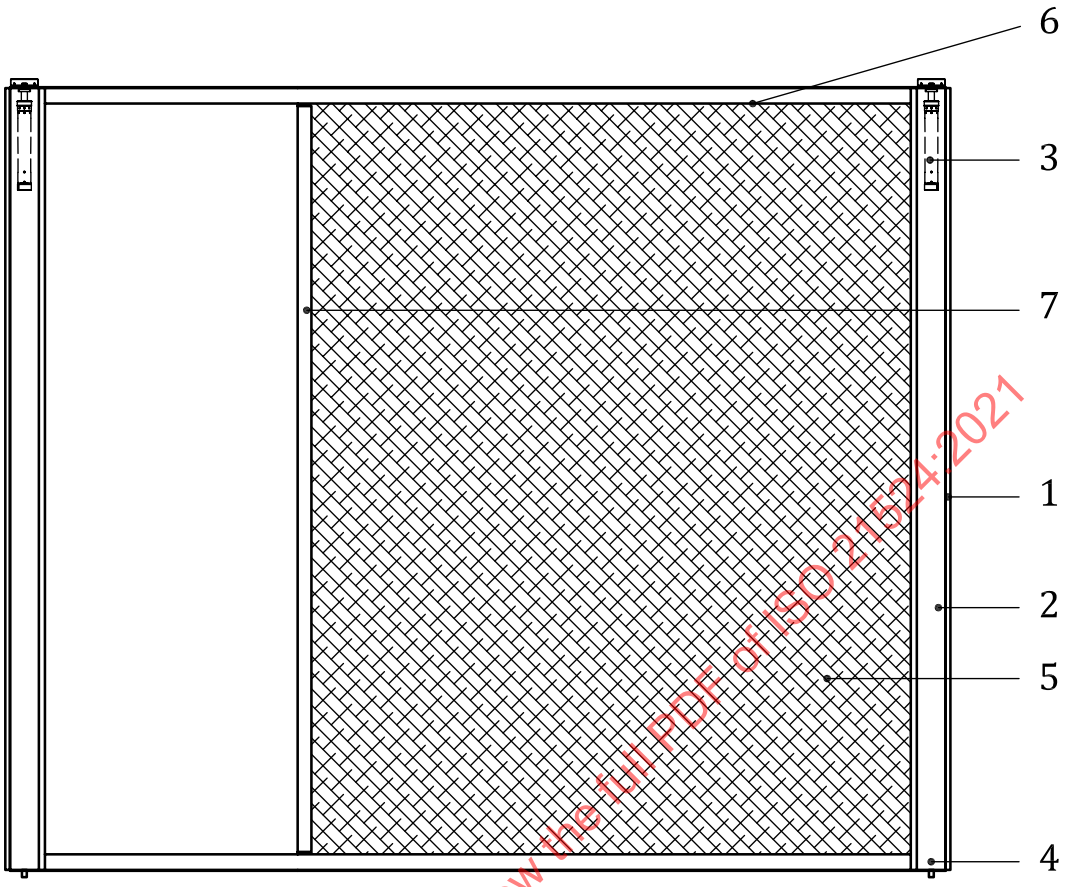
The test specimen and all its components shall be full size. When this is restricted by the size of the opening of the furnace (which is normally 3,0 m × 4,0 m), active fire curtains shall be tested at the maximum size possible and the fire resistance of the full-sized assembly shall be derived by an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

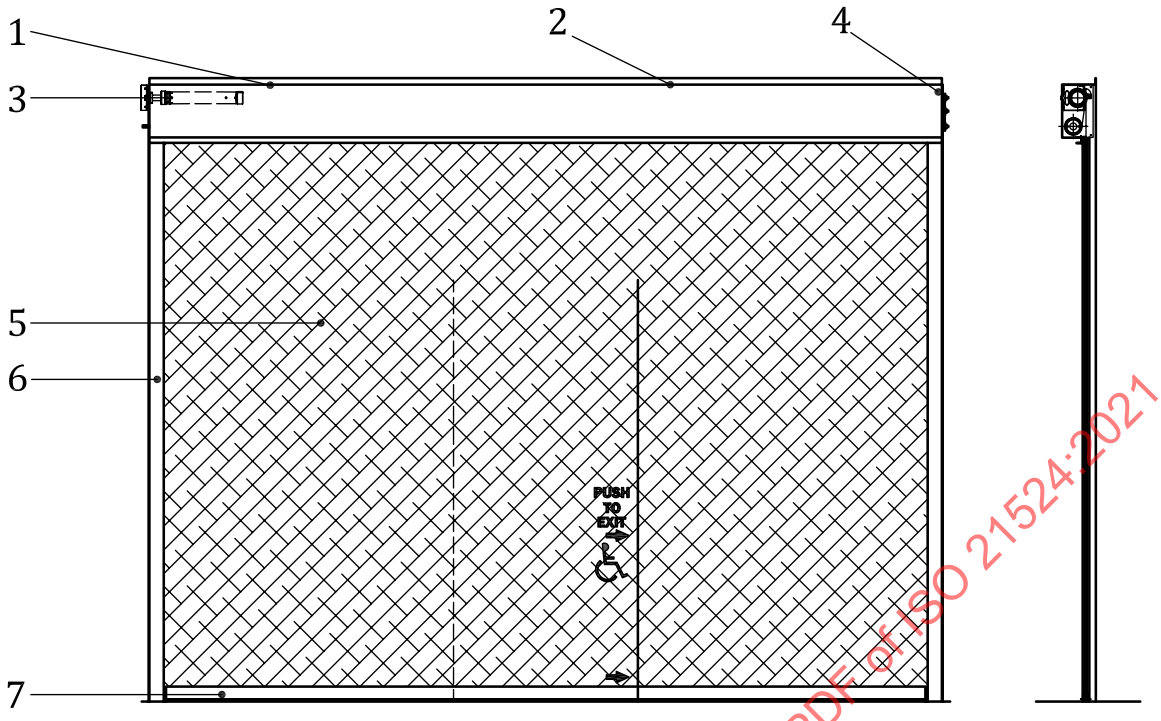
5.5 Pass door(s)

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.



Key

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

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

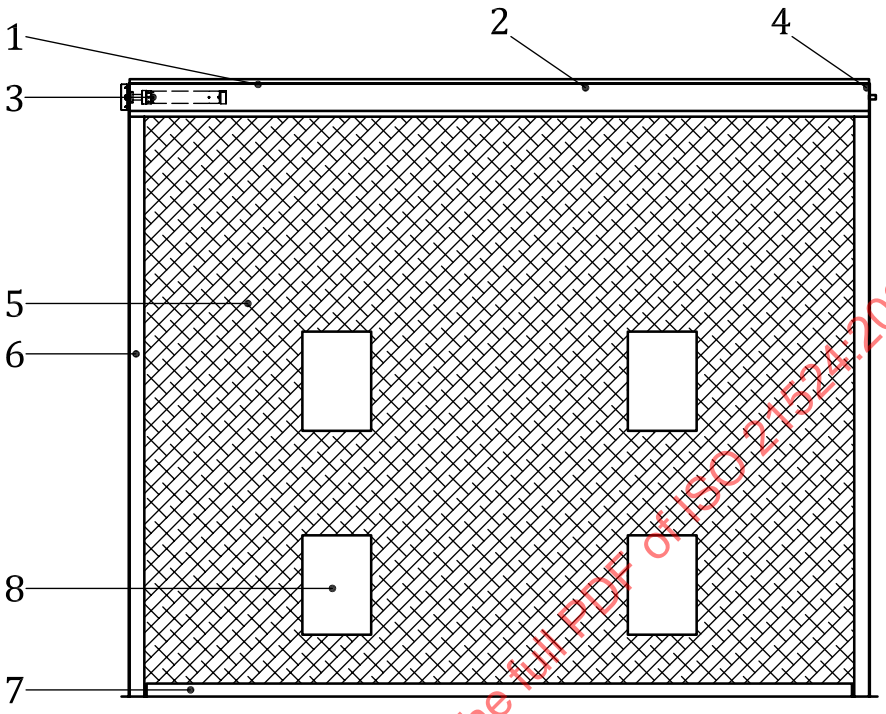
— decreased by a maximum of 25 % for integrity only and/or radiation control constructions and for insulation specimens where the unexposed surface temperature for both the construction and the vision panels have been maintained for the classification period; or

— 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 I	$(400\ ^{+10}_{0})$ N 35 N ± 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: ≥ 0,03 m/s at any height; ≤ 0,15 m/s below 2,0 m Horizontal: ≥ 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 I.7, it shall not fail (see I.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 controls is tested in accordance with I.8, it shall not fail (see I.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 F) 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.

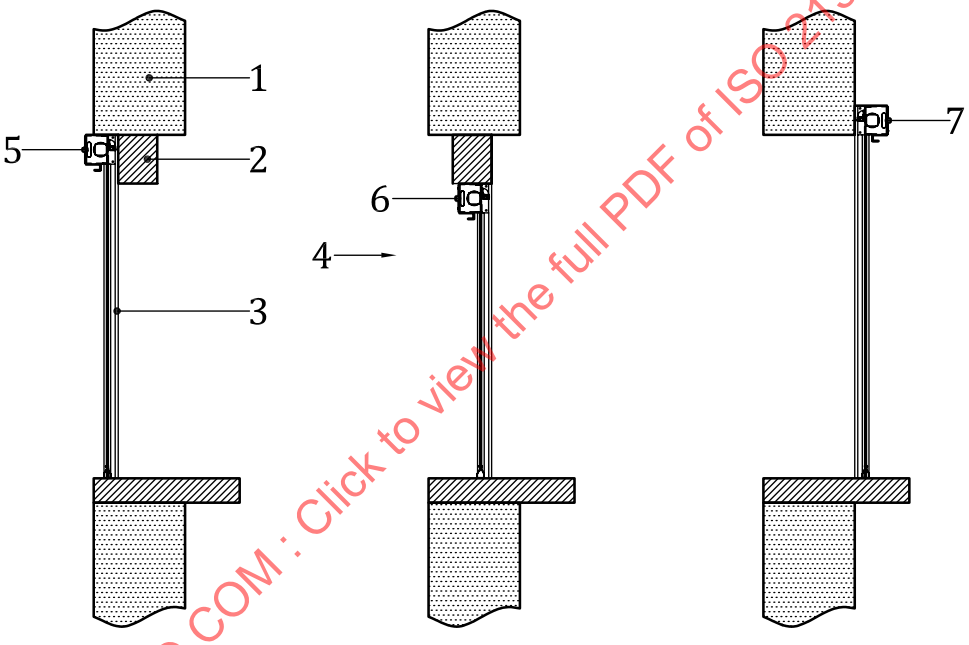
The test specimen shall be mounted in a supporting construction which covers the type in which it is intended to be used. The design of the connection between the active fire curtains and the supporting construction, including any fixings and materials used to make the junction, shall be as used in practice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

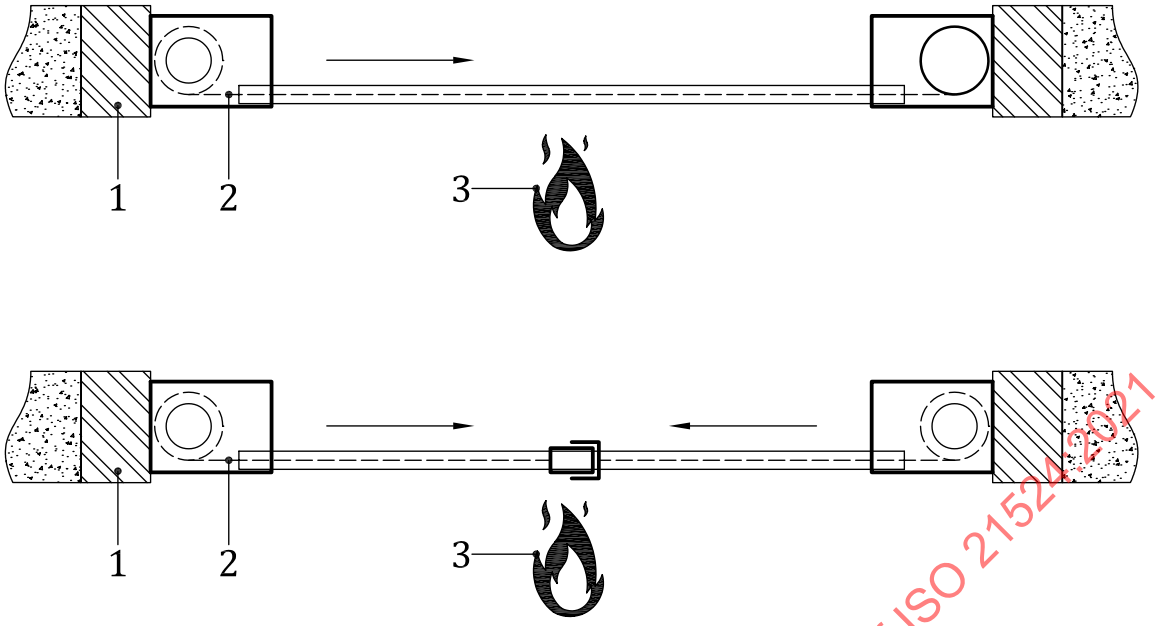
For active fire curtains required to be fire resisting for insulation or radiation from both sides, two test specimens shall be tested (one from each direction) unless the element is fully symmetrical, i.e. the construction of the active fire curtain is identical on both sides of a centre line through 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

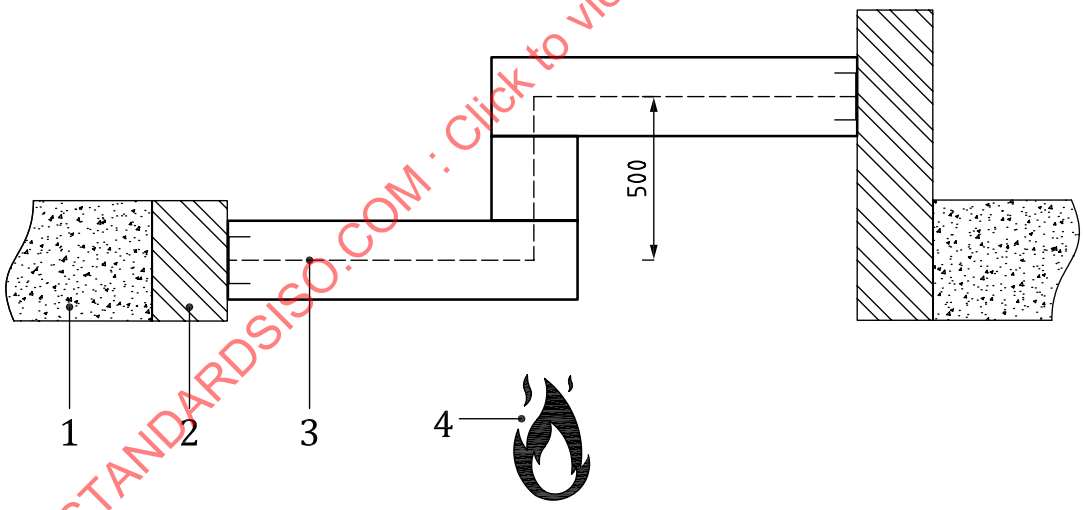
Figure C.1 — Typical example of asymmetrical vertical active fire curtains



Key

1 test frame
2 active fire curtain
3 fire

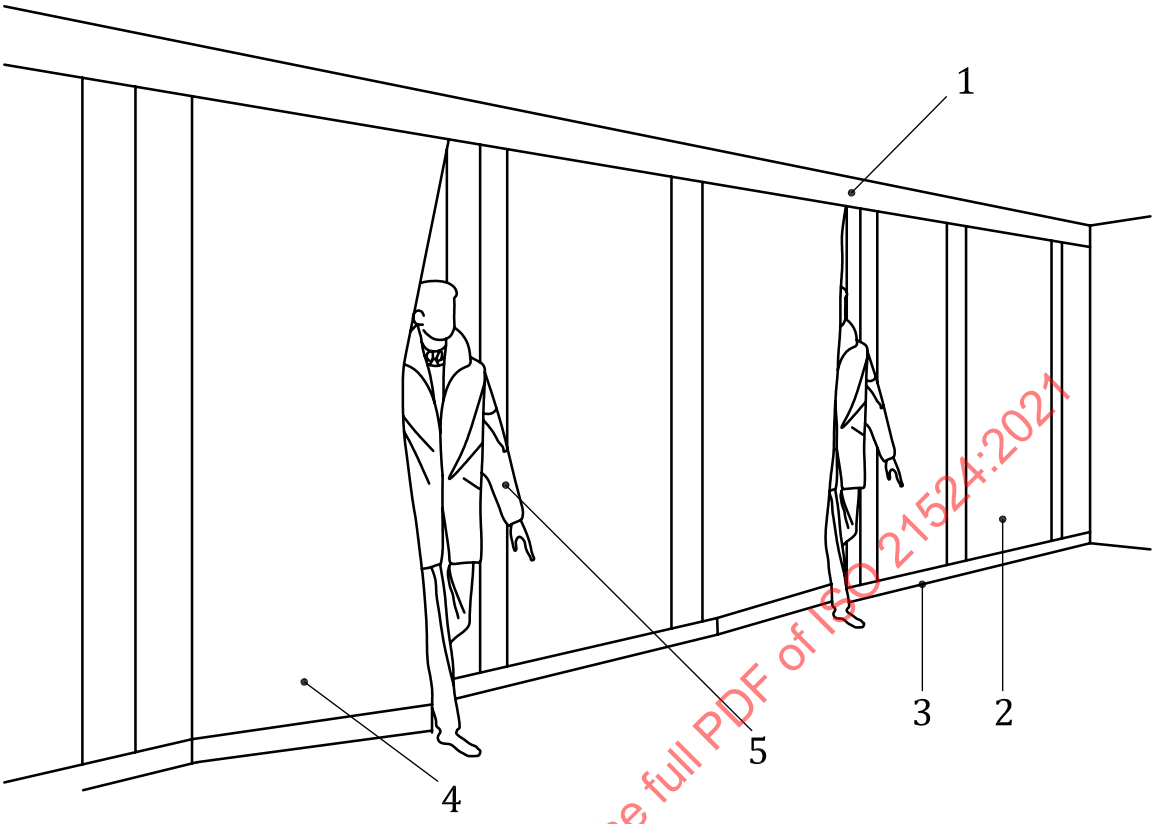
Figure C.2 — Example of a typical asymmetrical horizontal active fire curtains



