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Fire resistance tests for service installations - Part 4: Linear joint seals

Feuerwiderstandsprüfungen für Installationen - Teil 4: Abdichtungssysteme für Bauteilfugen

Essais de résistance au feu des installations techniques - Partie 4 : Calfeutremments de joints linéaires

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Fire resistance tests for service installations - Part 4: Linear joint seals

Essais de résistance au feu des installations techniques
- Partie 4 : Calfeutrements de joints linéaires

Feuerwiderstandsprüfungen für Installationen - Teil 4:
Abdichtungssysteme für Bauteilfugen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 127.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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prEN 1366-4:2019 (E)**European foreword**

This European Standard (prEN 1366-4:2019) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This document will supersede EN 1366-4:2006+A1:2010.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 1366 ‘Fire resistance tests for service installations’ consists of the following Parts:

- Part 1: Ventilation ducts
- Part 2: Fire dampers
- Part 3: Penetration seals
- Part 4: Linear joint seals
- Part 5: Service ducts and shafts
- Part 6: Raised access and hollow core floors
- Part 7: Conveyor systems and their closures
- Part 8: Smoke extraction ducts
- Part 9: Single compartment smoke extraction ducts
- Part 10: Smoke control dampers
- Part 11: Fire protective systems for cable systems and associated components
- Part 12: Non-mechanical fire barrier for ventilation ductwork
- Part 13: Chimneys

Introduction

Linear joint seals are positioned in joints, voids, gaps or other discontinuities within one or between two or more construction elements.

Normally such openings are denoted as linear because their length is greater than their width - defined by a typical ratio of at least 10:1 in practice.

Joints are present in buildings due to the following:

- a) acceptable dimensional tolerances between two or more building elements, e.g. between non-load bearing walls and floors;
- b) by design to accommodate various movements induced by thermal differentials, seismicity and movement induced by wind loads;
- c) as a result of inadequate design, inaccurate assembly, repairs or damage to the building.

The purpose of the tests in this European Standard is to assess:

- d) the effect of a linear joint seal on the integrity and insulation of the construction;
- e) the integrity and insulation performance of the linear joint seal;
- f) the effect of movement within the supporting construction on the fire performance of linear joint seals (see Annex B).

The results of these tests are one factor in assessing the fire performance of joint seals.

Annex A describes the principles of standard conditions for linear joint seals where no mechanically induced relative movement occurs between the joint faces.

Annex B provides standard conditions for joints with mechanically induced movement of opposing joint faces

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

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

prEN 1366-4:2019 (E)**1 Scope**

This document specifies a method for determining the fire resistance of linear joint seals based on their intended end use. This document is used in conjunction with EN 1363-1.

The following tests are included in this document:

- no mechanically induced movement;
- mechanically induced movement.

This document does not provide quantitative information on the rate of leakage of smoke and/or hot gases, or on the transmission or generation of fumes.

The load-bearing capacity of a linear joint seal is not addressed in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

EN 1994-1-1, *Eurocode 4: Design of composite steel and concrete structures — Part 1-1: General rules and rules for buildings*

EN 1994-1-2, *Eurocode 4 — Design of composite steel and concrete structures — Part 1-2: General rules - Structural fire design*

EN 10143, *Continuously hot-dip coated steel sheet and strip — Tolerances on dimensions and shape*

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

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

EN 13381-3, *Test methods for determining the contribution to the fire resistance of structural members — Part 3: Applied protection to concrete members*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1 and EN ISO 13943 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>

— ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

linear joint

linear void having a length to width ratio of at least 10:1 within one or between two or more juxtaposed construction elements

Note 1 to entry: Typical locations of linear joints include floors, the perimeter of floors, walls, ceilings and roofs.

3.2

linear joint seal

system designed to maintain the fire separating function and, if relevant, to accommodate a specified degree of movement within the linear joint

3.3

movement capability

maximum amount of movement the joint seal is able to tolerate as stated by the manufacturer or the test sponsor, expressed as a percentage of the nominal width,

Δ elongation (%) + Δ compression (%) = overall movement capability (%)

Note 1 to entry: The movement capability is usually the same over the entire range of the nominal widths. Δ elongation and Δ compression are considered to be identical.

