PAS 121:2007

PUBLICLY AVAILABLE SPECIFICATION

Specification for active fire curtain barrier assemblies and active fire curtain barrier assemblies with smoke rating

ICS 13.220.20

Publishing and copyright information

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Contents

Summary of pages

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Foreword

Publishing information

This Publicly Available Specification was published by BSI and came into effect on 31 August 2007.

Acknowledgement is given to the following organizations that were involved in the development of this specification:

- Bodycote warringtonfire
- Chiltern International Fire
- City of Westminster Building Control
- International Fire Consultants
- Royal Borough of Kensington & Chelsea Building Control
- Safety – Smoke and Fire Engineering Technology

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Information about this document

This Publicly Available Specification, PAS 121:2007, provides a comprehensive specification, including test requirements, for companies or individuals designing, manufacturing, installing and employing active fire curtain barrier assemblies. These active fire curtain barrier assemblies can be used in a range of built environments to provide fire separation in the horizontal, vertical or angled orientation.

This Publicly Available Specification is not intended to restrict new developments in design and materials.

NOTE This Publicly Available Specification takes into account the extended application general requirements of EN 15269-1 [1)].

Users of this Publicly Available Specification need to consider the environment in which these active fire curtain barrier assemblies are to be installed. Certain environments may expose the barrier to adverse conditions in which the barrier may not operate effectively.

1) In preparation.

Presentational conventions

The provisions of this Publicly Available Specification are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

Attention is drawn to national guidance documents in regard to fire safety. In England and Wales, for example, relevant documents include Approved Document B *Fire safety* [1] and Approved Document M *Access to and use of buildings* [2] of the Building Regulations.

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

Compliance with a Publicly Available Specification cannot confer immunity from legal obligations.

0 Introduction

0.1 General

It is common practice, driven primarily by aesthetic and economic motives, to provide more open planned and spacious buildings to allow ease of travel under normal conditions for building occupants. This increases the need for fire engineered buildings. Active fire curtain barrier assemblies can have a role to play in both fire engineered designs to assist smoke control and also as an alternative to fire doors and partitions in prescriptive means of escape codes and national guidelines such as Approved Document B [1] and BS 5588 (all parts).

NOTE BS 7974 provides a framework for developing a rational methodology for design of buildings using a fire safety engineering approach based on the application of scientific and engineering principles to the protection of people, property and the environment from fire.

Active fire curtain barrier assemblies can be used to control the movement of fire effluent within buildings in the event of fire. When used as part of a fire engineered design, fire curtain barrier assemblies become a critical element of that design. If fire curtain barriers do not deploy to their operational position, the system will not perform as designed. However, in the event that other elements of the fire protection system do not function, for example due to total power failure, the fire curtain barriers in the fire operational position will provide fire separation.

0.2 Function of gravity fail-safe fire curtain barrier assemblies

The gravity fail-safe active fire curtain barrier assembly allows free movement throughout a building, but on receipt of a fail-safe initiation signal or in the event of a system or wiring failure or total power failure, will move from its retracted position into its fire operational position in a controlled manner facilitating fire separation. A fire separating element may provide a barrier to fire and smoke where it is needed.

0.3 Application of active fire curtain barrier assemblies

Active fire curtain barrier assemblies used in life safety and property protection applications can be horizontal, vertical or angled. For example, these could be used in place of fire doors and shutters, non-load bearing walls, non-load bearing ceilings and glazing. They can be used to form fire separation, such as protected routes and protected lobbies. The typical advantage of active fire curtain barrier assemblies is that they enable greater widths and barrier movements with a smaller space requirement than other traditional methods, e.g. steel fire shutters, doors.

0.4 Deployment of active fire curtain barrier assemblies

Some examples of how active fire curtain barrier assemblies could be deployed are:

a) barriers deploy fully upon receipt of a signal from the fire alarm system;

b) barriers 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 fire curtain barrier assemblies to deploy are those where fire or smoke are in the vicinity;

c) barriers remain retracted when the fire alarm system is activated for a predetermined time to allow for evacuation before deploying fully;

d) barriers move to given height above fixed floor level when the fire alarm system is activated and act as a smoke barrier for a predetermined time before closing fully for fire containment;

e) barriers only deploy upon local detection of smoke or fire, independent of the fire alarm system such as a fusible link;

f) barriers are required to remain retracted as part of a buildings smoke extraction design;

g) barriers will deploy on loss of primary and auxiliary power supply.

1 Scope

This Publicly Available Specification gives requirements for design, specification, testing, installation, commissioning and maintenance of active fire curtain barrier assemblies.

It is applicable for use by active fire curtain barrier assemblies manufacturers, designers, specifiers, regulators and installers:

a) in creating protected routes for the purpose of means of escape as an alternative to fire doors, non-load bearing walls, non-load bearing ceilings or fire shutters;

b) in creating fire separation horizontally, vertically or angled for compartmentation;

c) as a method of upgrading 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) in providing a smoke barrier in conjunction with non-smoke rated doors/shutters and other products protecting openings to reduce leakage of smoke.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476-22, *Fire tests on building materials and structures – Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction*

BS 476-31.1, *Fire tests on building materials and structures – Part 31: Methods for measuring smoke penetration through doorsets and shutter assemblies – Section 1: Method of measurement under ambient temperature conditions*

BS 5839-1:2002, *Fire detection and fire alarm systems for buildings – Part 1: Code of practice for system design, installation, commissioning and maintenance*

BS 7346-6, *Components for smoke and heat control systems – Part 6: Specifications for cable systems*

BS 8434-2, *Methods of test for assessment of the fire integrity of electric cables – Part 2: Test for unprotected small cables for use in emergency circuits – BS EN 50200 with 930 deg flame and with water spray*

BS EN 949, *Windows and curtain walling, doors, blinds and shutters – Determination of the resistance to soft and heavy body impact for doors*

BS EN 1363-1:1999, *Fire resistance tests – Part 1: General requirements*

BS EN 1363-2, *Fire resistance tests – Part 2: Alternative and additional procedures*

BS EN 1364-1, *Fire resistance tests for non-loadbearing – Part 1: Walls*

BS EN 1364-2, *Fire resistance tests of non-loadbearing – Part 2: Ceilings*

BS EN 1634-1, *Fire resistance tests for door and shutter assemblies – Part 1: Fire doors and shutters*

BS EN 1634-3, *Fire resistance tests for door and shutter assemblies – Part 3: Smoke control doors and shutters*

BS EN 12101-1, *Smoke and heat control systems – Part 1: Specification for smoke barriers*

BS EN 12101-9, *Smoke and heat control systems – Part 9: Control panels* [2)]

BS EN 12101-10, *Smoke and heat control systems – Part 10: Power supplies*

BS EN 13501-2:2003, *Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services*

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2) In preparation.

BS EN 14600:2005, *Doorsets and openable windows with fire resisting and/or smoke control characteristics – Requirements and classification*

BS EN ISO 13943, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this Publicly Available Specification, the terms and definitions given in BS EN ISO 13943 and the following apply.

3.1 active fire curtain barrier assembly
product that facilitates fire separation and moves from its retracted position into its fire operational position automatically when called upon to do so

3.2 active fire curtain barrier assembly with smoke rating
product that facilitates fire and smoke separation and moves from its retracted position into its fire operational position automatically when called upon to do so

3.3 barrier movement
travel distance of an active barrier from its retracted position to its fire operational position

3.4 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 Compartmentation is mainly employed to assist the emergency 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 may be delayed, for example, 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") is employed as in certain designs of flat complexes.

NOTE 2 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 normally have a lesser fire time and may employ passive smoke resistance measures.

3.5 deployment
movement of a barrier from its retracted position to its fire operational position

3.6 fire operational position
position of a fire curtain barrier assembly which provides and sustains fire separation for a designated period

3.7 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

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

3.9 gravity fail-safe
property of a fire curtain barrier assembly to move to its fire operational position in a controlled manner to facilitate fire separation when all consumable primary and auxiliary power supplies are removed, in the event of wiring or system corruption, or any combination thereof

3.10 integrity
ability of a test specimen of a separating element of building construction, when exposed to fire on one side, to prevent the passage through it of flames and hot gases and to prevent the occurrence of flames on the unexposed side

3.11 insulation
ability of a test specimen of a separating element of building construction, when exposed to fire on one side, to restrict the temperature rise of the unexposed face to below specified levels

3.12 insulating zone
area created between the surface of the unexposed face of the separating element of building construction exposed to fire and the point at which the air temperature is 180 °C above ambient air temperature at any given time classification

3.13 life safety application
application of the smoke and heat control system in its fire operational condition for the period of time required for the occupants of the premises to be alerted, and to be able to exit the premises, with the smoke and heat control system assisting in the protection of the means of escape and emergency services access

3.14 multi-positional deployment
staged movement of active fire curtain barrier assemblies to provide initial smoke containment prior to full fire containment

3.15 radiation (total heat flux)
heat energy transported as electro-magnetic radiation

3.16 side retention
retention device of fire resisting material which holds the barrier to the building to contain fire

3.17 smoke and heat control system
arrangement of components installed in a building to limit the effects of smoke and heat from a fire

3.18 smoke barrier
device to channel, contain and/or prevent the migration of smoke (fire effluent)

NOTE Smoke barriers may also be referred to as smoke curtains, smoke blinds or smoke screens.

