BRITISH STANDARD

BS EN
15882-3:2009

Extended applications of results from fire resistance tests for service installations

Part 3: Penetration seals

ICS 13.220.50

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15882-3:2009.

The UK committee would like to draw the attention of readers of this standard to the fact that BS EN 15882-3:2009 references EN 1366-3:2004 and is intended to provide guidance on the extended application of results of tests conducted in accordance with EN 1366-3:2004. The UK committee voted against EN 1366-3:2004 because the standard required the use of a plate thermocouple and, consequently, the UK committee did not support the preparation of EN 15882-3.

EN 1366-3:2004 has subsequently been revised and superseded by EN 1366-3:2009 but BS EN 15882-3:2009 has not been revised to work with the results of tests conducted in accordance with the 2009 edition of EN 1366-3. It is envisaged that this will be rectified in due course.

The UK participation in its preparation was entrusted to Technical Committee FSH/22, Fire resistance tests.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Extended applications of results from fire resistance tests for service installations - Part 3: Penetration seals

Application étendue des résultats des essais de résistance au feu - Partie 3 : Calfeutrements

Erweiterter Anwendungsbereich der Ergebnisse aus Feuerwiderstandsprüfungen - Teil 3 : Abschottungen

This European Standard was approved by CEN on 11 January 2009.

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Foreword

This document (EN 15882-3:2009) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document was submitted to Enquiry under the reference prEN 15080-14.

EN 15882 "Extended applications of results from fire resistance tests for service installations" consists of the following Parts:

— Part 1: Fire resisting ducts

— Part 2: Dampers

— Part 3: Penetration seals

— Part 4: Linear joint seals

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

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1 Scope

The purpose of this European Standard is to provide the principles and guidance for the preparation of extended application documents for penetration sealing systems tested in accordance with EN 1366-3. The field of the extended application document is additional to the direct field of application given within EN 1366-3 and may be applied to or based on a single test, or a number of tests, which provide the relevant information for the formulation of an extended application.

It should be noted that this European Standard provides general guidance on the likely effects of a change. It gives no guidance as to the magnitude, nor how this magnitude is evaluated.

Composite pipes comprising both metallic and plastics components are not covered by this European Standard.

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.

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

EN 1363-2:1999, *Fire resistance tests — Part 2: Alternative and additional procedures*

EN 1366-3: 2004, *Fire resistance tests for service installations — Part 3: Penetration seals*

EN 13501-1:2007, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

EN 13501-2:2007, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN ISO 13943:2000, *Fire safety — Vocabulary (ISO 13943:2000)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1:1999, EN 1363-2:1999, EN 1366-3:2004, EN 13501-1:2007, EN 13501-2:2007, EN ISO 13943:2000 and the following apply.

3.1
bellows seal
flexible seal, often based on a coated fabric sleeve, to allow movement of services

3.2
block
product available in a variety of shapes and sizes. Generally cuboid for rectangular penetrations

3.3
bus bar
low impedance conductor to which several electric circuits can be connected

NOTE See IEC 60439-1.

3.4
cable box
consists of a metal frame with intumescent inlays that form a type of channel with lids

3.5
cable bundles
Several cables running in the same direction and bound closely together by mechanical means

3.6
collar
see pipe closure devices (3.14)

3.7
conduit
metal or plastic casing designed to accomodate cables. Normally a conduit is circular or oval in section. See also trunking (3.26)

3.8
foam seal
seal made from a material that cures at room temperature, increasing its volume upon application

3.9
metal pipes type 1
metallic pipes and conduits of reaction to fire class A1 according to EN 13501-1 with a melting or decomposition point greater than 1000°C (e.g. steel, cast iron, copper and copper alloys, nickel alloys), either insulated or non-insulated. Included in this group are the above pipes with a coating provided the overall reaction to fire class is minimum A2

3.10
metal pipes type 2
metallic pipes and conduits of reaction to fire class A1 or A2 according to EN 13501-1 with a melting or decomposition point equal to or less than 1000°C (e.g. lead, aluminium and aluminium alloys), either insulated or non-insulated

3.11
modular system
system comprising a steel frame into which elastomeric blocks are installed, compressed around the service.