Key

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

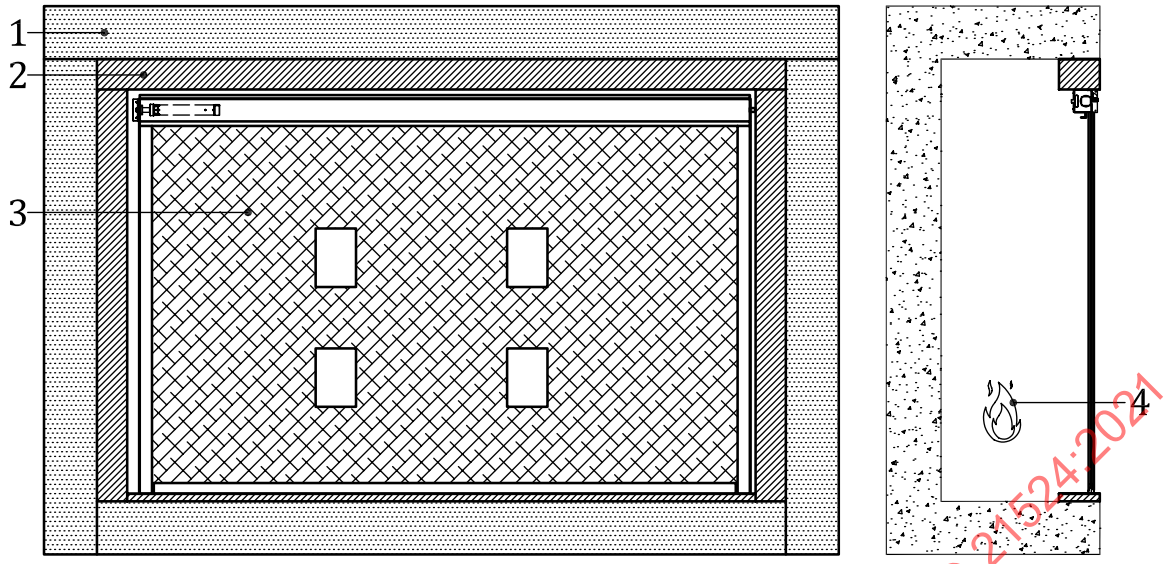
Figure C.3 — Example of typical asymmetrical pleated/folding active fire curtains



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.

The fire resistance of the active fire curtains is only applicable to active fire curtains mounted in a partition with a fire resistance equal to or greater than the partition in which it was tested.

C.2.6.5 Erection of standard-supporting and associated supporting constructions

For flexible standard supporting constructions and all associated supporting constructions, the partition or wall shall be erected so that it can distort freely perpendicular to the plane of the supporting construction along the vertical edges, i.e. there shall be a free edge at each vertical end of the test construction.

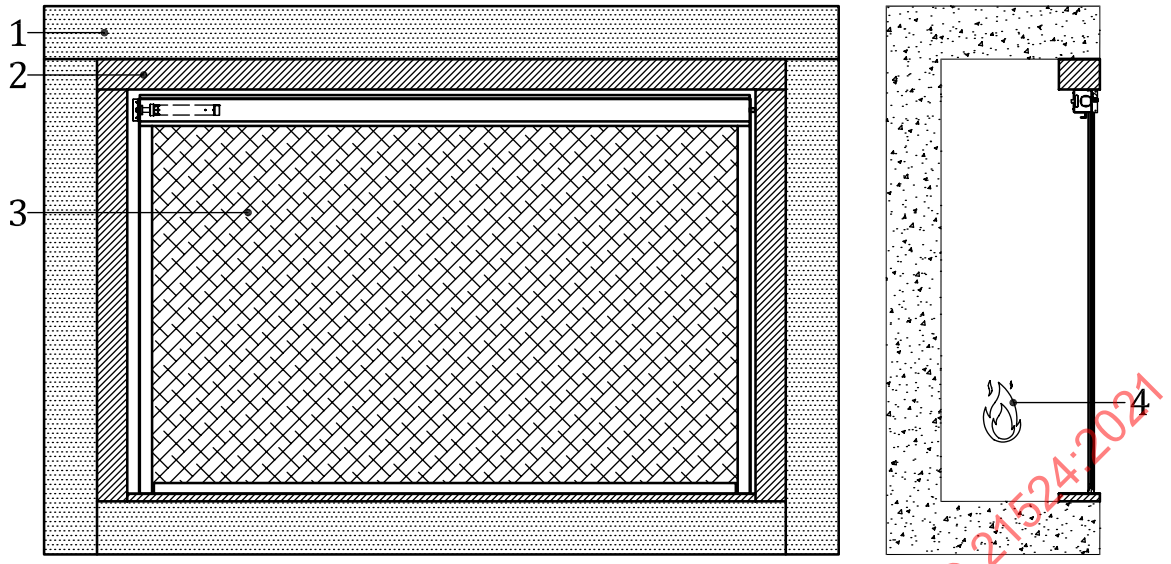
For rigid standard supporting constructions, the wall shall be erected with no freedom to distort perpendicular to the plane of the wall along the vertical edges, i.e. it shall be fixed to the inside of the test frame as in practice.

The supporting construction shall be built within a test frame conforming to ISO 834-1. The supporting construction shall be prepared in advance of the mounting of the test specimen, leaving an aperture of the desired size, except when it is normally erected in conjunction with active fire curtains using appropriate fixing methods.

There shall be a minimum zone of supporting construction of 200 mm wide (see Figure C.6) within the furnace opening, 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. In the horizontal or angled plane, the 200 mm zone is required all around the aperture.

If the bottom of the active fire curtains are at floor level in practice, then at the bottom of the aperture continuity of the floor shall be simulated using a floor extension of a solid non-combustible material which has a minimum dimension of 200 mm from the bottom edge on each side of the test specimen (i.e. from the exposed and the unexposed face) and which has a density of at least 450 kg/m^3. The furnace floor can be regarded as part of the simulation of the floor continuity, provided that it is level with the base of the test specimen. If a sill detail is incorporated as part of the active fire curtains, this shall be incorporated within or placed on top of the floor extension.

If active fire curtains are not to be used at floor level and provided that they have a frame detail to all four sides of the aperture, then they may be mounted simply within the thickness of the wall, without a floor extension.



Key

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

Figure C.6 — Supporting construction for active fire curtains

C.2.6.6 Associated supporting constructions

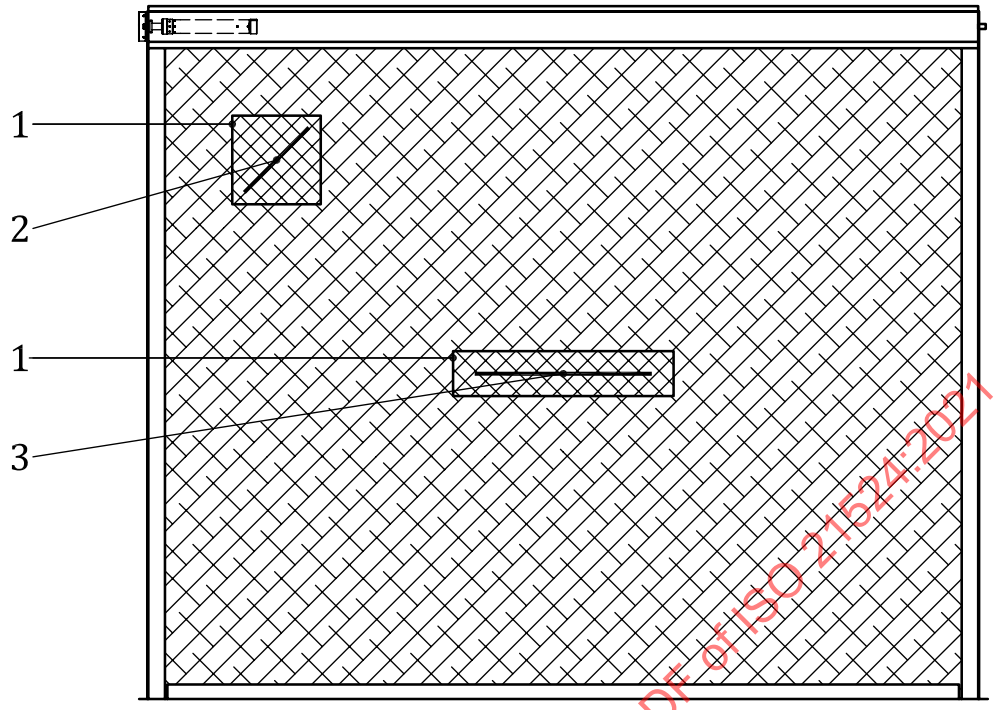
The fire resistance of active fire curtains tested in an associated supporting construction has no field of direct application. The applicability of the result to other supporting constructions shall be the subject of extended application.

C.3 Integrity

C.3.1 General

C.3.1.1 Introduction

The integrity shall be evaluated throughout the test by cotton wool pads, gap gauges and monitoring the test specimen for evidence of sustained flaming (see Figure C.1).



Key

1 fabric patches
2 diagonal tear 150 mm
3 horizontal tear 400 mm

Figure C.7 — Example of typical fabric material patches for active fire curtains

C.3.1.2 Cotton pad

A cotton pad is employed by placing the frame within which it is mounted against the surface of the test specimen for a maximum of 30 s, or until ignition (defined as glowing or flaming) of the cotton pad occurs. The cotton pad shall be applied to all surfaces, including areas where either flames or hot gasses from a discontinuity, a crack or a gap are present.

During measurements, care shall be taken to ensure at least 30 mm clearance between the surface of the pad facing the test specimen and the surface of the test specimen that is parallel to it. There shall also be at least 10 mm clearance between the periphery of the pad and any part of the test specimen. The cotton pad holder is provided with protuberances to maintain the appropriate separation between it and the test specimen. Small adjustments in position may be made so as to achieve the maximum effect from flames or hot gases.

The operator shall undertake these tests to evaluate the insulation criteria of the test specimen. Such screening may involve selective short duration applications of the cotton pad to areas of potential failure and/or the deployment of a single pad over and around such areas. Charring of the pad may provide an indication of imminent failure, but a new pad shall be employed in the prescribed manner for an integrity failure to be confirmed. The pad shall be removed immediately once glowing or flaming of the pad occurs.

Charring of the cotton pad without flaming or glowing shall be ignored. The pad shall not be shaken or air blown across its surface after application, in order to avoid igniting the pad when it should not otherwise be ignited.

The time of ignition, together with the location at which ignition occurred, shall be recorded.

C.3.1.3 Gap gauges

When gap gauges are used, the size of the opening in the surface of the test specimen shall be evaluated at intervals which are determined by the apparent rate of the specimen deterioration. Three gap gauges shall be employed, in turn, and without undue force to determine:

a) whether the 6 mm gap gauge can be passed through the test specimen, such that the gauge projects into the furnace, and can be moved a distance of 150 mm along the gap; or

b) whether the 25 mm gap gauge can be passed through the test specimen such that the gauge projects into the furnace; or

c) whether the 19 mm gap gauge can be passed through the test specimen along the floor level such that the gauge projects into the furnace.

The gap gauges shall be used without undue force to enter through the gap or to traverse within the gap.

Any small interruption to the passage of the gauge that has little or no effect upon the transmission of hot gases through the opening shall not be taken into account, e.g. a small fastening across a construction joint that has opened up due to distortion.

The time at which it proves possible to enter a gap gauge into any opening in the test specimen in the prescribed manner, together with the location, shall be recorded.

C.3.1.4 Flaming

The occurrence and duration of any flaming on the unexposed surface, together with the location of the flaming, shall be recorded.

C.3.1.5 Behaviour

Observations shall be made of the general behaviour of the test specimen during the course of the test and notes concerning phenomena such as smoke emission, distortion, cracking, melting, softening, or charring, etc. of materials of the test specimen shall be made.

C.3.1.6 Pressure

Install pressure measuring devices in the furnace in accordance with ISO 834-1.

C.3.1.7 Deflection

Appropriate instrumentation shall be provided to determine a history of all significant deployments perpendicular to the face of the test construction during the test (see Figure C.8). The following components are suggested as areas where significant deployment is likely to occur:

a) curtain material;

b) head section relative to supporting construction;

c) retention system/channels relative to supporting construction;

d) bottom bar/leading edge relative to supporting construction;

e) flexible and/or associated supporting construction.

The principle of the measurement shall be by measurement against a fixed datum. The interval between measurements shall be chosen to present a history of deflection throughout the test period.

A suitable method for determining deflection of the test construction, including proposals for the selection of suitable intervals between measurements, is as follows:

— 30 min test: Every 10 min up to 20 min; every 5 min thereafter.

— 60 min test: Every 10 min up to 50 min; every 5 min thereafter.

— 90 min test: Every 20 min up to 80 min; every 5 min thereafter.

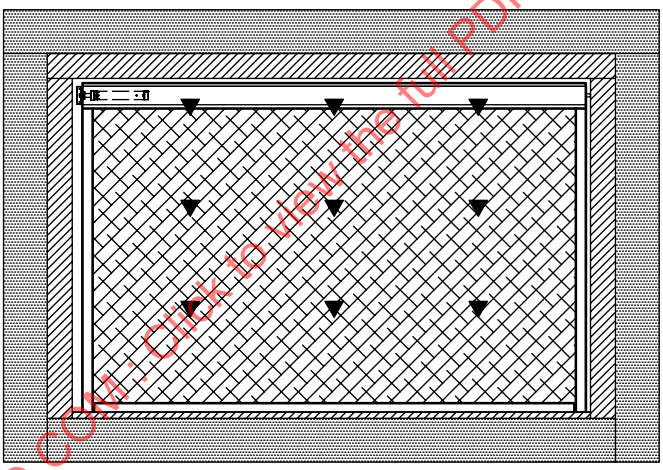
— 120 min test: Every 20 min up to 100 min; every 10 min thereafter.

— 180 min test: Every 30 min up to 150 min; every 10 min thereafter.

— 240 min test: Every 30 min up to 210 min; every 10 min thereafter.

Measurement of deflection is a mandatory requirement although there are no performance criteria associated with it. Information relating to the relative deflection between components of the test specimen, between the test specimen and the supporting construction and of the supporting construction itself can be important in determining the field of extended application of the test results. A minimum of three positions for measuring deflection shall be recorded as per C.3.1.7 (this subclause) and Figure C.8.

NOTE For further guidance on deflection refer to EN 15269-11:2018.



Key

▼ deflection measurements

Figure C.8 — Deflection measurements for active fire curtains

C.3.2 Radiation

C.3.2.1 Introduction

If radiation is to be measured, radiometers shall be positioned as described in the following subclauses.

C.3.2.2 General

The hazard presented by radiation is evaluated in the test by measuring total heat flux. However, as the convection heat transfer is negligible, the measurement is reported as heat flux. It considers the measurement of heat flux in a plane parallel to, and at a distance of 1,0 m from, the unexposed face of the test specimen. It includes the concept of both an average value, measured opposite the centre of the specimen, and the maximum value, which is equal to or greater than the average value if the specimen is not a uniform radiator.

Determination of the maximum value is 15 kW/m^2.

There is no requirement to measure the heat flux from a surface with a temperature below 300 °C because the radiation emitted from such a surface is low (typically 6 kW/m^2, even with an emissivity of 1,0).

C.3.2.3 Apparatus

Measurements of heat flux from the unexposed surface of specimens shall be made by an instrument conforming to the following specifications:

— target: the target of the instrument shall not be shielded by a window or subject to a gas purge, i.e. it shall be subject to convection as well as radiation;

— suggested range: 0 kW/m^2 to 50 kW/m^2;

— accuracy: ±5 % of maximum in range;

— time constant (time to reach 64 % of target value): < 10 s;

— view angle: 180° ± 5°.

C.4 Test procedure

C.4.1 Pre-test examination and preparation

C.4.1.1 General

Before the fire test, an examination and preparation shall be carried out in the following sequence:

a) mechanical pre-test conditioning carried out by the laboratory for the specimen for the fire-resistance test shall be checked for operability in the fire restraint frame prior to being mounted on the test furnace by operating:

   i) from fully closed to maximum movement and back to fully closed for 25 cycles; or

   ii) where pass door(s) are present then at least 45° and back to fully closed for 5 cycles.

   Notice that this opening and closing operation shall be manual unless the doorset is fitted with a self-closing device, in which case, this device shall perform the closing function.

b) gap measurements, see C.4.2;

c) retention force measurements when a closing mechanism provides assistance to fire resistance by retention of the test specimen, see C.4.3;

d) final setting, see C.4.4.

C.4.2 Gap measurements

Gaps shall be measured prior to the fire test in accordance with the sequence given in C.4.1.1. Sufficient measurements shall be made to adequately quantify the gaps. There shall be a minimum of three measurements made along each side, top and bottom. Measurements to determine the gaps shall be made at distances not greater than 750 mm apart and shall be given to an accuracy not exceeding 0,5 mm. Inaccessible gaps shall be measured indirectly or calculated.

C.4.3 Retention force measurements

The retention forces which incorporate closing devices and which are meant to be opened without the aid of mechanical power shall be measured. These measurements are needed to establish the

magnitude of the forces used to retain active fire curtains closed to ensure that they are representative of those used in normal practice.