4 Product requirements

NOTE The active fire curtain barrier assembly requirements are intended to provide the fire engineer and/or designer with an alternative to fire doors, shutters, walls and ceilings which fulfil the fire separation design requirements for life safety and property protection. Compliance with this specification does not necessarily, by itself, ensure fitness for purpose for an application, as defined in ISO/IEC Guide 2:1996.

The building design parameters will dictate the minimum classification and performance of active fire curtain barrier assemblies that can be used in any particular application. The criteria for the correct choice of active fire curtain barrier assembly should take into account the total system, function and location requirements without hindering the means of escape or endangering the occupants. Applications are based on a full series of tests on the complete assembly (including fire tests) as it is to be installed.

4.1 Installation

4.1.1 General

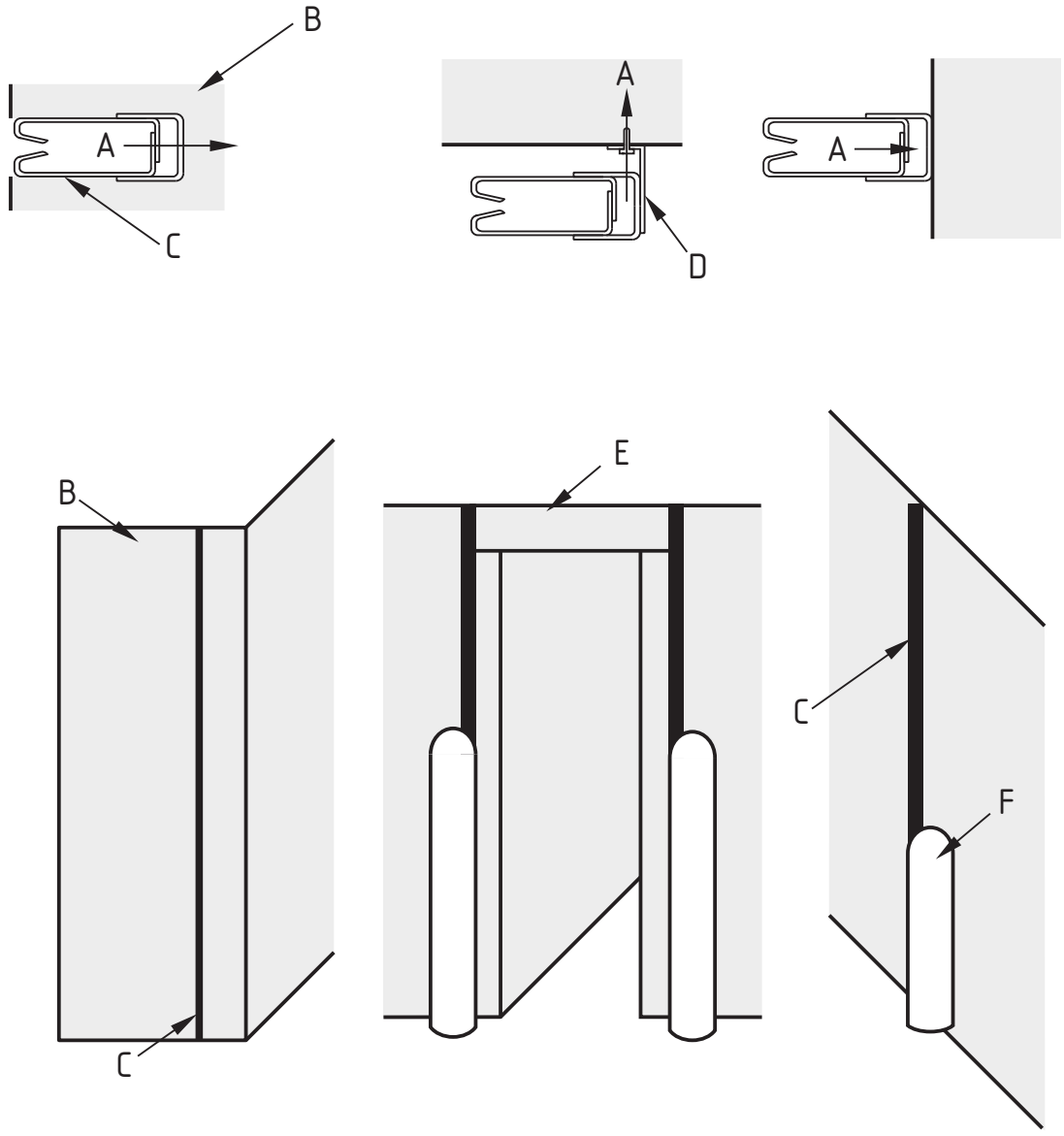
The active fire curtain barrier assembly shall be installed such that its deployment is not obstructed. The inclusion of an additional zone to compensate for the deflection of the barrier due to fire pressure shall be taken into account (see Annex A).

NOTE Care should be taken to ensure that any adjacent surfaces which form part of the barrier to fire, e.g. false ceilings or fittings, have at least equivalent properties as the fire/smoke barrier, e.g. resistance to temperature and permeability.

4.1.2 Side retention

Side retention shall be installed within the buildings' structure unless measures are taken to protect the side retention from mechanical damage by using, for example bollards (see Figure 1).

Figure 1 **Protection of side retention guide**



a) Side retention guides set into wall

b) Side retention guides face fixed require protection to prevent distortion of guides by impact

c) Side retention guides end fixed requires protection from both sides

Key

A Direction of fixing
B Wall
C Side retention guide
D Fixing bracket
E Head box
F Side protection, bollards or fixed protective framework

4.2 Operation

4.2.1 General

Active fire curtain barrier assemblies shall move to the fire operational position in a safe and controlled manner (see **5.3**, for response time and velocity) upon external initiation and according to their design type in Table 1.

Table 1 **Overview of typical barrier test specification**

Requirement	**Means of escape** Active fire curtain barrier assembly forming part of protected route for means of escape purposes	**Compartmentation** Active fire curtain barrier assembly used to provide fire separation of building
Fire resisting	30 min integrity and insulation *NOTE 1 Insulation is not needed in all cases – the guides on the use of non-insulated glass on escape routes from prescriptive means of escape codes can be used for guidance, e.g. Approved Document B [1]; BS 5588 (all parts).* *NOTE 2 When taking into account the additional requirements for thermocouple positioning, the insulating zone may be used as a guide to providing full fire separation.*	For time period of fire separation (integrity and insulation as specified or assessed) *NOTE Attention is drawn to the Building Regulations.*
Insulating zone	Where active fire curtain barrier assemblies form part of an escape route, the width of the route needs to be increased by the stated insulating zone	The stated insulating zone shall be taken into account when designing for fire separation
Smoke resisting	Leakage shall be not more than 3 $m^3/m/h$ for head and jambs when tested at 25 Pa in accordance with BS EN 1634-3 or BS 476-31.1 Material shall have a smoke leakage of (0.2 ± 0.2) $m^3/m^2/h$ when tested in accordance with BS EN 1634-3 under positive pressure at 25 Pa at ambient temperature; and where applicable additionally tested to 200 °C	Not required
Obstruction prevention	Sensor giving warning alarm	Labelled notice adjacent to barrier
Power supply backup	Conforming to BS EN 12101-10	Conforming to BS EN 12101-10
Pressure and impact test	In accordance with BS 949	In accordance with BS 949
Remote opening button	Positioned either side of deployed barrier (see **4.2.4**)	Not required unless requested for fire service access

Active fire curtain barrier assemblies shall gravity fail-safe to their fire operational position in a controlled manner when all consumable primary and auxiliary power sources are removed, in the event of wiring or system corruption, or any combination thereof.

NOTE Active gravity fail-safe fire curtain barrier assemblies do not need fire rated cables unless emergency retract is required.

4.2.2 Initiation of deployment

4.2.2.1 An active fire curtain barrier assembly shall be initiated in accordance with Table 2 depending upon its application as follows:

a) fire curtain barrier assembly operated by building fire alarm system;

b) fire curtain barrier assembly operated by a stand alone initiation on their own independent detectors separate from the alarm system;

c) fire curtain barrier assembly with more than one function (e.g. smoke control and fire resistance) where a fire engineered approach requires the fire curtain barriers to remain retracted or partially retracted until a defined stage in the fire development or depending on the fire location;

d) fire curtain barrier assembly requiring a double signal to operate such as the alarm system and a local heat detector (e.g. external barriers to prevent fire spread between buildings should only descend when actuated by a localized heat detector and not just on the alarm signal).

