EAD **090097-00-0404**

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European Assessment Document for

Kits for external wall claddings glued to the subframe

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Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The EAD covers the assessment of kits for external wall claddings which are fixed to the subframe by means of an adhesive system (from now on “kit”). The cladding element can be:

- purely glued or,
- glued with supplementary metal fixings.

The EAD is applicable to the vertical and horizontal adhesive beads configurations (see Figures 1.1.1).

The kits consist of the following components[1]:

1. Cladding elements made of one fully body material (except TMCS), see clause 1.1.1. Only for kits Type A (see paragraph below).
2. Adhesive systems, see clause 1.1.2.
3. Subframes, see clause 1.1.3. Optional in case of kits Type A (see paragraph below).
4. Supplementary mechanical fixings (optional), see clause 1.1.4
5. Thermal insulation layers (optional), see clause 1.1.5.
6. Other ancillary components (optional), see clause 1.1.6.

The kits are non-load bearing construction elements. They do not contribute to the stability of the substrate on which they are installed. The kits will normally contribute to durability of the works by providing enhanced protection from the effect of weathering. They are not intended to ensure airtightness of the building.

Kits do not contain windows or door products.

This EAD is applicable to the following compositions of the kits:

Type A - Glued cladding kits. Kits which include the cladding elements.

The minimum kit components for these kits Type A are the cladding elements and the adhesive systems. In this case, the other components of the external wall cladding systems (at least the subframe components) shall be available on the market and described in the ETA according to clauses 1.1.3 to 1.1.6 as part of the intended use of the kit, therefore, these components are part of the product assembly and are necessarily used within the product assessment process.

Type B - Subframe and adhesive kit. A kit which does not include the cladding element (cladding element is not supplied by the kit manufacturer).

The minimum kit components for these kits Type B are the adhesive system and the subframe components. In this case, the other components of the external wall cladding systems (at least the cladding elements) shall be available on the market and described in the ETA according to clauses 1.1.1 & 1.1.4 to 1.1.6 as part of the intended use of the kit, therefore, these components are part of the product assembly and are necessarily used within the product assessment process.

Between the cladding elements and the thermal insulation layer or the external wall substrate, there is an air space which is always drained and may be ventilated or not (see clause 1.3.11 of EAD 090062-01-0404).

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1 Any kit component may be produced (manufactured) or not produced (purchased on the market or from a specific supplier) by the kit manufacturer.

Figures 1.1.1 & 1.1.2 are schematic representations of the kit compositions. The components of the cladding kits are identified by the following legend.

Legend for the Figures 1.1.1 & 1.1.2:

1 – Cladding element (in kits Type A).
2 – Adhesive system (in kits Type A & Type B).
3 – Subframe profile (in kits Type B and optionally in kits Type A).
4 – Subframe bracket (in kits Type B and optionally in kits Type A).
5 – Subframe fixing (in kits Type B and optionally in kits Type A).
6 – Substrate (not part of the kit).
7 – Thermal insulation layer (optionally in kits Type A or Type B).
8 – Supplementary mechanical fixing (optionally in kits Type A or Type B).
9 – Anchor (optionally in kits Type A or Type B).

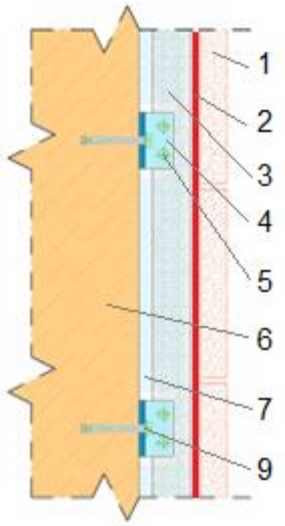

Figure 1.1.1: Configuration with vertical adhesive bead.

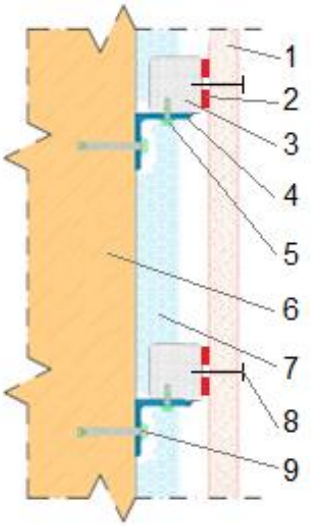

Figure 1.1.2: Configuration with horizontal adhesive bead with supplementary metal fixings.

Figure 1.1.3 is a schematic representation of the glued connexion representing the adhesive system components (see clause 1.1.2), in the installation process.

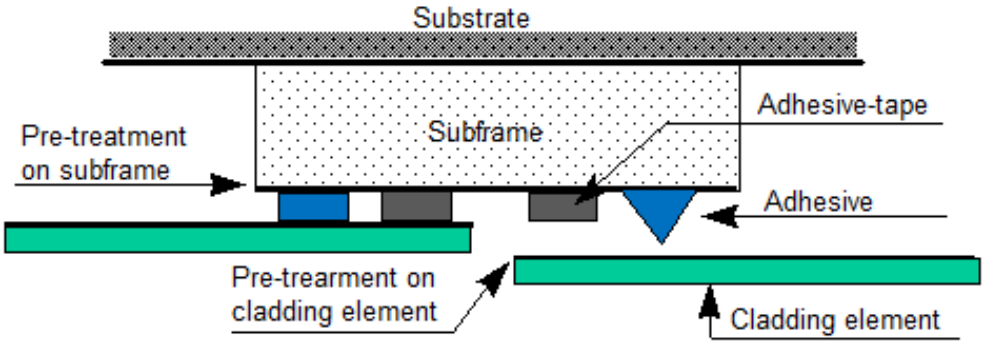

Figure 1.1.3: Glued connexion.

The product is not fully covered by the following harmonised technical specification:

- Cladding elements harmonised technical standards (hEN) (see Table 1.1.1.1 of EAD 090062-01-0404) because they do not cover kits, they only cover cladding elements alone and more generic intended uses (not the specific use for ventilated and non-ventilated façades).

- EAD 090001-00-0404[2] because it covers cladding kits where the cladding elements are made of prefabricated compressed mineral wool boards with thermo-setting synthetic binders mechanically fixed and also glued to a subframe. This EAD does not cover this type of cladding element material nor those that are mechanically fixed to subframes.

- EAD 090010-00-0404 (former ETAG 002) because it convers elements made of glass which is a material not considered in this EAD (see Table 1.1.1.1 of EAD 090062-01-0404).

- EAD 090062-01-0404, EAD 090034-00-0404, because it covers mechanically fixed kits (without adhesive which contributes to the support of the cladding element).

- EAD 090019-00-0404; EAD 090058-00-0404; EAD 090119-00-0404 because, in addition to that they cover kits mechanically fixed, they cover other cladding elements materials not considered for this EAD nor EAD 090062-01-0404.

- EN 1090-1 because this harmonised standard does not apply to non-structural products (see FAQ number 31 on European Commission website https://ec.europa.eu/growth/sectors/construction/construction-products-regulation-cpr/frequently-asked-questions_en). Besides, the cladding elements are not included on this standard.

- EN 13830 because this harmonised standard covers curtain walling kits which are a very different product that is intended to be used as the external wall itself, not as coverings of the external walls.

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.

The cladding elements are usually assembled according to a specific technical composition for adhesive systems, joints and construction discontinuities, which forms part of the product description.

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.

1.1.1 Cladding element

Cladding elements covered by this EAD are those defined in clause 1.1.1 of EAD 090062-01-0404 with flat geometry in the rear side surface, where the adhesive system is applied.

Cladding elements may have grooves when the kit includes supplementary metal cladding fixings (see clause 1.1.4).

Minimum data for describing the cladding elements are the type of material (in the case of natural stone, also name and petrographic designation), dimensions (where relevant, also grooves dimensions) and density or weight per square meter. Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

In the case of kits Type A (see clause 1.1), cladding elements are always part of the kit.

In the case of kits Type B (see clause 1.1), cladding elements are not part of the kit.

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

1.1.2 Adhesive system

The adhesive system consists of the following components:

- Adhesives, see clause 1.3.4.

  This EAD applies to one-component or two-component adhesives where:

  - The arithmetic average value of the stabilization of vertical displacement $S_{tv,m}$ [in mm] is not greater than 1 mm (see clause 2.2.3.2.8).
  - The arithmetic average value of the shrinkage according to EN ISO 10563 is not greater than 10 % (see Table 3.2.2).
  - The minimum adhesive bead thickness is 3 mm.

  Minimum data for describing the adhesive are the type of material, dimensions of the bead (thickness and width), physical properties (such as specific mass, shrinkage, hardness, flow resistance, thermogravimetric analysis) and mechanical properties (such as tensile stress, static shear stress, elastic modulus and displacement under dynamic shear stress, see Table 3.2.2). Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

- Pre-treatments:

  - Primers (optional), see clause 1.3.8.
  - Cleaning agents (optional), see clause 1.3.10.

  Minimum data for describing the primes and cleaning agents is the type of material. Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

- Adhesive-tapes (optional), see clause 1.3.9.

  Minimum data for describing the adhesive-tapes are the type of material and dimensions. Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

In both cases, kits Type A and Type B (see clause 1.1) the adhesive systems are always part of the kit.

1.1.3 Subframe

Subframes covered by this EAD are the metal subframes (steel or aluminium alloy) defined in clause 1.1.3 of EAD 090062-01-0404.

Minimum data for describing these components is given in clause 1.1.3 of EAD 090062-01-0404. Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

In the case of kits Type A (see clause 1.1), subframe components may or may not be part of the kit.

In the case of kits Type B (see clause 1.1), subframe profiles are always part of the kit. However, the other subframe components may or may not be part of the kit.

1.1.4 Supplementary mechanical cladding fixings (optional)

Supplementary mechanical cladding fixings covered by this EAD are small rails, clips, clamps, pins or other similar punctual fixings made of metal materials (steel or aluminium alloys) like those defined for Family C or Family F on subframes in clause 1.1.2 of EAD 090062-01-0404.

Minimum data for describing these components is given in clause 1.1.2 of EAD 090062-01-0404. Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

1.1.5 Thermal insulation layers (optional)

Thermal insulation layers may or may not be part of the kits. Thermal insulation layers covered by this EAD are those thermal insulation products defined in clause 1.1.4 of EAD 090062-01-0404.

1.1.6 Ancillary components (optional)

Ancillary components may or may not be part of the kits. Ancillary components covered by this EAD are those defined in clause 1.1.5 of EAD 090062-01-0404.

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

1.2.1 Intended use(s)

This EAD covers the following intended uses depending on the kit type described in clause 1.1:

Type A Glued cladding kits (kits with cladding elements), intended to be used as coverings of external walls (rainscreens):

- in ventilated façades, and/or
- in non-ventilated façades.

Type B Subframe and adhesive kits (kits without cladding elements), intended to be used as subframe and fixings of cladding elements in external wall cladding systems in ventilated and/or non-ventilated façades.

Kits are mechanically fixed to external vertical walls made of masonry (clay, concrete or stone), concrete (cast on site or as prefabricated panels), timber or metal frame in new or existing buildings (retrofit).

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 kits for the intended use of 25 years when installed in the works (provided that the kits is subject to appropriate installation (see clause 1.1). 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[3].

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.

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3 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.

1.3 Specific terms used in this EAD

Specific terms included in clauses 1.3.2 to 1.3.4, 1.3.6 to 1.3.13 of EAD 090062-01-0404 apply.

1.3.1 Glued cladding kits

Kits Type A, composed of cladding elements, adhesive systems (at least the adhesives) and optionally subframes, thermal insulation products and other ancillary components, which are to be used as coverings of external walls.

1.3.2 Subframe and adhesive kits

Kits Type B, without cladding elements, composed of adhesive systems (at least the adhesives), subframes and optionally thermal insulation products and other ancillary components, which are to be used as subframe and fixing of claddings elements in external wall claddings.

1.3.3 Adhesive system

A set of components for gluing the cladding element to the subframe profile. The minimum component is the adhesive bead (see clauses 1.3.5 & 1.3.6) and depending on the cladding element material, additional components such as primer (see clause 1.3.8), adhesive-tape (see clause 1.3.9) and cleaning agent (see clause 1.3.10) may be part of the adhesive system.

1.3.4 Subframe

See clause 1.1.3.

1.3.5 Adhesive

One-component or two-component polymer-based pastes (e.g., silicone, polyurethane, acryl, hybrid-based polymer) delivered in cartridges or other types of containers which may be extruded to form a bond when cured.

1.3.6 (adhesive) Bead

Fillet of adhesive which is of sufficient cross-section to adequately transfer forces between the cladding element and subframe profile, when cured.

1.3.7 Adhesion-surface

Continuous surface of the cladding element or of the subframe profile on which the bead is bonded.

1.3.8 Primer

Liquid product applied on adhesion-surfaces (see clause 1.3.7) before placing the adhesive in order to improve adhesion.

1.3.9 Adhesive-Tape

Foam tape to support the cladding element while the adhesive is curing and to ensure the adhesive thickness to be applied.

1.3.10 Cleaning agent

Products used to clean the adhesion-surfaces (see clause 1.3.7).

1.3.11 Glued connexion

Connexions composed of the adhesive and the adhesion-surfaces. Where relevant, primers shall also be part of this connexion.

1.3.12 Supplementary cladding fixing

See clause 1.1.4.

1.3.13 Symbols

NT =	Normal temperature test.
HT =	High temperature test.
LT =	Low temperature test.
HT+RH =	Temperature and hight humidity test.
H2O =	Immersion in water test.
RH+NaCl =	High humidity and NaCl atmosphere test.
RH+SO2 =	High humidity and SO_2 atmosphere test.
CTL =	After cyclic tensile loads test.
CSL =	After cyclic shear loads test.
TR =	Tear resistance test.
FzTh =	Freeze-thaw cycles test.
EMC =	Effect of materials in contact test.
P1 =	Test specimen piece with adhesion-surface 1.
P2 =	Test specimen piece with adhesion-surface 2.
X_C =	Generic symbol for the characteristic value for a series of test specimens giving 75 % confidence that 95 % of the test results will be higher than this value.
X_m =	Generic symbol for the mean or arithmetic average value for a series of test specimens.
S =	Generic symbol for standard deviation for a series of test specimens.
MPII =	Manufacturer's Product Installation Instructions.
ε [%] =	Generic symbol for tensile elongation defined as the quotient between the measured displacement and the thickness ($\varepsilon = \Delta e/e$).
$\varepsilon_{,lim}$ [%] =	Tensile elongation corresponding to the limit of the viscoelastic field of the glued connexion.
$\varepsilon_{u,i}$ [%] =	Individual value of the ultimate elongation (adhesive rupture) for a series of tested specimens.

$\varepsilon_{u,m}$ [%] =	Mean or arithmetic average value of the ultimate elongation (adhesive rupture) for a series of tested specimens.
τ_{∞} [MPa] =	Permanent shear stress value.
$\tau_{ds,C}$ [MPa] =	Characteristic value of the shear stress at a specific shar-displacement d_s, for a series of test specimens, obtained according to equation (F.1).
$\tau_{ds,C,lim}$ [MPa] =	Characteristic value of the shear stress at the limit of the viscoelastic field of the glued connexion.
$\tau_{ds,i}$ [MPa] =	Individual value of the shear stress at a specific shear displacement d_s.
τ_{ref} [MPa] =	Reference stress for carrying out the creep test.
$\tau_{u,C}$ [MPa] =	Characteristic value of the ultimate shear stress (adhesive rupture) for a series of test specimens, obtained according to equation (F.1).
$\tau_{u,i}$ [MPa] =	Individual value of the ultimate shear stress (adhesive rupture).
$\tau_{u,m}$ [MPa] =	Mean or arithmetic average value of the ultimate shear stress (adhesive rupture) for a series of tested specimens.
σ [MPa] =	Generic symbol for tensile stress.
$\sigma_{\varepsilon\%,C}$ [MPa] =	Tensile stress characteristic value at a specific elongation ε %.
$\sigma_{\varepsilon\%,C\_lim}$ [MPa] =	Tensile stress characteristic value at the limit of the viscoelastic field of the glued connexion.
$\sigma_{\varepsilon\%,i}$ [MPa] =	Tensile stress individual values at a specific elongation ε %.
σ_{cal} [MPa] =	Calculation value of tensile stress.
σ_{ref} [in MPa] =	Reference stress for carrying out the cyclic tensile load test.
$\sigma_{u,C}$ [MPa] =	Characteristic value of the ultimate tensile stress (adhesive rupture) for a series of test specimens, obtained according to equation (F.1).
$\sigma_{u,i}$ [MPa] =	Individual value of the ultimate tensile stress (adhesive rupture).
$\sigma_{u,m}$ [MPa] =	Mean or arithmetic average value of the ultimate tensile stress (adhesive rupture) for a series of tested specimens.
Δe [mm] =	Value of the measured displacement of the adhesive in tensile tests.
$\Delta e_{T,ref}$ [mm] =	Reference tensile displacement for defining the reference shear displacement $d_{s,ref}$.
a [--] =	Factor for defining the reference values.
A_b [mm^2] =	Area of the adhesive bead = l x b
b [mm] =	Adhesive bead width.
b_{min} [mm] =	Minimum width of the adhesive bead.
$C_{r,m}$ [%] =	Mean or arithmetic average value of the cohesive rupture area of the adhesive for a series of tested specimens.
d_s [mm] =	Generic symbol for shear displacement.

$d_{s,i}$ [mm] =	Individual value of the displacement under shear loading.
$d_{s,ref}$ [mm] =	Reference shear displacement for carrying out the cyclic shear load test.
d_{s_lim} [mm] =	Shear displacement corresponding to the limit of the viscoelastic field of the glued connexion.
$d_{s1,C}$ [mm] =	Characteristic value of the displacement due to shear creep at (168 $\pm$ 4) hours.
$d_{s1,i}$ [mm] =	Individual value of the displacement due to shear creep at (168 $\pm$ 4) hours.
$d_{s1,m}$ [mm] =	Mean or arithmetic average value of the displacement due to shear creep at (168 $\pm$ 4) hours.
$d_{s2,C}$ [mm] =	Characteristic value of the displacement due to shear creep at (1004 $\pm$ 4) hours.
$d_{s2,i}$ [mm] =	Individual value of the displacement due to shear creep at (1004 $\pm$ 4) hours.
$d_{s2,m}$ [mm] =	Mean or arithmetic average value of the displacement due to shear creep at (1004 $\pm$ 4) hours.
$d_{su,i}$ [mm] =	Individual value of the ultimate shear displacement of the ultimate load (adhesive rupture).
$d_{su,m}$ [mm] =	Mean or arithmetic average value of the ultimate shear displacement of the ultimate load (adhesive rupture) for a series of tested specimens.
$d_{Tu,m}$ [mm] =	Mean or arithmetic average value of the ultimate tensile displacement of the ultimate load (adhesive rupture) for a series of tested specimens.
e [mm] =	Adhesive bead thickness.
f_{cal} [mm] =	Displacement obtained by wind load resistance calculation.
$F_{u,C,}$ [N] =	Characteristic value of the ultimate load for a series of test specimens, obtained according to equation (N.1) of EAD 090062-01-0404.
$F_{u,m,}$ [N] =	Mean or arithmetic average value of the ultimate load for a series of tested specimens.
$F_{S,1max}$ [N] =	The maximum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 10^{th} and 110^{th} cycles.
$F_{S,1min}$ [N] =	The minimum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 10^{th} and 110^{th} cycles.
$F_{S,2max}$ [N] =	The maximum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 400^{th} and 500^{th} cycles.
$F_{S,2min}$ [N] =	The minimum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 400^{th} and 500^{th} cycles.
$F_{S,i}$ [N] =	Individual value for the maximum shear strength at the end of each cycle.
$F_{S,DL}$ [N] =	Constant dead load in the shear creep test.
$F_{Sds,i}$ [N] =	Individual value of the shear strength at a specific shear displacement d_s.
$F_{Su,i}$ [N] =	Individual value of the ultimate shear strength (adhesive rupture).
$F_{Su,m}$ [N] =	Mean or arithmetic average value of the ultimate shear strength (adhesive rupture) for a series of tested specimens.

