EUROPEAN ASSESSMENT DOCUMENT

EAD 350005-00-1104

May 2015

Intumescent products for fire sealing and fire stopping purposes

www.eota.eu

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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 No (EU) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The product assessed on the basis of this EAD is an intumescent product, traded as a coating, putty, plastic mass or an intumescent material processed to slabs, flexible mats, strips, pads, cut-outs of different shape, profiles of regular or irregular cross section, pre-shaped elements as blocks and plugs, coated fabrics or coated mesh for fire sealing and fire stopping purposes.

The specific product may be additionally equipped with a lamination, an all over cover or a self-adhesive tape made of different materials. All possible additional equipment shall be described in the ETA.

The product concerned is manufactured, delivered and sold on the market as sheets, rolls, packages, pre-shaped elements and cut-outs or in cartages, pails or containers.

Every product is characterized by an individual formulation (see Section 2.2). Product types may be variants in the form of delivery (for example liquid or fully dried with specific dimensions) or variants with additional laminations, covers or tapes as described above.

Exposed to high temperatures in case of fire the product expands and creates foam which closes gaps, seals voids and cavities and restricts the passage of heat, smoke, flames or any combination of them this way.

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

This EAD replaces parts of ETAG 026-2.

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.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s) (IU)

The product is intended to be used as a component essential for the fire sealing and fire protection effect of constructions, elements and assemblies, which shall meet requirements concerning the safety in case of fire. The product prevents and restricts the heat transmission and the propagation of fire by creating foam.

Products which are on the market without specific end-use but intended to be component of various fire sealing or fire stopping constructions and assemblies e.g. fire doors, glazing systems, fire resistant shutters, dampers, cabinets, partition penetrations, specific pipe or cable penetration seals, etc. are dealt with under "Intended use 1 (IU 1)".

Intended use 1 (IU 1):

No specific end-use[1].

Intended use 1 can only be mentioned informatively in the ETA when the classification of fire resistance according to EN 13501-2 of the whole assembly is not declared in the ETA.

[1] For this situation the resistance to fire be demonstrated for one specific final use and cannot be assessed generally.

Some constructions consist only of intumescent materials assessable according to this EAD. For these constructions the resistance to fire shall be evaluated according to this EAD with reference to the specific intended uses listed in the following:

Intended use 2 (IU 2):

Pre-shaped intumescent products (simple geometrical shape) used to form or to form a part of a large gap seal with the following construction:

- **Intended use 2-1:**

  The seal consists of ashlar-formed intumescent blocks which were tightly fitted into a rectangular opening so that the opening is completely filled. The blocks are located within the opening in one layer as shown in Figure 1, but without any services passing through the opening.

- **Intended use 2-2:**

  The seal consists of one or two cylindrical intumescent plug(s) which is (are) tightly fitted into a round opening so that the opening is completely filled. The plugs are located within the opening as shown in Figure 2, but without any services passing through the opening.

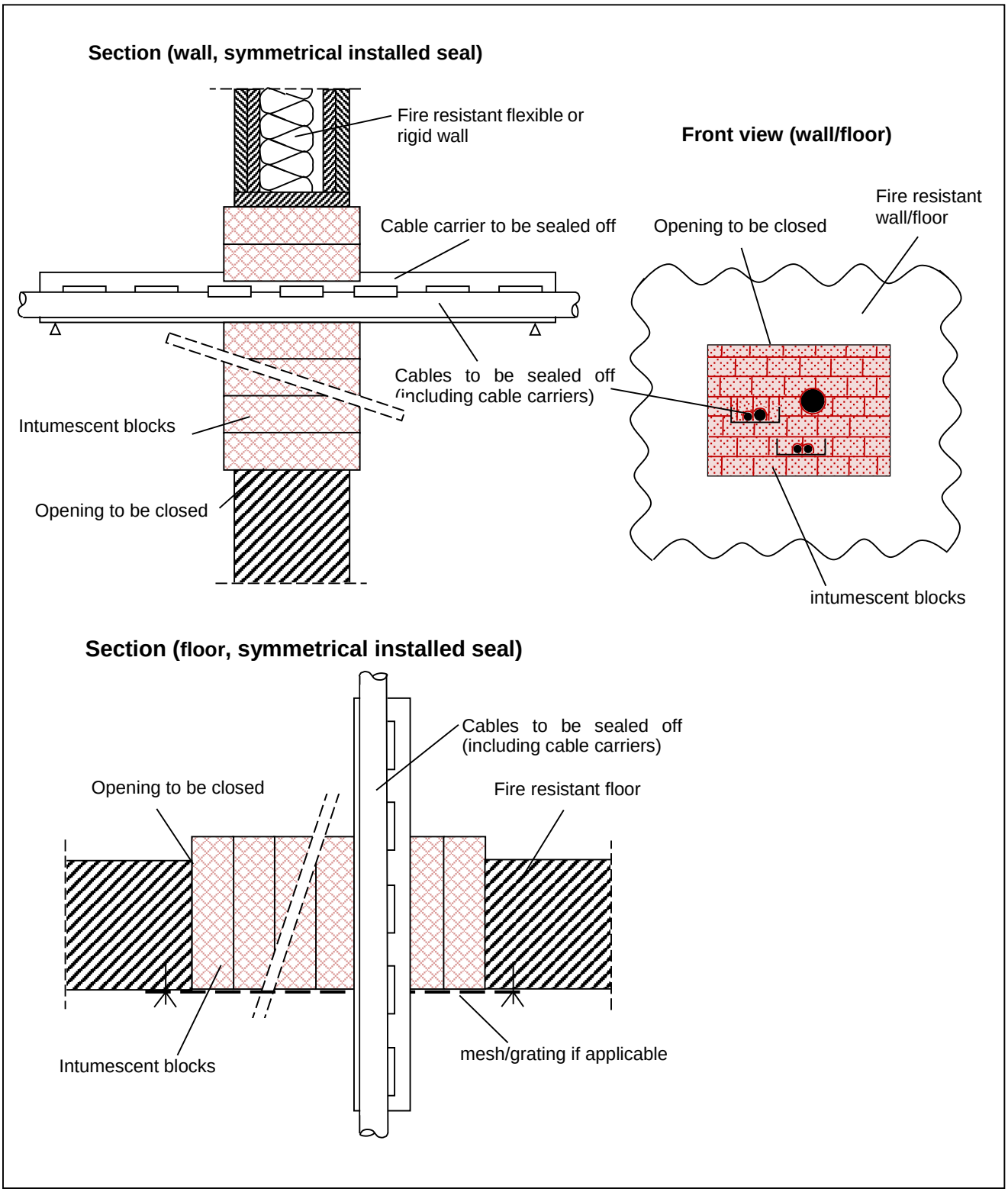
Intended use 3 (IU 3):

Pre-shaped intumescent products (simple geometrical shape) used to form or to form a part of a cable penetration seal with the following construction:

- **Intended use 3-1:**

  The seal consists of ashlar-formed intumescent blocks and/or parts of these blocks, which were tightly fitted into a rectangular opening to close all gaps between the reveals of the opening and the cables which penetrate the wall/floor. The blocks are located within the opening in one layer as shown in Figure 1. The maximum seal size is larger than 300 mm x 300 mm (see EN 1366-3).

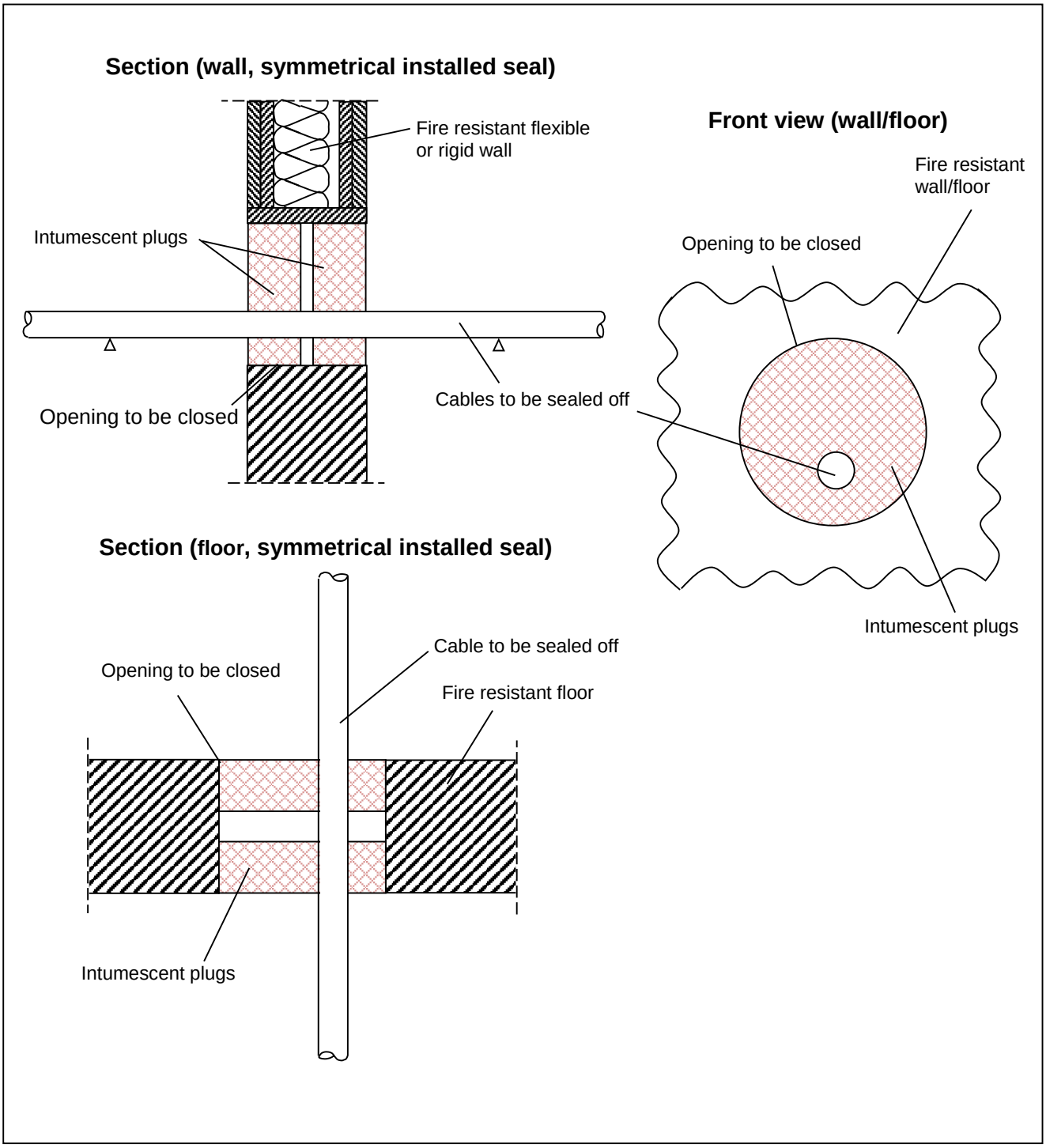
Figure 1: Cable penetration seal made of intumescent blocks - installation in walls/floors



- **Intended use 3-2:**

  The seal consists of one or two cylindrical intumescent plug(s) and/or parts of these plugs which are tightly fitted into a round opening to close all gaps between the reveal of the opening and the cables which penetrate the wall/floor. The plugs are located within the opening as shown in Figure 2. The maximum seal size is smaller than 430 mm in diameter (see EN 1366-3).