4.2.2.2 The associated smoke detection system shall conform to BS 5839-1:2002, class L5 system.

4.2.3 Multi-positional deployment

4.2.3.1 Where multi-positional deployment is used, it shall be in accordance with Table 3.

4.2.3.2 The active fire curtain barrier assembly, upon receipt of an initiating signal, shall either remain in position for a predetermined time or move to predetermined heights to act initially as a smoke barrier. The time between reaching this point and the fire curtain barriers' final movement to close the opening shall be determined by means of escape time calculations.

NOTE Means of escape time calculations are given in PD 7974-6.

4.2.3.3 Where active fire curtain barrier assemblies are used with multi-positional deployment, they shall be tested to be capable of deploying according to the time/temperature requirement for the application.

NOTE Consideration should be given to the use of multi-positional deployment of active fire curtain barrier assemblies where they cross access/egress routes.

Table 2 **Initiation of deployment**

Application	**Function**			
	Alarm system	**Stand alone initiation**		
		Smoke detector	**Heat detector** [A]	**Smoke and heat detector**
Compartmentation [B] **(non means of escape)**				
Vertical compartmentation full wall	No	No	Yes	No
Vertical compartmentation part wall	No	No	Yes	No
Hole in wall, e.g. door or shutter/glass	No	No	Yes	No
Lift lobby vertical	No	No	Yes	No
Service shafts	No	No	Yes	No
Escalator containment	No	No	Yes	No
Lifts	No	No	Yes	No
Horizontal, e.g. hole in floor	No	No	Yes	No
Atria	As required	No	Yes	No
Space separation [C]				
Unprotected areas	No	No	Yes	No
External vertical	No	No	Yes	No
Means of escape [D]				
Holes in walls, e.g. doors or shutters/glass	As required	Yes	No	No
Walls forming protected route	As required	Yes	No	No
Floors forming a protected route	As required	Yes	No	No
Reception counter within means of escape	As required	Yes	No	No
Serveries within means of escape	As required	Yes	No	No
Cloakroom counter within means of escape	As required	Yes	No	No
Kitchen containment	As required	Yes	No	No
Staircase lobby vertical	As required	Yes	No	No
Lift lobby vertical	As required	Yes	No	No
Evacuation lifts	As required	Yes	No	No
Refuges	As required	Yes	No	No
Lobbies	As required	Yes	No	No
Stairs	As required	Yes	No	No
External escape route	As required	Yes	No	No
Service shafts	As required	Yes	No	No
Atria (where escape is less than 4.5 m from atria openings through floors)	As required	Yes	No	No
Domestic dwellings	As required	Yes	No	No

NOTE Fire curtain barriers across escape routes should only descend where smoke/fire is present.

[A] Includes thermal fuse, fusible link and flow switch.
[B] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.3 [1].
[C] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.4 [1].
[D] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.1 [1].

Table 3 **Applications, method of deployment and initiation**

Application	Deployment power		Barrier movement			
	Gravity fail-safe	**Powered, e.g. mains**	**Immediate single movement**	**Immediate multiple staged movement** [A]	**Delayed deployment**	**Delayed deployment multiple staged movement**
Compartmentation [B] **(non means of escape)**						
Vertical compartmentation	Yes	No	Yes	No	No	No
Horizontal, e.g. hole in floor	No	Yes	Yes	No	No	No
Atria	Yes	No	As required	As required	As required	As required
Space separation [C]						
Unprotected areas	Yes	No	No	No	No	No
External vertical	Yes	No	No	No	No	No
Means of escape [D]						
Holes in walls, e.g. doors or shutters/glass	Yes	No	As required	As required	As required	As required
Walls forming protected route	Yes	No	As required	As required	As required	As required
Floors forming a protected route	No	Yes	As required	As required	As required	As required
Reception counter within means of escape	Yes	No	As required	As required	As required	As required
Serveries within means of escape	Yes	No	As required	As required	As required	As required
Cloakroom counter within means of escape	Yes	No	As required	As required	As required	As required
Kitchen containment	Yes	No	As required	As required	As required	As required
Staircase lobby vertical	Yes	No	As required	As required	As required	As required
Lift lobby vertical	Yes	No	As required	As required	As required	As required
Evacuation lifts	Yes	No	As required	As required	As required	As required
Refuges	Yes	No	As required	As required	As required	As required
Lobbies	Yes	No	As required	As required	As required	As required
Stairs	Yes	No	As required	As required	As required	As required
External escape route	Yes	No	As required	As required	As required	As required
Service shafts	Yes	No	Yes	No	No	No
Atria (where escape is less than 4.5 m from atria openings through floors)	Yes	No	As required	As required	As required	As required
Domestic dwellings	Yes	No	Yes	No	No	No

NOTE Fire curtain barriers across escape routes should only descend where smoke/fire is present.

[A] Staged deployment where fire curtain barrier stops at predetermined heights to initially form smoke reservoirs or descends as smoke layer drops.

[B] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.3 [1].

[C] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.4 [1].

[D] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.1 [1].

4.2.4 Emergency retract facility

Where active fire curtain barrier assemblies cross access/egress routes, to prevent occupants being trapped, retract facilities shall be installed for emergency egress and emergency services access and shall be in accordance with Table 4.

Where active fire curtain barrier assemblies cross access/egress routes, they shall be retractable at temperatures up to 300 °C unless an alternative temperature can be justified by means of fire engineering calculations for specific applications.

The height of the button or break glass unit shall be between 900 mm and 1 200 mm from the finished floor level. The retract button mounting plate or break glass unit shall be green (except where located in domestic premises, where choice of colour is not specified) and shall be clearly labelled.

NOTE Attention should be paid to the capabilities of the occupants.

Where an emergency retract facility is provided, the method of retracting an active fire curtain barrier assembly shall be a fit for purpose initiation, e.g. a break glass unit or push button, beam sensor, to conform to the following:

a) Means of escape:

   The means of escape initiation shall retract the barrier to at least 2 m above floor level, and hold it in position long enough for the passage of persons but not longer than 30 s unless occupant numbers/types/capabilities need longer. The fire curtain barrier assembly shall then deploy to the fire operational position.

b) Emergency services access:

   1) The initiation method provided for emergency services access shall retract the barrier only whilst the button is being pushed and be capable of multiple operation. Where emergency services access is required and in all domestic premises, there shall be a retract initiation device on both sides of the active fire curtain barrier assembly to prevent people being trapped in non-fire situations.

   2) Where the barriers are overlapped, the overlap may be used for access/egress by the emergency services as an alternative to raising the fire/smoke barrier. Relevant signage shall be considered.

Table 4 **Operation of barrier when in operational position**

Application	**Retraction from both sides as required, primary and secondary power needed**					
	Initiation reset	**Press button hold on** [A]	**Press button latched** [B]	**Fireman's over ride**	**Beam, e.g. radar and/or pressure pad** [C]	**Manual for means of escape**
Compartmentation [D] **(non means of escape)**						
Vertical compartmentation	Yes	No	No	As required	No	No
Vertical compartmentation part wall	Yes	No	No	As required	No	No
Hole in wall, e.g. door or shutter/glass	Yes	No	No	As required	No	No
Lift lobby vertical	Yes	No	No	As required	No	No
Service shafts	Yes	No	No	As required	No	No
Escalator containment	Yes	No	No	As required	No	No
Lifts	Yes	No	No	As required	No	No
Horizontal, e.g. hole in floor	No	No	No	No	No	No
Atria	Yes	No	No	As required	No	No
Space separation [E]						
Unprotected areas	No	No	No	No	No	No
External vertical	No	No	No	No	No	No
Means of escape [F]						
Holes in walls, e.g. doors or shutters/glass	Yes	No	Yes	If access route	Yes	As required
Walls forming protected route	Yes	No	No	If access route	Yes	As required
Floors forming a protected route	Yes	No	No	If access route	Yes	No
Reception counter within means of escape	Yes	No	No	If access route	No	No
Serveries within means of escape	Yes	No	No	If access route	No	No
Cloakroom counter within means of escape	Yes	No	No	If access route	No	No
Kitchen containment	Yes	No	No	If access route	No	No
Staircase lobby vertical	Yes	No	Yes	If access route	As required	Yes
Lift lobby vertical	Yes	No	Yes	If access route	As required	Yes
Evacuation lifts	Yes	No	Yes	If access route	As required	Yes
Refuges	Yes	No	Yes	If access route	As required	Yes
Lobbies	Yes	No	Yes	If access route	As required	Yes
Stairs	Yes	No	Yes	No	No	Yes
External escape route	Yes	No	No	No	No	As required
Service shafts	No	No	No	No	No	No
Atria (where escape is less than 4.5 m from atria openings through floors)	No	No	No	No	No	No
Domestic dwellings	No	No	Yes	No	No	Yes

NOTE Fire curtain barriers across escape routes should only descend where smoke/fire is present.

