EUROPEAN ASSESSMENT DOCUMENT

EAD 350141-00-1106

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FIRE STOPPING AND FIRE SEALING PRODUCTS

LINEAR JOINT AND GAP SEALS

This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Content

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD deals with linear joint and gap seals (called "seals" in this document). It includes perimeter joints for curtain wall facades. Glazing seals and door seals are not covered by this EAD.

☒ The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

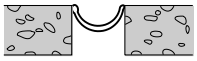
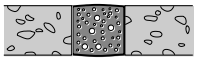
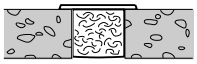
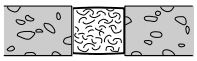
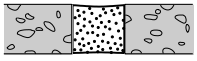
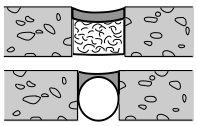
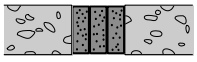
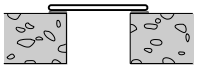
It is assumed that the product will be installed according to the manufacturer's instructions.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

The performance of the product regarding to the Basic Work Requirements (BRW) shall be described in the ETA with all details for the field of application.

The following table 1 (non-exhaustive) shows products that may be used individually or in combination with other components to form a linear joint or gap seal.

Table 1 examples for specific types of linear joint seal application

Product	**Type of fixing**[2]	**Illustration of the final sealing system (side elevation)**
Fabrics	AF, MF	
Foams (foamed in-situ type materials, e.g. PUR, silicone, dispensed from a cartridge or can)	SA	
Membrane-forming coatings (normally used together with a backing material)	SA	
Mineral wool (faced/coated or non-faced/coated)	AF*, FF*, MF ***	
Mortar (cement or gypsum based) [3]	SA, (MF)	
Sealants (e.g. acrylics, silicone, oil-based products (mastic), foamed in-situ; normally used together with a backing material)	SA	
Strips, compressible (including composite)	AF **, FF **, MF ***	
Strips, elastomeric	AF, MF	

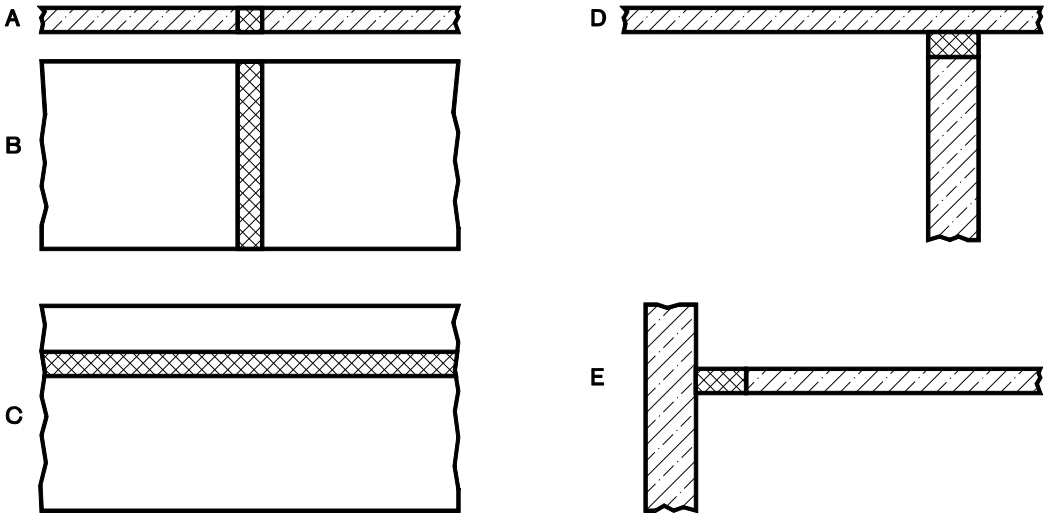
* e.g. mineral wool covered by fabric, mineral wool strips, edged with Al-foil
** e.g. foam strips (laminated, impregnated or composite)
*** e.g. by means of hangers or trays

[2] AF = adhesion fixed, FF = friction fixed, MF = mechanically fixed, SA = self-adherent

[3] This document covers products that require only the addition of water

Linear joint or gap seals often consist of several components (e.g. sealant and mineral wool). The assessment shall cover the whole assembly. Where the seal is sold as a kit, the components shall be specified in the ETA. If the product is not sold as a kit, it is the responsibility of the installer to obtain all components for incorporation into the assembled system as described in the ETA.

However, any component not included in a kit and hence not covered by the ETA, is not covered by the AVCP procedure of the ETA.

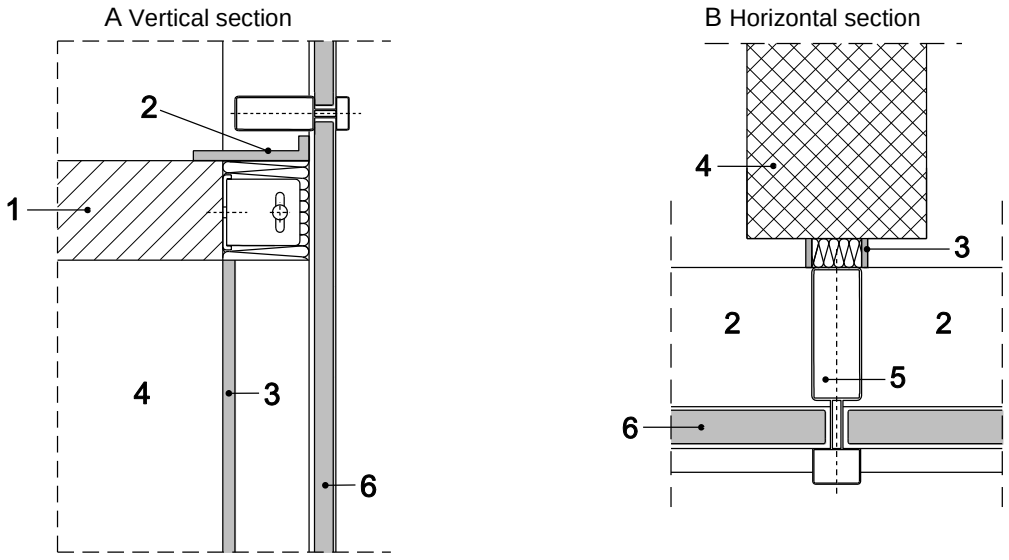


Key

Joint seal
Wall – front view
Wall or floor – section

A Joint seal in a floor
B Vertical joint seal in a wall
C Horizontal joint seal in a wall
D Horizontal wall joint abutting a floor, ceiling or roof
E Horizontal floor joint abutting a wall

Figure 1 – Possible orientations of linear joint seals



Key

1	Supporting floor	4	Wall abutting the curtain walling
2	Horizontal linear joint seal / perimeter seal	5	Mullion
3	Vertical joint seal	6	Spandrel area (upstand / downstand / combination)

Figure 2 – Linear joint seals abutting curtain walling

Joints between infills of facades are not covered by this EAD.

This EAD is not to be used to produce ETA for components that do not contribute to the fire resistance of the assembled system, e.g. PE foam backer rods.

It is important to consider linear joint seals in relation to the orientation of the joint/gap in which they are used (see Figure 1), as this can have a bearing on their adequacy.

1.2 Information on the intended use of the construction product

1.2.1 Intended use

The seals are intended to prevent or to restrict the passage of fire (and/or hot smoke) between elements or components or to maintain the integrity and insulation performance of one or more fire separating elements at linear discontinuities for a specified duration and are designed either to accommodate movement (hereafter designated as "movement joints") or not to accommodate movement (hereafter designated as "non-movement joints").

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the linear joint or gap seal for the intended use of 10 years or 25 years when installed in the works, provided that the product is subject to appropriate installation and use conditions. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[4].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD in addition to the definitions in CPR, Art 2

For the purpose of this document,

- the term "product" is used regardless of whether the linear joint seal or gap seal is offered as a kit or an individual component forming part of an assembled system in the works.
- the terms "linear joint seal" and "joint" are used regardless of whether the seal is designed to be used as a joint seal or a gap seal.

Linear joint seal
System designed to maintain the fire separating function of a joint within one or between two or more juxtaposed fire resisting elements, and if relevant, to accommodate a specified degree of movement within the linear joint.

Movement joint
Is a linear discontinuity between elements of construction or within the elements themselves, in order to accommodate relative movement of these elements. Examples of such relative movements may be accommodation of load deflection, thermal movement or settlement/subsidence or the joint may have a seismic function.

NOTE 1: *A movement capability of ≥ 7,5%[5] of the seal is considered to be necessary for a movement joint.*

4 The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works.

5 7,5% is the lowest class allowed for movement capability in ISO 11600

Non-movement joint

Non-movement joints (or gaps) do not allow for relative movement between elements.

Movement capability

Maximum amount of movement the joint seal is able to tolerate expressed as a percentage of the nominal width.

Strip

A pre-fabricated seal normally inserted into the gap and held in place by friction or by means of an adhesive.

Cover strip

A product normally made of plastic or metal designed to protect the joint seal from contamination and damage and/or for aesthetic purposes.

Joint depth

The overall distance between the exposed and unexposed faces across the thickness of the separating element – see Figure 3.

Seal depth

The shortest distance between the exposed and unexposed surfaces of the seal – see Figure 3.

Joint width

The distance between two adjacent faces – see Figure 3.

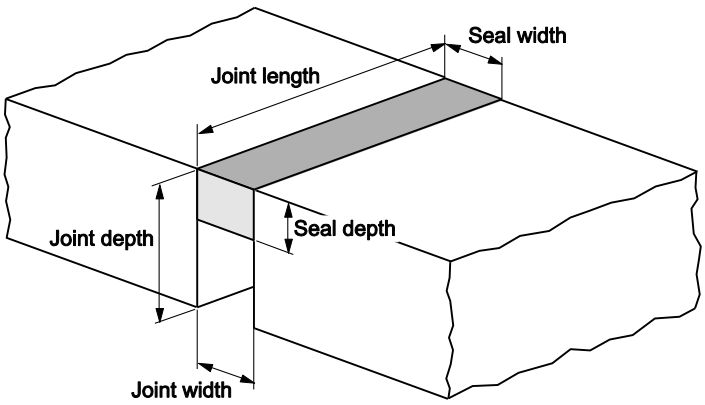


Figure 3 – Definition of seal depth, joint depth and joint width

Overall seal width

The overall width of the seal includes any fixings or overlap. This may differ from the joint width.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2 shows how the performance of linear joint seals is assessed in relation to the essential characteristics.

Table 2 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire[6]	Clause 2.2.1	Class (A1 to F)
2	Resistance to fire	Clause 2.2.2	Class
Basic Works Requirement 3: Hygiene, health and the environment			
3	Content, emission and/or release of dangerous substances	Clause 2.2.3	description
4	Air permeability (material property)	Clause 2.2.4	description
5	Water permeability (material property)	Clause 2.2.5	description
Basic Works Requirement 4: Safety and accessibility in use			
6	Mechanical resistance and stability	Clause 2.2.6	description
7	Resistance to impact/movement	Clause 2.2.7	description
8	Adhesion	Clause 2.2.8	description
9	Durability	Clause 2.2.12	description/type
10	Movement capability	Clause 2.2.13	description
11	Cycling of perimeter seals for curtain walls	Clause 2.2.14	description
12	Compression set	Clause 2.2.15	description
13	Linear expansion on setting	Clause 2.2.16	description

[6] In this text "classified according to EN 13501-1" means classification according to EN 13501-1, or classification A1 according to Decision 96/603/EEC as amended or according to a relevant CWFT Decision as stated in the FOREWORD of EN 13501-1:2007

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 5: Protection against noise			
14	Airborne sound insulation	Clause 2.2.9	description
Basic Works Requirement 6: Energy economy and heat retention			
15	Thermal properties	Clause 2.2.10	description
16	Water vapour permeability **	Clause 2.2.11	description

The linear joint and gap seals may be used in various environmental conditions, related to the type of environmental conditions:

Type X: intended for use in conditions exposed to weathering.

Type Y_1: intended for use at temperatures below 0 °C with casual exposure to UV but no exposure to rain.

Type Y_2: intended for use at temperatures below 0 °C, but with no exposure to rain or UV radiation.

Type Z_1: intended for use in internal conditions with humidity equal to or higher than 85 % RH, excluding temperatures below 0 °C (no exposure to frost or changing frost-thaw but permanent or alternating condensation)

Type Z_2: intended for uses in internal conditions with humidity lower than 85 % RH excluding temperatures below 0 °C.

Products that meet requirements for type X, meet the requirements for all other types. Products that meet requirements for types Y_1 also meet the requirements for type Y_2, Z_1 and Z_2. Products that meet requirements for types Y_2 also meet the requirements for type Z_1 and Z_2. Products that meet the requirements for type Z_1, also meet the requirements for type Z_2.

It should be recognised, however, that although it is acceptable for a linear joint seal to be intended for indoor applications only, the product may be subjected to more exposed conditions for a period during the construction process before the building envelope is closed. In this case the following shall be considered:

1. Special provisions to protect temporarily the exposed linear joint seals according to the instructions of the manufacturer which are referenced in the ETA.
2. Evaluation and assessment of the linear joint seal as if it were to be intended for exposed applications (type X)

or

3. For established products only, evaluation of the product for type Y or type Z applications (as appropriate) and acceptance by the Assessment Body of the possibility of short term exposure based on long term experience and evidence of such exposure, provided that

— this long term experience is well documented, and

— the product subject to the technical assessment procedure is the same as the product for which the performance is established by this long term experience.

This EAD does not define specific test methods for the resistance to conditions other than those listed above. So it may be necessary to assess the product's resistance to specific environmental conditions case by case. The Assessment Body shall obtain suitable evidence for the assessment and present details in the ETA.

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

Characterisation of products to be assessed shall be done in accordance with available specifications, notably with the basic material properties especially those, which are essential for the fire sealing and fire stopping function and relating to the declared performance.

2.2.1 Reaction to fire

Case 1: Normal case

The linear joint seal shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to EN 13501-1.