3.4

nominal joint width

specified width of a joint seal, to be selected by the manufacturer or test sponsor

3.5

splice

connection or junction between or within the length of a linear joint seal

3.6

supporting construction

construction that may be required for the testing of some separating elements into which the test specimen is assembled, e.g. the wall into which a linear joint seal is fitted

3.7

test construction

complete assembly of the test specimen(s) together with its supporting construction

3.8

test specimen

linear joint seal of a specific material, design and dimensions provided for the purpose of determining either its fire resistance or its contribution to the fire resistance of another separating element

4 Test equipment

In addition to the test equipment specified in EN 1363-1, and if applicable EN 1363-2, the internal dimensions of the test furnace shall be such that a distance of at least 200 mm exists between the long edge of a linear joint and the wall of the furnace, subject to a minimum internal size of 1 m × 1 m × 0,75 m. Where the nominal width of the linear joint seal is greater than 300 mm, the internal size of the furnace shall be at least 3 m × 3 m × 0,75 m (see 6.2). Where the nominal width of

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the linear joint seal in the test specimen is greater than 100 mm and less than or equal to 300 mm, the size of the furnace shall at least be able to heat a length of 10 times the nominal width of the linear joint.

5 Test conditions**5.1 Heating conditions**

The heating and furnace atmosphere shall conform to those given in EN 1363-1 or, if applicable, EN 1363-2.

5.2 Pressure conditions

A vertical furnace shall be operated so that a minimum pressure of 15 Pa exists in the centre of the test specimen mounted in the lowest position.

A horizontal furnace shall be operated so that a pressure of (20 ± 3) Pa is established at a position (100 ± 10) mm below the lowest point of the test construction.

6 Test specimen**6.1 General**

The test specimen consists of a linear joint seal. One test specimen shall be prepared for each type of supporting construction and type of movement, if relevant, for which the sponsor seeks classification (see Annexes A and B).

6.2 Size

A linear joint seal shall be of uniform design cross-sectional area and of the maximum length that can be accommodated in the separating element selected for test. For non-movement joints a shorter length may be used subject to a minimum of 900 mm. In order to avoid boundary effects, the distance between the long edge of the linear joint seal and the outer perimeter of the heated part of the separating element shall be not less than 200 mm at any point.

A typical minimum length to width ratio for a linear joint seal is 10:1. In order to maintain this ratio a test furnace of appropriate dimensions shall be used.

6.3 Number of test specimens

In the case of vertical elements two tests shall be carried out, one from each direction of exposure. If in practice the fire risk can be identified as coming from one side only, or where the linear joint seal is fully symmetrical, then only one specimen may be tested with the appropriate face exposed to the heating regime.

Where it can be established clearly in a non-symmetrical construction that there is a weaker direction of exposure only one specimen may be tested. In such a case, a full justification for the procedure adopted shall be included in the report.

In the case of horizontal elements the test specimen shall be exposed to heating from the underside.

Where a linear joint seal is intended for use in both horizontal and vertical separating elements, each orientation shall be tested.

7 Installation of test specimen

7.1 General

All materials used in the construction, fabrication and installation process of the test specimen shall be representative of the design, materials and workmanship of those to be used in practice.

Where voids exist within a linear joint seal (e.g. when it is in the form of a tube), the ends shall be hermetically sealed in order to prevent airflow through the test specimen.

The standard conditions are given in Annexes A and B.

7.2 Supporting construction

7.2.1 General

The supporting construction shall be of known fire resistance and representative of that used in practice. The supporting construction for test purposes shall be as shown in Figures 26, 27 and 28. The supporting construction may be either one of the standard constructions listed in 7.2.2 or a specific construction. In the latter case, however, the field of direct application is limited (see 13.2). The thickness of the supporting construction shall be chosen by the test sponsor.

7.2.2 Standard supporting construction

7.2.2.1 Wall constructions

7.2.2.1.1 Rigid wall constructions

Density: (650 ± 200) kg/m³ Material: Autoclaved aerated concrete

or $(2\ 400 \pm 200)$ kg/m³ Material: Normal density concrete

7.2.2.1.2 Flexible wall constructions

The standard supporting construction shall be in accordance with the provisions given in EN 1363-1, subject to the following:

- the size of the flexible wall shall be minimum 2,4 m in height and minimum 1,20 m in width. The flexible wall shall contain minimum 1 vertical joint between the boards;
- the wall shall be restrained only on the top and bottom edge;
- the overall thickness and number of the gypsum board(s) shall be as given in Table 2;
- a construction including insulation shall be used. The insulation material shall be mineral wool with a classification of A1 or A2 according to EN 13501-1. For thickness and density of the insulation see Table 2. The thickness shall be such that the remaining gap between the board and the insulation is maximum 15 mm;
- steel studs of varying widths may be used to fit the flexible wall constructions defined in Table 2.