$F_{T\varepsilon\%,i}$ [N] =	Individual value of the tensile strength at a specific elongation ε %.
f_{test} [mm] =	Maximum displacement obtained by wind load resistance testing.
$F_{Tu,i}$ [N] =	Individual value of the ultimate tensile strength (adhesive rupture).
$F_{Tu,m}$ [N] =	Mean or arithmetic average value of the ultimate tensile strength (adhesive rupture) for a series of tested specimens.
H_{clad} [mm] =	Cladding element height or length, the one in the same direction of the adhesive bead depending on the configuration (vertical or horizontal respectively, see Figures 1.1.1 and 1.1.2).
h_{eff} [mm] =	Total length of the applied adhesive bead (bond-line), in both, vertical configuration (same direction of the height of the cladding element) and horizontal configuration (same direction of the length of the cladding element).
j [mm] =	Length of each incision in the tear resistance test.
K [--] =	Variable as a function of the number of test specimens.
K_{ext} o K_{int} [--] =	Constant value as a function of the number of profiles (supports), see Table E.3.1, where “ext” refers to the extreme-profile and “int” refers to the intermediate-profile.
l [mm] =	Adhesive bead length in the test specimen.
L [mm] =	Length of the test specimen piece.
l_{ext} [mm] =	Distance between the extreme-profile and the cladding element border. Dimension perpendicular to the bead-lines.
l_p [mm] =	Distance (span) between profiles.
$n_{b,ext}$ [--] =	Number of beads (bond-lines) by extreme-profile.
$n_{b,int}$ [--] =	Number of beads (bond-lines) by intermediate-profile.
Q [kN/m^2] =	Maximum wind suction load resistance of the assembled kit.
Q_{cal} [kN/m^2] =	Wind suction load obtained by calculation.
Q_{test} [kN/m^2] =	Maximum wind suction load resistance obtained by testing.
$S_{t,m}$ [%] =	Mean or arithmetic average value of the stabilization of the load.
$S_{tv,C}$ [mm] =	Characteristic value of the stabilization of vertical displacement.
$S_{tv,i}$ [mm] =	Individual value of the stabilization of vertical displacement.
$S_{tv,m}$ [mm] =	Mean or arithmetic average value of the stabilization of vertical displacement.
W, W1 or W2 [mm] =	Width of the test specimen piece.
γ_1 [--] =	Factor by effective bonding.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of kits for external wall claddings glued to the subframe is assessed in relation to the essential characteristics.

Table 2.1.1 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
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class
2	Façade fire performance (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.2	Description / Class / Level (as relevant)
3	Propensity to undergo continuous smouldering	EAD 090062-01-0404 clause 2.2.3	Description
Basic Works Requirement 3: Hygiene, health and the environment			
4	Watertightness of joints (protection against driving rain) (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.4	Description (for open joints) Level (for closed joints)
5	Water absorption (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.5	Level
6	Water vapour permeability (for non-ventilated façades) (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.6	Level
7	Drainability (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.7	Description
8	Content, emission and/or release of dangerous substances	EAD 090062-01-0404 clause 2.2.8	Description
Basic Works Requirement 4: Safety and accessibility in use			
9	Wind suction load resistance	2.2.2	Level
10	Resistance to horizontal point loads	EAD 090062-01-0404 clause 2.2.10	Description
11	Impact resistance (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.11	Description
12	Bending strength of cladding elements (*) (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.12.1	Level

No	Essential characteristic	Assessment method	Type of expression of product performance
13	Resistance of grooves of cladding elements (*) (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.12.2	Level
14	Tensile stress and elongation at normal temperature (NT) of glued connexion (*)	2.2.3.1.1	Level
15	Shear stress and shear displacement at normal temperature (NT) of glued connexion (*)	2.2.3.1.2	Level
16	Tensile stress and elongation at high temperature (HT) and low temperature (LT) of glued connexion (*)	2.2.3.2.1	Level
17	Tensile stress after ageing under high temperature and high humidity (HT+RH) of glued connexion (*)	2.2.3.2.2	Level
18	Tensile stress after immersion in water (H2O) of glued connexion (*)	2.2.3.2.3	Level
19	Tensile stress after ageing under high humidity and NaCl atmosphere (RH+NaCl) of glued connexion (*)	2.2.3.2.4	Level
20	Tensile stress after ageing under high humidity and SO_2 atmosphere (RH+SO2) of glued connexion (*)	2.2.3.2.5	Level
21	Tensile stress after cyclic tensile loads (CTL) of glued connexion (*)	2.2.3.2.6	Level
22	Tensile stress after cyclic shear loads (CSL) of glued connexion (*)	2.2.3.2.7	Level
23	Shear creep (at high temperature and high humidity) of glued connexion (*)	2.2.3.2.8	Level
24	Tear resistance (TR) of glued connexion (*)	2.2.3.2.9	Level
25	Resistance of profiles (*)	EAD 090062-01-0404 2.2.12.14	Description
26	Tension/ pull-out resistance of subframe fixings (*)	EAD 090062-01-0404 2.2.12.15	Level
27	Shear load resistance of subframe fixings (*)	EAD 090062-01-0404 2.2.12.16	Level
28	Brackets resistance (horizontal and vertical load) (*)	EAD 090062-01-0404 2.2.12.17	Level
29	Mechanical resistance of supplementary metal cladding fixings (*)	2.2.3.3	Level

No	Essential characteristic	Assessment method	Type of expression of product performance
30	Resistance to seismic loads. Out-of-plane fundamental vibration period	EAD 090062-01-0404 2.2.13.1	Level
31	Resistance to seismic loads. Out-of-plane acceleration	EAD 090062-01-0404 2.2.13.2	Level
32	Resistance to seismic loads. In-plane displacement	EAD 090062-01-0404 2.2.13.3	Level
Basic Works Requirement 5: Protection against noise			
33	Airborne sound insulation (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.14	Level
Basic Works Requirement 6: Energy economy and heat retention			
34	Thermal resistance	EAD 090062-01-0404 clause 2.2.15	Level
Aspects of durability (**)			
35	Hygrothermal behaviour (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.16.1	Description
36	Freeze-thaw resistance	2.2.4.1	Level
37	Behaviour after immersion in water	2.2.4.2	Level
38	Dimensional stability by humidity (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.16.5.1	Level
39	Linear thermal expansion	EAD 090062-01-0404 clause 2.2.16.5.2	Level
40	Chemical and biological resistance	EAD 090062-01-0404 clause 2.2.16.6	Level
41	UV radiation resistance (only relevant for kits Type A)	EAD 090062-01-0404 clause 2.2.16.7	Level
42	Corrosion	2.2.4.3	Description / Level
43 to 55	Accelerated ageing behaviour of kits when the cladding element is made of thin metallic composite sheets (TMCS) (only relevant for kits Type A)	EAD 090062-01-0404 Table 2.1.3	Level

(*) Mechanical resistance of the kit is assessed by means of the mechanical characteristics of the relevant kit components and their connexions. See clause 2.2.3 and the relevant clauses 2.2.12 in EAD 090062-01-0404.

(**) Durability of the kit is assessed by means of relevant component durability, where relevant. See clause 2.2.4 and the relevant clauses 2.2.16 in EAD 090062-01-0404.

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.

If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant essential characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

2.2.1 Reaction to fire

Reaction to fire of the kits shall be assessed by considering the reaction to fire of the components (cladding elements, adhesive system components, subframe components, thermal insulation products, etc.), in order to be classified according to Commission Delegated Regulation (EU) 2016/364.

Where relevant (e.g., asymmetrically composed cladding elements, or relevant surfaces of the kit components of the rear side), reaction to fire of the rear side of the kits shall also be assessed in order to be classified according to Commission Delegated Regulation (EU) 2016/364.

For the assessment of reaction to fire of the kits, one of the following options shall apply:

a) The kits shall be assessed based on the worst reaction to fire class of the kit components obtained according to a CWFT[4] Decision or tested using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1.

   Note: if option a) is followed, the field of application of the individual reaction to fire class of every kit component (i.e., the product and installation conditions for which the reaction to fire of the individual component is valid) shall completely match the end-use conditions of such a component when assembled into the kit.

b) If the option (a) leads to too onerous classification of the kits, or if classification for one or several components are missing, then the kits shall be tested, using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1.

Criteria indicated in Annex A shall be taken into account. Associated mounting and fixing rules for the SBI test as well as for tests according to EN ISO 11925-2 shall be in accordance with Annex B.

The kits shall be classified according to the Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

When the thermal insulation products are part of the kits, the individual reaction to fire of the thermal insulation products shall be assessed, depending on the material, according to the thermal insulation product standards given in clause 1.1.4 of EAD 090062-01-0404. The thermal insulation products shall be classified according to the Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Components fulfilling the conditions as stated in clause A.6 can be considered as small components without the need for testing and assessment of their reaction to fire performance, except where it is explicitly prescribed in Annexes A and B.

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4 CWFT = Classified Without Further Testing.

2.2.2 Wind suction load resistance

The wind suction load resistance of assembled kits shall be assessed by structural calculations supplemented by testing.

Wind load resistance calculation (see clause E.2) shall be validated by testing according to clause E.1 of EAD 090062-01-0404. Validation criteria are defined in clause E.1.

For this validation purpose, at least the worst case (the mechanically weakest case, see clause E.1.1.1 of EAD 090062-01-0404 where the bullet referring to “Number of cladding fixings by cladding element area (e.g., minimum number)” shall be replaced by “Number of adhesive beads by cladding element area (e.g., minimum number)”) or the most representative case (according to the Manufacturer’s Product Installation Instructions (MPII)) of the assembled cladding kits shall be tested.

By confirming the results of the validated calculation, the wind load resistance calculation, input and output conditions (see clause E.2) shall be used for other configurations for the same kits, i.e., for other dimensional range of the same kit components, other greater resistance of the same kit components, number of adhesive beads by cladding element area, lower span between the subframe profiles and lower span between the brackets.

For each assessed assembled cladding kit configuration (at least for the mechanically weakest configuration), the maximum wind load resistance Q in [kN/m^2] shall be stated in the ETA. In addition, maximum wind load resistances obtained by testing shall also be stated in the ETA.

2.2.3 Mechanical resistance

The assessment of the kits mechanical resistance is carried out by means of the assessment of the mechanical resistance of the relevant kit components (cladding elements, adhesive systems and subframe components) and the connexions between them, which are representative of this essential characteristic for the kits.

The assessment depends on the applicable kit (Type A or Type B) and the kit composition to be assessed (minimum kits, complete kits, others intermediate kits), see clause 1.1.

Mechanical essential characteristics are divided in four groups:

a) Mechanical resistance of the cladding elements (only relevant for kit Type A):

- Bending strength. See clause 2.2.12.1 of EAD 090062-01-0404.
- Resistance of grooves. See clause 2.2.12.2 of EAD 090062-01-0404.

b) Mechanical resistance of the glued connexion between the cladding element and the subframe profile (relevant for all the kits Type A and Type B):

- Initial mechanical resistance of the glued connexion.
  - Tensile stress and elongation at normal temperature (NT). See clause 2.2.3.1.1.
  - Shear stress and shear displacement at normal temperature (NT). See clause 2.2.3.1.2.
- Residual mechanical resistance of the glued connexion.
  - Tensile stress and elongation at high temperature (HT) and low temperature (LT). See clause 2.2.3.2.1.
  - Tensile stress after ageing under high temperature and high humidity (HT+RH). See clause 2.2.3.2.2.
  - Tensile stress after immersion in water (H2O). See clause 2.2.3.2.3.

- Tensile stress after ageing under high humidity and NaCl atmosphere (RH+NaCl). See clause 2.2.3.2.4.
- Tensile stress after ageing under high humidity and SO_2 atmosphere (RH+SO2). See clause 2.2.3.2.5.
- Tensile stress after cyclic tensile loads (CTL). See clause 2.2.3.2.6.
- Tensile stress after cyclic shear loads (CSL). See clause 2.2.3.2.7.
- Shear creep (at high temperature and high humidity). See clause 2.2.3.2.8.
- Tear resistance (TR). See clause 2.2.3.2.9.

c) Mechanical resistance of subframe components (relevant for all the kits Type A and Type B):

- Resistance of profiles. See clause 2.2.12.14 of EAD 090062-01-0404.
- Tension/pull-out resistance of subframe fixings. See clause 2.2.12.15 of EAD 090062-01-0404.
- Shear load resistance of subframe fixings. See clause 2.2.12.16 of EAD 090062-01-0404.
- Bracket resistance (horizontal and vertical load). See clause 2.2.12.17 of EAD 090062-01-0404.

d) Mechanical resistance of supplementary metal cladding fixings (when are part of the kit, relevant for all the kits Type A and Type B):

- Resistance of supplementary metal cladding fixings. See clause 2.2.3.3.

2.2.3.1 Initial mechanical resistance of the glued connexion

Mechanical resistance of the glued connexion depends exclusively on the mechanical resistance of the adhesive when the adherence resistance between the adhesive and the adhesion-surface (cladding element or profile) is greater than the cohesive resistance of the adhesive.

In this case, it is possible to carry out the mechanical resistance tests using representative materials according to Option 2 given in clause C.1.1 and C.11.1.

2.2.3.1.1 Tensile stress and elongation at normal temperature (NT) of glued connexion

Tensile stress and elongation after (24 ± 4) hours conditioning at normal temperature, NT: (23 ± 5) ºC shall be tested according to the method indicated in clause C.1.

Normal temperature conditioning is indicated in clause C.2.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,NT}$ [in MPa] and the characteristic value $\sigma_{u,C,NT}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,NT}$ [in %] of the elongation at adhesive rupture.
- Arithmetic average value $C_{r,m,NT}$ [in %] of the cohesive rupture area of the adhesive.

Tensile stress and elongation values are to be used for the following characteristics:

- Tensile stress and elongation at high and low temperature. See clause 2.2.3.2.1.
- Tensile stress after ageing under high temperature and high humidity. See clause 2.2.3.2.2.
- Tensile stress after immersion in water. See clause 2.2.3.2.3.
- Tensile stress after ageing under high humidity and NaCl atmosphere. See clause 2.2.3.2.4.

- Tensile stress after ageing under high humidity and SO_2 atmosphere. See clause 2.2.3.2.5.
- Tensile stress after cyclic tensile loads. See clause 2.2.3.2.6.
- Tensile stress after cyclic shear loads. See clause 2.2.3.2.7.
- Tear resistance. See clause 2.2.3.2.9.
- Freeze-thaw resistance. See clause 2.2.4.1.

2.2.3.1.2 Shear stress and shear displacement at normal temperature (NT) of glued connexion

Shear stress and elongation after (24 ± 4) hours conditioning at normal temperature, NT: (23 ± 5) ºC shall be assessed according to the methods in clause C.11.

Normal temperature conditioning is indicated in clause C.2.

The following data shall be stated in the ETA:

- The arithmetic average value $\tau_{u,m,NT}$ [in MPa] and the characteristic value $\tau_{u,C,NT}$ [in MPa] according to equation (F.1) of the shear stress at adhesive rupture.
- The arithmetic average value of the maximum shear displacement $d_{Su,m,NT}$ [in mm] at adhesive rupture.
- Arithmetic average value $C_{r,m,NT}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.2 Residual mechanical resistance of the glued connexion

Mechanical resistance of the glued connexion depends exclusively on the mechanical resistance of the adhesive when the adherence resistance between the adhesive and the surface of the cladding element or the profile surface is greater than the cohesive resistance of the adhesive.

In this case, it is possible to carry out the mechanical resistance tests using representative materials according to Option 2 given in clause C.1.1 and C.11.1.

2.2.3.2.1 Tensile stress and elongation at high temperature (HT) and low temperature (LT) of glued connexion

Tensile stress and elongation after conditioning at high and low temperature shall be tested according to the method indicated in clause C.1.

High and low temperature conditioning is indicated in clause C.3.

For each temperature considered in the test series, the following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,HT}$ and $\sigma_{u,m,LT}$ [in MPa] and the characteristic value $\sigma_{u,C,HT}$ and $\sigma_{u,C,LT}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,HT}$ and $\varepsilon_{u,m,LT}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after HT or LT and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,HT}$ and $C_{r,m,LT}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.2.2 Tensile stress after ageing under high temperature and high humidity (HT+RH) of glued connexion

Tensile stress and elongation after medium term conditioning at high temperature and high humidity shall be tested according to the method indicated in clause C.1.

Medium term conditioning at high temperature and high humidity is indicated in clause C.4.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,HT+RH}$ [in MPa] and the characteristic value $\sigma_{u,C,HT+RH}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,HT+RH}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after HT+RH and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,HT+RH}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.2.3 Tensile stress after immersion in water (H2O) of glued connexion

Tensile stress and elongation after immersion in water shall be tested according to the method indicated in clause C.1.

Immersion in water conditioning is indicated in clause C.5.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,H2O}$ [in MPa] and the characteristic value $\sigma_{u,C,H2O}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,H2O}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after H2O and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,H2O}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.2.4 Tensile stress after ageing under high humidity and NaCl atmosphere (RH+NaCl) of glued connexion

Tensile stress and elongation after ageing under high humidity and NaCl atmosphere shall be tested according to the method indicated in clause C.1.

High humidity and NaCl atmosphere ageing is indicated in clause C.6.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,RH+NaCl}$ [in MPa] and the characteristic value $\sigma_{u,C,RH+NaCl}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,RH+NaCl}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after RH+NaCl and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,RH+NaCl}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.2.5 Tensile stress after ageing under high humidity and SO_2 atmosphere (RH+SO2) of glued connexion

Tensile stress and elongation after ageing under high humidity and SO_2 atmosphere shall be tested according to the method indicated in clause C.1.

High humidity and SO_2 atmosphere ageing is indicated in clause C.7.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,RH+SO2}$ [in MPa] and the characteristic value $\sigma_{u,C,RH+SO2}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,RH+SO2}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after RH+SO2 and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,RH+SO2}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.2.6 Tensile stress after cyclic tensile loads (CTL) of glued connexion

Tensile stress and elongation after cyclic tensile loads shall be tested according to the method indicated in clause C.1.