The retention forces for all active fire curtains which incorporate closing devices operated without the aid of mechanical power shall be measured as follows:

— Open active fire curtains slowly, using a force gauge attached to the closing edge (i.e. bottom bar) and operating against the direction of closing, to a distance of 100 mm away from its closed position.

— Record the highest gauge reading between the closed and 100 mm positions.

C.4.4 Final setting

Prior to the fire test, active fire curtains shall be subjected to a final closing involving opening an active fire curtain fully and returning it to the closed position. When applicable, this shall be performed by the closing device.

If the final setting procedures are carried out with the test specimen in position on the furnace, then the furnace shall be in an ambient pressure condition (i.e. with no air input or extraction).

C.5 Fire test

C.5.1 General

Carry out the test using the equipment and procedures in accordance with ISO 834-1.

C.5.2 Integrity

When monitoring for integrity, the 6 mm gap gauge shall not be employed along the floor level, i.e. only the 19 mm gap gauge shall be used at this position.

C.5.3 Insulation

When monitoring for insulation, the roving thermocouple shall not be employed where fixed thermocouples are not permitted as per ISO 834-1.

C.5.4 Radiation

Details of the procedure for measuring radiation are given in C.3.2.

C.6 Field of direct application of test results

C.6.1 General

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

NOTE When extended product size requirements are envisaged, the dimensions of certain components within the test specimen can be less than those intended to be used at full size in order to maximize the extrapolation of the test results by modelling the interaction between components at the same scale.

C.6.2 Materials and construction

C.6.3 General

C.6.3.1 Introduction

Unless otherwise stated in the following text, the materials and construction of active fire curtains shall be the same as that tested. The number of sections and the mode of operation (e.g. vertical, horizontal or angled) shall not be changed.

C.6.3.2 Specific restrictions on materials and construction

a) Fabric curtain

The thickness of the curtain material shall not be reduced but may be increased. For active fire curtains with multiple sections, each section shall be increased by the same amount.

The curtain material thickness and/or density may be increased provided the total increase in weight is not greater than 10 %.

b) Metal constructions

The dimensions of metal frames may be increased to accommodate increased supporting construction thickness. The thickness of the metal may also be increased by up to 25 %.

The type of metal shall not be changed from that tested.

The number of stiffening elements for uninsulated active fire curtains and the number and type of fixings of such members within the panel fabrication may be increased proportionally with the increase in size but shall not be reduced.

c) Decorative finishes

— Paint

Where the paint finish (on metallic surfaces only) is not expected to contribute to the fire resistance of the active fire curtains, alternative paints are acceptable and may be added to frames for which unfinished test specimens were tested. Where the paint finish contributes to the fire resistance of active fire curtains (e.g. intumescent paints), then no change shall be permitted.

— Decorative laminates

Decorative laminates up to 1,5 mm thickness may be added to the faces (but not the edges) of frames which satisfy the insulation criteria.

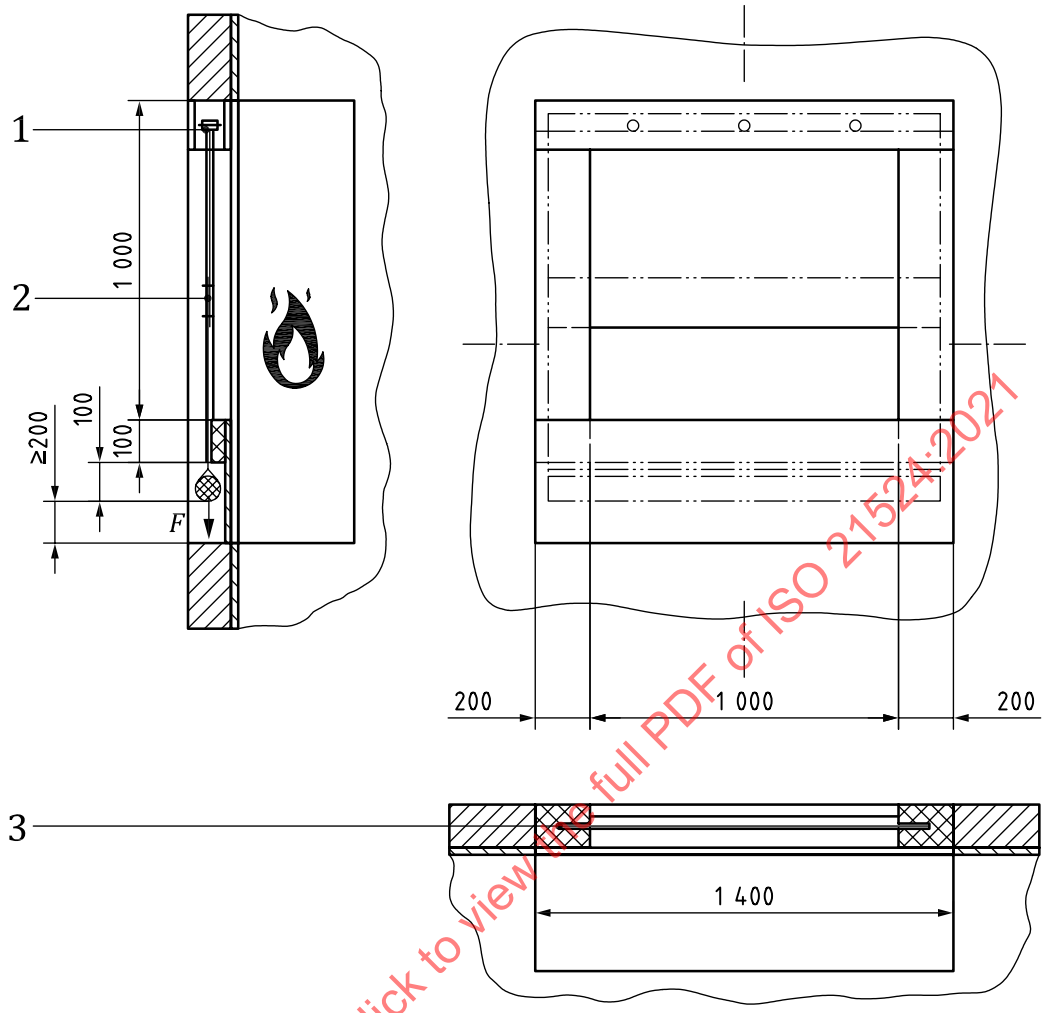
Decorative laminates applied to frames which do not satisfy the insulation criteria and/or those in excess of 1,5 mm thickness shall be tested as part of the test specimen. For all frames tested with decorative laminate faces the only variations possible shall be within similar types and thicknesses of material (e.g. for colour, pattern, manufacturer).

C.6.4 Fixings

The number of fixings used to attach active fire curtains to supporting constructions may be increased but shall not be decreased and the distance between fixings may be reduced but shall not be increased.

C.6.5 Additional test requirements

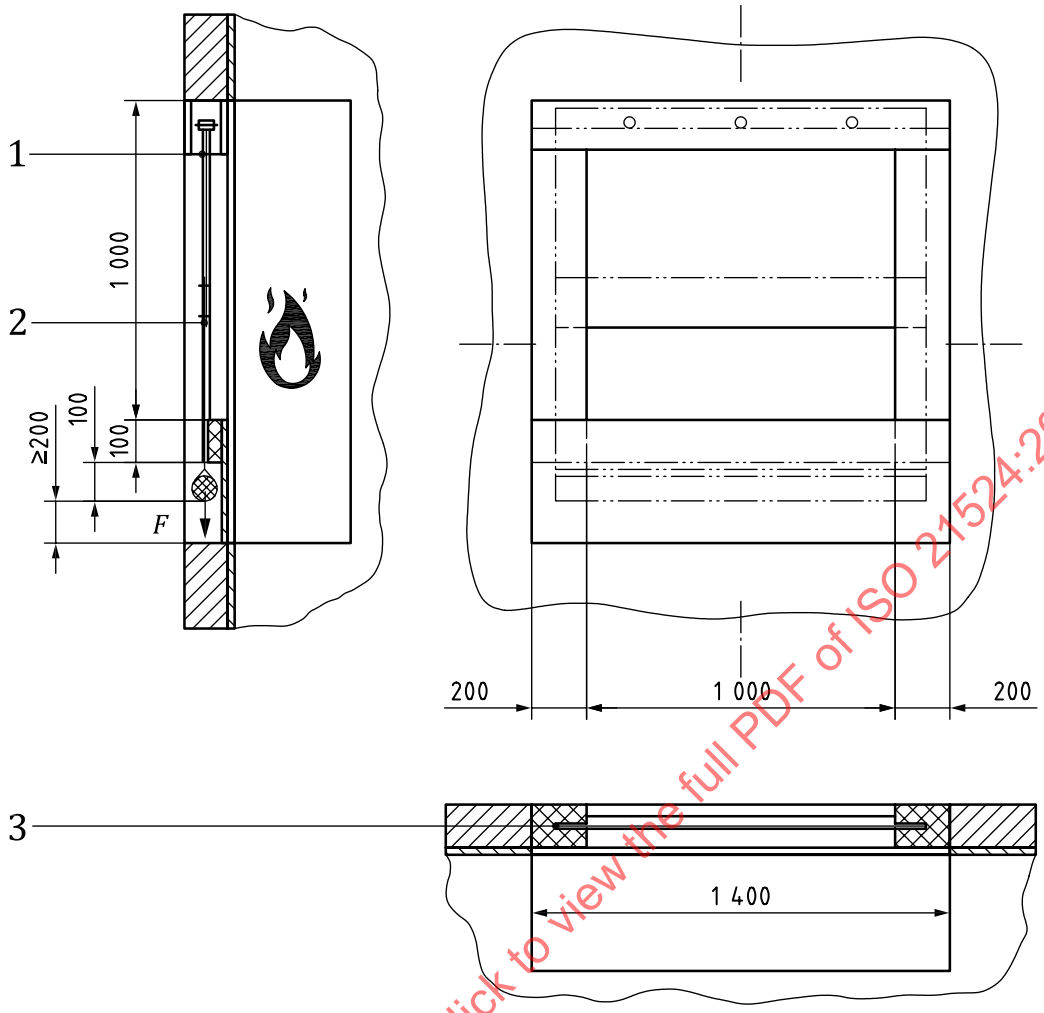
NOTE For further guidance on extending applications from the fire-resistance test refer to EN 15269-11:2018.



Key

1 retention system
2 seam
3 thermal blank mineral rock fibre
F distance of weight bottom edge from furnace sill

Figure C.9 — Reduced scale test for the vertical seam direction and loads on retention systems



Key

1 tube with curtain to tube fixing
2 seam
3 thermal blank mineral rock fibre
F distance of weight bottom edge from furnace sill

Figure C.10 — Reduced scale test for the horizontal seam direction and loads on barrel/ barrel to tube fixing

C.7 Acceptance

a) No flaming shall occur on the unexposed surface,

b) No passage of hot gases sufficient to ignite the cotton pad when evaluating for insulation criteria,

c) Gap gauges (see C.3.1.3);

   1) 25 mm,

   2) 6,0 mm × 150 mm,

   3) sill gap 19 mm maximum.

Annex D
(normative)

Overlapping multiple active fire curtains

D.1 Introduction

In this annex, a factor and equations are derived for calculating:

a) the required minimum width of the end curtain; and

b) the required minimum width of the overlap.

See Figure 2.

The values for the minimum width of the end curtain and the minimum width of the overlap are calculated based upon the dimensions of a successfully tested fire curtain.

D.2 Symbols

For the purpose of calculating end curtain widths and overlaps, the symbols in Clause 4 apply.

D.3 Calculation

The minimum required end curtain width and the minimum required overlap shall be calculated based upon the actual height, the actual end curtain and the overlap dimensions of the fire curtain that was successfully tested.

From the dimensions of the end curtain and the width of the overlap, a factor is derived for scaling the required minimum width of the end curtain and the required minimum width of the overlap.

This factor, f, is:

$$f = \left(\frac{H_p}{H} \right)$$

The required minimum width of the end curtain for the proposed size, W_m (m), shall be calculated as:

$$W_m = \left(\frac{H_p}{H} \right) \times W$$

The required minimum width of the overlap for proposed active fire curtains size, O_m (m), shall be calculated as:

$$O_m = \left(\frac{H_p}{H} \right) \times O$$

D.4 Example for increasing overlapping systems

A fire resistance test on active fire curtains with an overlap has demonstrated that active fire curtains with the following dimensions have been capable of passing the test:

— Height of the active fire curtains tested: H = 3,0 m.

— Width of the end curtain tested: W = 1,74 m.

— Width of the overlap tested: O = 0,6 m.

For example, if the proposed height, H_p, is 8,0 m, the factor for scaling the required minimum width of the end curtain and the required minimum width of the overlap, f, is:

$$f = \left(\frac{H_p}{H} \right) = \left(\frac{8{,}00}{3{,}00} \right) = 2{,}667$$

Typical minimum required widths of the end curtain and minimum widths of the overlap are presented in Table D.1 for various heights, H_p, of active fire curtains.

Table D.1 — Minimum required width of end curtain and minimum required width of overlap for this example

Proposed height, H_p m	Width of end curtain, W_m m	Width of overlap, O_m m
1	0,58	0,20
2	1,16	0,40
3	1,74	0,60
4	2,32	0,80
5	2,90	1,00
6	3,48	1,20
7	4,06	1,40
8	4,64	1,60
9	5,22	1,80
10	5,80	2,00

NOTE 1 If there are only two curtains, both curtains count as end curtains.

NOTE 2 For non-overlapping systems (those that are closed or continuous) see EN 15269-11:2018 for further guidance.

Annex E
(normative)

Test method for active fire curtains reliability and response time and the durability of materials

E.1 Principle

The active fire curtains are tested for their reliability and response time using the control system which is intended to be used to modify their operating speed.

E.2 Test specimen

The specimens used for testing shall be Specimen 1, Specimen 2 and Specimen 3, conforming to A.2, including any dedicated controls, and fitted in a supporting structure suitable for providing a level of restraint that reflects that which is deemed to be appropriate for the end-use application of the product.

E.3 Apparatus

E.3.1 Gap gauges

E.3.2 C.3.1.2 applies.

E.4 Method

E.4.1 General

The specimen shall be tested in the orientation intended by the manufacturer for the number of cycles required, according to the classifications in Table 3 and Table 4.

Mount the test specimen using fixings intended for use in accordance with the manufacturer's installation information. Do not make adjustments to any speed controls during the test after the initial setting.

Carry out a durability and force gauge test in accordance with 7.2 to achieve a 400 N rating, where there is no damage to the specimen and active fire curtains can function fully. Operate the specimen for the relevant number of complete cycles as specified in Table 3 (when supplied with a pass door[s]) and Table 4 using the primary power source. Where active fire curtains have a manual emergency egress control, operate the specimen for a further ten complete cycles using the auxiliary power source (e.g. batteries).

NOTE A cycle is defined as moving the active fire curtains from the fully retracted position to the fire-operational position and back to the fully retracted position.

At the end of the test cycles for active fire curtains that are designed to be gravity fail-safe, remove all power sources and allow the active fire curtains to move to its fire-operational position under the effect of gravity.

E.4.2 Procedure for proving 'open' circuit gravity fail-safe (see Figure E.1)

WARNING — AC rated motor(s) or direct terminations to an AC source should only be performed by qualified persons.

a) Ensure that there is no external power source between the motor and its control device that could assist 'open' circuit testing.

b) For 'open' circuit, disconnect the motor cable/wires from the external power source of the control device.

c) Ensure that the motor wires are not touching.

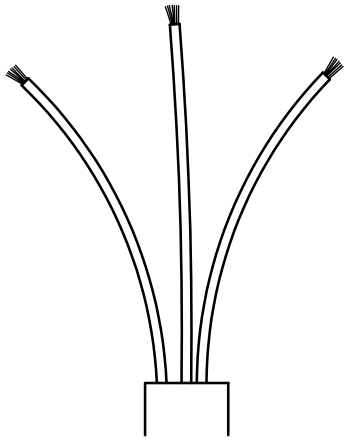


Figure E.1 — Open circuiting motor supply cable

E.4.3 Procedure for proving 'short' circuit gravity fail-safe (see Figure E.2)

a) Ensure that there is no external power source between the motor and its control device that could assist 'short' circuit testing.

b) For 'short' circuit, disconnect the motor cable/wires from the external power source of the control device.

c) Ensure that the motor wires are now touching.

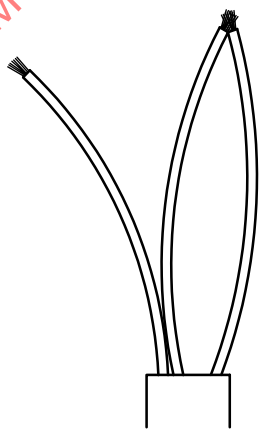


Figure E.2 — Short circuiting motor supply cable

Do not carry out maintenance or repair during the test period.

Measure and record the cycle time, covering the time taken for the active fire curtains to travel the final 2,0 m to the fire position (or the total travel if less than 2,0 m) at the beginning and end of the test period (see Table 4 for the relevant tests).

Check whether the gap gauge (see E.3.1) can pass through any perforation, tear or crack in the material using the pass/fail criteria as defined in ISO 834-1.

Repeat the force gauge test in Annex J.

Record any actions and observations taken.

E.5 Test results

Failure shall be deemed to have occurred if:

a) the specimen does not commence deployment upon receipt of an initiation signal within the response time stated in 7.4;

b) the specimen does not commence deployment immediately upon disconnection of the power supply with a response velocity conforming to 7.4; the specimen does not move to its fire-operational position under all gravity modes in accordance with 7.4;

c) the specimen does not complete a minimum number of continuous cycles in accordance with Table 3 and Table 4;

d) the specimen does not complete a further ten cycles using the auxiliary power source (where required);

e) after completion of a minimum number of continuous cycles in accordance with Table 4, the gap gauge (see E.3.1) can be passed through any perforation, tear or crack in the fabric curtain.