[A] Retract button to raise barrier only whilst button is pressed, for use by trained personnel and management only.

[B] Retract button raises barrier to predetermined height for a predetermined time before redeploying.

proaching occupants raises barriers to allow passage.

nd Wales Building Regulations, Approved Document B – Clause B.3 [1].

nd Wales Building Regulations, Approved Document B – Clause B.4 [1].

nd Wales Building Regulations, Approved Document B – Clause B.1 [1].

4.2.5 Warning systems

Where active fire curtain barrier assemblies are to be deployed in areas where occupants might be moving, the use of warning systems shall be considered and, where used, shall be in accordance with Table 5.

NOTE 1 An example of this is where they are deployed across escalators, the use of a voice warning system with warning lights might be required.

Where active fire curtain barrier assemblies obstruct emergency lighting, additional emergency lighting shall be installed.

NOTE 2 Due to the location of active fire curtain barrier assemblies, consideration should also be given to additional lighting where it is deemed necessary.

Table 5 **Warning systems**

Application	**Obstruction warning**		**Deployment warning**		
	Markings [A]	**Detector** [B]	**Signage, e.g. directional sign** [C]	**Beacon and audible or voice warning**	**Photo-luminescent** [D]
Compartmentation [E] **(non means of escape)**					
Vertical compartmentation	Yes	Yes	As required	As required	As required
Hole in wall, e.g. door or shutter/glass	Yes	Yes	Yes	Yes	As required
Lift lobby vertical	No	No	No	No	As required
Service shafts	No	Yes	As required	Yes	As required
Escalator containment	No	Yes	As required	No	As required
Lifts	No	Yes	No	No	No
Horizontal, e.g. hole in floor	Yes	No	No	No	No
Atria	Yes	Yes	As required	Yes	As required
Space separation [F]					
Unprotected areas	Yes	As required	No	No	No
External vertical	Yes	As required	No	No	No
Means of escape [G]					
Holes in walls, e.g. doors or shutters/glass	If location of barrier is not obvious	Yes	As required	As required	As required
Walls forming protected route	If location of barrier is not obvious	Yes	As required	As required	No
Floors forming a protected route	If location of barrier is not obvious	Yes	As required	As required	No
Reception counter within means of escape	If location of barrier is not obvious	As required	No	No	No
Serveries within means of escape	If location of barrier is not obvious	As required	No	No	No

A) For example, different floor covering or hatched floor paint.
B) For example beam is broken for more than 30 seconds an alarm is sounded.
C) Directional exit signs when deployed barrier could hide signs, or a DO NOT USE sign when positioned in front of a lift.
Wales Building Regulations, Approved Document B – Clause B.3 [1].
Wales Building Regulations, Approved Document B – Clause B.4 [1].
Wales Building Regulations, Approved Document B – Clause B.1 [1].
and bottom bars in low lighting conditions.

Table 5 **Warning systems** (*continued*)

Application	Obstruction warning		Deployment warning		
	Markings [A]	**Detector** [B]	**Signage, e.g. directional sign** [C]	**Beacon and audible or voice warning**	**Photo-luminescent** [D]
Cloakroom counter within means of escape	If location of barrier is not obvious	As required	No	No	No
Kitchen containment	If location of barrier is not obvious	As required	No	No	No
Staircase lobby vertical	If location of barrier is not obvious	Yes	Yes	Yes	As required
Lift lobby vertical	If location of barrier is not obvious	Yes	Yes	Yes	As required
Evacuation lifts	If location of barrier is not obvious	Yes	Yes	No	No
Refuges	If location of barrier is not obvious	As required	As required	As required	As required
Lobbies	If location of barrier is not obvious	Yes	Yes	As required	As required
Stairs	If location of barrier is not obvious	Yes	Yes	As required	As required
External escape route	No	No	No	No	As required
Service shafts	No	No	No	No	No
Atria (where escape is less than 4.5 m from atria openings through floors)	Yes	No	No	No	No
Domestic dwellings	No	Yes	No	Yes	As required

[A] For example, different floor covering or hatched floor paint.
[B] For example beam is broken for more than 30 seconds an alarm is sounded.
[C] Directional exit signs when deployed barrier could hide signs, or a DO NOT USE sign when positioned in front of a lift.
[D] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.3 [1].
[E] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.4 [1].
[F] As described in, e.g. England and Wales Building Regulations, Approved Document B – Clause B.1 [1].
[G] Applied to barrier channels/guides and bottom bars in low lighting conditions.

4.3 Power supplies

4.3.1 General

4.3.1.1 If batteries are used as the primary or secondary power source, the batteries shall be subjected to an active battery test at intervals not exceeding 60 min. During this test the connected load shall be at least 110% of the normal motor current and shall be powered solely from the battery set. A fault indicating signal shall be given as a volt free contact and as an optical indication on the control panel upon:

a) battery set insufficiently charged;

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

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

4.3.1.2 Upon detection of a fault signal the active fire curtain barrier assembly shall move to the fire operational position.

NOTE 1 Attention is drawn to regulations regarding power supplies and BS EN 12101-10.

NOTE 2 Fire rated cables may be required depending upon application.

4.3.2 Electrical

4.3.2.1 The fire alarm system shall conform to BS 5839-1.

4.3.2.2 The power supply equipment to the fire curtain barriers shall either have inherent resistance to or be protected from mechanical damage.

4.3.2.3 Where the effects of fire could result in the failure or incorrect operation of the fire curtain barriers for the appropriate fire resistance of the compartment, all electrical wiring, the drive mechanism, the control equipment, etc., shall be rated to 300 °C or located such that it is not exposed to temperatures above its operational rating.

4.3.2.4 The power supply and related equipment shall be clearly labelled as to their purpose and be secured against unauthorized operation. The cables for the power supplies shall conform to one of the following cable fire test standards:

a) BS 7346-6;

b) BS 8434-2 for cables with a core size of up to 2.5 mm^2.

NOTE 1 BS 8434-1and BS EN 50200 only require a fire survival time of 30 min.

NOTE 2 Fire curtain barriers assemblies without a retract facility do not need fire rated cables.

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

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

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

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

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

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

4.3.2.7 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 shall be monitored and indication provided at a position of responsible manning.

4.3.3 Secondary power supplies

4.3.3.1 Where any part of the fire curtain barrier arrangements is electrically operated, an independent secondary power supply shall be provided capable of moving the components to the appropriate fire position. The primary and secondary power supplies shall be provided from separate sources.

4.3.3.2 The changeover from primary power to secondary power shall be automatic.

4.3.3.3 Where the secondary power source is battery or batteries, they shall be:

a) the rechargeable type;

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

c) clearly labelled.

4.3.3.4 The charger for the secondary battery power source shall be designed so 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 manufacturers' specification.

4.3.3.5 Where the secondary power source is by individual batteries, each battery shall have the capacity to operate each individual device for 6 operations independently. If the secondary power source is by one central battery, the central battery shall have the capacity to operate the complete system for 6 operations independently.

4.3.3.6 The manual override controls for emergency services use shall:

a) be accessible without the use of a key but protected to prevent operation by unauthorized persons (e.g. located in an enclosure with a front made of transparent frangible material glass). Where there could be confusion with a fire alarm call point, the break glass casing shall be coloured yellow; and

b) have permanent markings to indicate its purpose and the operating positions of the controls.

NOTE For further information on power supplies, refer to BS EN 12101-10.

4.4 Resistance to heat

All auxiliary equipment shall conform to the requirements of BS EN 12101-9 [3)].

NOTE The resistance to heat of equipment might determine the location. The location of equipment will be 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.

[3)] In preparation.

5 Performance requirements and classifications

5.1 General

Active fire curtain barrier assemblies shall be tested in accordance with Annexes B, C and D.

5.2 Reliability and durability

5.2.1 Active fire curtain barrier assemblies shall be tested in the orientation and use intended by the manufacturer for their application and installation.

5.2.2 Active fire curtain barrier assemblies shall be tested in accordance with Annex C and shall complete a minimum number of cycles in accordance with Table 6 and shall be classified in accordance with BS EN 14600:2005.

Table 6 **Number of cycles for testing reliability and durability**

Frequency of intended use	Number of cycles
More than once a day	50 000
Daily	5 000
Weekly	500
Monthly or less frequently	500

5.2.3 Active fire curtain barrier assemblies shall be proven to be reliable for the application in which they are designed to work through testing in accordance with Annex C.