Figure 2: Cable penetration seal made of intumescent plugs - installation in walls/floors



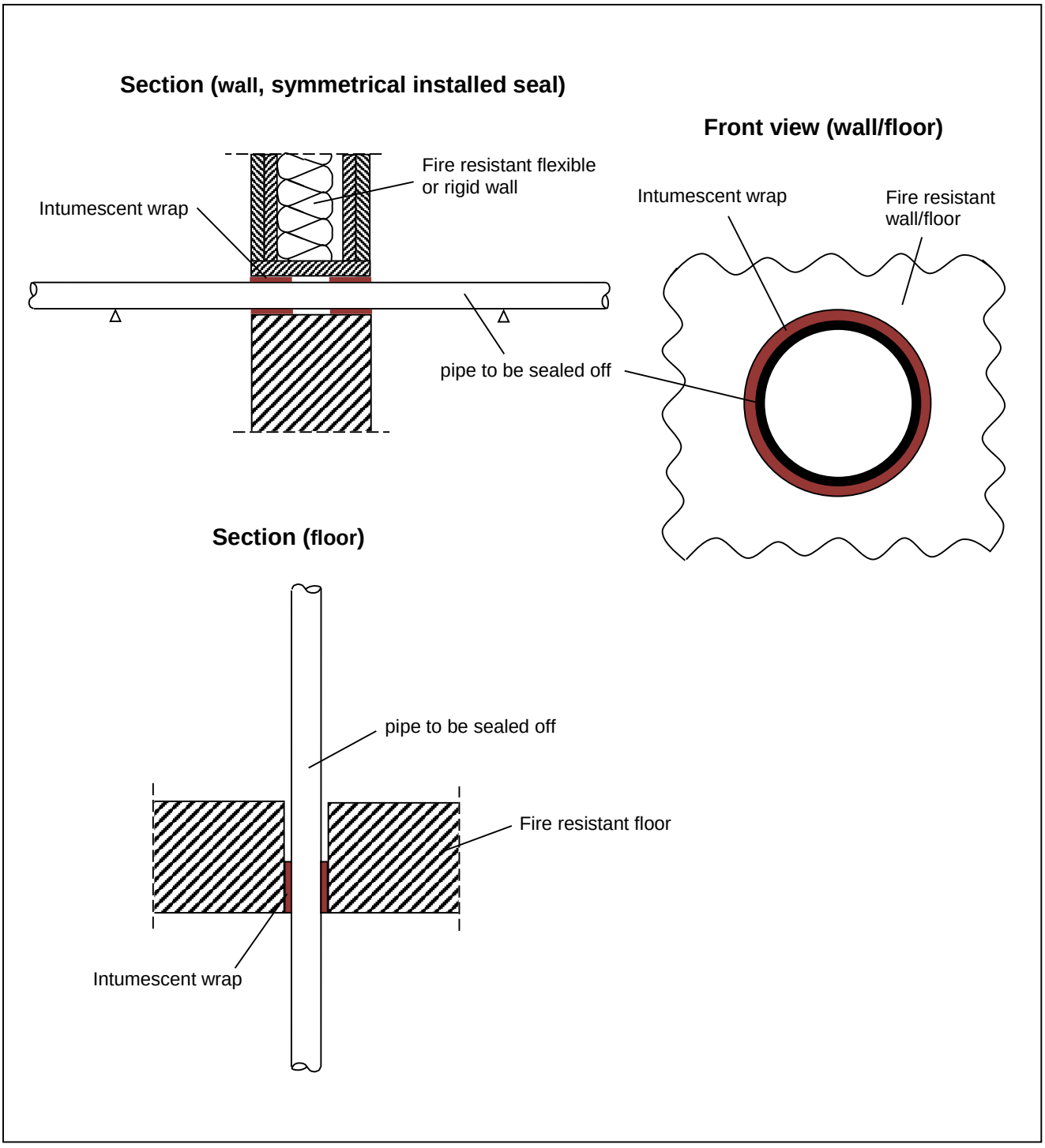
Intended use 4 (IU 4):

Intumescent mats or strips used to form or to form a part of a pipe penetration seal for plastic pipes with the following construction:

Intended use 4-1:

The seal consists of one or two intumescent mats or strips, which are wrapped around a plastic pipe in the position of a wall or floor penetration. The wraps are located within the opening as shown in Figure 3.

Figure 3: Pipe penetration seal made of intumescent wraps - installation in walls/floors



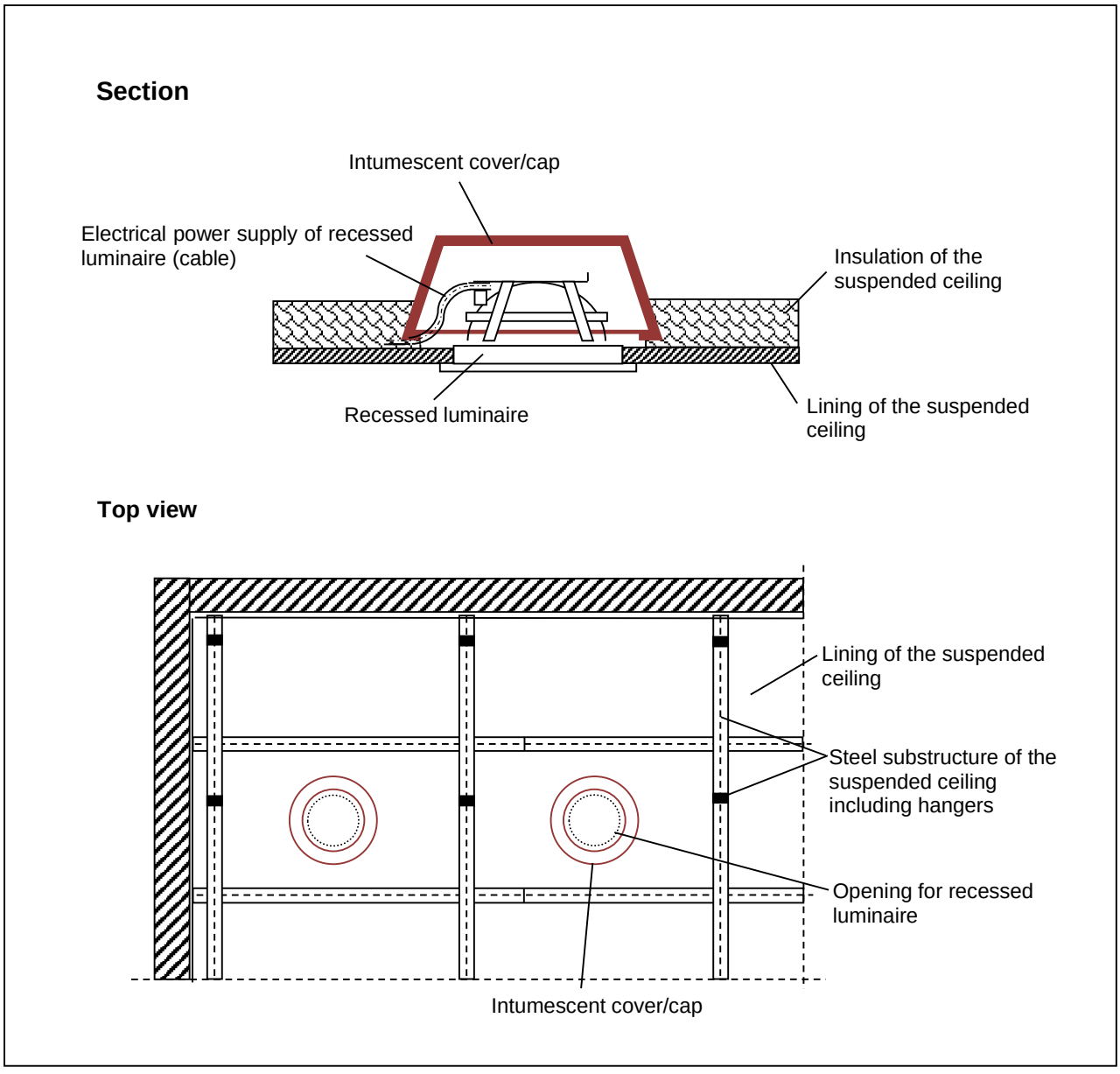
Intended use 5 (IU 5):

Pre-shaped intumescent products used to form or to form a part of a penetration seal for recessed luminaire in fire-resistant suspended ceilings with the following construction:

Intended use 5-1:

The seal consists of a shaped piece of an intumescent material, which is installed on the top of a suspended ceiling with metal substructure and insulation made from mineral wool in the position of a recessed luminaire. The intumescent cover/cap is installed as shown in Figure 4.

Figure 4: Penetration seal for recessed luminaire - installation in fire-resistant suspended ceilings



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 intumescent product for the intended use of 10 years when installed in the works. 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[2].

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.

The applicant shall define the conditions for application taking into account the climatic conditions of use as given in EOTA TR 024:

Type X intended for use at conditions exposed to weathering (rain, UV, frost)

Type Y_1 intended for use at temperatures below 0 °C with exposure to UV radiation but no exposure to rain (roofed out-door application)

Type Y_2 intended for use at temperatures below 0 °C but no exposure to rain nor UV (in-door application at changing humidity, temporary and permanent condensation)

Type Z_1 intended for use at internal conditions with high humidity (incl. temporary condensation) excluding temperatures below 0 °C

Type Z_2 intended for use at dry internal condition without frost (relative humidity between 50 % and 85 % and temperatures between +5 °C and 35 °C (± 5 °C)

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

1.3.1 Intumescent product

An intumescent product is a product made of or containing an intumescent material. It is supplied directly to the market to be used as an effective component of specific fire protective or fire sealing products or directly for permanent in-corporation into the works.

1.3.2 Intumescent material (EOTA TR 024, clause 2.5)

An intumescent material is a reactive material which expands, creating foam or char, when exposed to high temperatures in case of fire.

1.3.3 Expansion ratio (EOTA TR 024, clause 2.8)

The expansion ratio is the quotient of the thickness of an expanded sample/specimen of an intumescent material and the original thickness of the same sample/specimen before exposed to high temperature.

1.3.4 Expansion pressure (EOTA TR 024, clause 2.9)

The expansion pressure is the pressure exerted by an intumescent material as a result of intumescent activity.

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[2] 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. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the assumed working life.

1.3.5 Large gap seal

System used to maintain the fire resistance of a separating element at the position of an opening (not foreseen to accommodate services) having a length to width ratio less than 10:1.

1.3.6 Cable penetration seal

System used to maintain the fire resistance of a separating element at the position where cables (including cable carriers if relevant) pass through.

1.3.7 Pipe penetration seal

System used to maintain the fire resistance of a separating element at the position where pipes pass through.

1.3.8 Penetration seal for …

System used to maintain the fire resistance of a separating element at the position where specific services pass through or end devices (like drains or recessed luminaire) are built in.

1.3.9 "The assessment according to this EAD is only valid for the tested use scenario"

The assessment is only valid for the tested type and dimensions of the wall/floor, opening, seal components and services[3] and to the arrangement of the seal components and the services in the opening. Product names and manufacturers shall be given in the ETA for all seal components and services[3]**.**

1.3.10 "Fire resistance class of the tested assembly"

All measurements for the insulation criterion (with thermocouples according to EN 1366-3) and the integrity criterion (with gap gauge according to EN 1366-3) shall fulfil the requirements of the assessed resistance to fire classification according to EN 13501-2 for the tested seal. The assessed fire resistance period shall be equivalent to the period from the beginning of the test to the time when the first thermocouple installed to the test specimen reaches the 180 K temperature rise or, if applicable, the average temperature rise reaches the 140 K temperature rise or the first integrity failure occurs (even if related to a specific service).

Example: The thermocouple on one cable in a cable penetration seal exceeds the temperature rise of 180 K in the 70th minute. All other thermocouples had a temperature rise lower than 180 K up to the 96th minute. No integrity failure was observed. The resulting classification of the cable penetration seal as installed in the fire test is E 90, EI 60.