E.6 Test report

A test report shall be produced in accordance with A.3.

Annex F
(normative)

Test method for reliability of motor operation at elevated temperatures

F.1 Principle

The reliability of the operation of an active fire curtains motor at elevated temperatures is tested by mounting the motor(s) with the active fire curtains specimen in a furnace, heating and maintaining the temperature of the furnace, and operating the motor(s) for a specified number of cycles.

F.2 Materials

Specimen 4 (see A.2.4), consisting of:

a) a roller, incorporating the motor(s) under test;

   — Where a roller is not used in the active fire curtains, the manufacturer's recommended method of support should be used.

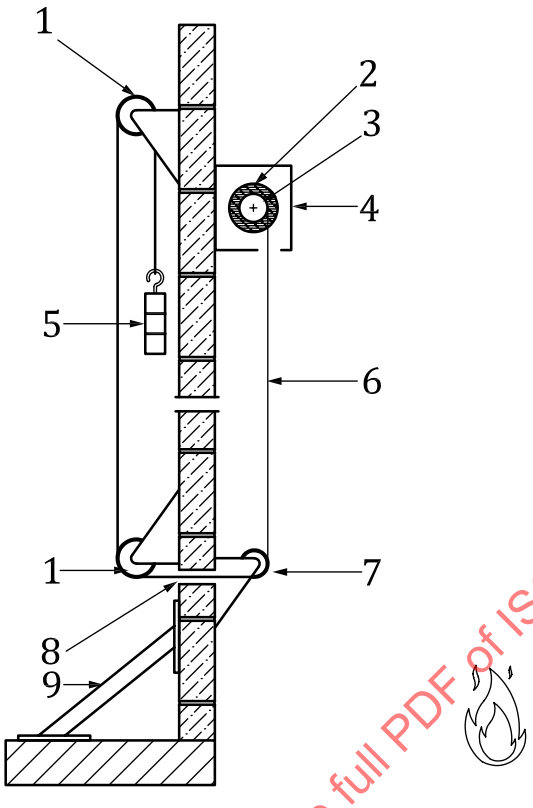
b) active fire curtains fabric material;

   — If the active fire curtains are designed to have residual layers of fabric around the roller when fully extended at the maximum drop, then the test specimen should have an identical number of residual layers of fabric, up to a maximum of two layers.

c) a motor(s), controlling the operation of the roller and which is controlled and operated by a control panel. Not less than 1,5 m of power cable shall be installed in the furnace for the test.

   — There are many ways of installing the motors and weights in a test furnace. Figure F.1 shows a typical complete test arrangement with a head box. There is no restriction on the number of motors that can be tested individually and simultaneously within one furnace. If the entire test specimen is installed within the furnace, a viewing panel is advisable.

   — Wiring between the panel and the motor in the test specimen should be identical to the wiring in the production of active fire curtains and/or that specified in the manufacturer's installation instructions or drawings.



Key

1 pulley
2 roller, with layers of fabric representative of barrel condition with fully deployed curtain
3 motor
4 headbox
5 weight/weight hanger
6 flexible connection e.g. strap/cable
7 50 mm diameter steel tube
8 holes for straps/cables (passage of flames to be prevented)
9 optional bracing as necessary (shown low but may meet wall height)

Figure F.1 — Sectional view of a typical complete test arrangement for motor operation at elevated temperatures (shown with a head box)

F.3 Apparatus

F.3.1 **Furnace**, conforming to ISO 834-1. The furnace temperature shall be measured by four thermocouples (see F.3.2). The furnace shall have an opening at the front to accommodate a test assembly measuring not less than 1,2 m × 1,2 m. The furnace shall have a depth measuring not less than 0,7 m.

F.3.2 **Thermocouples**, including the following:

— Four furnace thermocouples, conforming to ISO 834-1. These shall be fitted in the positions shown in Figure F.2 and positioned and maintained throughout the duration of the test at a distance of (100 ± 50) mm from the face of the test assembly.

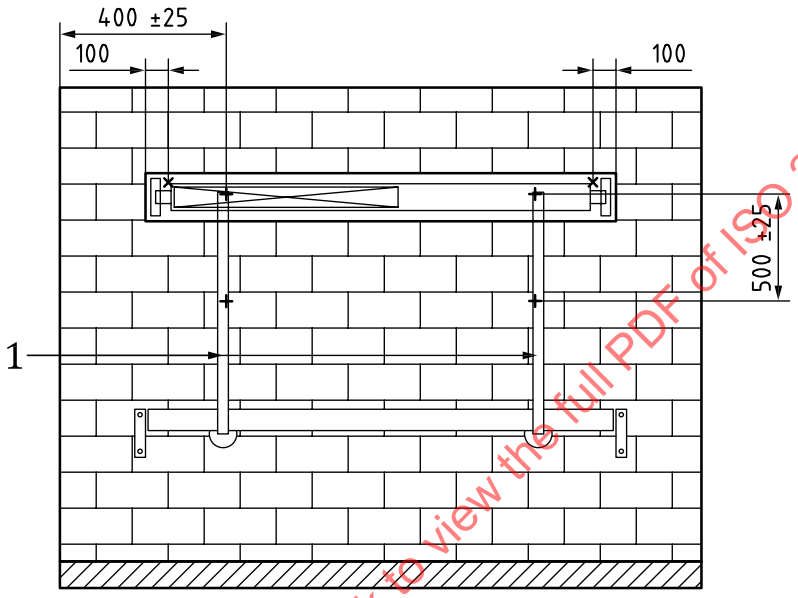
NOTE 1 In ISO 834-1, furnace thermocouples are referred to as “plate thermometers”.

— Two stainless steel grounded, sheathed thermocouples, measuring 1,5 mm in diameter, positioned in accordance with Figure F.2.

NOTE 2 Figure F.3 shows a detail of thermocouple locations in a typical test arrangement.

F.3.3 **Flexible strap(s) or cable(s)**, measuring 10 mm ± 2 mm in diameter, attached to the roller and the weight(s) (see F.3.4).

F.3.4 **Weight(s)**, the total force of which simulates the maximum weight of the bottom bar and fabric of the largest single active fire curtains in the range. The force of the weights shall be evenly distributed along the roller and suspended by flexible strap(s) or cable(s) (see F.3.3) and shall be such that they do not fall on the test apparatus during the course of the test.



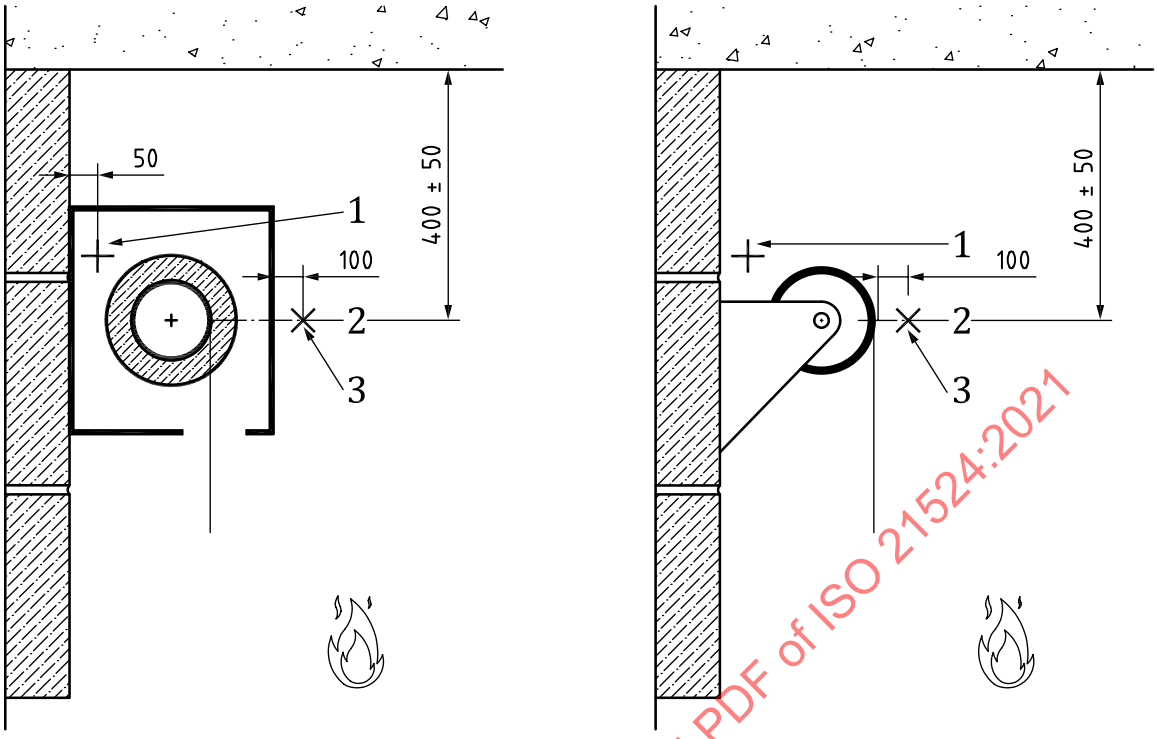
Key

1 flexible steel strap(s)/cable(s)

× sheathed thermocouple used with headboxes

\+ furnace thermocouples

Figure F.2 — Elevation view showing thermocouple locations



a) barrel/motor (with head box) **b) barrel/motor (without head box)**

Key

1 thermocouple in line with top of roller
2 centre line of roller
3 furnace thermocouple

Figure F.3 — Detail of thermocouple positions in a typical test arrangement

F.4 Procedure

F.4.1 Furnace testing of motor(s)

Mount the motor(s) with a length of barrel, representative of that used in actual active fire curtains, inside the furnace. Where active fire curtains are designed to be installed with a head box, install one of an identical type and construction. Figure F.4 shows the dimensions of a typical furnace in relation to a specimen.

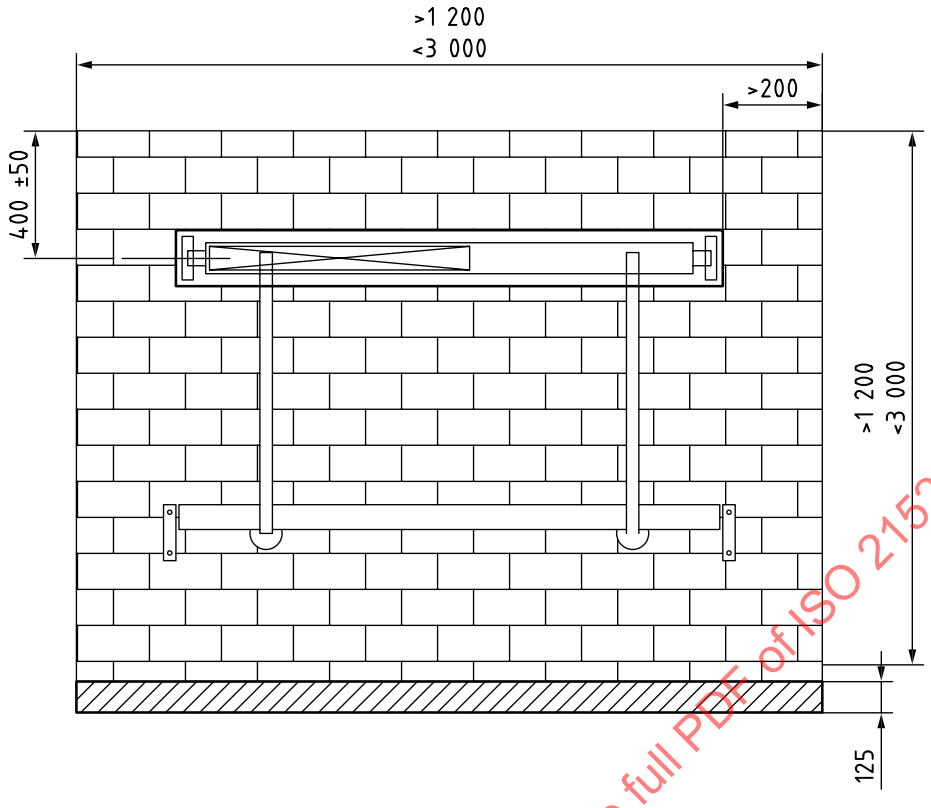


Figure F.4 — Elevation showing dimensions of a typical furnace in relation to specimen

Position the four furnace thermocouples 100 mm ± 50 mm away from the face of the active fire curtains and/or head box on the furnace face as shown in Figure F.2.

Using the flexible strap(s) or cable(s), suspend the weight(s) from the test active fire curtains.

Operate the motor(s) for one cyclic operation at ambient temperature (5 °C to 35 °C).

NOTE 1 One cyclic operation is counted as the weight travelling a minimum distance of 500 mm and then being retracted to its original position.

For each cyclic operation, the specimen should commence deployment in each direction within 10 s of activation from the control panel.

If the active fire curtains are vertical, deployment during the test should be under gravity and should not be assisted by primary or auxiliary power to the motor. For non-vertical orientations, e.g. horizontal or angled, primary or auxiliary power may be used to deploy the curtain.

Ignite the burners and heat the furnace to 400 °C ± 20 °C. Measure the temperature using the average measurement made by the four furnace thermocouples over a period of between 5 min and 9 min. Maintain this temperature for 1 min before commencing the motor operation tests. Commence the first cyclic operation within 2 min of stabilizing the furnace temperature by retracting the weights.

Repeat this cyclic operation by using the motor to retract the active fire curtains once every 60^{+10}_{0} s for ten further cycles, in accordance with Table F.1, whilst maintaining the furnace temperature throughout.

NOTE Table F.1 gives an example of motor operation cycle initiation times.

Table F.1 — Motor operation test parameters

Temperature °C	Operation of motor cycle	Example of cycle initiation times[a] min
Ambient	1	0
400 ± 20	2	7
400 ± 20	3	8
400 ± 20	4	9
400 ± 20	5	10
400 ± 20	6	11
400 ± 20	7	12
400 ± 20	8	13
400 ± 20	9	14
400 ± 20	10	15
400 ± 20	11	16
400 ± 20	12	30

[a] This column gives example values based on the premise that the furnace takes 6 min to stabilize in temperature and that the cyclic testing commences 1 min after.

Maintain the furnace at 400 °C ± 20 °C after cycle 11 for a further 14 min then initiate a final cycle if the active fire curtains are designed for emergency access.

Record that the test specimen has completed either 1, 11 or 12 cycles or has failed.

Annex G
(normative)

Calculation of ambient temperature smoke leakage

G.1 Symbols

For the purpose of calculating smoke leakage, the symbols in Clause 4 apply.

NOTE Perimeter gaps refer to the gap between the fabric material of the active fire curtains and supporting/restraining elements at the sides and top.

G.2 Calculations

Prior to testing, the sill (gap below the bottom bar) shall be sealed so that any leakage through this gap is not included in the calculation.

This methodology is not designed to evaluate leakage between the active fire curtains and the supporting construction. As such, background leakage of the test rig, including any leakage between the active fire curtains and the supporting construction, should not be included in the measurements.

Where gaps cannot be taped due to the nature of the surface of the fabric, an alternative material which is dimensionally the same and installed in the same manner may be tested in addition in order to determine the leakage at the perimeter gaps.

The relationship between perimeter leakage and fabric leakage is not linear. Therefore, it cannot be assumed that sizes smaller or larger than those tested would achieve an equivalent or better performance. The following calculation method allows test results to be extrapolated to specimens of sizes different to that tested.

The following values shall be established by testing:

a) the measured leakage through the complete active fire curtains (perimeter gaps and fabric), L_c (m^3/h);

b) the measured leakage through the fabric and the horizontal edge (both vertical edges sealed), L_{fh} (m^3/h);

c) the measured leakage through the fabric only (both vertical edges and the horizontal edge sealed), L_{fa} (m^3/h);

The effective linear perimeter leakage shall then be determined as follows:

1) The leakage per square metre of fabric, L_{fb} ($m^3/m^2/h$), shall be calculated from L_{fa} and the exposed fabric area, A_f (m^2), using the following formula:

$$L_{fb} = \frac{L_{fa}}{A_f}$$

2) The leakage through the perimeter gap at the horizontal edge alone, L_{ph} (m^3/h), shall be calculated from L_{fh} and L_{fa} using the following formula:

$$L_{ph} = L_{fh} - L_{fa}$$

3) The leakage per metre through the perimeter gap at the horizontal edge, L_{phb} ($m^3/m/h$), shall be calculated from L_{ph} and the tested width of the exposed fabric, W (m), using the following formula:

$$L_{phb} = \frac{L_{ph}}{W}$$

4) The leakage through the perimeter gaps at the two vertical edges, L_{pv} (m^3/h), shall be calculated from L_c and L_{fh} using the following formula:

$$L_{pv} = L_c - L_{fh}$$

5) The leakage per metre through the perimeter gaps at the vertical edges, L_{pvb} ($m^3/m/h$), shall be calculated from L_{pv} and the tested height of the exposed fabric, H (m), using the following formula:

$$L_{pvb} = \frac{L_{pv}}{2H}$$

6) The total leakage for any size of active fire curtains can then be calculated and expressed as an effective linear perimeter leakage, L_{lt} ($m^3/m/h$), using the following equation, where W_r and H_r refer to the required exposed fabric widths and height:

$$L_{lt} = \left[\frac{(A_r \times L_{fb}) + (W_r \times L_{phb}) + (2H_r \times L_{pvb})}{W_r + 2H_r} \right]$$

NOTE For a worked example of smoke leakage calculations, see Table G.1.

