DAU 19/114 B

Documento de adecuación al uso

Trade name

SikaTack® Panel System

Generic type and use

System for concealed adhesive fixing of opaque external cladding of ventilated façades on aluminium subframes with vertical profiles in new builds and renovations.

Holder of DAU

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Control of editions

Edition	Date	Nature of the changes with respect to the previous edition of the DAU and affected sections
A	19.07.2019	Creation of the document.
B	19.07.2024	Technical revision in accordance with current editions of reference documents. The SikaTack® Panel adhesive is manufactured by SIKA Polyurethane Manufacturing SRL at its premises in Italy. Updating of the trade name of the system and components. SikaTack® Panel System, SikaTack® Panel Primer and SikaTack® Panel Fixing Tape replace SikaTack® Panel system, SikaTack® Panel-Primer and SikaTack® Panel-Tape. Extension of the validity date of the DAU until 18.07.2029.

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1. Description of the system and intended uses

1.1. Definition of the system

The subject of this DAU is the SikaTack® Panel System, adhesive fixing system (see figure 1.1 and figure 1.2) which consists of the following components:

- Adhesive SikaTack® Panel.
- Surface pre-treatment:
  - Primer SikaTack® Panel Primer.
  - Activator Sika® Aktivator-205.
- Double-sided tape SikaTack® Panel Fixing Tape.

For more information about these components, see chapter 2.

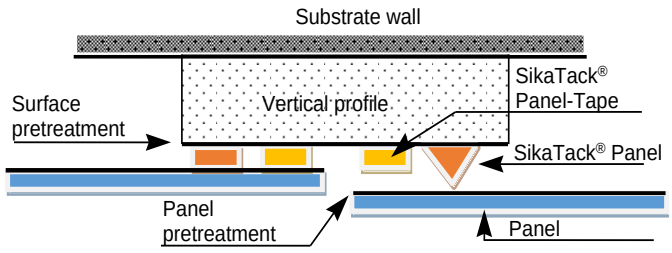


Figure 1.1: Composition of the SikaTack® Panel system.

Table 1.1 shows the design values of the SikaTack® Panel system for the design of exterior cladding systems in walls[1] of ventilated façades[2].

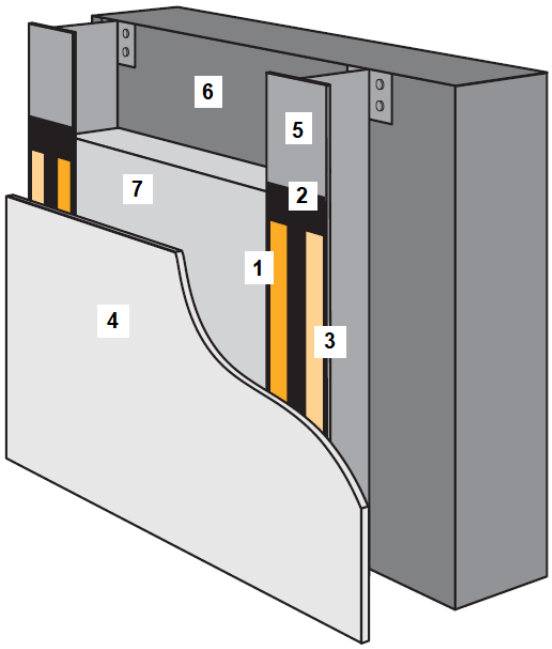
Characteristic	Reference	SikaTack® Panel system
Adhesive bead thickness	---	e ≥ 3.0 mm
Adhesive bead width	---	b ≥ 12.0 mm
Tensile strength	Section 9.3	σ_{des} ≤ 0.15 MPa
Shear strength		τ_{des} ≤ 0.12 MPa
Shear displacement		$\Delta L_{s,des}$ ≤ 1.00 mm

Table 1.1: Design values of the SikaTack® Panel system.

1.2. Intended uses

The SikaTack® Panel system is used for the fixing of opaque panels for external cladding of ventilated façades on a subframe with vertical profiles in new buildings or renovations.

The evaluation carried out in this DAU covers the performance of the SikaTack® Panel system. The cladding panels and vertical profiles to be considered together with the SikaTack® Panel system are specified in detail in chapter 4, so that they can be conveniently chosen for each project.



1. Adhesive: SikaTack® Panel.
2. Pre-treatment: SikaTack® Panel Primer and Sika® Aktivator-205.
3. Adhesive tape: SikaTack® Panel Fixing Tape.
4. Opaque cladding panel.
5. Vertical profile.
6. Supporting wall.
7. Thermal insulation.

Figure 1.2: Ventilated façade system with SikaTack® Panel.

[1] A ventilated facade wall is mainly made up of an exterior sheet system of the facade (which incorporates the exterior cladding), the ventilated air chamber, and the interior sheet of the facade (which can contain the thermal insulation layer).

[2] Air chamber with a minimum thickness of 20 mm and minimum ventilation openings of 50 cm^2 per linear metre at the bottom and top ends of the façade, as defined in the European reference documents on ventilated façades.

2. Summary of product performance

In table 2.1 there is a brief summary of the performance of the SikaTack® Panel system for fixing opaque panels for exterior cladding of ventilated façades on a subframe with vertical profiles, as well as the sections of the DAU linked to them.

For the correct interpretation of the information in this section and the correct use of the product, which is the subject of this DAU, it is necessary to consult the entire text of the DAU and, particularly, chapters 5 to 7 that specify the project, execution and maintenance criteria that must be respected in order to ensure the product performance.

Requirement	Characteristic	Performance
SE	Mechanical resistance and stability	Calculations must be carried out to verify that the exterior cladding design, fixed by means of the SikaTack® Panel system considered in the project, responds to the actions affecting it. The design values of the resistance of the glued connection are set out in table 1.1. Said data is valid if proper adherence is guaranteed between the panel material and the profile and the SikaTack® Panel system (see section 7.4). The criteria for this justification are stipulated in section 5.2.
SI	Reaction to fire	It mainly depends on the reaction to fire of the cladding panel. See section 5.3.1. The thermal insulation of the air chamber must meet the requirements indicated in section SI2 of the DB-SI of the CTE (Spanish Technical Building Code).
	Resistance to fire	Not applicable exclusively to the SikaTack® Panel system. See section 5.3.2.
HS	Degree of impermeability to rainwater	Not applicable exclusively to the SikaTack® Panel system. See section 5.4.1.
	Limitation of condensation	Not applicable to the SikaTack® Panel system. See section 5.4.2.
	Airtightness	Not applicable to the SikaTack® Panel system. See section 5.4.3.
SUA	Resistance against impacts from outside	Not applicable exclusively to the SikaTack® Panel system. See section 5.5.
	Electrical bonding of metallic parts	Not applicable to the SikaTack® Panel system. See section 5.5.
HR	Protection against exterior noise	Not applicable exclusively to the SikaTack® Panel system. See section 5.6.
HE	Thermal insulation	Not applicable to the SikaTack® Panel system. See section 5.7.

Table 2.1: Summary of the performance of the SikaTack® Panel system.

3. System components

3.1. SikaTack® Panel

SikaTack® Panel is a one-component polyurethane adhesive with a paste-like consistency that cures on exposure to atmospheric moisture to form an elastomer.

The main characteristics of the SikaTack® Panel adhesive are shown in table 3.1.

3.2. Surface pre-treatment

3.2.1. SikaTack® Panel Primer

SikaTack® Panel Primer is a liquid primer that cures on exposure to atmospheric moisture, specifically formulated for the treatment of surfaces (porous and non-porous) to be adhered to.

The main characteristics of SikaTack® Panel Primer are shown in table 3.2.

3.2.2. Sika® Aktivator-205

Sika® Aktivator-205 is an alcohol solution designed to activate the surface in order to improve the difference between the surface energy of the substrate and the surface tension of the adhesive.

The main characteristics of Sika® Aktivator-205 are shown in table 3.2.

3.3. SikaTack® Panel Fixing Tape

SikaTack® Panel Fixing Tape is a double-sided spacer tape made of closed cell polyethylene foam.

This tape is used for the initial fastening of the cladding panels until the complete curing (or polymerization) of the SikaTack® Panel adhesive has taken place and to ensure the correct size of the adhesive bead.

The main characteristics of SikaTack® Panel Fixing Tape are shown in table 3.3.

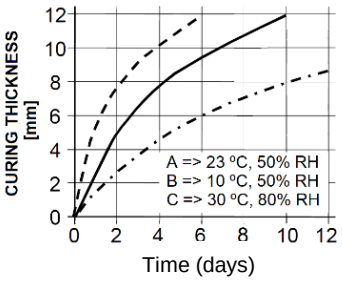
Characteristic	**Reference**	**SikaTack® Panel**
Chemical base	---	1-C polyurethane
Colour	CQP 001-1	Ivory white
Cure mechanism	---	Moisture curing
Density Uncured	CQP 006-4	1.1 kg/l ± 0.1
Application temperature	---	5 ºC to 35 ºC
Skin formation at 23 ºC and 50% RH	CQP 019-1	35 min ± 1 min
Curing speed	CQP 049-1	
Shrinkage	CQP 014-1	6% ± 0.5%
Hardness Shore A	CQP 023-1 / EN ISO 868	45 ± 1
Tensile stress	CQP 036-1 / EN ISO 37	≥ 2.5 N/mm²
Elongation at break		≥ 500%
Tear propagation resistance	CQP 045-1 / ISO 34-2	≥ 7.0 N/mm
Tensile shear strength	CQP 046-1 / ISO 4587	≥ 2.0 N/mm²
Glass transition temperature	CQP 509-1 / ISO 4664-2	- 40 ºC ± 1 ºC
Service temperature	CQP 513-1	from - 20 ºC to 90 ºC 130 ºC (4 hours) 150 ºC (1 hour)
Application temperature	---	from 5 ºC to 35 ºC
Shelf life in storage at ≤ 25ºC	CQP 016-1	9 months
CQP = SIKA corporate quality procedure		

Table 3.1: SikaTack® Panel adhesive.