1.3.11 "Resulting fire resistance class of tested assemblies"

The minimum class from all tested specimens used to assess a seal with more intended (=assessed) use scenarios than tested, whereas for all specimens “only the fire resistance class of the tested assembly" (see 1.3.10) shall be used.

Example: For a cable penetration seal two specimens were tested. The one with services exceeds EI 90 and the blank seal exceeds EI 60. The resulting fire resistance class of the tested assemblies is EI 60.

1.3.12 Intended use

The Intended use describes the penetration seal type in which the product shall be integrated.

The intended use shall be defined by the specification of all penetration seal components, the design of preformed products (if any), the arrangement of the penetration seal components in the opening, on top of the separating element and/or on the services (examples: fixed on both sides or on one side of the

[3] If used in the fire test.

separating element; installation in the middle or flush with one side of the separating element; mineral fibre boards arranged in the middle of the separating element and application of the coating on both sides of the board layer; interrupted or sustained local (or continued) insulation of pipes …).

1.3.13 Intended use scenario

The intended use scenario(s) describe(s) the situation(s) on site for which the penetration seal incorporating the product according to this EAD is intended to be used.

The intended use scenario(s) shall be defined by the type, structure (including for example thickness of linings or density) and thickness of the separating element, the distance to other apertures or cast-in-components, the aperture form and size and the nature of the reveal, the type(s) of the service(s) which penetrate the wall or floor, the number and arrangement of the service(s) and the intended use of the pipework (if any). A change of this/these situation(s) may have influence on the performance of the penetration seal incorporating the product according to this ETA.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the intumescent product is assessed in relation to the essential characteristics with respect to the relevant intended use according to section 1.2.1.

Table 1 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 *(level, class, description)*
Basic Works Requirement 2: Safety in case of fire			
Intended use 1			
1	Reaction to fire	2.2.1	Class (according to EN 13501-1)
2	Resistance to fire[4]	standard test methods for example EN 1366-3, EN 1364-1, EN 1634-1	
Intended uses 2 to 5			
1	Reaction to fire	2.2.1	Class according to EN 13501-1
2	Resistance to fire	2.2.2	Class according to EN 13501-2

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 TR 024, version July 2009.

[4] This EAD defines principles of technical assessment for intumescent products, which are on the market without a specific final intended use but for fire sealing and fie stopping purposes in works. The resistance to fire essentially depends on the end-use. The intumescent product itself does not show a "fire resistance" but if it is used in a defined assembly (end-use), the assembly may be classified concerning "resistance to fire". So the resistance to fire only could be an example for a defined application.

For intumescent products no material properties can be defined which directly or indirectly (for example by using calculation methods) lead to a specific resistance to fire performance when they are installed in the works. Even for specific intended uses according to section 1.2 or use scenarios (in terms of "field of application", see section 1.3) no correlation is known.

For example: For a pipe wrap a high expansion pressure may be an advantage, whereas for a pipe collar it may happen that the collar tears out of the wall and cause a failure of the pipe closure device. It may also happen, that a specific composition of an intumescent material cause a failure in contrast to a variation of that material, because the material expands to fast (before the pipe melts) or to slow (the pipe melts faster which causes an integrity failure on the "cold side"). For another pipe material this may not happen because of another melting/decomposition behaviour of the pipe to be sealed off.

The products are normally developed and adapted to a specific end use (in terms of "field of application"/"use senarios"), taking into consideration some characteristics which have been found to give a rough indication of the behaviour in case of fire (see Annex A). For products without a specific end-use the expansion ratio and if relevant the expansion pressure are seen to be essential for their fire sealing and fire stopping effect and may be used to select specific uses.

Taking into account this situation a technical description is necessary to allocate every variation in formulation to a specific performance (see also Section 3.4). The intumescent product may be identified by a set of properties (see EOTA TR 024). The properties used for the technical description depend on the chemical nature and–the form of delivery. The product characteristics, methods of determination and assessment are laid down in Tables A1 to A3, depending on the product type/form of delivery (Annex A).

2.2.1 Reaction to fire

The intumescent material/product for fire sealing and fire stopping purposes 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.

Mounting and fixing procedure for reaction to fire tests see ANNEX B.

2.2.2 Resistance to fire

2.2.2.1 General

The part of the works or assembled system in which the intumescent product 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 the appropriate part of EN 13501.

To allow every member state to keep its safety level, the intended (=assessed) use scenarios for intended uses 2 to 5 shall be given with a reference to the assessment level defined in the following. Where no levels are specified in the ETA for the relevant intended use (see Sections 2.2.2.3 to 2.2.2.6) automatically level 5 applies (i.e. it has to be assumed that individual rules were used for the assessment). According to the definition of level 1 only one test specimen is used for the classification of the seal. For higher levels more than one test specimen may be used to assess the use scenarios, as given in the definition of the relevant level (see below). For these levels it is possible to assess a seal with more use scenarios than tested. To extent the field of application (the number of use scenarios) defined rules shall be used (see below). Using this rules it is assumed that for all defined installation conditions the requirements for the resulting fire resistance class are fulfilled.

Concept of levels:

Level 1:

The intended use is restricted to that what was tested (see 1.3.9). Only the fire resistance class of the tested assembly shall be given (see 1.3.10).

Level 2:

In addition to the use scenarios of Level 1 a defined set of rules for each intended use (see relevant Annex) may be used to extend the field of application (the number of use scenarios). The rules of level 2 are defined in a way that no individual judgement is necessary. The rules apply directly for the given type of seal

(example: When tested in a rigid wall with a density of 650 kg/m³, the result is also valid for rigid walls with a higher density.).

Level 3:

In addition to Level 2 the results from additional test specimens according to EN 1366-3 may be used for the assessment. All rules regarding extension of test results of EN 1366-3 may be used. The version of EN 1366-3 used for the assessment shall be given together with the classification.

Level 4:

In addition to Level 3 the results from additional test specimens according to EN 1366-3 may be used for the assessment. All rules regarding extension of test results of the current EXAP standard may be used. The version of the EXAP standard used for the assessment shall be given together with the classification.

Level 5:

In addition to Level 4 additional test evidence may be used for the assessment of the use scenarios for the intumescent product. The evidence and the rules shall be given in the evaluation report.

Limits of the assessment

The evaluation does not address any risks associated with the emission of dangerous liquids or gases caused by failure of the pipe(s) in case of fire nor does it prove the prevention of the transmission of fire through heat transfer via the medium in the pipes.

The evaluation does not verify the prevention of destruction of adjacent building elements with fire separating function or of the pipes themselves due to distortion forces caused by extreme temperatures. These risks shall be accounted for by taking appropriate measures when designing or installing the pipe work.

The risk of downward spread of fire (for example caused by burning material which drips through a pipe to floors below) is not considered in this evaluation (see EN 1366-3).

When evaluating resistance to fire of a penetration seal it is assumed that

- the installation of the penetration seal does not affect the stability of the adjacent building elements – even in case of fire,
- the installations are fixed to the adjacent building elements (not to the seal) in accordance with the relevant regulations in such a way that, in case of fire, no additional mechanical load is imposed on the seal,
- the support of the installations is maintained for the classification period required and
- pneumatic dispatch systems, compressed air systems, etc. are switched off by additional means in case of fire (only relevant when pipes close in case of fire, for example plastic pipes with pipe closures).

2.2.2.2 Intended use 1 – no specific end use

For intumescent products without a defined specific end-use (IU 1) it is sufficient to present any fire resistance test for an assembly where the product is used. The ETA for the intumescent product shall not contain a statement on the resistance to fire.

2.2.2.3 Intended use 2 – large gap seal

The large gap seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219) with the modifications given in Annex A.

The intended use is restricted to that what was tested (see 1.3.9). Only the fire resistance class of the tested assembly shall be given (see 1.3.10).

2.2.2.4 Intended use 3 – cable penetration seals

The cable penetration seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219) with the specifications given in

- Annex B for intended use 3.1 – Cable penetration seal made of Blocks
- Annex C for intended use 3.2 – Cable penetration seal made of Plugs

The rules to define use scenarios for level 2 are given in the relevant Annex (Annex B or C).

2.2.2.5 Intended use 4 – pipe penetration seals for plastic pipes

The pipe penetration seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219) with the specifications given in Annex D.

The rules to define use scenarios for level 2 are given in Annex D.

2.2.2.6 Intended use 5 – penetration seals for recessed luminaire

The pipe penetration seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219) with the modifications given in Annex E.

The rules to define use scenarios for level 2 are given in Annex E.

2.2.2.7 Aspects of durability

To simulate a working life of the intumescent fire sealing and fire stopping product for the intended use of 10 years when installed in the works the intumescent product shall be tested in accordance with the TR 024, version July 2009 taking into account the intended final use conditions according to section 1.2.2.

The durability assessment does not take account of the possible effect on a penetration seal of substances permeating through pipe walls.

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

The system is: **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 2.

Table 2 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Raw material/constituents - Checking of conformity with the ordered quality	3.4.1		depends on the ordered quantity	Every lot delivered
2	Product - Density	3.4.2	density	3	Every production lot

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
3	Product - Loss of mass at a certain temperature / ash content	3.4.3	Percentage of mass loss	3	Every production lot
4	Product - Ability of a sample to create foam at a certain temperature	3.4.4	Expansion ratio	6	Every production lot
5	Product - Development of expansion pressure[5] during foaming	3.4.5	Expansion pressure	10	Every production lot

[5] if relevant (There are products not developing significant expansion pressure. For those products the criterion is not relevant)

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 intumescent products are laid down in Table 3.

Table 3 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	Raw material/constituents - Checking of conformity with the ordered quality	check			
2	Product - Density	3.4.2	documentation		
3	Product - Loss of mass at a certain temperature / ash content	3.4.3	Percentage of mass loss after exposure		
4	Product - Ability of a sample to create foam at a certain temperature	3.4.4	description in the ETA		
5	Product - Development of expansion pressure[5] during foaming	3.4.5	description in the ETA		
Continuous surveillance, assessment and evaluation of factory production control					
1	Product - Density	3.4.2	description in the ETA	3	2/a
2	Product - Loss of mass at a certain temperature / ash content	3.4.3	description in the ETA	3	2/a
3	Product - Ability of a sample to create foam at a certain temperature	3.4.4	description in the ETA	6	2/a
4	Product - Development of expansion pressure[5] during foaming	3.4.5	description in the ETA	10	2/a

3.4 Special methods of control and testing used for the AVCP procedure

The assessment regarding resistance to fire of a penetration seal incorporating the product (see section 1.1 for products and section 1.2.2, IU 2 to IU 5 for the intended penetration seals) is very expensive (time and costs). Therefore the constancy of performance regarding resistance to fire may not directly be verified by large scale fire tests. Instead, the characterization/identification tests given in Annex A can be used to verify that the product to be examined is identical in shape/composition to the one installed in the large scale fire test(s) according to EN 1366-3 (see section 2.2) and therefore the performance regarding resistance to fire can be assumed to be as demonstrated in this/these tests.

3.4.1 Checking raw materials

The procedure shall be agreed between the notified body and the manufacturer and shall include defined characteristics of the materials/constituents.

3.4.2 Density

EOTA TR 024, clause 3.1.4

3.4.3 Loss of mass at a certain temperature / ash content

EN ISO 3451-1 (see EOTA TR 024)

3.4.4 Ability of a sample to create foam at a certain temperature

EOTA TR 024, clause 3.1.11

3.4.5 Development of expansion pressure[5] during foaming

EOTA TR 024, clause 3.1.12

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.