G.3 Calculation of results

G.3.1 General

For a 2,3 m high × 2,1 m wide specimen with an exposed fabric height and width of 2,0 m and 2,0 m:

a) the measured leakage through the full test specimen (L_c) is: 13,4 m^3/h;

b) the leakage through the fabric and the horizontal edge (L_{fh}) is: 10,0 m^3/h; and

c) the leakage through the fabric only (L_{fa}) is: 8,8 m^3/h.

The following calculations can then be made:

1) the leakage per square metre of fabric (L_{fb}) is: 8,8 m^3/h/4,0 m^2 = 2,2 $m^3/m^2/h$;

2) the leakage through the perimeter gap at the horizontal edge (L_{ph}) is: 10 m^3/h – 8,8 m^3/h = 1,2 m^3/h;

3) the leakage per metre through the perimeter gap at the horizontal edge (L_{phb}) is: 1,2 m^3/h ÷ 2,0 m = 0,6 m^3/h;

4) the leakage through the perimeter gaps at the two vertical edges (L_{pv}) is: 13,4 m^3/h – 10 m^3/h = 3,4 m^3/h;

5) the leakage per metre through the perimeter gaps at the two vertical edges (L_{pvb}) is: 3,4 m^3/h ÷ (2,0 m × 2,0 m) = 0,85 m^3/h.

G.3.2 Calculation for other sizes of specimen, based on 2,3 m × 2,1 m test results

The effective linear perimeter leakage can be calculated for all sizes of active fire curtains that the manufacturer intends to produce, using the known leakage of the fabric, the known leakage at the horizontal edge and the known leakage at the vertical edges.

For example, for a specimen with an exposed fabric area 3,0 m high × 1,0 m wide:

— A_r = 3,0 m × 1,0 m = 3,0 m^2;

— H_r = 3,0 m;

— W_r = 1,0 m;

— L_{fb} = 2,2 $m^3/m^2/h$;

— L_{phb} = 0,6 $m^3/m/h$;

— L_{pvb} = 0,85 $m^3/m/h$.

Therefore, the linear leakage is as follows:

$$\frac{\left(3{,}0\text{m}^2\times 2{,}2\text{m}^3/\text{m}^2/\text{h}\right)+\left(1{,}0\text{m}\times 0{,}6\text{m}^3/\text{m}/\text{h}\right)+\left(2\times 3{,}0\text{m}\times 0{,}85\text{m}^3/\text{m}/\text{h}\right)}{1{,}0\text{m}+\left(2\times 3{,}0\text{m}\right)}=1{,}8\text{m}^3/\text{m}/\text{h}$$

The values that variations in the size of the example active fire curtains would achieve, including the size where the level of performance outlined in 7.5.2 (maximum 3 $m^3/m/h$) has been exceeded, can be demonstrated in Table G.1.

Table G.1 — Worked example of smoke leakage calculations

Effective leakage rates (example)				
Width	**Leakage rate** ($m^3/m/h$)			
	Height 1,0 m	**Height 2,0 m**	**Height 3,0 m**	**Height 4,0 m**
1,0 m	1,50	1,68	1,76	1,80
2,0 m	1,83	2,23	2,44	2,56
3,0 m	2,02	2,63	2,97	3,18 [a]
4,0 m	2,15	2,93	3,39[a]	3,70 [a]
[a] These leakage rates exceed 3 $m^3/m/h$ and hence the corresponding dimensions do not meet the leakage rate requirements.				

Annex H
(normative)

Test method for the durability and reliability of alternative or additional motors

H.1 Test specimen

The test in this annex shall be carried out on Specimen 4 (see A.2.4).

H.2 Apparatus

H.2.1 Mounting frame, having a top pulley at least 3,0 m above floor level or any obstruction.

H.2.2 Control panel.

H.2.3 Flexible strap(s) or cable(s), which if used shall have a diameter of not less than 2 mm.

H.2.4 Weight(s), exerting a force that is equivalent to 90 % of the maximum declared lift capacity of the motor under test.

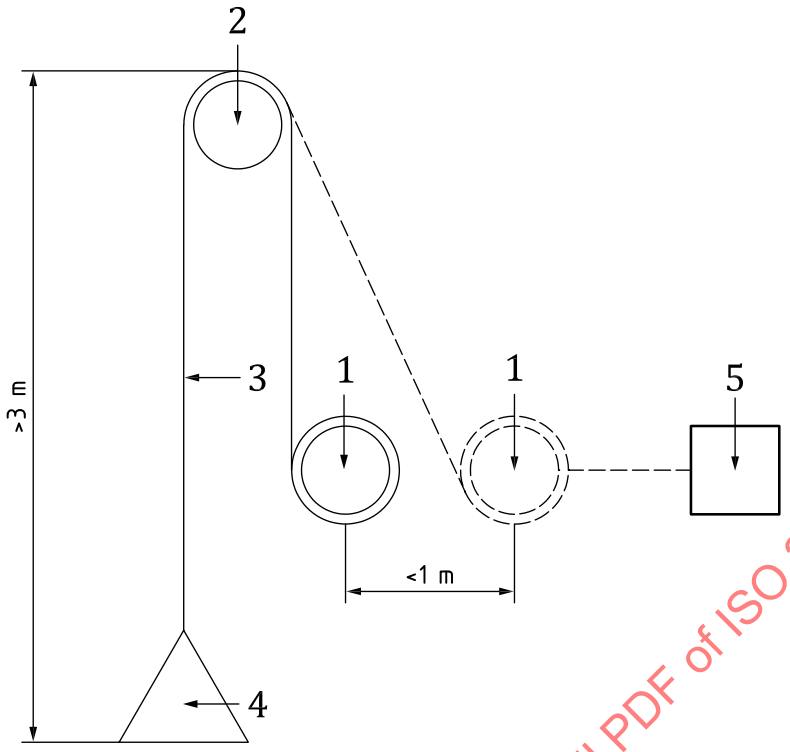
H.2.5 Timing circuit.

H.2.6 Clock counter.

H.3 Procedure

a) No maintenance or repair is permitted during the test period.

b) Mount the specimen, using fixings conforming to the manufacturer's instructions (see Figure H.1). Ensure that the specimen has a minimum drop height of 3,0 m and is connected to its control equipment via its primary energy source.



Key

1 motor
2 pulley
3 2 mm steel cable
4 variable load
5 control panel/power supply

Figure H.1 — Motor test and mounted specimen

c) Load the motor with the weight(s) using the flexible strap(s) or cable(s) and the test apparatus, set up in accordance with Figure H.1.

d) Using the electrical cable, wire the motor to the control panel.

e) Using the timing circuit and clock counter, set the specimen to continuously cycle.

f) Operate each specimen (if the manufacturer offers a range of motors or controls) and complete the required number of cycles as specified for the intended classification in Table 4 using the primary energy source.

g) If the active fire curtains include an auxiliary power source for any part of its function, e.g. battery, carry out an additional 50 cycles using the auxiliary power source to move the specimen to the fire-operational position.

NOTE 1 A cycle is defined as moving the specimen from the fully retracted position to the fire position and back to the fully retracted position.

h) Check that the specimen moves to the fire-operational position within the limits given in 7.4.1 and record the operating speeds.

NOTE 2 The cycle period tested constitutes the minimum cycle period for the specimen.

H.4 Test results

Produce a test report conforming to A.3. Record the classification (see Table 4) for each motor.

Annex I
(normative)

Test method for ancillary and optional equipment

I.1 Introduction

Inclusion of a test in this annex does not mean a manufacturer has to provide such equipment. Only the tests relevant to the equipment offered by the manufacturer need be carried out.

I.2 Test specimen

The tests in this annex shall be carried out on Specimen 1 (see A.2.2).

I.3 Procedure

a) The specimen, including all ancillary and optional equipment, shall be mounted using fixings in accordance with the manufacturer's installation instructions.

b) The specimen, including all ancillary and optional equipment, shall be electrically connected in accordance with the manufacturer's instructions. Where the manufacturer provides a standard control panel with the active fire curtains, this shall be used in the tests.

c) Each test shall be carried out five times using the primary power supply and five times using the secondary power supply, where the supplies are different. Each test shall be started with the active fire curtains in the retracted position, except where stated otherwise.

d) The tests may be carried out in any order.

e) Where more than one of any type of device is offered by the manufacturer, each shall be tested in turn.

f) If the velocity of the deployment of the specimen appears abnormally high or low during any test, it shall be measured to check that it falls within the permitted velocity range (see 7.4.1).

I.4 Obstruction warning devices

I.4.1 Single beam detectors

Obstruct the beam to initiate the alarm by placing an object or person across the beam. Record the time taken to trigger an audible and/or visual warning alert and make note of any audible message.

I.4.2 Multi-beam detector

a) Obstruct the beams over the range of the beams to initiate the alarm.

b) Place an object or person into the opening of the active fire curtains in five different locations (one after the other) and record whether the alarm is activated.

c) If the alarm response time is adjustable, the test may be sped up by setting the timer to a shorter period than set in 7.8.5.

d) If the timer was reset to a short time period, reset it to 10 min. Place an object or person into the opening. Record the time taken to trigger an audible and/or visual warning alert and make note of any audible message.

I.5 Pressure-sensitive equipment

a) Place an obstruction 100 mm ± 10 mm wide in the plane of the specimen 500 mm ± 50 mm from the deployed position. Deploy the active fire curtains and check that the specimen stops once the bottom bar contacts the obstruction.

b) Repeat with the obstruction 800 mm ± 50 mm from the deployed position.

I.6 Activation devices

I.6.1 Fire alarm

Simulate the operation of a fire alarm by breaking the fire alarm circuit to the specimen. Record the response time before the active fire curtains start to deploy.

I.6.2 Smoke detector

Operate the smoke detector using canned smoke. Check that the specimen deploys when the smoke is detected.

I.6.3 Heat detector

Operate the heat detector by using a suitable heat source, e.g. hot air heat gun. Check that the specimen deploys when heat is detected.

I.6.4 Short circuit of smoke and heat detectors

Simulate failure of the wiring (short circuiting) by crossing the wires that connect to the detector and check that the specimen deploys.

I.6.5 Secondary power supply

Connect to the primary power supply for 24 h (to charge the batteries) then disconnect the primary power supply and check that the specimen remains retracted for at least 30 min. Record the time period before the active fire curtains deploys.

This test is only required to be carried out once.

I.6.6 Delayed and/or multi-positional deployment

Check that the delayed and/or multi-positional deployment of the specimen operates in accordance with the manufacturer's claims. Where the initial position and/or the time delay are adjustable, the tests shall include operation with the settings at the maximum level and at the minimum level.

I.7 Emergency egress control

I.7.1 General

Check that the retract button or switch retracts the active fire curtains by the distance specified by the manufacturer and automatically redeploys it to the closed position after a set time. Record the time paused.

During the fifth descent, press the retract button again and check that the active fire curtain immediately retracts, then pauses and redeploys to the closed position.

I.7.2 Emergency egress failure (short circuit)

Short circuit the retract button or switch, check that the active fire curtain either remains deployed or only retracts once and subsequently redeploys.

I.7.3 Emergency egress failure (fire damage)

Heat the retract button or switch to a temperature of 68 °C +10 °C for a period of 5 min. Check that the active fire curtain either remains deployed or only retracts once and subsequently redeploys.

I.8 Emergency access control

I.8.1 General

Check that the retract button or switch retracts the specimen while pressed and that the specimen redeploys once pressure is removed.

I.8.2 Emergency access failure (short circuit)

Short circuit the retract button or switch, check that the active fire curtains either remain deployed or only retract once and subsequently redeploy.

I.8.3 Emergency access failure (fire damage)

Heat the retract button or switch to a temperature of 68 °C +10 °C for a period of 5 min. Check that the active fire curtains either remain deployed or only retract once and subsequently redeploy.

I.8.4 Self-test device

Where a self-test device is fitted to active fire curtains specimen, adjust the controls to operate a cycle at a set time and observe whether the specimen deploys and retracts fully on receipt of the signal. Check that the occurrence of a self-test is recorded within the control panel.

I.9 Test results

Failure of the ancillary devices shall be deemed to have occurred if:

a) the specimen does not commence deployment immediately upon receipt of an initiation signal;

b) the specimen does not react as specified in case of fault (short circuit or fire damage);

c) the specimen does not remain retracted for at least 30 min under power from the secondary power supply or does not move to its fire-operational position once the secondary power supply is exhausted;

d) the audible and visual warning alarms do not function after a time delay of between 5 min and 10 min when their path is obstructed;

e) the specimen does not deploy and retract fully on receipt of a signal from the monthly self-test device or the operation is not recorded;

f) any time delay is not within the required range specified in this document or by the manufacturer;

g) the deployment velocity (if measured) is not within the range specified in 7.4.

I.10 Test report

A test report shall be produced that conforms to A.3. The description of the specimen shall include:

a) the type and make of control panel being used;

b) a list of all ancillary devices tested, along with manufacturers' details.

Annex J
(normative)

Test method for durability and force gauge

J.1 Introduction

This test requires active fire curtains to be subjected to uniform force applied to five separate locations on the test specimen. This shall be to determine the suitability of the active fire curtains to maintain their fire performance after normal wear and tear throughout their normal use that can occur in a fire event.

J.2 General

Testing shall be performed on Specimens 1, 2 and 3 as representative of those to be supplied and/or erected in practice and fitted on to a suitable support frame. Dimensions of specimens are as stated in A.2.2 and A.2.3.

J.3 Apparatus

The following apparatus is required to complete the testing.

J.3.1 **Support frame**, that is suitable to secure the headbox and side channels in place. Fixing strength and positioning of the fixings to the frame should be of the same type and strength as those used for Specimen 3.

J.3.2 **Force-measuring device**, that is capable of measuring force to an accuracy of ±5 N.

J.3.3 **125 mm ± 0,5 mm pressure plate**, made of minimum 3 mm thick solid, rigid material.

J.4 Procedure

J.4.1 Attach the test specimen to the support frame.

J.4.2 Apply the centre of the 125 mm pressure plate to the specimen with a force of 400 N $^{+10}_{0}$ N . The pressure plate shall be applied for 3 s, held for a minimum of 5 s, and withdrawn within 3 s. This step shall be repeated three times at each of the locations in Figure J.1 and as listed in J.4.3 to J.4.7.

J.4.3 200 mm in from the face of the side channel and 200 mm down from the bottom of the headbox.

J.4.4 200 mm in from the face of the retention system at mid-height.

J.4.5 200 mm in from the face of the retention system and 200 mm above the top of the bottom bar.

J.4.6 200 mm above the top of the bottom bar at mid-width.

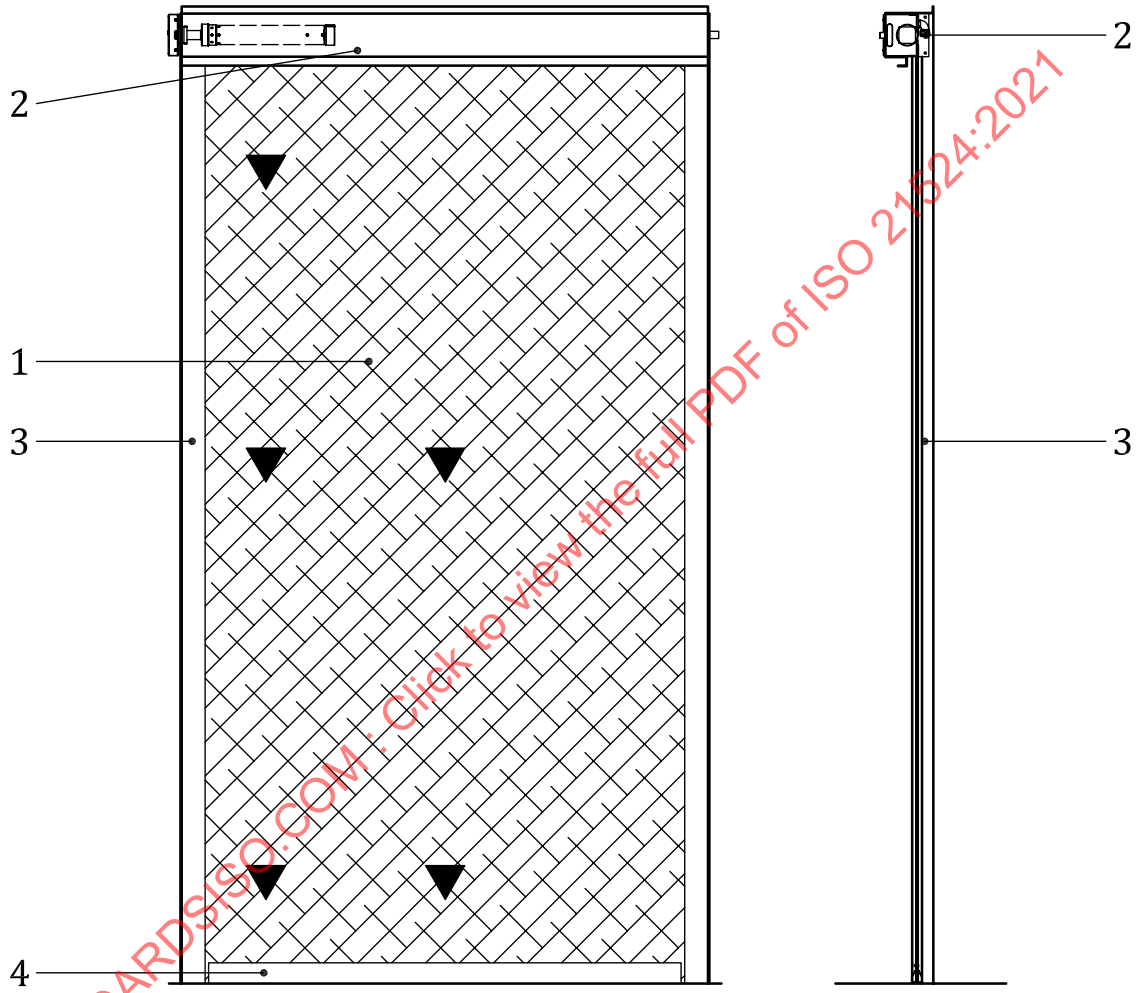
J.4.7 At the centre of the specimen where the horizontal and vertical planes meet.