Cyclic tensile loads ageing is indicated in clause C.8.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,CTL}$ [in MPa] and the characteristic value $\sigma_{u,C,CTL}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,CTL}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after CTL and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,CTL}$ [in %] of the cohesive rupture area of the adhesive.
- The maximum number of cycles considered in the test: 5000 cycles (reference test) or 10000 cycles (optional test).
- Reference tensile stress σ_{ref} [in MPa] considered in the assessment for cyclic loading.
- Description if any damage occurs in the glued connexion after each group of cycles (100, 250, 5000 and, optionally 10000 times).

2.2.3.2.7 Tensile stress after cyclic shear loads (CSL) of glued connexion

Tensile stress and elongation after cyclic shear loads shall be tested according to the method indicated in clause C.1.

Cyclic shear loads ageing is indicated in clause C.9.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,CSL}$ [in MPa] and the characteristic value $\sigma_{u,C,CSL}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,CSL}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after CSL and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,CSL}$ [in %] of the cohesive rupture area of the adhesive.
- Arithmetic average value of the stabilization of the load $S_{t,m}$ [in %]. See clause C.9.
- Reference shear displacement $d_{s,ref}$ [in mm] considered in the assessment for cyclic loading.
- Description if any damage occurs in the glued connexion after all cycles.

2.2.3.2.8 Shear creep (at high temperature and high humidity) of glued connexion

Shear creep at high temperature and high humidity shall be tested according to the method indicated in clause C.12.

The following data shall be stated in the ETA:

- The arithmetic average value $d_{s1,m}$ [in mm] and the characteristic value $d_{s1,C}$ [in mm] of the displacement after (168 $\pm$ 4) hours.
- The arithmetic average value $d_{s2,m}$ [in mm] and the characteristic value $d_{s2,C}$ [in mm] of the displacement after (1004 $\pm$ 4) hours.
- The arithmetic average value $S_{tv,m}$ [in mm] and the characteristic value $S_{tv,C}$ [in mm] of the stabilisation of vertical displacement.
- Reference shear stress τ_{ref} [in MPa] and the dead load $F_{S,DL}$ [in N] considered in the assessment.

2.2.3.2.9 Tear resistance (TR) of glued connexion

Tensile stress and elongation after an incision or cutting in the adhesive bead shall be tested according to the method indicated in clause C.1.

Incision or cutting in the adhesive bead is indicated in clause C.10.

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,TR}$ [in MPa] and the characteristic value $\sigma_{u,m,TR}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,TR}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after TR and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,TR}$ [in %] of the cohesive rupture area of the adhesive.

2.2.3.3 Resistance of supplementary metal cladding fixings

This characteristic is only relevant when the kit includes supplementary metal cladding fixings as it is indicated in clause 1.1.4.

Resistance of supplementary metal cladding fixings to horizontal and vertical loads shall be tested according to the methods given in clause J.3 of EAD 090062-01-0404.

At least the worst case (the mechanically weakest case, i.e., weakest material and minimum geometry) shall be tested.

The arithmetic average value $F_{u,m}$ [in N] and the characteristic value $F_{u,C}$ [in N] according to equation (N.1) of EAD 090062-01-0404 shall be stated in the ETA.

2.2.4 Aspects of durability

The assessment of the durability of the kits is carried out by means of the assessment of the following characteristics which are representative of this essential characteristic for cladding kits:

- Residual mechanical resistance of the glued connexion. See clauses 2.2.3.2.

- Freeze-thaw resistance. See clause 2.2.4.1
- Behaviour after immersion in water. See clause 2.2.4.2
- Corrosion of kit components. See clause 2.2.4.3.
- Other aspects of durability of kit components. See clauses 2.2.16.5 to 2.2.16.7 of EAD 090062-01-0404. In particular, in case of kits Type A when the cladding elements are made of TMCS/TMCP, clause 2.2.16.9 of EAD 090062-01-0404 applies.

2.2.4.1 Freeze-thaw resistance

Depending on the kit Type A or Type B, the behaviour after freeze-thaw cycles shall be assessed by means of the following relevant mechanical resistance tests before and after the freeze-thaw cycles.

For both, kits Type A and Type B:

Kits behaviour after freeze-thaw cycles shall be assessed by means of tensile stress and elongation test of the glued connexion before and after cycles.

At least five specimens shall be tested.

Freeze-thaw cycles shall be carried out according to clause M.3 of EAD 090062-01-0404.

After completion of the freeze-thaw cycles the test specimens shall be tested according to tensile stress test (see clause C.1).

The following data shall be stated in the ETA:

- The arithmetic average value $\sigma_{u,m,FzTh}$ [in MPa] and the characteristic value $\sigma_{u,m,FzTh}$ [in MPa] according to equation (F.1) of the tensile stress at adhesive rupture.
- The arithmetic average value $\varepsilon_{u,m,FzTh}$ [in %] of the elongation at adhesive rupture.
- Ratio (division between the results after FzTh and after NT according to clause 2.2.3.1.1).
- Arithmetic average value $C_{r,m,FzTh}$ [in %] of the cohesive rupture area of the adhesive.
- The number of cycles applied according to clause M.3 of EAD 090062-01-0404.

For kits Type A:

In addition, for glued cladding kits Type A where the cladding element materials are known or are suspected of being sensitive to freeze-thaw, behaviour after freeze-thaw cycles shall also be assessed by means of bending strength test (see clause 2.2.12.1 of EAD 090062-01-0404) before and after cycles.

For cladding elements made of TMCS clause 2.2.16.9 of EAD 090062-01-0404 applies.

The number of test specimens shall be the same as those of the bending strength test.

Freeze-thaw cycles shall be carried out according to clause M.3 of EAD 090062-01-0404.

The following data shall be stated in the ETA:

- Bending strength test results according to clause 2.2.12.1 of EAD 090062-01-0404.
- Number of cycles applied according to clause M.3 of EAD 090062-01-0404.
- Ratio (division between the results after and before cycles).

2.2.4.2 Behaviour after immersion in water

For both, kits Type A and Type B, behaviour after immersion in water of the glued connexion is already considered in the assessment given in clause 2.2.3.2.3.

In addition, for kits Type A, where the cladding element materials are known or are suspected of being sensitive to water penetration, behaviour after immersion in water shall also be assessed by means of bending strength test (see clause 2.2.12.1 of EAD 090062-01-0404) before and after immersion in water.

For cladding elements made of TMCS clause 2.2.16.9 of EAD 090062-01-0404 applies.

The number of test specimens shall be the same as those of the bending strength test.

Immersion in water shall be carried out according to clause M.4 of EAD 090062-01-0404.

The following data shall be stated in the ETA:

- Bending strength test results according to clause 2.2.12.1 of EAD 090062-01-0404.

- Ratio (division between the results after and before cycles).

2.2.4.3 Corrosion

Corrosion of the glued connexion is already considered in the assessment given in clauses 2.2.3.2.4 and 2.2.3.2.5.

In addition, metal kit components shall be assessed according to clause 2.2.16.8 of EAD 090062-01-0404.

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 Commission Decision 2003/640/EC.

The applicable AVCP system is 2+ for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire[5] the applicable AVCP systems regarding reaction to fire are 1, or 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.

The manufacturer (regarding the components he buys from the market with DoP) shall take into account the Declaration of Performance issued by the manufacturer of that component. No retesting is necessary.

Table 3.2.1 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	Reaction to fire (i)				
	▪ Reaction to fire (for any classification)	Indirect tests as specified in Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Table 3.2.2	See Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Tables 3.2.2	See Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Tables 3.2.2	See Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Tables 3.2.2
	▪ Reaction to fire (for class A1)	Direct test according to EN ISO 1182	According to Control Plan	According to test method and Control Plan (v)	(iv)
	▪ Reaction to fire (for class A1 or A2)	Direct test according to EN ISO 1716	According to Control Plan	According to test method and Control Plan (v)	At least once each two years
	▪ Reaction to fire (for class A2 to D)	Direct test according to EN 13823 (ii)	According to Control Plan	According to test method and Control Plan (v)	(iv)
	▪ Reaction to fire (for class B and F)	Direct test according to EN ISO 11925-2	According to Control Plan	According to test method and Control Plan (v)	(iv)

5 Including propensity to undergo continuous smouldering, where relevant.

Table 3.2.1 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
2	When applicable, Propensity to undergo continuous smouldering	Direct control method based on relevant clause 2.2.3 of EAD 090062-01-0404	According to Control Plan	One (v)	At least once each two years
		Indirect tests as specified in Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Table 3.2.2	See Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Tables 3.2.2	See Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Tables 3.2.2	See Tables 3.2.2 to 3.2.5 of EAD 090062-01-0404 and Tables 3.2.2
3	Components produced by the manufacturer himself:				
	▪ Cladding elements	See Table 3.2.2 of EAD 090062-01-0404	See Table 3.2.2 of EAD 090062-01-0404	See Table 3.2.2 of EAD 090062-01-0404	See Table 3.2.2 of EAD 090062-01-0404.
	▪ Adhesive system components	See Table 3.2.2	See Table 3.2.2	See Table 3.2.2	See Table 3.2.2
	▪ Subframe components and supplementary metal cladding fixings	See Table 3.2.3 of EAD 090062-01-0404	See Table 3.2.3 of EAD 090062-01-0404	See Table 3.2.3 of EAD 090062-01-0404	See Table 3.2.3 of EAD 090062-01-0404.
	▪ Thermal insulation product	See Table 3.2.4 of EAD 090062-01-0404	See Table 3.2.4 of EAD 090062-01-0404	See Table 3.2.4 of EAD 090062-01-0404	See Table 3.2.4 of EAD 090062-01-0404
	▪ Ancillary components	According to the Control Plan	According to the Control Plan	According to the Control Plan	According to the Control Plan
4	Components not produced by the manufacturer himself (iii)	See Table 3.2.5 of EAD 090062-01-0404	See Table 3.2.5 of EAD 090062-01-0404	See Table 3.2.5 of EAD 090062-01-0404	See Table 3.2.5 of EAD 090062-01-0404.

(i) Indirect tests shall be applied to all components independent from the source of their classification (Testing, Decision 96/603/EC as amended or any other applicable CWFT decision). Direct tests within the FPC shall only apply to those components where the classification is based on the prescribed tests for the corresponding class(es) according to Commission Delegated Regulation (EU) 2016/364 and EN 13501-1.

(ii) If it is necessary to perform SBI tests within the FPC, the test set-up that was classified as the worst case within the ETA procedure shall be tested.

(iii) Components produced by the supplier under the specifications of the manufacturer.

(iv) The tests shall always be carried out whenever the performance is not verified by means of indirect tests (see Tables 3.2.2 to Table 3.2.5) or, at least, once each five years when the indirect tests verify the performance. For this minimum frequency, the sufficient correlation between the foreseen system of indirect FPC measures and the direct tests shall be stated in the Control Plan. Otherwise, the minimum frequency of direct tests within the FPC shall be at least once per two years.

(v) The necessary number of specimens shall be more detailed in the control plan depending on the test method and the class to be verified within the FPC. The tests shall be performed on randomly taken specimens from the production process.

Table 3.2.2 Control plan when the adhesive system components are produced by the manufacturer himself; 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]					
Incoming materials (all adhesive system components)					
1	Receipt materials	Delivery ticket or label on the package	Conformity with the order	---	Each delivery
		Checking of supplier certificates or supplier tests	Conformity with the order	---	Each delivery
2	Type of component material (i)	Checking of supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Finished component (adhesive & glued connexion)					
2	Specific mass or density of the adhesive (i)	Based on EN ISO 1183-1 or EN ISO 2811-1	According to Control Plan	According to Control Plan	According to Control Plan (ii)
3	Aspect (colour, homogeneity, etc.) of the adhesive	Based on EN ISO 11664-4 or ISO 4660	According to Control Plan	According to Control Plan	According to Control Plan (ii)
4	Flow resistance of the adhesive	Based on EN ISO 7390, method A	According to Control Plan	According to Control Plan	According to Control Plan (ii)
5	Elastic modulus of the adhesive	Based on EN ISO 527-3	According to Control Plan	According to Control Plan	According to Control Plan (ii)
6	Mechanical characteristics of the glued connexion	Peel test according to Annex G	According to Control Plan	According to Control Plan	According to Control Plan (ii)
7		Test according to 2.2.3.1 & 2.2.3.2	According to Control Plan	According to Control Plan	At least once each 5 years
8	PCS value (for class B to D) (i)	Test according to EN ISO 1716	According to Control Plan	According to Control Plan	Monthly (ii)
9	Organic content (i)	Ash content / loss on ignition according to clause 3.4.3. Otherwise, Thermogravimetry test based on EN ISO 11358-1	According to Control Plan	According to Control Plan	Once per batch (ii)
10	Shrinkage	EN ISO 10563	According to Control Plan	According to Control Plan	At least once each 5 years
11	Gas inclusion	Test according to 3.4.1	According to Control Plan	According to Control Plan	At least once each 5 years
12	Effect of materials in contact	Test according to 3.4.2	According to Control Plan	According to Control Plan	At least once each 5 years
Finished component (pre-treatment products)					
13	Specific mass or density (i)	Based on EN ISO 1183-1 or EN ISO 2811-1	According to Control Plan	According to Control Plan	According to Control Plan (ii)
14	Colour	Visual check	According to Control Plan	According to Control Plan	According to Control Plan (ii)
15	PCS value (for class B to D) (i)	Test according to EN ISO 1716	According to Control Plan	According to Control Plan	Monthly (ii)

Table 3.2.2 Control plan when the adhesive system components are produced by the manufacturer himself; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
16	Organic content (i)	Ash content / loss on ignition according to clause 3.4.3. Otherwise, Thermogravimetry test based on EN ISO 11358-1	According to Control Plan	According to Control Plan	Once per batch (ii)
Finished component (adhesive-tape)					
17	Geometry (form and dimensions) (i)	Measuring and visual check	According to Control Plan	According to Control Plan	According to Control Plan (ii)
18	PCS value (for class B to D) (i)	Test according to EN ISO 1716	According to Control Plan	According to Control Plan	Monthly (ii)
19	Organic content (i)	Ash content / loss on ignition according to clause 3.4.3. Otherwise, Thermogravimetry test based on EN ISO 11358-1	According to Control Plan	According to Control Plan	Once per batch (ii)

(i) Indirect characteristic related to reaction to fire and, when applicable, propensity to undergo continuous smouldering.

(ii) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the kit 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 manufacturing plant and of factory production control					
1	Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the Kit.	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to Control plan	According to Control plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control					
3	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1	According to Control plan	According to Control plan	1/year

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire[6] for products/materials for which 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 3.3.2

Table 3.3.2 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 carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire-retardants					
1	Where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 are fulfilled for reaction to fire, the notified body will consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire-retardants or a limiting of organic material).	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	As defined in the control plan agreed between the TAB and the manufacturer	As defined in the control plan agreed between the TAB and the manufacturer	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire-retardants					
2	Where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 in the Decisions regarding reaction to fire are fulfilled, the notified body will consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire-retardants or a limiting of organic material)	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1	As defined in the control plan agreed between the TAB and the manufacturer	As defined in the control plan agreed between the TAB and the manufacturer	2/year

6 Including propensity to undergo continuous smouldering, where relevant.

3.4 Special methods of control and testing used for the assessment and verification of constancy of performance

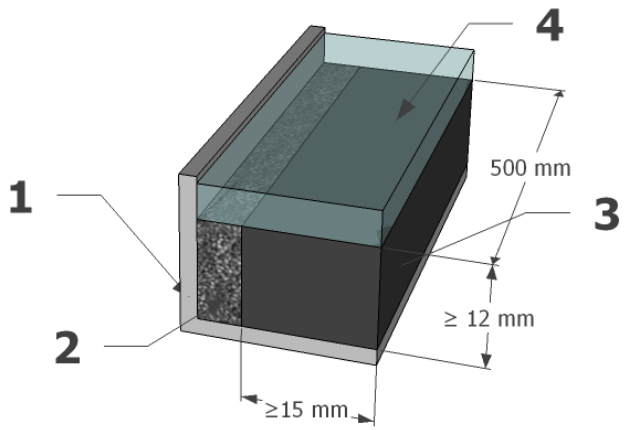
3.4.1 Gas Inclusion Test

This test is only relevant for two-component adhesives.

One test specimen with a float glass upper face shall be prepared. The adhesive shall completely fill the space created between the glass, adhesive-tape, and the aluminium, without any air pockets (see Figure 3.4.1.1).

The test specimen shall be stored at (23 ± 2) °C and at (50 ± 5) % relative humidity for (21 ± 1) days. The test specimen shall be checked visually every (7 ± 1) days. Generation of gas bubbles and their rate of growth shall be recorded.

No bubbles shall be observed with the naked eye for validating the adhesive production.



Key:
1- Aluminium profile
2- Adhesive-tape
3- Adhesive
4- Glass

Figure 3.4.1.1: Gas inclusion test specimen.

3.4.2 Effects of Materials in Contact Test

The stability of the glued connexion may be affected by chemical incompatibility between the adhesive and other materials (e.g., adhesive-tape materials).

Test specimens shall be prepared according to the MPII taking into account all the materials to be put in contact and the pre-treatment components.

Five test specimens Type I or Type II according to Figures C.1.1.1 and C.1.1.2 shall be prepared.

Figure 3.4.2.1 shows one example, using a bond breaker for a test specimen Type I.

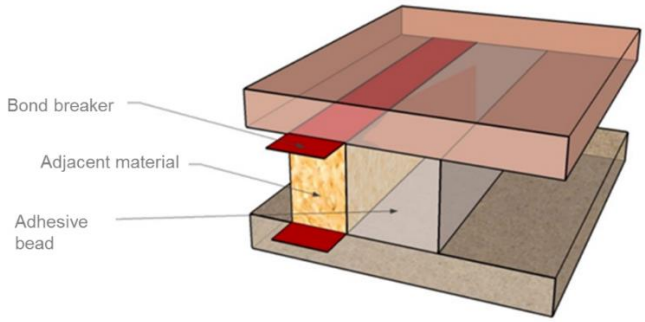


Figure 3.4.2.1: Test specimen Type I with a bond breaker.

The test pieces shall be conditioned for (1000 ± 4) hours at (60 ± 2) °C and (85 ± 5) % relative humidity.

The specimens shall be removed from the climatic chamber and conditioned for (24 ± 4) hours at (23 ± 2) °C and (50 ± 5) % relative humidity.

The five specimens shall be subjected to the tensile test according to clause 2.2.3.1.1. The adjacent material shall be removed so that the result refers to the adhesion between the adhesive and the adhesion-surfaces. If the adhesive and the adjacent material cannot be separated without damage, additional five test specimens shall be prepared and tested in tension at the initial state.

During the conditioning (1000 ± 4) hours, the specimens shall be examined with normal corrected vision every 14 days in order to note any changes in colour. No discolouration shall be allowed.

3.4.3 Ash content or Loss on ignition

For products which are inorganic, i.e., products containing a low percentage of organic compounds and for thermal insulation products as well, the test method shall be based on EN 13820.

For products which are organic, the test method shall be based on EN ISO 3451-1.