Technical Documents

EOTA Technical Report 024:

Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products, July 2009

EOTA Technical Report 034:

General BWR 3 Checklist for EADs/ETAs – Content and/or release of dangerous substances in products/kits

Standards

EN 1363-1	Fire resistance tests - Part 1: General Requirements
EN 1366-3	Fire resistance tests for service installations – Part 3: Penetration seals
EN 13501	Classification of construction products and building elements; Part 1+A1:2009: Classification using test data from reaction to fire tests Part 2: Classification using data fire resistance test, excluding ventilation services
EN 12092:2002-02	Adhesives – Determination of viscosity
EN 13820:2003-12	Thermal insulating materials for building applications – Determination of organic content
EN ISO 2811:2011-06	Paints and varnishes - Determination of density; Part 1: Pyknometer method
EN ISO 3219:1994-10	Plastics - Polymers/resins in the liquid state or as emulsion or dispersion- Determination of viscosity using a rotational viscosimeter with defined shear rate
EN ISO 3251:2008-06	Paints, varnishes and plastics - Determination of non-volatile matter content
EN ISO 3451:2008	Plastics - Determination of ash content; Part 1: General methods

ANNEX A – TECHNICAL DESCRIPTION OF THE CONSTRUCTION PRODUCT

The intumescent products may be described technically by their properties (see EOTA TR 024). The properties used for such characterization purpose depend on the chemical nature and the form of delivery.

For products without a specific end-use the expansion ratio and if relevant the expansion pressure are essential for their fire sealing and fire stopping effect and may be used for targeted selection for specific uses. Combined with aspects like density/viscosity and loss of mass at a certain temperature or the content of volatile components a clear characterization is possible.

The "fingerprint" described in TR 024 takes into account the chemical composition and should be used for a qualitative description independent of the form of delivery

A.1 Means of characterization

The product which is the subject of a European Technical Assessment issued based on this EAD has been identified for the purposes of this assessment on the basis of:

- Testing of product characteristics as laid down in 3.2.2,
- Fingerprinting,
- Formulation,
- Manufacturing process parameters,
- detailing, drawings (except for intended use 1).

This characterisation can also be used for AVPC.

A.2 Technical characteristics which are relevant for describing the product

The product characteristics, methods of determination and criteria used for checking the product identity are laid down in Tables A1 to A3, depending on the product type/form of delivery.

Table A1: boards, blocks, plugs, mats, strips, profiles, pads, cuts, coated fabrics, coated mesh, pre-fabricated elements

No	Product characteristic	Determination method	Criteria for product identity
1a	appearance	visual	Product description (colour/shape/dimensions etc.)
1b	Dimensions/thickness(es)/shape	calliper gauge	Thickness or dimensions/ drawings if relevant
2	Mass per unit area	EOTA TR 024 clause 3.1.5	Mass per unit area
3	Loss of mass at a certain temperature / ash content	EN ISO 3451-1 or the standard applied at a certain temperature (see EOTA TR 024)	Percentage of mass loss after exposure
4	Ability to create foam at high temperature	EOTA TR 024 clause 3.1.11	Expansion ratio*)
5	Development of expansion pressure during foaming[5]	EOTA TR 024 clause 3.1.12	Expansion pressure*)
6	Fingerprint	EOTA TR 024 clause 3.1.9	Specific diagram (TG/TGA; IR spectroscopy etc)
*) This characteristic is also related to the Basic Works Requirements (BWR 2)			

Table A2: coatings, putties, mastics

No	Product characteristic	Determination method	Criteria for product identity
1	viscosity	EN ISO 3219; EN 12092	viscosity
2	density	ISO 2811	density
3	Loss of mass at a certain temperature / ash content	EN ISO 3451-1 or the standard applied at a certain temperature (see EOTA TR 024)	Percentage of mass loss after exposure
4	Content of non-volatile components	EN ISO 3251, EN 13820	Percentage of volatile matter
5	Ability of an applied layer to create foam at high temperature	EOTA TR 024 clause 3.1.11	Expansion ratio*)
6	Development of expansion pressure during foaming[5]	EOTA TR 024 clause 3.1.12	Expansion pressure*)
7	Fingerprint of dry layer	EOTA TR 024 clause 3.1.9	Specific diagram (TG/TGA; IR spectroscopy etc)
*) This characteristic is also related to the Basic Works Requirements (BWR 2)			

Table A3: granules

No	Product characteristic	Determination method	Criteria for product identity
1	appearance	visual	Product description in the ETA (colour/particle shape etc.)
2	Particle size distribution	EN 1015-1 or other method (see EOTA TR 024 clause 3.1.6	Particle size distribution
3	Loss of mass at a certain temperature / ash content	EN ISO 3451-1 or the standard applied at a certain temperature (see EOTA TR 024)	Percentage of mass loss after exposure
4	Content of non-volatile components	EN ISO 3251, EN 13820	Percentage of volatile matter
5	Ability of a applied layer to create foam at high temperature	EOTA TR 024 clause 3.1.11	Expansion ratio*)
6	Development of expansion pressure during foaming[5]	EOTA TR 024 clause 3.1.12	Expansion pressure*)
7	Fingerprint of dry layer	EOTA TR 024 clause 3.1.9	Specific diagram (TG/TGA; IR spectroscopy etc)
*) This characteristic is also related to the Basic Works Requirements (BWR 2)			

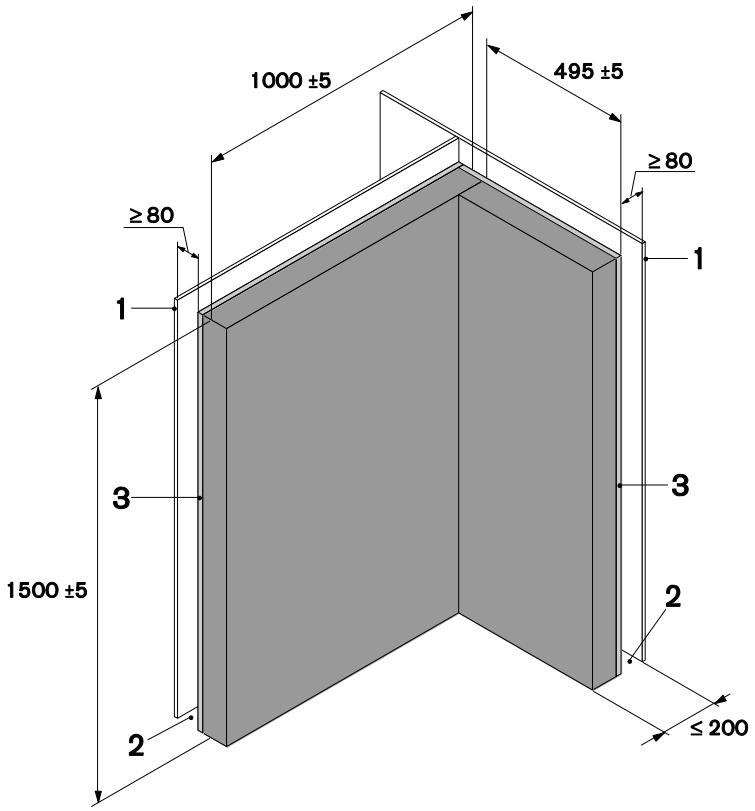
ANNEX B – MOUNTING AND FIXING PROCEDURES FOR REACTION OT FIRE TESTS

B.1 Tests according to EN 13823 (SBI)

The intended maximum thickness of the flexible intumescent fire sealing product shall be tested. The flexible intumescent fire sealing product with a self-adhesive plastic tape and/or a lamination made of coloured plastic (e.g. PVC, melamine resin) foil or of Aluminium foil shall be tested in end use conditions. Regarding the size of the specimen the standard configuration shown in Figure B.1 is used[6].

Where no lateral spread of flame is expected, outside the area on the long wing covered by the specimen, the configuration shown in Figure B.2 can be used alternatively. When in a test using the configuration according to B.2, lateral spread of flame outside this area is observed the test shall be repeated using the standard configuration according to B.1.

The long wing of specimens that are built from a high number of relatively small parts (e.g. strips or pads) can be mechanically stabilized by fixing them on the backside to a cross-type frame made of steel as shown in figure B.3.

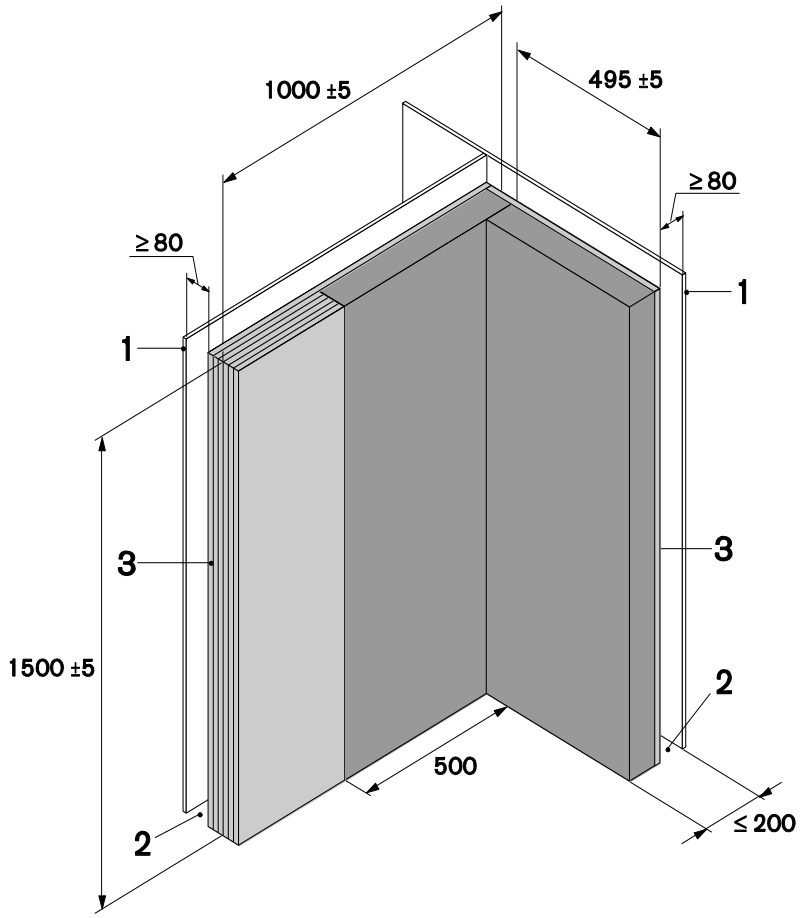


Key

	Specimen area
1	Backing boards
2	Air gap
3	Supporting board

[6] The size of the test specimen was chosen considering the fact that even if the size of a single opening is restricted in the ETA because of other reasons, e.g. the resistance to fire performance, it will always be possible to install several penetration seals in a single wall or floor in close proximity. Results of indicative tests with commonly used product types have shown that the full height of the test specimen must be used to get a reliable result.

