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European Assessment Document for

Insulating foils as barrier against substances with relevance to indoor air quality

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) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The construction products covered by this EAD are insulating foils used as barrier against substances with relevance to indoor air quality, hereinafter referred to as "insulating foils".

The insulating foils are composite films made of several layers (polyethylene (PE), aluminium foil and optionally raw paper).

After direct adhesion to walls, ceilings and/or floors the product is typically covered by various surface layers (e.g., wallpaper, floor coverings, tiles, plasterboards), which are not part of the product.

The substructure itself is not part of this EAD, but shall be indicated in the ETA, if relevant with regard to the reaction to fire classification and/or the release of volatile organic substances. The tightness of the product against harmful substances is only ensured by using suitable adhesive(s) for sealing its joints (e.g., overlaps, butt-joint with covering strip/tape). The same adhesive(s) is (are) used for bonding the insulating foils on the various substrates. The used adhesive(s) is (are) not part of the product but shall be specified in the ETA as they have an influence of the product's performance and have, thus, to be taken into account in the assessment.

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 or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations, e.g., with regard to the intended end use conditions, 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 as long as the details of the assessment methods as laid down in this EAD are respected.

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

1.2.1 Intended use(s)

The insulating foils are intended to be used in contaminated buildings for building restoration as a diffusion barrier to harmful substances, such as polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), dichlorodiphenyltrichloroethane (DDT), radon, wood preservatives etc.

The product is intended to be used on walls, ceilings and floors. The product is intended to be used on various substrates such as mortar, masonry, concrete, gypsum board, wood-based material etc.

The assessment of the insulating foils applies if the product is used inside buildings (indoor) where it is protected from weathering. Afterwards, the insulating foils may be covered with a levelling compound, final surface layers such as wallpaper, floor coverings, tiles, plasterboards or with both.

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 insulating foils for the intended use of 25 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 works¹.

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 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 referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the insulating foils are assessed in relation to the essential characteristics.

Table 2.1.1Essential 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	2.2.1	Class			
	Basic Works Requireme	nt 3: Hygiene, health and th	e environment			
2	Content, emission and/or release of dangerous substances	2.2.2	Level [µg/m³, mg/m³] Description			
3	Gas permeability	2.2.3	Level, q _A in [cm³/(d*m²*bar)]			
4	Radon diffusion	2.2.4	Level, D in [m²/s]			
5	Tensile properties	2.2.5	Level, $\sigma_{50,x,y}$ in [N/50 mm], $\varepsilon_{x,y}$ in [%]			
6	Resistance to tearing	2.2.6	Level, TR _{x,y} in [N]			
7	Impact resistance	2.2.7	Level, m _f in [g]			
8	Bond strength	2.2.8	Level, S in [MPa]			
9	Artificial ageing by long-term exposure to elevated temperature	2.2.9	Level, $\sigma_{50,x,y}$ in [N/50 mm], $\varepsilon_{x,y}$ in [%]			
10	Water vapour transmission	2.2.10	Level, µ			

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

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as "shall be stated in the ETA" or "it has to be given in the ETA" shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

2.2.1 Reaction to fire

The insulating foils shall be tested, using the test method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The provisions given in Annex A shall be taken into account within the tests.

The products shall be classified in accordance with Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1 taking into account the EXAP (extended application) rules given in Annex A.

The obtained reaction to fire class shall be stated in the ETA together with those conditions (see relevant parameters in Annex A) for which the classification is valid.

2.2.2 Content, emission and/or release of dangerous substances

The performance of the insulating foils related to the emissions and/or release and, where appropriate, the content of dangerous substances shall be assessed on the basis of the information provided by the manufacturer² after identifying the release scenarios 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 are:

- IA1: Product with direct contact to indoor air.³
- IA2: Product with indirect contact to indoor air (e.g., covered products) but possible impact on indoor air.⁴

2.2.2.1 SVOV and VOC

For the intended uses covered by the release scenarios IA1 and IA2 semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) shall be determined in accordance with EN 16516.

The respective loading factor [m²/m³] used for emission testing can be taken from the following table:

² The manufacturer may be asked to provide to the TAB the REACH related information which shall accompany the DoP (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

provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS, taking into account the installation conditions of the construction product and the release scenarios resulting from there.