3.12
mortar
blend of gypsum or cement based powder, fillers, water and chemical modifiers, with or without reinforcement

3.13
pillow (also referred to as bag or cushion)
deformable, pillow-like bag, filled with reactive or non-reactive material, for the temporary or permanent closing of penetrations or openings. Examples of filling materials are glass and mineral wool, vermiculite, sand, organic and inorganic foams with or without intumescent or ceramising additives

3.14
pipe closure devices
pre-fabricated, heat activated device that, under fire exposure, acts to crush plastic pipes or service ducts that pass through vertical or horizontal separating elements and/or fill the hollow space with an intumescent foam

NOTE Three types are considered here: collars, wraps and sleeves:

Collars incorporate an outer casing which acts as a restraint for an intumescent material, enabling the collar to be either surface fixed to the separating element or incorporated within it;

Wraps have no casing and hence must be located within the separating element, which acts as a restraint for the intumescent;

Sleeves pass completely through the separating element and may include an outer casing.

3.15
pipe diameter
nominal external diameter of the service pipe

3.16
plastic pipes
pipes not classified to A1 or A2 according to EN 13501-1 (e.g. made from thermoplastic or thermosetting material) including non-homogeneous materials (e.g. glass fibre reinforced plastic pipes or layered pipes), either insulated or non-insulated, hereafter referred to as "plastic pipes".

3.17
plug
as block (3.2), but cylindrical/conical in shape (for circular penetrations)

3.18
interrupted insulation
pipe insulation that does not pass through the seal

3.19
sustained insulation
pipe insulation that passes through the seal

3.20
putty
material similar to some sealants/mastics, capable of being formed and directly installed by hand, but remaining in a plastic condition

3.21
seal depth
shortest distance between the exposed and unexposed surfaces of the seal

3.22
seal thickness
shortest distance between the surface of the service and the surrounding aperture

3.23
sealant/mastic, flexible
single or multi-component material, comprising organic and/or inorganic fillers pre-dispersed in a binder (i.e. acrylic, polysulphide, silicone, etc) that cures or dries after application to an elastic or plasto-elastic material

3.24
service support construction
mechanical support provided in the form of clips, ties, hangers, ladder racks or trays, or any device designed to carry the load of the penetrating services

3.25
sleeves
see pipe closure devices (3.14)

3.26
trunking
metal or plastic casing with a removable lid designed to accommodate cables. Normally square or rectangular in section (also see conduit 3.7)

3.27
waveguide
circular, elliptical or rectangular metal tube or pipe or a coaxial assembly of tubes/pipes through which electromagnetic waves are propagated in microwave and radio wave frequency communications

3.28
working clearances
distances between services or between services and the seal edge

3.29
wrap
see pipe closure devices (3.14)

4 Extended application principles

4.1 General

Due to the diverse nature of materials and constructions used to seal openings in fire resistant separating elements it has been necessary to separate the extended application principles into generic seal types. Where more than one variation is to be incorporated the overall effect shall be considered. Principles common to all generic seal types are given in 4.2. Principles and guidance relating to each specific generic seal type are given in Annex A. Annex B provides guidance on the application of test results on plastic pipe seals.

Variables for each seal type, which require consideration, are included in this report. These are as follows:

1) Separating element;

2) Type of service;

3) Size of service;

4) Seal size and configuration.

Each sub-clause gives the possible variation and the rule relating to the variation.

4.2 Principles common to all generic seal types

The rules given in the following sub-clauses are applicable to all generic penetration seal types incorporated in Annex A, unless stated otherwise in the specific section.

Table 1 – Seal material (primary generic penetration seal material as per Annex A)

Variation	Rules
Change of material(s) comprising parts of the sealing system	Not permitted unless otherwise specifically stated in Annex A

Table 2 – Separating elements — Concrete or masonry

Variation	Rules
Decrease in thickness and/or density	Not permitted
Increase in thickness	Permitted except in the case of pipe closure devices where specific rules regarding the position of the seal within the separating element are outlined in the relevant section

Table 3 – Separating elements – Flexible constructions

Variation	Rules
Decrease in thickness	Not permitted
Increase in thickness	Permitted except in the case of pipe closure devices where specific rules regarding the position of the seal within the separating element are outlined in the relevant section
Change of the flexible construction	Constructions not defined in EN 1366-3 shall be tested
Change of wall lining material	Permitted if the lining has an equal or greater thickness, reaction to fire class and the alternative flexible wall construction has an equivalent or greater fire resistance
Increase in wall lining thickness	Permitted
Decrease in wall lining thickness	Not permitted
Change in aperture framing (design, etc.)	Not permitted
Change in aperture framing material	Permitted provided reaction to fire class, thickness and mechanical strength are equal or greater than tested
Change of insulation material (density, thickness or type)	Not permitted