5.3 Response time and velocity

Active fire curtain barrier assembly specimens shall be tested in accordance with Annex C and shall operate within the velocity ranges as specified in BS EN 12101-1 as follows.

a) Active fire curtain barrier assemblies shall commence deployment immediately upon initiation or any initiation failure and move to their fire operational position, in all operating modes, at a velocity range between 0.06 m/s and 0.30 m/s.

b) Active fire curtain barrier assemblies which may be located in critical areas of a building, e.g. escape routes, entrances/exits to escalators or stairways, shall have a velocity range of 0.06 m/s to 0.15 m/s.

NOTE Precautions should be taken to ensure that descending barriers in such areas do not cause injury, panic, confusion, etc. The use of multi-positional barriers or visual or audible warnings, should be considered.

5.4 Smoke leakage (containment efficiency)

5.4.1 General

NOTE Active fire curtain barrier assemblies have a functional requirement to contain and/or prevent the migration of smoke (fire effluent).

Where smoke seals are required, the requirements of **5.4.2** and **5.4.3** shall be followed.

5.4.2 Permeability of full active fire curtain barrier assembly to smoke

5.4.2.1 General

Material shall not produce excessive quantities of smoke and toxic products or give rise to toxic hazards.

NOTE 1 Attention is draw to IMO Resolution MSC61 (67): Annex 1, Part 2 [3] which covers smoke and toxicity testing.

NOTE 2 Whilst an active fire curtain barrier assembly may use materials which are permeable to air resulting in apparent higher than usual air leakage rates, testing has shown that larger smoke particles do not pass through the same materials.

5.4.2.2 Total smoke leakage of active fire curtain barrier assemblies with smoke rating

5.4.2.2.1 Active fire curtain barrier assemblies with smoke rating shall be tested in accordance with BS EN 1634-3 or BS 476-31.1. The material air leakage shall not be included for the purposes of this test.

NOTE As specified in the UK Building Regulations, Approved Document B [1], the leakage rate may not exceed 3 $m^3/m/h$ (head and jambs only) when tested at 25 Pa in accordance with BS 476-31.1.

5.4.2.2.2 The material shall have a leakage rate of (0.2 ± 0.2) $m^3/m^2/h$ when tested using the principles of BS EN 1634-3 or BS 476-31.1 at ambient temperatures using a 1 m^2 sample with edges tightly sealed.

5.4.3 Multiple barrier applications

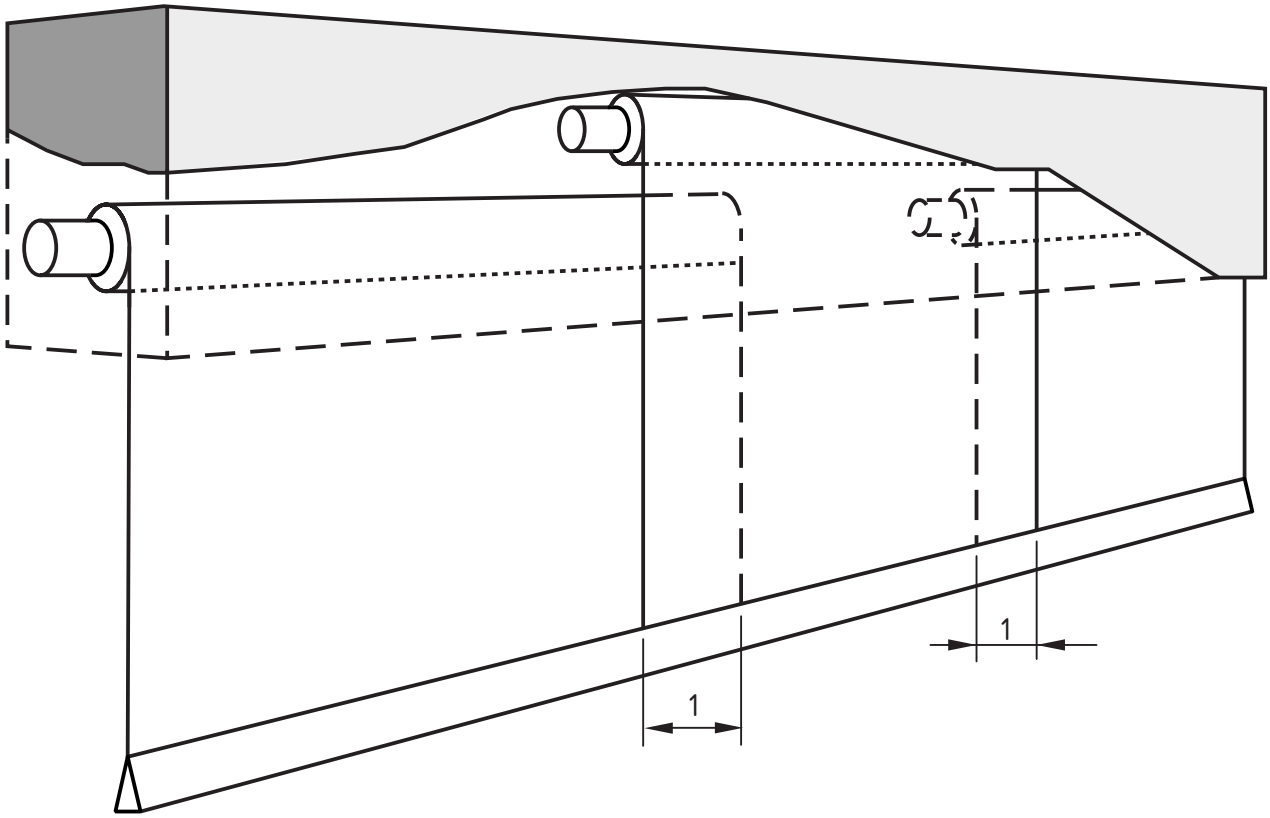
5.4.3.1 Active fire curtain barrier assemblies incorporating more than a single unit, (to cover an area greater than the maximum width of the manufacturer's widest single active fire/smoke barrier) shall be overlapped and conjoined to provide additional fire resistance and to prevent smoke leakage.

NOTE 1 Figure 2 illustrates the overlapping and conjoining of active fire curtain barrier assemblies.

NOTE 2 The sealing effect of the overlap is directly proportionate to the pressure, i.e. the greater the pressure the greater the seal.

5.4.3.2 The amount of overlap shall be determined by the total drop of the active fire curtain barrier assembly based on fire resistance test evidence. For fire curtain barriers larger than tested, supporting assessment evidence shall be required.

Figure 2 **Overlapping and conjoining of active fire curtain barrier assemblies – Typical example**



Key

1 Overlapping and conjoining of multiple units of fire curtain barrier assembly

5.5 Integrity

5.5.1 Active fire curtain barrier assemblies shall be subjected to the test in accordance with the relevant standard for the required application, for example, as a fire door in accordance with BS EN 1634-1 or a non-load bearing wall or ceiling in accordance with BS EN 1364-1 and BS EN 1364-2, and shall be classified in accordance with BS EN 13501-2:2003.

5.5.2 The performance criteria of active fire curtain barrier assembly test specimens when tested in accordance with Annex D are as follows.

a) The assessment of integrity shall be made on the basis of the following three aspects:

   1) cracks or openings in excess of dimensions given in the relevant fire resistance test standard (see **5.5.1**);

   2) ignition of a cotton pad;

   3) sustained flaming on the unexposed face.

b) Test specimens shall not release flaming droplets or particles within the first 600 s.

NOTE Observation of any components or droplets falling during the test will be recorded in the test report. When selecting a barrier for a particular application where falling components would be considered a significant threat to occupants, for example where people are expected to escape beneath active fire curtain barrier assemblies, the full test report should be obtained and checked.

5.5.3 Integrity shall be classified in one of the following two ways.

a) Where an element is classified for insulation (I), the integrity value (E) shall be determined by whichever of the three aspects [see **5.5.2** a)] fails first.

b) Where an element is not classified for insulation (I), the integrity value (E) shall be defined as the time to failure of only the cracks/openings or sustained flaming criteria, whichever fails first.

*NOTE The cotton pad test should be applied in accordance with the requirements of the relevant fire resistance test method (see **5.5.1**).*

5.6 Insulation

5.6.1 Where end use requires insulation, insulation shall be in accordance with BS EN 1634-1 or BS 476-22.

NOTE 1 Insulation is not needed in all cases – the guides on the use of non-insulated glass on escape routes from prescriptive means of escape codes can be used for guidance, e.g. Approved Document B [1], BS 5588 (all parts).

NOTE 2 When taking into account the additional requirements for thermocouple positioning, the insulated exclusion zone may be used as a guide to providing full fire separation.