Figure B.1 – Standard configuration



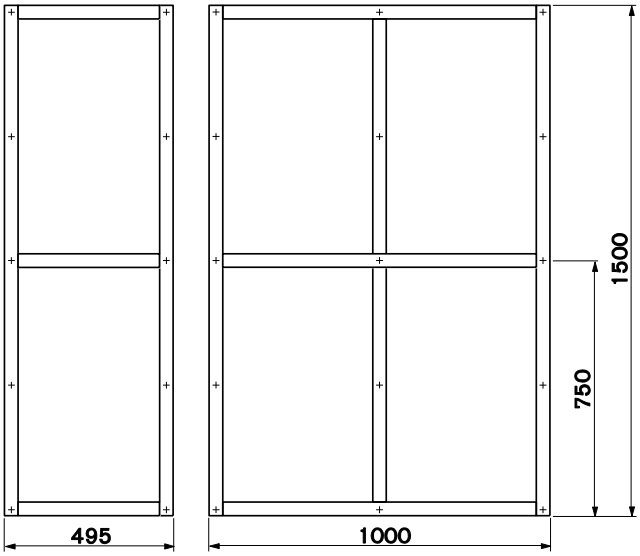
Key

	Specimen area
	Calcium silicate board
1	Backing boards
2	Air gap
3	Supporting board

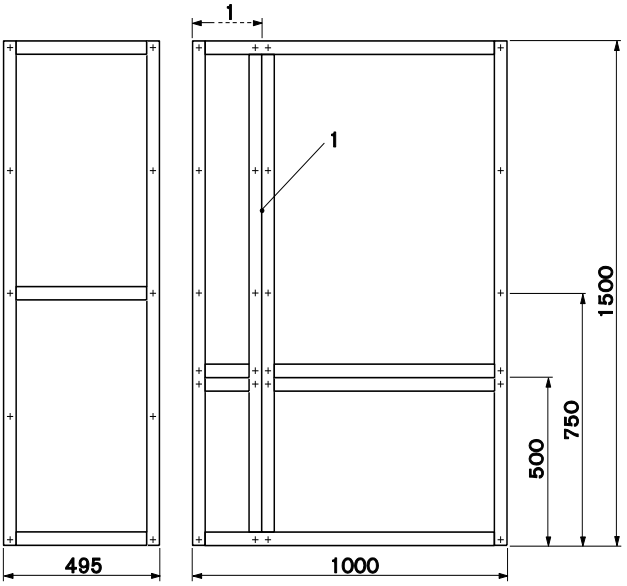
Figure B.2 – Extended standard configuration

When using the configuration according to Figure B.2 the part of the wing that is not covered by the test material shall be made of Calcium Silicate board.

A



B



Key

A	Frame for specimens without joints
B	Frame for specimens with joints
1	Position of the vertical joint[7]

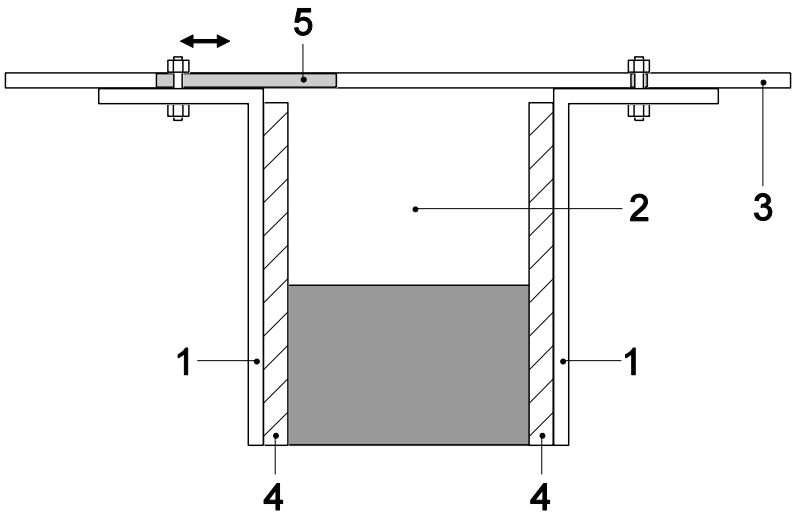
Figure B.3 Cross-type frame on the back of the long wing

[7] The position of the vertical joint and the related frame depends on the thickness of the specimen as the overall length of the long wing is defined with (1000 ± 5) mm and the position of the joint at 200 mm from the corner line when the wings are mounted ready for testing

B.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 the applied flexible intumescent fire sealing product. The faces are made from steel angles and calcium silicate boards.
- The flexible intumescent fire sealing product shall have the intended maximum nominal width applied for, subject to maximum 90 mm. The product is tested without any backfilling material/backer rod. The smallest thickness applied for shall be used, When the thickness is smaller than 10 mm a backing board shall be used, preferably made of 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;



Key

	Specimen
1	Steel angle
2	Air gap
3	Base plate
4	Optional Calcium silicate or fiber cement board
5	Slot to allow adjustment to different specimen width

Figure B.4 – Example for a test setup for the small burner test

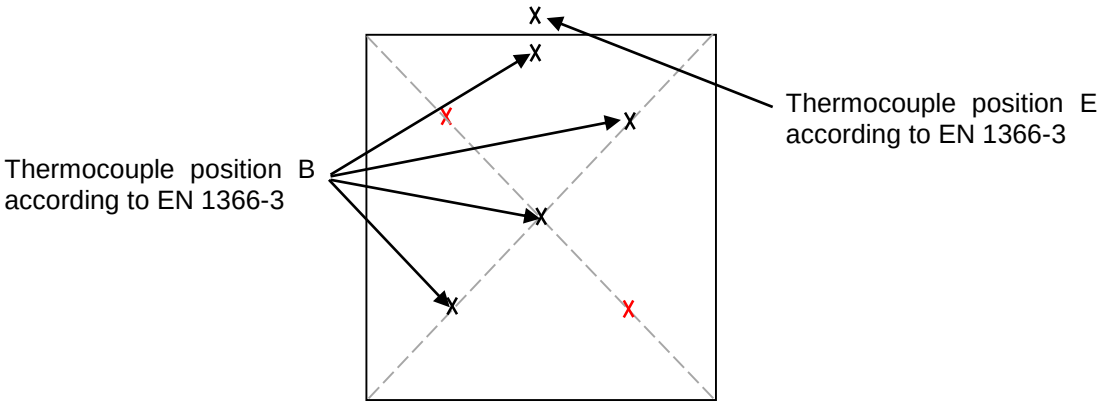
ANNEX C – LARGE GAP SEALS

The intended use scenarios (see section 1.3.13) shall be clearly specified by the manufacturer in order to allow the TAB to decide if the EAD needs to be enlarged or if a new EAD is necessary. The intended (=assessed) use scenario(s) shall be given in the ETA.

Intended use 2-1:

The large gap seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219) with the following modification: Only a blank seal according to prEN 1366-3 shall be used in the test. In addition to the thermocouples defined in prEN 1366-3 the following thermocouples shall be installed on the surface of the seal outside the furnace:

Fig. C.1

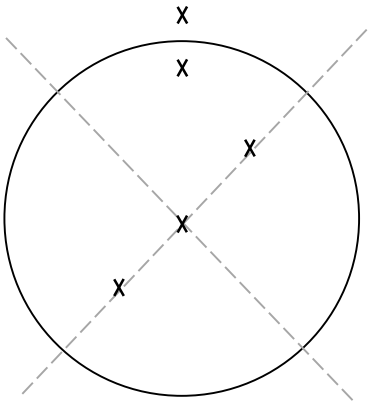


Intended use 2-2:

The large gap seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219) with the following modification:

Only a blank seal according to prEN 1366-3 shall be used in the test. The thermocouples shall be applied as given in EN 1366-3:

Fig. C.2



ANNEX D – CABLE PENETRATION SEAL MADE OF BLOCKS

For large cable penetration seals according to EN 1366-3 (maximum seal size ≥ 300 mm x 300 mm) in addition to Level 1 a blank seal (if relevant) may be used for the assessment. Only the resulting fire resistance class (resulting class = minimum class from class of blank seal (if this has to be tested) and class of seal with services whereas for all specimens “only the fire resistance class of the tested assembly shall be used”) of the tested assembly/assemblies shall be given.

- For symmetrical/symmetrical installed cable penetration seals:

  Only results from one or two test specimen (seal with standard configuration according to EN 1366-3 and – if relevant – a blank seal) shall be used for the assessment. The only difference between the blank seal and the seal with services shall be the presence/absence of installed services.
- For unsymmetrical/unsymmetrical installed cable penetration seals:

  Only results from two test specimens (seals with standard configuration according to EN 1366-3) shall be used for the assessment. The only difference between these specimens shall be the position of the seal/seal component which is not symmetrical.

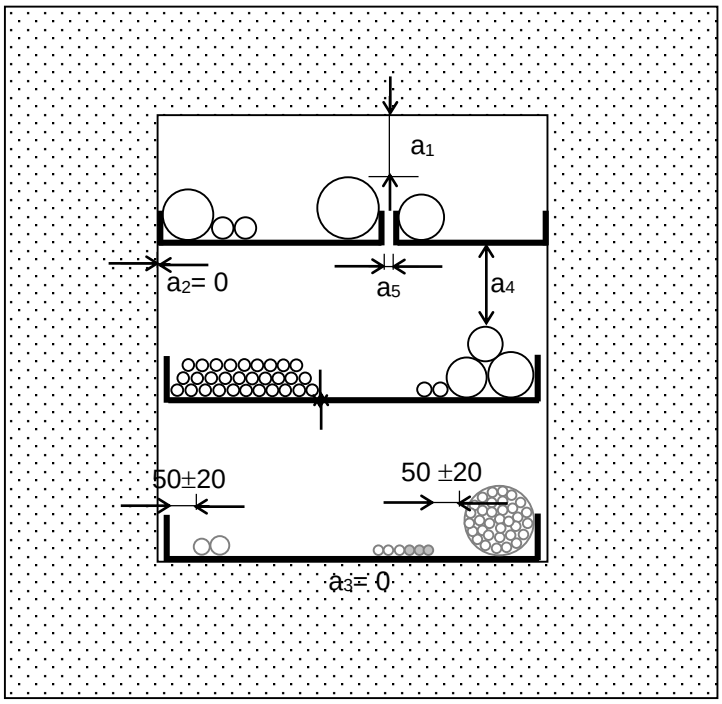
  If a blank seal has to be tested (see EN 1366-3) two test specimens shall be used for the assessment in addition. The only difference between the blank seals and the seals with services shall be the presence/absence of installed services.

  Only the resulting fire resistance class of the tested assemblies shall be given (if relevant, resulting class = minimum class from class of blank seal in one installation situation, class of blank seal in the other installation situation, class of seal with services in one installation situation and seal with services in the other installation situation whereas for all specimens “only the fire resistance class of the tested assembly shall be used”).

The cable penetrations seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219). The intended use scenarios (see section 1.3.13) shall be clearly specified by the manufacturer in order to allow the TAB to decide if the EAD needs to be enlarged or if a new EAD is necessary. The intended (=assessed) use scenario(s) shall be given in the ETA.

One of the standard configurations according to EN 1366-3 (with cable groups 1 to 3, cable groups 1 and 2 or only cable group 1 – each with or without optional cables/tubes) shall be used in the fire test. The standard configurations – depending on the type and dimensions of the services which should be sealed off by the cable penetration seal – are:

Fig D.1 Standard configuration level 2 – cables up to 80 mm diameter



Cable groups 1 to 3 – with or without optional cables/tubes (grey)