Table 4 – Penetrating services — Changes to service items — Metal pipes type 1

Variation	Rules
Change of type of pipe material	Permitted provided melting point is equal to or greater than that tested and thermal conductivity equal to or less than that tested
Change of pipe dimensions	Permitted between the diameters tested and wall thicknesses tested
Insulated pipes	Data relating to insulated pipes shall not be used to support assessments in respect of non-insulated pipes and vice versa.
Change of insulation material	For pipes with sustained insulation a change of insulation material is not permitted For pipes with interrupted insulation the insulation material may be changed within the same generic type, such as stone wool, glass wool, PVC etc. where the alternative provides an equal or superior reaction to fire classification
Change in thickness and/or density of insulation material to insulated pipes	Not permitted
Increase in length of applied insulation	Permitted
Decrease in length of applied insulation	Not permitted

Table 5 – Plastic pipes

Variation	Rules
Change of type of pipe material	Not permitted with the exception of PVC which is permitted based on tests on PE and PP of the same size (range) up to a maximum nominal pipe diameter of 160 mm
Change in pipe dimensions	Permitted within the diameter and wall thickness range tested provided the seal thickness and depth remains the same across the pipe dimension range. In the case of pipe closure devices this refers to the thickness and length of the intumescent component.

Annex B provides further information for extended application of test results of plastic pipes.

Table 6 – Cables – Single cables / bundles not tested to standard configuration

Variation	Rules
Increase in size	Single cables: permitted up to 25% Bundle diameter: permitted up to 10%
Decrease in size	Single cables or bundles — permitted subject to meeting ± 10 % of the tested conductor to cable CSA ratio (CSA = cross sectional area)
Increase in conductor cross sectional area (CSA)	Permitted — up to 10 %
Change of generic conductor material.	Not permitted
Change of type of insulation material.	Not permitted

Table 7 – Cable trunking

Variation	Rules
Decrease in size	Permitted subject to not exceeding the ratio of overall cross sectional area (CSA) of cable(s) to the internal CSA of the trunking used in the test
Inclusion of trunking	If cable trunking has not been included in tests, results from non-perforated lidded cable trays of same generic material and thickness may be used. The width and height of the trunking shall not exceed the maximum cable tray width and height. Where an internal seal was used within the cable tray it shall also be provided within the trunking. CSA of cable(s) may be up to 60% of the internal CSA of the trunking.

Table 8 – Conduits

Variation	Rules
	As pipes (steel or plastic as appropriate)

Table 9 – Bus bars

Variation	Rules
	No changes permitted

Table 10 – Number of services / increase in unsupported span

Variation	Rules
Reduction in services or increase in unsupported span	Permitted provided a seal with a service infill rate equivalent to that of the standard configuration and a blank seal of an at least equivalent size has been tested

Table 11 – Service support conditions

Variation	Rules
Change of the distance of support from the face of the seal	Distance of support from the face of the seal must not exceed that tested

5 Extended application report

5.1 Contents of the extended application report

The extended application report, prepared using this standard shall contain the following information:

a) The name and address of the issuing body;

b) The name and address of the sponsor;

c) The date of issue of the extended application report;

d) The unique reference number for the report;

e) Summary of the report(s) that the extended application is based upon;

f) The proposed extended field of application of the test results and the justification for that extension;

g) Reference to this document;

h) Classification of the modified construction in accordance with EN 13501-2;

i) The following statement:

“This extended application is issued on the basis of test data and information to hand at the time of issue. If contradictory evidence becomes available to the assessing authority the extended application will be unconditionally withdrawn and the applicant will be notified in writing.

Similarly, the extended application is invalidated if the assessed construction is subsequently tested since actual test data is deemed to take precedence over an expressed opinion. The extended application is valid

for a period defined in the classification report anticipated to be five years after which time it is recommended that it be submitted to the assessing authority for re-evaluation."

5.2 Review of the extended application report

If requested by the applicant, the assessor may review the extended application report with a view to extending the period of validity of the classification report for a further period (five years). The purpose of the review is to ensure that opinions incorporated are based on current information, the original test information is still valid and any reference data, etc., are consistent with the current methodology. Any review of an extended application shall be conducted in accordance with this standard.

Annex A
(normative)

Extended application principles for generic penetration seal types

A.1 Introduction

A.1.1 General

A general overview on the rules for various seal types are given in Table A.1. Rules specific to a particular type of seal are given in section A.2.

