

Part E -

**Fire Properties of
Building Elements and
Components**

This Part contains six Sections:

- **Section 1 – General**
- **Section 2 – Loadbearing Elements**
- **Section 3 – Non-loadbearing Elements**
- **Section 4 – Protection of Openings in Fire Barriers**
- **Section 5 – Non-combustibility**
- **Section 6 – Fire Testing Authorities**
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Section 1 – General

Subsection E1 – Use of this Part

Clause E1.1

This Part provides the Deemed-to-Comply provisions for the fire properties of building elements and components and should be read in conjunction with all other Parts in this Code.

Clause E1.2

The Building (Construction) Regulation 90 stipulates the requirements for the design and construction of buildings to inhibit and resist the spread of fire and Regulations 39 and 43 stipulate the combustibility requirements for cladding and curtain walls. This Part provides guidance on how the fire properties of building elements and components may comply with these Regulations.

Clause E1.3

Relevant parts of the International standard of ISO and the national standards stipulated in this Part are considered acceptable to the Building Authority for demonstrating the fire properties of the building elements and components. Where it is intended to use other standards, authorized persons should demonstrate complying with Clause E16.2 that such standards are equivalent or not inferior to the international or the national standards stipulated in this Part.

Subsection E2 – Scope

Clause E2.1

Part E is applicable to all Use Classifications in Table A1 of Part A.

Commentary

There are two principal groups of fire tests for building elements, materials and components:

- (a) Reaction to fire – the extent to which a product burns and contributes to the development of a fire. Products include walls, floors and ceiling linings, etc.
- (b) Resistance to fire – the ability of a product to prevent the spread of flame and/or smoke from a fully developed (post-flashover) fire, and where relevant, to maintain stability, integrity and insulation characteristics.

Section 2 – Loadbearing Elements

Subsection E3 – Fire Tests for Loadbearing Elements

Clause E3.1

Loadbearing elements should be tested in accordance with the following applicable standards to demonstrate the required FRR (structural stability, integrity and insulation as appropriate):

- (a) BS EN 1363-1:1999, *Fire resistance tests. General requirements*;
- (b) BS EN 1365-1:1999, *Fire resistance tests for loadbearing elements. Walls*;
- (c) BS EN 1365-2:2000, *Fire resistance tests for loadbearing elements. Floors and roofs*;
- (d) BS EN 1365-3:2000, *Fire resistance tests for loadbearing elements. Beams*;
- (e) BS EN 1365-4:1999, *Fire resistance tests for loadbearing elements. Columns*;
- (f) BS EN 1365-5:2004, *Fire resistance tests for loadbearing elements. Balconies and walkways*;
- (g) BS EN 1365-6:2004, *Fire resistance tests for loadbearing elements. Stairs*.

Commentary

FRR of loadbearing elements is classified in accordance with BS EN 13501-2:2007, *Fire Classification of Construction Products and Building Elements – Classification using data from fire resistance tests, excluding ventilation services*.

Clause E3.2

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 21:1987, *Fire tests on building materials and structures. Methods for determination of the fire resistance of load bearing elements of construction*.

Section 3 – Non-loadbearing Elements

Subsection E4 – Fire Tests for Non-loadbearing Elements

Clause E4.1

Composite walls involving plasterboard systems should be constructed in accordance with the manufacturer's specifications. The assembled products should be tested in accordance with BS EN 1364-1:1999, *Fire resistance tests for non-loadbearing elements. Walls* to demonstrate the required FRR.

Clause E4.2

Other materials used as fire barriers should be installed in accordance with the manufacturer's specifications and tested in accordance with an appropriate testing regime, such as BS EN 1364-1:1999, *Fire resistance tests for non-loadbearing elements. Walls*.

Clause E4.3

Materials forming a ceiling that requires an FRR should be tested in accordance with BS EN 1364-2, *Fire resistance tests for non-loadbearing elements. Ceilings*.

Clause E4.4

False ceilings and elevated floors that require an FRR should be tested in accordance with the following applicable standards:

- (a) BS EN 1366-6:2004, *Fire resistance tests for service installations. Raised access and hollow core floors*;
- (b) BS EN 1364-2:1999, *Fire resistance tests for non-loadbearing elements. Ceilings*.

Clause E4.5

The following British Standards will still be applicable until they are obsolete:

BS 476 Part 22:1987, *Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction*.

Commentary

False ceilings and elevated floors forming part of an air plenum should be non-combustible – see Subsection E10.