Where the test regime for a certain class requires a test according to EN 13823 (SBI) the mounting and fixing procedure described in Annex A.1 shall be used.

Further details for tests according to EN ISO 11925-2 are given in Annex A.2.

Case 2: Products satisfying the requirements for the fire reaction class A1, without the need for testing

The linear joint seal is considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that Decision.

The product shall be classified according to EN 13501-1.

NOTE 2: *A European reference fire scenario has not been laid down for façades. In some Member States, the classification of the linear joint seal according to EN 13501-1 might not be sufficient for the use in façades. An additional assessment of the linear joint seal according to national provisions (e.g. on the basis of a large scale test) might be necessary to demonstrate the compliance with Member State regulations or administrative provisions.*

2.2.2 Resistance to fire

General

The part of the works or assembled system in which the linear joint seal is intended to be incorporated, installed or applied shall be tested, using the test method relevant for the corresponding fire resistance class, in order to be classified according to EN 13501-2.

Tests shall be conducted in accordance with EN 1364-4 in the case of perimeter seals for curtain walling, in accordance with EN 1364-3 in the case for vertical linear joints abutting curtain walling or EN 1366-4 for all other linear joint seals together with the following provisions of this Guideline to allow a classification according to EN 13501-2.

The test configuration shall be determined based on the desired application, taking account of the standard configurations and the rules given in EN 1366-4 or EN 1364-4 or EN 1364-3 and this EAD. For tests in accordance with EN 1366-4, standard test orientations A, B and C are shown in Figure 1 of this EAD.

The largest and the smallest intended width of a linear joint sealing system shall be tested. The TAB shall check, whether the smallest intended seal width can be filled in the intended seal depth.

It is normally not permissible to derive intermediate width/depth combinations between those tested. However, where sufficient data are available to allow sensible analysis, this approach may be considered.

2.2.2.1 Test configuration regarding seal width and depth

- **Fabrics**

For seals made of either various thicknesses or several layers of one thickness of fabric the following shall apply:

The maximum nominal joint width shall be tested with the relating intended number of layers in the seal and with the minimum material thickness for the intended fire resistance performance.

- **Foams – foamed in-situ and compressible strips (including composite)**

To achieve a field of application that covers the available joint width / seal depth combinations for the required fire resistance performance, the following shall be applied for defining the necessary tests:

Test results for a particular seal depth and nominal joint width cover narrower nominal joint widths or greater seal depths, provided the smallest intended seal width can be filled in the intended seal depth.

NOTE 3: *Normally the thickness of the supporting construction will limit the seal depth. For certain seal types the seal depth may be limited mechanically e.g. by its own mass.*

- **Membrane forming coatings**

The test shall be carried out using the minimum thickness (minimum of tolerance band for the nominal thickness) of the membrane, minimum depth of mineral wool (or other backfilling material), maximum width and minimum overlap at the substrate for the intended fire resistance performance. This fire resistance performance will apply for all thicknesses within the tolerance band for the membrane, thicker mineral wool (or other backfilling material), smaller width and higher overlap. When a primer is part of the system, it shall be included in the test. Each primer shall be tested separately.

- **Mineral wool (faced/coated or non-faced/coated)**

The compression characteristics through a slab of mineral wool will vary depending on which axis the compression is applied. As a result, the field of application for a mineral wool joint seal will depend on its orientation within the joint. Similarly, this can also be dependent on the fibre orientation introduced during production and the way it was cut from its original slab.

Figure 4 depicts a slab of mineral wool, with the three potential directions of applying the required compression to produce an effective fire-stopping seal:

- A⇔A – through the slab thickness, as produced
- B⇔B – along the slab length
- C⇔C – across the slab width

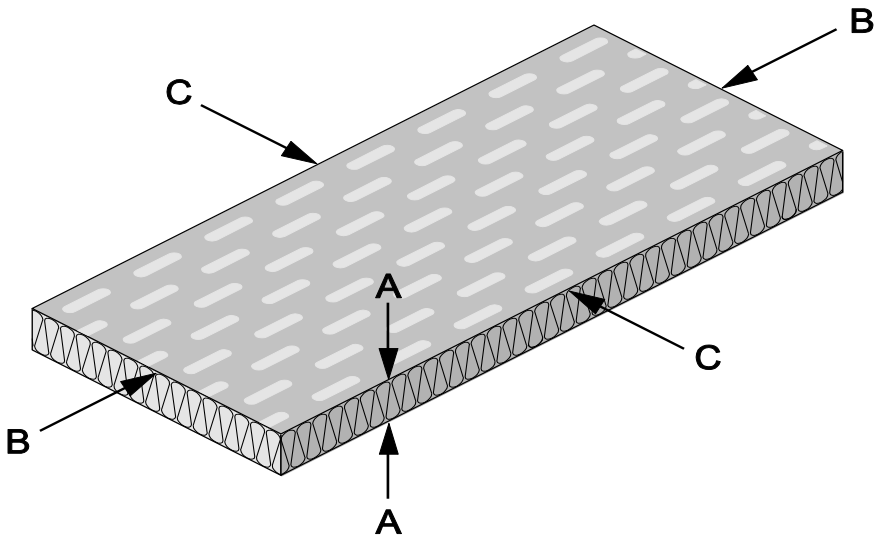


Figure 4 – Mineral wool – Compression directions

When a seal with a constant depth but variable joint width is considered, it shall be subjected to a fire resistance test at the maximum nominal joint width, provided the smallest intended seal width can be filled in the intended seal depth. The degree of initial compression (%) exerted on the seal by the joint width shall be recorded.

For a seal compressed in the A⇔A direction, such a test covers smaller joint width, provided the degree of compression (%) exerted on the seal is equal to or greater than that used in the test.

For a seal compressed in the B⇔B or C⇔C directions, such a test covers smaller joint width and/or higher compression, provided that the compression applied is not sufficient to induce a mechanical failure of the seal e.g. a de-lamination fracture of the mineral wool or coating.

- **Sealants**

These products are normally used in combination with a backing material. The seal depth is the sum of the thicknesses of the sealant and the backing material.

To achieve a field of application that covers the available joint width / seal depth combinations for the required fire resistance performance, the following rules shall be applied for defining the necessary tests:

NOTE 4: *Normally the thickness of the supporting construction will limit the seal depth. For sealants the thickness may be limited by mechanical stability.*

Where only one seal depth, with a specified combination of sealant to backing material thickness, is specified for all joint widths a single test may be sufficient provided the smallest intended seal width can be filled in the intended seal depth. If the thickness of the sealant or the backing material varies with the joint width a test shall be conducted at the maximum and minimum nominal joint width for each related seal depth specified by the manufacturer.

It is normally not permissible to derive intermediate width/depth combinations between those tested. However, where sufficient data are available to allow sensible analysis, this approach may be considered.

- **Mortar/plaster**

A single test at maximum nominal joint width and the corresponding minimum seal depth may be sufficient, provided the smallest intended seal width can be filled in the intended seal depth.

- **Strips, elastomeric**

Test at the minimum thickness (minimum of tolerance band for the nominal thickness) of the strip, maximum joint width and minimum overlap at the substrate. Extrapolation is permissible to thicknesses within the tolerance band for the strip, smaller widths of the joint and higher overlap.

When a primer is part of the system it shall be included in the test. Each primer shall be tested separately.

2.2.2.2 Test conditions regarding movement

- Tests according to EN 1366-4

Where a movement capability of ≥ 7,5% is claimed the seals shall be tested with a superimposed displacement.

The test conditions are:

a) Maximum width (nominal joint width + lateral elongation corresponding to 100% of the movement capability, see Figure D.1 in Annex D)

or

b) Maximum width (nominal joint width + shear corresponding to 100% of the movement capability, see Figure D.2 in Annex D)

For further details see Annex D.

The displacement may be imposed prior to the test or during the test in accordance with EN 1366-4. The displacement shall amount to 100% of the movement capability determined according to clause 2.2.15, claimed by the manufacturer. For details see Annex D.

If required by the manufacturer, displacement conditions, other than the standard conditions described in EN 1366-4, may be used additionally.

- **Tests of perimeter seals according to EN 1364-4**

A test according to clause 2.2.15 shall be performed with the fire test specimen before the fire test. The fire test is commenced at the nominal joint width.

- **Tests of vertical linear joint seals abutting curtain walling according to EN 1364-3**

The movement is assumed to be generated by bending of the mullions comparable as in practice as this is a full scale test.

2.2.2.3 Standard flexible wall constructions for tests according to EN 1366-4 and EN 1364-3

The provisions given in EN 1366-3, concerning the construction may be applied for linear joints.

The part of the works or assembled system in which the linear joint seal is intended to be incorporated, installed or applied shall be classified according to EN 13501-2.

Field of application

Depending of the type of linear joint seal tested, EN 1366-4, EN 1364-3 or EN 1364-4 shall be applied.

Further principles are given in Annex E.

The tables in Annex E show the possible variations, the expected effect and a comment on that effect. The effects are annotated as + (a positive effect expected), - (a negative effect expected) or = (no significant effect expected). Where no annotation of effect is given the effect is currently not known.

At present the rules in Annex E only consider the effect of one variation at a time, all other parameters remaining unchanged.

If more than one variation is to be incorporated, the overall effect shall be considered.

The rules are considered applicable to joint assemblies tested either with or without induced movement.

2.2.3 Content, emission and/or release of dangerous substances

The performance of the product/kit related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer[7] after identifying the release scenarios (in accordance with EOTA TR 034) taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.

The identified intended release scenarios for this product and intended use with respect to dangerous substances for this product are:

IA1: Product with direct contact to indoor air.

IA2: Product with indirect contact to indoor air (e.g. covered products) but possible impact on indoor air.

S/W 2: Product with indirect contact to soil, ground- and surface water.

2.2.3.1 SVOC and VOC

For the intended use covered by the release scenarios IA1 and IA2 semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) are to be determined in accordance with EN 16516. The loading factor to be used for emission testing is 0,007 m^2/m^3.

The preparation of the test specimen is performed by the use of a concrete member in which the sealing/kit is installed in accordance with the manufacturer's product installation instructions (MPII) or (in absence of such instructions) the usual practice of installation. The maximum nominal joint width shall be tested considering all materials and components of the sealing/kit.

Once the test specimen has been produced, it should immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results have to be reported for the relevant parameters (e.g. chamber size, temperature and relative humidity, air exchange rate, loading factor, size of test specimen, conditioning, production date, arrival date, test period, test result) after 3 and 28 days testing.

The relevant test results shall be expressed in [mg/m^3] and stated in the ETA.

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[7] The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011).
The manufacturer is **not** obliged:
- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

2.2.4 Air permeability

2.2.4.1 Testing

The leakage rate is the sum of the leakage between the seal and the surrounding structure and the permeability of the seal itself. The former is proportional to the length of the seal and the latter is proportional to the exposed area of the seal for a given depth of seal. In many cases one of these mechanisms predominates and it is only necessary to consider this mechanism. In others it may not be clear which predominates and both mechanisms may have to be evaluated. A comparison of the results for a 1 m length of seal will reveal whether one mechanism dominates or whether both mechanisms need to be taken into account to obtain the overall leakage rate.

To determine air permeability [8] the principles of the test method described in EN 1026:2000, cl. 6 shall be used, considering the following with reference to this standard:

Clause 6: A nominal length of the linear joint seal of 1 m together with the intended supporting construction (to be agreed between the Assessment Body and the ETA applicant) is considered to be sufficient. Regarding selection of the appropriate width all effects that could influence the test result shall be considered (e.g. degree of compression). Linear joint seals shall be tested from both sides separately unless symmetrical in construction. A splice/butt joint shall be included in the test specimen where relevant. Linear joint seals intended to be used for movement joints shall be tested using the displacement conditions described in clause 2.2.2.2.

When seal edge leakage is intended to be determined for permeable materials coat the seal surface with an impermeable coating, e.g. varnish, epoxy resin, self-adhesive film or impermeable sealant.

When seal material permeability is intended to be determined reduce edge leakage to zero using an impermeable sealant or adhesive to bond the seal to the surrounding construction.

2.2.4.2 Assessing

Seal edge leakage

The test result shall be presented as leakage rate per unit length of the seal, with the unit being $m^3h^{-1}m^{-1}$ since leakage is proportional to length of seal. For symmetrical seals there are two leakage edges but results shall be expressed in terms of linear metres of seal.

Seal material permeability

The test result shall be presented as leakage rate per unit area of the seal, with the unit being $m^3h^{-1}m^{-2}$ (in deviation from clause 8 of EN 1026:2000 for a defined pressure differential and seal depth since leakage is proportional to the exposed surface area.

The leakage rate of seals of greater depth than that tested can be assumed to be equal or less.

2.2.5 Water permeability

For testing and assessing the water permeability EN 12390-8 may be used.

For external seals: test method and assessment see Annex C.1 (normally relevant only to walls)

For internal seals: test method and assessment see Annex C.2 (normally relevant only to floors).

2.2.6 Mechanical resistance and stability relating to BWR 4

see 2.2.7

It is assumed that the impact test covers both static and dynamic loads.

The impact energy shall be given in the ETA together with the maximum dimensions of the linear joint seal and the type of impactor used.

2.2.7 Resistance to impact/movement

2.2.7.1 Testing

General

Tests according to EOTA TR 001:2003 shall be used to show evidence of impact resistance/ load-bearing capacity, only where

- the seal width is in excess of 150 mm and where either

8 While the test described in EN 1026:2000 is similar in principle to that described in EN 1634-3:2005 it is included here because the differential air pressures in EN 1634-3:2005 relate only to those occurring under fire conditions.

- no precautions (precautions/protection are not covered by this ETAG) are taken to prevent a person stepping onto a horizontal linear joint seal or falling against a vertical, or sloped, linear joint seal or
- the necessary load-bearing capacity (to prevent any injury of persons e.g. by failure of the seal) is required to be maintained,.