Characteristic	Reference	SikaTack® Panel Primer	Sika® Aktivator-205
Chemical base	---	Solvent-based adhesive primer	Solvent-based adhesive primer
Colour	---	Black	Colourless
Density	CQP 006-3 EN ISO 2811-1	1.0 kg/l ± 0.1	0.8 kg/l ± 0.1
Flash point	CQP 007-1 EN ISO 13736	- 4 ºC	12 ºC
Solid content	---	32% ± 1	---
Application temperature	---	from 5 ºC to 35 ºC	From 5 ºC to 40 ºC
Applicator	---	Brush, felt or foam	Cotton cloth or paper towel
Consumption	---	from 50 to 150 ml per m^2 (*)	From 30 to 60 ml per m^2 (*)
Curing / drying time	---	10 min. (≥ 15 ºC) 30 min. (< 15 ºC) max. 8 hours	From 10 min. to 15 min. (23 ºC and 50% HR)
Activation time	---	---	2 hours
Shelf life in storage at ≤ 25ºC	CQP 016-1	9 months	12 months

CQP = SIKA internal procedure (Corporate Quality Procedure).

(*) Depending on the porosity and the surface of the substrate.

Table 3.2: Characteristics of SikaTack® Panel Primer and Sika® Aktivator-205.

Characteristic	Reference	SikaTack® Panel Fixing Tape
Chemical base	---	Closed cell polyethylene foam body with pressure sensitive adhesive
Section dimensions	---	3 mm x 12 mm
Density	---	0,064 kg/dm^3
Colour	---	Black, dark grey
Tensile strength	EN ISO 527-1	MD: 25 N / 15 mm TD: 20 N / 15 mm
Elongation at break		MD: 250% TD: 150%
Compression strength	EN ISO 844	0.02 MPa (10%·ε) 0.05 MPa (25%·ε) 0.12 MPa (50%·ε)
Peel strength (180º, 30 min., stainless steel)	FTM 1	23 N / 25 mm
Shear strength (1 kg / 25 mm x 25 mm)	FTM 2	150 h
Application temperature	---	from 5 ºC to 35 ºC
Service temperature	---	from - 40 ºC to 70 ºC
Shelf life in storage at ≤ 25ºC, in a dry place and protected from the sun	---	24 months

MD = Longitudinal direction.

TD = Transversal direction.

FTM = FINAT test method.

Table 3.3: Double-sided tape - SikaTack® Panel Fixing Tape.

4. Manufacture and production control

4.1. Manufacture

All components of the SikaTack® Panel system are distributed in Spain by SIKA SAU.

The SikaTack® Panel adhesive is manufactured by SIKA Polyurethane Manufacturing SRL at its premises in Italy.

The rest of the components are manufactured by other supplier companies of SIKA Services AG and SIKA SAU.

The raw materials and the process for manufacturing the components of the SikaTack® Panel system is confidential information of SIKA Services AG and SIKA SAU that is available to ITeC.

The system components are presented as indicated in table 4.1.

Component	Type of packet	Quantity per packet	Label information
SikaTack® Panel adhesive	Cartridge	300 ml	Name of the company / Date of manufacture / Manufacture centre / Time of manufacture / Number of bottle or bag / Weight / Instructions of use / Danger warning labels
	Unipack	600 ml	
Primer SikaTack® Panel Primer	Bottle	1 l	
Activator Sika® Aktivator-205	Bottle	750 ml	
Double-sided tape SikaTack® Panel Fixing Tape	Roll	33 m	

Table 4.1: Presentation of the system components

4.2. Production control

SIKA SAU checks that all the system components are in accordance with the specifications indicated in chapter 3 through the application of the Control Plan agreed upon with the ITeC.

SIKA SAU has a Quality Management System that complies with the requirements of the standard UNE-EN ISO 9001.

The control that SIKA Services AG and SIKA SAU carry out on each of the system components is adjusted to the particularities of manufacturing, purchasing and supply of each of the components and is defined in the Control Plan.

All the information related to the Control Plan is presented in the Technical Dossier of this DAU.

4.3. Control on site

The technician responsible for the building work must carry out a control of the execution of the external façade cladding system using the SikaTack® Panel system, which ensures that:

- The installers are SIKA SAU *Approved Installers* for the application of the SikaTack® Panel system (see also section 7.3) with a valid card.

  The *Approved Installer Protocol* is the document agreed upon between SIKA SAU and ITeC which includes the procedure that a company must follow so that its installers are considered *Approved Installers*.

  The *Approved Installer* card is strictly for personal use and is linked to the installation company that has made the request to SIKA SAU. The card is valid for 3 years.

- The panel material and the subframe profile material to be used has been explicitly validated by SIKA SAU or is included in the tables in Appendix 1 of this DAU.

  The *Material Validation Protocol* is the document agreed between SIKA SAU and ITeC which includes the procedure that SIKA SAU must follow for the *Validation of Materials*. Section 7.4 indicates the main phases of said validation.

- The system is carried out according to the solution adopted in the project and taking into consideration the criteria indicated in chapters 5 and 6.

4.4. Storage, transport and reception on site

4.4.1. Storage

The components of the SikaTack® Panel system are stored in the SIKA SAU facilities or in the warehouses of its suppliers or distributors until they are transported to the site.

Both in the warehouse and on the construction site, the conditions of this storage must be controlled so that the components do not suffer damage or misuse. All components must be protected from the elements (it is especially important to protect the components from temperature and sun exposure).

For the correct storage, handling and transfer of the system components, the regulations in force regarding the prevention of occupational risks and the recommendations included in the technical data and safety sheets of the components must be followed.

4.4.2. Transport

The system components can be transported by any conventional means as long as it is taken into account that these components must not suffer deterioration or damage in any of the phases of this process: loading, transportation and unloading (see also section 7.2).

During transportation, the components must be protected from sun exposure.

4.4.3. Control of reception on site

When the components are received at the site, the state of the supplied material must be controlled, at least by way of a visual inspection.

In particular, the following aspects must be taken into account:

- The products supplied in boxes must not display any type of deterioration or impairment in the packaging thereof and must be received properly sealed.
- No components shall be accepted that fall outside the specifications set out in the different sections of chapter 3.

It is recommended that the manufacturer or supplier present certificates or documentation confirming that the product supplied is the one specified in the project.

5. Project criteria

The complete wall of the ventilated façade that includes the SikaTack® Panel system as a way of fixing the exterior cladding panels to the profiles of the subframe must comply with the basic requirements of: structural safety, fire safety, safety of use, health and hygiene, protection against noise and energy savings defined by the Technical Building Code (CTE), as well as other requirements related to the durability of materials.

This chapter indicates the criteria that must be considered for the justification of said requirements.

5.1. Design criteria

5.1.1. General criteria

For the correct design of external cladding systems for ventilated façades with the SikaTack® Panel system, the following points should be taken into account:

- This document indicates the general technical aspects recommended for standard building works; however, additional aspects may be required that should be checked with the Technical Department of SIKA SAU.
- In renovation, it is common for the existing support walls to have deteriorated somewhat. This loss of verticality must be rectified using solutions in the design of the subframe so that the vertical profiles are perfectly upright.
- The design of the external cladding system for ventilated façades must be modular in such a way as to rationalise the use of material, avoiding waste and unnecessary cuts in panels, subframe, insulation, etc. For this, the dimensions and geometry of the surface to be covered must be taken into account, considering the position of the openings and other façade elements, as well as the size of the products.
- The final appearance of the façade will be that provided by the chosen panels, their horizontal or vertical layout and their position on the façade. These panels must meet the specifications indicated in section 5.1.3).

5.1.2. Glued connection

The SikaTack® Panel system is a hidden fixing system for exterior cladding panels (see section 5.1.3) on vertical profiles (see section 5.1.4) of ventilated façade subframes without the need for additional mechanical fixings.

A cladding panel must be fixed on at least two vertical profiles positioned at the ends of the panel; however, depending on the dimensions and other characteristics of the panel and the subframe (see section 5.2), other intermediate vertical profiles may be necessary (see figure 5.1).



Figure 5.1: End profiles and intermediate profiles.

Depending on the characteristics of the cladding panel, the surface of the vertical profiles and the need to take into account a movement joint (structural joint of the building or expansion joint of the supporting wall), the following types of connection can be considered:

- Connection on end profiles:
  - a) without movement joint (see figure 5.2a), with two adhesive beads per profile.
  - b) with movement joint (see figure 5.2b), with one adhesive bead per profile.
- Connection on intermediate profiles
  - c) with one adhesive bead per profile (see figure 5.2c).
  - d) with two adhesive beads per profile (see figure 5.2d).

In all cases, each adhesive bead requires its corresponding double-sided tape.

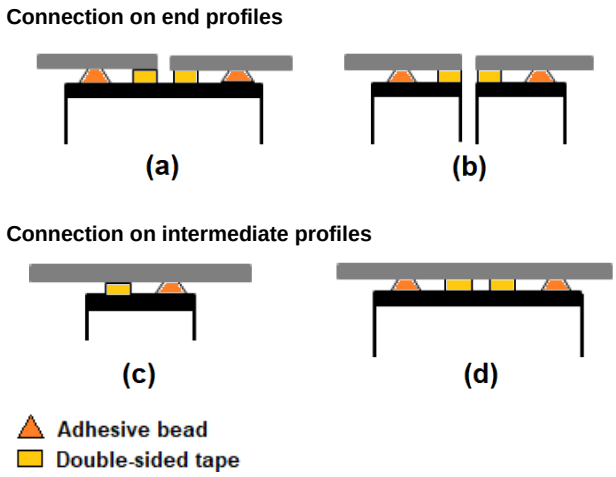


Figure 5.2: Connection on end profiles and intermediate profiles.