Section 4 - Protection of Openings in Fire Barriers

Subsection E5 - Openings in Fire Barriers (Doors, Windows, Shutters and associated Penetrations)

Clause E5.1

Elements that protect openings, such as doors, windows and fire shutters in fire barriers should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity and insulation as appropriate):

- (a) BS EN 1634-1:2008, *Fire resistance and smoke control tests for door, shutter and openable window assemblies and elements of building hardware. Fire resistance test for doors, shutters and openable windows;*
- (b) BS EN 1634-2:2008, *Fire resistance tests for door, shutter and openable window assemblies and elements of building hardware. Fire resistance characterisation test for elements of building hardware;*
- (c) BS EN 1634-3:2004, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies;*
- (d) BS EN 14600:2005, *Doorsets and openable windows with fire resisting and/or smoke control characteristics. Requirements and classification.*

Commentary

The FRR of fire rated doors, fire shutters and openable windows designed for installation within openings in vertical separating elements should be tested in accordance with BS EN 1634-1:2008. BS EN 1634-1:2008 sets out two options of maximum temperature rise criteria for insulation. These options are based on the classification of thermal insulation (Classification I1 or I2) and the classification shall be in accordance with BS EN 13501-2:2007. The thermal criterion of Classification I1 is recommended for consistency with BS 476.

Clause E5.2

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles);*
- (b) BS 476: Part 22:1987, *Fire tests on building materials and structures. Methods for determination of the fire resistance of non-load bearing elements of construction.*

Clause E5.3

All tested fire rated doors, fire shutters and fire windows should be “tagged” or otherwise labelled to ensure ease of identification.

Commentary

The FRR of elements to prevent fire spread through openings in fire barriers is classified in accordance with BS EN 13501-2:2007, *Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services*.

The performance for protected openings in fire barriers includes:

- (a) Integrity – the ability of the element of construction that has a fire separating function, to withstand fire exposure on one side only, without the transmission of fire to the unexposed side as a result of the passage of flames or hot gases;
- (b) Thermal insulation – the ability of the element of construction to withstand fire exposure on one side only, without the transmission of fire as a result of significant transfer of heat from the exposed side to the unexposed side. Transmission shall be limited so that neither the unexposed surface nor any material in close proximity to the surface is ignited;
- (c) Radiation – the ability of the element of construction to withstand fire exposure on one side only, so as to reduce the probability of the transmission of fire as a result of significant radiated heat either through the element or from its unexposed surface to adjacent materials;
- (d) Self-closing – the ability of an open door to close fully into its frame and engage any latching device that may be fitted, without human intervention, by stored energy, or by mains power backed up by stored energy in case of power failure.

Subsection E6 - Openings in Fire Barriers (Ventilation Ducts and associated Penetrations)

Clause E6.1

Elements that protect openings where ventilation ducts and the like penetrations in fire barriers, such as seals, should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity and insulation as appropriate):

- (a) BS EN 1366-1:1999, *Fire resistance tests for service installations. Fire resistance tests for service installations. Ducts*;
- (b) BS EN 1366-8:2004, *Fire resistance tests for service installations. Smoke extraction ducts*;
- (c) BS EN 1366-9:2008, *Fire resistance tests for service installations. Single compartment smoke extraction ducts*.

Clause E6.2

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 24:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts*.

Subsection E7 - Openings in Fire Barriers (General Penetrations)

Clause E7.1

Penetration seals for electrical cables, plumbing and other services, should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity only):

- (a) BS EN 1366-3:2009, *Fire resistance tests for service installations. Penetration seals*;
- (b) BS EN 1366-4:2006, *Fire resistance tests for service installations. Linear joint seals*.

Clause E7.2

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 23:1987, *Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure*.

Commentary

The same control on pipe penetrations applies to all pipes penetrating fire barriers, irrespective of they are water-borne, their diameter or material of construction.

Subsection E8 - Fire and Smoke Dampers

Clause E8.1

Fire and smoke dampers in ventilation ducts should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity only):

- (a) BS EN 1366-2:1999, *Fire resistance tests for service installations. Fire dampers*;
- (b) BS ISO 10294-1:1996, *Fire-resistance tests. Fire dampers for air distribution systems. Test method*;
- (c) BS ISO 10294 -2:1999, *Fire-resistance tests. Fire dampers for air distribution systems. Classification, criteria and field of application of test results*;
- (d) BS ISO 10294-3:1999, *Fire-resistance tests. Fire dampers for air distribution systems. Guidance on the test method*;
- (e) BS ISO 10294-5:2005, *Fire-resistance tests. Fire dampers for air distribution systems. Intumescent fire dampers*.

Clause E8.2

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 23:1987, *Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure*.
- (c) BS 476: Part 24:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts*.