Table A.1 – Overview general rules

Seal type	Seal depth		Aperture			Position within the separating element	Orientation (wall / floor)
	Increase	Decrease	Increase in size	Decrease of size	Shape		Change of orientation
Bellows	Y	N	N	Y	see A.2.1	see A.2.1	(1)
Blocks / plugs	Y	N	AI	AD	S	P	N
Boards [a]	Y	N	AI [b]	AD [b]	S [b]	P	N
Foams	Y	N	AI	AD	S	P	N
Modular systems	Y	N	see A.2.5	see A.2.5	see A.2.5	P	N
Mortar	Y	N	AI	AD	S	P	F/W [c]
Pillows	Y	N	AI	AD	S	P	N
Pipe closure devices [d]	Y	N	N	Y	N	see A.2.7	(1)
Sealants / mastics / putties	see A.2.8	see A.2.8	AI	AD	N.R.	P	F/W

Y Permitted

N Not permitted

(1) Extension permitted from floor to wall up to and including a nominal pipe diameter of 75 mm subject to the rules given for supporting constructions given in this document and EN 1366-3.

AI Wall application: see A.1.2

Floor application: no further extension than the direct field of application given in EN 1366-3.

AD Permitted, provided the working clearances from the test are maintained and the CSA ratio of services to the seal size is not greater than 60%.

S Interpolation permitted between shapes used in the test provided the minimum working clearances are as tested and the maximum seal area is as tested or in compliance with the rules given in Table A.1.

P Change of position within the wall/floor permitted within the range of positions tested

F/W Floor seal generally more onerous than wall and may be used as supporting evidence for a wall mounted application. Test evidence from wall applications shall not be used to support floor applications.

N.R. Not relevant

[a] For example coated mineral wool slabs

[b] If changes in size or shape require board to board joints, the joints must have been proven by tests.

[c] Non-reinforced mortar seals only. Floor tests of reinforced mortar seals do not cover wall applications and vice versa.

[d] Only single penetrations; no combinations of the seals listed in the table.

A.1.2 Permissible size variations for wall applications

A.1.2.1 General

Seals of sizes different from those of tested specimens are permitted within certain limitations but the variations are dependent on the length of time that the performance criteria are fulfilled.

A.1.2.2 Test periods

The amount of variation of size permitted is dependent on whether the classification time was just reached (category 'A') or whether an extended duration (category 'B') in accordance with the values given in Table A.2 was fulfilled before the test was concluded.

Table A.2 – Extended test duration requirements for Category 'B'

Classification time (minutes)	All performance criteria fulfilled for at least (minutes)
15	18
20	24
30	36
45	52
60	68
90	100
120	132
180	196
240	260

A.1.2.3 Limits of permitted size variations

Table A.3 – Limits of permitted size variations

Category 'A' allowances	Category 'B' allowances
Unlimited size reduction is permitted subject to maximum permissible ratio of seal/service cross section area.	Unlimited size reduction is permitted subject to maximum permissible ratio seal/service cross sectional area. Size increase is permitted up to either: — 25% height or — 25% width or — 25% area

A.2 Specific rules

A.2.1 Bellows

Variation	Rules
Increase in length of bellows	Permitted
Decrease in length of bellows	Not permitted
Change of aperture shape e.g. square to round.	Permitted provided the aperture is not increased in any direction
Increase / decrease in outer diameter of bellows adjacent to separating element	Not permitted
Increase in size / number of fixings or mechanical restraint	Permitted
Reduction in size / number of fixings or mechanical restraint	Not permitted
Use of single sided bellows seals	Not permitted from double sided test.
Variation in exposure direction for single sided bellows seals	Not permitted

A.2.2 Blocks / plugs

Variation	Rules
Change in size of block / plug	Change of cross section permitted Change of block depth (seal depth) not permitted

A.2.3 Boards

Variation	Rules
Change of board material	Not permitted
Increase in board thickness	Permitted (supporting evidence for framing systems/fixings must be provided)
Decrease in board thickness	Not permitted
Change in nominal board density	Not permitted
Change of coating material	Not permitted
Change in coating thickness	Not permitted
Change of perimeter / joint adhesive(s) / sealants or gap fillers	Not permitted
Change of air gap between boards	Permitted between the size of air gaps demonstrated by test
Change of internal support frames for boards	Not permitted