Where the linear joint is designed for a width in excess of 150 mm but less than 400 mm the test methods described in EOTA TR 001:2003, clause 3 apply. Where the width is in excess of 400 mm EOTA TR 001:2003, clause 2 applies, subject to the following provisions:

Design of the specimens

The specimens shall consist of a supporting construction with the joint seal located at the mid position. The standard material for the supporting construction is aerated concrete. Where other materials for the supporting construction are used, results are only valid for the material used in the test. The specimen shall be mounted in a steel frame (see figures 5 and 6). The thickness of the steel frame shall be minimum 5 mm. The frame shall be fixed rigidly and measures shall be taken to minimise deflection of the supporting construction at impact. Where L angles were used for the frame the impact shall be at the specimen face opposed to the steel angle.

Size of the specimen, when the hard body impactor is used (see Figure 5)

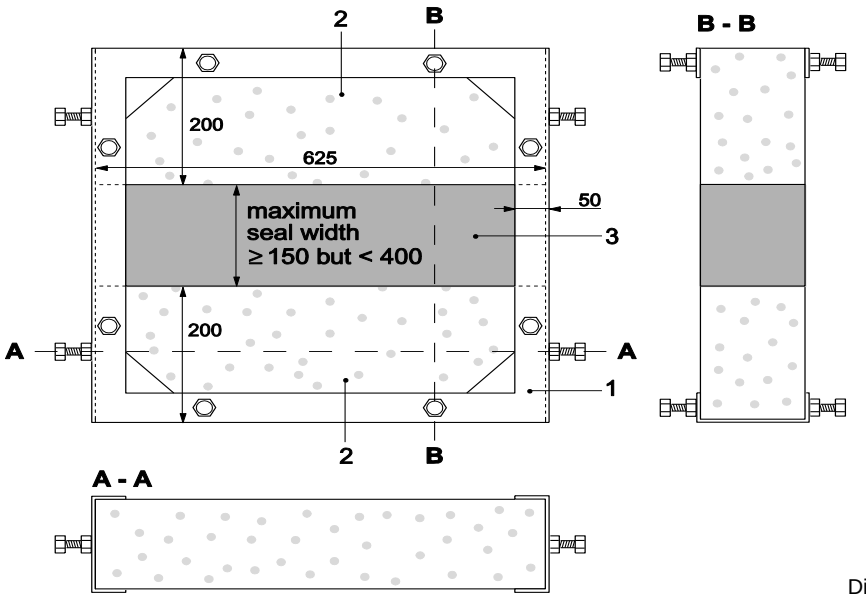
The specimen shall have a size of 625 mm x (200 + maximum seal width applied for + 200) mm [9]. It is recommended to use the specimen with the seal in horizontal position to avoid impacting the supporting construction.

Size of the specimen, when the soft body impactor is used (see Figure 5)

The specimen shall have a size of 1250 mm x (200 + maximum seal width applied for + 200) mm[9]. It is recommended to use the specimen with the seal in vertical position to avoid impacting the supporting construction.

2.2.7.2 Assessing

The impact energy (see EOTA TR 001) shall be given in the ETA together with the maximum dimensions of the linear joint seal and the type of impactor used.



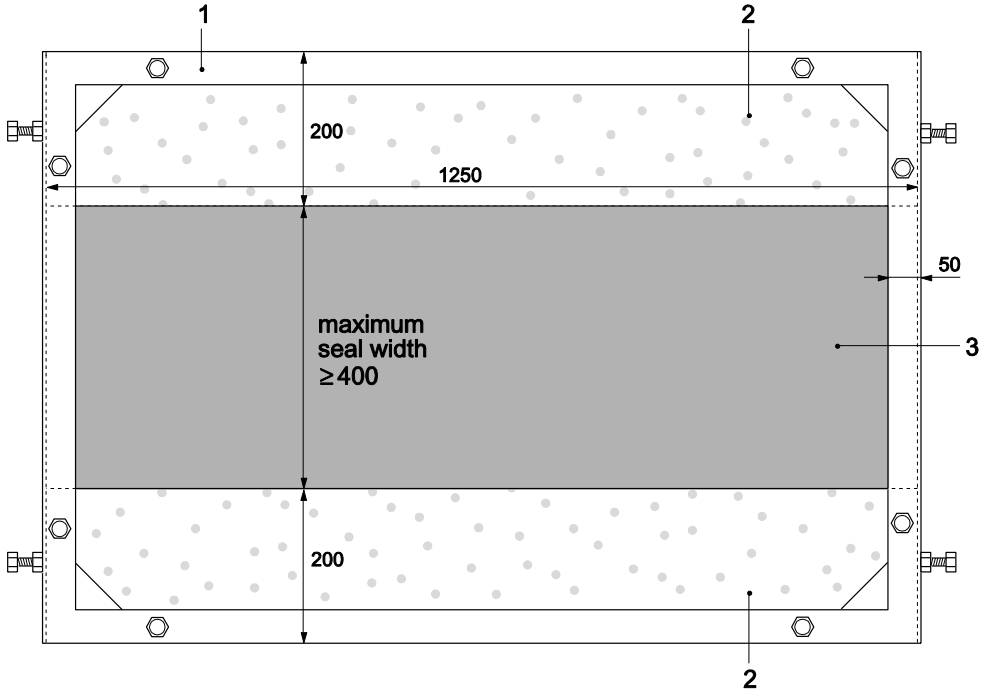
Dimensions in mm

Key

1 Steel frame 2 Supporting construction 3 Joint seal

Figure 5 – Specimen for impact tests using the hard body impactor

[9] 625 mm, 200 mm and 1250 mm are nominal values



Dimensions in mm

Key
1 Steel frame 2 Supporting construction 3 Joint seal

Figure 6 – Specimen for impact tests using the soft body impactor

2.2.8 Adhesion

Adhesion is covered by tests carried out for the determination of movement capability (see clause 2.2.13.2) and, where relevant, by tests performed according to clause 2.2.7.1. When a primer is considered necessary to improve either adhesion of the product to the substrate or to enhance the cohesion of the substrate the primer shall also be used in the tests.

For the assessment see 2.2.7.2 and 2.2.13.2.

2.2.9 Airborne sound insulation

EN ISO 10140 Part 1, 2, 4 and 5 shall be used for determination of the sound reduction index of joints R_S. In particular Annex J of EN ISO 10140-1 shall be considered.

The airborne sound insulation is expressed as weighted sound reduction index of joints $R_{S,W}$ in accordance with EN ISO 717-1.

2.2.10 Thermal insulation

The thermal conductivity shall be determined according to EN 12664, EN 12667 or EN 12939.

The thermal resistance and the thermal transmittance (U-value) shall be determined by testing according to EN ISO 8990.

If necessary, the thermal resistance shall be calculated on the basis of EN ISO 6946.

NOTE 5: *In principle, thermal bridges should be prevented.*

The thermal conductivity shall be stated as λ-value (W/m·K).
The thermal resistance shall be stated as R-value (m^2·K/W).
The thermal transmittance shall be stated as U-value (W/m^2·K).

EN ISO 10456 may be used, as far as applicable for the product or its components concerned.

The source of the declared values or the standard used to determine the values shall be quoted.

2.2.11 Water vapour permeability

Water vapour permeability shall be tested in accordance with EN ISO 12572 or EN 12086.

Water vapour permeability shall be declared as vapour diffusion resistance factor (μ-value). The source of the declared values or the standard used to determine the values shall be quoted.

EN ISO 10456 may be used, as far as applicable for the product concerned.

2.2.12 Durability

2.2.12.1 Testing

General

The principle of the durability tests is to take the product properties listed in the subsequent tables and to check whether these properties are changed after exposure of the product to defined exposure conditions.

There are two groups of materials/products used for linear joint seal products:

- Materials/products covered by a standard: see 2.2.12.1, a) and 2.2.12.1, c)
- Materials/products not covered by a standard: see 2.2.12.1, b) and 2.2.12.1, c).

The assessment of any single product may need consideration of materials of both types.

If the joint seal is intended to be used in specific environmental conditions (acid, alkaline or saline conditions) further confirmatory evidence or tests will be necessary as determined by the Assessment Body.

Durability tests are only necessary for components of the product that have a function after installation in the works.

In determining suitability of a component or material in a particular application the Assessment Body shall take due account of the consequences of failure, in particular related to the costs of access and the associated dismantling of the building.

a) Durability of materials/products covered by a standard (e.g. metal or plastic components)

- **Painted/coated steel**

The adequacy of a coating on steel shall be assessed by reference to EN ISO 12944 in its various parts.

- **Galvanised and aluminium coated steel**

The adequacy of zinc or aluminium corrosion protection shall be assessed by reference to EN ISO 14713, which gives general recommendations on corrosion protection.

- **Coil-coated steel**

Coil-coated steel shall be assessed by reference to EN 10169.

- **Coil-coated aluminium**

Coil-coated aluminium shall be assessed by reference to EN 1396.

- **Stainless steel**

Stainless steels shall be classified by reference to EN 10088. Annex B of EN 10088-1:2005 contains general guidance on the use of stainless steels including the aspect of corrosion resistance.

- **Thermoplastic Polymeric Materials**[10]

Thermoplastic polymeric materials used in these products are generally used to form cover plates, frames etc. and thus do not fulfil a primary function. It is therefore sufficient to ensure that the component/material possesses characteristics that define it as being an acceptable quality moulding or extrusion. An exception may arise where a component has an aesthetic function and retention of appearance is important. However, performance in this respect is not regulated and falls outside the scope of this EAD.

[10] This assessment is not intended to assess the durability and tightness of wrappings/casings used to protect reactive materials that are not durable on their own. These are assessed as part of the reactive component.

Extruded profiles in PVC-U shall be designated and assessed for suitability using EN 13245-1 and the associated tests in EN 13245-2. These standards allow a distinction to be made between profiles that are to be externally exposed and those that are for internal use only.

For injection moulded components, the effects of heating shall be determined, as a measure of quality, using the method described in EN ISO 580, on 3 samples selected from each of 5 production batches.

After conditioning, no weld line shall have opened completely and no cracks or de-lamination shall penetrate more than 50 % of the thickness, at the point of injection. If 1 of any 3 samples exhibits a failure a retest may be undertaken on 6 further components. If any of these samples fails the product shall be deemed unacceptable.

- **Mineral wool**

Mineral wool complying with those requirements of EN 13162 or EN 14303 which are related to durability is deemed to satisfy the durability requirements for use conditions type Z_1, Z_2, Y_1 and Y_2.

b) Materials/products not covered by a standard

- **Fabrics – non-elastic (folded etc.)**

Property	*Test method*
Appearance	B.12
Tear strength of fabric	B.5.4.1

- **Foam (foamed in-situ), non-reactive**

Property	*Test method*
Appearance	B.12
Density of cured foam	B.6.2 (trimmed surfaces)
Loss of mass to determine a "corrosion rate"	B.15

- **Foam (foamed in-situ), containing reactive components**

Property	*Test method*
Appearance	B.12
Density of cured foam	B.6.2 (trimmed surfaces)
Expansion ratio[11]	See EOTA TR 024, clause 3.1.11

- **Membrane-forming coatings, sealants and self-levelling joint fillers**

Environmental conditions regarding use conditions type Z_1 and Z_2 are covered when tests according to ISO 7389, ISO 8339 or ISO 8340 and ISO 9046 or ISO 9047 are successfully carried out using conditioning method B for all tests (see the relevant part of Annex B).

For use conditions type X, Y_1 and Y_2 the same test procedure shall be applied but instead of conditioning method B the relevant exposure conditions according to EOTA TR 024, clause 4.2 shall be used.

- **Mortar (cement based) and Plaster (gypsum based)**

Property	*Test method*
Appearance	B.12
Compressive strength	B.5.1.1 / B.5.1.2

The specimens shall be made from the same batch of material at the same time. Fully cured specimens shall be used for the exposure. The reference specimens shall be stored under standard conditions (23 ± 3 °C, 50 ± 5 % RH) and tested together with the exposed specimens.

11 Only for intumescent products

- **Strips, compressible (including composite), non-reactive**

Strips made from mineral wool complying with the requirements of EN 13162 are deemed to satisfy the durability requirements for use conditions type Z_1, Z_2, Y_1 and Y_2.

Other materials:

Property	*Test method*
Appearance	B.12
Compression set	B.14

- **Strips, compressible (including composite), reactive or containing reactive components or ingredients**

Property	*Test method*
Appearance	B.12
Expansion ratio [11]	See EOTA TR 024, clause 3.1.11
Compression set	B.14

- **Strips, elastomeric**

Property	*Test method*
Appearance	B.12
Tensile strength	B.5.2.1

- **Adhesives**

ISO 10354 shall be used to characterise the durability of adhesives.

For the tests and exposure conditions relating to the use conditions types (as described in 2.1) see EOTA TR 024;

c) Components and material compatibility

The TAB shall examine the design of the linear joint seal and make an assessment, using well-established principles, of the suitability of materials in contact. It is impossible to prescribe all the possible risk areas but these include for example the possibility of bi-metallic corrosion, the effects of wood preservatives on metals and the effects of solvent based coatings on the impact strength of plastics.

2.2.12.2 Assessment

- Materials/products covered by a standard

When the material/product (e.g. metal parts or other components) meet the relevant requirements given in the standards referenced it is considered being durable for the specific use conditions tested.

- **Materials/products not covered by a standard**

As repeatability and reproducibility of most of the test methods used to determine relevant properties are unknown, a deviation of the mean values of the property assessed before and after exposure of not more than 15% is taken as a positive result of the durability assessment.

Alternatively where the result falls outside the 15% requirement, an assembly for an indicative resistance to fire test may be exposed to the relevant exposure conditions and afterwards tested according to EN 1366-4, EN 1364-3 or EN 1364-4.

The ETA shall refer to the specific use conditions tested.

2.2.13 Movement capability[12]

For a general introduction to the assessment approach see Annex B.13.