Table 2 — Standard flexible wall constructions

Intended fire resistance	Steel stud depth [mm]	Gypsum board type F according to EN 520		Insulation: Mineral wool		Overall wall thickness [mm]
		Number of layers at each side	Thickness of boards [mm]	Thickness [mm]	Density [kg/m ³]	
EI 30	44 - 55	1	12,5	40 - 50	30 - 60	69 - 80
EI 60	44 - 55	2	12,5	40 - 50	30 - 60	94 - 105
EI 90 or EI 120	44 - 55	2	12,5	40 - 50	85 - 115	94 - 105
EI 120	62 - 70	2	15	60 - 70	85 - 115	122 - 130

7.2.2.2 Floor constructions

7.2.2.2.1 Rigid floor constructions

Density: (650 ± 200) kg/m³ Material: Autoclaved aerated concrete

or (2 400 ± 200) kg/m³ Material: Normal density concrete

7.2.2.2.2 Concrete slabs with profiled steel sheets

The standard supporting construction shall be in accordance with the provisions given in EN 1363-1, EN 1994-1-1 and EN 1994-1-2, subject to the following:

- steel sheet according to EN 10143, Gauge range 0,7 mm to 1,25 mm (nominal thickness);
- Normal density concrete, density (2 400 ± 200) kg/m³.

7.2.2.3 Timber elements

Timber used for test constructions shall have a nominal density of (500 ± 50) kg/m³ as measured at 12 % moisture content.

7.2.2.4 Steel elements

Any steel joint face may be simulated by the following test construction. The face of a concrete supporting construction is covered by 10 mm mineral fibre insulation of a density of at least 35 kg/m³ and by an 8 mm thick steel angle. The side of the test construction where the steel angle is visible shall be at the non-exposed side of the test construction.

7.3 Test construction

For the purpose of tests, joints may be formed in monolithic slabs or by adjacent discrete members (see Figures 26 and 27).

The linear joint seal shall be installed in accordance with the manufacturer's instructions. The linear joint seal shall have a minimum heated length of 900 mm. The installation procedures shall be described in the test report.

A test construction may incorporate several discrete linear joint seals, evaluating the performance of different systems or the effect of different joint face substrates (see Figures 28 and 29) provided that the following conditions are met:

- a) The minimum distance on the exposed side between adjacent seals shall be not less than the thickness of the supporting construction, but not less than 200 mm. On the unexposed side the minimum distance between adjacent seals shall not be less than 200 mm (see Figure 30). Where a monolithic slab is used for non-movement joints the minimum distance between all edges of the joint and the edge of the supporting construction shall be minimum 200 mm.
- b) The test construction can either be inserted in the furnace opening or put onto the furnace walls. The minimum width of the supporting elements adjacent to the edges of the furnace opening shall be such that a distance of at least 200 mm exists between the longitudinal edge of the linear joint seal and the interior furnace face (see Figure 30).

The minimum distance between a joint edge and an adjacent blackout edge shall be at least 200 mm (see Figure 30).

In flexible wall constructions horizontal joint seals shall be tested only in Top of Wall configurations. Vertical joint seals in flexible walls shall be tested at the edges of a flexible wall. Horizontal linear joint seals in a flexible wall construction shall have a minimum heated length of 900 mm. Vertical joints shall have a minimum heated length of 2 400 mm.

7.4 Splice locations

Where splices (see 3.5) or consecutive lengths of pre-formed components require to be jointed in practice, a typical joint shall be included in a location with a minimum furnace pressure of 15 Pa. If two methods of joining consecutive lengths of component(s) are to be incorporated in the same specimen of linear joint seal, then each method shall be separated by at least 200 mm and shall be subject to a minimum furnace pressure of 15 Pa. [SIST EN 1366-4:2021](https://standards.iteh.ai/catalog/standards/sist/d198d7b5-9823-413b-934c-7edae200e722/sist-en-1366-4-2021)

7.5 Induced movement

The various possibilities to impose mechanically induced movement, including standard conditions, are described in Annex B.

8 Conditioning

The test construction shall be conditioned in accordance with EN 1363-1.

9 Application of instrumentation

9.1 General

The control, monitoring and recording equipment shall be in accordance with EN 1363-1.