4 REFERENCE DOCUMENTS

EAD 090001-00-0404	Pre-fabricated compressed mineral wool boards with organic or inorganic finish and with specified fastening system.
EAD 090010-00-0404	Bonded glazing kits and bonding sealants.
EAD 090019-00-0404	Kits for ventilated external wall claddings made of expanded glass granulates boards, magnesium oxide boards or other mineral boards, with rendering applied in situ.
EAD 090034-00-0404	Kit composed by subframe and fixings for fastening cladding and external wall elements.
EAD 090058-00-0404	Ventilated external wall cladding kit comprising a metallic honeycomb panel and its associated fixings.
EAD 090062-01-0404	Kits for external wall claddings mechanically fixed.
EAD 090119-00-0404	Kits for external wall cladding of mineral boards with renderings applied in situ.
EN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components.
EN 13022-2:2014	Glass in building - Structural sealant glazing - Part 2: Assembly rules.
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 13820:2003	Thermal insulating materials for building applications - Determination of organic content.
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 13830:2003	Curtain walling - Product standard.
EN ISO 10563:2023	Building and civil engineering sealants - Determination of change in mass and volume.
EN ISO 11358-1:2022	Plastics - Thermogravimetry (TG) of polymers - Part 1: General principles.
EN ISO 1182:2020	Reaction to fire tests for products - Non-combustibility test.
EN ISO 1183-1:2019	Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method.
EN ISO 11925-2:2020	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test.
EN ISO 1716:2018	Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value).
EN ISO 2811-1:2023	Paints and varnishes - Determination of density - Part 1: Pycnometer method.
EN ISO 22479:2022	Corrosion of metals and alloys - Sulfur dioxide test in a humid atmosphere (fixed gas method).
EN ISO 3451-1:2019	Plastics - Determination of ash - Part 1: General methods.
EN ISO 527-3:2018	Plastics -- Determination of tensile properties -- Part 3: Test conditions for films and sheets.
EN ISO 7390:2003	Building construction - Jointing products - Determination of resistance to flow of sealants.
EN ISO 9227:2022	Corrosion tests in artificial atmospheres -- Salt spray tests.
EN ISO/CIE 11664-4:2019	Colorimetry - Part 4: CIE 1976 L*a*b* Colour space.
ISO 12491:1997	Statistical methods for quality control of building materials and components.
ISO 16269-6:2014	Statistical interpretation of data -- Part 6: Determination of statistical tolerance intervals.
ISO 4660:2020	Rubber, raw natural -- Colour index test.

ANNEX A: REACTION TO FIRE

A.1 - GENERAL

A.1.1 - Principle

The determination of reaction to fire of the kits is based on testing of “the worst case” – the most critical configuration in sense of reaction to fire. According to the rules described further in the text, the classification obtained on the most critical configuration of the kit components is valid for all configurations of kit components having better performance in sense of reaction to fire.

For testing of the kit, the following principles shall apply regarding the selection of the relevant kit components:

- The kit components’ materials with the highest amount of organic content[7] (if there are only differences in the amount of organic content but no difference in the organic component itself) or with the highest gross heat of combustion - Q_{PCS} [MJ/kg] according to EN ISO 1716 (from now on called “Q_{PCS}-value”) shall be tested.

- The influences of different colours shall be considered by performing tests on a light, on a dark and on a colour in the middle of the range (e.g., CIELAB 40.51, 59.28, 47.98; RGB 184, 29, 19; Munsell ref. 7.5R 4/13; RAL 3020; or BS04E56).

- In addition, each kit components material selected for testing according to the previous point shall have the smallest amount of fire-retardants.

Components of a kit which are classified A1 without testing according to Decision 96/603/EC (as amended by Commission Decision 2000/605/EC and Commission Decision 2003/424/EC) do not need to be tested for an assessment according to option "a)" of clause 2.2.1. They also do not need to be tested for an assessment according to option "b)" of clause 2.2.1 if applying those test methods where each component shall be tested separately (e.g., EN ISO 1182, EN ISO 1716). In case of further calculation to determine to total Q_{PCS}-value of a composite product or a kit, these components do not contribute to the total Q_{PCS}-value, therefore, their individual Q_{PCS}-value shall be set as zero.

A.1.2 - Physical properties influencing the reaction to fire behaviour

- Type of cladding elements (e.g., material composition, thickness, density, weight per unit area).

- Organic content (binder and any other additives) of kit components, where applicable, (e.g., cladding elements made of fibre-cement, concrete, cement bonded particle, agglomerated stone, and other materials according to Table 1.1.1.1 of EAD 090062-01-0404).

- Type and amount of fire-retardant[8].

- Type and nature of the adhesive system components, the subframe components and the supplementary metal cladding fixings.

Note: Fire breaks and cavity barriers are important for the behaviour of the whole facade cladding system and cannot be assessed on the basis of SBI-testing. The influence can only be observed during a

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7 The organic content can be checked by providing the formulation or, by performing suitable characterization tests or by determining the glow loss (loss on ignition or ash content). When information on organic content per unit area is not available, the Q_{PCS}-value shall be tested to decide about the worst case.

8 The term “fire-retardant” refers both to chemicals incorporated into a product composition during the manufacturing process (sometimes known as flame-retardant) and to coatings applied onto a finished product, in both cases with the purpose of improving the product’s reaction to fire.

large-scale test (see Annex Q of EAD 090062-01-0404). Therefore, breaks shall not be included in the mounting and fixing rules for the SBI-test.

Although in the rest of this annex applies the “worst case scenario” for deciding what to test, it is accepted that, where the manufacturer wants to assess a range of kit configurations having different overall classifications, it may group these together into a number of different sub-groups (e.g., each sub-group corresponding to a different overall classification) with the ‘worst case scenario’ being identified for each sub-group.

A.2 - TESTING ACCORDING TO EN ISO 1182

This test method is relevant for classes A1 and A2 according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Using this test method, only the substantial components of the kit shall be tested. ‘Substantial components’ are defined by thickness (≥ 1 mm) and/or mass per unit area (≥ 1 kg/m^2).

Physical properties as given in clause A.1.2 (in particular product type, density, organic content, fire-retardants) and the principles given in clause A.1.1 for the determination of the probable worst case shall be considered for selection of the specimens and the testing purposes.

A.3 - TESTING ACCORDING TO EN ISO 1716 (Q_{PCS}-VALUE)

This test method is relevant for classes A1 and A2 according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

This test method shall be performed to all components of the kit except for cases which are classified as A1 without testing.

Parameters relevant for this test method are composition (when performing calculation of the Q_{PCS}-value, density or mass per unit area and thickness are relevant). Discrete and non-continuous mechanical fixings and ancillary components which fulfil the conditions for small components according to clause A.6 shall not be considered for testing and for the calculation of the Q_{PCS}-values.

It is not necessary to test a cladding element with different grain sizes if the organic content is the same as or lower than that of the tested cladding element.

A.4 - TESTING ACCORDING TO EN 13823 (SBI-TEST)

This test method is relevant for classes A2, B, C and D (in some cases also for A1) according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Mounting and fixing provisions for the SBI-test for kits are indicated in Annex B.

Parameters which are relevant for this test method:

- Type of kit components (e.g., material composition, dimensions, density, weight per unit area).
- Amount of organic content of the kit components.
- Amount of fire-retardant, if any.
- Colour according to the principles as in A.1.1.

In principle, it is desirable to find the test specimen configuration that gives the worst case concerning the reaction to fire test results. In the test procedure according to EN 13823, values for the rate of heat release, total heat release, lateral flame spread, rate of smoke release, total smoke release and burning droplets shall be determined.

The test specimen shall be prepared with the kit components with the highest organic content or Q_{PCS}-values per unit area.

A.4.1 – Direct application rules of test results

See clause B.1.3.

A.5 - TESTING ACCORDING TO EN ISO 11925-2

This test method is relevant for classes B, C, D, E and F according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Mounting and fixing provisions for the tests are indicated in Annex B.

Parameters which are relevant:

- Type of kit components (e.g., material composition, dimensions, density, weight per unit area).
- Amount of organic content of the kit components.
- Amount of fire-retardant, if any.
- Colour according to the principles as in A.1.1.

For cladding elements with covered edges, the specimens shall be prepared both with covered edges and edges without covering (cut edges).

The tests are performed with surface exposure of the front side, edge exposure and possibly edge exposure of multi-layered test specimen turned 90° on their vertical axis according to the rules of standard EN ISO 11925-2. Besides, the principles specified in clause A.1 shall be applied.

A.5.1 - Application of test results

See section B.1.3.

A.6 - SMALL COMPONENTS

Adhesive beads cannot be considered as a small component in any case.

For other kit components, clause B.6 of EAD 090062-01-0404 applies.

ANNEX B: MOUNTING AND FIXING PROVISIONS FOR THE SBI TEST (EN 13823) AND SINGLE-FLAME SOURCE TEST (EN ISO 11925-2)

B.1 - TESTING OF THE REACTION TO FIRE ACCORDING TO EN 13823 (SBI TEST)

Considerations for kits included in clause A.4 shall also be considered for SBI test.

The reaction to fire testing shall be given for the whole assembled kit, in simulating its end-use conditions.

The testing standard EN 13823 gives a general description of the arrangement of the test specimen for SBI test, applicable to classes A2, B, C and D (in some cases also to A1).

This Annex describes specific provisions for kits.

B.1.1 - General information

As a function of the use of the kit, the specimen shall be installed on a substrate in accordance with standard EN 13238:

- Calcium silicate or fibre-cement board or laminated gypsum board simulates a wall made of masonry or concrete,
- Non-fire-retardant treated particle board or plywood board simulate a frame wall made with an outer planking of wood or wood-based boards.
- Steel sheet simulates a frame wall made with an outer planking of metal sheets with a melting point of at least 1000 °C.
- Aluminium sheet simulates a frame wall made with an outer planking of metal sheets with a melting point of minimum 500 ºC.
- Additional substrates not covered by EN 13238 for specific uses. In such cases, test results are only applicable for the tested configuration.

  A necessary subframe shall be formed by vertically directed beams or profiles made of non-fire-retardant treated timber (spruce recommended, saw-cut, density not less than 350 kg/m³), aluminium or steel.

  A non- fire-retardant-treated timber subframe also covers metal subframes. Aluminium profiles cover subframes made of metal with a melting point of at least 500 °C. Steel profiles in the tests cover metal subframes with a melting point of at least 1000 °C.

All ancillary components which form part of the kit (e.g., breather membranes, thermos-stop pads, gaskets or seals) shall be included in a representative manner in the test specimen unless they may be considered as small components according to clause A.6.

An air space shall always be provided behind the cladding element in accordance with the MPII (minimum 20 mm). The bottom and top edges of the specimen shall also remain opened.

For ventilated cladding kits, a continuous airflow (without any interruption) in the air space shall be ensured. To that end, the provisions to allow a lateral airflow given in EN 13823 shall be considered as a first option. Only when the subframe profiles or studs (or any other kit component) do not allow this continuous airflow from the outer lateral edges of the test specimen wings, there shall be a gap of 10 mm between the bottom of the specimen and top level of U-profile of the SBI-test device.

For kits without thermal insulation products applied to the substrate (supporting wall), two cases regarding the depth of an air gap shall be considered within the tests:

- the minimum air gap depth (between rear surface of the cladding element and the substrate) as stated according to the MPII and allowed by the subframe dimensions and geometry (but not less than 20 mm) and,

- a 40 mm air gap depth between rear surface of the cladding element and the substrate.

First, an indicative test shall be performed for each of both air gap depths. The depth showing the worst results shall be completed (at least two additional tests) in order to obtain the worst classification.

If both indicative tests point to the same classification, any greater depth of the air gap than the tested minimum one shall be classified based on this result, without additional testing.

If the indicative tests point to different classifications, additionally, the case (air gap depth) showing the best results in the indicative test can also be fully tested for classification (two additional SBI test specimens to complete the required three test results) to determine if a better classification is obtained. If so, this better classification will apply only to the best-case air gap depth and the rest of the range will have the classification obtained with the worst-case air gap depth, unless additional intermediate depths are tested to determine the point (air gap depth) where classification changes.

For kits with thermal insulation products applied to the substrate (supporting wall), two cases regarding the depth of an air gap shall be considered within the tests:

- the minimum air gap depth (between rear surface of the cladding element and front surface of the thermal insulation product) as stated according to the MPII and allowed by the subframe dimensions and geometry (but not less than 20 mm) and,

- a 40 mm air gap depth between rear surface of the cladding element and front surface of the thermal insulation product.

First, an indicative test will be performed (1 specimen out of 3 for the SBI test) for both air gap depths. The depth showing the worst results will be completed (additional 2 tests) in order to obtain the worst classification.

If both indicative tests point to the same classification, any greater depth of the air gap than the tested minimum one could be classified based on this worst result, without additional testing.

If the indicative tests point to different classifications, additionally, the case (air gap depth) showing the best results in the indicative test can also be fully tested for classification (two additional SBI test specimens to complete the required three test results) to determine if a better classification is obtained. If so, this better classification will apply only to the best-case air gap depth and the rest of the range will have the classification obtained with the worst-case air gap depth, unless additional intermediate depths are tested to determine the point (air gap depth) where classification changes.

If the kit includes the thermal insulation products, for insulation materials class A1 or A2 as part of the kit, a standard mineral wool insulation product according to EN 13162, but with a thickness of 50 mm, shall be installed between frame and substrate.

For other insulation materials, different conditions can be used for testing (e.g., maximum and/or minimum thicknesses, maximum and/or minimum density, unless proven otherwise). In absence of representative insulation materials, the test results shall only be valid for those applications as tested.

Tests on specimen with a total thickness of at least 200 mm (maximum testable thickness according to EN 13823, including cladding element, airgap, subframe, thermal insulation product and substrate) shall be valid for kit with greater thickness.

The kit is fixed to the subframe. The kit shall be installed with the number of adhesive beads according to the MPII. If no information is available from the manufacturer regarding the number of adhesive beads, each cladding element being part of the specimen shall be fixed with one adhesive bead at each lateral of the cladding element.

The first (closer to the corner) adhesive bead of the long wing shall be positioned in accordance with the MPII. If there is a range of installation variations, the vertical middle axis of the first adhesive bead shall be

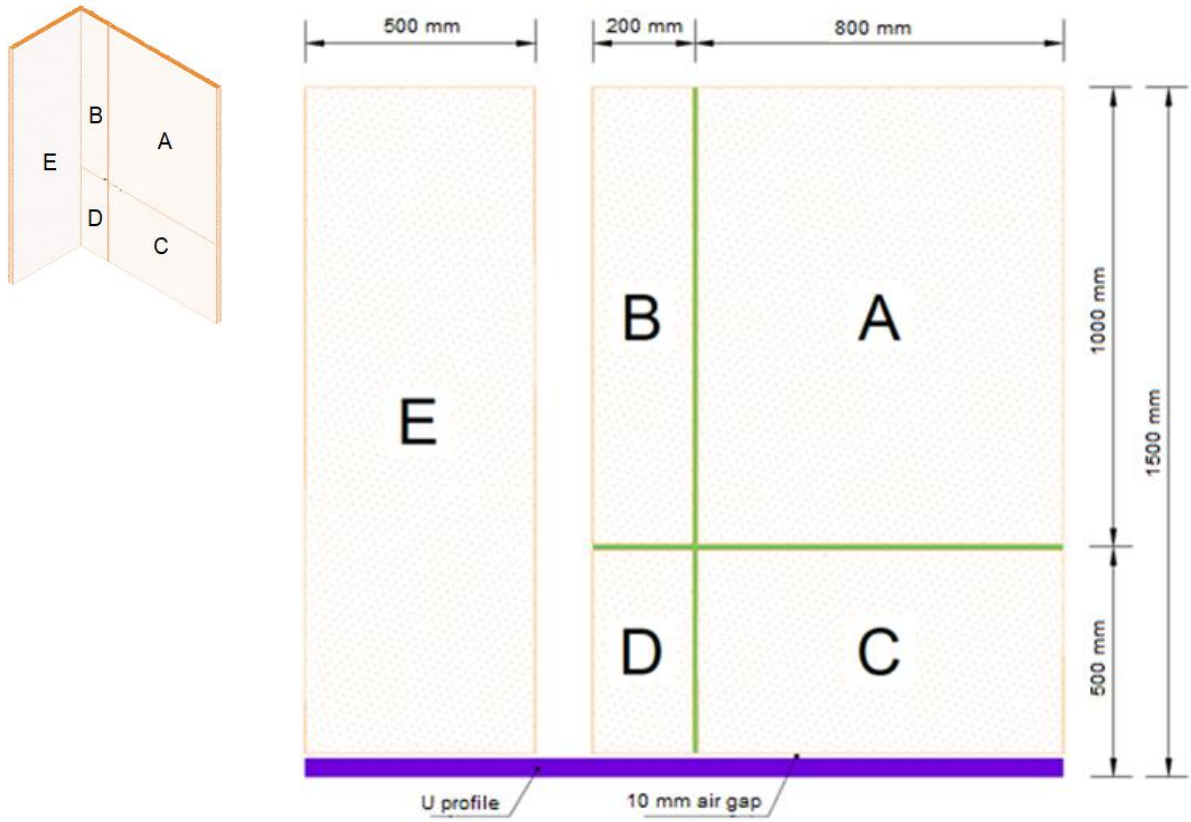
positioned at a distance “d” to the inner edge of the cladding element on the long wing (see Figures B.1.1.2 & B.1.1.3).

When the kit presents horizontal joints, it shall be tested with, at least, a horizontal joint in the long wing at a height of 500 mm from the bottom edge of the specimen to the centre axis of the joint and when the kit tested presents vertical joints, it shall be tested with, at least, a vertical joint in the long wing at a distance of 200 mm from the corner line to the centre axis of the joint, in accordance with the Figures B.1.1.1 to B.1.1.3. In the areas A, B, C, D and E, it is possible to have other vertical and/or horizontal joints between cladding elements.

For covering a range of different widths of open joints the test shall be conducted on specimens with the highest possible width of the open joints. If only butt joints are foreseen it is recommended to conduct the test with butt joints in the test assembly.

In case where the cladding element size requires more joints than described before, the minimum and maximum density of joints shall be tested. In the internal vertical angle, no profile shall be used and the cladding elements create a vertical closed joint. Cladding elements shall not be extended up to the substrate board in order to close the air cavity behind and provide additional protection. Air cavity shall be unobstructed.

When tested rear side kit (in case of asymmetrically composed cladding elements), the test shall involve a free-hanging arrangement with the flame impingement to the rear side in accordance with EN 13823 (test arrangement without open joints between the cladding elements and without insulation layer on A1 or A2 substrate, so that the distance between the backing board and the cladding elements amounts to at least 80 mm – see Figure B.1.2.3).



Note: 10 mm air gap is only to be included when necessary to ensure continuous airflow (see clause B.1.1).

Figure B.1.1.1: Schematic representation of SBI test installation (front view).

Legend for Figures B.1.1.2 & B.1.1.3:

1. Cladding element.
2. Adhesive bead.
3. Substrate.
4. Air space.
5. Subframe.
6. Thermal insulation product.

d = short wing cladding element thickness.