Any information provided by the manufacturer regarding the chemical composition of the products is not to be distributed to EOTA, to other TABs or beyond.

³ Scenario IA1 is applicable for products which are in contact with indoor air in a way that dangerous substances could be released directly out of the product.

⁴ Scenario IA2 is applicable for products which are covered with other products but nevertheless could release dangerous substances to indoor air (e.g., products covered with porous/unsealed coverings incapable of avoiding migration, such as gypsum panels).

Intended use	Loading factor [m ² /m ³]
Walls	1,0
Floor, ceiling	0,4
Small surfaces (e.g., door, wooden beam)	0,05

Table 2.2.2.1.1 Loading factor L, depending on the product type (in accordance with EN 16516)

To prepare the test specimen the outer layer of the roll shall be discarded and the specimen shall be taken from the middle of the foil band, appropriate to the size of the test chamber. Once the test specimen has been produced, as described above, it shall immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results shall be recorded 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/m³] or [µg/m³] and stated in the ETA.

2.2.3 Gas permeability

Gas permeability shall be determined as described in Annex B.

The gas transmission rate (q_A) shall be stated in [cm³/(d*m²*bar)] in the ETA where *d* is the unit for time (days).

2.2.4 Radon diffusion

Radon diffusion shall be determined using at least three specimens in accordance with ISO/TS 11665-13, Method C.

The radon diffusion coefficient D in $[m^2/s]$ shall be stated in the ETA.

2.2.5 Tensile properties

Tensile strength and elongation in longitudinal (x, direction of production) and transverse (y) direction of the insulating foils shall be determined in accordance with EN 12311-1 with modifications as described in Annex A of EN 13859-1.

The resulting product performance (tensile strength $\sigma_{50,x,y}$ in [N/50 mm] and elongation $\varepsilon_{x,y}$ in [%]) shall be stated in the ETA.

2.2.6 Resistance to tearing

The resistance to tearing in longitudinal (x, direction of production) and transverse (y) direction shall be determined in accordance with EN 12310-1 with modifications as described in Annex B of EN 13859-1.

The resulting product performance (tear resistance TR_{x,y} in [N]) shall be stated in the ETA.

2.2.7 Impact resistance

The impact resistance shall be determined in accordance with EN ISO 7765-1, Method A.

The resulting impact failure mass m_f in [g] to the nearest 1 g shall be stated in the ETA.

2.2.8 Bond strength

The bond strength of the insulating foils to the substrate shall be assessed in accordance with clause A.6.2 of EN 14891 but without a ceramic tile wearing surface.

The preparation of the test specimens shall be made in accordance with EN 14891, A.6.1, with the following adjustments:

- The used substrate(s) shall be one or more of the following, based on the intended use(s) specified in the Manufacturer's Product Installation Information:
 - Default substrate 1: A slab made of concrete in accordance with EN 12004-2, clause 5.3.1 and Annex A,
 - Default substrate 2: Gypsum plasterboard in accordance with EN 520, type D, with a density of 800 ± 100 kg/m³ und a thickness equal to 25 ± 1 mm,
 - Default substrate 3: Particleboard in accordance with EN 312 with a density of 680 ± 50 kg/m³ and a thickness equal to 38 ± 2 mm,
 - Other substrates relevant for the intended use.
- The insulating foils shall be glued to the substrate using the adhesive and curing instructions specified in the Manufacturer's Product Installation Information.
- No tile or tile adhesive shall be applied on the insulating foil.
- 9 square metal pull head plates (50 × 50 mm) in accordance with EN 14891, clause A.4.2, shall be glued directly to the insulating foils at a distance apart of 50 mm with a suitable high strength adhesive, e.g., solvent free epoxy adhesive.
- After at least one day of bonding of the pull head plates to the insulating foil, the surface of the applied insulating foil shall be cut through to the surface of the substrate around the perimeter of each pull head plate.
- In the following, each of the pull head plates shall be considered as one test specimen.

After that⁵, the test shall be performed in accordance with EN 14891, clause A.6.2, using the test speed (250 \pm 50 N/s).

One set of 9 test specimens shall be tested for each combination of adhesive and substrate.

The 9 test outcomes shall be evaluated as described in EN 14891, clause A.6.10.

The resulting bond strength S in [MPa] shall be given in the ETA. The related adhesive(s) and substrate(s) as specified in the Manufacturer's Product Installation Information shall be stated in the ETA.