J.4.8 Where a pass door is intended then the pass door shall be opened using the force gauge at 35 N ± 1 N at the leading edge of the opening at mid-height (see Table 3).

J.4.9 Record gaps (see C.3.1.3) when force is applied.

J.5 Performance criteria

J.5.1 Any gaps recorded in J.4 that exceed C.3.1.3 will result in an integrity failure.



Key

1	fabric curtain
2	headbox
3	side channel
4	bottom bar
▼	force gauge points

Figure J.1 — Example of typical of active fire curtain durability and force gauge test

J.6 Test report

The test report shall include all items given in J.2, together with the following:

a) drawings showing the position at which the force gauge is applied to the specimen;

b) the level of force;

c) any surface or structural damage;

d) the permanent deformation;

e) a record of any changes observed during the test;

f) the condition of the specimens tested, for example "no damage occurred" or report any damage or detachment, loosening or dislodgement of its parts or fixings, including diagrams or photographs where appropriate.

g) the average deflection of the bottom bar, i.e. the threshold gap, during each test J.4.6.

h) the integrity results to J.5.1.

Annex K
(informative)

Typical product performance summary

An example of a typical product performance summary is given in Table K.1.

Table K.1 — Example of a typical product performance summary

ACTIVE FIRE CURTAINS – product performance summary					
Product name:					
Name and address of product manufacturer:					
Additional accreditation (if applicable):					
Performance parameter	**Test**	**Test date**	**Valid until** (where applicable)	**Test result/ classification**	**Limits of application** (based upon test)
Maximum tested or assessed size	Width: Height: Configuration:				
Durability and force gauge, 7.2	Annex J			400 N	
Reliability and durability, 7.3	Annex E			500 cycles, C1 minimum, classified in accordance with Table 4	Cycle test > 500 cycles depending upon the application
Response time and velocity, 7.4.1	Annex E			Vertical: ≥ 0,03 m/s at any height; ≤ 0,15 m/s below 2,0 m Horizontal: ≥ 0,03 m/s at any length; ≤ 0,3 m/s below 2,0 m	
Smoke leakage, 7.5.2	ISO 5925-1			Maximum 3,0 m^3/m/h Head/side edges	
Smoke leakage material, 7.5.2	ISO 5925-1				Used to calculate leakage for any size of active fire curtains in accordance with Annex G
Gravity fail-safe, 7.4	Annex E			Pass in accordance with 7.4.1	
Multi-positional deployment	Annex I				
Fire resistance and integrity, 7.6.2	ISO 834-1			E, EW, EI_1 or EI_2	
Fire resistance and insulation, 7.6.3	ISO 834-1			E, EW, EI_1 or EI_2	

Table K.1 *(continued)*

ACTIVE FIRE CURTAINS – product performance summary					
Product name:					
Name and address of product manufacturer:					
Additional accreditation (if applicable):					
Performance parameter	**Test**	**Test date**	**Valid until** (where applicable)	**Test result/ classification**	**Limits of application** (based upon test)
Radiometer readings at 1,0 m, 7.6.4	C.3.2			State readings at: 5 min = X kW/m^2 10 min = X kW/m^2 20 min = X kW/m^2 30 min = X kW/m^2	Radiometer readings to be analysed in accordance with Annex Q
Reaction to fire, 7.7	ISO 1182 or ISO 1716			Non-combustible, or Limited combustibility	
Deflection zone, 7.6.5	ISO 834-1			State distance recorded, X mm	
Emergency egress control, 7.4.3	Annex I			Tested with manufacturer's control equipment and active fire curtains	
Motor test for retract control, 7.6.6	Annex F			400 °C	
Ancillary devices (fire alarm system), 7.8.4	Annex I				
Ancillary devices (PSPE), 7.8.5	Annex I			Tested with manufacturer's control equipment and active fire curtains	
Ancillary devices (obstruction prevention), 7.8.6	Annex I			Tested with manufacturer's control equipment and active fire curtains	
Self-testing, 7.8.7	Annex I			Tested with manufacturer's control equipment and active fire curtains	
Control panels, Annex I	ISO 21927-9				
Power supplies, Annex I	ISO 21927-10			Class B and environmental Class 1 minimum	

Annex L
(normative)

System design

L.1 Introduction

The recommendations given in Annex L are intended to provide the fire engineer and/or designer with a separating element which fulfils the means of escape and compartmentation requirements relating to life safety and property protection and maintains appropriate access for fire-fighting activities.

The building design parameters dictate the minimum classification and performance of active fire curtains that can be used in any particular application. It is important that the criteria for the correct choice of active fire curtains take into account the total system, function and location requirements without hindering the means of escape or endangering life.

L.2 Active fire curtains selection

A copy of the product summary (see NOTE 1) should be obtained from the manufacturer. This may be used to check that the barrier assembly meets the selection criteria for the proposed application.

NOTE 1 See Annex K, for an example of a product performance summary sheet.

NOTE 2 By contacting the relevant approving authority prior to installation of the active fire curtains, it is possible to demonstrate that an appropriate product has been selected to fit the particular application with which it is to be used. An example of an approving authority pre-installation checklist is provided in Annex P.

L.3 Selection of active fire curtains

L.3.1 Operational performance

Active fire curtains should be selected to meet the appropriate performance criteria given in Table L.1 for the specific application. Details of the selected performance criteria should be provided by the supplier/installer.

L.3.2 Initiation of deployment

Active fire curtains should be initiated by one or more of the following methods, selected in accordance with Table L.2, depending upon their application:

a) the automatic fire alarm system of the building or individual dwelling;

b) a separate detection system provided solely to initiate operation of fire protection systems and taking into consideration national codes;

c) multi-positional deployment, e.g. partial descent upon operation of the building fire alarm system followed by full descent after a pre-set delay or upon operation of a local detector.

The building fire strategy can also require a sprinkler-flow switch taking into consideration national codes to initiate active fire curtains deployment.

L.3.3 Method of deployment

Active fire curtains should be deployed in one of the following methods, selected in accordance with Table L.3, depending upon its application:

a) immediate single deployment: active fire curtains deploy fully upon receipt of initiating signal;

b) immediate multi-positional deployment: active fire curtains move to predetermined height upon receipt of initiating signal for a predetermined time or until receipt of a second signal (double-knock);

c) delayed single deployment: active fire curtains remain in place for a predetermined time before deploying fully;

d) delayed multi-positional deployment active fire curtains remain in place for a predetermined time before moving to a predetermined height for a further predetermined time or until receipt of a second signal (double-knock).

For any active fire curtains, only one form of deployment is required unless specified otherwise in the building fire strategy.

Where multi-positional deployment is used, where active fire curtains cross an access/egress route, the second and any subsequent deployments should be actuated via a local detector, depending upon the building fire strategy.

Table L.1 — Performance criteria for active fire curtains

Parameter	Performance criteria for active fire curtains forming part of protected route for means of escape purposes	Performance criteria for active fire curtains used to provide compartmentation within the building
Fire resistance integrity (E) (7.6.2)	Should take into consideration national codes.	Should take into consideration national codes.
Fire resistance insulation (I) (7.6.3)	Should take into consideration national codes. Non-insulated active fire curtains with sprinklers may be used in place of insulated active fire curtains when ad hoc test evidence is used as part of a fire engineered approach.	Should take into consideration national codes. Non-insulated active fire curtains with sprinklers may be used in place of insulated active fire curtains when ad hoc test evidence is used as part of a fire engineered approach.
Fire resistance radiation (W) (7.6.4)	As determined by the building fire strategy. NOTE For example, 30 min.	As determined by the building fire strategy. NOTE For example, 60 min.
Radiation and tenability	In accordance with L.4.2 (see also Annex Q).	As determined by the building fire strategy.
Deflection zone (7.6.5)	The minimum width of the route should be increased by the depth of the measured deflection zone.	The measured deflection zone should be taken into account when designing for fire separation.
Smoke leakage (7.5 and Annex G)	The demonstrated leakage rate of the active fire curtains should take into consideration the limitations indicated in national codes [a].	As determined by the building fire strategy.
Obstruction warning (L.3.5.2)	Should incorporate a device giving a warning alarm.	Should incorporate a device giving a warning alarm, and/or permanent markings should be provided to indicate the area to be kept clear.
Control panel (L.5)	Should conform to ISO 21927-9.	Should conform to ISO 21927-9.

[a] This includes protected routes in dwellings.

Table L.1 *(continued)*

Parameter	Performance criteria for active fire curtains forming part of protected route for means of escape purposes	Performance criteria for active fire curtains used to provide compartmentation within the building
Power supplies (main and back-up) (L.5)	Should conform to ISO 21927-10.	Should conform to ISO 21927-10.
Supporting construction	Declare as rigid, flexible or associated.	Declare as rigid, flexible or associated.
Frequency of intended use (cycle class) (Table 3, Table 4 and Annex E)	Class C1. Where a pass door is used the pass door shall be Class B1.	Class C1. Where a pass door is used the pass door shall be Class B1.
Emergency egress and access facility (L.3.4)	Dependent upon location and as determined by the building fire strategy. See Table L.3.	Dependent upon location and as determined by the building fire strategy. See Table L.3.
Self-test facility (7.8.7)	Should be provided for dwellings taking into consideration national codes, and for other buildings as determined by the building fire strategy.	As determined by the building fire strategy.
[a] This includes protected routes in dwellings.		

Table L.2 — Selection of deployment initiation method

Application	Suitability of deployment method for each application[a]			
	Automatic building fire alarm system or category L5 system[b]	Stand-alone initiation		
		Smoke detector	Heat detector	Smoke and heat detector
Compartmentation (non-means of escape)				
Vertical compartmentation service shaft, escalator containment or similar areas	No	Yes, any one of these three methods depending upon fire strategy.		
Atria	No, unless part of the fire strategy.	Yes, any one of these three methods depending upon fire strategy.		
Space separation				
Unprotected areas or external vertical	No, unless part of the fire strategy.	No	Yes	No
Means of escape				
Holes in walls, lobbies, refuges, services, lift lobbies, cloakroom/ reception counters, protected routes or similar areas	Yes, if required by the fire strategy.	Yes	No	No
Kitchens or similar areas[c]	Yes, if required by the fire strategy.	Dining-side	Kitchen-side	No

[a] "Yes" means that a method should be used; "No" means that a method is not usually used.

[b] Taking into consideration national codes and does not apply to dwellings.

[c] Special consideration is advised for situations where the containment of kitchens (or similar areas) from a means of escape route is proposed, as installing smoke detection within kitchen areas is impractical. Under such circumstances, it is possible that installing heat detection within the kitchen compartment with an appropriate smoke detector immediately outside the compartment opening(s) is an acceptable approach. Operation of either the heat detector or the associated smoke detector allows for the deployment of the active fire curtains, thereby maintaining the protection to the means of escape and reducing the risk of unwanted fire signals.

[d] Taking into consideration national codes.

Table *(continued)*

Application	Suitability of deployment method for each application[a]			
	Automatic building fire alarm system or category L5 system[b]	Stand-alone initiation		
		Smoke detector	Heat detector	Smoke and heat detector
Compartmentation (non-means of escape)				
Atria (where escape is less than 4,5 m from atria openings through floors)	Yes, if system is fitted.	Yes	No	No
Across means of escape	No, unless multi-positional.	Yes, any one of these three methods depending upon fire strategy.		
Multi-positional deployment				
All areas	Yes, for first position and any time delay	Yes, any one of these three methods, if required as part of the fire strategy for the second or subsequent position(s).		
Dwellings				
All areas	Yes, LD1 system[d]	Yes, any one of these three methods[c]		

[a] "Yes" means that a method should be used; "No" means that a method is not usually used.

[b] Taking into consideration national codes and does not apply to dwellings.

[c] Special consideration is advised for situations where the containment of kitchens (or similar areas) from a means of escape route is proposed, as installing smoke detection within kitchen areas is impractical. Under such circumstances, it is possible that installing heat detection within the kitchen compartment with an appropriate smoke detector immediately outside the compartment opening(s) is an acceptable approach. Operation of either the heat detector or the associated smoke detector allows for the deployment of the active fire curtains, thereby maintaining the protection to the means of escape and reducing the risk of unwanted fire signals.

[d] Taking into consideration national codes.

Table L.3 — Selection of deployment method

Application	Suitability of deployment method for each application[a]			
	Immediate single deployment	Immediate multi-positional deployment	Delayed single deployment	Delayed multi-positional deployment
Compartmentation non-means of escape)				
Vertical compartmentation	Yes	No	No	No
Horizontal, e.g. hole in floor	Yes	No	No	No
Atria	Yes, any one of these four methods depending upon fire strategy.			
Space separation				
Unprotected areas or external vertical	Yes	No	No	No
Means of escape				
Vertical protection of holes in walls (e.g. doors/glass), cloakroom/reception counters, serveries, kitchens, stairs and staircases, lobbies, evacuation lifts, refuges and adjacent to external escape routes	Yes, either one of these two methods depending upon fire strategy.		No	No
Walls forming a protected route	Yes	No	No	No
Floors forming a protected Route	Yes	No	No	No

[a] "Yes" means that a method should be used; "No" means that a method is not usually used.

Table L.3 *(continued)*

Application	Suitability of deployment method for each application[a]			
	Immediate single deployment	Immediate multi-positional deployment	Delayed single deployment	Delayed multi-positional deployment
Atria (where escape is less than 4,5 m from atria openings through floors)	Yes	No	No	No
Across means of escape	Yes, either one of these two methods depending upon fire strategy.		No	No
Service shafts	Yes	No	No	No
Dwellings				
All areas	Yes, any one of these four methods depending upon fire strategy.			
[a] "Yes" means that a method should be used; "No" means that a method is not usually used.				

L.3.4 Active fire curtains crossing access/egress routes

L.3.4.1 Introduction

It is important to assess the capabilities of the likely occupants of a building when determining whether it is appropriate to provide active fire curtains across egress routes as part of the fire strategy process.

Fire and rescue service access arrangements can vary significantly from building to building, and these can influence how active fire curtains are applied within premises. It is important to assess the positioning, size and configuration of active fire curtains in the context of the overall building fire safety design strategy so that fire and rescue service access is adequately maintained.

L.3.4.2 General

Where active fire curtains cross access/egress routes, emergency access/egress controls should be installed in accordance with Table L.4 to allow active fire curtains to be temporarily retracted.

Emergency access controls are provided to allow access through active fire curtains by the fire and rescue service. Emergency egress controls are provided to allow occupants to escape through active fire curtains.

Active fire curtains crossing egress or access routes should provide a clear height of at least 2,0 m when retracted.

Active fire curtains should cross egress routes only when 60 persons or fewer are expected to use the route in question.

The motor of the active fire curtains should conform to 7.6.7 for emergency egress control and 7.6.8 for emergency access control.

The initiation device used to retract active fire curtains should conform to 7.4.3 for emergency egress control and 7.4.4 for emergency access control.

Emergency access/egress controls should be located in a prominent, well-illuminated position and should be sited within 2,0 m of the associated active fire curtains, mounted against a contrasting background to assist with easy recognition. They should be easily accessible and free from potential obstruction.

L.3.4.3 Emergency egress controls

The emergency retract button should raise the active fire curtain and hold it open for at least 5 s before redeploying. This period should be extended where more than six people are expected to use the exit, or as required by the building fire strategy, depending upon the occupancy level and type.

The height of the emergency egress retract control should be between 750 mm and 1 200 mm from the finished floor level. The measurement should be made between the finished floor level and the centre of the retract control.

The externally visible colour of the retract control unit should be green (except where located in dwellings where choice of colour is not specified). The retract control unit should be clearly labelled with permanent signage indicating its purpose and operation, using upper case letters of at least 10 mm in height on a contrasting background.

An example of signage wording is: “IN EMERGENCY PUSH BUTTON TO RAISE ACTIVE FIRE CURTAIN”.

Table L.4 — Provision of emergency access/egress controls

Application	Suitability of access/egress control for each[a]	
	Emergency egress control (press button; latched)	Emergency access control (press button; hold on)
Compartmentation (non-means of escape)		
Vertical compartmentation	Yes, if an emergency access control is fitted; otherwise no.	Yes, if no other access; otherwise no.
Horizontal, e.g. hole in floor	No	No
Atria	No	No
Space separation		
Unprotected areas or external vertical	No	No
Means of escape		
Vertical protection of holes in walls (e.g. doors/glass), stairs and staircases, lobbies, evacuation lifts, refuges	Yes	Yes
Walls and floors forming a protected route	No	No
Walls and floors forming a protected route where a door would have been incorporated	Yes	Yes
Cross-corridor separation	Yes, both sides (fire side and non-fire side).	No
Reception counters, serveries and cloakroom counters	Yes, if no alternative means of escape; otherwise no.	No
Kitchen containment	Yes	Yes
Service shafts and adjacent to external escape routes	No	No
Across means of escape	Yes	Yes
Atria (where escape is less than 4,5 m from atria openings through floors)	No	No
Dwellings		
All areas	Yes, both sides (fire side and non-fire side).	No
Fire-fighting access		
Designated access routes	No	Yes

[a] "Yes" means that the control should be provided; "No" means that it is not necessary.

In all domestic premises, there should be manual emergency egress controls on both sides of active fire curtains to prevent people being trapped in non-emergency situations.

This sometimes need to be considered for non-domestic premises, as well.

L.3.4.4 Emergency access controls

The emergency access controls retract active fire curtains only while the control is being activated, i.e. while the button is being pushed. Active fire curtains redeploy to the fire-operational position once the activation ceases.