Cable types see EN 1366-3

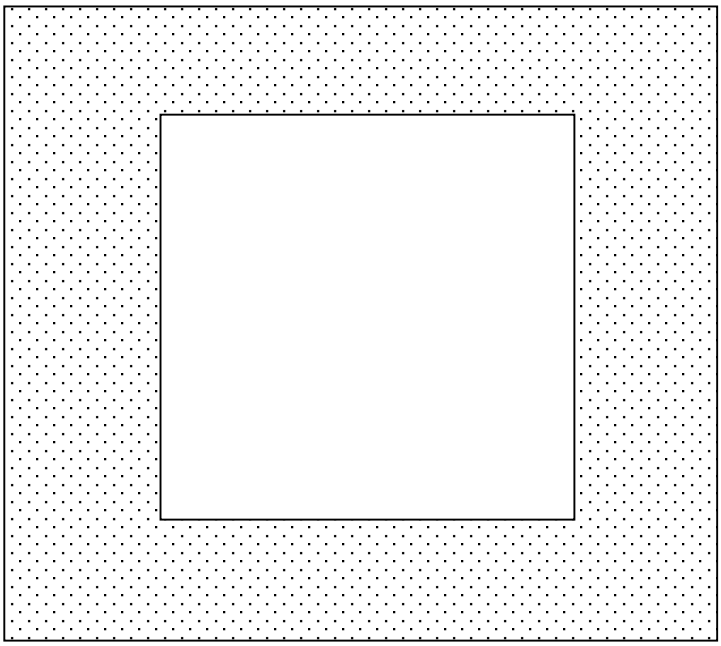
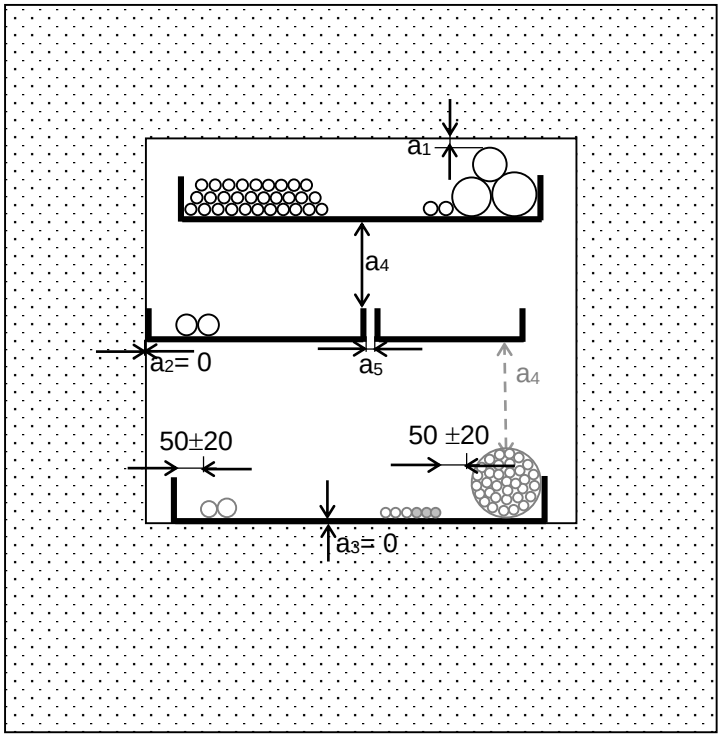


Fig D.2 Standard configuration level 2 – cables up to 50 mm diameter



Cable groups 1 and 2 – with or without optional cables/tubes (grey)

If this distance is smaller than the a_4-distance indicated with ⟷, use the distance for the distance between cable layers

Cable types see EN 1366-3

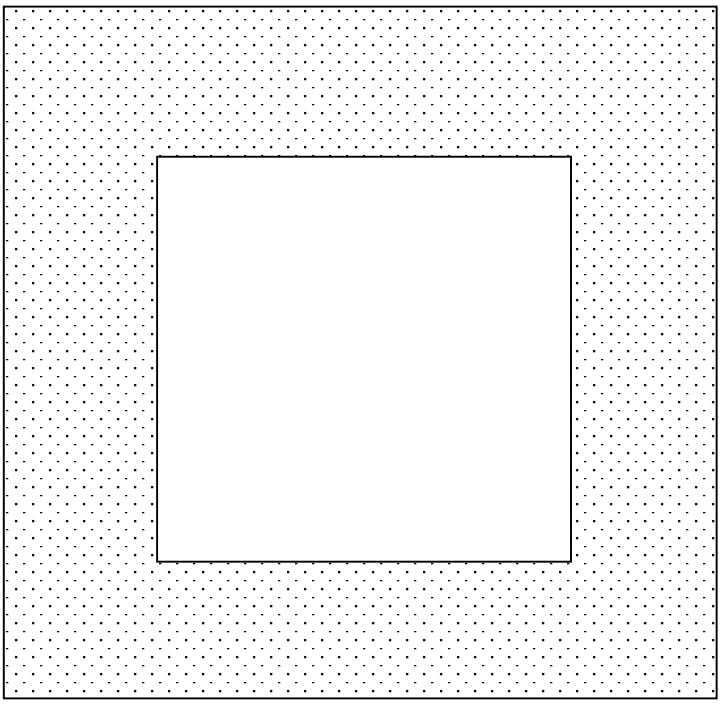
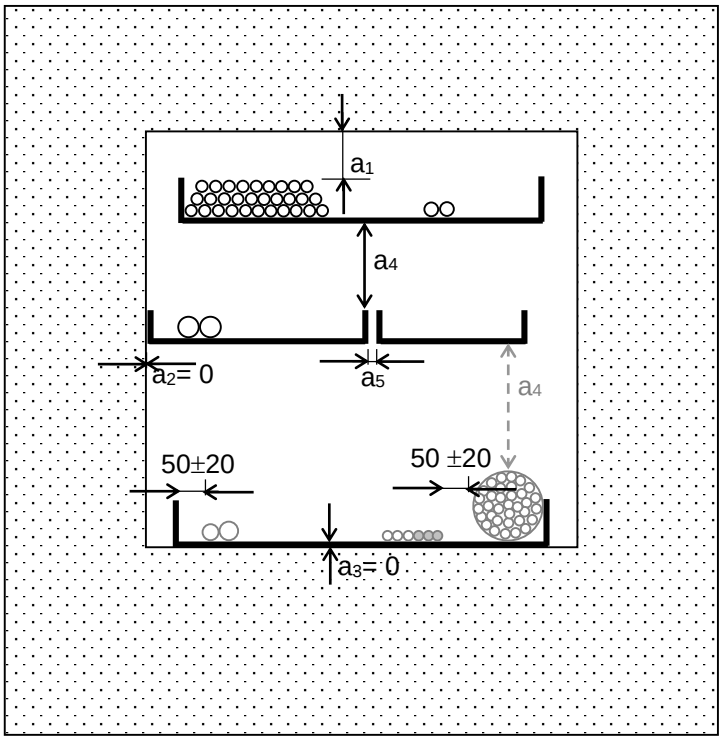


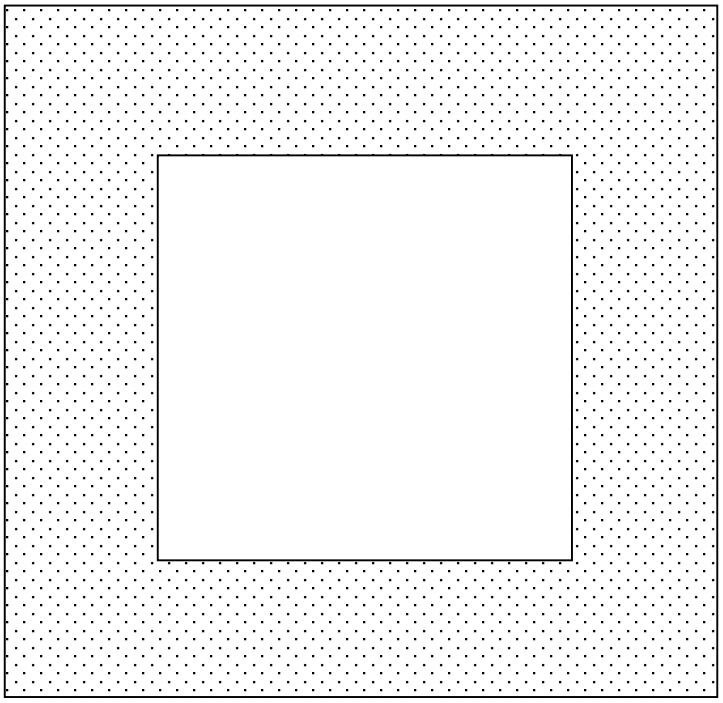
Fig D.3 Standard configuration level 2 – cables up to 20 mm diameter



Cable group 1 – with or without optional cables/tubes (grey)

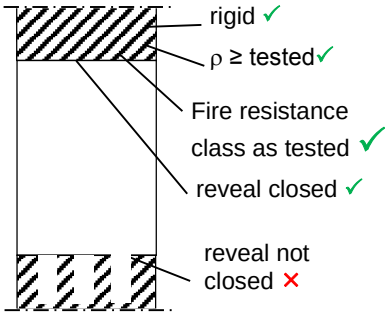
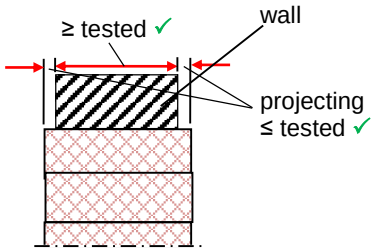
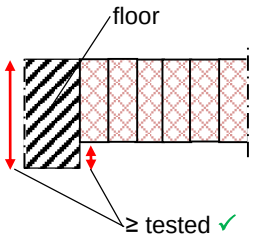
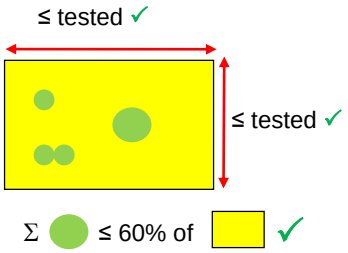
If this distance is smaller than the a_4-distance indicated with ⟷, use the distance for the distance between cable layers

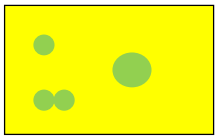
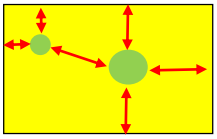
Cable types see EN 1366-3



The rules given in table D.1 may be used for the assessment of symmetrical/symmetrical installed cable penetration seals for level 2.

Table D.1 Level-2-rules for the assessment of symmetrical/symmetrical installed seals

Changes with respect to the tested assembly/assemblies	Assessment of the changes	to check on site
Wall/floor		
Type of wall/floor for rigid elements	May be changed as long as - the density is equal to or larger than that tested - the reveal of the opening is closed (no cavities) - the fire resistance classification of the element is equivalent to the nominal class given in EN 1366-3 for the tested wall/floor	
Thickness of rigid wall	May be larger than tested as long as - the requirements for the position of the blocks in the wall are fulfilled	
Thickness of floor	May be larger than tested as long as - the requirements for the position of the blocks in the floor are fulfilled	
Opening in the wall/floor		
Size of the opening if standard configuration according to EN 1366-3 was used in the test	The width and/or the length of the opening may be smaller than tested as long as - the distance requirements can be fulfilled - the total cross section of the installations (for example cables, cable carriers) is not more than 60% of the opening size	

Services/installations		
Type, dimensions and number of services	The type and number of cables may be different to those tested as long as - the cable diameter is equal to or lower than that given in Annex A.3.3 of EN 1366-3 for the tested cable group - the total cross section of the installations (for example cables, cable carriers) is ≤ 60% of the opening size - type as given in EN 1366-3, Annex A.3.2	 Σ ● ≤ 60% of ▭ ✓ ⌀ ≤ given in EN 1366-3 for the tested cable group ✓ ● ≙ Type given in EN 1366-3 for the tested cable group ✓
Arrangement of the services in the opening	The arrangement of the services may be different to those tested as long as - all distances between services and between services and aperture edges are larger than the corresponding distance a_1 to a_5 as tested	 ↔ ≥ tested ✓ a_1 = distance between services and upper aperture edge a_2 = distance between services and aperture edge on side a_3 = distance between services and lower aperture edge a_4 = distance between cable layers a_5 = distance between cable carriers in one layer (distance between cables = 0)
Products/Components		
Dimensions of the blocks	Length of the blocks (= thickness of the seal) may be larger than that tested Thickness and height of the blocks may be different to those tested (the blocks have to be cut into size to fit between the reveal of the opening/ the cables.)	