Details for the various types of products are given in:

- Annex B.13.2 - Adhesive-fixed products (AF)

[12] Only where movement capability performance is claimed by the applicant

- Annex B.13.3 - Friction-fixed products (FF)
- Annex B.13.4 - Mechanically fixed products (MF)
- Annex B.13.5 - Self-adhering products (SA)

2.2.14 Cycling of perimeter seals for curtain walls

The test construction shall be subject to cycling a minimum of 500 times between the minimum and maximum joint width corresponding to the movement capability for a certain nominal joint width. Cycling shall start at the nominal joint width and finish at the maximum joint width. Cyclic rates of 30 cpm (cycles per minute) shall be designated as seismic, cyclic rates of 10 cpm shall be designated wind sway, and those rates below 1 cpm shall be designated thermal. The applicant shall designate a cyclic rate that shall be recorded in the test report.

After cycling, the test construction shall be allowed to stabilise for 24 hours, without alteration before fire testing, if not, the reasons shall be stated in the report.

Joint seals tested at a higher frequency are deemed to perform at lower frequencies.

Compression set data shall be provided on test specimens relying solely upon compression for placement in joints to satisfy long term performance.

The resistance against movement is given as "cycle tested at 30 cpm", "cycle tested at 10 cpm", or "cycle tested at 1 cpm".

2.2.15 Compression set

It is relevant for mineral wool (AF, FF, MF)[2] and compressible strips (including laminated, impregnated and composite) (AF, FF, MF), for movement as well as for non-movement joints. For details of the test method and the assessment see B.14.

NOTE 6: *Necessary also for mechanically supported systems (if a gap is created by failure to recover after compression the fire resistance function may no longer be given).*

2.2.16 Linear expansion on setting

This characteristic is relevant for gypsum based mortars. For details of the test method and the assessment see Annex B.11.2.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is Decision 1999/454/EC (EU).[13]

The system is: system 1

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.

Table 3 Control plan for the manufacturer; cornerstones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method	Criteria, if any	Minimum number of samples[14]	Minimum frequency of control[15]
Factory production control (AVCP) including testing of samples taken at the factory in accordance with a prescribed test plan					

Tab 3.1 Fabrics

1	Type of material(s)	check specification	-	see footnote 13	1/b or 1/day
2	Dimensions, if relevant	B.10	-	see footnote 13	1/b
3	Tear strength of fabric	B.5.4.1	-	see footnote 13	1/b or 1/day
4	TGA or DTA	B.2	-	see footnote 13	1/10 b
5	Content of non-volatile components	B.3	-	see footnote 13	1/10 b
6	Loss of mass on heating	B.4	-	see footnote 13	1/b or 1/day
7	Tear strength of seams (if relevant)	B.5.4.2	-	see footnote 13	1/b
8	Mass per unit area of fabric	B.6.6	-	see footnote 13	1/b or 1/day

[13] Official Journal of the European Communities: N° L 178/52 of 14 July 1999, p.3.

[14] One specimen is normally considered to be sufficient. The final number of specimens is to be defined in the specific control plan for the ETA-applicant.

[15] The abbreviations given stand for the frequency of tests: 1/b = once per batch or lot, 1/10 b = once per 10 batches, 1/6 m = once per 6 month, 1/h = once per hour, conf = conformation with the technical specification provided by the supplier of the component(s)
Batch/lot: for discontinuous production: a batch is the specific amount of material produced at one time using the same process and the same conditions of manufacture;
for continuous production the frequency shall be defined by the EOTA body on a case by case basis depending on the peculiarities of the production process and the level of quality management system installed.

Tab 3.2 Foams in-situ applied

1	TGA or DTA	B.2	-	see footnote 13	1/10 b
2	Content of non-volatile components	B.3	-	see footnote 13	1/10 b
3	Loss of mass on heating	B.4	-	see footnote 13	1/10 b
4	Density of cured foam	B.6.2	-	see footnote 13	1/b
5	Expansion ratio[11]	EOTA TR 024, cl. 3.1.11	-	see footnote 13	1/b
6	Curing behaviour (tack free time)	B.9.1	-	see footnote 13	1/b
7	Dimensional stability (change in volume)	B.11	-	see footnote 13	1/10b[16]

Tab 3.3 Membrane-forming coatings

1	TGA or DTA	B.2	-	see footnote 13	1/10b
2	Content of non-volatile components	B.3	-	see footnote 13	1/10b
3	Loss of mass on heating	B.4	-	see footnote 13	1/10b
4	Viscosity of liquid material	B.7	-	see footnote 13	1/b
5	Density of liquid material	B.6.1	-	see footnote 13	1/b
6	Expansion ratio[11]	EOTA TR 024, cl. 3.1.11	-	see footnote 13	1/b

Tab 3.4 Mineral wool boards/slabs/batts/strips

Mineral wool manufactured according to EN 14303 or EN 13162 [17]					
1	see EN 14303 or EN 13162 annex B		-	see footnote 13	
2	Apparent density	B.6.3	-	see footnote 13	1/h
3	“Melting” point	B.8	-	see footnote 13	1/b of raw material
4	Thickness of facing or mass per unit area of facing, if relevant	B.10.1	-	see footnote 13	conf (every delivery)
Mineral wool not manufactured according to EN 14303 or EN 13162					
1	Apparent density	B.6.3	-	see footnote 13	1/h
2	“Melting” point	B.8	-	see footnote 13	1/b of raw material
3	See EN 13162 Annex B [18]		-	see footnote 13	
4	Thickness of facing or mass per unit area of facing, if relevant	B.10.1	-	see footnote 13	conf (every delivery)

[16] Depending on how close the result of the performance test is to the threshold value of the specification

[17] Products produced according to EN 13162 may be suitable for linear joint seal applications but melting point and density are properties relevant for this application which are not covered in EN 13162

[18] The following properties are not considered essential for the fire resistance performance: thermal resistance, thermal conductivity, durability, compressive stress or strength, water absorption, water vapour transmission, small amount of water soluble ions and pH-value.

Tab 3.5 Mortar (cement based or gypsum based)

1	TGA or DTA	B.2	-	see footnote 13	1/10b
2	Content of non-volatile components	B.3	-	see footnote 13	1/10b
3	Loss of mass on heating	B.4	-	see footnote 13	1/10b
4	Non-compacted bulk density	B.6.4	-		1/b
5	Setting time	B.9.2	-	see footnote 13	1/b
6	Compressive strength after 3 or 7 days (cement based), if relevant	B.5.1	-	see footnote 13	1/b
7	Compressive strength after 28 days (cement based), if relevant	B.5.1	-	see footnote 13	1/6m
8	Compressive strength after 24 hours - fully saturated (gypsum based), if relevant	B.5.1	-	see footnote 13	1/b
9	Compressive strength fully dried (gypsum based), if relevant	B.5.1	-	see footnote 13	1/6m

Tab 3.6 Sealants/ mastics and putties/ self-levelling joint fillers (non-intumescent)

1	TGA or DTA	B.2	-	see footnote 13	1/10b
2	Content of non-volatile components	B.3	-	see footnote 13	1/10b
3	Loss of mass on heating	B.4	-	see footnote 13	1/10b
4	Density of uncured (“liquid”) material	B.6.1	-	see footnote 13	1/b
5	Viscosity of uncured (“liquid”) material	B.7	-	see footnote 13	1/b
6	Hardness after curing, if relevant	B.5.3.1	-	see footnote 13	1/10b
7	Expansion ratio[11]	EOTA TR 024:	-	see footnote 13	1/b

Tab 3.7 Strips, compressible (including composite, laminated, impregnated)

1	Dimensions (including laminations etc.)	B.10	-	see footnote 13	1/b
2	Density before lamination / impregnation (degree of impregnation) etc., if relevant	B.6.5	-	see footnote 13	1/b or conf
3	Density after lamination / impregnation (degree of impregnation) etc., if relevant	B.6.5	-	see footnote 13	1/b
4	Expansion ratio[11]	EOTA TR 024:,	-	see footnote 13	1/b

Tab 3.8 Strips, elastomeric

1	TGA or DTA	B.2	-	see footnote 13	1/10b
2	Content of non-volatile components	B.3	-	see footnote 13	1/10b
3	Loss of mass on heating	B.4	-	see footnote 13	1/10b
4	Density of cured material	B.6.5	-	see footnote 13	1/b
5	Hardness after curing or tensile strength	B.9.1 B.5.2.1	-	see footnote 13	1/10b

3.3 Tasks of the notified body

The corner stones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the linear joint seal are laid down in Table 4.

Table 4Control plan for the notified body; corner stones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the production plant and of factory production control					
1	Raw materials/constituents	accordance with technical specification of raw materials and constituents		See footnote 13	
2	Physical product characteristics as given in table 3	See table 3			
Continuous surveillance, assessment and evaluation of factory production control					
1	Physical product characteristics as given in table 3	See table 3			

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance.

Product specifications

EN 520	Gypsum plasterboards, Definition, requirements and test methods
EN 1396	Aluminium and aluminium alloys - Coil coated sheet and strip for general applications - Specifications
EN 10088:2005	Stainless steels – Part 1: List of stainless steels
EN 10169	Continuously organic coated (coil coated) steel flat products –
	Part 1: General information (definitions, materials, tolerances, test methods)
	Part 2: Products for building exterior applications
	Part 3: Products for building interior applications
EN 13162	Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification
EN 13245	Plastics – Unplasticized poly vinyl chloride (PVC-U) profiles for building applications – Part 1: Designation of light coloured profiles Part 2: Profiles for internal and external wall and ceiling finishes
EN ISO 12944	Paints and varnishes - Corrosion protection of steel structures by protective paint systems –
	Part 1: General introduction
	Part 2: Classification of environments
	Part 3: Design considerations
	Part 4: Types and surface preparation
	Part 5: Protective paint systems
	Part 6: Laboratory performance test methods
	Part 7: Execution and supervision of paint work
	Part 8: Development of specifications for new work and maintenance
EN 14303	Thermal insulation products for building equipment and industrial installations; Factory made mineral wool products (MW); Specification
EN ISO 14713	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings – Guidelines

Test methods and classification standards

EN 196-3	Methods for testing cement – Part 3: Determination of setting time and soundness
EN ISO 580	Plastics piping and ducting systems – Injection-moulded thermoplastics fittings – Methods for visually assessing effects of heating
EN 1015-11	Methods of test for mortars for masonry – Part 11: Determination of flexural and compressive strength of hardened mortar
EN 1026:2000	Windows and doors – Air permeability – Test method
EN 1364	Fire resistance tests for non-loadbearing elements
	Part 3: Curtain walling; Full configuration (complete assembly)
	Part 4: Curtain walling – Part configuration
EN 1366-3	Fire resistance tests for service installations, Part 3: Penetration seals
EN 1366-4	Fire resistance tests for service installations, Part 4: Linear joint seals
EN 1426	Bitumen and bituminous binders - Determination of needle penetration
EN 1602	Thermal insulating products for building applications – Determination of the apparent density

EN 1634-3:2005	Fire resistance tests for door and shutter assemblies – Part 3: Smoke control doors and shutters
EN 12092	Adhesives – Determination of viscosity
EN 12154	Curtain walling – Watertightness – Performance requirements and classification
EN 12390-8	Testing hardened concrete – part 8 Depth of penetration of water under pressure
EN 12155	Curtain walling – Watertightness – Laboratory test under static pressure
EN 13238	Reaction to fire tests for building products: Conditioning procedures and general rules for selection of substrates
EN 13501	Fire classification of construction products and building elements
	Part 1: Classification using test data from reaction to fire tests
	Part 2: Classification using test data from fire resistance tests
EN 13823	Reaction to fire tests for building products – Building products excluding – floorings – Thermal attack by a single burning item
EN 14706	Thermal insulation products for building equipment and industrial insulation – Determination of maximum service temperature
EN 16516	Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air
EN 29073-1	Textiles; test method for nonwovens - Part 1: Determination of mass per unit area
EN ISO 527-2	Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics
EN ISO 2811	Paints and varnishes – Determination of density –
	Part 1: Pyknometer method
	Part 2: Immersed body (plummet) method
	Part 3: Oscillation method
EN ISO 3219	Plastics – Polymers/resins in the liquid state or as emulsions or dispersions – Determination of viscosity using a rotational viscometer with defined shear rate
EN ISO 3251	Paints, varnishes and plastics – Determination of non-volatile-matter content
EN ISO 3451	Plastics – Determination of ash
	Part 1: General methods
	Part 4: Polyamides
	Part 5: Poly(vinyl chloride)
EN ISO 11925-2	Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test
EN 12390-8	Testing hardend concrete – Part 8: Depth of penetration of water under pressure
EN ISO 13934-1	Tensile properties of fabrics – Part 1: Determination of maximum force and elongation at maximum force using the strip method
EN ISO 13935	Seam tensile properties of fabrics and made-up textile articles –
	Part 1: Determination of maximum force to seam rupture using the strip method
	Part 2: Determination of maximum force to seam rupture using the grab method
EOTA TR 001:2003	Determination of impact resistance of panels and panel assemblies
EOTA TR 024	Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products
EOTA TR 034	General BWR3 Checklist for EADs/ETAs - Content and/or release of dangerous substances in construction products
ISO 37	Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties
ISO 3049	Gypsum plasters – Determination of physical properties of powder
ISO 7389	Building construction – Jointing products – Determination of elastic recovery of sealants
ISO 7390	Building construction – Jointing products – Determination of resistance to flow of sealants

ISO 7619	Rubber, vulcanized or thermoplastic – Determination of indentation hardness – Part 1: Durometer method (Shore hardness) Part 2: IRHD pocket meter method
ISO 8339	Building construction – Jointing products – Sealants – Determination of tensile properties
ISO 8340	Building construction – Jointing products – Sealants – Determination of tensile properties at maintained extension
ISO 9046	Building construction – Jointing products – Determination of adhesion / cohesion properties of sealants at constant temperature
ISO 9047	Building construction – Jointing products – Determination of adhesion / cohesion properties of sealants at variable temperatures
ISO 10563	Building construction – Sealants for joints – Determination of change in mass and volume
ISO 11600	Building construction - Sealants - Classification and requirements

Other standards

EN ISO 13788	Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods

ANNEX A MOUNTING AND FIXING PROCEDURES FOR REACTION TO FIRE TESTS

A.1 Tests according to EN 13823 (SBI)