The minimum dimension of the bead is indicated in table 1.1, with other larger dimensions possible depending on the specific requirements of the building. These dimensions must be obtained through the corresponding calculation (see section 5.2) carried out by a trained professional.

In all cases, the width and number of adhesive beads are fundamental parameters in the control of the building work (see section 4.3) and, as such, must be considered in the corresponding specifications.

The design limit values for the resistance of the glued connection (panel – adhesive – vertical profile) are defined based on the characteristic values of the results of the resistance tests of this connection and considering the safety factors adopted by SIKA SAU (see section 9.2).

Table 1.1 shows the design limit values for the glued connection. These values correspond to cohesion failure values of the adhesive to which a reduction factor is applied as indicated in section 9.2. Therefore, they are valid as long as the adherence between the adhesive and the surfaces to be bonded (of the panels and profiles) is greater than the cohesive failure values.

Furthermore, it must be considered that the material of the panels and profiles must also have strength values parallel to their faces (cohesion of the material) greater than the cohesive failure values of the adhesive.

5.1.3. Cladding panels

Cladding panels intended to be used with the SikaTack® Panel system must be opaque.

The cladding panels must be validated according to the *Material Validation Protocol* agreed between SIKA SAU and ITeC. The Tables of Use referred to in Appendix 1 include the cladding panels for which ITeC has been able to verify the correct application of the *Material Validation Protocol*.

Other panels not indicated in said tables could be used provided that SIKA SAU explicitly validates their use. These panels will only form part of this DAU when ITeC has verified the correct application of the *Material Validation Protocol* and they are included in the Tables of Use.

The main characteristics of the cladding panels that must be known and specified in the project are:

- Material, trade name and specific model (including the type of surface or treatment).
- Dimensions of the panels (length, height and thickness).

- Weight per unit area or density.
- Flexural strength and modulus of elasticity, the latter only in the case of flexible panels.
- Linear thermal expansion coefficient of the material.
- Dimensional variation due to relative atmospheric humidity, in materials sensitive to humidity.
- Reaction to fire.

These characteristics must be obtained from the technical information (e.g., declaration of performance when applicable, technical sheet, etc.) provided by the manufacturer or distributor of the cladding panel.

5.1.4. Vertical profile of the subframe

The vertical profiles of the subframe intended to be used with the SikaTack® Panel system must be made of aluminium.

The specific materials of the vertical profiles must be validated according to the *Material Validation Protocol* agreed between SIKA SAU and ITeC. The Tables of Use referred to in Appendix 1 include the materials of the vertical profiles for which ITeC has been able to verify the correct application of the *Material Validation Protocol.*

Other materials not indicated in said tables could be used provided that SIKA SAU explicitly validates their use. These panels will only form part of this DAU when ITeC has verified the correct application of the *Material Validation Protocol* and they are included in the Tables of Use.

The minimum dimension of the profile wing (panel support surface where the SikaTack® Panel system is applied) must be:

- For single profiles, minimum 42 mm: profiles that contain a single adhesive bead with its corresponding double-sided tape (see figures 5.3, 5.2b and 5.2c).
- For double profiles, minimum 84 mm: profiles that contain two adhesive beads with their corresponding double-sided tape (see figures 5.3, 5.2a and 5.2d).

These minimum dimensions correspond to the minimum dimensions of the adhesive bead and double-sided tape indicated in table 1.1 and table 3.3, respectively.

Other characteristics of the vertical profiles of the subframe that must be known and specified in the project are:

- Material, surface treatment and type of coating when relevant.
- Shape of the section and dimension of the wing.
- Moment of inertia and resistance modulus in relation to the axis of the section of the profile that corresponds to the bend due to the wind load (axis parallel to the panel).
- Minimum elastic limit of the material.
- Modulus of elasticity of the material.
- Linear thermal expansion coefficient of the material.

These characteristics must be obtained from the technical information (e.g., declaration of performance when applicable, technical sheet, etc.) provided by the manufacturer or distributor of the vertical profile of the subframe.

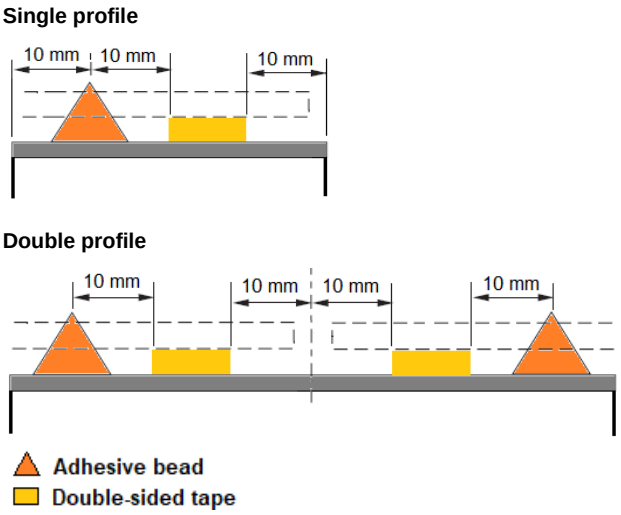


Figure 5.3: Connection on single and double profiles.

5.1.5. Other components of the ventilated façade cladding system

To complete the design of external cladding systems for ventilated façades, the professional responsible for the project must also specify the following products:

- Brackets for fixing the vertical profiles to the support structure (wall or floor slab).
- Fixing screws between the vertical profile and the brackets.
- Anchors[3] for fixing the brackets to the support structure.
- External thermal insulation product, when relevant.

5.2. Structural safety

External cladding systems for ventilated façades are non-load-bearing construction systems, they do not contribute directly to the stability and strength of the support structure on which they are built, but they do

[3] When possible, it is recommended that the fixings have the corresponding CE marking. For example, metal anchors for concrete (expansion, undercut or chemical), anchors with plastic plugs for concrete or masonry, injection anchors for masonry, etc.

contribute to its durability by providing protection against the elements.

It must be justified by means of calculations that the solution adopted for the project withstands the actions applicable thereto as the external cladding system for ventilated façades.

The support structure (wall or floor slab) must have adequate strength and stability to withstand the actions transmitted by the exterior cladding system.

In renovation works, special attention must be paid to the state of the support to ensure that it will withstand the actions transmitted by the exterior cladding systems. In case of doubt, the necessary interventions should be made to improve stability, resistance, etc.

The actions to which the façade and the structure are to be subjected must be defined depending upon the general geometry of the building and its topographic location, taking into account the DB-SE (Basic Document - Structural Security) of the CTE.

For the calculation of the wind loads, it must be considered that the ends of the façades or the protruding corners constitute the zones that are most exposed to wind and generate actions which are double those which are applicable at the centre of the façade section.

Following is the specification of the criteria to be considered for the justification of the structural safety of the external façade cladding systems carried out using the SikaTack® Panel system, depending on the different actions applied to them.

5.2.1. Glued connection

It must be verified that the glued connection can withstand the following actions:

- Dead load (see section 5.2.1.1).
- Wind (see section 5.2.1.2).
- Environmental conditions (see section 5.2.1.3).
- Movement of the support structure (see section 5.2.1.4).

5.2.1.1. Dead load

In each project, calculations must be carried out to verify that the glued connection withstands the dead load of the cladding panels used.

The design limit value to be considered in the calculations is indicated in table 1.1, value that has been assessed considering the results of the shear strength tests of the glued connection under static load (see section 9.2).

For the calculations, the following equations can be used depending on whether the value to be determined is:

- the maximum acceptable dead load (eq.1), or
- the minimum bead width (eq.2).

$$Q_{pp} \cdot \gamma_{pp} \leq \frac{\tau_{cal} \cdot b_{min} \cdot N_b \cdot \gamma_1}{L_{clad}} \cdot 10^5 \quad \text{(eq.1)}$$

$$b_{min} \geq \frac{Q_{pp} \cdot \gamma_{pp} \cdot L_{clad}}{\tau_{cal} \cdot N_b \cdot \gamma_1} \cdot 10^{-5} = b_{cort} \quad \text{(eq.2)}$$

Where:

- Q_{pp} (in kg/m²) = dead load of the panel.
- b_{min} (in mm) = minimum width of the bead.
- τ_{cal} (in MPa) = calculation value of the permanent shear strength:

$$\tau_{cal} = \tau_{des} \cdot \gamma_t \cdot \gamma_{age} \quad \text{(eq.3)}$$

- τ_{des} (in MPa) = design value of the permanent shear strength (see table 1.1).
- γ_t = reduction factor depending on the intended use temperature (see table 5.1).
- γ_{age} = reduction factor due to other ageing conditions (fatigue, freeze-thaw, etc.).
- N_b = total number of beads (bond-lines) per panel. It is important to take into account that when there are 3 or more than 3 profiles, the end profiles can have just one bead (bond line) (see figure 5.4b).
- L_{clad} (in mm) = length of the panel. Dimension perpendicular to the beads (bond-lines).
- γ_1 = reduction factor due to effective adherence

$$\gamma_1 = \frac{h_{eff}}{H_{clad}} \quad \text{(eq.4)}$$

- h_{eff} (in mm) = length of the bead applied.
- H_{clad} (in mm) = width of the panel. Dimension parallel to the beads (bond-lines).
- γ_{pp} = dead load safety factor. According to the DB-SE of the CTE; γ_{pp} = 1.35.

5.2.1.2. Wind suction load

Calculations to verify the resistance of the glued connection to the wind suction load on the cladding panels must be carried out for each project

The design limit value to be considered in the calculations is indicated in table 1.1, value that has been assessed considering the results of the tensile strength tests of the glued connection (see section 9.2).