5.6.2 Active fire curtain barrier assemblies shall be classified with an EI rating for insulation in accordance with BS EN 13501-2:2003.

5.7 Insulating zone

5.7.1 Where end use requires an insulating zone, active fire curtain barrier assembly test specimens shall be tested in accordance with Annex D and shall meet the performance requirements in **5.7.2** and **5.7.3**.

5.7.2 The specimen shall be evaluated at the extent of the insulating zone against the maximum temperature rise criterion specified in BS EN 1363-2 with the exception of the limit for temperature rise in the frame of the active fire curtain barrier assembly shall be 360 °C. The classification for insulation (see BS EN 13501-2:2003) shall include the distance measured.

NOTE 1 Traditionally, insulation values are taken from the surface of an element as typically this is a static partition where combustible items can be fixed or stored against – the aim being to prevent fire spread by spontaneous combustion and radiation (total heat flux) and to protect people against high temperatures and associated risks. Active fire curtain barrier assemblies replace such partitions and therefore have to descend within a clear zone or clear space. Therefore, the above problems of surface temperatures do not apply.

NOTE 2 The method of monitoring the air temperature adjacent to the test specimen was employed due to the practicalities of attaching thermocouples to any reactive or unsuitable material. The methodology employed should still follow the BS 476-20 where possible including the critical temperature requirements of 180 °C above ambient temperature as the failure criteria.

NOTE 3 See Annex E for information on the application of the insulating zone.

5.7.3 Where the active fire curtain barrier assembly is to be installed within the building structure or enclosed in the relevant Fire Resistant (FR rated) material, no readings are required, but the installation method shall be stated on the test report.

5.8 Radiation (total heat flux)

5.8.1 Radiation shall be tested in accordance with BS EN 1634-1 or BS 476-22.

NOTE 1 Radiation (total heat flux) is preferred to surface temperatures in many European countries as it considered to be a more efficient method of ensuring fire separation and protecting escaping occupants than just measuring temperature rise on the unexposed surface.

NOTE 2 Where active fire curtain barrier assemblies are used in conjunction with sprinklers, insulation will be achieved, however the insulation requirement of this specification is based upon non-sprinklered applications and as such non-insulated applications in excess of recommendations should be agreed with the relevant Authority.

5.8.2 The specimen shall be evaluated at a distance of 1 m from the furnace face taken at 1 min intervals in accordance with Annex D. The performance criteria for radiation shall be as specified in BS EN 13501-2. Failure shall be deemed to have occurred when radiation levels exceed 15 kW/m^2 unless a lower limit is specified for a specific fire risk scenario.

5.8.3 Active fire curtain barrier assemblies shall be classified with an W rating for radiation in accordance with BS EN 13501-2:2003.

NOTE The effects of radiation (total heat flux) upon the human body is given in Annex F.

5.9 Pressure and impact

Active fire curtain barrier assemblies shall be manufactured from materials capable of withstanding impact when tested in accordance with BS EN 949.

6 Installation information

The manufacturer shall provide appropriate installation information, which shall include the following:

a) fixing component information;

b) power requirements and connections;

c) installation instructions including perimeter requirements of insulating zone to allow for fire pressure and to prevent contact with other items where applicable;

d) commissioning procedure;

e) warnings to avoid obstructions to operation;

NOTE 1 Care should be taken to ensure that the operation of an active fire curtain barrier assembly is not obstructed, e.g. by cosmetic finishes, lighting, shelving, sales displays or racking. Consideration should be given to the use of the sensory equipment to detect obstructions.

NOTE 2 Warnings may be in the form of instructions, plaques, labels or floor markings.

f) operating instructions, with maximum operating and loading tolerance for the product, e.g. maximum barrier weight, bottom bar weights, minimum/maximum motor speeds, overlapping and conjoining, and fixing methods.

7 Maintenance information

NOTE 1 In order to ensure continued compliance, reliability and integrity, active fire curtain barrier assemblies need to be inspected, serviced and tested by personnel trained and qualified in the product.

The manufacturer shall provide maintenance and testing information which shall include the following:

a) inspection and maintenance procedures;

b) recommended procedures for operational checks;

c) recommended check for obstructions to operation, e.g. by cosmetic finishes, lighting, shelving, sales displays or racking;

d) recommended insulating zone area;

e) recommended check for the effects of corrosion, etc.;

f) recommended check for mechanical fastenings;

g) recommended check for power supplies and controls;

h) recommended check for penetrations, holes, etc.;

i) recommended check for anything which materially affects the performance of the product.

NOTE 2 Information on long-term maintenance of buildings (building management) can be found in Annex A.

8 Marking and labelling

Active fire curtain barrier assemblies conforming to this Publicly Available Specification shall be marked (on the product itself or on its accompanying commercial documents) with the following:

a) the number and date of this specification, i.e. PAS 121:2007 [4)];

b) the product, i.e. active fire/smoke barrier;

c) installation and maintenance requirements;

d) the response time (see **5.3**);

e) the openings, gaps and leakage (see **5.4**);

f) integrity (see **5.5**);

g) insulation (see **5.6**) or insulating zone (see **5.7**);

h) radiation (see **5.8**).

4) Marking PAS 121:2007 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Annex A (informative) Building management

The building management procedures should include details of the insulating zone within its Fire Safety Manual (see BS 5588-12 for further information) and ensure that all staff are aware of the importance of maintaining a clear area for the barrier to ensure full fire separation.

Depending upon what signal activates the active fire curtain barrier assembly will determine how often they are tested. The tests should be recorded in the Fire Safety Manual and should be carried out in accordance with Table A.1.

Table A.1 **Maintenance testing of active fire curtain barrier assemblies**

Frequency	Maintenance testing
Daily	Check for obstructions to operational area of insulating zone, e.g. by cosmetic finishes, lighting, shelving, sales displays or racking
Monthly	All barrier types shall be operated at least once a month

NOTE It is recommended that to assist in keeping the area clear of obstructions the insulating zone is defined by highlighting the floor area of the zone, for example by using different floor colouring or demarcation lines. The use of sensory detection equipment should also be considered.

Annex B (normative) General testing requirements

B.1 General

B.1.1 Tests carried out in Annexes C and D shall be representative of all sizes and field of applications in the family.

B.1.2 The supplier shall provide, with the test specimen, engineering drawings, calculations and parameters, e.g. equivalent active fire curtain barrier assembly dimensions (as defined in **D.2**) and joints to prove that all sizes in the family are represented by the test specimen. An assessment shall be made to endorse proposed sizes and end uses of the finished product.

B.1.3 The following performance requirement tests shall be performed for active fire curtain barrier assemblies in the sequence below:

a) reliability and durability of product (see Annex C);

b) default operation to fire operational position (see Annex C);

c) response time and performance (see Annex C);

d) material permeability to smoke (see **5.4.2**);

e) temperature/time classification (see Annex D);

f) integrity (see Annex D);

g) radiation (see Annex D);

h) insulating zone test procedure for product (see Annex D).

B.2 Test specimen

Where the manufacturer produces a product where the maximum in the family is equal to or less than 3 m width and 3 m barrier movement, only one specimen, the largest in the range, shall be tested. Active fire curtain barrier assemblies which overlap, physically interact or are mechanically connected shall be assembled in the manufacturer's normal manner.

Where the manufacturer produces a range of products greater than 3 m × 3 m, at least two specimens shall be tested separately as follows:

a) One specimen shall have a maximum width of 3 m and a minimum test barrier movement of 60% of the claimed maximum barrier movement. If the 60% rule is applied, all relevant test criteria shall be increased/compensated to simulate the claimed maximum barrier movement, e.g. weight increased, number of moving parts, number of test cycles increased, (such modification to not enhance or assist the sample in any way) to represent the claimed maximum barrier movement. The top section of this specimen shall be used for the tests in Annex E.

b) The other specimen shall be tested for reliability and durability only and shall have a minimum width of 10 m (or the largest width in the family if smaller than 10 m). Active fire curtain barrier assemblies which overlap, physically interact or are mechanically connected shall be assembled in the manufacturer's normal manner. The barrier movement tested shall be 60% of the claimed maximum barrier movement. If the 60% rule is applied, all relevant test criteria shall be increased/compensated to simulate the claimed maximum barrier movement, e.g. weight increased, number of moving parts, number of test cycles increased, (such modification to not enhance or assist the sample in any way) to represent the claimed maximum barrier movement.

Tests on these two specimens shall be considered representative of all fire curtain barrier assemblies in their particular family.

B.3 Test report

B.3.1 A test report shall be prepared in accordance with the requirements of **B.1** 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) full and detailed description of the test specimen, which shall include any comments regarding the family, the material integrity, weight and tensioning, if appropriate;

f) reference to the test method(s);

g) observations during the test(s);

h) approved insulating zone;

i) fixing and installation methods;

j) test results and classifications achieved.