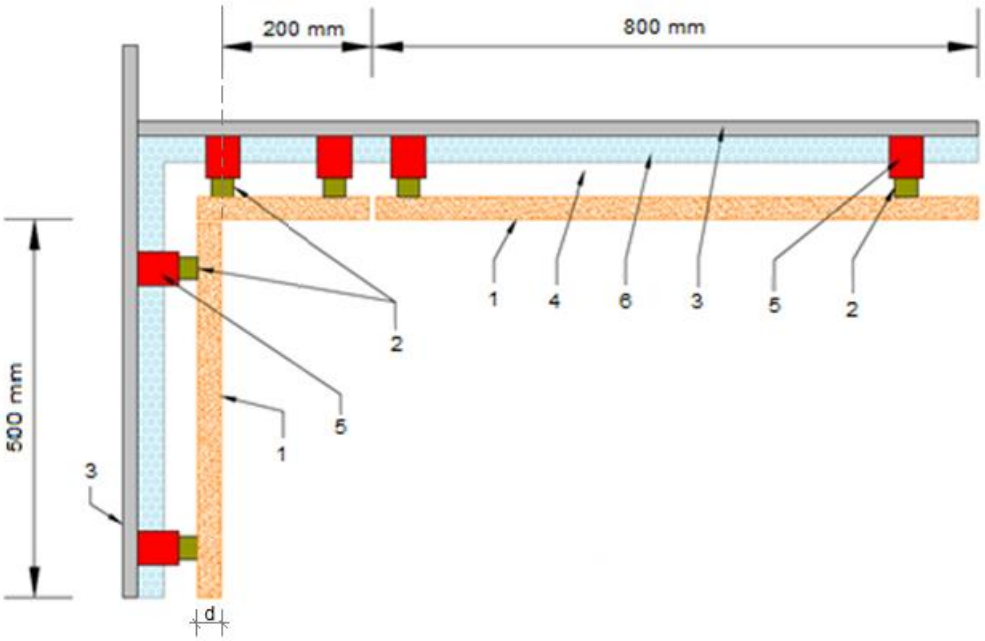


Figure B.1.1.2: Schematic representation of SBI test installation with vertical profiles (top view – test specimen with subframe and thermal insulation product).

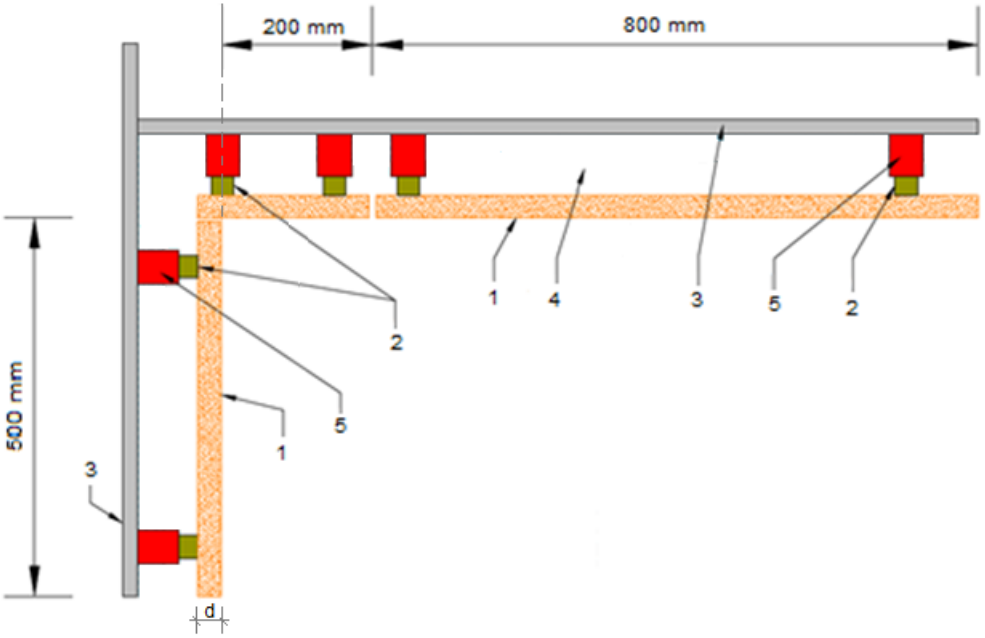


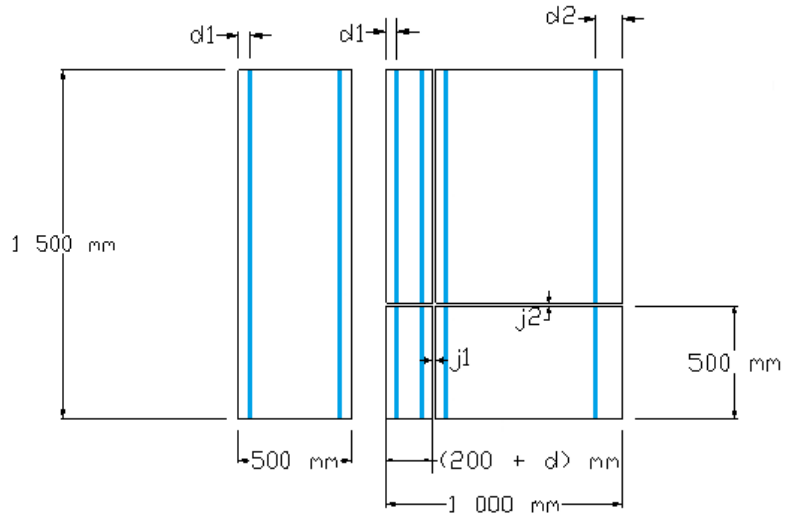
Figure B.1.1.3: Schematic representation of SBI test installation (top view – test specimen with subframe and without thermal insulation product).

B.1.2 - Specific information

The kits are tested in a limited number of configurations to cover the influence of the parameters indicated in clause A.4.

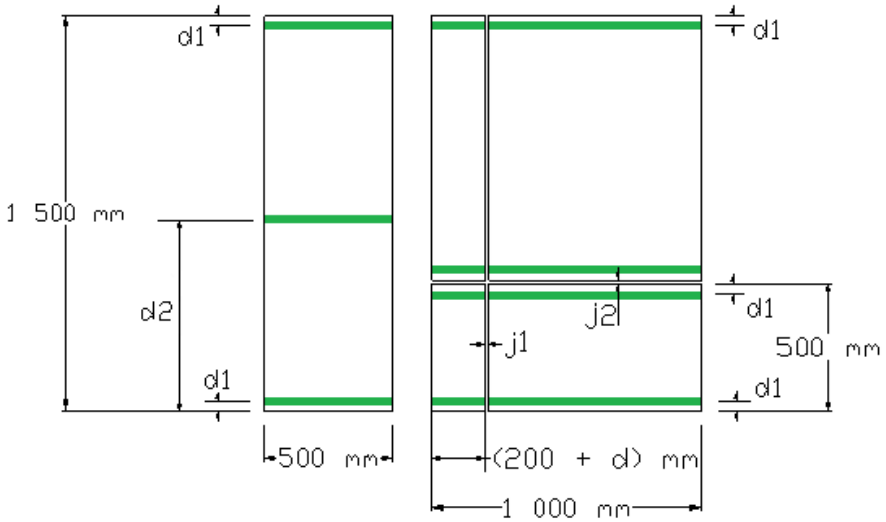
The cladding elements can be cut to size as shown in Figures B.1.2.1 and B.1.2.2.

The subframe shall be fixed to the substrate through fixings adapted to the type and material of the substrate.



Legend:
j1 = width of vertical joint
j2 = width of horizontal joint
d1, d2 = distances of the axis of subframe profiles to the edges of the cladding element.
d = short wing cladding element thickness.

Figure B.1.2.1: Example of installation for assembled systems with vertical profiles.



Legend:
j1 = width of vertical joint
j2 = width of horizontal joint
d1, d2 = distance of the axis of subframe profiles to the edges of the cladding element.
d = short wing cladding element thickness.

Figure B.1.2.2: Example of installation for assembled systems with horizontal profiles.

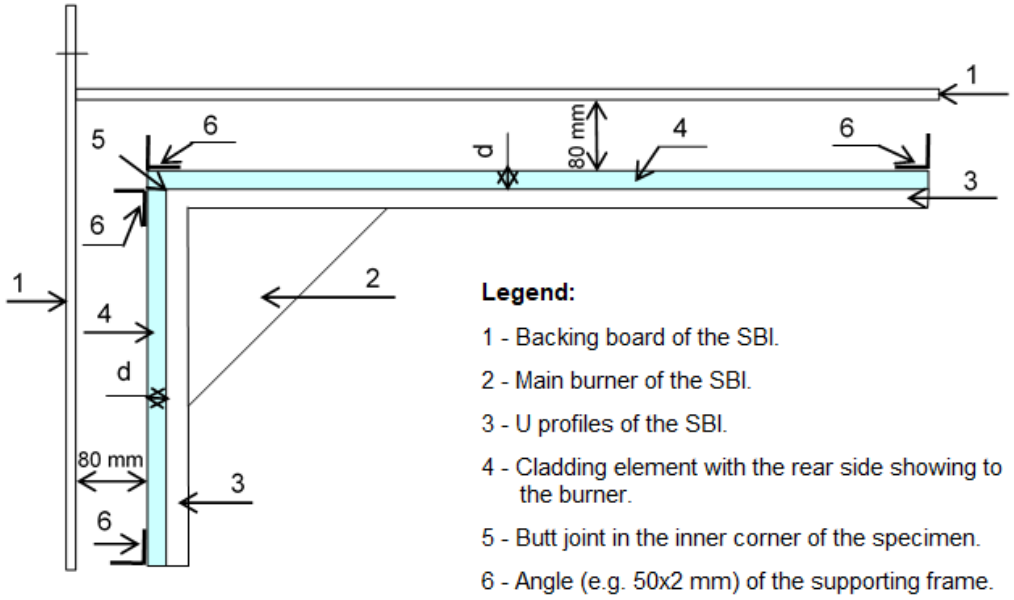


Figure B.1.2.3: Principle of testing the rear side.

B.1.3 - Extension of results

The test result (classification) shall remain valid, without test:

- For greater dimensions (height and width) of cladding elements.
- For the same adhesive with equal or lower applied quantity per unit area. For the same type of cladding element used in applications with open vertical joint ≤ j1 (tested value) and open horizontal joint ≤ j2 (tested value) (see j1 and j2 in Figures B.1.2.1 and B.1.2.2).
- For other greater depth of air gap.
- When the test is carried out without thermal insulation layer, the test result is only applicable to end-use applications without thermal insulation layers.
- When the test is carried out with mineral wool insulation panels the test results shall be valid for:
  - all other greater thickness of mineral wool insulation panel with the same or greater density and the same or better reaction to fire classification;
  - the same type of panel used without thermal insulation panel, if the substrate chosen according to EN 13238 is made of panel with Euro-class A1 or A2 (e.g., fibre-cement panel).
- The results of reaction to fire tests, where a combustible thermal insulation material was used as substrate, are also valid for end-use applications of the tested product without thermal insulation product on solid mineral substrates of class A1 or A2-s1,d0 like masonry or concrete.
- The test result of a test with non-fire-retardant-treated timber subframe shall be valid, without test, for the same type of cladding element used with aluminium or steel subframe. The test result of a test with an aluminium frame shall be valid, without test, for the same type of cladding element used with aluminium or steel frame. Result of tests with a steel frame are only valid for the same type of cladding elements used with metal frames with a melting point higher than 1000 °C

- If the classification is the same, the test result of the lowest and highest thickness of the cladding element shall be valid, without test, for all the thickness in between. In other case the worst classification applies to the other thicknesses of the range.

- The result from a test with open joints shall be valid, without test, for the same type of cladding element used in applications with butt joints or joints closed by steel or aluminium profiles.

- The test results are valid for cladding elements with the same composition and same assembly (or alternatively: all product types of the same defined product family) than used in the tests. In addition, the provisions of clause A.1.1. regarding organic content and content of fire-retardants shall be considered.

- The test results are valid for the same density / weight per unit area (if only one value was tested) or the range between those values evaluated in the tests.

- The test results are valid for the same organic coating/finish or any other coatings/finishes with the same or lower Q_{PCS}-value (related to the mass in dried condition), each with the same or lower applied quantity (in dried condition) than tested.

- The test results are valid for the same inorganic coating or facing and other inorganic coatings / facings with the same or higher applied quantity per unit area.

- The test results are valid for the same colour of cladding elements than tested or for the entire range of colours, if colours as prescribed in clause A.1.1. were tested.

- The test results are valid for the same or greater size of overlapping of cladding elements than tested.

Note: other aspects indicated in the technical specifications for the cladding element material (see Table 1.1.1.1 of EAD 090062-01-0404) shall be also taken into account.

B.2 - TESTING OF THE REACTION TO FIRE ACCORDING TO EN ISO 11925-2 (SINGLE FLAME SOURCE TEST)

B.2.1 - General

Due to the very limited size of the specimens as prescribed by the test standard, it is widely impossible to test the kit as whole. Therefore, all essential components of the kit shall be tested separately except in cases prescribed below.

For the relevant flame exposure types to be applied within testing, see clause A.5.

B.2.2 - Thermal insulation

When the kit contains the thermal insulation product, the following cases shall be considered:

Case 1:

According to the second paragraph of clause 2.2, thermal insulation products shall not be tested if reaction to fire is declared in their DoP and the given class according to EN 13501-1 is equal to or better than the intended class for the cladding kit (e.g., cladding kits class B or C, then the thermal insulation product shall be classified as class C).

Case 2:

When the reaction to fire class according to EN 13501-1 of the thermal insulation product is not declared in the DoP or the declared class is worse than the intended class for the cladding kit, testing of the thermal insulation product shall be carried out, the test shall be performed according to the provisions of the test

standard and taking into consideration the specific mounting and fixing provisions of the thermal insulation relevant product standards (see clause 1.1.4 of EAD 090062-01-0404) in connection with EN 15715.

Results and classification according to cases 1 and 2 are valid for the application of the insulation product on any substrate covered by standard substrates according to EN 13238 using mechanical fixing means or adhesives (mortars) with an organic content equal to or lower than 15% (related to the mass in dried condition; see clause B.2.3).

If an adhesive with an organic content higher than 15% (related to the mass in dried condition) is used for fixing the thermal insulation product to the substrate, separate testing is required as prescribed in B.2.3.

B.2.3 - Fixing means

Case 1:

Supplementary metal cladding fixings of the cladding element or thermal insulation product mechanical fixings do not need to be tested according to EN ISO 11925-2 within the assessment of the kit, because their contribution to fire spread and fire growth is zero (in case of metal fixings) or low (in case of punctual plastic fixings) due to their limited dimensions and the distance to each other.

Case 2:

When the cladding kit contains the thermal insulation product fixed by means of an adhesive (mortar) with an organic content of equal or lower than 15 % (related to the mass in dried condition), such an adhesive does not need to be part of the thermal insulation test specimen according to EN ISO 11925-2 (see clause B.2.2).

Case 3:

When the cladding kit contains the thermal insulation product fixed by means of an adhesive (mortar) with an organic content of more than 15% (related to the mass in dried condition) used for fixing the thermal insulation product to the substrate, it is necessary to carry out a complete set of six tests on specimens turned at 90 degrees on their vertical axis with edge exposure of the adhesive layer. The specimens consist of the substrate, the adhesive and the thermal insulation product. The following rules shall be applied for preparing the specimens:

- each type of adhesive with a different composition shall be used by selecting the variant with the highest amount of organic content and with the highest thickness,
- the thermal insulation product shall be used with the lowest thickness applied for the assessment,
- the substrate shall be the same as the one used for SBI testing of the external kit as a whole.

B.2.4 - Breather membranes

Case 1:

Products covered by a harmonised product specification do not need to be tested, if reaction to fire is declared in their Declaration of performance (DoP), the given class according to EN 13501-1 of the breather membrane is equal to or higher than the intended class for the external kit (e.g., class B or C shall be determined for the kit, than at least the breather membrane shall be classified as class C too) and the field of application of the classification given in the DoP (product parameters and end-use conditions as stated in the MPII) is valid when using the membrane as part of the kit.

Case 2:

If testing of the breather membrane is required, the test shall be performed according to the provisions of the test standard and taking into consideration the following mounting and fixing provisions:

- free-hanging arrangement of the specimens without any substrate behind, it covers all end use applications with or without any material behind,

- arrangement of the specimens directly mechanically fixed onto a representative standard substrate according to EN 13238 covering the specific application of the membrane as part of the kit.

The following product parameters are relevant for testing:

- variations of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- organic content - where relevant, the product with the highest organic content shall be tested,
- thickness – where relevant, the highest and lowest thickness shall be tested,
- density / weight per unit area – where relevant, the highest and lowest density as well as the highest and lowest weight per unit area shall be tested.

Breather membranes glued to a thermal insulation product shall be tested and assessed together with the thermal insulation product.

B.2.5 - Subframe

Case 1:

Metal subframe profiles classified as A1 according to Decision 96/603/EC (as amended by Commission Decision 2000/605/EC and Commission Decision 2003/424/EC), as well as subframe profiles made of wood / wood-based materials which are covered by an applicable CWFT Decision, do not need to be tested.

Case 2:

Subframe components used for mechanically fixed cladding elements and not covered by case 1 shall be tested separately according to the provisions of the test standard and using a free-hanging test arrangement.

B.2.6 - Cladding elements

Glue-fixed cladding elements shall be tested together with the adhesive and the subframe profile.

If the cladding elements are built-in with a specific type of joints (except open joints) between neighbouring elements, this type of joint shall be considered at the lengthwise centre axis of at least two specimens of both flame exposure types (edge flaming and surface flaming).

B.2.7 - Other ancillary components

Each different ancillary component of the kit (except small components as defined in clause A.6 shall be tested separately according to the provisions of the test standard and their own harmonised product specification, if available.

Otherwise, the component shall be tested using a free-hanging test arrangement. If these tests fail, a test set-up with an appropriate standard substrate according to EN 13238 can be used representing the end-use application of the component in the kit.

ANNEX C: GLUED CONNEXION MECHANICAL RESISTANCE TESTS

This Annex contains the following information:

1) Assessment test methods:
   - Tensile stress and elongation test (see clause C.1).
   - Shear stress and shear displacement test (see clause C.11).
   - Shear creep test (see clause C.12).
2) Conditioning methods:
   - Normal temperature conditioning (see clause C.2).
   - High and low temperature conditioning (see clause C.3).
   - High temperature and high humidity ageing (see clause C.4).
   - Immersion in water (see clause C.5).
   - High humidity and NaCl atmosphere ageing (see clause C.6).
   - High humidity and SO_2 atmosphere ageing (see clause C.7).
   - Cyclic tensile loads ageing (see clause C.8).
   - Cyclic shear loads ageing (see clause C.9).
   - Tear resistance (see clause C.10).
3) Criteria to reduce the number of tests for different adhesion-surface materials:
   - Tests to confirm the mechanical performance obtained from representative materials (see clause C.13).

C.1 – TENSILE STRESS AND ELONGATION TEST

The aim of this test is to obtain the tensile stress and elongation at rupture of the adhesive when a tensile strength is acting on the glued connexion.

C.1.1 - Test specimens

Test specimens shall correspond with one of the configurations indicated in Figure C.1.1.1 and Figure C.1.1.2 depending on the test equipment considered. Test specimens shall be prepared according to the MPII.