For the calculations, the following equations can be used depending on whether the value to be determined is:

- the maximum admissible wind suction load, for
  - the scenario with two profiles per panel (see figure 5.4a) or external profiles (eq.5a), or
  - the scenario with three or more profiles per panel (see figure 5.4b) (eq.5c), or

- the minimum bead width, for:
  - the scenario with two profiles per panel (see figure 5.4a) or external profiles (eq.6a), or
  - the scenario with three or more profiles per panel (see figure 5.4b) (eq.6c).

$$(Q_e \cdot \gamma_Q)_{ext} \le \frac{\sigma_{cal} \cdot b_{min} \cdot n_{b\text{-}ext} \cdot \gamma_1}{K_{ext} \cdot l_p + l_{ext}} \cdot 10^3 \quad \text{(eq.5a)}$$

$$(Q_e \cdot \gamma_Q)_{int} \le \frac{\sigma_{cal} \cdot b_{min} \cdot n_{b\text{-}int} \cdot \gamma_1}{K_{int} \cdot l_p} \cdot 10^3 \quad \text{(eq.5b)}$$

$$Q_e \cdot \gamma_Q \le \min [\ \text{(eq.5a)}\ ;\ \text{(eq.5b)}\ ] \quad \text{(eq.5c)}$$

$$(b_{min})_{ext} \ge \frac{Q_e \cdot \gamma_Q \cdot (K_{ext} \cdot l_p + l_{ext})}{\sigma_{cal} \cdot n_{b\text{-}ext} \cdot \gamma_1} \cdot 10^{-3} \quad \text{(eq.6a)}$$

$$(b_{min})_{int} \ge \frac{Q_e \cdot \gamma_Q \cdot K_{int} \cdot l_p}{\sigma_{cal} \cdot n_{b\text{-}int} \cdot \gamma_1} \cdot 10^{-3} \quad \text{(eq.6b)}$$

$$b_{min} \ge \max [\ \text{(eq.6a)}\ ;\ \text{(eq.6b)}\ ] = b_{tens} \quad \text{(eq.6c)}$$

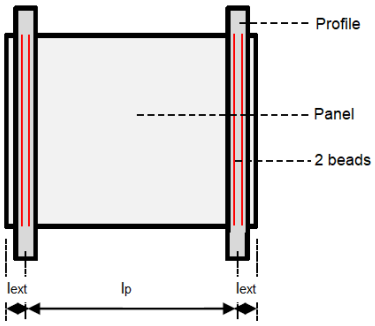
Where:

- Q_e (in kN/m²) = wind suction load.
- K_{ext} or K_{int} = constant depending on the number of profiles (see table 5.2).
- b_{min} (in mm) = minimum width of the bead.
- σ_{cal} (in MPa) = tensile stress calculation value

$$\sigma_{cal} = \sigma_{des} \cdot \gamma_t \cdot \gamma_{age} \quad \text{(eq.7)}$$

- σ_{des} (in MPa) = tensile stress design value (see table 1.1).
- γ_t = reduction factor depending on the intended use temperature (see table 5.1).
- γ_{age} = reduction factor due to other ageing conditions (fatigue, freeze-thaw, etc).
- $n_{b\text{-}ext}$ = number of beads (bond lines) per end profile.
- $n_{b\text{-}int}$ = number of beads (bond lines) per intermediate profile.
- l_p (in mm) = distance between vertical profiles.
- l_{ext} (in mm) = distance between the end profile and the edge of the panel. Perpendicular dimension to the beads (bond lines).
- γ_1 = reduction factor due to effective adherence (see eq.4).
- h_{eff} (in mm) = length of the bead applied.
- H_{clad} (in mm) = width of the panel. Dimension parallel to beads (bond lines).
- γ_Q = wind load safety factor. According to the DB-SE of the CTE; γ_Q = 1.50.

(a) Two profiles per panel



(b) T hree or more profiles per panel

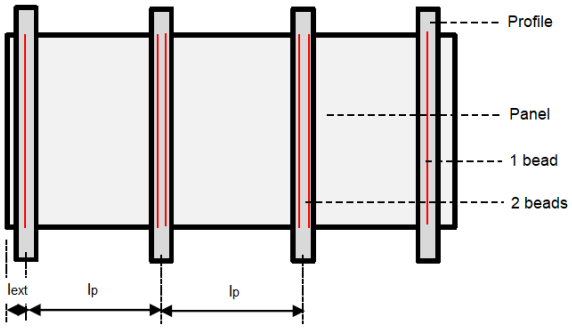


Figure 5.4: Connection on single and double profiles.

Temperature (ºC)	30	40	50	60	70	80
γ_t	0.86	0.73	0.65	0.60	0.53	0.50

Table 5.1: Reduction factor depending on the intended use temperature for the SikaTack® Panel system.

Scenario	K_{ext}	K_{int}
2 profiles	0.50	---
3 profiles	0.375	1.25
4 or more profiles	0.40	1.10

Table 5.2: Constants for equations depending on the number of profiles

5.2.1.3. Combination of dead load and wind load

The combination of dead load and wind load is verified according to the minimum bead width data from equations eq.2 and eq.6c.

$$b_{min} \ge b_{total} = \sqrt{b_{cort}^2 + b_{tens}^2} \quad \text{(eq.8)}$$

5.2.1.4. Actions due to environmental conditions

Environmental variations in temperature and humidity (relative humidity or due to rain) may cause differential movements in the cladding panels and vertical profiles that must be absorbed by the shear displacement of the glued connection.

The design limit value to be considered in the calculations is indicated in table 1.1, value that has been

assessed considering the results of the shear stress tests of the glued connection (see section 9.2).

The following equation can be used to calculate displacement (eq.9).

$$\Delta L_{s,des} \geq \sqrt{\Delta L_v^2 + \Delta L_h^2} \quad \text{(eq.9)}$$

Where:

- $\Delta L_{s,des}$ (in mm) = shear displacement design value (see table 1.1).
- ΔL_v (in mm) = vertical differential displacement
- ΔL_h (in mm) = horizontal differential displacement

The differential displacements ΔLv and ΔLh depend on the cladding panels and vertical profiles linear thermal expansion values, as well as the dimensional variation due to changes in environmental relative humidity for specific cladding panel materials (e.g. HPL laminated, agglomerated stone, etc.)

$$\Delta L_v = \Delta L_{v,T^a} + \Delta L_{v,RH} \quad \text{(eq.10a)}$$

$$\Delta L_h = \Delta L_{h,T^a} + \Delta L_{h,RH} \quad \text{(eq.10b)}$$

In the case of linear thermal expansion, differential displacements can be calculated according to the following equations

$$\Delta L_{v,T^a} = \left[(\alpha_{clad} \cdot \Delta T_{clad}) - (\alpha_p \cdot \Delta T_p)\right] \cdot \frac{H_{clad}}{2} \quad \text{(eq.11a)}$$

$$\Delta L_{h,T^a} = \left[(\alpha_{clad} \cdot \Delta T_{clad}) - (\alpha_w \cdot \Delta T_w)\right] \cdot \frac{L_{clad}}{2} \quad \text{(eq.11b)}$$

Where:

- L_{clad} (in mm) = panel length. Dimension perpendicular to the beads (bond-lines)
- H_{clad} (in mm) = panel width. Dimension parallel to the beads (bond-lines).
- α_{clad} (in mm/(mm·ºC) = cladding panel linear thermal expansion coefficient.
- α_p (in mm/(mm·ºC) = profile linear thermal expansion coefficient
- α_w (in mm/(mm·ºC) = supporting wall linear thermal expansion coefficient.
- ΔT_{clad} (in ºC) = cladding panel temperature difference.

  $$\Delta T_{clad} = T_{0,clad} - T_{1,clad} \quad \text{(eq.12)}$$

- ΔT_p (in ºC) = profile temperature difference.

  $$\Delta T_p = T_{0,p} - T_{1,p} \quad \text{(eq.13)}$$

- ΔT_w (in ºC) = supporting wall temperature difference.

  $$\Delta T_w = T_{0,w} - T_{1,w} \quad \text{(eq.14)}$$

- $T_{0,i}$ (in ºC) = temperature of the cladding panel, profile or external wall, when the adhesive is applied. As a reference, $T_{0,i}$ = 10 ºC may be considered, assembly temperature according to clause 3.4.2 from DB-SE-AE from CTE (Spanish regulation).
- $T_{1,i}$ (in ºC) = cladding panel, subframe or external wall service temperature. As a reference, the criteria indicated in clause 3.4.2 from DB-SE-AE from CTE (Spanish regulation) may be considered.

In case of cladding panel movements due to dimensional variation caused by fluctuations in environmental relative humidity, differential displacements can be calculated according to the following equations

$$\Delta L_{v,RH} = VD_v \cdot \frac{H_{clad}}{2} \quad \text{(eq.15a)}$$

$$\Delta L_{h,RH} = VD_h \cdot \frac{L_{clad}}{2} \quad \text{(eq.15b)}$$

Where:

- VD_v (in mm/m) = cladding panel cross dimensional variation due to humidity
- H_{clad} (in m) = cladding panel width. Dimension parallel to the beads (bond-lines)
- VD_h (in mm/m) = cladding panel longitudinal dimensional variation due to humidity.
- L_{clad} (in m) = cladding panel length. Dimension perpendicular to the beads (bond-lines)

Depending on the final design of the external wall cladding system, some movements can be negligible. E.g., horizontal movement of the wall when it includes expansion joints.

5.2.1.5. Actions due to movement of the support structure

The resistance of cladding systems for ventilated façades against actions due to movements of the support structure is calculated through the design of the system, considering that structural expansion joints are to be respected at all times. An example for addressing this particular issue is given in Fig. 5.2b.

5.2.2. Cladding panel

It must be verified that the cladding panels are wind resistant. For this, their resistance to bending must be analysed and, in the case of flexible panels, also their maximum deflection (deflection should not exceed L/100).

In these calculations, the simple bending equations can be used, taking into account whether the panel is fixed to two end profiles or to 3 or more profiles (see figure 5.1).

5.2.3. Subframe

For the supporting subframe of the panels, the type of profiles, the separation between vertical profiles, the type of brackets (fixed point or sliding point), the separation between brackets and the number of fixings profile-bracket and bracket-structure must be determined.