9.2 Thermocouples

9.2.1 Furnace thermocouples

Plate thermometers shall be provided in accordance with EN 1363-1. The plate thermometer shall be located in a plane 100 mm from the exposed face of the separating element. At least one thermometer shall be provided for every 1,5 m² of the heated area of the test construction, subject to a minimum

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number of four thermometers for each test construction. These thermometers shall be symmetrically distributed with respect to the heated area of the test construction.

For vertical test constructions, the plate thermometers shall be oriented so that side 'A' faces the walls of the furnace opposite the test construction being evaluated.

For horizontally oriented test constructions, side 'A' of the plate thermometers positioned below the test construction being evaluated shall face the floor of the furnace.

9.2.2 Unexposed face thermocouples

Surface temperature measurements and the thermocouples shall be in accordance with EN 1363-1. The test specimen thermocouples shall be at the centre line of the linear joint seal. Figures 1 to 10 show examples of thermocouple application.

In the case any additional component (protection, insulation, or coating) as part of the linear joint seal is applied to the supporting construction at head of wall joints on the surface of the supporting construction (e.g. concrete slab with metal sheet), a thermocouple at a distance of 25mm after the edge of component shall be installed.

If a potential weak point can be identified, additional fixed thermocouples shall be attached to this point, e.g. over a splice.

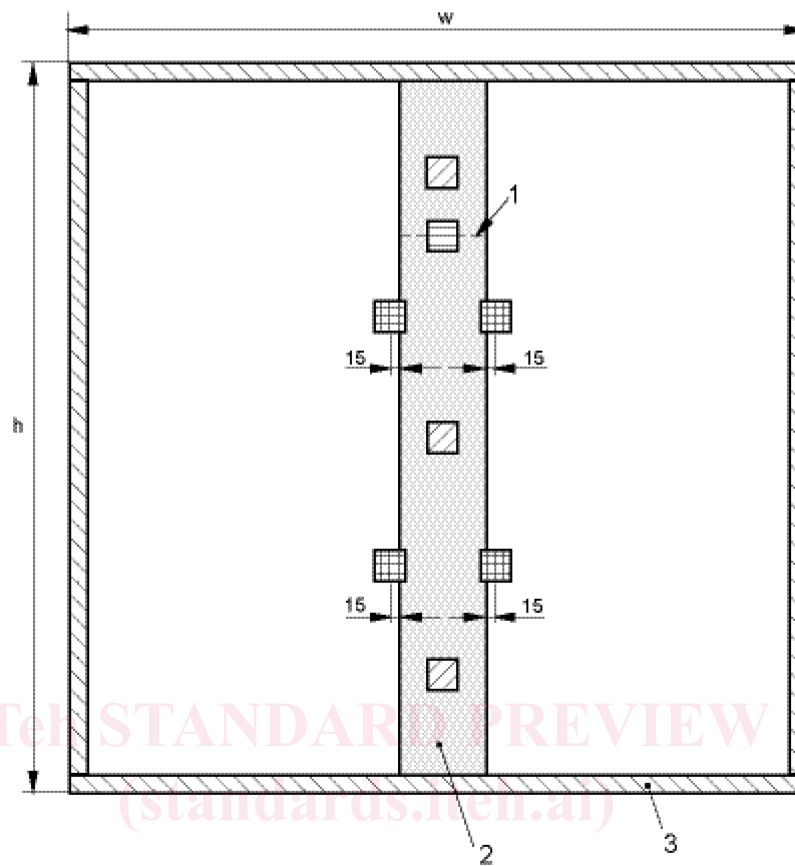
Where it is impractical to attach thermocouples because of the nature of the surface of the linear joint seal (which may change significantly during the test period), careful use may be made of a roving thermocouple.

In the case of non-planar surfaces the disc and the pad shall be deformed to follow the surface profile. In the case of small sections it is permissible to reduce the size of the pad to a minimum dimension of 12 mm. If a linear joint seal is recessed from the unexposed face of the supporting construction and the linear joint seal is less than 12 mm wide, thermocouples according to EN 13381-3 shall be used. See Figure 10.

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Dimensions in millimetres

**Key**

splice thermocouple



test specimen thermocouple



junction thermocouple

1 splice

2 joint seal

3 furnace frame

h height of the test construction

w width of the test construction

Figure 1 — Typical thermocouple layout (full scale vertical furnace, single test specimen)