B.3.2 These observations shall include any comments regarding the suitability of the active fire curtain barrier assembly to meet the functional requirements which may affect it or its fitness for purpose.

Annex C (normative) Test method for reliability and response time of the product and the durability of materials

C.1 Principle

The active fire curtain barrier assembly is tested for reliability and response time with its intended control system used to govern speed of operation.

C.2 Test equipment

C.2.1 *Control system/panel*, conforming to BS EN 12101-9 [5]. Adjustable speed controls shall not be further adjusted during the test after initial setting.

C.3 Test specimen

The test specimen shall be in accordance with **B.2**.

C.4 Test method

C.4.1 Mount the test specimen, using normal fixings in accordance with the manufacturer's installation information.

C.4.2 Operate the specimen a number of complete cycles as given in Table 6 using the primary energy source and shall be followed by 50 complete cycles using the auxiliary power source, e.g. batteries.

NOTE A cycle is defined as moving the active fire curtain barrier assemblies from the fully retracted position to the fire operational position and back to the fully retracted position.

C.4.3 At the end of the test cycles, remove all power sources and allow the barrier to move to its fire operational position in a controlled manner.

C.4.4 Do not carry out maintenance or repair during the test period.

C.4.5 Measure and record the cycle time and the time taken for each active fire curtain barrier assembly to reach the fire position at the beginning and end of the test period.

C.4.6 Measure and record the operating speeds in both directions of operation.

C.4.7 Check whether a 6 mm diameter rod or a 15 mm × 2 mm strip will pass through any perforation, tear or crack in the material without undue force.

C.4.8 Any actions and observations taken shall be recorded.

[5] In preparation.

C.5 Expression of results

C.5.1 The active fire curtain barrier assembly shall be deemed to have passed the reliability and response time of the product test if the specimen commences movement immediately upon initiation or initiation failure with a response velocity as given in **5.3**.

C.5.2 Failure shall be deemed to have occurred if one of the following occurs:

a) the active fire curtain barrier fails to complete a minimum number of continuous cycles in accordance with Table 6;

b) after completion of a minimum number of continuous cycles in accordance with Table 6, a 6 mm diameter rod or a 25 mm × 2 mm strip can be passed through any perforation, tear or crack in the material without undue force.

C.6 Test report

The test report shall be written and information provided in accordance with the requirements of Annex B.

Annex D (normative) Test method for the determination of the fire resistance performance of fire curtain barrier assemblies

D.1 Principle

The fire resistance performance of the fire curtain barrier assembly is determined by testing in accordance with BS EN 1634-1. The specimen is evaluated against the integrity in accordance with BS EN 1634-1 and, when required, the insulation and radiation performance requirements of this PAS.

*NOTE At the request of the test sponsor, the test specimen may also be evaluated against the insulating zone performance requirements (as detailed in **5.7**).*

D.2 Test specimen

D.2.1 Dimensions

D.2.1.1 The test specimen shall be tested as a complete installed active fire curtain barrier assembly including side guides, channels, motors, head boxes, bottom bars or tensioning devices.

D.2.1.2 For fire curtain barrier assemblies where the largest size is less than 3 m × 3 m, the largest barrier in the family shall be tested.

D.2.1.3 For fire curtain barrier assemblies where the largest size is greater than 3 m × 3 m, a 3 m × 3 m specimen shall be tested.

D.2.1.4 To represent barriers of increased drop, an additional load shall be applied evenly across the bottom of the barrier, equivalent to the additional mass of barrier for the largest drop in the family.

D.2.2 Hems and joints

For materials that in normal use have hems or joints, e.g. seams, welds or overlaps, the following shall be incorporated into the test.

a) Fire curtain barrier assemblies with horizontal joints shall be tested with a horizontal joint within 1 m of the top of the barrier.

b) Fire curtain barrier assemblies with a vertical joint shall be tested with at least one joint located 0.75 m to 1.25 m from a vertical side of the barrier.

c) Fire curtain barrier assemblies with side hems shall be tested with at least one side hem.

D.2.3 Orientation

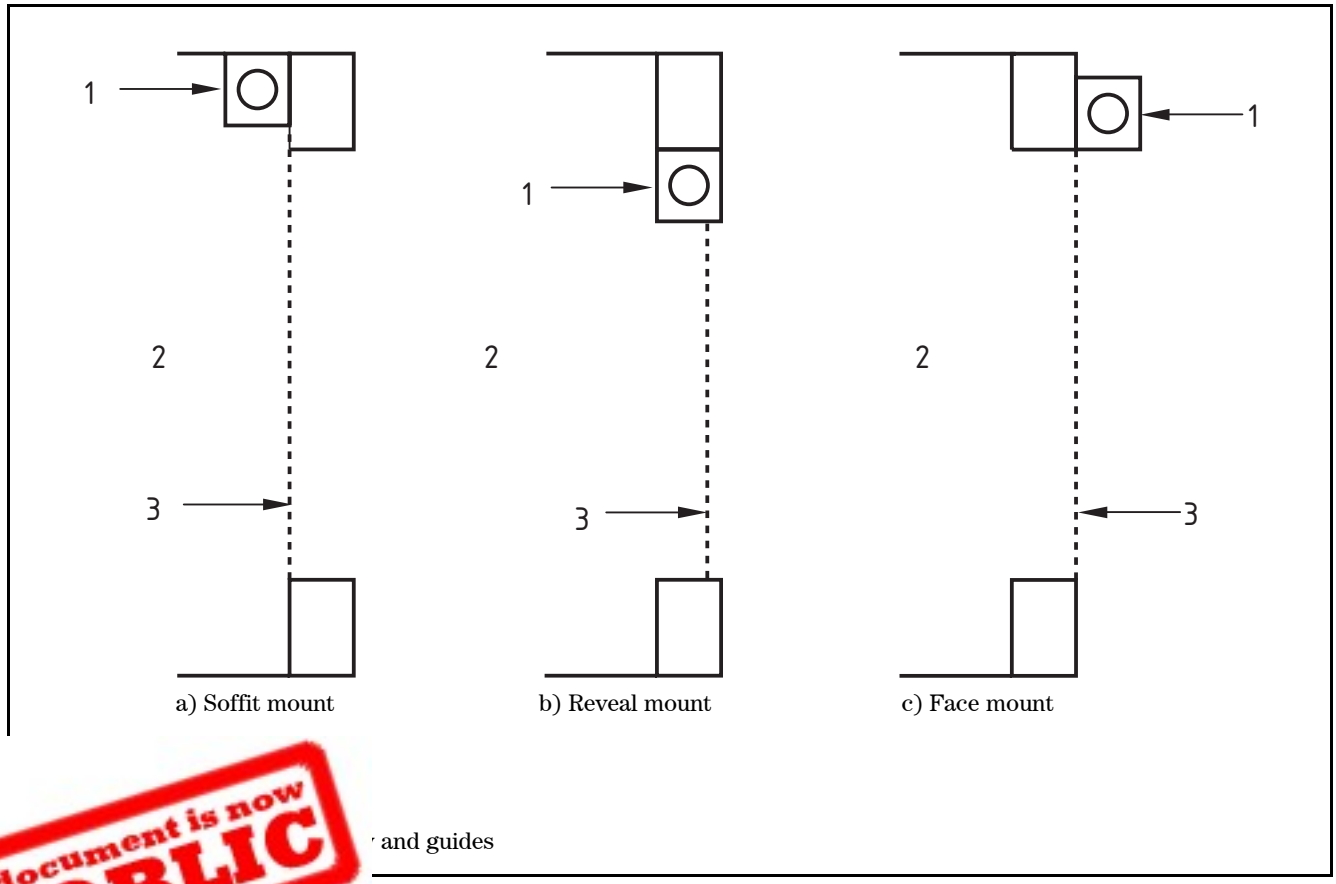
D.2.3.1 The active fire curtain barrier assembly shall be installed within the furnace opening in accordance with BS EN 1634-1 [see Figure D.1 a)] and the direct and extended field of application rules can be used.

D.2.3.2 Where the end use application requires soffit or reveal mounting, the test specimen shall be installed as shown in Figure D.1 b) with the pass criteria satisfying positions shown in Figure D.1 a) and c).

NOTE 1 It is recommended that the suitability of soffit or reveal mounted test evidence for use in supporting surface mounted end use applications is determined by assessment by the test house.

NOTE 2 Attention is drawn to Approved Document B [1] which states that laboratories accredited by UKAS for conducting the relevant tests and suitably qualified fire safety engineers might be expected to have the necessary expertise.