It is recommended that:

- The vertical profiles comply with the following deflection values:
  - L/200 for deflections of the profile between supports.
  - L/150 for deflections of the cantilever profile.
- The brackets comply with the following values (e.g., obtained through the test indicated in the European reference documents):
  - Value of permanent deformation under the action of horizontal force (suction) = 1 mm.
  - Value of displacement under the action of vertical force (dead load) ≤ 3 mm.

As a reference, in the calculations of the subframe, the following can be considered: a minimum wind load safety factor, γ_Q = 1.50, a minimum dead load safety factor, γ_{pp} = 1.35, a minimum reduction factor for the material strength over design values, γ_m = 2.00 and a minimum safety factor on the resistance of the anchor to the substrate or support structure, γ_{anc} = 3.5. In the case of seismic zones, the actions due to earthquakes will be considered with a minimum factor, γ_s = 1.30 and all actions will be taken into account simultaneously.

5.3. Safety in case of fire

5.3.1. Reaction to fire

In accordance with point 4, part 1 of section SI2 of the DB-SI (Basic Document - Fire Safety) of the CTE on fire propagation on façades and party walls, compliance with the requirements for reaction to fire applies to materials that occupy more than 10% of the surface of the exterior finish of the façades or of the interior surfaces of the ventilated chambers that said façades may have.

The system which is the subject of this DAU (SikaTack® Panel system) occupies less than this 10%, so it can be considered that said requirement does not apply to it.

The reaction to fire classification of external cladding systems in ventilated façades depends mainly on the material of the cladding panel and the material of the thermal insulation product that is incorporated in the chamber behind the cladding panel. Consequently, the materials of the panel and the thermal insulation product must be chosen so that, when applicable, they comply with the requirements indicated in section SI2 of the DB-SI (Basic Document – Fire Safety) of the CTE for exterior propagation on façades.

In each case, the designer must verify that the reaction to fire declared by the manufacturer of the cladding panel and the thermal insulation product complies with the requirement indicated in the CTE.

The verification of the reaction to fire of the panels must be carried out considering the SikaTack® Panel system as the fixing of the panels.

Section 9.1 provides the available evidence for the classification of façade cladding systems that incorporate the SikaTack® Panel fixing system.

5.3.2. Resistance to fire

Resistance to fire is a characteristic applicable to all of the components that form part of the façade wall and not solely or exclusively to the SikaTack® Panel system.

In any event, the composition and design of the main sheet must ensure compliance with the requirement of fire resistance as provided for in section SI2 of the DB-SI (Basic Document - Fire Safety) of the CTE.

5.3.3. Other aspects

In addition to the purely regulatory characteristics of reaction and resistance to fire, in the design of a ventilated façade wall, other aspects must be considered aimed at preventing the spread of fire through the façade and protecting escape routes and safe outdoor spaces from falling objects or parts.

The following points must be considered:

- The need to incorporate horizontal and/or vertical fire barriers in the ventilated chamber to prevent the fire from spreading through the air chamber due to the chimney effect or the combustibility of the materials, breaking through the sectorisation of the building.

  This aspect will depend on the complete design of the ventilated façade wall, it is not exclusively applicable to the SikaTack® Panel system.
- The risk of falling objects or parts that could affect evacuation routes, safe outdoor spaces or the intervention of firefighters.

5.4. Health and hygiene

5.4.1. Degree of impermeability to rainwater

The degree of impermeability to rainwater is a performance characteristic that is applicable to the complete façade wall, including the composition and design of both the inner and outer sheets, and not only to the SikaTack® Panel fixing system.

As set out in paragraph 2.3.1 of section HS1 of the DB-HS (Basic Document - Hygiene and Health) of the CTE, the minimum degree of impermeability required for façades in respect of the penetration of rainwater is obtained in table 2.5 of said section HS1 depending upon the average rainfall zone and the degree of exposure to wind that corresponds to the location of the building.

The influence of the SikaTack® Panel fixing system in defining the degree of impermeability of a façade can be considered negligible.

To define the degree of impermeability of a façade, the equivalence of the exterior cladding system to be incorporated (which includes the SikaTack® Panel system) must be considered with respect to the façade conditions indicated in section HS1 of the DB-HS (Basic Document - Hygiene and Health) of the CTE, establishing the level of performance (R, B and C).

Cladding panels influence performance level R and B, but not C.

Due to the fact that the joints between panels are open, this type of cladding should be considered as not waterproof; however, it does represent an initial barrier against rain.

The design of the air chamber, subframe and singular points must guarantee that the water that can penetrate inside the chamber does not reach the outer surface of the inner sheet (e.g., insulation) and is evacuated to the outside without accumulating.

5.4.2. Limitation of condensation

Condensation limitation is a performance feature that is applicable to the complete façade wall, including the composition and design of the inner sheet, and not only to the SikaTack® Panel fixing system.

This complete façade wall must ensure the limitation of superficial and interstitial condensation as set out in section HE1 of the DB-HE (Basic Document - Energy Savings) of the CTE.

For said purposes, for each project the necessary verifications must be carried out, taking into account the external hygrothermal characteristics (depend upon the location of the building), the internal hygrothermal characteristics (depend upon the use of the building), and the hygrothermal characteristics of the materials used within the complete façade wall.

In the case of a ventilated façade wall, the limitation of condensation corresponds to the inner sheet of the wall, taking into account the external surface resistance corresponding to a ventilated chamber.

For carrying out said verifications, the provisions of the section HE1 of the DB-HE (Basic Document - Energy Savings) of the CTE are to be followed.

5.4.3. Airtightness

Airtightness is a performance characteristic that is applicable to the complete ventilated façade wall, including the composition and design of the inner sheet, and not to the outer sheet or to the SikaTack® Panel system.

In the case of façade walls with ventilated air chambers, airtightness is a characteristic that must be guaranteed exclusively by the inner sheet, situated behind the air chamber.

5.5. Safety in use

The safety in use of external cladding systems in ventilated façades against impact depends mainly on the cladding panel (material, geometry and physical properties) in conditions of final use (which is influenced by its fixing method).

Therefore, it is recommended to request from the manufacturer or distributor of the cladding panel the corresponding justification of the impact class of the panel fixed by means of the SikaTack® Panel system.

In order to carry out said justification, the European reference documents can be considered, where distinct categories are established based on the reaction of the cladding to hard and soft body impacts.

Furthermore, given that ventilated façade construction systems include many metallic components, it should be analysed whether the entire façade wall system must be earthed to maintain equipotentiality.

5.6. Protection against noise

Insulation from airborne noise coming from the outside is a characteristic applicable to the set of components that make up the façade wall (mainly the joinery of the windows and doors) and not exclusively to the exterior cladding panels or the SikaTack® Panel system.

If insulation is included in the façade wall on the outer face of the inner sheet of the wall, it could improve the insulation against airborne noise from outside.

In any case, while there is no specific data on this improvement[4], the composition and design of the inner sheets, located behind the ventilated chamber, must guarantee the limitation of insulation from noise as established in the DB-HR (Basic Document – Noise Protection) of the CTE.

5.7. Energy saving and thermal insulation

The thermal insulation in ventilated façades is a characteristic mainly applicable to the set of layers that form the inner sheet of the façade wall and the layer of thermal insulation product that is incorporated, therefore, the contribution of the exterior cladding panels or the SikaTack® Panel system can be considered negligible.

[4] If necessary, the improvement of the insulation from airborne noise can be tested in accordance with Annex G of standard EN ISO 10140-1.

5.8. Durability

The durability of the SikaTack® Panel system is mainly ensured with good project design measures (see section 5.1), paying special attention to the solution of the specific points of the façade, a correct execution (see chapter 6) and adequate maintenance (see chapter 7).

In particular, the durability of adhesive-fixed ventilated façade systems depends on the durability of the glued connection (see section 5.8.1), the cladding panels (see section 5.8.2) and the profiles and other components. of the subframe, as well as its degree of exposure to the outside environment.

The following points should be taken into account:

- The installation and application of the SikaTack® Panel system must be carried out by SIKA SAU *Approved Installers* (see sections 4.3 and 7.3).
- The panels and materials of the vertical profiles explicitly validated by SIKA SAU following the *Material Validation Protocol* (see section 7.4) should be considered.
- The different products must be kept in their original packaging during storage and until the time of installation.

5.8.1. Glued connection

Based on the stress tests carried out in the initial state and after different conditioning (see section 9.2), it can be considered that the glued connection has adequate durability against variations in temperature, humidity and accumulation of water.

Other exposures of the glued connection considered in the European reference documents have not been evaluated in this DAU. When the person in charge of the project considers this evaluation necessary in a specific project, the corresponding tests may be carried out or additional safety factors may be applied in the calculation (see section 5.2.1).

As an example, tensile strength tests or peel-tests can be considered in the following exposures in addition to those indicated in section 9.2:

NaCl: After conditioning in a saline atmosphere for 480 ± 2 hours, according to EN ISO 9227.

SO_2: After 20 cycles in a humid atmosphere containing sulphur dioxide, according to EN ISO 3231.

CTL: After cycles of pulsating tensile loads.

CSL: After cycles of pulsating shear loads.

Fz-Th: After freeze-thaw cycles.

RT: Tear from an incision 10% of the length of the adhesive bead.

5.8.2. Cladding panels

The durability of the cladding panels must be guaranteed by the manufacturer or distributor of the panel based on the declaration of the applicable durability characteristics depending on the material of the panel and taking into account the reference documents that are applicable to it (e.g., harmonized standards, European assessment documents, etc.).

It must be taken into account that the durability of the adhesion between the panel and the adhesive (an aspect that must always be guaranteed) may depend on the durability of the panel and especially on the possible loss of cohesion of the panel material when exposed to certain environmental conditions.

5.8.3. Subframe components

The project designer must take into account the degree of corrosivity associated with the specific environment in which the project is located, considering factors such as the high presence of salinity or contaminating elements and the *time of wetness*[5].