In order to differentiate emergency access controls, they should be positioned higher than any other controls provided, up to a maximum of 1 800 mm from the finished floor level. This measurement should be made between the finished floor level and the centre of the control.

The externally visible colour of the control unit should be orange. The control unit should be clearly labelled with permanent signage indicating its purpose and operation, using upper case letters of at least 10 mm on a contrasting background.

An example of signage wording is: “EMERGENCY SERVICES USE ONLY: PUSH BUTTON TO RAISE ACTIVE FIRE CURTAIN”.

In areas where emergency access controls are likely to be subject to operation by unauthorized persons or to damage, it might be acceptable, subject to the agreement of the relevant approving authorities, for a transparent, hinged cover (or similar protection measure) to be fitted to the control unit.

NOTE While the provision of emergency access controls helps to assist fire and rescue service access for some active fire curtains, it is possible that additional access measures need to be provided elsewhere, depending on the nature of the end-use application of active fire curtains and the use or occupancy of the building involved. The most effective way of dealing with this matter is to consult the local approving authorities and the fire and rescue service.

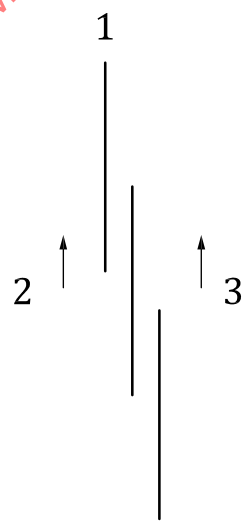
Where active fire curtains are to be used in non-domestic premises, it is important that the provision of suitable premises information for fire-fighters is considered and that the nature, operation and emergency access arrangements relating to these installations is documented.

L.3.4.5 Overlapped active fire curtains

Where active fire curtains are overlapped, it is sometimes possible to use the overlap as a means of providing emergency services access. This should be discussed in conjunction with the local approving authorities and the fire and rescue service.

L.3.4.6 Overlapped active fire curtains on the side of a protected route

Where overlapped active fire curtains form the side of a protected route, the overlapping edge shall face the direction of escape to prevent catch hazards (see Figure L.1).



Key

1 direction of escape

2 not acceptable

3 acceptable

Figure L.1 — Example of overlapping active fire curtains on protected routes

L.3.5 Warning systems

L.3.5.1 Deployment warning

Except in dwellings, deployment warning systems should be installed to active fire curtains within circulation areas, means of escape routes, and areas such as lobbies, stairs and lifts. Such systems should be in the form of a beacon and either an audible or a voice warning.

L.3.5.2 Obstruction warning

Where active fire curtains are to be deployed in areas which might be obstructed, e.g. by storage or furniture, one or more of the following obstruction warnings should be used:

a) markings on the closing surface, e.g. a yellow-hatched area;

b) a single beam (directional) which detects items left in the path of active fire curtains and sounds an alarm;

c) a multi-beam detection system (covering the whole opening) which detects items left in the path of active fire curtains and sounds an alarm.

A multi-beam detection system should always be provided if active fire curtains are protecting a means of escape.

Alarms should sound after 5 min to 10 min of continuous interruption, unless otherwise agreed with the relevant authority.

L.4 Fire resistance

L.4.1 General

The fire resistance of active fire curtains should be appropriate for the fire-separating element of the structure in which it is installed, according to the relevant documentation.

Integrity should be provided by all active fire curtains.

Where insulation is required, active fire curtains should either provide the appropriate insulation, or meet the radiation and tenability recommendations given in L.3.2.

Traditionally, insulation values are taken from the surface of an element, as typically this is a static partition against which combustible items can be fixed or stored. The aim is to prevent fire spread by spontaneous non-piloted combustion and radiation (total heat flux) and to protect people against exposure to high temperatures and associated risks. Active fire curtains replace static partitions and therefore have to descend within a clear space (see M.1). Therefore, the problems of surface temperatures do not apply, but integrity, radiation and occupant tenability are still relevant.

Where it is impracticable to fix or hang thermocouples to the surface of the test specimen, as it would prevent the intumescent process working, the insulation performance of the specimen cannot be determined, and active fire curtains can be tested only for integrity and radiation.

L.4.2 Radiation and tenability

L.4.2.1 General

Where radiated heat flux, as opposed to insulation, is to be used to assess whether conditions are tenable, one of the following approaches should be used:

a) simplified approach for horizontal routes in dwellings (see L.3.2.2);

b) fully fire engineered approach for horizontal escape routes (see Annex Q);

c) fully fire engineered approach for all other applications.

L.4.2.2 Simplified approach for horizontal routes in dwellings

The recommendations given in L.3.2 and Table L.5 should be applied to active fire curtains with a width of 5,0 m or less and a height of 3,0 m or less that are installed in dwellings:

— having a fire alarm system that takes into consideration national codes;

— in which occupants are assumed to be capable of a travel speed of 0,8 m/s;

— having a separation distance between escaping occupants and active fire curtains of ≥ 0,25 m, taking into account the deflection of active fire curtains (see Annex Q).

Radiation readings from the test evidence (see Annex K) at 15 min should be no greater than the values given in Table L.5.

Pre-deployment times in dwellings that have a fire alarm system installed is between 5 min and 10 min as the occupants can be sleeping. Travel time through the dwelling thereafter is generally short.

Table L.5 — Radiation tenability at 15 min

Length of active fire curtains run along escape route m	Max. radiation permitted[a] kW/m^2
1,0	13,7
2,0	7,6
3,0	5,5
4,0	4,4
5,0	3,7

[a] As measured in a fire resistance test in accordance with 7.6.4. The radiation measurement is taken after 15 min.

L.5 Power supplies

L.5.1 General

For non-vertical (e.g. horizontal or low-angle) active fire curtains that do not permit fail-safe by gravity, both a primary and a secondary power supply should be provided.

NOTE Where active fire curtains are held in position by a primary power source prior to deployment by gravity (gravity fail-safe), it is sometimes beneficial to provide a secondary power supply, to avoid nuisance deployment in the event of mains failure.

Where emergency access or egress controls are provided, and batteries are used as the primary or secondary power source, the batteries should be subjected to an active battery test at intervals not exceeding 60 min. It should be possible to test the batteries manually without the cabinet being opened (e.g. by use of a button). During this test the connected load should be at least 110 % of the normal motor current and should be powered solely from the battery set. A fault-indicating signal should be given as a volt-free contact and as an optical indication on the control panel of:

a) an insufficiently charged battery set;

b) a faulty battery set (e.g. short circuit);

c) a battery set not connected to a load (e.g. open circuit).

L.5.2 Electrical

The power supply equipment to active fire curtains should either have inherent resistance to or be protected from mechanical damage.

Fire-resistant cables or protection taking into consideration national codes should be selected when:

a) wiring is required to carry current for initial deployment of active fire curtains, e.g. for horizontal active fire curtains;

b) emergency egress or access control is provided;

c) multi-positional deployment is provided;

d) active fire curtains are required to stay in the raised position under some fire scenarios;

e) pressure-sensitive protective equipment is provided.

Fire-resisting cables are not otherwise required.

The power supply and related equipment should be permanently and legibly labelled as to its purpose and be secured against unauthorized operation.

The primary power supplies should be capable of operating the full load of the equipment including supplying the monitoring equipment and charging current for the batteries.

The control panel monitoring the primary and secondary power supplies should be capable of indicating the following faults:

1) loss of primary power source, within 30 min of the occurrence;

2) loss of secondary power source, within 15 min of the occurrence;

3) loss of battery charger, within 30 min of the occurrence;

4) reduction of the battery voltage to less than 90 % of its rated voltage, within 30 min of the occurrence.

Where there is no main control panel (i.e. the system is controlled via numerous sub-panels), the status of the primary and secondary power supplies, including any charger, should be monitored and indication provided at a position of responsible manning.

L.5.3 Secondary power supplies

The primary and secondary power supplies should be provided from separate sources.

Where mains supply provides power via transformers and also charges batteries, the batteries are regarded as a separate power source.

The changeover from primary power to secondary power should be automatic. Where the secondary power source is a battery or batteries, they should be:

1) the rechargeable type;

2) suitable to be maintained in a fully charged state; and

3) clearly labelled with the battery manufacturer's date, the installed/replacement date, and the expiry date.

The charger for the secondary battery power source should be designed such that:

a) the battery is charged automatically;

b) if the battery has been discharged to its final minimum voltage, it can be recharged to at least 80 % of its rated capacity within 24 h;

c) the charging characteristics are within the battery power source manufacturer's specification.

Where the secondary power source is by individual batteries, each battery should have the capacity to operate each individual device for five operations independently. If the secondary power source is by one central battery, the central battery should have the capacity to operate the complete system for five operations independently.

NOTE 1 For further information on power supplies, refer to ISO 21927-10.

NOTE 2 The resistance to heat of equipment sometimes determines its location. The location of equipment is, in effect, determined by its resistance to heat. Equipment can only be located in an area exposed to temperatures at which the equipment can be proven to work by test of a representative sample.

Annex M
(informative)

Installation

M.1 General

Active fire curtains should be installed in accordance with the manufacturer's instructions and as determined by site-specific conditions, taking account of the need for:

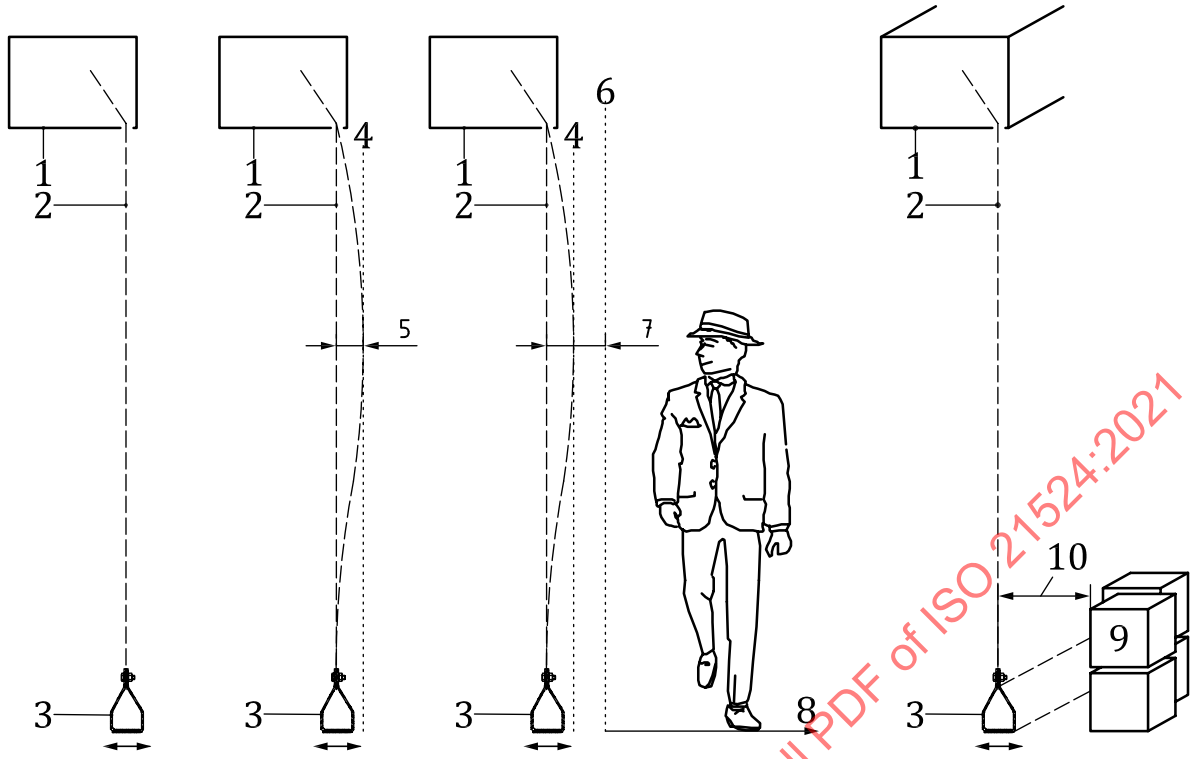
a) a deployment zone, to provide a clear area for active fire curtains to descend [see Figure M.1a)]; and

b) a deflection zone, taking into account the deflection of active fire curtains due to fire pressure [see Figure M.1b)]; and where relevant

c) a tenable zone, taking into account the deployment zone, the deflection zone and radiative heat flux [see Figure M.1c)], where active fire curtains form part of the boundary of an escape route; and/or

d) a clear zone, to provide a clear area to avoid combustion of nearby objects, e.g. stored goods and furniture, based on a maximum radiative heat flux of 15 kW/m2 [see Figure M.1d)].

NOTE For radiation and tenability, see L.4.2



Key

1 top of fabric barrier, ceiling or housing, whichever is lower
2 flexible fire barrier panel
3 weighted bottom of barrier assembly (fire operational position deployment zone)
4 boundary of calculated deflection
5 deflection caused by fire pressure
6 boundary of area of calculated untenable radiative heat flux
7 untenable area
8 tenable area
9 combustible items
10 area to be kept clear (radiative heat flux >15 kW/m^2)
a Deployment zone.
b Deflection zone.
NOTE The deflection zone is included in the untenable area, beyond which is the tenable zone for passing occupants.
c Tenable zone.
d Clear zones.

Figure M.1 — Clear areas for active fire curtain deployment

Escape route widths should be increased as necessary to take into account the space needed for the deployment zone, deflection zone and untenable area.

Any adjacent surfaces which form part of active fire curtains to fire, e.g. false ceilings or fittings, should have at least equivalent properties to those of the fire/smoke active fire curtain, e.g. resistance to temperature and permeability.

The pressure readings noted during the fire test (ISO 834-1 and the leakage test (ISO 5925-1 and ISO/TR 5925-2) should be taken into account when installing with pressure differential systems or areas of high pressure where a full fire engineered approach is required.

The active fire curtains should be sequenced with the smoke control system to ensure they operate correctly and are not affected by pressure differences and airflows caused by the either the smoke control system and/or other environmental air-movement, i.e. opening doors, windows, etc.

Notice that excess pressure differences and airflows can cause barriers to jam during operation.

Using the product performance summary supplied by the manufacturer/supplier in accordance with Annex M, the installer should complete an installation checklist to ensure that the correct product has been supplied and installed. An example of an installation checklist is given in Annex S.

An installation certificate should also be completed. A model installation certificate is given in Annex T.

M.2 Side retention

Side retention should be installed within the building's structure unless measures are taken to protect the side retention from mechanical damage by using, for example, bollards (see Figure M.2).

NOTE Protection is not needed in areas where there is only pedestrian traffic.

M.3 Support systems for active fire curtains

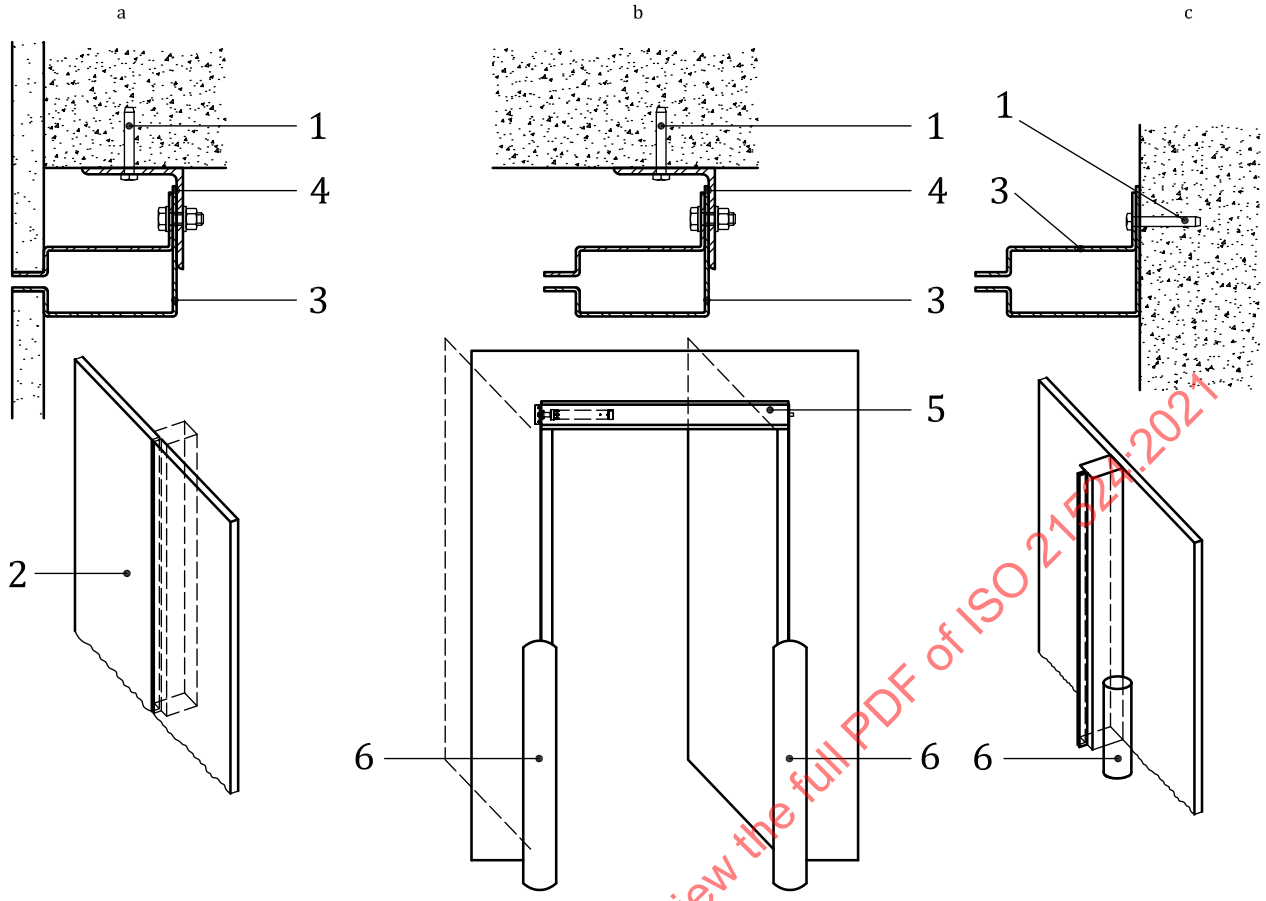
The support system used for active fire curtains should be confined to the system(s) specified by the manufacturer, including provisions for the type of fire separating element to be penetrated, and should conform to arrangements which have been fire tested or assessed in the appropriate substrate (masonry or dry wall construction, etc.).