Clause E8.3

All newly installed dampers should be inspected and certified by a registered specialist contractor in the ventilation works category that the dampers are in safe and efficient working order.

Subsection E9 – Smoke Leakage for Doors with Smoke Seal

Clause E9.1

Doors with smoke seal should be tested at ambient temperature and medium temperature and demonstrated to comply with the smoke leakage rate criteria in accordance with the following applicable standards:

- (a) BS EN 1634-3:2004, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies;*
- (b) BS EN 14600:2005, *Doorsets and openable windows with fire resisting and/or smoke control characteristics. Requirements and classification;*
- (c) ISO 5925-1:2007, *Fire tests - Smoke-control door and shutter assemblies - Part 1: Ambient- and medium-temperature leakage tests;*
- (d) UL 1784:2009, *UL Standard for safety air leakage tests of door assemblies;* or
- (e) AS 1530:Part 7:2007, *Methods for fire tests on building materials, components and structures- Smoke control assemblies. Ambient and medium.*

Clause E9.2

[Clause deleted.]

Section 5 – Non-combustibility

Subsection E10 – Non-combustibility

Clause E10.1

Any product that complies with one of the following is considered to be non-combustible:

- (a) Class A1 in BS-EN 13501-1:2007, *Fire classification of construction products and building elements - Classification using data from reaction to fire tests*;
- (b) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test and BS EN ISO 1716:2010 Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS 476-4:1970, *Fire tests on building materials and structures. Part 4: Non-combustibility test for materials*.

Commentary

Other appropriate non-combustibility tests include:

- (a) AS 1530.1:1994, *Methods for fire tests on building materials, components and structures Part 1: Combustibility test for materials*;
- (b) ASTM E136–11, *Standard test method for behavior of materials in a vertical tube furnace at 750°C*.

Subsection E11- Limited Combustibility

Clause E11.1

Materials of limited combustibility are classified as Class A2-s3, d2 or better in accordance with:

- (a) BS EN 13501-1:2007, *Fire classification of construction products and building elements, Part 1 – Classification using data from reaction to fire tests to BS EN ISO 1182:2002, Reaction to fire tests for building products – Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)* and BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item*.

Commentary

The European classifications are developed through a suite of fire tests. Building elements except flooring, are classified as A1, A2, B, C, D, E or F (with A1 being the highest performance and F being the lowest) in accordance with BS EN 13501-1:2007, *Fire classification of construction products and building elements, Classification using data from reaction to fire tests*.

The relevant fire tests are:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item*;
- (d) BS EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*;
- (e) BS EN 13238:2010, *Reaction to fire tests for building products. Conditioning procedures and general rules for selection of substrates*.

The European test methods are based on performance in the ISO 9705, *Room Corner Test*. Products tested in accordance with the room corner test (ISO 9705), in tandem with the Cone Calorimeter (ISO 5660-1) are acceptable.

Table E1 is the comparison of classification of fire performance of materials tested in accordance with BS EN 13501-1:2007 and BS 476: Parts 4 and 7.

Table E1 - European Classes on Reaction to Fire Performance

European Classification	British Standard Equivalent
A1	Non-combustible
A2	Limited combustibility
B	0
C	1
D	3
E	4
F	Unclassifiable or no performance determined

Subsection E12 - External Facades

Clause E12.1

External facades should be tested in accordance with the following applicable standards:

- (a) BS EN 1364-3:2006, *Fire resistance tests for non-loadbearing elements. Curtain walling. Full configuration (complete assembly)*;
- (b) BS EN 1364-4:2007, *Fire resistance tests for non-loadbearing elements. Curtain walling. Part configuration*.

Commentary

There are other options for testing of facades, including:

- (a) Large scale testing:
 - (i) NFPA285:2006, *Standard fire test method for evaluation of fire propagation characteristics of exterior non-loadbearing wall assemblies containing combustible components*;
 - (ii) ULC-S134-92, *Fire test of exterior wall assemblies (Vertical channel test)*.
- (b) Small scale testing:
 - (i) ULC-S134-92, *Fire test of exterior wall assemblies (Vertical channel test)*;
 - (ii) AS 1530.1:1994, *Methods for fire tests on building materials, components and structures Part 1: combustibility test for materials*.

Subsection E13 – Linings of Internal Wall and Ceiling and Decorative Finishes

Clause E13.1

Linings of internal wall and ceiling and decorative finishes in the following Use Classifications, where the combustibility is required to be controlled, should comply with the following when tested in accordance with BS EN 13501-1:2007:

- (a) All Use Classifications – within protected exits, Classification C of Table E1;
- (b) Use Classification 3 – general accommodations (including corridors, circulation spaces and rooms) that are not forming the protected exit, Classification B or above of Table E1;
- (c) Use Classification 5a – within cinemas, auditoria and theatres, Classification C or above of Table E1;

When tested in accordance with the British Standards, the performance should meet the equivalent European classification in Table E1.