Figure D.1 **Orientation of test specimen**



and guides

D.3 Fire test

D.3.1 General

D.3.1.1 The fire curtain barrier assembly shall be operated for 25 cycles prior to the commencement of the fire test.

D.3.1.2 The fire resistance performance of the fire curtain barrier assembly shall be determined by testing in accordance with BS EN 1634-1.

NOTE At the request of the test sponsor, the test specimen may also be evaluated against the performance criteria for insulating zone in ***D.3.2****.*

D.3.2 Insulating zone

NOTE Where it is impracticable to fix or hang thermocouples to the surface of the test specimen, as it would prevent the insulation process working and would not be application specific, the insulation performance of the specimen would not be determined. In order to ascertain temperatures adjacent to the surface of the test specimen the concept of the insulating zone was developed. This is a method of establishing what temperature a thermocouple will experience when adjacent to, but not in contact with, the surface of the specimen.

D.3.2.1 Thermocouple type and mounting details

Two movable thermocouples (unexposed face type K in accordance with BS EN 1363-1:1999) shall be provided but shall not include thermocouple pads. The thermocouples shall be attached to a movable support such that its distance from the specimen can be adjusted during the test. The face of the thermocouples shall be maintained parallel to the surface of the specimen during the test.

NOTE 1 It is recommended that a pair of thermocouples is used together in the test to allow for the fact that replacing a thermocouple, if it were to fail during the test, would be impractical.

NOTE 2 Depending upon the test house, the support frame or bar can be either vertical or horizontal, although a method of measuring the distance of the thermocouple from the furnace dictates that a horizontal bar would be more efficient.

D.3.2.2 Test method

D.3.2.2.1 Turn the furnace on and establish the pressure regime for the test. Once the pressure has been stabilized at the required pressure levels, then move the thermocouple to a distance of (50 ± 5) mm from the centre of the surface of the specimen.

D.3.2.2.2 Monitor the temperature continuously throughout the test and, if necessary, move the thermocouple away from the specimen so that the temperature it records is kept as close as possible (but always below) the failure criteria temperature of 180 °C plus ambient temperature.

D.3.2.2.3 Monitor the distance of the thermocouple from the specimen surface a minimum of every 30 min. Ensure that the thermocouple does not come into contact with the surface and that it maintains the minimum (50 ± 5) mm separation or greater if the failure criteria temperature has been exceeded.

NOTE It is recommended that the distance of the thermocouple from the specimen surface is monitored every 15 min and immediately prior to test termination.

D.3.2.2.4 Record the following information:

a) the temperature change of the thermocouple throughout the test;

b) the distance between the thermocouple and the specimen surface a minimum of every 30 min.

D.4 Performance criteria

D.4.1 Integrity

The integrity performance of the test specimen shall be in accordance with the performance characteristics given in BS EN 13501-2.

D.4.2 Insulation

The insulation performance of the test specimen shall be in accordance with the performance characteristics given in BS EN 13501-2.

D.4.3 Radiation

The radiation performance of the test specimen shall be in accordance with the performance characteristics given in BS EN 13501-2.

D.4.4 Insulating zone

The insulation zone for each given time period shall be taken as the minimum distance from the surface of the specimen at which the failure criteria temperature (180 °C above ambient air temperature) as in BS EN 1363-1 has not been exceeded.

D.5 Expression of results

The specimen shall be evaluated against the integrity in accordance with BS EN 1634-1 and, where applicable, the insulation and radiation performance requirements in **5.6**, **5.7** and **5.8**.

D.6 Test report

D.6.1 The test report shall be written and information provided in accordance with BS EN 1634-1.

D.6.2 Where the insulating zone test is carried out, information on the following additional items shall be included in the test report:

a) insulation zone measurements;

b) radiation output data;

c) parts, components and flaming droplets falling from the test specimen;

d) changes in the specimen relating to the fixing methods;

e) holes or cracks occurring in the test specimen.

Annex E (informative)

An engineered approach to using insulating zones

When considering the use of active fire curtain barrier assemblies as part of either prescriptive or fire engineered solutions, a designer should take into account the insulating zone. The insulating zone for an active fire curtain barrier assembly may reduce the effective width of the escape route due to the barrier deflecting.

Under a prescriptive solution, the designer will need to increase escape route widths to compensate for the reduction in the effective width.

Under a fire engineered solution, the designer will need to consider the following factors when specifying an active fire curtain barrier assembly:

- the actual width of the escape route where the active fire curtain barrier assembly is to be installed;
- whether the insulating zone of the active fire curtain barrier assembly impinges on the effective width of the corridor and if so, by how much.

With this information, the designer will be able to identify whether the use of the active fire curtain barrier assembly will affect a prescriptive solution. Where a prescriptive solution is not possible or not adopted, the designer will need to consider the following fire engineered solutions:

- phased evacuation, thereby reducing the required escape route widths;
- evacuation analysis as the basis of a justification for reduced escape route widths;
- recessing the active fire curtain barrier assembly in order that the insulating zone is within the recess;
- consideration to be given to mounting the active fire curtain barrier assemblies so as to maintain the width of the escape route.

NOTE 1 All fire engineered solutions need to be evaluated in detail by a suitably qualified person and any justification needs to form part of the complete Fire Safety Strategy for the building.

NOTE 2 Prescriptive testing does not always ensure the product is fit for the intended purpose.

The main advantages of using the active fire curtain barrier assemblies as part of a fire engineered solution are:

- it maintains an open plan design by using active fire curtain barrier assemblies to reduce the compartment size or to protect escape routes in the event of a fire, thereby enhancing life safety and property protection;
- it supplements a phased evacuation strategy by closing off areas and reducing the compartment size, thereby restricting fire spread. This may only necessitate the evacuation of people within the fire compartment of fire origin initially.

A designer should also consider how the insulating zone is to be kept clear in order that the active fire curtain barrier assembly is not affected during its operation. This may be achieved quite simply by highlighting an area on the floor in which items are not to be placed or, if a greater reliance is required, by using a beam detection system which triggers an alarm if an item were to be placed within the insulating zone.

Annex F (informative)

Thermal limits – Human factors

According to research on the effect of heat on the human body by Mecklenburg (1985) [4], the intensity tolerable to escaping personnel is 5 kW/m^2 as they will be moving.

At 4 kW/m^2 the human body will only feel pain on uncovered skin after exposure in excess of 15 s and between 35 s and 100 s would elapse before the possibilities of blistering.

At 10 kW/m^2 these times would be reduced to 5 s before the onset of pain on unprotected skin and between 12 s and 40 s before blistering.

Based upon this, other studies and acceptable European National Standards, the limit should be set within these limits with the aim of protecting occupants, with radiation (total heat flux) not exceeding 3 kW/m^2 during the first 10 min and 5 kW/m^2 at 30 min.

National Standards of radiation levels should be taken into account and complied with.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476-20, *Fire tests on building materials and structures – Part 20: Method for determination of the fire resistance of elements of construction (general principles)*

BS 5588 (all parts), *Fire precautions in the design, construction and use of buildings*

BS 5588-12, *Fire precautions in the design, construction and use of buildings – Part 12: Managing fire safety*

BS 7974, *Application of fire safety engineering principles to the design of buildings – Code of practice*

BS 8434-1, *Methods of test for assessment of the fire integrity of electric cables – Part 1: Test for unprotected small cables for use in emergency circuits. BS EN 50200 with addition of water spray*

BS EN 50200, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

EN 15269-1, *Extended application of test results for fire resistance for doorsets and shutter assemblies – For doors and shutters – Part 1: General requirements for fire resistance* [6)]

ISO/IEC Guide 2, *Standardization and related activities – General vocabulary*

PD 7974-6, *The application of fire safety engineering principles to fire safety design of buildings – Human factors – Life safety strategies – Part 6: Occupant evacuation, behaviour and condition (Sub-system 6)*

Other publications

[1] COMMUNITIES AND LOCAL GOVERNMENT. The Building Regulations 2000: Approved Document B – Fire safety (Volume 1 and Volume 2). Newcastle upon Tyne: NBS, 2006. (http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADB_2000.pdf)

[2] COMMUNITIES AND LOCAL GOVERNMENT. The Building Regulations 2004: Approved Document M – Access to and use of buildings. Newcastle upon Tyne: NBS, 2006. (http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADM_2004.pdf)

[3] IMO Resolution MSC61 (67): Annex 1, Part 2. 1999 Publisher: International Maritime Organization. (http://www.mss-int.com/msc61.html#PART%202%20-%20SMOKE%20AND%20TOXICITY%20TE)

[4] J C MECKLENBURG. Chemical engineering (process plant layout). London: Godwin in association with the Institution of Chemical Engineers, 1985.

6) In preparation.

Further reading

BS 8300, *Design of buildings and their approaches to meet the needs of disabled people – Code of practice*

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