NOTE See ISO 834-1 for guidance on construction substrates.

M.4 Ancillary devices

Ancillary devices should be installed in accordance with the manufacturer's instructions.

NOTE Where a local heat detector is permitted by national legislation as part of a release mechanism, it is advisable that it be installed locally to active fire curtains and that it responds at 70 °C to release the closing mechanism. Where normal ambient conditions exceed a value of 40 °C, it is advisable to use a higher rated local heat detector to activate the release at 30 °C above the ambient temperature.



Key

1 direction of wall fixing
2 wall
3 side retention
4 fixing bracket
5 headbox
6 side protection, bollards or fixed protective framework
a Side retention guides set into wall.
b Side retention guides face-fixed (required protection to prevent distortion of guide by impact).
c Side retention guides end-fixed (required protection from both sides).

Figure M.2 — Typical example of how to protect side retention guides

Annex N
(informative)

Commissioning

N.1 General

Once installed, the product should be commissioned in accordance with this annex.

It can be necessary to demonstrate the installed system to the relevant approving authority. An example of an inspection checklist is given in Annex U.

During commissioning, the following actions should be undertaken, where applicable:

a) Check that active fire curtains are labelled in accordance with Clause 8.

b) Visually inspect the side retention system in the passive open (up) position to check that they are free from debris and obstructions prior to operation.

c) Where smoke seals are installed, check that they are intact, free from obstructions and able to perform their function.

d) Simulate activation by each activation device and check that active fire curtains descend to their fire-operational position (e.g. down).

e) Check any multi-positioning (split drop) function, where relevant.

f) Firmly press the edges of the fabric where they interface with side retention guide channels to check that no gaps are visible beyond the leading edge of the retention guide.

g) Operate active fire curtains using any emergency access controls (where installed). Active fire curtains should open only when the control is pressed and held. When the control is released, active fire curtains should redeploy.

h) Operate active fire curtains using any emergency egress controls (where installed). Active fire curtains should open, pause and then redeploy. During redeployment, operate the control again. Active fire curtains should open, pause and redeploy.

i) Remove all primary power (e.g. mains) and check that the emergency access/egress controls operate correctly under secondary power (e.g. batteries).

j) Reinstate active fire curtains. Remove all auxiliary secondary power (e.g. batteries) and primary power (e.g. mains) in this order to check functionality of gravity fail safe.

NOTE 1 See national codes regarding disconnection of the control panel from the primary power (e.g. the mains) by a certified electrician.

k) Re-instate the auxiliary secondary power (e.g. batteries) and primary power (e.g. mains) in accordance with the manufacturer's instructions to close active fire curtains to their passive open (up) position.

l) With active fire curtains in the open position, use the test switch (where provided) to deploy the control panel to its fire-operational position (e.g. down).

m) Check that any obstruction warnings (e.g. single or multi-beam) are functioning correctly or that any specified markings are correctly provided.

n) Check that any deployment warnings (e.g. beacon, voice warning) are functioning correctly.

o) Check that overlaps, where installed, conform to the manufacturer's instructions.

p) Where an emergency access or egress control is installed, check that a suitable cable has been installed, taking into account the fire-resisting standards of national codes.

q) Set any timers for activation (self-test facility).

A commissioning certificate should be completed which confirms that testing has been undertaken and indicates any limits of application. Ancillary devices should also undergo testing during commissioning (see N.2).

NOTE 2 A model commissioning certificate is given in Annex V.

The commissioning checklist is intended to supplement information supplied by the manufacturer relating to testing that has been undertaken on the product and the classifications achieved, e.g. fire and smoke resistance, to provide a consolidated record for the user, maintenance personnel and, where applicable, approving authorities.

Upon completion of the installation and commissioning work, a written document confirming conformity to this document (ISO 21524:2021) should be issued by the installer.

NOTE 3 A model completion certificate is given in Annex W.

Where applicable, it is suggested that the standard user check that active fire curtains are recorded as working correctly by the approving authority and entered into the fire safety log.

N.2 Commissioning of ancillary devices

N.2.1 Initiating equipment

All means of initiation provided should undergo testing during commissioning.

Examples of such equipment include:

— smoke detector (optical or ionizing);

— heat detector;

— sprinkler-flow switch;

— emergency access/egress control;

— manual call point (break glass).

N.2.2 Operational equipment

The following equipment should be tested:

a) deployment delay;

b) multi-positional deployment;

c) voice warning system;

d) flashing warning beacon.

Check that the operation and delay times of the ancillary control equipment listed in a) to d) match the fire strategy documentation and that warning devices operate continuously upon initiation and cease when the specimen is deployed or is reset.

N.2.3 Obstruction warning

Obstruction warning devices (where fitted) should be tested to check that they operate when items are placed in the deployment zone of active fire curtains under test.

N.2.4 Self-test facility

When active fire curtains are operated by the self-test facility, the device should be tested to check that it operates correctly and records the date and time of operation.

Annex O
(informative)

Inspection, testing and maintenance

O.1 General

Planned inspection, testing and maintenance should be carried out by a competent person who is able to check and confirm that active fire curtains are operating and performing effectively, when required. A log detailing frequency and results of inspections, tests and maintenance should be kept. Any alterations, additions, repairs or modifications to active fire curtains should be carried out only by competent persons.

NOTE 1 National codes contain further guidance relating to the maintenance of fire protection measures and fire safety manuals.

During the lifetime of the product, only components tested with the product should be used as replacement parts during servicing and maintenance.

When maintenance and servicing is carried out on active fire curtains, a servicing certificate should be provided.

NOTE 2 A model servicing certificate is given in Annex X.

O.2 Inspection and testing

It is essential that regular testing is carried out to:

a) confirm that there has not been any failure of active fire curtains;

b) allow the occupants of the premises to become, and remain, familiar with active fire curtains.

Adhering to the manufacturer's instructions is particularly important when battery-powered devices are being tested.

Inspection and tests should be carried out in accordance with the manufacturer's instructions and Table O.1. Any faults should be noted and logged, and should prompt end users to seek remedial action.

Those tests to be carried out on a weekly basis should be undertaken at approximately the same time each week. In non-domestic premises where some employees only work outside the hours in which tests are normally undertaken, the tests should be repeated at least once every month so that these employees are familiar with active fire curtains.

If it is found that alterations, additions, repairs or modifications to active fire curtains are required, these should be carried out immediately or as soon as practicably possible.

NOTE Attention is drawn to national codes in respect of the need to perform fire safety risk assessments of buildings.

Occupants and/or owners should be given a copy of the inspection and testing regime, as shown in Table O.1.

Table O.1 — Inspection and testing of active fire curtains

Frequency	Inspection and testing
Daily	Where no sensory equipment is installed, check for obstructions to operational areas, e.g. by alterations to cosmetic finishes, lighting, shelving, sales displays or racking or by furniture or temporary or moveable displays.
Weekly	Operate all barrier assemblies. Where a barrier assembly forms part of a smoke control system protecting a means of escape, the barrier assembly should be operated in conjunction with the smoke control system.[a]
Monthly	Test the release of self-closing devices and automatic release mechanisms via a test switch. Check that any sensory detection equipment is functioning correctly. Check that the barrier fabric is undamaged. Check that the self-test facility is functioning correctly. Every three months operate any barrier assembly forming part of any smoke control system, testing all zones separately.[a]
Every six months	Check that smoke seals are undamaged. Check that the barrier assembly is not structurally damaged or excessively bowed or deformed. Arrange inspection and testing of the barrier assembly by competent persons.

[a] A smoke control system might include fans and powered exhaust ventilators, smoke dampers, natural exhaust ventilators, active smoke barriers, etc.

O.3 Maintenance

O.3.1 General

In addition to the inspection and testing recommended in O.2, active fire curtains and their controls should be maintained in accordance with the manufacturer's instructions.

Batteries are to be replaced in accordance with the manufacturer's recommendations.

The building owner/occupier is responsible for the completion of the prescribed programme of maintenance, as specified by the manufacturer.

O.3.2 Replacement of smoke seals

There are different types of edge seals available to minimize smoke leakage through active fire curtains. These seals are designed to restrict the flow of smoke while maintaining integrity when installed to active fire curtains (see Annex M).

Damage to or degradation of smoke seals can have a significant and adverse impact on the ability of an active fire curtain to perform its designated function. Where a seal is missing in part or in total, it should be replaced immediately. To maintain the design performance, the replacement seal should be of the same formulation, dimensions and configuration as that in the manufacturer's fire test report.

Replacement seals should be fitted in accordance with the manufacturer's instructions.

Smoke seals should be replaced if they are damaged or are not making adequate contact with adjacent active fire curtains components. Such seals should be replaced as continuous lengths, as joints are a further source of potential leakage.

Annex P
(informative)

Typical approving authority pre-installation checklist

Figure P.1 shows an example of a typical approving authority pre-installation checklist.

Approving authority pre-installation of active fire curtains checklist Site address:		
Details of applicant:		
Details of installer:		
Details of manufacturer:		
The following document(s) should be obtained: Product summary: Annex K		
Approving authority pre-installation checklist	**Yes/No**	**Notes**
Has the correct product been selected by the designer to meet the design being applied for?		
Has the correct paperwork been submitted by the manufacturer, their agent, or the person who will be installing active fire curtains?		
Have active fire curtains been checked for their ability to be installed into the intended substrate and is this within the supporting evidence?		
Have the fixings to be used by the installer for the substrate been confirmed to be the same as those that are intended to be used in accordance with the manufacturer's instructions?		
Have the fire resistance materials to be used for any gaps between active fire curtains and the intended substrate been confirmed?		
Has cabling been selected in accordance with the end use application and the manufacturer's instructions?		
Are those persons who have been selected to carry out the electrical works qualified to do so in accordance with national codes?		
Name of approving authority……		Date……

Figure P.1 — Example of a typical approving authority pre-installation checklist

Annex Q
(informative)

An engineered approach to using radiative heat flux for tenable conditions for single-level horizontal routes

Q.1 Symbols

For the purpose of this annex, the symbols in Clause 4 apply.

This annex relates to means of escape. It does not give detailed guidance on ignition of stored goods and subsequent fire spread.

This annex is intended for use only by people who are suitably qualified or experienced in the field of fire engineering.

Q.2 Guidance on the determination of the acceptability of active fire curtains in terms of radiative heat flux received by escaping occupants

In the absence of a bespoke fire engineering analysis of the conditions local to the installation, and subject to the assumptions and limitations outlined within Q.5, generic engineering guidance on the determination of the acceptability of active fire curtains in terms of radiation is given in Table Q.1 and Table Q.2. Figure Q.1 shows this process as a flow chart.

These tables are provided to give guidance so that the measured radiation, as determined in a fire resistance test carried out on active fire curtains of the size dictated by the relevant test standard (see Note), can be used to establish whether the radiation performance of proposed active fire curtains is acceptable for a given proposed installation or real-life scenario. There are several factors which define the scenario. These include, for example, the length of active fire curtains being traversed, the speed of the escaping occupants and the available separation distance between the escaping occupants and active fire curtains.

NOTE 1 The exposed dimensions of active fire curtains tested to ISO 834-1 are typically based on a typical furnace opening size of 3,0 m wide × 3,0 m high.

NOTE 2 The exposed dimensions of active fire curtains tested to EN 1634-1 are typically based on a typical furnace opening size of 2,8 m wide × 2,6 m high.

Table Q.1 and Table Q.2 cover life safety situations (as opposed to stored goods or wider property protection design objectives), for applications where ceiling heights are limited to 3,0 m (e.g. typically small office and residential situations). When using Table Q.1 and Table Q.2, it is important that the user reviews the limitations and assumptions given in Q.5.

Table Q.1 — Table of permitted radiation performance, R_{max}[a]

Minimum separation between escaping occupants and Fire Curtain, d_s	Speed of escaping occupants, v_o	Permitted radiation performance, R_{max}[a]											
		For I_c 1 m[b]	For I_c 2 m[b]	For I_c 3 m[b]	For I_c 4 m[b]	For I_c 5 m[b]	For I_c 6 m[b]	For I_c 7 m[b]	For I_c 8 m[b]	For I_c 9 m[b]	For I_c 10 m[b]	For I_c 11 m[b]	For I_c 12 m[b]
m	m/s	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2	kW/m^2
0,25	0,3	6,5	3,6	2,8	2,2	1,9	1,6	1,4	1,3	1,2	1,1	1,0	0,9
0,25	0,8	14,6	8,1	5,9	4,7	3,9	3,4	3,0	2,7	2,5	2,3	2,1	2,0
0,25	1,0	17,0	9,6	6,9	5,5	4,6	4,0	3,6	3,2	2,9	2,7	2,5	2,3
0,25	1,2	21,2	11,2	8,0	6,4	5,4	4,6	4,1	3,7	3,4	3,1	2,9	2,7
0,25	1,4	20,2	12,3	8,8	7,0	6,0	5,1	4,6	4,1	3,8	3,5	3,2	3,0
0,5	0,3	7,9	4,2	3,0	2,4	2,0	1,7	1,5	1,3	1,2	1,1	1,0	1,0
0,5	0,8	16,5	8,9	6,3	5,0	4,2	3,6	3,2	2,9	2,6	2,4	2,2	2,1
0,5	1,0	19,5	10,5	7,5	5,9	4,9	4,3	3,8	3,4	3,1	2,8	2,6	2,5
0,5	1,2	22,5	12,1	8,6	6,8	5,7	4,9	4,3	3,9	3,6	3,3	3,0	2,8
0,5	1,4	24,8	13,6	9,6	7,6	6,4	5,5	4,9	4,4	4,0	3,7	3,4	3,2
0,75	0,3	9,8	4,7	3,3	2,6	2,1	1,8	1,6	1,4	1,3	1,2	1,1	1,0
0,75	0,8	18,7	9,9	6,9	5,4	4,5	3,9	3,4	3,1	2,8	2,6	2,4	2,2
0,75	1,0	22,2	11,7	8,2	6,4	5,3	4,6	4,1	3,6	3,3	3,0	2,8	2,6
0,75	1,2	25,5	13,4	9,4	7,4	6,1	5,3	4,7	4,2	3,8	3,5	3,2	3,0
0,75	1,4	28,5	15,0	10,5	8,3	6,9	5,9	5,2	4,7	4,3	3,9	3,7	3,4
1,0	0,3	10,1	5,2	3,6	2,8	2,3	2,0	1,8	1,6	1,4	1,3	1,2	1,1
1,0	0,8	21,2	11,0	7,6	5,9	4,9	4,2	3,7	3,3	3,0	2,8	2,6	2,4
1,0	1,0	25,1	13,0	9,0	7,0	5,8	5,0	4,4	4,0	3,6	3,3	3,1	2,9
1,0	1,2	28,8	14,9	10,4	8,1	6,7	5,8	5,1	4,5	4,1	3,8	3,5	3,3
1,0	1,4	16,8	16,8	11,6	9,1	7,5	6,5	5,7	5,1	4,6	4,3	4,0	3,7
1,25	0,3	11,5	5,9	4,0	3,1	2,6	2,2	1,9	1,7	1,6	1,4	1,3	1,2
1,25	0,8	24	12,3	8,5	6,6	5,4	4,6	4,1	3,7	3,3	3,1	2,8	2,6

[a] Based on a 3 m high × 3 m wide test specimen with radiation measured at 1 m from the geometric centre.

[b] Length of fire curtain run along escape route, l_c (m).

Table Q.1 *(continued)*

Minimum separation between escaping occupants and Fire Curtain, d_s	Speed of escaping occupants, v_o	Permitted radiation performance, R_{max}[a]											
		For I_c 1 m[b]	For I_c 2 m[b]	For I_c 3 m[b]	For I_c 4 m[b]	For I_c 5 m[b]	For I_c 6 m[b]	For I_c 7 m[b]	For I_c 8 m[b]	For I_c 9 m[b]	For I_c 10 m[b]	For I_c 11 m[b]	For I_c 12 m[b]
1,25	1,0	28,4	14,6	10,0	7,8	6,4	5,5	4,8	4,3	3,9	3,6	3,3	3,1
1,25	1,2	32,5	16,7	11,5	8,9	7,4	6,3	5,6	5,0	4,5	4,2	3,8	3,6
1,25	1,4	36,5	18,8	12,9	10,0	8,3	7,1	6,2	5,6	5,1	4,7	4,3	4,0
1,5	0,3	12,9	6,6	4,5	3,5	2,8	2,4	2,1	1,9	1,7	1,6	1,5	1,4
1,5	0,8	27,0	13,8	9,4	7,3	6,0	5,1	4,5	4,0	3,7	3,3	3,1	2,9
1,5	1,0	32	16,3	11,2	8,6	7,1	6,1	5,3	4,8	4,3	4,0	3,7	3,4
1,5	1,2	36,7	18,7	12,8	9,9	8,1	7,0	6,1	5,5	5,0	4,6	4,2	3,9
1,5	1,4	41,2	21,0	14,4	11,1	9,1	7,8	6,9	6,1	5,6	5,1	4,7	4,4

[a] Based on a 3 m high × 3 m wide test specimen with radiation measured at 1 m from the geometric centre.

[b] Length of fire curtain run along escape route, l_c (m).