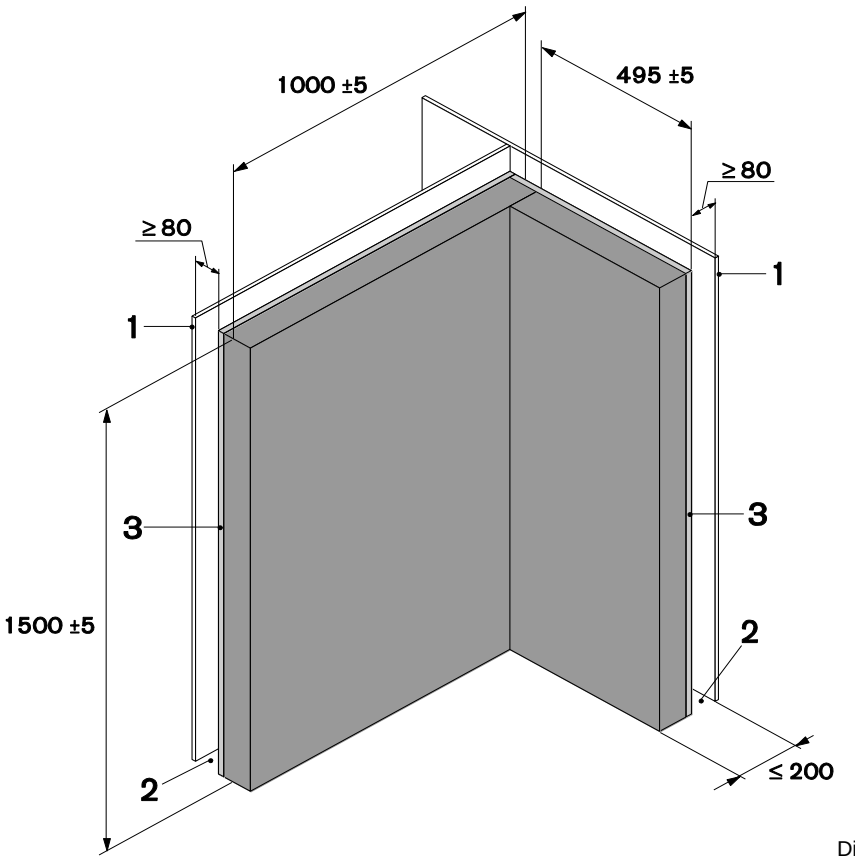
With linear joint seals a major concern of some regulators is vertical spread of flames and spread of flames into voids.

Vertical spread of flame is not directly used as a performance criterion in the SBI test.

However, by testing a specimen comprising the full area of the SBI rig (see Figure 7) as opposed to the normal format of a linear joint, the normal SBI data is useful in evaluating a potential vertical flame spread as the threshold values for FIGRA and THR are related to a situation where the full specimen area potentially contributes to the heat release.

The thickness of each component of the linear joint seal shall be representative of the installation in practice. The maximum thickness of 200 mm given in EN 13823 may be reduced, provided a minimum unaffected thickness of 10 mm of the product or component forming the surface is left after the test. [19]

Regarding the size of the specimen the standard configuration shown in Figure 7 is normally used. [20].



Dimensions in millimetres

Key

Specimen area 1 Backing boards 2 Air gap 3 Supporting board

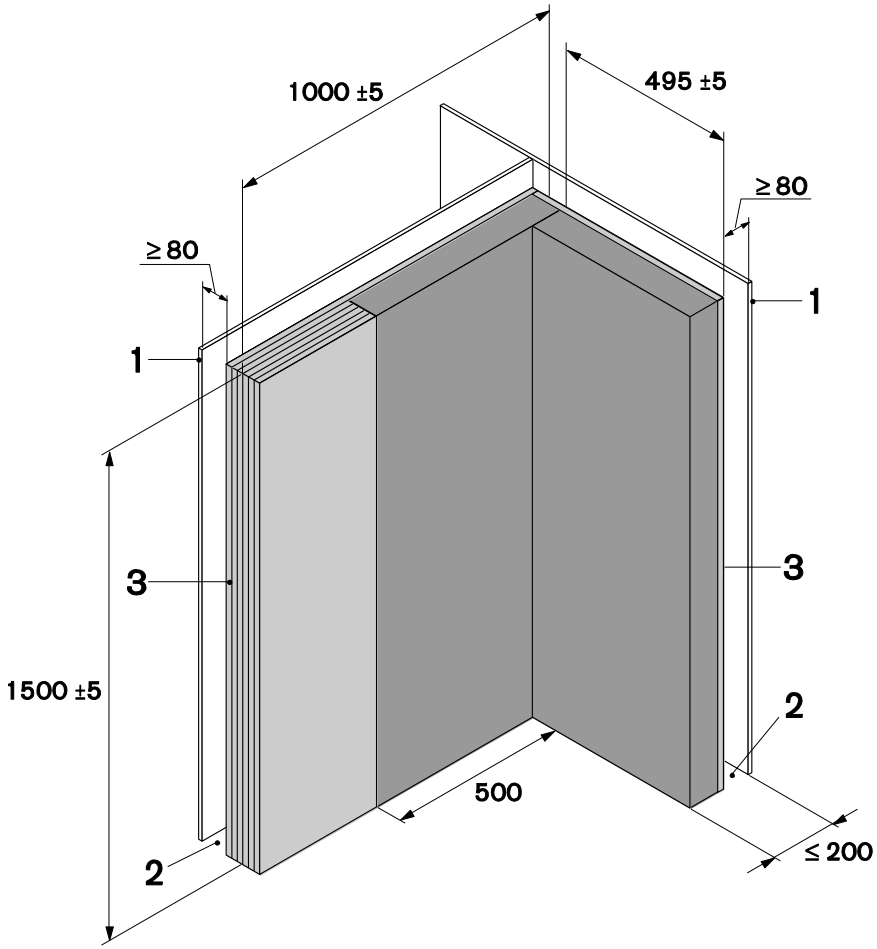
Figure 7 – Standard configuration

[19] This may be relevant for e.g. strips or composite strips. An indicative test, for example using a Bunsen burner will give an estimate of the necessary thickness.

[20] While not representative of the normal form of a linear joint seal in practice, an extended size of test specimen was chosen to allow a better observation of potential flame spread.

Where no lateral spread of flame is expected, outside the area on the long wing covered by the specimen, the configuration shown in Figure 8 can be used alternatively. When in a test using the configuration according to Figure 8, lateral spread of flame outside this area is observed the test shall be repeated using the standard configuration according to 8.

In cases where the specimen is to be built from a high number of relatively small parts (e.g. strips), they may be mechanically stabilized by fixing them, from the reverse side, to a supporting board made from calcium silicate.



Dimensions in millimetres

Key

Specimen area

Calcium silicate board

1 Backing boards 2 Air gap 3 Supporting board

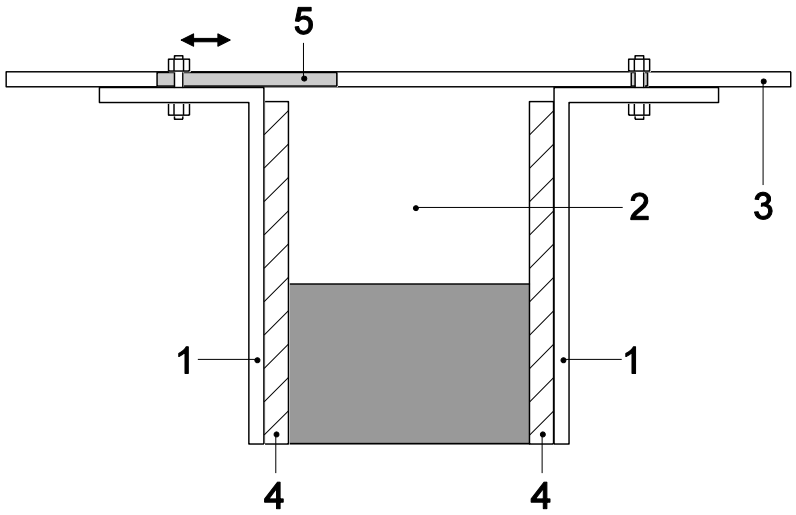
Figure 8 – Extended standard configuration

When using the configuration according to Figure 8 the part of the wing that is not covered by the test material shall be made of calcium silicate board.

A.2 Tests according to EN ISO 11925-2 (small burner test)

The test shall be conducted according to EN ISO 11925-2 subject to the following provisions:

- The test specimen used shall simulate a joint seal. The joint faces are made from steel angles, calcium silicate or fibre cement board. An example for a set-up is shown in Figure 9;
- The joint seal shall have the maximum nominal width applied for, subject to maximum 90 mm. The seal is tested without any backfilling material / backer rod;
- The smallest and the biggest depth[21] applied for shall be used. When the depth is smaller than 10 mm a backing board shall be used, made from calcium silicate.
- Any surface (face) that may be exposed in practice shall be tested;
- Where two adjacent surfaces forming an edge are exposed in practice, edge exposure shall be used;
- Compressed materials: The compression used in practice shall be simulated in the test. The result only will be valid for the equal or higher compression.
- For membrane forming coatings used on mineral wool (slabs) the standard mineral wool substrate according to EN 13238 shall be used. The thickness of the coating shall be the maximum of the range requested by the ETA applicant. If another substrate will be used in practice this substrate shall be used in the test. In the latter case the results are only valid for the substrate used in the test.



Key

Specimen
1 Steel angle
2 Air gap
3 Base plate
4 Calcium silicate
5 Slot to allow adjustment to different specimen width and compression

Figure 9 – Example for a test setup for the small burner test

21 The Assessment Body can reduce the test amount for justified reasons (e.g. only to test the smallest depth if minimum and maximum depth do not vary essentially)

ANNEX B TECHNICAL PRODUCT CHARACTERISTICS FOR AVCP AND DURABILITY ASSESSMENT

B.1 IR (Infra-Red Spectroscopy)

Execute according to the instruction manual of the equipment used. See also EOTA TR 024:07/2009, Annex C.3 for details when used as method for a Fingerprint.

B.2 Thermo-analytical methods

B.2.1 Thermo-gravimetric Analysis (TGA)

See EOTA TR 024: 07/2009, Annex C.2.

Where the method is used for Fingerprinting the prescribed heating rate, size of specimen, material of crucible and rinsing gas shall be used.

B.2.1 DTA (Differential Thermal Analysis)

This method is less suitable for intumescent materials than TGA, especially for the purpose of "Fingerprinting".

B.3 Content of non-volatile components

Test according to EN ISO 3251.

The value reported as a declared value shall be the mean value of at least three specimens.

B.4 Loss of mass on heating

Test according to EN ISO 3451-1, subject to the following provisions: As loss of mass on heating is a characteristic of a material, protective foils or coatings should be removed if at all possible. When the product is tested with a protective foil or coating this shall be recorded to ensure consistency with future tests.

The standard was written for plastics but other materials can also be tested following the principles of the standard.

The value reported as a declared value shall be the mean value of at least three specimens.

B.5 Mechanical properties

B.5.1 Compressive strength

Mortars (cement based)

Test according to EN 1015-11.

The strength at 3, 7 or 28 days may be determined dependent on whether high early strength or normal cement is used.

Plaster (gypsum based)

Test according to EN 1015-11

This method may be applied to gypsum based products subject to the product being tested after 24 hours, fully saturated, and after oven drying at 30 to 35ºC to constant mass (for conditioning see EN 13238).

B.5.2 Tensile strength

Rubber, elastomeric strips

Test according to ISO 37 or EN ISO 527-2.

B.5.3 Hardness

Sealants (cured)

Test according to ISO 7619 -1 or ISO 7619-2.

Pre-foamed products

A penetrometer is used with a steel ball of suitable diameter at the tip. The ball is positioned at the surface of the specimen (freshly cut surface) and then allowed to penetrate the material by means of a suitable weight on top. The depth of the penetration into the specimen is determined and given in the unit [mm].

Alternatively EN 1426 may be used.

B.5.4 Tear strength

Fabrics

EN ISO 13934-1

Seam

EN ISO 13935-1 or EN ISO 13935-2

B.6 Density

B.6.1 Sealants, membrane-forming coatings and other paste like materials

Sealants, coatings and other paste like materials may be tested according to the principles of EN ISO 2811-1 (pyknometer). The mean value of 3 specimens and the standard deviation shall be reported. For the AVCP procedure EN ISO 2811-2 is a suitable method.

B.6.2 Foams (in-situ, cured foam)

A cardboard beaker (coated with paraffin) is filled with the foam (take care of avoiding any holes and cavities). The foam is cut at the edge of the beaker after curing. The specimen shall be kept at ambient temperature. Density = mass total – mass beaker / volume of beaker (kg/m^3). The mean value of 3 specimens and the standard deviation shall be reported.

B.6.3 Mineral wool

Test according to EN 1602

B.6.4 Non-compacted bulk density (mortar)

Test according to ISO 3049 subject to the following:

When preparing the sample the material is not passed through a 2 mm mesh sieve.

B.6.5 Pre-formed products

The density is calculated from the mass and the volume of the specimen. The mass of the specimen shall be determined with a balance of an accuracy of 0.1g. The dimensions can be determined to the nearest mm either using a ruler when the product has a regular shape, or determining the volume by using a water displacement technique.

B.6.6 Mass per unit area of fabrics

Test according to EN 29073-1.

B.7 Viscosity

Liquids with high viscosity

Test according to EN ISO 3219

Liquids with low viscosity

Test according to EN 12092

B.8 Behaviour of mineral wool at high temperature (for AVCP)

B.8.1 Visual method of determining the "Melting point"

A sample of the mineral wool shall be pre-treated at 550 ± 10 °C in a muffle furnace until the organic binder will be eliminated**.** Cut cube specimens of 10 mm x 10 mm x 10 mm from the pre-treated sample.