The materials specified for the subframe components are aluminium alloys, therefore, a high resistance to corrosion can be assumed, although, depending on the type of aluminium alloy, they may require additional protection in harsh industrial or marine environments.

When choosing the materials for the components of the support subframe, possible chemical incompatibilities between the different metallic materials must also be taken into account so that galvanic torque is not produced that exacerbates a possible corrosion process.

Horizontal profile subframes should not be used as they pose a high risk of corrosion that can affect adhesion.

[5] As indicated in the ISO 9223 standard, the time of wetness is the period (hours/year) during which a metallic surface is covered by a liquid and/or adsorption film of an electrolyte capable of causing atmospheric corrosion.

6. Execution criteria

6.1. Assemblers and assembly teams

The SikaTack® Panel system must only be installed by SIKA SAU *Approved Installers* (see sections 4.3 and 7.3).

For the recognition of an *Approved Installer*, the provisions set out in the *Approved Installer Protocol* must be followed.

Auxiliary components and construction machinery must meet the functional and quality conditions established in the current regulations and provisions relating to the manufacture and industrial control of this equipment.

6.2. Handling at the work site. Safety conditions

Generally speaking, in relation to any handling of the materials on the work site, care must be taken to not cause any damage or defects to the materials.

During the assembly and maintenance processes, the applicable occupational hazards regulations must be taken into account and said provisions must be included in the health and safety plan for the works.

6.3. Application of the SikaTack® Panel system

The SikaTack® Panel system must be applied according to the instructions set out by SIKA SAU in the *General Guide – SikaTack® Panel System.*

When applying the SikaTack® Panel system, only the components included in this DAU must be used (see chapter 3).

Below is a summary of the phases that make up the system application process, and those aspects of the application that could cause a change in the system's performance:

1) The cladding panels and the material of the vertical profiles to be used in the work must have been validated by SIKA SAU (see section 5.1.3).

   In particular, the panels must be completely flat and not deformed due to manufacturing defects or due to incorrect storage on site.

2) Pre-treatment (sanding where appropriate, cleaning and priming) of the cladding panels and the vertical profiles.

   This phase is essential to ensure that the glued connection has the features indicated in this DAU.

3) The minimum dimension (width and thickness) of the adhesive bead should be that indicated in table 1.1 unless other larger dimensions are specified in the project due to the need for greater resistance to wind suction or greater movement in the glued connection (see section 5.2).

4) Structural joints must be respected (see section 5.1.2).

6.4. Control of application of the SikaTack® Panel system

The control of the application of the SikaTack® Panel system must be carried out by the professional responsible for the work, following the criteria below:

- The panel and material of the vertical profile of the subframe to be used in the work must have been explicitly validated by SIKA SAU.
- The installer must prove their validation as an *Approved Installer* by means of the corresponding card (see sections 4.3 and 7.3).
- The installer shall carry out the quality control of the application and complete the *Daily Installation Log* as described in the *General Guide – SikaTack® Panel System.*
- The panels must be completely flat and not deformed due to manufacturing defects or incorrect storage on site.
- The vertical profiles must be perfectly upright.

7. Other criteria

7.1. Maintenance or conservation criteria

As with any other type of construction system, the ventilated façade cladding systems fixed with the SikaTack® Panel system must be the subject of periodic maintenance and conservation inspections.

For the purposes of carrying out said inspections, the operations and inspection periods set out in table 6.1 of section HS1 of the DB-HS (Basic Document - Hygiene and Health) for façades must be taken into account.

Said inspection operations must be complemented with the following specific aspects:

- The appearance of any deterioration of the cladding panels such as cracks, breaks, loss of material, chipping, movement, etc.
- Penetration of water or presence of damp in the joints with construction elements such as windows, guttering, windowsills, skirting boards, parapets or in general those joints that are susceptible to deterioration over time.
- An aesthetic consideration is the normal soiling of the façade due to the passage of time, which varies from one area to another and also depends on the urban, industrial or rural environment. For the cleaning and maintenance of the façade, the recommendations of SIKA SAU and the manufacturer or distributor of the cladding panel are to be followed.

If any of the foregoing defects or any other type of damage is detected, the degree of importance thereof must be determined and, if considered necessary, said defects or damage must be repaired. As with any other type of building maintenance activities, said operations must be analysed by the building owners and carried out by qualified professionals in accordance with the instructions and recommendations of SIKA SAU and by the manufacturer or supplier of the cladding panel.

7.2. Measures for the protection of the environment

The use of the materials of the different components of the system must be optimised in order to avoid excess and to minimise waste material. The indications set out on the safety sheet, for those components that have one, must be adhered to.

7.2.1. Waste treatment

By virtue of Decision 2000/532/EC and the modifications thereof, a European Waste Catalogue (EWC) has been established that provides that all products must be assigned an EWC code that enables the user to know the type of waste management that corresponds thereto.

Table 7.1 sets out the EWC codes established for the different components.

The waste generated during the installation must be managed in accordance with applicable waste management regulations by a waste management company authorised for said purposes (see Royal Decree 105/2008 that governs the production and management of construction and demolition waste).

System components	EWC code	TR
• SikaTack® Panel	080409	Special
• SikaTack® Panel Primer	080111	
• Sika® Aktivator-205		
• SikaTack® Panel Fixing Tape	170604	Not special
Oher materials/packaging		
• Contaminated packaging	150110	Special
• Sacks and composite packaging	150105	Not special

Table 7.1: Declared EWC codes.

7.2.2. Wastewater

The treatment of the water used for the cleaning of the tools should also be taken into consideration.

7.3. Conditions regarding the installers of the system

The SikaTack® Panel system must only be installed by SIKA SAU *Approved Installers* according to the *Approved Installer Protocol,* a document that has been agreed upon between SIKA SAU and ITeC.

The main phases indicated in the *Approved Installer Protocol* are:

- Application for recognition as an *Approved Installer.*
- Theoretical and practical training.
- Identification of responsibilities.

If specifically required, SIKA SAU can provide the list of *Approved Installers* according to the location of the project.

Furthermore, it is recommended that installation companies be certified in relation to their capacity to install the system. Said certification must be issued by a body authorized for this purpose and registered in the General Registry of the Technical Building Code (CTE); for example, the ApTO Declaration (Technical Aptitude in Building Work) granted by the ITeC.

7.4. Validation of materials

The SikaTack® Panel system must be used exclusively on cladding panels and materials of the vertical profiles of the subframe explicitly validated by SIKA SAU following the *Material Validation Protocol*, a document agreed between SIKA SAU and ITeC.

The Tables of Use referred to in Appendix 1 indicate the panels and materials of the vertical profiles for which ITeC has been able to verify the correct application of the *Materials Validation Protocol.*

The main phases indicated in the *Material Validation Protocol* are:

- Identification of whether the material has been previously validated.
- As appropriate, confirmation of previously validated material or test plan for validation following the accelerated aging process defined by SIKA SAU.
- Conditions for the SIKA SAU guarantee.
- Conditions for the incorporation of a new material in the Tables of Use of Appendix 1 of this DAU.

8. References of use and site visits

8.1. References of use

The following list of building works has been provided as references for use:

- New ABC Museum of Drawing and Illustration. Aluminium composite panel on aluminium subframe 235 m^2. Year 2010. Madrid.
- Union Residential Tower building. Large format ceramic panel on aluminium subframe. Year 2016. Doha (Qatar).
- Skyline Plaza Building. HPL panel on aluminium subframe. 4,000 m^2. Hampshire (United Kingdom).
- BMW car dealer. Aluminium composite panel on aluminium subframe. Beddington. London (United Kingdom).
- Lambeth Water Tower. Aluminium composite panel on aluminium subframe. 275 m^2. London (United Kingdom).
- Buckinghamshire New University. Aluminium composite panel on aluminium subframe. High Wycombe (United Kingdom).
- Barking Library. HPL panel on aluminium subframe. London (United Kingdom).
- VW Financial Services HQ. Aluminium composite panel on aluminium subframe. Milton Keynes (United Kingdom).
- SAAB Center. Aluminium composite panel on aluminium subframe. Remetschwil (Switzerland).
- Sports Center Zamet. Ceramic panel on aluminium subframe. Rijeka (Croatia).
- B.V. Kreishaus. HPL panel on aluminium subframe. Aachen (Germany).

8.2. Site visits

Building works carried out with the SikaTack® Panel system have been visited, both once completed and while in progress. The works were inspected by ITeC staff.

The objective of the visits was, on the one hand, to assess how applicable the installation instructions are with the human and material resources defined by SIKA SAU and, on the other hand, to identify the aspects that help avoid potential problems that may affect the system.

The relevant aspects identified during said site visits have been included within the project and execution criteria set out in chapter 6.

9. Assessment of tests and calculations

The fitness for use of the SikaTack® Panel system has been assessed in relation to compliance with the *Specific Assessment Procedure of the DAU*. Said procedure has been drafted by the ITeC taking into consideration the Spanish construction regulations applicable in each case:

- for buildings, the basic requirements established by the CTE shall be taken into account for each of the basic requirements,
- in other construction areas, the specific regulations applicable thereto shall be taken into consideration,

as well as other additional requirements related to the durability and service conditions of the system.

The tests that form part of this assessment have been carried out in external laboratories previously validated by ITeC on samples provided by SIKA SAU according to ITeC instructions.

All test and calculation reports, as well as the list of samples, are set out in the *DAU Technical Dossier*.

The following sections present the applicable characteristics and evidence considered for the assessment of the SikaTack® Panel system.

9.1. Reaction to fire

The possible influence of the SikaTack® Panel fixing system on the reaction to fire of the Trespa Meteon FR cladding panel has been assessed, the classification for which when mechanically fixed is known.