2.2.9 Artificial ageing by long-term exposure to elevated temperature

The artificial ageing by long-term exposure to elevated temperature shall be determined in accordance with the following procedure:

Exposure to heat ageing shall be performed in accordance with EN 1296, with modifications as described in Annex C of EN 13859-1 (namely clauses C.3.2, C.4.1, C.4.2, C.4.3 and C.5.2). No prior UV exposure as described in EN 13859-1, C.5.1, is necessary.

The tensile strength and elongation in longitudinal (x, direction of production) and transverse (y) direction shall be assessed on exposed materials in accordance with EN 12311-1 and considering modifications as described in Annex A of EN 13859-1.

The tensile strength $\sigma_{50,x,y}$ in [N/50 mm] and elongation $\varepsilon_{x,y}$ in [%] after exposure shall be stated in the ETA.

2.2.10 Water vapour transmission

The water vapour diffusion resistance shall be carried out in accordance with EN 1931, Method B in accordance with clause 4.2.

⁵ The minimum waiting time given in EN 14891, clause A.6.2, of 27 days as well as of a total of 28 days, which corresponds with the common curing time of the tile adhesives, is not applicable for this EAD as no tile adhesive is applied on the insulating foils.

The moisture resistance factor μ [-] shall be calculated with comprehensive formula in accordance with EN 1931, clause 9.1, and shall be given in the ETA.

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 Commission Decision 1999/90/EC, as amended by Commission Decision 2001/596/EC.

The applicable AVCP system is 3 for any use except for uses being subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems are 1, 3 or 4 depending on the conditions defined in the said Decision.

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 3.2.1.

Table 3.2.1	Control plan for the manufacturer; cornerstones
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No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control	
[ir	Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Reaction to fire	2.2.1	Control plan	At least 1 (depending on the obtained class and the test method(s) to be applied)	 With production start and: EN ISO 11925-2 every three months EN 13823 once a year EN ISO 1182 once a year EN ISO 1716 once a year 	
2	Content, emission and/or release of dangerous substances	2.2.2	Control plan	1	Once every 5 years or after product changes	
3	Gas permeability	2.2.3	Control plan	3	Once every 5 years or after product changes	
4	Radon diffusion	2.2.4	Control plan	3	Once every 5 years or after product changes	
5	Tensile properties	2.2.5	Control plan	3	Once per 10 shifts	
6	Resistance to tearing	2.2.6	Control plan	3	Once per 40 shifts	
7	Impact resistance	2.2.7	Control plan	3	Once per year	
8	Bond strength	2.2.8	Control plan	9	Once every 5 years or after product changes	
9	Artificial ageing by long term exposure to elevated temperature	2.2.9	Control plan	10	Once every 5 years or after product changes	
10	Water vapour transmission	2.2.10	Control plan	3	Once every 5 years or after product changes	

3.3 Tasks of the notified body

The intervention of a notified body under AVCP system 1 for this product is only necessary for reaction to fire if a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material).

In this case, the cornerstones of the actions to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.3.1.

 Table 3.3.1
 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 manufactur	ing plant and of	factory p	roduction c	ontrol
1	The notified body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product covered by the European Technical Assessment, taking especially into account a limiting of organic material, the addition of fire retardants and/or another clearly identifiable stage in the production process which results in the improvement of the reaction to fire classification. In particular the following items shall be appropriately considered - presence of suitable test equipment - presence of trained personnel - the suitability of the factory production control established by the manufacturer - full implementation of the prescribed test plan	Verification of the complete FPC, to be implemented by the manufacturer	See control plan	See control plan	Before production start and after relevant changes (e.g., starting a new production line or modification of the production process)
	Continuous surveillance, assessment	and evaluation	of factory	/ productior	n control
2	It shall be verified that the system of factory production control and the specified manufacturing process are maintained, taking especially into account a limiting of organic material, the addition of fire retardants and/or another clearly identifiable stage in the production process which results in the improvement of the reaction to fire classification. In particular the following items shall be appropriately considered: - Inspection of factory, of the production of the product and of the facilities for factory production control - Evaluation of the documents concerning factory production control - Issuing a report of surveillance	Verification of the controls carried out by the manufacturer on the process and on the product as indicated in table 3.2.1 concerning reaction to fire	See control plan	See control plan	Once a year