The materials of the two pieces to be glued shall be representative of the cladding element and profile materials. Representability shall be confirmed by one of the following options:

Option 1 (reference method): by using the actual materials of the cladding elements and profiles to be assessed.

Option 2: by using representative materials. In this case, extra tests shall be carried out to confirm the performance values for each cladding element material and profile material to be assessed. See clause C.13.

The selection of this Option 2 is only possible when the performance of all the mechanical characteristics given in clauses C.2 to C.11 have been obtained by cohesive rupture in the adhesive as it is defined in clause C.13.

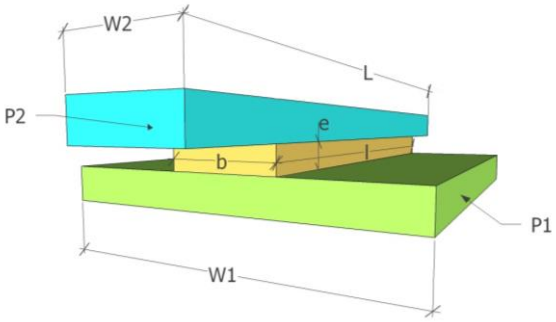
Actual adhesive bead length (l), width (b) and thickness (e) of each specimen after cured shall be recorded.

Adhesive of test specimens shall be cured considering the MPII or (28 ± 1) days at (23 ± 2) ºC and (50 ± 2) % RH.

After cured, test specimens shall be prepared according to the relevant tests (see clauses C.2 to C.10).

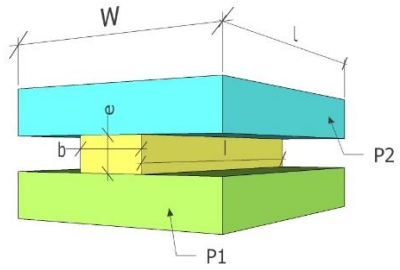
Legend for the Figures C.1.1.1 & C.1.1.2:

P1 = Test specimen piece with adhesion-surface 1.
P2 = Test specimen piece with adhesion-surface 2.
b = Adhesive bead width.
l = Adhesive bead length and also length of the test specimen piece P1.
e = Adhesive bead thickness.
L = Length of the test specimen piece P2.
W = Width of the test specimen piece P1 or P2 accordingly.



l = 50 ± 2 mm
L ≥ 75 mm
W2 = b
W1 ≥ 40 mm

Figure C.1.1.1: Test specimen Type I.



l = L = 50 ± 2 mm
W ≥ 40 mm

Figure C.1.1.2: Test specimen Type II.

C.1.2 - Test procedure

After the relevant conditioning (see clauses C.2 to C.10) the test specimens shall be subjected to tension until failure (see Figures C.1.2.1 & C.1.2.2) with a speed of (5 ± 1) mm/min. Tensile strength-elongation curve shall be recorded.

From tensile strength-elongation curve, the following data shall be recorded:

- Tensile strength $F_{T,\varepsilon\%,i}$ [in N] at elongations ($\varepsilon = \Delta e/e$) of 5%, 10%, 15%, 20% and 25%.
- Tensile strength $F_{Tu,i}$ [in N] and elongation at rupture $\varepsilon_{u,i}$ [in %].
- Then, tensile stress $\sigma_{u,i}$ [in MPa] shall be calculated from tensile strength $F_{Tu,i}$ [in N]:

$\sigma_{u,i} = F_{Tu,i} / A_b$ [in MPa] (C.1.2.1)

where, A_b = area of the adhesive bead = l x b [in mm^2].

- In addition, percentages of cohesive rupture of each test specimen shall be recorded.

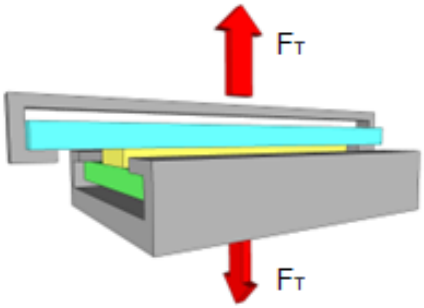


Figure C.1.2.1: Tensile strength test (specimen Type I).

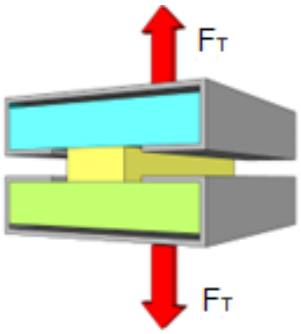


Figure C.1.2.2: Tensile strength test (specimen Type II).

C.2 – NORMAL TEMPERATURE CONDITIONING

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned for (24 ± 4) hours at:

- Normal temperature, NT: (23 ± 5) ºC and (50 ± 5) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.

C.3 – HIGH AND LOW TEMPERATURE CONDITIONING

A minimum of five specimens shall be tested for each temperature (HT and LT).

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned for (24 ± 4) hours at:

- High temperature, HT: For ventilated façades (+ 60 ± 1) ºC reference temperature, or (+ 80 ± 1) ºC, and for non-ventilated façades (+ 100 ± 1) ºC.
- Low temperature, LT: (- 20 ± 1) reference temperature, or (- 40 ± 1) ºC.

The temperature to be used in the test shall be selected by considering the geographical area where the kit is intended to be used, the cladding element material and colour, and the exposure to sun radiation. E.g., -40 ºC may be used for those countries or areas that may reach this temperature, or +80 ºC may be used for those cladding elements exposed to sun radiation, especially those made of metal and black materials.

Then, they shall be subjected to the tensile test according to clause C.1.2.

C.4 – HIGH TEMPERATURE AND HIGH HUMIDITY AGEING

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned for (1004 ± 4) hours in a climatic chamber at (60 ± 2) ºC and (85 ± 2) % RH.

After the conditioning time, test specimens shall be removed from climatic chamber and conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.

C.5 – IMMERSION IN WATER

A minimum of three specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be immersed in water for 7 days (one week) at ambient temperature.

After the immersion time, test specimens shall be removed from water and conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.

C.6 – HIGH HUMIDITY AND NaCl ATMOSPHERE AGEING

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned according to EN ISO 9227 for NSS (Neutral Salt Spray) atmosphere. The NSS atmosphere shall be maintained for (480 ± 2) hours in a climatic chamber.

After the conditioning time, test specimens shall be removed from climatic chamber and conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.

C.7 – HIGH HUMIDITY AND SO_2 ATMOSPHERE AGEING

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned according to EN ISO 22479 Table 2 for test method B with an atmosphere of 0,20 litres of SO_2. The number of cycles shall be 20.

After the cycles, test specimens shall be removed from climatic chamber and conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.

C.8 – CYCLIC TENSILE LOADS AGEING

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

After initial conditioning, test specimens shall be subjected to all the repetitive tensile loads with a cycle time 6 to 8 seconds (see Figure C.8.1) as follows:

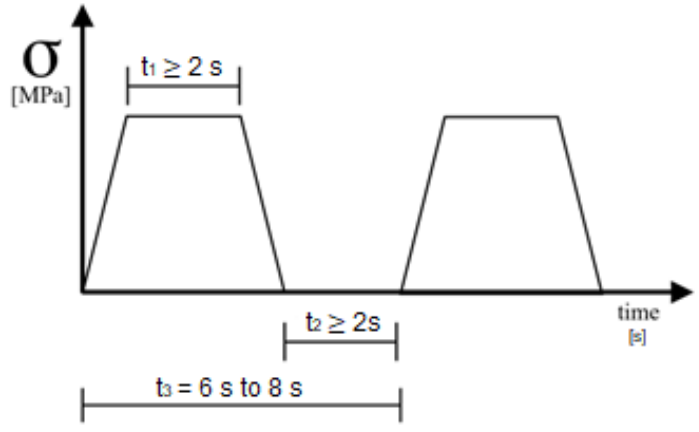
- 100 times from $0,1 \cdot \sigma_{ref}$ to $1,0 \cdot \sigma_{ref}$.
- 250 times from $0,1 \cdot \sigma_{ref}$ to $0,8 \cdot \sigma_{ref}$.
- 5000 times from $0,1 \cdot \sigma_{ref}$ to $0,6 \cdot \sigma_{ref}$.
- Optionally: 10000 times from $0,1 \cdot \sigma_{ref}$ to $0,6 \cdot \sigma_{ref}$.

Where:

- σ_{ref} = reference tensile stress [in MPa], see clause D.1 of Annex D.
- t_1 = duration of the peak load; t_2 = rest time; t_3 = total time of the cycle (see Figure C.8.1).
- After each group of cycles (100, 250, 5000 and, optionally 10000 times), the glued connexion shall be visually inspected recording any damage such as cracking, loss of adhesion or visual deformation of adhesive bead cross-section form.

After the cycles, test specimens shall be conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.



t_1 = duration of the peak load.
t_2 = rest time.
t_3 = total time of the cycle.

Figure C.8.1: Tensile cyclic loads test.

C.9 – CYCLIC SHEAR LOADS AGEING

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

After initial conditioning, test specimens shall be subjected to 500 shear loading cycles between 0 mm (unloading) to 2 x $d_{s,ref}$ (see Figure C.9.1) with a speed loading (5 ± 1) mm/min.

Where:

- $d_{s,ref}$ = reference shear displacement [in mm], see clause D.3 of Annex D.
- The maximum strength $F_{S,i}$ [in N] at the end of each cycle shall be recorded.
- After all cycles, the glued connexion shall be visually inspected recording any damage such as cracking, loss of adhesion or visual deformation of adhesive bead cross-section form.

After the cycles, test specimens shall be conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

Then, they shall be subjected to the tensile test according to clause C.1.2.

In addition, stabilization of the load $S_{t,m}$ shall be calculated as follows:

$$S_{t,m} = (F_{S,1} – F_{S,2}) / F_{S,1} \quad [\text{in \%}] \quad (C.9.1)$$

With:

$$F_{S,1} = (F_{S,1min} + F_{S,1max}) / 2 \quad [\text{in N}] \quad (C.9.2)$$

and

$$F_{S,2} = (F_{S,2min} + F_{S,2max}) / 2 \quad [\text{in N}] \quad (C.9.3)$$

Where:

$F_{S,1min}$ = The minimum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 10th and 110th cycles.

$F_{S,1max}$ = The maximum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 10th and 110th cycles.

$F_{S,2min}$ = The minimum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 400th and 500th cycles.

$F_{S,2max}$ = The maximum strength at 2 x $d_{s,ref}$ displacement of the strength recorded between the 400th and 500th cycles.

Figure C.9.1: Shear cyclic loads ageing.

C.10 – TEAR RESISTANCE

The aim of this test is to establish the mode of propagation of a cut in the adhesive bead.

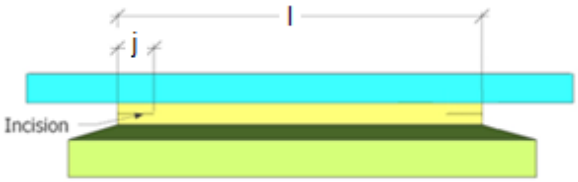
A minimum of five specimens shall be tested.

Test specimens shall be prepared according to clause C.1.1.

After cured, test specimens shall be conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

After initial conditioning, test specimens shall be cut at the end of the adhesive bead (see Figure C.10.1). The length of each incision shall be 10% of total bead length. Incisions shall be clean, without removal of material.

Then, they shall be subjected to the tensile test according to clause C.1.2.



Dimensions according to Figure C.1.1.1 where j = 0,10 x l

Figure C.10.1: Tear resistance specimen.

C.11 – SHEAR STRESS AND SHEAR DISPLACEMENT TEST

The aim of this test is to obtain the shear stress and deformation at rupture of the adhesive when a shear strength is acting on the glued connexion.

C.11.1 - Test specimens

Test specimens shall correspond with the Figure C.11.1. Test specimens shall be prepared according to the MPII.

The materials of two pieces to be glued shall be representative of the cladding element and profile materials. Representability shall be confirmed by one of the following options:

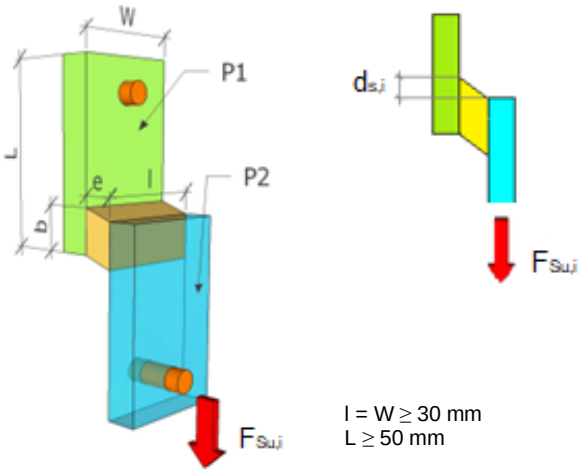
Option 1 (reference method): by using the actual materials of the cladding elements and profiles to be assessed.

Option 2: by using representative materials. In this case, extra tests shall be carried out to confirm the performance values for each cladding element material and profile material to be assessed. See clause C.13.

The selection of this Option 2 is only possible when the performance of all the mechanical characteristics given in clauses C.2 to C.11 have been obtained by cohesive rupture in the adhesive as it is defined in clause C.13.

Actual adhesive bead length (l), width (b) and thickness (e) of each specimen after cured shall be recorded.

Adhesive of test specimens shall be cured considering the MPII or (28 ± 1) days at (23 ± 2) ºC and (50 ± 2) % RH.



Legend:
P1 = Test specimen piece with adhesion-surface 1.
P2 = Test specimen piece with adhesion-surface 2.
b = Adhesive bead width.
l = Adhesive bead length and width of the test specimen pieces P1 & P2.
e = Adhesive bead thickness.
L = Length of the test specimen pieces P1 & P2.
W = Width of the test specimen pieces P1 & P2.
$d_{s,i}$ = Shear load displacement.

Figure C.11.1: Shear strength test.

C.11.2 - Test procedure

A minimum of ten specimens shall be tested.

After initial conditioning the test specimens shall be subjected to a uniformly applied shear strength until failure (see Figure C.11.1) with a speed of (5 ± 1) mm/min. Shear strength-displacement curve shall be recorded.

From shear strength-displacement curve, the following data shall be extracted:

- Shear strength $F_{Su,i}$ [in N] and shear displacement $d_{Su,i}$ [in mm] at rupture.
- Shear stress $\tau_{u,i}$ [in MPa] at rupture shall be calculated from ultimate shear strength $F_{Su,i}$ [in N]:

$\tau_{u,i} = F_{Su,i} / A_b$ [in MPa] (C.11.2)

where, A_b = area of the adhesive bead = l x b [in mm^2].

- In addition, percentages of cohesive rupture of each test specimen shall be recorded.

C.12 – SHEAR CREEP TEST

The aim of this test is to assess the resistance of the adhesive bead creep under the combined effect of water vapour, heat and a dead load.

A minimum of ten specimens shall be tested.

Test specimens shall be prepared according to clause C.11.1.

After cured, test specimens shall be conditioned for (24 ± 4) hours at (23 ± 2) ºC and (50 ± 2) % RH.

After initial conditioning, test specimens shall be subjected to a constant dead load $F_{S\text{-}DL}$ [in N] (see Figure C.12.1) for (1004 ± 4) hours at (60 ± 2) ºC and > 85% RH. Condensation on the test specimens is allowed.

Dead load is calculated as follows:

$F_{S\text{-}DL} = 4 \times \tau_{ref} \times A_b$ [in N] (C.12.1)

Where:

- τ_{ref} [in MPa] = reference shear stress [in MPa], see clause D.2 of Annex D.
- A_b = area of the adhesive bead = l x b [in mm^2].

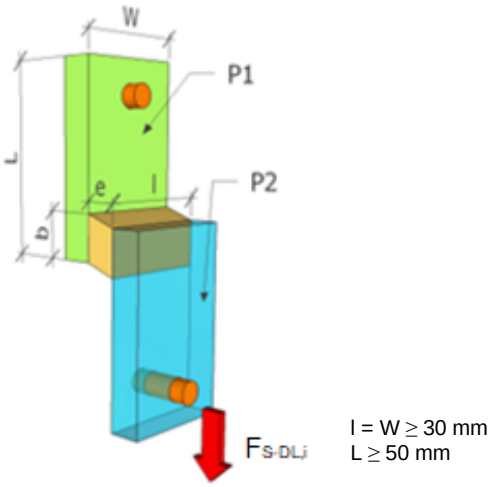
The following displacements shall be measured and recorded:

- Vertical displacement $d_{s1,i}$ [in mm] after (168 ± 4) hours (7 days);
- Vertical displacement $d_{s2,i}$ [in mm] after (1004 ± 4) hours (42 days);

The stabilization of vertical displacement $S_{tv,i}$ [in mm] shall be calculated as follows:

$$S_{tv,i} = d_{s1,i} - d_{s2,i} \qquad \text{(C.12.2)}$$

At the end of the testing, the glued connexion shall be visually inspected recording any damage such as cracking, loss of adhesion or visual deformation of adhesive bead cross-section form.



l = W ≥ 30 mm
L ≥ 50 mm

Legend:
P1 = Test specimen piece with adhesion-surface 1.
P2 = Test specimen piece with adhesion-surface 2.
b = Adhesive bead width.
l = Adhesive bead length and width of the test specimen pieces P1 & P2.
e = Adhesive bead thickness.
L = Length of the test specimen pieces P1 & P2.
W = Width of the test specimen pieces P1 & P2.

Figure C.12.1: Shear strength test.

C.13 –TESTS TO CONFIRM THE MECHANICAL PERFORMANCE OBTAINED FROM REPRESENTATIVE MATERIALS

The selection of Option 2 given in clause C.1.1 and clause C.11.1 is only possible when the rupture of all the mechanical characteristics given in clauses C.2 to C.11 are by cohesive rupture in the adhesive bead.

Cohesive rupture is defined when the test specimens' average value is greater than 90% of the glued connexion area (b x l). In addition, when the number of test specimens is ten or more, maximum two specimens' values shall be lower than 90% but greater than 85% of the glued connexion area. When the number of test specimens is lower than ten, only one specimen value shall be lower than 90% but greater than 85% of the glued connexion area.

These tests are relevant when the mechanical resistance of the glued connexion have been obtained from pieces made of other materials different from those cladding element and profile materials to be considered in the scope (for kits Type A or Type B) or in the intended use (for kits Type B) of the ETA.

Mechanical resistance performance obtained from representative materials shall be confirmed by means of peel test (see Annex G) at normal temperature (see clause C.2) and also after ageing (see clauses C.3 to C.7) all to be carried out taking into account the actual materials of the cladding elements and profiles to be considered in the scope (for kits Type A or B) or in the intended use (for kits Type B) of the ETA.

The values obtained for each adhesion-surface material shall confirm the cohesive rupture definition given in the paragraph above.

When these results do not occur, the cohesive rupture in the adhesive bead is not confirmed, therefore, all the test to obtain the mechanical performance of the glued connexion shall be carried out with test specimens according to Option 1 given in clause C.1.1 or C.11.1 (the actual materials of the cladding elements and profiles).