The cube specimens are inserted into a tube furnace having an internal diameter of 25 mm pre-heated to a temperature approximately 30 degrees below the expected melting temperature. This is achieved by placing the specimen on a suitable carrier (e.g. a metal or ceramic pin or spatula) which is supported outside the tube furnace. The specimen is moved slowly to the centre of the furnace, where the temperature sensor is located. The specimen is held for 10 minutes in that position. The specimen is than carefully removed from the furnace and examined to see whether it has melted. The furnace temperature is noted.

If the specimen is unchanged, raise the furnace temperature by 10 degrees, wait until the temperature is stabilized and repeat the test with a new specimen.

If the specimen has melted, lower the temperature by 10 degrees and repeat the measurement with a new specimen. The temperature where the wool started melting is called the “melting” point.

The dimensions of the inner diameter of the tube furnace and the specimen may be changed provided the ratio is kept constant.

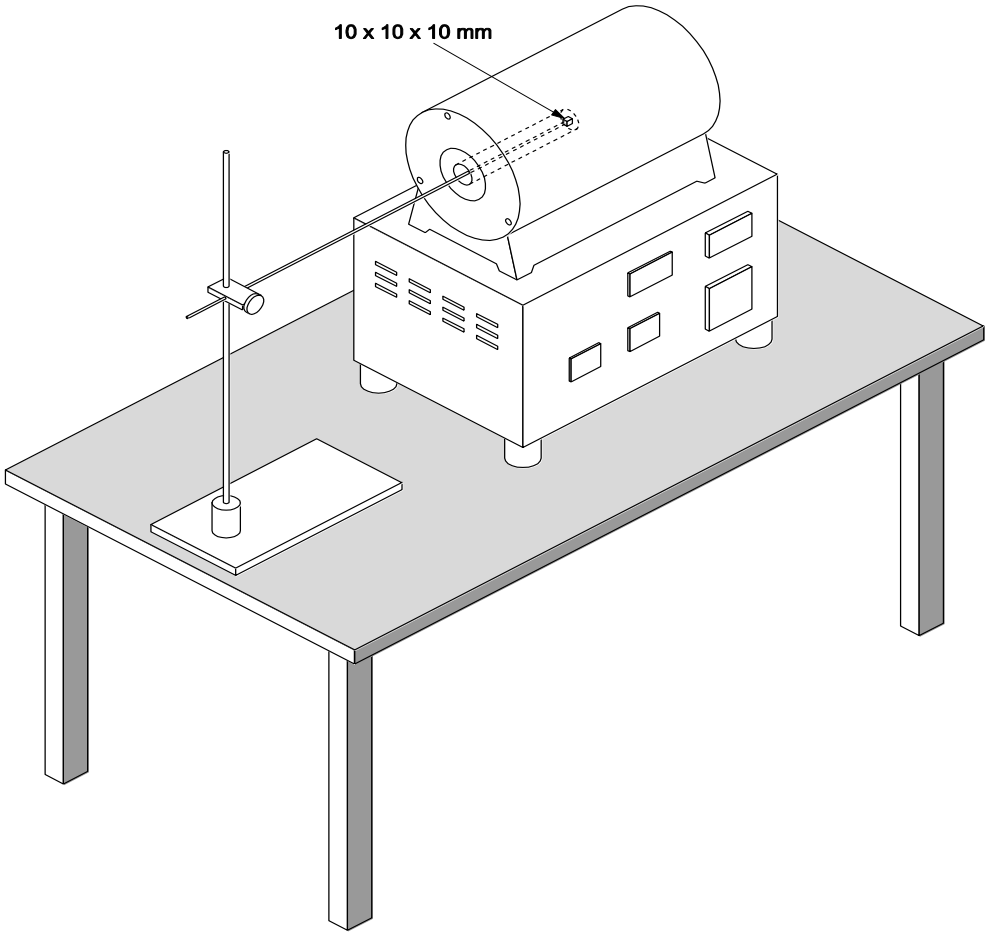


Figure 10 –Setup for visual method

B.8.2 Thermo-analytical methods (for AVCP)

Any thermo-analytical method may be used, e.g. DTA or TGA.

B.8.3 Chemical analysis (for AVCP)

The details (definition of the elements/components to be determined) are to be agreed between the EOTA body and the manufacturer and to be outlined in the documentation accompanying the ETA.

B.8.4 Determination of the melting point of mineral fibre insulating materials

This method is suitable for mineral fibre material to test whether its "melting point" is above a temperature of 1000°C.

Preparation

For every mineral fibre material use at least 2 dry samples.
Cut 2 specimen of 500 x 500 mm. The maximum thickness shall be 80 mm.
Dry at 23 ± 2 and 50 ± 5% RH until equilibrium (change in mass less than 0,1% within 24 hours).

Apply a steel-plate of a size of 200 mm x 200 mm and a mass of 0,4 kg (causing a pressure of 0,1 kN/m^2) with a whole in the centre for determining the thickness of the material (round up to full millimetre).
The density of every specimen will be determined geometrically from mass and the geometrical dimensions.

Test procedure

Cover both sides of every specimen by a steel-sheet of a thickness of 1 mm and install them vertically into a small scale furnace and expose the specimen to a heat regime according to the standardized temperature-time curve according to EN 13501-2, clause 4.2, for 90 minutes.
The thickness shall be measured again after exposure (see "

B.8.5 Test report and assessment preparation").

Following data shall be recorded:

- density (see B.6)

- thickness of the specimen before and after exposure to heat
- difference between thickness before and after exposure to heat
- visual appearance and changes in appearance after exposure to heat (description, photo etc.)

The change of thickness of both specimen shall be less than 50% for products having a "melting point" higher than 1000 °C.

B.9 Curing behaviour

B.9.1 Tack free time of foams (for AVCP)

A suitable amount of the material is extruded in to a beaker. The surface of the foam is touched by means of a wooden spatula at suitable intervals. The tack free time is reached when no foam sticks on the spatula.

B.9.2 Setting time of mortar

Test according to EN 196-3 subject to the following:

— Soundness is not relevant
— Setting time test: A penetration depth of 16-20 mm shall used for testing plaster based mortars
— Determination of final setting time is not relevant for plaster based mortars, as it is the working time to initial set which is critical to an end user and is the figure normally quoted in the product specification.

B.10 Dimensions

B.10.1 Thickness

The thickness of products in the form of plates, sheets, boards, strips, fabrics, foils etc. is determined by means of a suitable gauge to the nearest 0.1 mm at 5 locations of the specimen. The minimum size of the specimen is 10x10 cm or a minimum length of 50 cm in case of strips.

For foils and similar products / components thickness is determined to the nearest 0.01 mm.

B.10.2 Other dimensions

The dimensions shall be determined to an accuracy of 0,5% by means of a suitable gauge.

B.11 Dimensional stability

B.11.1 Foams

General

Dimensional stability is a measurement of the resistance of foam cured to shrink or post-expand after curing as measured in this test. The following protocol describes how to measure dimensional stability in a controlled testing environment.

Required equipment

- The application tool (e.g. dispenser) that belongs to the tested system
- Spacers (minimum 100 mm x (15 mm ± 1 mm) x 20 mm, made of dimensionally stable material (for example: PE, PTFE,...), on which polyurethane does not adhere.
- Exterior grade plywood, about 130 mm x 100 mm, so that a net foam area of 100 mm x 100 mm remains. The thickness of the plywood shall be minimum 9.5 mm and it shall have at least one sanded face.
- Hand clamps
- Suitable measuring gauge (± 0,5 mm)
- Knife
- Climatic chamber (controlled environment test equipment)
- Heating chamber, dry but unspecified relative humidity

Testing

The foam, the application tool, and the substrate shall be conditioned in accordance with EN 13238 to constant mass. Three specimens shall be made according to Figures 11 and 12. Be sure that the clamps sit directly on the spacers so as not to compress the assembly. The specimen shall have a gap with the required width of approximately 20 mm. The net foam space shall be an area of approximately 100 mm x 100 mm. Figure 13 shows how the assembly shall be oriented during foaming and how the foam shall be applied. Use the sanded face against the foam. Again, make sure that the clamps sit directly on the spacers. After 24 hours, remove the hand clamps and the spacers. Cut the excess foam that has expanded from the interior of the assembly so that it is flush with the plywood edges. Measure the initial, inner

plywood to plywood board dimensions. After taking the measurements, store the assemblies in the required test climates.

The test climates are:

(40 ± 2) ºC / (90 ± 5) % relative humidity

(30 ± 2) ºC / (30 ± 5) % relative humidity

Evaluation

At day 7 and 14, the specimens shall be removed from the respective test chambers and then stored for a minimum of 2 hours at standard conditions in accordance with EN 13238, procedure for conditioning to constant mass. At the four corners, the distance between the boards is measured as near as possible to the interior foam surface (distance “c” in Figure 11). Alternatively, if there are any surface irregularities, the distance can be measured at the exact middle of the specimen where the two spacers were placed (Figure 12). After the first measurement, place the specimens back in the proper chamber.

Dimensional stability calculation

The dimensional stability, d, is calculated as the percentage change in the assembly dimensions:

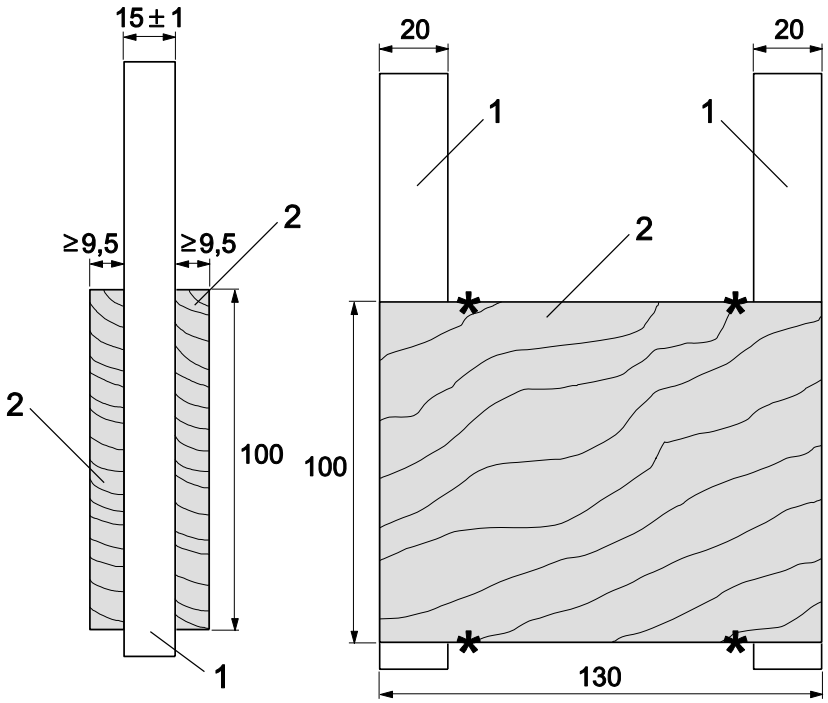
$$d = (\frac{b}{c} \times 100) - 100\,(\%)$$

b (mm) = Measured width of the gap after storage in the test chamber

c (mm) = Starting value before storage

The dimensional stability d of one specimen is given by the mean value of the four or two measuring points. The mean value of each assembly and the mean value of all assemblies as well as the standard deviation are recorded.

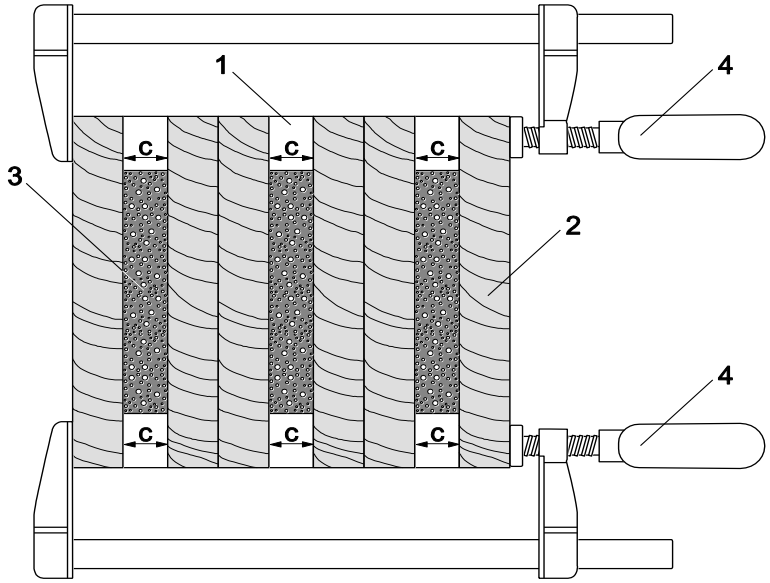
The overall mean value together with its standard deviation shall be reported.