ANNEX E – CABLE PENETRATION SEAL MADE OF PLUGS

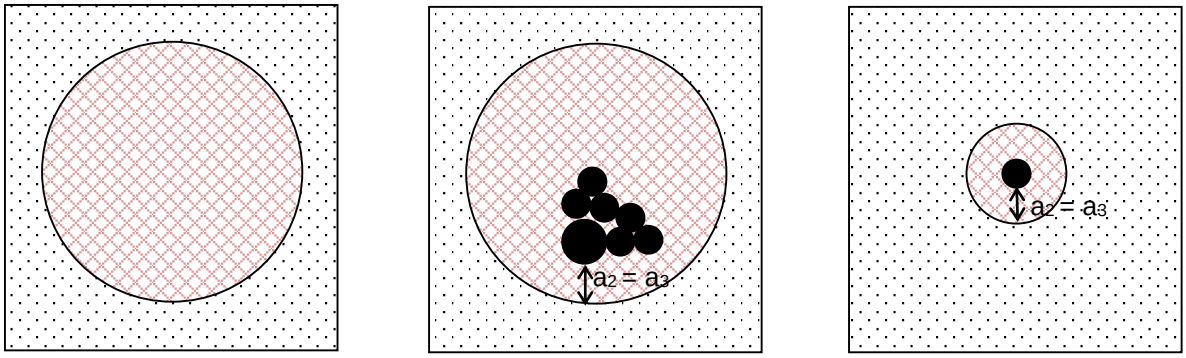
For small cable penetration seals according to EN 1366-3 (maximum seal size < 300 mm x 300 mm) a set of standard specimen shall be used for the assessment (see below). Only the resulting fire resistance class of the tested assemblies shall be given (see 1.3.11). For symmetrical/unsymmetrical seals the rules given in Annex B apply accordingly.

The cable penetrations seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219). The intended use scenarios (see section 1.3.13) shall be clearly specified by the manufacturer in order to allow the TAB to decide if the EAD needs to be enlarged or if a new EAD is necessary. The intended (=assessed) use scenario(s) shall be given in the ETA.

The standard configurations according to EN 1366-3 shall be used in the fire test. The standard configurations – depending on the type and dimensions of the services which should be sealed off by the cable penetration seal – are:

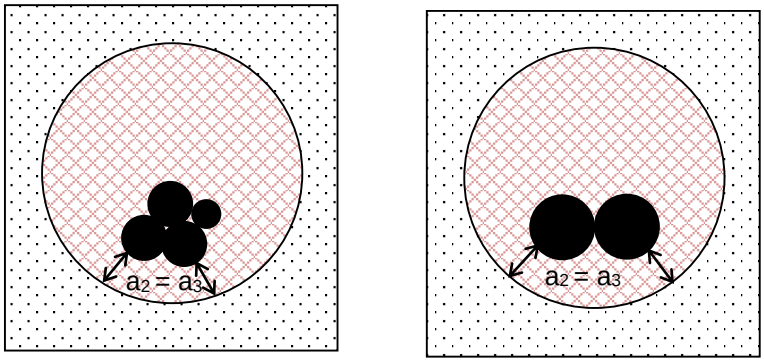
Fig E.1 Standard configuration level 2 consisting of 3 to 7 test specimens

3 specimens for all cable groups according to EN 1366-3



In addition for cable group 2 and 3 according to EN 1366-3

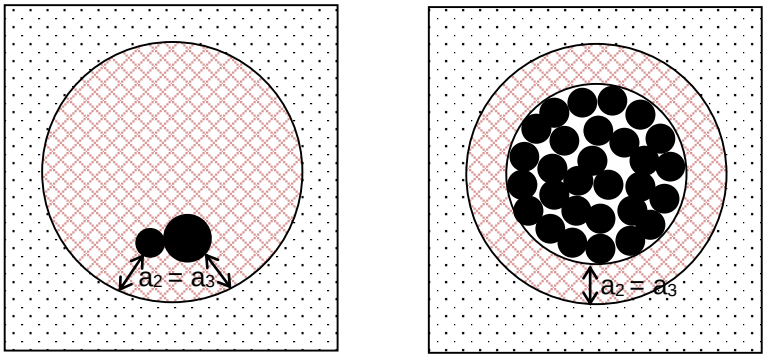
In addition for cable group 3 according to EN 1366-3



Cable types see EN 1366-3

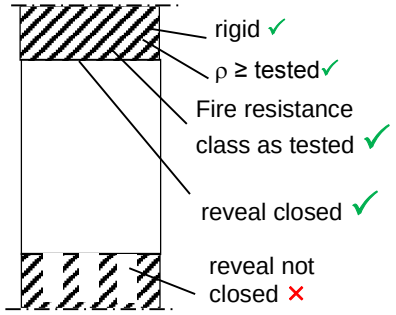
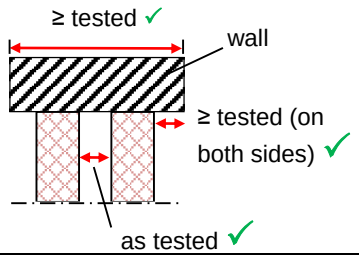
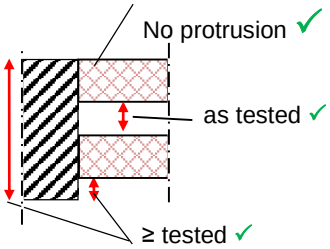
a_2 = a_3 = distance from cables to seal edges ≥ 0 (according to manufacturers choice)

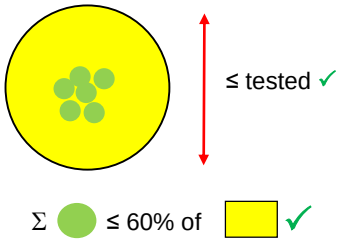
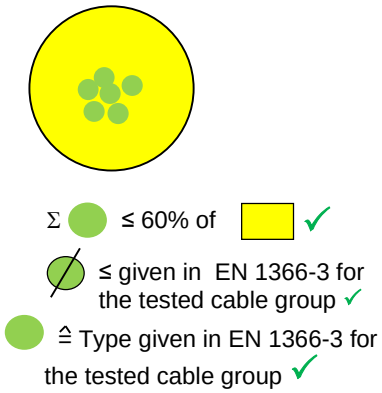
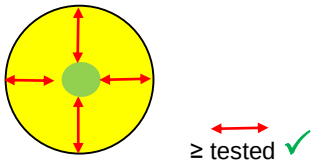
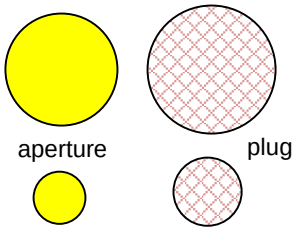
In addition for optional cables according to EN 1366-3



The rules given in table E.1 may be used for the assessment of symmetrical/symmetrical installed pipe penetration seals for level 2.

Table E.1 Level-2-rules for the assessment of symmetrical/symmetrical installed seals

Changes with respect to the tested assembly/assemblies	Assessment of the changes	to check on site
Wall/floor		
Type of wall/floor for rigid elements	May be changed as long as - the density is equal to or larger than that tested - the reveal of the opening is closed (no cavities) - the fire resistance classification of the element is equivalent to the nominal class given in EN 1366-3 for the tested wall/floor	
Thickness of rigid wall	May be larger than tested as long as - the requirements for the position of the plugs in the wall are fulfilled - the distance between two plugs is as tested	
Thickness of floor	May be larger than tested as long as - the requirements for the position of the plugs in the floor are fulfilled	

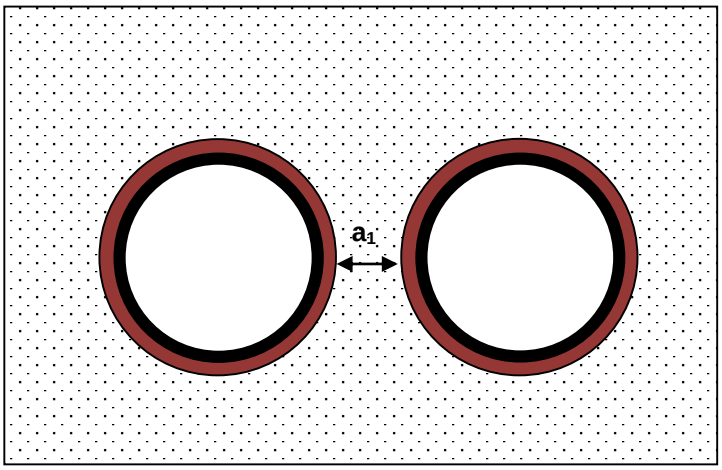
Opening in the wall/floor		
Size of the opening (standard configuration according to EN 1366-3 was used in the test)	The diameter may in between those tested as long as - the distance requirements can be fulfilled - the total cross section of the installations (for example cables, cable carriers) is not more than 60% of the opening size - the relation between outer plug diameter and diameter of the opening is as tested (same compression of the installed plug)	
Type, dimensions and number of services	The type and number of cables may be different to those tested as long as - the cable diameter is equal to or lower than that given in Annex A.3.3 of EN 1366-3 for the tested cable group - the total cross section of the cables is ≤ 60% of the opening size - type as given in EN 1366-3, Annex A.3.2	
Arrangement of the services in the opening	The arrangement of the services may be different to those tested as long as - all distances between services and between services and aperture edges are larger than the corresponding distance a_1 to a_4 as tested	 a_1 = a_2 = a_3 = distance between services aperture edges = as tested a_4 = distance between cables = 0
Products/Components		
Dimensions of the blocks	Diameter of the plug may be in between those tested as long as - the compression of the installed plug is as tested (relation between outer plug diameter and diameter of the opening)	

ANNEX F – PIPE PENETRATION SEAL WITH INTUMESCENT WRAP

The pipe penetrations seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219). The intended use scenarios (see section 1.3.13) shall be clearly specified by the manufacturer in order to allow the TAB to decide if the EAD needs to be enlarged or if a new EAD is necessary. The intended (=assessed) use scenario(s) shall be given in the ETA.

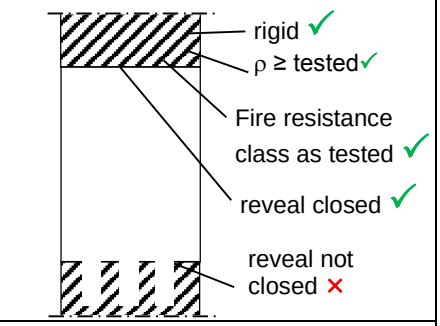
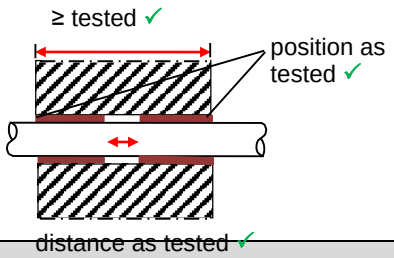
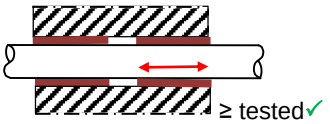
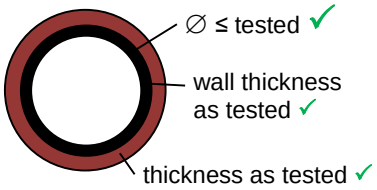
The following configuration according to EN 1366-3 shall be used in the fire test:

Fig F.1 Standard configuration for one pipe



The rules given in table F.1 may be used for the assessment of symmetrical installed pipe penetration seals.