ANNEX D: METHODS FOR OBTAINING THE REFERENCE VALUES FOR GLUED CONNEXION

Reference values σ_{ref}, $d_{s,ref}$ & τ_{ref} for glued connexion, that shall be used in the mechanical tests given in clauses C.8, C.9 & C.12 respectively, and calculation assessment given in clauses E.2 & E.3, shall be obtained from the MPII considering the manufacturer's experience and knowledge on the specific adhesive behaviour.

When this information is not available, the methods described in this annex may be used for obtaining these reference values for glued connexions. MPII may include lower values.

D.1 – REFERENCE VALUE FOR TENSILE STRESS AND ELONGATION

Reference value of tensile stress (σ_{ref}) is obtained from tensile stress and elongation test at normal temperature NT (see clause 2.2.3.1.1).

One of following methods may be considered.

D.1.1 - Method 1 (reference method)– From tensile stress-elongation test - extremity of viscoelastic part

From the tensile stress-elongation curves at normal temperature (NT) recorded from the tensile stress test (see clause 2.2.3.1.1 and clause C.2), the characteristic tensile stress $\sigma_{\varepsilon\%,C}$ shall be calculated from the tensile strength values $F_{T\text{-}\varepsilon\%,i}$ [in N] at elongations ε = 5%, 10%, 15%, 20% and 25%.

$\sigma_{\varepsilon\%,i} = F_{T,\varepsilon\%,i} / A_b$ [in MPa] (D.1.1.1)

where, A_b = area of the adhesive bead = l x b [in mm^2]

$\sigma_{\varepsilon\%,C}$ is obtained from the individual values $\sigma_{\varepsilon\%,i}$ according to equation (F.1).

The couples (characteristic tensile stress $\sigma_{\varepsilon\%,C}$ [in MPa], elongations $\varepsilon = \Delta e/e$ [in %] are the reference points to build the tension stress–elongation characteristic curve ($\sigma_{\varepsilon\%,C}$, ε).

The viscoelastic part of the curve of the reference couples includes the maximum number of points for which the linear regression coefficient is R ≥ 0,99.

The extremity of the viscoelastic curve is determined and represented by the couple ($\sigma_{\varepsilon,C,lim}$, $\varepsilon_{,lim}$).

The reference tensile stress is defined as follows:

$\sigma_{ref} \leq \sigma_{\varepsilon\%,C,lim} / a$ [in MPa] (D.1.2.2)

where:

$\sigma_{\varepsilon\%,C,lim}$ = Tensile stress characteristic value at the limit of the viscoelastic field of the glued connexion.

$\varepsilon_{,lim}$ = elongation corresponding to the limit of the viscoelastic field of the glued connexion.

a = factor considering the reduction performance during service life due to fatigue effects, ageing effects, exposure to critical environment and temperature effects. Reference value is a = 2,5, however, another greater value may be defined according to the MPII.

If the reference value σ_{ref} obtained according to this Method 1 is greater than the minimum characteristic value of tensile stress obtained from each residual mechanical tests (see clauses 2.2.3.2.1 to 2.2.3.2.5), the reference value σ_{ref} shall be corrected to be equal or lower than this minimum characteristic value considering the residual mechanical tests.

Example:

The values recorded during the tensile stress test according to clause 2.2.3.1.1, the standard deviation and the characteristic tensile stress by elongation steps 5% are given in the following table.

Table D.1.1.1 Example of values recorded during the tensile test, the standard deviation, and the characteristic stress by elongation steps 5%.

Specimen number	Tensile stress values for an elongation of				
	5%	**10%**	**15%**	**20%**	**25%**
1	0,198	0,305	0,42	0,48	0,56
2	0,22	0,325	0,425	0,513	0,569
3	0,25	0,37	0,42	0,522	0,58
4	0,217	0,34	0,418	0,496	0,552
5	0,21	0,33	0,41	0,5	0,54
6	0,212	0,341	0,415	0,495	0,554
7	0,237	0,356	0,428	0,508	0,566
8	0,225	0,366	0,41	0,512	0,55
9	0,23	0,353	0,4	0,502	0,558
10	0,204	0,34	0,43	0,49	0,53
$\sigma_{\varepsilon\%,m}$: Average	0,2203	0,3426	0,4176	0,5018	0,5559
S : standard deviation	0,01492	0,018667	0,00872	0,01172	0,013612
K (10 specimens)	2,1	2,1	2,1	2,1	2,1
characteristic value $\sigma_{\varepsilon\%,C}$	0,19	0,30	0,40	0,48	0,53

Where:

$\sigma_{\varepsilon\%,C} = \sigma_{\varepsilon\%,m} - K \cdot S$ (see Annex F)

A first tentative to define the viscoelastic field with a 5 points curve (from ε = 5% to ε = 25%) give the result R = 0,989 that does not fulfil the criterion R > 0,99.

A second attempt to define the viscoelastic flied with a 4 points curve (from ε = 5% to ε = 20%) gives the result R = 0,996 that fulfils the criterion R > 0,99.

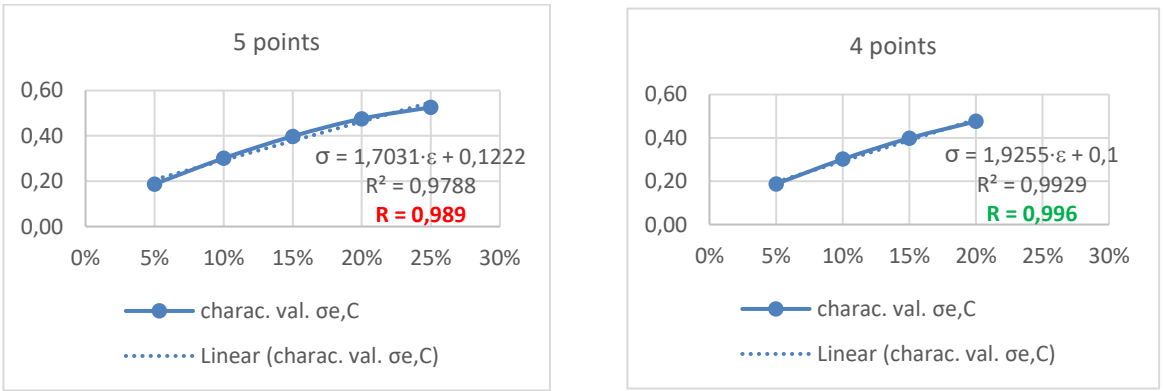


Figure D.1.1.1: Linear regression cases with 5 points (does not fulfil the criterion R > 0,99) and 4 points (fulfils the criterion R > 0,99).

The reference tensile stress is then:

$\sigma_{ref} = \sigma_{\varepsilon,C,lim} / a = 0,48 / 2,5 =$ **0,19 MPa**

Remarks:

- In the case where the curve with 4 points of reference would not answer to the linear regression coefficient criteria, it is possible to build the curve with less points of reference.
- Where relevant, for increasing the accuracy, the curve of points may be built with elongation steps less than 5%.

D.1.2 - Method 2 – Factor direct application

The reference tensile stress shall be calculated according to:

$\sigma_{ref} \leq \sigma_{u,C,NT} / a$ [in MPa] (D.1.2.1)

where:

$\sigma_{u,C,NT}$ = characteristic value of the rupture tensile stress at normal temperature (see clause 2.2.3.1.1).

a = factor considering the reduction performance during service life due to fatigue effects, ageing effects, exposure to critical environment and temperature effects. Default value is a = 4, however, another greater value may be defined according to the MPII.

If the reference value σ_{ref} obtained according to this Method 2 is greater than the minimum characteristic value of tensile stress obtained from each residual mechanical tests (see clauses 2.2.3.2.1 to 2.2.3.2.5), the reference value σ_{ref} shall be corrected to be equal or lower than this minimum characteristic value considering the residual mechanical tests.

D.1.3 - Method 3 – From tensile stress-elongation test - Intersection point (only applicable for adhesive based on silicones)

Method according to clause B.2.5.2.7 of EN 13022-2.

If the reference value σ_{ref} obtained according to this Method 3 is greater than the minimum characteristic value of tensile stress obtained from each residual mechanical tests (see clauses 2.2.3.2.1 to 2.2.3.2.5), the reference value σ_{ref} shall be corrected to be equal or lower than this minimum characteristic value considering the residual mechanical tests.

Example for B.2.5.2.7.1 of EN 13022-2:

Using the same values given in the example of method 1 but adding the initial point (0,0).

For 5 points (elongation until 25%), 4 points (elongation until 20%) and 3 points (elongation until 15%) the regression coefficient R does not fulfil the criterion R > 0,99.

For 2 points (elongation until 10%), the regression coefficient R = 0,09901 fulfils the criterion. Linear regression equation is: $\sigma = 3,0325 \cdot \varepsilon + 0,0124$.

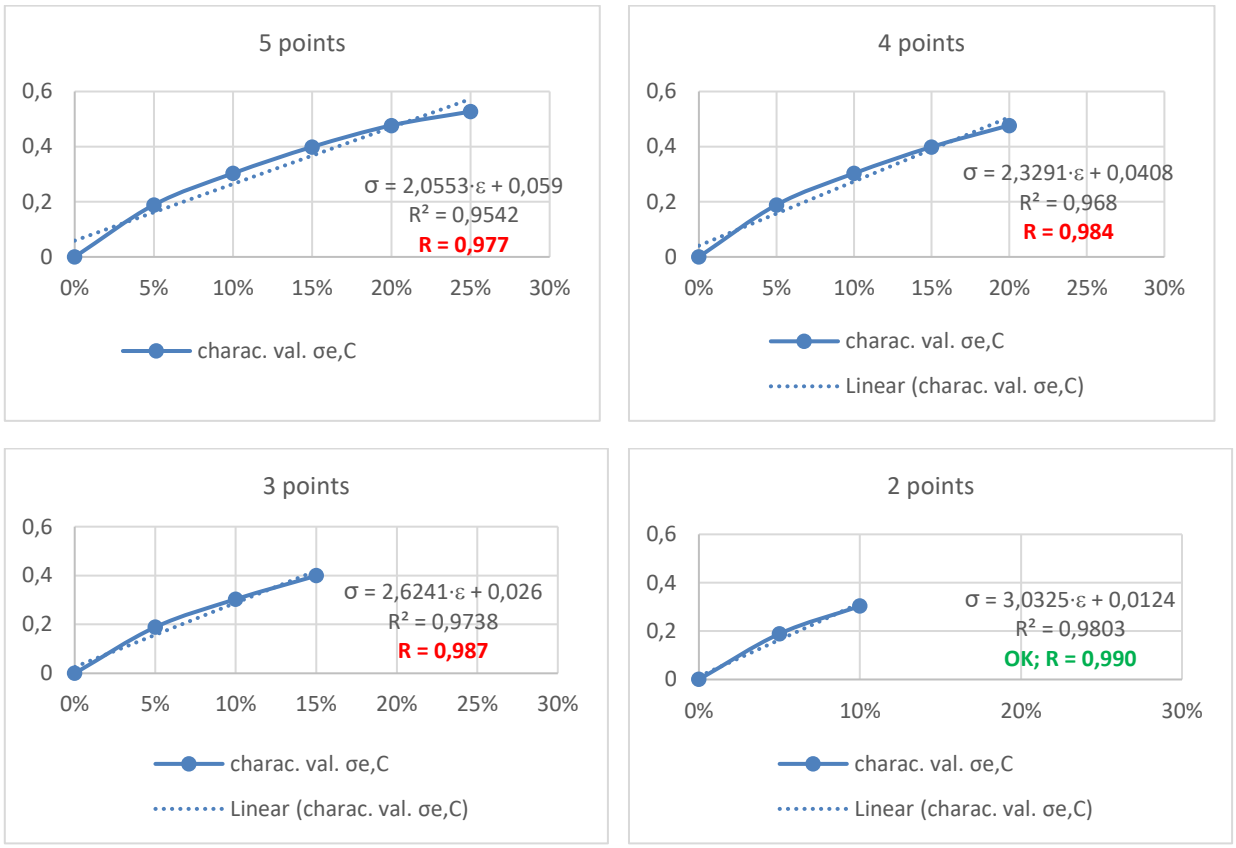


Figure D.1.3.1: Linear regression cases with 5 points, 4 points, 3 points and 2 points.

The equation of the line parallel to linear regression which pass on the point (σ = 0; ε = 5%) is: $\sigma = 3{,}0325 \cdot \varepsilon - 0{,}1516$.

The intersection point is then calculated from tension stress-elongation curve and the parallel curve which pass on the point (σ = 0; ε = 5%), see Figure D.1.3.2. Therefore: **σ_{ref} = 0,50 MPa; ε_{ref} = 21,5%**.

From here, clauses B.2.5.2.7.2 to B.2.5.2.7.4 of EN 13022-2 shall be applied.

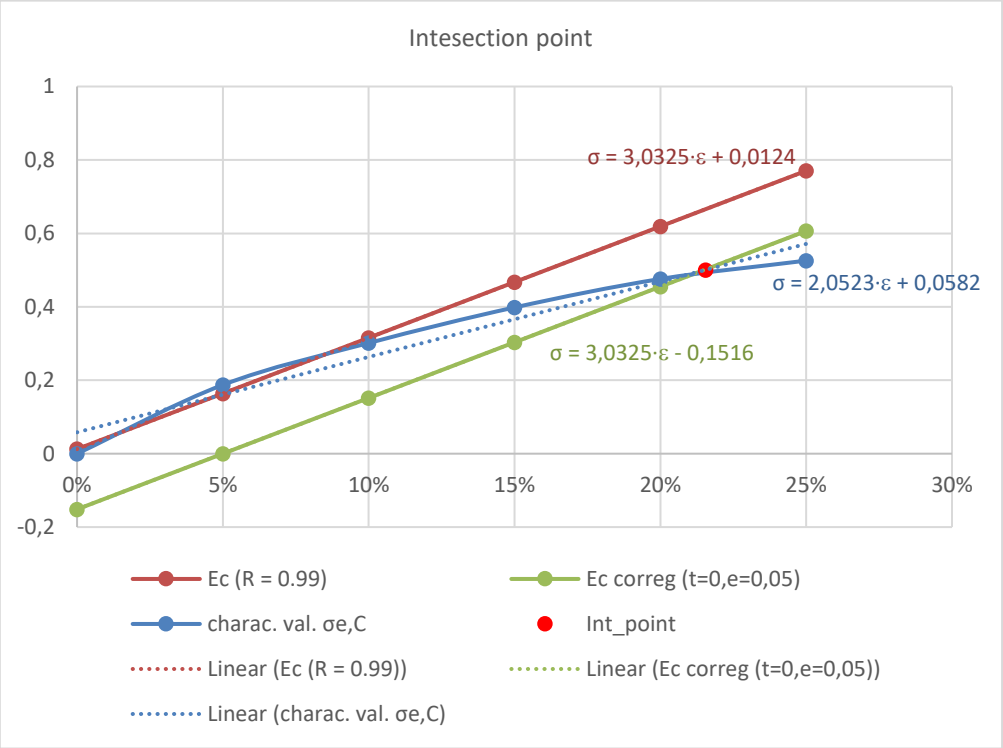


Figure D.1.3.2: Intersection point.

D.2 – REFERENCE VALUE FOR SHEAR STRESS

Reference value for shear stress (τ_{ref}) is obtained from shear stress and shear displacement test at normal temperature NT (see clause 2.2.3.1.2).

One of following methods may be considered.

D.2.1 - Method 1 (reference method) – From shear stress-shear displacement test

From the shear stress-shear displacement curves at normal temperature (NT) recorded from the shear stress test (see clause 2.2.3.1.2), the characteristic shear stress $\tau_{ds,C}$ is calculated for the shear displacement d_s = from 0,5 mm; 1,0 mm; …… ; until $d_{Su,i}$ [in mm] in representative steps (e.g., 0,5 mm or 1,0 mm).

where:

$d_{Su,i}$ = individual value of the shear displacement corresponding to the rupture of the glued connexion.

$\tau_{ds,i} = F_{Sds,i} / A_b$ [in MPa] (D.2.1.1)

where, A_b = area of the adhesive bead = l x b [in mm^2].

$\tau_{ds,C}$ is obtained from the individual values $\tau_{ds,i}$ according to equation (F.1).

The couples (characteristic shear stress $\tau_{ds,C}$ [in MPa], shear displacement d_s [in mm] are the reference points to build the shear stress–shear displacement characteristic curve ($\tau_{ds,C}$, d_s).

The viscoelastic part of the curve of the reference couples includes the maximum number of points for which the linear regression coefficient is R ≥ 0,99. The extremity of the viscoelastic curve may then be determined and represented by the couple ($\tau_{ds,C,lim}$, $d_{s,lim}$).

The reference shear stress is defined as follows:

$\tau_{ref} \leq \tau_{ds,C,lim} / a$ [in MPa] (D.2.1.2)

where:

$\tau_{ds,C,lim}$ = Shear stress characteristic value at the limit of the viscoelastic field of the glued connexion.

$d_{s,lim}$ = shear displacement corresponding to the limit of the viscoelastic field of the glued connexion.

a = factor considering the reduction performance during service life due to fatigue effects, ageing effects, exposure to critical environment and temperature effects. Default value is a = 2,5, however, greater values may be defined according to the MPII.

If the reference value τ_{ref} obtained according to this Method 1 is greater than the characteristic value of shear stress obtained at normal temperature (see clause 2.2.3.1.2) multiplied by the maximum value of the ratio factors obtained from each residual mechanical tests (see clauses 2.2.3.2.1 to 2.2.3.2.5), the final reference value τ_{ref} shall be equal to this calculated value considering the residual mechanical tests.

Permanent shear stress value (τ_{∞}) may be defined applying to the shear stress reference value (τ_{ref}) a reduction factor of 10 (e.g., see clause B.2.5.2.4 of EN 13022-2).

Example:

The values recorded during the shear stress test according to clause 2.2.3.1.2, the standard deviation and the characteristic shear stress by shear displacement steps (1,0 mm) are given in the following table.

Table D.2.1.1 Example of values recorded during the shear test, the standard deviation and the characteristic stress by shear displacement (steps 1,0 mm).