Key
dimensions in mm

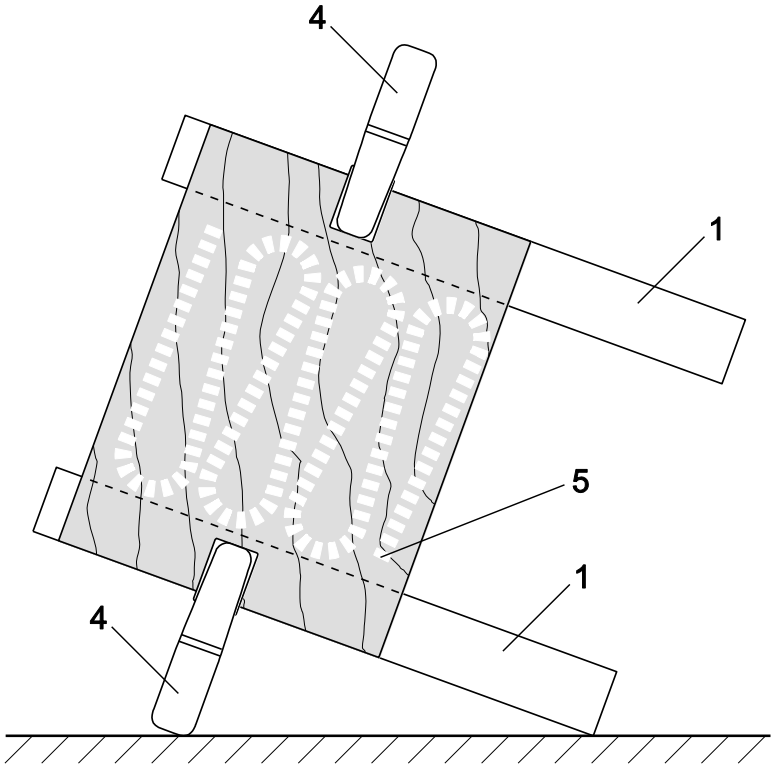
1 Spacer
2 Plywood
* Locations for determination of thickness after exposure

Figure 11 – Specimens for determination of dimensional stability – side view



Key
dimensions in mm
1 Spacer
2 Plywood
3 Foam
4 Clamps
c Dimension of the specimens determined after exposure

Figure 12a – Specimens for determination of dimensional stability – top view



Key **dimensions in mm**
1 Spacer
4 Clamps
5 Starting point for foaming

Figure 12b – Set-up for foaming

B.11.2 Linear expansion on setting (gypsum based mortar)

B.11.2.1 General

The linear expansion on setting shall be determined in continuous damp air storage by means of a simple extensometer described in B.11.2.2 with the neat plaster gauged to a standard final coat consistence. The plaster shall be stabilised before test by the method described in B.11.2.5.

B.11.2.2 Extensometer

The extensometer has an open V-shaped cradle closed at one end by a fixed plate and at the other end by a movable partition carried on the stem of an ordinary watch pattern dial micrometer gauge reading to 1/100 mm (see Fig. 13). The cradle is of brass or bronze 100 mm long, about 60 mm wide and 25 mm deep with a rounded bottom. The take-up or returning spring shall be light and the movement free.

To prevent the plaster sticking to the sides of the cradle, grease before use and line internally with thin non-absorbent paper having a glazed surface. Renew the paper lining for each test. Fill the gauged plaster into the cradle while the movable plate is held against the end, and strike off smooth and level with the top of the cradle.

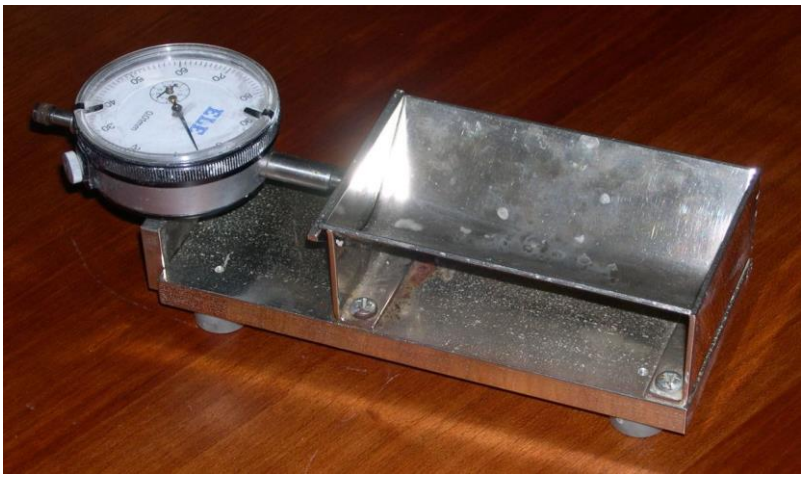


Figure 13 – Extensometer

B.11.2.3 Zero adjustment

Move the movable partition very slightly forward clear of the end to eliminate backlash. Bring the plaster solid against the movable partition. Make any necessary zero adjustment on the dial.

B.11.2.4 Gauging and measurement

A convenient quantity of plaster to use is about 200 g. Gauge this with water in the manner and to the standard final coat consistence described in B.11.2.6. Fill the gauged plaster immediately into the cradle of the extensometer and adjust the zero point as described in B.11.2.3. Place the extensometer in the damp closet and note the zero reading. Leave it undisturbed for 24 hours and then take the final reading. Calculate the percentage linear expansion

$$\text{Percent linear expansion} = \frac{difference\ \ in\ dial\ \ readings\ in\ 1/100\ mm}{100}$$

B.11.2.5 Method of stabilizing plasters

Expose the plaster for 3-4 days in a layer not more than 12 mm in thickness to an atmosphere of 65 ± 3 % relative humidity at a temperature of 20 ± 5 °C with vigorous air circulation over the specimen throughout this period.

If a conditioned room is not available, maintain the humidity by means of a saturated solution of ammonium nitrate contained together with the solid salt in a wide dish, and placed in a tightly-closed cabinet. Keep the air in the cabinet moving over both solution and plaster.

B.11.2.6 Standard consistence

The standard final coat consistence shall be determined by means of a dropping ball penetrometer precisely as described below.

Fill a ring mould made from a rigid material, 100 mm internal diameter, 25 mm internal depth with the paste under test. Rest the mould on a non-porous plate, fill it by using a flexible palette-knife in about ten increments in such a manner as to eliminate voids or air-bubbles. Smooth off the surface of the paste level with the top of the mould.

Drop a 25 mm diameter methylmethacrylate ball of a mass of 9,8 ± 1 g from rest from a height of 250 mm measured from the bottom of the ball to the surface of the paste, so that it falls approximately into the centre of the ring. Record the penetration as the distance from the lowest point of the ball to the level of the original surface of the material.

Measure the depth of penetration by a suitable method.

The paste is of the correct consistence, when the ball penetrates 15-16 mm.

When early stiffening occurs, 0,1 g of sodium citrate may be added to the gauging water for the determination of consistence.

B.12 Visual examination

The appearance of the product shall be examined for changes in e.g. colour, texture, shape or for the appearance of cracksand fissures. If changes in appearance are not reflected in the results of the examination of the other properties, possible consequences of the changes in appearance, on durability, shall be assessed on a case by case basis.

B.13 Methods for determination of movement capability (mc)

B.13.1 General

This section only applies to joint seals where the claimed movement capability is ≥ 7.5%.

A cycling test shall be used to determine movement capability for all product types except for sealants / mastics. For these the method given in ISO 11600 is used.

The principle of the test is to simulate the joint seal with a specimen of minimum 30 cm length and the maximum intended nominal width and the related depth. The specimen shall be subjected to a cycling of minimum 500 cycles at a frequency of 0,1 cpm and an amplitude corresponding to the intended movement capability. The movement may be lateral or shear.

The temperature of the test assembly shall be maintained within a range of (23 ± 5) °C.

After cycling, the test construction shall be allowed to stabilise for 1 hour, without disturbance before assessment of the specimen. Failure criteria are cohesion or adhesion failure or failure at the fixings for AF, MF and SA type of seals and displacement of the seal for FF type seals. FF type seals are to be cycled in a horizontal position. After the stabilisation period following the cycling the specimen is turned upright to check whether the seal remains in position.

B.13.2 Adhesion fixed products (AF)

The maximum nominal joint width intended shall be used for the test. The product shall be installed as in practice regarding depth of the seal in relation to the chosen width (gap-mounted) or overlap (surface-mounted), type and amount of adhesive and preparation of the surface of the joint face (e.g. use of primer).

B.13.3 Friction fixed products (FF)

The maximum nominal width intended shall be used for the test. The product shall be installed as in practice regarding depth of the seal in relation to the chosen width and compression.

B.13.4 Mechanically fixed products (MF)

The maximum nominal width intended shall be used for the test. The product shall be installed as in practice regarding depth of the seal in relation to the chosen width (gap-mounted) or overlap (surface-mounted), type, location and minimum number / distance of fixings. If necessary the specimen may be enlarged to accommodate the fixings.

B.13.5 Self-adherent products (SA)

Sealants / mastics and putties

The following tests shall be conducted to get a classification according to ISO 11600:

For all types:

- Elastic recovery according to ISO 7389 (conditioning method B)
- Loss of volume according to ISO 10563
- Flow of sealants according to ISO 7390

for materials with expected mc of ≥ 12.5 % (elastic materials):	for materials with expected mc of < 12.5 % (plastic materials):
• Tensile properties at maintained extension according to ISO 8340 using conditioning method B	• Tensile properties according to ISO 8339 using conditioning method B
• Adhesion/cohesion at variable temperature according to ISO 9047 using conditioning method B.	• Adhesion/cohesion at constant temperature according to ISO 9046 using conditioning method B

Others

The maximum nominal width intended shall be used for the test. The product shall be installed as in practice regarding depth of the seal in relation to the chosen width (gap-mounted) or overlap (surface-mounted) and preparation of the surface of the joint face (e.g. use of primer).

B.14 Compression set

The test is carried out with the same type and size of specimen as the cycling test for determination of movement capability except that the specimen is not cycled but compressed with a static load corresponding to the intended movement capability. After 24 hours under compression the specimen is release to the nominal width. The same assessment procedure and failure criteria as for the cycling test are used.

B.15 Determination of a deterioration rate

The test specimen shall have a minimum length of 200 mm, a minimum width and depth of 100 mm. Where any surface of the specimen was produced by cutting it shall be cleaned from loose particles. The overall surface area is determined, expressed in m^2. Afterwards the specimen is conditioned according to EN 13238 to constant mass. The final mass, determined to the nearest 0,01 g is recorded.

After exposure to the test climate the specimen is cleaned by removing any loose particles and weighed to the nearest 0.01 g. The "deterioration rate" is calculated

$$\text{"corrosion rate"} = \frac{\text{Mass before (g)} - \text{mass after (g)}}{\text{surface } (m^2) \cdot \text{exposure duration (h)} \cdot 8760} \quad (g/m^2 \cdot \text{year})$$

ANNEX C WATER PERMEABILITY TEST

C.1 Test to simulate external use (rain)

Test according to EN 12155 using the classes from EN 12154 as use conditions, subject to the following: A sample representative of the fire stopping or fire sealing product shall be used to prepare a linear joint seal following the installation instructions of the manufacturer. If a splice is required to construct longer seals a single splice shall be included in the test specimen. The length of the joint seal shall be minimum 1 m. Water tightness is always relevant for the seal and not only for the seal material, so the interface shall be tested, i.e. the supporting constructions claimed shall be represented (e.g. steel, dense concrete, aerated concrete). This representation may be achieved by using a facing material on a structure of another material.

C.2 Test to simulate internal use (water pressure test)

Test sample

A sample representative of the fire stopping or fire sealing product shall be used to prepare a linear joint seal following the installation instructions of the manufacturer. If a splice is required to construct longer seals a single splice shall be included in the test specimen.

Conditioning

The test specimen shall be conditioned in accordance with EN 13238 using the procedure for conditioning to constant mass.

Test apparatus

The water leakage test apparatus shall consist of a container open both ends the base of which shall form a watertight seal against the test specimen. The container shall accommodate a specimen of minimum 1 m length and the intended width and sufficient part of the supporting construction.

Test procedure

The water leakage test apparatus shall be sealed to the test specimen using non-hardening sealants, pressure-sensitive tape or rubber gaskets with clamping devices.

Water, with a permanent dye, shall be placed in the water leakage test chamber. The water shall cover the penetration seal to a depth corresponding to the required pressure[22], which shall be maintained during the test. The temperature of the test assembly shall be maintained within a range of (23 ± 5) °C.

A white indicating medium shall be placed immediately below the test specimen.

The test shall be continued until leakage is observed or a maximum of 72 hours.

Evaluation of the test results

The leakage of water through the penetration seal shall be noted by the presence of water or dye on the indicating media or on the underside of the test assembly.

Recorded test data

The result is given as “water tight to x mm of water pressure” or “water tight to x Pa”.

The test report shall include the following:

1. A description of the assembly and materials of the linear joint seal under test, including drawings depicting geometry, exact size (length, width, and thickness), and location of the seal within the test assembly.
2. The relative humidity of the test assembly and linear joint seal materials, if applicable.

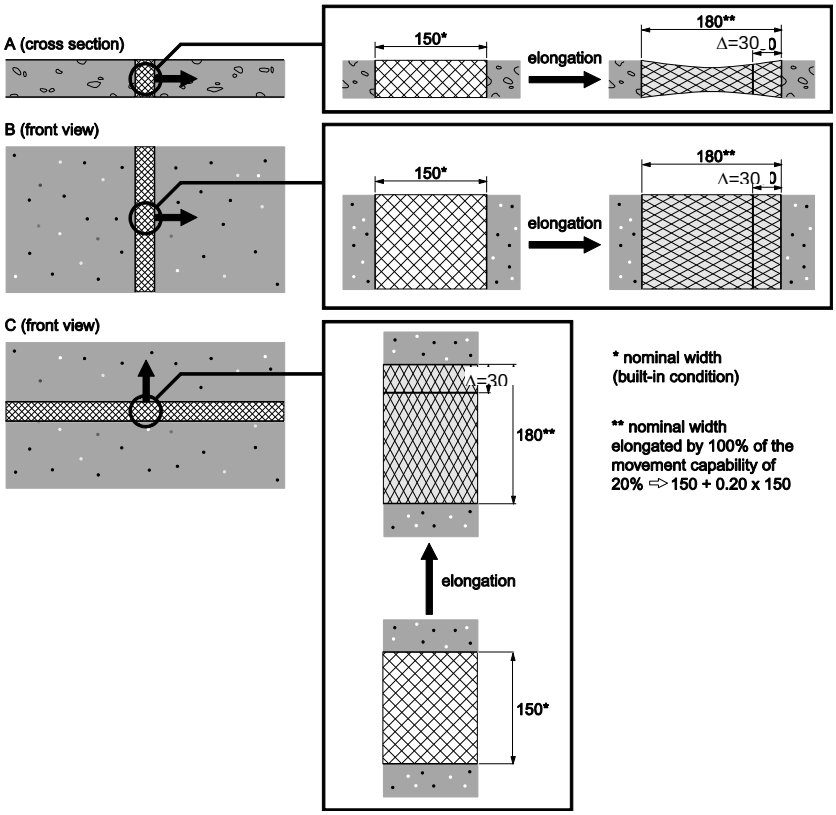
[22] Requirement from a regulation or comparable specification

ANNEX D DETAILS FOR RESISTANCE TO FIRE TEST CONDITIONS FOR MOVEMENT JOINT SEALS

D.1 Case a) Membrane forming coatings: Nominal width + elongation

The product shall be installed at the nominal width selected according to 2.2.2 with superimposed lateral elongation of 100% of the movement capability given by the manufacturer (see Figure 14).