The reaction to fire of this same panel but fixed using the SikaTack® Panel system has been classified according to the UNE-EN 13501 1 standard (as established by Royal Decree 842/2013) based on the tests carried out according to the standards UNE-EN ISO 11925-2 and UNE-EN 13823 (SBI test). The latter have been carried out under exposed conditions on the outside face of the panel (reports 18-16250-891-1 and 18-16250-891-2) and also on the inside face of the panel (reports 18-16250-892-1 and 18-16250-892-2).

The samples for the SBI tests were selected taking into account the conditions of final use (panels with open joints mounted on vertical aluminium profiles and applying all the components of the SikaTack® Panel system as defined in chapters 1 and 2 of this DAU).

The reaction to fire classification obtained in both cases is B-s1,d0, the same classification as that defined for these same panels with mechanical fixings.

9.2. Mechanical resistance of the glued connection

The following mechanical resistance tests of the connection have been carried out in different conditioning situations according to the methods established in the European reference documents (report 18-17284-1486).

- Tensile strength and elongation at:

  NT: Normal temperature, 23 ºC ± 5 ºC.

  HT: High temperature, 80 ºC ± 1 ºC.

  LT: Low temperature, - 20 ºC ± 1 ºC.

  HT+HR: After conditioning for 1004 ± 4 hours at high temperature, 60 ºC ± 2 ºC and high relative humidity, 85 ± 2 % HR.

  H_2O: After immersion in water for 7 days at room temperature.

- Shear stress and deformation under dynamic load at:

  NT: Normal temperature, 23 ºC ± 5 ºC.

- Creep-test:

  HT+HR: After conditioning for 1004 ± 4 hours at high temperature, 60 ºC ± 2 ºC and high relative humidity, 85 % ± 2 % HR.

The results of the tests are those indicated in table 9.1. The results of these tests have been used to confirm the design values indicated in table 1.1. (See section 9.3).

9.3. Checking the design values of the glued connection

The design tensile and shear strength values of the SikaTack® Panel adhesive established by SIKA (see table 1.1) are confirmed by the results of the mechanical resistance tests (see table 9.1).

The minimum global factor of safety in relation to the ultimate values of tensile and shear strength (in dynamic load) is a = 6.5.

Furthermore, it is confirmed that the shear displacement under static load is lower than the design value indicated in table 1.1.

On the other hand, using the stress-elongation curve of the characteristic values, it is observed that:

- for the design value of tensile strength 0.15 MPa, the elongation value is 20% and the load displacement is 0.61 mm.
- for the design value of shear strength under dynamic load, 0.12 MPa, the elongation value is 39% and the load displacement is 1.17 mm.

These results are admissible for the design of glued connection systems.

Characteristic			Conditioning				
			NT	HT	LT	HT+HR	H_2O
Tensile	Ultimate tensile strength (MPa)	$R_{u,m}$	1.30	1.48	1.40	1.48	1.41
		$R_{u,c}$	1.13	0.99	1.20	1.18	1.27
	Ultimate tensile elongation (%)	$\varepsilon_{u,m}$	209	229	210	254	224
		$\varepsilon_{u,c}$	157	145	139	183	160
	Tensile cohesive rupture (%)	C_{tm}	100	100	100	100	100
	Resistance ratio in relation to the initial value (%)	V_m	---	1.25	1.19	1.25	1.19
		V_c	---	1.10	1.33	1.31	1.41
Dynamic shear stress	Ultimate shear strength (MPa)	$R_{u,m}$	1.05	---	---	---	---
		$R_{u,c}$	0.83	---	---	---	---
	Ultimate shear displacement (mm)	$\Delta L_{s,m}$	11.5	---	---	---	---
		$\Delta L_{s,c}$	7.9	---	---	---	---
	Shear cohesive rupture (%)	$C_{s,m}$	100	---	---	---	---
Static shear stress (creep test	Displacement after 7 days (mm)	$d_{1,m}$	---	---	---	1.82	---
		$d_{1,c}$	---	---	---	2.27	---
	Displacement after 42 days (mm)	$d_{2,m}$	---	---	---	2,98	---
		$d_{2,c}$	---	---	---	3,84	---
	Shear displacement stabilisation (mm)	$\Delta L_{s,m}$	---	---	---	0,45	---
		$\Delta L_{s,c}$	---	---	---	0,92	---

Where:

m = mean (average) value.

c = characteristic value that gives 75% confidence that 95% of the results will be greater than this value.

--- = data not applicable.

NT= Normal temperature, 23 ºC ± 5 ºC.

HT = High temperature, 80 ºC ± 1 ºC.

LT = Low temperature, -20 ºC ± 1 ºC.

HT+HR = 1004 ± 4 hours at high temperature, 60 ºC ± 2 ºC and high relative humidity, 85 ± 2 % HR.

H_2O = After immersion in water for 7 days at room temperature.

Table 9.1: Test results for the mechanical resistance of the glued connection.

9.4. Peel tests

Peel tests have been carried out under normal conditions (NT) on the panel and profile materials according to the methods established in the European reference documents (report 18-17284-1486).

This test determines the adhesion capacity of the adhesive.

In all cases, the ruptures are confirmed as 100% cohesive in the SikaTack® Panel adhesive.

9.5. Calculations

The resistance of the glued connection has been verified considering the minimum design values of the glued connection and the most representative configuration. The vertical and horizontal actions (dead load and wind load) have been considered independently of each other, that is, the actions have not been contemplated simultaneously.

Furthermore, these tests have not taken into account the possible dimensional restrictions of the panels because of variations that certain materials may have due to the action of temperature and humidity (see section 5.2.1.3).

The input data considered, and the results obtained by applying the equations indicated in section 5.2.1 for the dead load and wind load, are indicated below.

In no case does this data include the panel verifications (see section 5.2.2) or the subframe verifications (see section 5.2.3).

9.5.1. Dead load

The input data considered are:

- Cladding panel data:
  - Panel length, extreme values: $L_{clad,min}$ = 600 mm and $L_{clad,max}$ = 1500 mm. The possible dimensional restrictions of the panels

because of variations that certain materials may have due to the action of temperature and humidity are not considered.

- Panel height, $H_{clad} = h_{eff}$. The adhesive bead is considered to cover the whole height of the panel.
- Number of support profiles, cases with 2, 3 and 4 profiles are analysed.
- Length between the edge of the panel and the first profile: l_{ext} = 0 mm.

- Adhesive bead data:
  - Minimum bead width (see table 1.1): b_{min} = 12 mm.
  - Design shear strength (see table 1.1): τ_{des} = 0.12 MPa.
  - Number of beads per profile: n_b = 2 in all cases except for the end profiles in a situation of 3 or more profiles per panel, in which case it is n_b = 1 per end profile.
- The safety factors considered are:
  - Weight safety factor: γ_{pp} = 1.35.
  - Reduction factor due to effective adherence: γ_1 = 1.0.
  - Reduction factor due to temperature: γ_t = 0.60.
  - Reduction factor due to other ageing conditions (permanent load, freeze-thaw, etc.): γ_{age} = 0.10.

9.5.2. Wind suction load

The input data considered are:

- Cladding panel data:
  - Distance between vertical profiles, extreme values: $l_{p,min}$ = 500 mm and $l_{p,max}$ = 1500 mm. The possible dimensional restrictions of the panels because of variations that certain materials may have due to the action of temperature and humidity are not considered.
  - Panel height, $H_{clad} = h_{eff}$. The adhesive bead is considered to cover the entire height of the panel.
  - Number of support profiles, cases with 2, 3 or 4 or more profiles are analysed.
  - Length between the edge of the panel and the first profile: l_{ext} = 0 mm.
- Adhesive bead data:
  - Minimum bead width (see table 1.1): b_{min} = 12 mm.
  - Design tensile stress (see table 1.1): σ_{des} = 0.15 MPa.
  - Number of beads per end profile: $n_{b\text{-}ext}$ = 1.
  - Number of beads per intermediate profile: $n_{b\text{-}int}$ = 2.
- The safety factors considered are:
  - Wind load safety factor: γ_Q = 1.50.
  - Reduction factor due to effective adherence: γ_1 = 1.0.
  - Reduction factor due to temperature: γ_t = 0.60.
  - Reduction factor due to other aging conditions (fatigue, freeze-thaw, etc.): γ_{age} = 0.50.

9.6. Durability aspects of the glued connection

The assessment of the durability of the glued connection of the SikaTack® Panel system is established by comparing the results of the mechanical resistance tests and peel-tests before and after conditionings or accelerated aging cycles.

In all cases of mechanical resistance tested (see table 9.1), the resistance capacity of the connection after conditioning is higher than the resistance capacity under normal temperature conditions.

10. Expert commission

This DAU has been submitted to the opinion of an Expert Commission, as indicated in the *DAU Regulation* and in the Work Instruction for the elaboration of the DAU.

The Expert Commission was constituted by representatives of different organizations and institutions, which have been chosen for their knowledge, independence and impartiality to give a technical opinion regarding the scope of this DAU.

The general list of experts that have made up the expert commissions of DAUs is available on the website of ITeC, itec.es.

Comments and observations raised by members of this Commission have been included in the text of the present DAU.

The following aspects have been considered relevant:

- The specialization of installers is important for all ventilated façade systems. In the case of systems where panel fixing is exclusively by means of an adhesive system, this specialisation of the installers is essential.
- Only panels and profile materials that have been previously verified by SIKA SAU must be admitted to work sites.