Table F.1 Level-2-rules for the assessment of symmetrical/symmetrical installed seals

Changes with respect to the tested assembly/assemblies	Assessment of the changes	to check on site
Wall/floor		
Type of wall/floor for rigid elements	May be changed as long as - the density is equal to or larger than that tested - the reveal of the opening is closed (no cavities) - the fire resistance classification of the element is equivalent to the nominal class given in EN 1366-3 for the tested wall/floor	
Thickness of rigid wall/floor	May be larger than tested as long as - the position of the wraps in the wall/floor in relation to the surfaces of the wall/floor are as tested - the wrapping is enlarged equally (distance between wraps as tested)	
Products/Components		
Dimensions of the wrapping	Length of the wrapping may be larger than that tested (thickness as tested)	
Services/installations		
Size of services	The diameter of the pipe may be reduced as long as - the dimensions of the wrap (number of layers, length of the wrapping) are as tested - the wall thickness of the pipe is as tested	

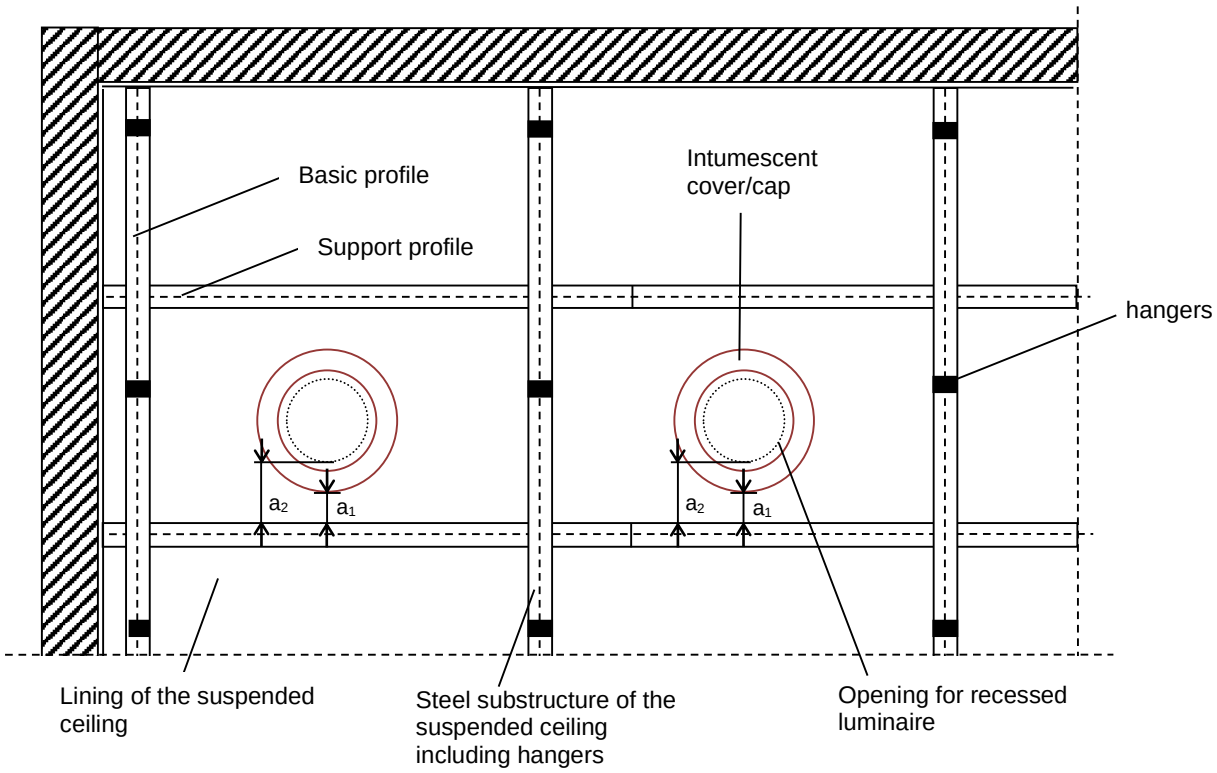
ANNEX G – PENETRATION SEAL FOR RECESSED LUMINAIRE

The penetration seal in which the intumescent product is intended to be incorporated shall be tested using the test method of prEN 1366-3 (N 219). The intended use scenarios (see section 1.3.13) shall be clearly specified by the manufacturer in order to allow the TAB to decide if the EAD needs to be enlarged or if a new EAD is necessary. The intended (=assessed) use scenario(s) shall be given in the ETA.

If level 2 is desired by the manufacturer: In addition to EN 1366-3 the suspended ceiling including the penetration seal shall be tested from both sides: one test with fire from the upper side and one test with fire from the underside.

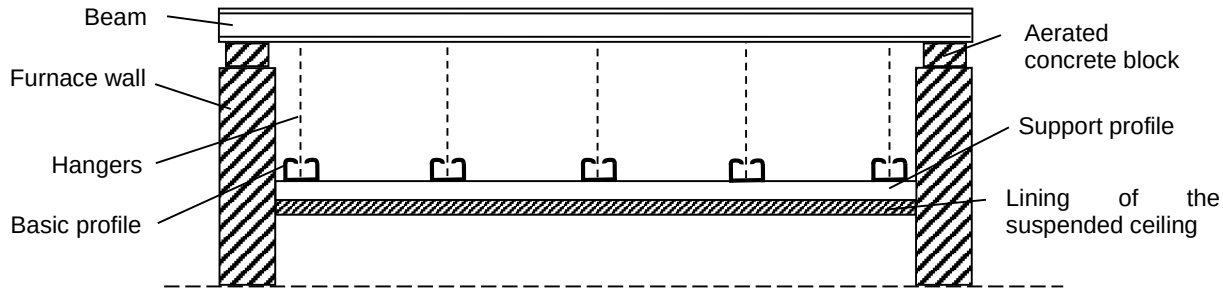
In particular the following configuration shall be used in the fire tests:

Fig G.1 Standard configuration – top view



The penetration seal shall be installed in a suspended ceiling with a minimum size of 2000 mm x 3000 mm and a resistance to fire classification equal to the target classification of the seal. The suspended ceiling shall consist of a two-level steel substructure. For fire from the underside the substructure shall be fixed (using fixing methods required for the ceiling) to steel beams lying across the furnace opening on the furnace walls. For fire from the upper side the substructure shall be fixed to the furnace ceiling. If the construction of the ceiling allows different distances of the steel profiles the maximum distance shall be used in the test.

Fig. G.2 Standard configuration – section



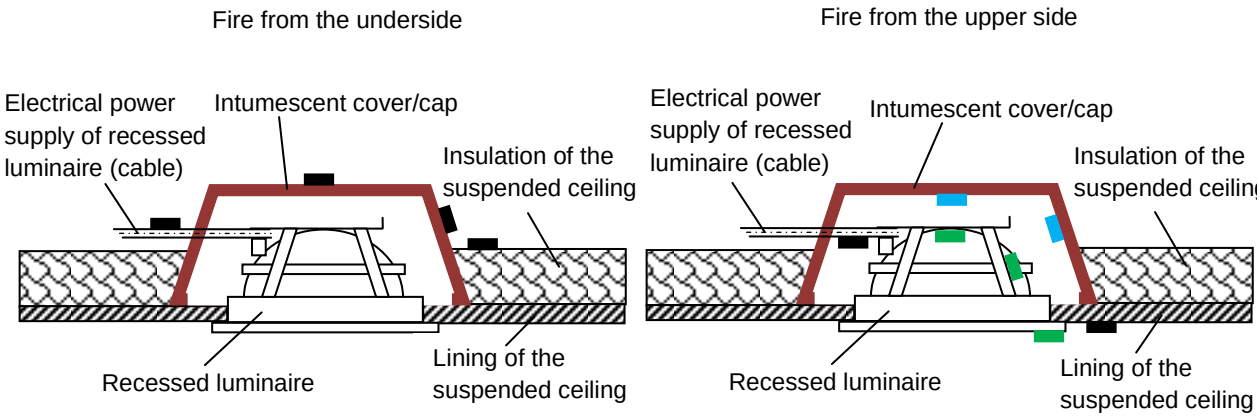
The penetration seal shall be installed from the underside of the ceiling according to the manufacturer´s instruction. First two round openings shall be cut into the lining of the ceiling, having a minimum distance a_2 as given by the manufacturer (a_1 result from a_2, because cover/cap is located symmetrically). Then the intumescent covers/caps shall be feed through the openings and moved in position after installing the cable(s) as foreseen. If the suspended ceiling includes mineral fibre insulation, it shall be described in the test report, if/how the insulation was removed around the opening before installing the seal. Afterwards in one specimen the luminaire shall be fixed in the opening. The other one shall be tested without luminaire.

The thermocouples on the cold side shall be fixed on the specimens in the following positions (wall thickness of cover/cap is constant):

Fire from the underside: one in the middle of the upper surface of the cover/cap and one on the side, 25 mm from the upper ceiling surface, three evenly spread around the cover/cap on the upper surface of the ceiling with a distance of 25 mm away from the cover/cap, one on each cable 25 mm away from the emersion point from the cover/cap and one on the flange of the cover/cap, if possible.

Fire from the upper side: In any case: one on each cable 25 mm away from the emersion point from the cover/cap, three evenly spread around the luminaire/openig on the lower surface of the ceiling with a distance of 25 mm away from the luminaire/opening. For seals with luminaire: one in the middle of the recessed luminaire – if no glass is foreseen, inside the luminaire – one on the inner side of the luminaire (if possible), one on the flange of the luminaire. For seals without luminaire: one in the middle of the upper side of the cover/cap and three evenly spread around inner wall of the cover/cap.

Fig G.3 position of thermocouples



Thermocouple; black: in any case; green: specimen with luminaire; blue: specimen without luminaire

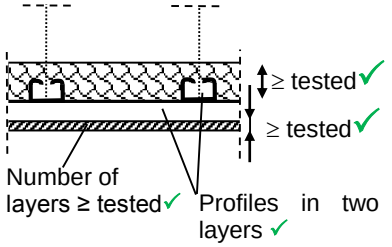
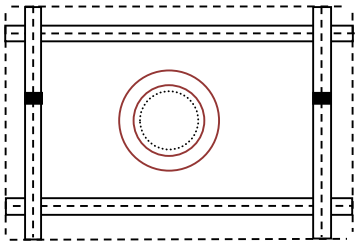
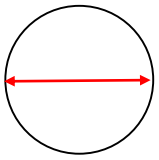
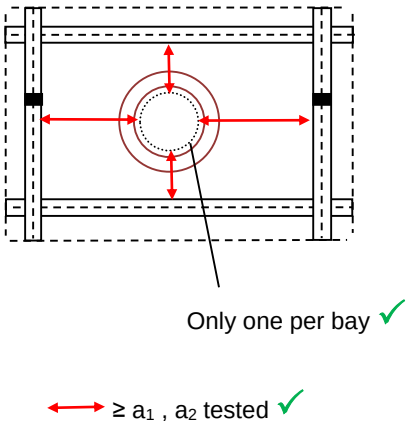
The furnace pressure of 20 Pa shall be measured in a distance of 100 mm from the surface (fire side) of the ceiling.

Assessment for Level 2:

In addition to Level 1 two seals shall be used for the assessment (see Section 2.2.2.2.5: one seal with fire from above and one seal with fire from the underside of a suspended ceiling). Only the resulting fire resistance class (see 1.3.11) of the tested assemblies shall be given.

The rules given in table G.1 may be used for the assessment of the penetration seal for level 2.

Table G.1 Level-2-rules for the assessment of penetration seals for recessed luminaire

Changes with respect to the tested assembly/assemblies	Assessment of the changes	to check on site
Ceiling		
construction of ceiling	May be different as long as - the number of layers of the lining is equivalent to the tested ceiling - the overall thickness of the lining is ≥ tested - the ceiling is allowed to carry a load of the seal including luminaire - the substructure is made from steel profiles in two layers (as tested) - the lining is fixed with screws and joints are filled - the thickness of the mineral fiber insulation is ≥ tested - the fire resistance classification of the ceiling is equal to the one of the tested ceiling	 Fire resistance class as tested ✓ 
Opening		
Size of opening	The size of the opening may be reduced.	
Position of opening	May be changed as long as - the distances a_1 and a_2 are ≥ tested - in each bay only one opening is installed	

Installations		
Luminaire	May be changed as long as - the overall size is ≤ tested - the fixing of the luminaire is as tested - the opening size fits to the luminaire - the materials are equal to the tested luminaire	
Number of cables, diameter of cable (same type)	May be reduced as long as - the position of the cable is a tested one	