A.2.4 Foams

Variation	Rules
Change of formwork	Not permitted if it forms part of the system

A.2.5 Modular systems

Variation	Rules
Increase in number of frame openings in aperture	Permitted provided the system tested contained at least three frame openings. Maximum width eight openings, maximum height three openings.
Increase in individual frame opening size.	Not permitted
Decrease in individual frame opening size.	Permitted
Change of frame opening shape, e.g. round to square.	Not permitted

A.2.6 Pillows

Variation	Rules
Change in size of pillow	Permitted within size range tested
Change of infill material	Not permitted
Change of bag/pillow outer material	Not permitted

A.2.7 Pipe closure devices

Variation	Rules
Change of position within thickness of separating element	Test results from surface mounted pipe collars may not be used to cover fully recessed/cast-in applications May be used to cover partly recessed
	Distance of cast in collars, wraps or sleeves from the exposed face shall not be increased.
Use of single sided bellows seals	Not permitted from double sided test.
Variation in exposure direction for single sided bellows seals	Not permitted
Increase in size / number of fixings or mechanical restraint	Permitted
Reduction in size / number of fixings or mechanical restraint	Not permitted

A.2.8 Sealants/mastics/putties

Variation	Rules
Increase in sealant (depth)	Permitted provided the depth of the backing material is not decreased (Class A1/A2 backing material)
Decrease in sealant (depth)	Not permitted
Increase in backing material depth	Permitted for Class A1 and A2 materials
Decrease in backing material depth	Not permitted
Change of backing material	Polyethylene may be replaced by man made mineral wool; i.e. glass wool, stone wool or ceramic wool (including ceramic alternatives)
	Glass wool may be replaced by stone wool or ceramic wool (including ceramic alternatives)
	Stone wool may be replaced by ceramic wool (including ceramic alternatives)

Annex B
(informative)

Additional information relating to the extended application of test results on plastic pipes

At present there is little available comparative data regarding the performance of the different generic plastics under the standardised EN test conditions. Some National data does exist, although there is no comparison of its compatibility with the EN test conditions. As such the interpolation of material types will be limited, based on available data relating to performance of the generic polymer types. Data relating to the characteristic properties of plastic pipes has been collected from several sources [1], [2] and compiled into Table B.1 below.

Table B.1 – Characteristic properties of plastic pipes

Plastic Type	Nominal density g/cm³	Vicat softening point °C	Melting point °C	Flash ignition temperature °C	Decomposition temperature range °C	Heat of combustion kJ/kg
PE - LD	0.91 – 0.92	84 - 128	104 - 113	340	340 - 440	46 500
PE - HD	0.94 – 0.96	108 - 129	124 - 131	340	340 - 440	46 500
CPVC	1.47 – 1.52	106 - 115	does not melt	390	200 - 300	20 000
PP	0.90 – 0.91	130 - 152	134 - 165	350 - 370	300 - 410	46 000
ABS	1.02 – 1.07	80 - 106	108 – 131[a]	390	-	36 000

PE-LD Low density Polyethylene

PE-HD High density Polyethylene

CPVC Chlorinated Polyvinylchloride

PP Polypropylene

ABS Acrylonitrilebutadienestyrene

[a] This is the glass temperature, not a true melting temperature

The most commonly used plastic for building services is PVC. This is due to its method of degradation; it chars rather than melts, and so is generally more resistant to ignition at comparable temperatures than its counterparts, which can liquefy. It also has a lower heat of combustion, producing a lower fuel input when ignited, than comparative plastics.

From the data above it is clear that the lower softening point of CPVC falls between that of PE-LD and PP, and although having a decomposition temperature range, it will not melt, unlike PE and PP. From this it is considered that results from tests conducted on pipe closures with both PE and PP pipes can also be used to cover CPVC pipes within the same range of diameters and wall thickness.

It is also considered that results from tests conducted on both low or medium density PE and PP pipes can be used to cover both PE-HD and CPVC pipes within the same range of diameters and wall thickness.

Available data for ABS indicates that although it softens slightly earlier than PE-LD, it has a higher flash ignition temperature and lower heat output when ignited. It is therefore considered that it may not be used as a point of reference in place of PE-LD, but must be tested separately.

Other single polymer plastics and composite plastics/metal pipes are also, due to the limited information available, excluded from interpolation and must be considered separately for testing purposes.

Bibliography

[1] J. Troitzsch; International Plastics Flammability Handbook, 2nd Edition 1990; Hanser

[2] Plastic manufacturers data sheets, e.g. Matweb Material Property Data

[3] IEC 60439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*

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