11. Reference documents

- Technical Building Code (CTE). Basic Documents of the CTE: DB-SE, DB-SI, DB-HS, DB-SUA, DB-HR and DB-HE in force at the date of issue of this DAU.
- DA DB-HE/1. 2015. Support document for the DB-HE Basic Document Energy saving. Calculation of characteristic parameters of the envelope.
- DA DB-HE/2. 2017. Support document for the DB-HE Basic Document Energy saving. Verification of limitation of superficial and interstitial condensation in the external walls.
- EAD 250005-00-0606. Facade cladding adhesive.
- EN 755-2. Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Part 2: Mechanical properties.
- EN ISO 13736/A1 Determination of flash point. Abel closed-cup method. (ISO 13736:2021/Amd1:2022).
- EN ISO 2811-1. Paints and varnishes. Determination of density. Part 1: Pycnometer method. (ISO 2811-1:2023).
- EN ISO 3231. Paints and varnishes. Determination of resistance to humid atmospheres containing sulphur dioxide. (ISO 3231:1993).
- EN ISO 37. Rubber, vulcanised or thermoplastic. Determination of tensile stress-strain properties.
- EN ISO 527-1. Plastics. Determination of tensile properties. Part 1: General principles. (ISO 527-1:2019).
- EN ISO 844. Rigid cellular plastic. Determination of compression properties.
- EN ISO 868. Plastics and ebonite. Determination of indentation hardness by means of a durometer (Shore hardness). (ISO 868:2003)
- EN ISO 9227. Corrosion tests in artificial atmospheres. Salt spray tests. (ISO 9227:2022).
- ISO 34-2. Rubber, vulcanised or thermoplastic. Determination of tear strength. Part 2: Small (Delft) test pieces.
- ISO 4587. Rubber, vulcanised or thermoplastic. Determination of dynamic properties. Part 2: Torsion pendulum methods at low frequencies.

- ISO 4664-2. Paints and varnishes. Determination of density. Part 1: Pycnometer method. (ISO 2811-1:2016).
- UNE-EN 13501-1. Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.
- UNE-EN 13823. Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item.
- UNE-EN ISO 11925-2. Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test. (ISO 11925-2:2020).
- UNE-EN ISO 9001. Quality management systems. Requirements (ISO 9001:2015).

12. Assessment of fitness for use

Based on the following technical test results obtained during the preparation of the DAU 19/114 according to the criteria defined in the *Specific Assessment Procedure of the DAU,* prepared by ITeC:

- tests and calculations results
- information obtained from site visits
- factory production control
- instructions for system application
- project and execution criteria of the system

and taking into account the methodology prescribed in the *DAU Regulation*, the authorization and the register of ITeC for awarding the DAU* and the indications in section 5.2 of article 5 of the *Technical Building Code* (CTE), regarding the assessment of innovative building products and systems, it is considered that ITeC has the evidence to declare that the SikaTack® Panel system, of SIKA SAU, consisting of the products stipulated in chapter 2 and installed according to instructions and criteria exposed in this DAU, is appropriate for its use in:

- concealed fixing of opaque external cladding for ventilated façades on a subframe of vertical aluminium profiles, in new builds and renovations.

since it fulfils the relevant regulatory requirements in terms of mechanical resistance and stability, protection against fire and safety of use, as well as durability and serviceability requirements.

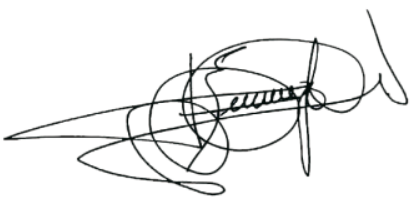
As a result, and once this document has been submitted to the Expert Commission and their comments have been included in it, ITeC awards the DAU to the SikaTack® Panel system of SIKA SAU.

The validity of the DAU is subject to the actions and monitoring conditions specified in chapter 13 and to the use conditions of chapter 14.

(*) ITeC is an authorized organism for awarding the DAU (BOE 94, 19 April 2002) for construction products (building and civil engineering) registered in the General Register of the CTE: https://www.codigotecnico.org/RegistroCTE/OrganismosAutorizados.html.

DAU 19/114 Documento de adecuación al uso

ITeC



Technical Director of ITeC

DAU 19/114 SikaTack® Panel

ITeC

13. DAU monitoring

The present DAU is subject to the monitoring actions that ITeC carries out periodically, in accordance with the provisions of the *DAU Regulation.* The purpose of this monitoring is to check that the characteristics of the product and the construction system, as well as the execution and manufacturing conditions, are still valid for the envisaged intended uses.

If relevant changes affecting the DAU validity occur, these will result in a new DAU edition that will supersede the previous one (this new edition will take the same DAU code as the superseded one and a new letter edition).

When changes are of minor importance and they do not affect the DAU validity, these will be specified in a list of changes that will be incorporated as chapter 15 of the DAU; furthermore, these changes will be included as well in the DAU text.

The DAU user must always look up the DAU electronic version available in pdf format on the website of ITeC itec.es, in order to make certain of its possible revisions that may occur during its validity. This document is also available through the QR code included in the DAU stamp.

14. DAU conditions of use

In granting the DAU, the ITeC is not responsible for:

- The potential presence or absence of any patent, intellectual property or similar existing rights subsisting in the product the subject matter of the DAU or any other product, nor rights that affect third parties or the fulfilment of obligations to any of these third parties.
- The right of the DAU holder to manufacture, supply, install or maintain the product the subject matter of the DAU.
- The actual works or individual batches in which the product is installed, used and maintained; including its nature, design or execution.

In addition, the DAU cannot be ever interpreted as a guarantee, commitment or responsibility of the ITeC relating to the commercial viability, patentability, registrability or innovation of the results derived from the preparation of the DAU. It is, then, the holder's responsibility to check the viability, patentability and registrability of the product.

The assessment of the DAU does not imply the conformity of the product with the requirements foreseen by the health and safety or occupational risk prevention regulations, in relation to the manufacture, distribution, installation, use and maintenance of the product. Therefore, ITeC is not responsible for any loss or personal injury that may occur due to non-compliance with the requirements of the aforementioned regulatory framework.

15. List of changes to the present edition

The electronic version of the DAU includes, if any, the updating, changes and corrections of the present edition B of the DAU 19/114, indicating, for each of them, the date of incorporation, according to the format of the following table. The changes shown in the table will also be included in the text of the DAU, which is available on the Institute's website, itec.es.

The DAU user must always consult this DAU electronic version to be aware of any possible revisions which may occur during its validity.

Number	Page and chapter	Where it said...	It says…

Appendix 1 – Tables of Use

Tables A1.1 and A1.2 are tables of use that specify the cladding panels and vertical profile materials intended to be used respectively with the SikaTack® Panel system.

The reference to cladding panels in table A1.1 is exclusively for use in the SikaTack® Panel system. The data included in the table is compiled from the technical information available for the panels. The assessment of the panels for their use as façade cladding is outside the scope of this DAU.

Other panels and materials not indicated in tables A1.1 and A1.2 can be used as long as they are explicitly validated by SIKA SAU. Said validation is based on carrying out the tests and controls agreed with ITeC and indicated in the *Material Validation Protocol* (see section 7.4 of the DAU).

The panels and materials validated by SIKA SAU will only form part of this DAU when ITeC has verified the correct application of the *Material Validation Protocol* and they are included in tables A1.1 and A1.2.

SIKA SAU is responsible for confirming with the suppliers of the validated panels included in table A1.1 that these panels, even with the same trade name, do not present any changes in their performance and/or their surface finishes after the date of incorporation in said table, which may affect said validation.

Table A1.1: Cladding panels validated for the SikaTack® Panel system.

Material	Trade name and model		Surfaces / Classes (**)	Density of reference [kg/m³]	Linear thermal expansion [µm/(m·ºC)]	Dimensional stability due to humidity	Reaction to fire	Date included
Laminate HPL	Trespa® Meteon® FR		NA; MT; ST	1.400	ND	0.25% long. 0.25% trans.	B-s1,d0 (*)	June 2019
	Max Exterior Calidad F		NT; NG	1.400	18	0.30% long. 0.60% trans.	B-s1,d0 (**)	June 2019
	Polyrey Facade Compacto Exterior		ST	1.400	ND	0.20% long. 0.40% trans.	B-s1,d0 (**)	June 2019
	ProdeEX ING		NA	1.400	ND	0.30% long. 0.60% trans.	B-s1,d0 (**)	June 2019
Aluminium composite - TMCP	Larson®	A2	Lacquered	2.100	23	ND	A2-s1,d0 (**)	June 2019
		FR					B-s1,d0 (**)	June 2019
		PE					E	June 2019
	Larcore®	A2	Lacquered	600	23	ND	A2-s1,d0 (**)	June 2019
	Stacbond®	A2	Primed	2.100	23	ND	A2-s1,d0 (**)	June 2019
		FR					B-s1,d0 (**)	June 2019
		PE					ND	June 2019
	Alucobond®	A2	ND	1.900	24	ND	A2-s1,d0 (**)	June 2019
		Plus					B-s1,d0 (**)	June 2019
Ultra compact ceramic	Dekton®	Family I to IV	With mesh	2.600	7.0	0,05 mm/m	A1 without mesh (**) A2-s1,d0 with mesh (**)	June 2019
	Techlam®	Vulcano	ST, with mesh	2.400	ND	ND	A1 without mesh (**) ND with mesh (**)	June 2019
		Hydra						
	Neolith®	Skyline	With mesh	2.500	5.7	0.1 mm/m	A1 without mesh (**) ND with mesh (**)	June 2019
Polymer mortar	Krion®		ND	1.800	35	ND	B-s1,d0 (**)	June 2019

ND = Information not available.

(*) Classification with panel fixed with the SikaTack® Panel system.

(**) Classification with panel mechanically fixed.

(***) NA or NT = Natural; MT = Matt; ST = Satin; NG = Gloss.

Table A1.2: Vertical profile materials validated for the SikaTack® Panel system.

Generic material	Material code	Surface treatment	Density [kg/m³]	Elastic limit [MPa]	Modulus of elasticity [MPa]	Linear thermal expansion [µm/(m·°C)]	Reaction to fire	Date included
Aluminium alloy according to EN 755-2	AW-6063	T5	2.700	≥ 130	≥ 70.000	23	A1 (without organic coating)	June 2019
		T6		≥ 170				
	AW-6060	T5		≥ 120				
		T6		≥ 150				

ND = Information not available

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