Specimen number	Shear stress value for a shear displacement (mm) of														
	1,0	**2,0**	**3,0**	**4,0**	**5,0**	**6,0**	**7,0**	**8,0**	**9,0**	**10,0**	**11,0**	**12,0**	**13,0**	**14,0**	**15,0**
1	0,128	0,239	0,367	0,495	0,616	0,723	0,817	0,885	0,934	0,966	0,966	0,945	0,870	0,759	0,625
2	0,115	0,223	0,343	0,454	0,560	0,660	0,752	0,832	0,900	0,999	0,999	1,023	1,031	1,016	0,960
3	0,135	0,258	0,379	0,491	0,603	0,711	0,810	0,900	0,977	1,096	1,096	1,126	1,130	1,096	1,025
4	0,149	0,299	0,438	0,577	0,707	0,824	0,926	1,008	1,070	1,127	1,127	1,112	0,972	0,855	0,729
5	0,147	0,279	0,416	0,549	0,673	0,788	0,890	0,984	1,062	1,145	1,145	1,156	1,150	1,132	1,099
6	0,115	0,210	0,309	0,409	0,508	0,609	0,705	0,793	0,868	0,966	0,966	0,859	0,769	0,711	0,615
7	0,133	0,255	0,369	0,484	0,591	0,693	0,787	0,874	0,952	1,083	1,083	1,132	1,166	1,181	1,015
8	0,125	0,230	0,341	0,454	0,565	0,668	0,759	0,843	0,907	0,912	0,912	0,843	0,783	0,669	0,524
9	0,128	0,245	0,361	0,477	0,591	0,698	0,792	0,875	0,941	1,032	1,032	1,028	0,992	0,899	0,785
10	0,158	0,292	0,419	0,539	0,662	0,771	0,853	0,916	0,917	0,775	0,775	0,710	0,581	0,429	0,254
$\tau_{d,m}$: Average	0,133	0,253	0,374	0,493	0,608	0,714	0,809	0,891	0,953	1,010	1,010	0,993	0,944	0,875	0,763
S : standard deviation	0,014	0,030	0,040	0,050	0,059	0,065	0,066	0,066	0,067	0,112	0,112	0,150	0,192	0,238	0,267
K (10 specimens)	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1
Characte-ristic value $\tau_{ds,C}$	0,103	0,191	0,290	0,387	0,483	0,579	0,670	0,752	0,813	0,774	0,774	0,678	0,542	0,374	0,202

Where:

$\tau_{ds,C} = \tau_{ds,m} - K \cdot S$ (see Annex F)

A first tentative to define the viscoelastic field with a 10 points curve (from d_s = 1 mm to d_s = 10 mm in steps of 1 mm) give the result R = 0,985 that does not fulfil the criterion R > 0,99.

A second attempt to define the viscoelastic flied with 9 points curve (from d_s = 1 mm to d_s = 9 mm) gives the result R = 0,998 that fulfils the criterion R > 0,99.

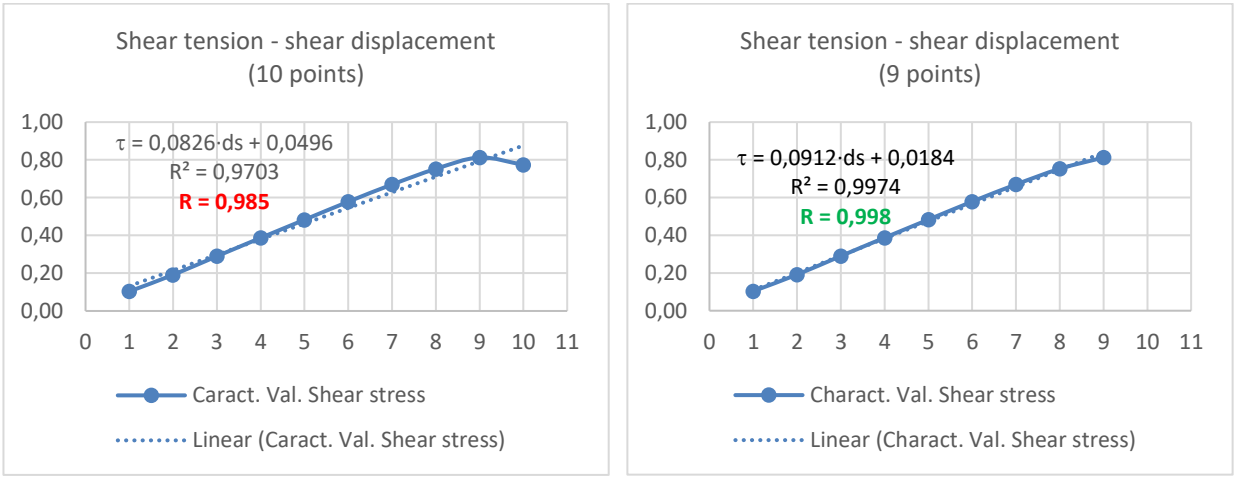


Figure D.2.1.2: Linear regression cases with 10 points (does not fulfil the criterion R>0,99) and 9 points (fulfils the criterion R>0,99).

The reference shear stress is then:

$d_{s,lim}$ = 9 mm; $\tau_{ds,C,lim}$ = 0,83

$\tau_{ref} \leq \tau_{ds,C,lim}$ / a = 0,83 / 2,5 = **0,33 MPa**

Remarks:

- In the case where the curve with 9 points of reference would not answer to the linear regression coefficient criteria, it is possible to build the curve with less points of reference.
- Where relevant, for increasing the accuracy, the curve of points may be built with shear displacement steps less than 1 mm.

D.2.2 - Method 2 – Factor direct application

The reference shear stress is calculated according to:

$\tau_{ref} \leq \tau_{u,C,NT}$ / a [in MPa] (D.2.2.1)

where:

$\tau_{u,C,NT}$ = characteristic value of the rupture shear stress at normal temperature (see clause 2.2.3.1.2).

a = factor considering the reduction performance during service life due to fatigue effects, ageing effects, exposure to critical environment, temperature effects and permanent loading. Default value is a = 4, however, another greater value may be defined according to the MPII.

If the reference value τ_{ref} obtained according to this Method 2 is greater than the characteristic value of shear stress obtained at normal temperature (see clause 2.2.3.1.2) multiplied by the maximum value of the ratio factors obtained from each residual mechanical tests (see clauses 2.2.3.2.1 to 2.2.3.2.5), the reference value τref shall be corrected to be equal or lower than this calculated value considering the residual mechanical tests.

Permanent shear stress value (τ_∞) may be defined applying to the shear stress reference value (τ_{ref}) a reduction factor of 10 (e.g., see clause B.2.5.2.4 of EN 13022-2).

D.3 – REFERENCE VALUE FOR SHEAR DISPLACEMENT

Reference value for shear displacement ($d_{s,ref}$) may be obtained from one of following methods:

Reference value for shear displacement ($d_{s,ref}$) is obtained from shear stress and shear displacement test at normal temperature NT (see clause 2.2.3.1.2).

One of following methods may be considered.

D.3.1 - Method 1 (reference method) – From tensile stress-elongation test

Reference value for shear displacement ($d_{s,ref}$) is obtained from tensile stress and elongation test at initial conditioning (see clause 2.2.3.1.1).

The reference shear displacement is calculated according to:

$(d_{s,ref})^2 \leq (e + \Delta e_{T,ref})^2 - e^2$

$\Delta e_{T,ref} \leq 40\% \times (\varepsilon_{,lim} \times e)$

where:

e = thickness of the test specimen adhesive bead.

$\varepsilon_{,lim}$ = tensile elongation corresponding to the limit of the viscoelastic field of the glued connexion (see clause D.1.1).

$\Delta e_{T,ref}$ = reference value of the tensile deformation corresponding to the 40% of the limit of the viscoelastic field of the glued connexion.

Example:

From the example of Method 1 in clause D.1.1:

$\varepsilon_{,lim}$ = 20% (see figure D.1.1.1); and supposing e = 12 mm (value of the test specimen thickness for the example given in clause D.1.1);

$\Delta e_{T,ref} \leq 40\% \times (\varepsilon_{,lim} \times e) = 0{,}96$ mm

Considering a thickness for the application of e = 3 mm;

$(d_{s,ref})^2 \leq (e + \Delta e_{T,ref})^2 - e^2$

$d_{s,ref} \leq 2{,}58$ mm.

D.3.2 - Method 2 – From shear stress-shear displacement test

The reference shear displacement shall be calculated according to:

$d_{s,ref} \leq 40\% \times d_{s,lim}$

where:

$d_{s,lim}$ = characteristic value of the shear displacement corresponding to the limit of the viscoelastic field of the glued connexion (see clause D.2.2).

Example:

Using the values of the example of Method 2 in clause D.2.2:

$d_{s,lim}$ = 9,0 mm.

Then, $d_{s,ref} \leq 40\% \times d_{s,lim}$ = 3,6 mm.

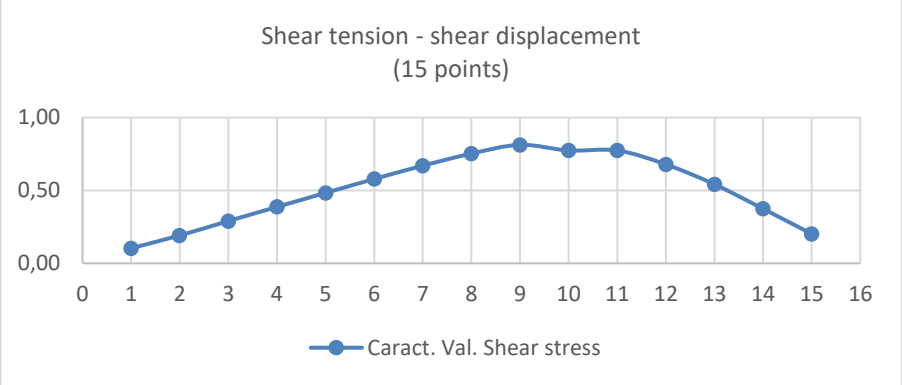


Figure D.3.1: Shear stress characteristic values – shear displacement curve

ANNEX E: WIND LOAD RESISTANCE ASSESSMENT AND SIMPLIFIED CALCULATION PROCEDURES ON GLUED CONNEXION

E.1 – CRITERIA FOR THE VALIDATION OF THE CALCULATION ON WIND LOAD RESISTANCE

The validation shall be made in a way that the results of the calculation remain on the safe side.

The validation criteria are:

1) The maximum wind load obtained by testing Q_{test} [in kN/m^2] according to clause E.1 of EAD 090062-01-0404, shall not be lower than the wind load value Q_{cal} [kN/m^2] obtained by calculation (see clause E.2) for the same tested assembled kit configuration.

$Q_{test} \geq Q_{cal}$ [in kN/m^2]

No safety factors shall be used for the validation purposes.

2) The maximum displacement measured by testing f_{test} [in mm] shall not be lower than the calculated displacement f_{cal} [in mm] for the same measured point on the tested kit configuration and the same applicable load.

$f_{test} \geq f_{cal}$ [in mm]

When these criteria are not met, the wind load resistance calculation method and/or model shall be corrected for meeting with these criteria (e.g., by using correcting factors or by changing the method and/or model). Otherwise, the maximum value obtained by testing shall be considered as the maximum wind load resistance Q in [kN/m^2] for any assembled kit configuration.

E.2 – CRITERIA FOR THE WIND LOAD RESISTANCE CALCULATION

Calculations shall be performed either through a numerical structural analysis (FEM[9]) at elastic state or through simplified methods based on elasticity and resistance equations (e.g., beams related equations) considering the mechanical resistance of the kit components and connexions obtained in the relevant clauses 2.2.3 and clauses 2.2.12 of EAD 090062-01-0404.

The calculation method shall be validated by testing according to clause E.1.

For the calculation of the wind load resistance all relevant kit components that contribute to the load bearing capacity, load transitions as well as to the load itself shall be simulated/represented through the calculation models.

The calculation models shall include all relevant kit components, connexions between them, defined dimensions, and spans between components. All the relevant contacts between individual kit components shall be included in the calculation model either by considering a calculation model that includes all kit components (usually applicable when FEM analysis is used) or by considering individual calculation models taking into account the interaction/load-transition between kit components.

The wind load resistance calculation of the assembled kit shall cover, at least, the mechanical resistance properties of the components and their connexions (see Table E.2.1). Output data shall be wind load actions Q_{cal} [kN/m^2] obtained by calculation of the kit components and connexions resistance values.

9 FEM = Finite Element Method.

The wind load resistance of the assembled kit Q [kN/m²] shall be defined by the level of the weakest resistance component or connexion between them.

Table E.2.1 Criteria for the wind load calculations

Mechanical resistance property	Resistance values	Additional information
Bending resistance of the cladding element (when the kit contains the cladding element – Type A)	▪ Bending strength resistance according to EAD 090062-01-0404 clause 2.2.12.1. ▪ Maximum displacement (only for flexible cladding elements) according to the MPII. Elastic modulus of the cladding element is needed.	The dimensions of the cladding element and the position of the adhesive beads shall be represented in the calculation model. Simplified method according to clause E.3 may be applied.
Reaction strength at the connexion with the adhesive bead	▪ Resistance of the adhesive bead when $\sigma_{cal} = \sigma_{u,C}$ where: ▪ $\sigma_{u,C}$ = minimum value of the characteristic values for the rupture tensile stress (see clauses 2.2.3.1.1, 2.2.3.2.1 to 2.2.3.2.5, & 2.2.3.2.9). ▪ Resistance of the adhesive bead when $\sigma_{cal} = \sigma_{ref}$ (see clause D.1 of Annex D).	
Resistance of the subframe profiles (when the kit contains the subframe – Type A or Type B)	▪ Elastic limit of the subframe profile material by considering the characteristics given in EAD 090062-01-0404 clause 2.2.12.14. ▪ Maximum displacement of the subframe profile defined according to EAD 090062-01-0404 clause 2.2.12.14.	Simplified calculation methods based on theories of beams may be applied. E.g., relevant elasticity and resistance equations for continuous beams with two, three or more supports with uniformly distributed loads or punctual loads may be applied.
Reaction strength at the subframe connexion with the substrate (when the kit contains the subframe – Type A or Type B)	▪ Resistance to horizontal load at failure of the brackets according to EAD 090062-01-0404 clause 2.2.12.17. ▪ Resistance to horizontal load at 1 mm permanent deformation of the brackets according to EAD 090062-01-0404 clause 2.2.12.17. ▪ Shear load resistance of subframe fixings according to EAD 090062-01-0404 clause 2.2.12.16.	

E.3 – WIND SUCTION LOAD SIMPLIFIED CALCULATION PROCEDURE ON GLUED CONNEXION

Maximum wind suction load (in kN/m²) shall be obtained as follows, considering both, the case of two profiles by cladding element and the case of three or more profiles by cladding element:

$$(Q_{cal})_{ext} \leq \frac{\sigma_{cal} \cdot b_{min} \cdot n_{b,ext} \cdot \gamma_1}{K_{ext} \cdot l_p + l_{ext}} \cdot 10^3 \qquad \text{(E.3.1a)}$$

$$(Q_{cal})_{int} \leq \frac{\sigma_{cal} \cdot b_{min} \cdot n_{b,int} \cdot \gamma_1}{K_{int} \cdot l_p} \cdot 10^3 \qquad \text{(E.3.1b)}$$

$$Q_{cal} \leq \min[(E.3.1a) ; (E.3.1b)] \qquad \text{(E.3.1c)}$$

Note: partial safety factors by National Regulations are not considered in these equations.

Where:

Q_{cal} = maximum wind suction load [in kN/m²]. Where “ext” refers to the extreme-profile and “int” refers to the intermediate-profile.

b_{min} = minimum width of the adhesive bead [in mm].

σ_{cal} = calculation value of tensile stress [in MPa] (see Table E.2.1). Default value equal to σ_{ref} (see clause D.1 of Annex D).

$n_{b,ext}$ = number of beads (bond-lines) by extreme-profile.

$n_{b,int}$ = number of beads (bond-lines) by intermediate-profile.

l_p = distance (span) between profiles [in mm].

l_{ext} = distance between the extreme-profile and the cladding element border [in mm]. Dimension perpendicular to the bead-lines.

γ_1 = reduction factor by effective bonding. $\gamma_1 = h_{eff} / H_{clad}$

h_{eff} = total length [in mm] of the applied adhesive bead (bond-line).

K_{ext} or K_{int} = constant value as a function of the number of profiles (supports), see Table E.3.1, where "ext" refers to the extreme-profile and "int" refers to the intermediate-profile.

Table E.3.1 Constant value as a function of the number of profiles.

Supports	**K_{ext}**	**K_{int}**
2 profiles	0,50	---
3 profiles	0,375	1,25
4 or more profiles	0,40	1,10

ANNEX F: TEST RESULTS STATISTICAL DESCRIPTION

$X_C = X_m - K \cdot S$ (F.1)

Where:

X_C = the characteristic value giving 75 % confidence that 95 % of the test results will be higher than this value.

X_m = the mean or arithmetic average value.

K = the variable as a function of the number of test specimens for 5 % (p = 0,95) with 75 % confidence level when the population standard deviation is unknown (see table F.1).

S = the standard deviation of series under consideration.

Table F.1 The variable K as a function of the number of test specimens (see ISO 12491, table 6, Vx, unknown or ISO 16269-6, table D.2).

Number of specimens	3	4	5	6	7	8	9	10	20	30	∞
Variable K	3,15	2,68	2,46	2,34	2,25	2,19	2,14	2,10	1,93	1,87	1,64

ANNEX G: PEEL TEST

The peel test is used for both:

- To confirm the mechanical performance obtained from representative materials (Option 2 in clause C.1.1 and C.11.1).
- The verification of constancy of constancy of performance (see Table 3.2.2).

Note: This test may also be used for the control of the installation in the works which is not part of the scope of this EAD.

The aim of this test is to assess the adhesion behaviour between the adhesive bead and the adhesion-surfaces (cladding element or profile surfaces).

The peel test specimens shall be made with the actual materials of the cladding elements and profiles to be assessed. Where relevant, pre-treatment products shall be considered in the test specimens.

The application of the adhesive and pre-treatment products shall be carried out according to the MPII.

Specimens are prepared applying, at least, six adhesive beads on the adhesion-surfaces (cladding element and profile surfaces), where relevant, previously the adhesion-surface shall be treated with the pre-treatment products. Dimensions of the adhesive beads shall be those indicated in the Figure G.1 (default values). Other dimensions can be considered according to the MPII, in this case, bead length (l), width (b) and thickness (e) of each specimen shall be recorded.

Adhesive of test specimens shall be cured according to the MPII or, in absence of such information, during (28 ± 1) days at (23 ± 2) ºC and (50 ± 2) % relative humidity.

After conditioning, each adhesive bead piece shall be peeled back to 180°. The bead shall be detached from the adhesion-surface at one end and manually peeled back at 180° until rupture of the bead occurs. When rupture occurs, the next peel test shall be initiated via cuts with a knife at the interface adhesive adhesion-surface or at the other end of the bead.

Cutting and peeling shall be repeated until the bead is totally peeled off the adhesion-surface on the whole adhesive length.

Percentages for cohesive rupture of the adhesive bead area shall be recorded for each adhesive bead.

For manufacturer's internal control matters, this test shall also be carried out after artificial ageing (e.g., those defined in clauses C.3 to C.7 and clause 2.2.4.1) on the test specimens.

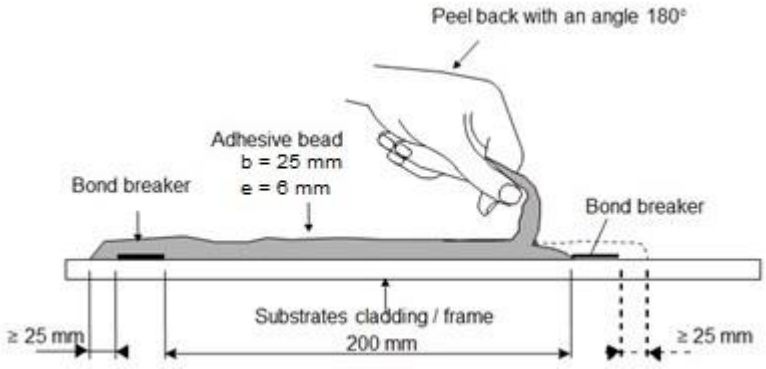


Figure G.1: Peel test.