4 REFERENCE DOCUMENTS

EN 312:2010	Particleboards - Specifications
EN 520:2004+A1:2009	Gypsum plasterboards — Definitions, requirements and test methods
EN 1296:2000	Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roofing - Method of artificial ageing by long term exposure to elevated temperature
EN 1931:2000+AC:2001	Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of water vapour transmission properties
EN 12004-2:2017	Adhesives for ceramic tiles - Part 2: Test methods
EN 12310-1:1999	Flexible sheets for waterproofing - Part 1: Bitumen sheets for waterproofing - Determination of resistance to tearing (nail shank)
EN 12311-1:1999	Flexible sheets for waterproofing - Part 1: Bitumen sheets for roof waterproofing - Determination of tensile properties
EN 13238:2010	Reaction to fire tests for building products – Conditioning procedures and general rules for selection of substrates
EN 13501-1:2018	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
EN 13823:2020+A1:2022	Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
EN 13859-1:2010	Flexible sheets for waterproofing - Definitions and characteristics of underlays - Part 1: Underlays for discontinuous roofing
EN 14891:2012+AC:2012	Liquid applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, assessment and verification of constancy of performance, classification and marking
EN 16516:2017+A1:2020	Construction products: Assessment of release of dangerous substances – Determination of emissions into indoor air
EN ISO 1182:2020	Reaction to fire tests for products – Non-combustibility test (ISO 1182:2020)
EN ISO 1716:2018	Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value) (ISO 1716:2018)
EN ISO 7765-1:2004	Plastics film and sheeting - Determination of impact resistance by the free- falling dart method - Part 1: Staircase methods (ISO 7765-1:1988)
EN ISO 11925-2:2020	Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test (ISO 11925-2:2020)
ISO/TS 11665-13:2017	Measurement of radioactivity in the environment - Air: radon 222 - Part 13: Determination of the diffusion coefficient in waterproof materials: membrane two-side activity concentration test method (ISO/TS 11665- 13:2017)

ANNEX A: MOUNTING AND FIXING PROVISIONS AS WELL AS EXTENDED APPLICATION RULES FOR THE TEST RESULTS OF THE RELEVANT REACTION TO FIRE TESTS

A.1 EN ISO 1182 and EN ISO 1716

These test methods are relevant for reaction to fire classes A1 and/or A2 in accordance with EN 13501-1.

Note: Due to the nature of the insulating foils the application of these both methods is likely not necessary, because such insulating foil products normally are not able to meet the criteria for the aforementioned classes.

If these two test procedures shall be used despite the above information, the tests shall be performed in accordance with the provisions of the relevant test standard. In addition, the following parameters of homogenous foils and any layer of composite films shall be considered for choosing and preparing the test specimens and the execution of tests:

- product variations of a defined product family 6,7 ,
- density,
- organic content,
- type and amount of flame retardants.

In addition, thickness and weight per unit area of each layer of non-homogenous (multi-layer) composite products shall be considered, when calculating the total Q_{PCS} value of the entire product.

The results of these tests considering the aforementioned parameters are valid for

- all product variations of the same product family,
- with the same density (if only one was tested) or a density between highest and lowest density tested,
- with equal or lower organic content,
- with the same type and equal or higher amount of flame retardants,
- with any thickness in case of homogenous products, and
- with the same thickness and weight per unit area of the layers of non-homogenous composite products used for calculating the total Q_{PCS} value of the entire product or
- with any thickness and weight per unit area between the highest and lowest values of these two
 parameters of the layers of non-homogenous composite products used for calculating the total Q_{PCS}
 value of the entire product.

A.2 EN 13238 (SBI test)

This test method is relevant for reaction to fire classes A2 to D in accordance with 13501-1 simulating the use of the insulating foil as directly adhered to walls, ceilings and as underlay under various floor coverings.

A.2.1 Dimension of the test rig and the test specimens

The dimension of the L-shaped test specimens (consisting of a long wing and a short wing) shall be as prescribed in the test standard.

On the long wing of each test specimen at least one vertical and one horizontal joint shall be considered as prescribed in the test standard (200 mm for away from the inner corner of the test specimen and 500 mm above the floor of the specimen trolley).

A.2.2 Substrate

The test specimens shall be glued onto an appropriate standard substrate in accordance with EN 13238 representing a range of substrates. The standard substrate shall be chosen in accordance with the intended end use applications as specified in the Manufacturer's Product Installation Information.