NOTE 7: *The Figure shows only joints with 20 % elongation; smaller lateral elongations would be used for joints with smaller specified elongations.*



Key

Floor – section

Wall – front view

Joint seal – before elongation

Joint seal – after elongation

Direction of elongation

A Joint seal in a floor B Vertical joint seal in a wall C Horizontal joint seal in a wall

Figure 14 – Test condition with lateral elongation at the maximum of the nominal width

D.2 Case b) Fabrics: Nominal width + shear

The product shall be installed at the nominal width with superimposed shear so that Δ equals 100% of the movement capability given by the manufacturer (see Figure 15)[23]. The "shear extension" x can be calculated from the formula given below.

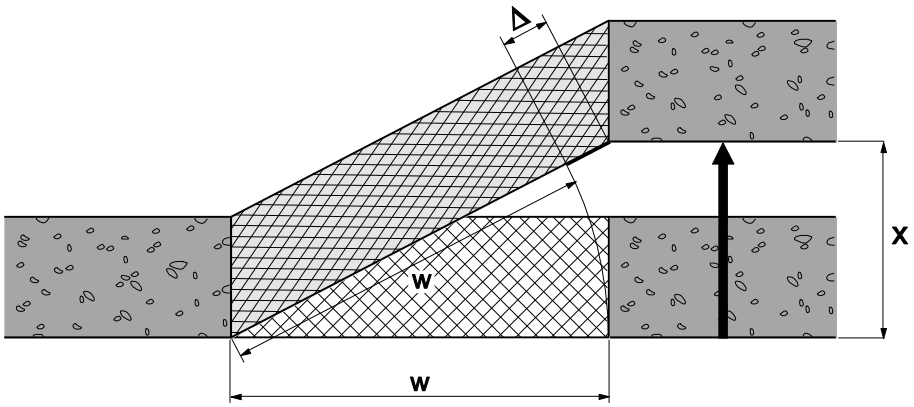
$$x = w \sqrt{mc/100\ (2 + mc/100)}$$

where

x = "shear extension" (vertical displacement of one joint edge, see Figure 15)
w = nominal joint width (millimetres)
mc = movement capability (%) as requested by the applicant and determined according to B.13

Example with w = 150 mm and mc = 20%:

$$x = 150 \sqrt{20/100\ (2 + 20/100)} = 150 \sqrt{0{,}2 \times 2{,}2} = 150 \times 0{,}663 = 99{,}5 \text{ mm}$$



Key

Floor / wall – section
Joint seal – before displacement
Joint seal – after displacement
Direction of displacement

Δ Displacement equalling 100% of the movement capability given by the manufacturer
w Nominal joint width
x "Shear extension"

Figure 15: Test condition with superimposed shear at the maximum of the nominal width

D.3 Combination of elongation and shear

Where a combination of elongation and shear is desired to be used the specimen shall be treated according to Figure 16. Δ shall equal to 100% of the movement capability given by the manufacturer. The "shear extension" portion x_S can be calculated using the formula given below for any chosen value of the elongation portion x_E.

23 This method is normally not suitable for testing strip type seals

$$x_S = \sqrt{w^2 mc/100\ (2 + mc/100) - x_E\ (2w + x_E)}$$

where

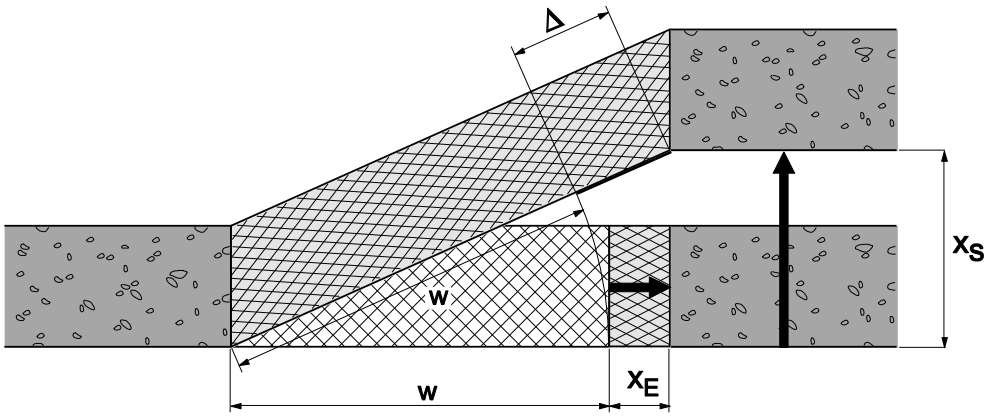
x_S = "Shear extension" portion of the displacement (vertical displacement of one joint edge, see Figure 16)

x_E = Elongation portion of the displacement (horizontal displacement of one joint edge, see Figure 17)

w = Nominal joint width

mc = Movement capability (%) as requested by the applicant and determined according to B.13

Figure 17 shows the dependence of x_S on x_E for a joint width of 100 mm for several movement capability values for a particular material as an example.



Key

Floor / wall – section

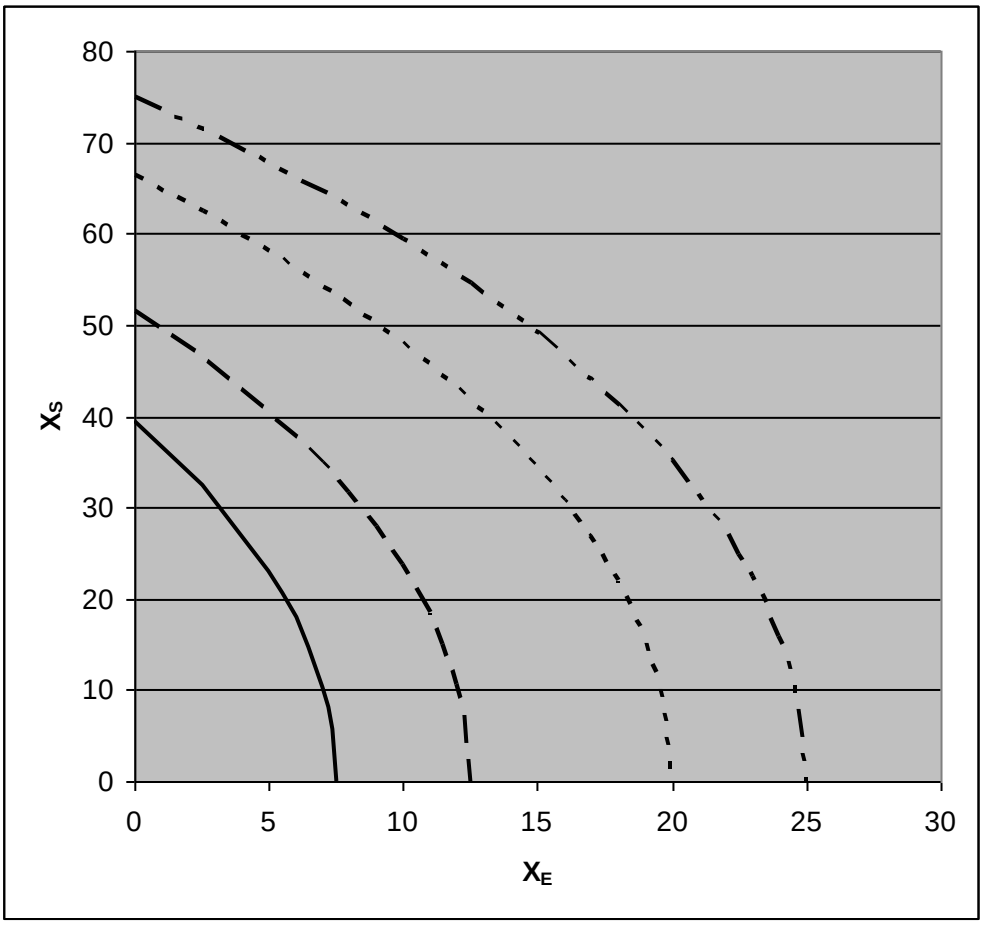
Joint seal – before displacement

Joint seal – after displacement

Direction of displacement

Δ Displacement equalling 100% of the movement capability given by the manufacturer
w Nominal joint width
x_E Elongation
x_S "Shear extension"

Figure 16: Test condition with a combination of lateral elongation and shear at the maximum of the nominal width



Key

Movement capability = 7,5 %
Movement capability = 12,5 %
Movement capability = 20 %
Movement capability = 25 %

Figure 17 – Example for the dependence of x_S on x_E for several movement capability values for a particular material of a joint width of 100 mm

ANNEX E RESISTANCE TO FIRE – ASSESSMENT FOR DETERMINING THE FIELD OF APPLICATION

E.1 Supporting Construction

A rating obtained on a specific supporting construction applies only to that particular type of separating element. When a standard supporting construction described either in the relevant test standard or in this document is used, the range of application may be extended.

E.1.1 Separating elements — Concrete or masonry

See sentence in EN 1366-3 (equal or greater thickness and density)

E.1.2 Separating elements – Flexible wall constructions

Test results obtained with the standard flexible wall constructions with a movement capability of ≥ 7,5 % cover all flexible wall constructions of the same fire resistance classification provided the following:

- the construction is classified in accordance with EN 13501-2,
- the construction has an overall thickness not less than the standard configuration used in the test

Test results obtained with the flexible standard wall constructions with a movement capability of ≥ 7,5 % also apply to flexible constructions with timber studs (breadth/depth ≥ 50 mm × 75 mm) constructed in the same manner with at least the same number of layers, provided that no part of the linear joint seal is closer than 100 mm to a stud, that the cavity is closed between the linear joint seal and the stud, and that 100 mm of insulation is provided within the cavity between the linear joint seal and the stud.

A specific edge closure is considered as being part of the linear joint seal. Results from such tests are only valid provided the same edge closure is used in practice.

The standard flexible wall construction does not cover sandwich panel constructions. Linear joints in such constructions shall be tested on a case by case basis.

Test results obtained with flexible wall constructions may be applied to concrete or masonry elements of a thickness equal to or greater than that of the element used in the tests.

For end-to-end joints in separating walls, which are only fixed at the head and the bottom, the maximum height of the tested separating wall shall be specified in the assessment.

E.2 Seal depth

Variation	Effect	Comment
Increase in seal depth	= or +	Acceptable
Decrease in seal depth	-	Not acceptable

E.3 Backing material

This section relates to the change of material used to back a seal or sealant as part of a linear joint seal

Backing material	Effect	Comment
Polyethylene / Polyurethane rods	= or +	May be replaced by mineral wool
Glass wool	= or +	May be replaced by stone wool or ceramic wool
Stone wool	= or +	May be replaced by ceramic wool
Ceramic wool (including ceramic alternatives)	=	May only be replaced by alternative material of equivalent material properties, i.e. density, thermal conductivity, melting point, shrinkage, reaction to fire classification - for example alkaline earth silicate fibres
Increase in backing material depth	+	Acceptable for class A1 and A2 materials
Decrease in backing material depth	-	Not acceptable

NOTE 8 *The above comments relate to materials of an equivalent or greater depth and/or density*.

E.4 Configuration

E.4.1 General

For foam seals (foamed in-situ and pre-formed), compressible strips (including composite, laminated, impregnated) and sealants the distance of the seal from the exposed face in concrete/masonry wall/floor may be increased from that tested.

EN 1366-4:20xx paragraph 13.3 shall be considered concerning the position of the linear joint in the construction element.

For mineral wool based seals a seal protruding outside the joint is acceptable, where the depth of seal within the joint is equal or greater than that tested.

E.4.2 Distance between splices

An increase in the distance between splices is acceptable. A reduction in the distance between splices is not acceptable. Figure 18 shows an example for a mineral based seal

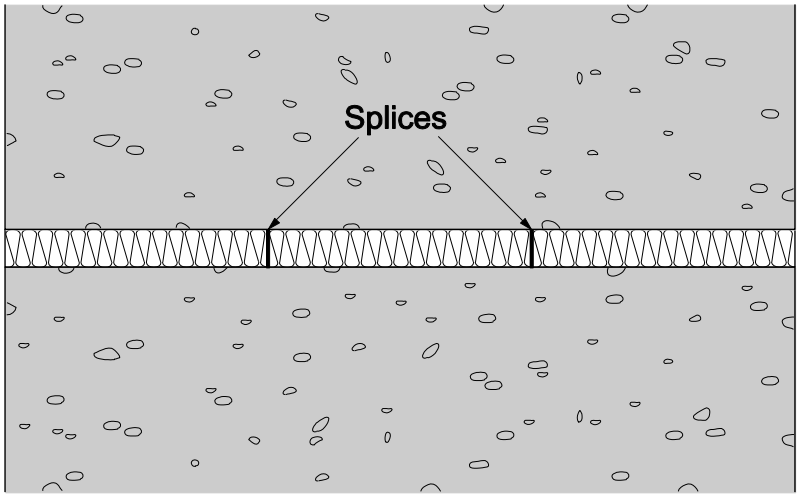


Figure 18 – Mineral wool – Distance between splices

E.4.3 Material thickness

For fabrics, elastomeric strips and membrane forming coatings the material thickness may be increased but not reduced.

E.4.4 Material density

For mineral wool based seals tested with a nominal density between 50 kg/m³ and 200 kg/m³, an increase in density up to a maximum of 200 kg/m³ is acceptable.

A reduction of density is not acceptable without test evidence to support the change.

E.4.5 Surface coatings/ coverings/ facings

The subsequent application of a surface covering (facing) to mineral wool based seals is acceptable, providing the seal depth is not reduced. The thickness of the surface covering shall not be considered as part of the effective seal depth.

The removal of a surface covering which formed an intrinsic part of the seal system as tested is not acceptable.