Clause E13.2

For compliance with Clause E13.1, the linings and finishes should be tested in accordance with the following applicable standards:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item*;
- (d) BS EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*.

Clause E13.3

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476-4:1970, *Fire tests on building materials and structures. Part 4: Non-combustibility test for materials*.
- (b) BS 476 Part 6:1989, *Fire tests on building materials and structures - Method of test for fire propagation for products*;
- (c) BS 476 Part 7:1997, *Fire tests on building materials and structures - Method of test to determine the classification of the surface spread of flame of products*.

Commentary

Decorative finishes are materials that are fixed to walls and ceilings. For cinemas and theatres only, decorative finishes also include seat linings.

There is another option for testing of linings: NFPA 265: 2011, *Standard methods of fire tests for evaluating room fire growth contribution of textile coverings on full height panels and walls*.

Subsection E14 - Linings and Coverings of Floors

Clause E14.1

Linings and coverings of floors, where the combustibility is required to be controlled, should comply with the following when tested in accordance with BS EN 13501-1:2007:

- (a) All Use Classifications – within protected exits, Classification C of Table E1;
- (b) Use Classification 3 – general accommodation (including corridors, circulation spaces and rooms) that are not forming the protected exit, Classification B or above of Table E1;
- (c) Use Classification 5a – within cinemas, auditoria and theatres, Classification C or above of Table E1.

When tested in accordance with the British Standards, the performance should meet the equivalent European classification in Table E1.

Clause E14.2

For compliance with Clause E14.1, the linings and coverings of floors should be tested in accordance with the following applicable standards:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN ISO 9239-1:2010, *Reaction to fire tests for floorings. Determination of the burning behaviour using a radiant heat source*;
- (d) BS EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*.

Clause E14.3

Other small scale tests may also be applicable:

- (a) BS 4790:1987, *Determination of the effects of a small source of ignition on textile floor coverings (hot metal nut method)*;
- (b) BS 6307:1982, ISO 6925-1982, *Method for determination of the effects of a small source of ignition on textile floor coverings (methenamine tablet test)*.

Commentary

Whilst a floor is not usually the prime vehicle for fire spread, the contribution of floor coverings such as carpets to fire spread can be significant. The Flooring Radiant Panel represents the exposure of a carpet or other floor covering to a nearby fire, and measures the propensity of the floor covering to be an agent of flame spread over flat floors (in the absence of significant air flow). The Hot Nut Test (BS 4790) and the Methenamine Pill Test (BS 6307, ISO 6925) represent small ignition sources falling on a carpet in the absence of any external radiation.

Subsection E15 - Acoustic and Thermal Insulation

Clause E15.1

Acoustic and thermal insulation in ductings and concealed locations should be tested in accordance with the following applicable standards:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding flooring exposed to the thermal attack by a single burning item*;
- (d) EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*;
- (e) BS EN 13501-1:2007, *Fire classification of construction products and building elements. Classification using data from reaction to fire tests*.

Clause E15.2

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476-4:1970, *Fire tests on building materials and structures. Part 4: Non-combustibility test for materials*;
- (b) BS 476 Part 6:1989, *Fire tests on building materials and structures. Method of test for fire propagation for products*;
- (c) BS 476 Part 7:1997, *Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products*.

Section 6 – Fire Testing Authorities

Subsection E16 - Criteria for Choosing Testing Authorities

Clause E16.1

The Building Authority will recognize the laboratories accredited by the Hong Kong Accreditation Services (HKAS) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or other laboratory accreditation bodies which have reached mutual recognition agreements with HOKLAS. The Building Authority will also recognize the certification bodies accredited by HKAS under the Hong Kong Certification Body Accreditation Scheme (HKCAS) or other accredited certification bodies which have reached multilateral recognition arrangements with HKCAS.

Clause E16.2

The fire properties of materials, products or construction components should be tested in accordance with or assessed against the standards stipulated in this Part and certified as being capable of achieving such fire properties to the satisfaction of the Building Authority. Such certification should be established by:

- (a) a test report prepared by a recognized laboratory. The test should be within the accredited scope for testing of the laboratory; or
- (b) an assessment report prepared by a recognized laboratory or certification body. The subject category or type of the materials, products or components of the assessment should be within the accredited scope for testing or certification by the laboratory or the certification body.