⁶ as defined by a certain combination of raw materials and produced in a certain type of production process

⁷ In order to permit the TAB to apply rules for the extended application of test results within the assessment, it is recommended that the manufacturer should provide (but he is not obliged to do so) sufficient information (e.g., on the basis of the composition of the products in questions), allowing the TAB to determine which products or product variants should be submitted to testing and so to reduce the number of tests required.

Other substrate (deviating from EN 13238) may also be used for testing purposes. However, in this case the test results will only be valid for the practical use of the insulating foils on this specific substrate. For both cases mentioned above (use of substrate in accordance with EN 13238 or deviating from this standard) the ETA shall specify the possible substrate(s) in practice covered by the reaction to fire classification of the insulating foil.

A.2.3 Test specimens

The following parameters shall be considered when preparing the test specimens:

- product variations of a defined product family ^{6 7}– each different variation regarding composition and assembly (e.g., number, type and dimensions of the various layers of the insulating foils) shall be considered within the tests;
- Colour if there is a range of different colours but no difference in the chemical composition itself, tests with a light, a dark and a medium colour (e.g., White, Black and Red) shall be performed;
- Thickness the highest as well as the lowest thickness of the entire insulating foil shall be tested;
- Weight per unit area the highest as well as the lowest weight per unit area shall be tested;
- Orientation if relevant, the specimen shall be mounted and tested with vertical as well as with horizontal orientation;
- Adhesive each adhesive foreseen for fixing purposes in the end-use shall be considered within the tests of the insulating foil, taking into account the highest possible applied quantity per unit area of the adhesive.

The results of tests taking into consideration completely the aforementioned parameters are valid for:

- only the chemical composition and assembly as tested,
- the complete range of colours,
- any thickness between those evaluated for the entire insulating foil or the tested thickness only (if only one thickness was tested),
- any weight per unit areas between those assessed or the tested weight per unit area only (if only one weight per unit area was tested),
- any orientation of the insulating foils, and
- the tested adhesive only with equal or lower applied quantity per unit area than tested.

Due to the intended end-use of the insulating foils as direct adhered to walls and ceilings the whole specimen (including the substrate) shall be positioned directly in front of the SBI backing board. At least one test with any of the identified specimen configurations (based on the aforementioned parameters) shall be performed and two further tests with the most onerous specimen configuration as

A.3 EN ISO 11925-2 (Small ignition source test)

This test method is relevant for reaction to fire classes B to E in accordance with EN 13501-1 simulating the use of the insulating foils as direct adhered to walls and ceilings as well as underlay under various floor coverings.

A.3.1 Dimensions of the test specimens and preparation

The dimension of the test specimens shall be as prescribed in EN ISO 11925-2.

A.3.2 Substrate

basis for the classification.

The test specimens shall be glued onto an appropriate standard substrate in accordance with EN 13238 representing a range of substrates in end use applications.

Other substrate (deviating from EN 13238) may also be used for testing purposes. However, in this case the test results will only be valid for the practical use of the insulating foils on this specific substrate.

For both cases mentioned above (use of substrate in accordance with EN 13238 or deviating from this standard) the ETA shall specify the possible substrate(s) in practice covered by the reaction to fire classification of the insulating foil.

A.3.3 Test specimens

The following parameters shall be considered when preparing the test specimens:

- product variations of a defined product family^{6,7} each different variation regarding composition and assembly (e.g., number, type and dimensions of the various layers of the insulating foils) shall be considered within the tests;
- Colour if there is a range of different colours but no difference in the chemical composition itself, tests with a light, a dark and a medium colour (e.g., White, Black and Red) shall be performed;
- Thickness the highest as well as the lowest thickness of the entire insulating foils shall be tested;
- Weight per unit area the highest as well as the lowest weight per unit area shall be tested;
- Orientation if relevant, the specimen shall be mounted and tested with vertical as well as with horizontal orientation;
- Adhesive each adhesive foreseen for fixing purposes in the end-use shall be considered within the tests of the insulating foils, taking into account the highest possible applied quantity per unit area of the adhesive.

The results of tests taking into consideration completely the aforementioned parameters are valid for:

- only the chemical composition and assembly as tested,
- the complete range of colours,
- any thickness between those evaluated for the entire insulating foils or the tested thickness only (if only one thickness was tested,
- any weight per unit areas between those evaluated or the tested weight per unit area only (if only one weight per unit area was tested),
- any orientation and
- each tested adhesive with equal or lower applied quantity per unit area than tested.

Due to the various intended end-use applications of the insulating foils the test specimens shall be tested with edge exposure as well as with surface exposure.

At least two tests with any of the identified specimen configurations (based on the aforementioned parameters) shall be performed and four further tests with the most onerous specimen configuration as basis for the classification.

ANNEX B: ASSESSMENT OF GAS PERMEABILITY

B.1 Test Principle

The test specimen shall be mounted in a two-chamber cell as a sealed barrier between the two chambers as shown in Figure B.1.1. One chamber shall be purged with a stream of carrier gas while the other chamber contains oxygen. Oxygen passing through the specimen shall be transported to a coulometric sensor.

The oxygen which permeates the specimen shall be detected using an oxygen-sensitive coulometric sensor with nickel, cadmium, and graphite electrodes saturated with potassium hydroxide solution or an equivalent sensor. This method can be used to determine transmission rates ranging from about 0,05 cm³/(m^{2*}d*bar) to 1000 cm³/(m^{2*}d*bar) for film and sheeting.



Figure B.1.1: Test setup for the assessment of gas permeability

B.2 Reagents

The carrier gas shall be dry nitrogen containing 0,5 vol% to 3 vol% hydrogen and not more than 0,01 vol% oxygen. Before purging the test chamber, oxygen impurities shall be removed by passing the carrier gas through a metal tube containing about 5 g of a 0,5% platinum or palladium catalyst on alumina which causes any residual oxygen to react with the hydrogen in the carrier gas to form water. Alternatively, if pure nitrogen (99,99 %) is used as the carrier gas, the metal cartridge shall be filled with an oxygen absorbent.

The oxygen gas used shall be dry and shall contain not less than 99,5 vol % of oxygen or oxygen-gas mixtures (preferably, oxygen containing nitrogen) free of carbon dioxide and having an oxygen content known within a tolerance of ± 0.5 %.

B.3 Apparatus and Specimen Preparation

The diffusion cell in which the specimen is clamped shall consist of two metal halves of circular cross section. The exposed specimen area shall be at least 50 cm² and the total internal volume of the two halves of the cell shall be about 25 cm³. The temperature in each chamber shall be measured with separate thermometers. The O-ring seal between the two chambers and the clamped film shall be such that it forces the specimen against the flat rim of the lower chamber as close to its inner edge as possible. The lower chamber (carrier gas side) shall have a flat, raised rim about 5 mm wide which, since it is a critical sealing surface against the specimen, shall be smooth and flat, without scratches.

The test specimen shall be prepared as follows: The insulating foils shall be cut in such a way that they fit in the test chamber. The insulating foils shall be cut straight in the middle and an adhesive film shall be glued over the joint area, overlapping, as described in the manufacturer's product installation instructions.

B.4 Testing and Evaluation

The sensor shall be calibrated and a leak test of the setup shall be conducted.

Both halves of the cell shall be flushed with carrier gas, while the gas line to the sensor is closed. After flushing for 30 minutes, the carrier gas from the lower half of the cell shall be diverted to the sensor. The sensor output current will possibly increase at first due to oxygen residues in the gas line or the specimen. The resulting zero level shall not exceed a value of $0.4 \text{ cm}^3/(\text{m}^2\text{*}d\text{*}\text{bar})$. Once the sensor output current is steady, the carrier gas shall be replaced by oxygen in the upper half of the cell. The sensor output current will increase and eventually stabilize.

Once steady-state conditions have been attained and the respective voltage determined, the area-related gas transmission rate shall be calculated using the following equation:

$$q_A = \frac{(U_E - U_0) * Q_A * 100}{A * R * Q_{O_2} * p_{amb}}$$

Where

- UE is the steady-state voltage, in mV
- U₀ is the zero-level voltage, in mV
- A is the test area of the specimen, in cm²
- Q_A is the calibration constant, in cm^{3*}cm^{2*} $\Omega/(m^{2*}d^*mV)$
- R is the resistance of the resistor, in Ω
- p_{amb} is the atmospheric pressure, in bar
- go2 is the percentage by volume of oxygen in the test gas

(B.4 1)