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European Technical Report

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Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)

Trade name of the construction product

GECOL TERM SATE CERAMICO

Product family to which the construction product belongs

External Thermal Insulation Composite System with discontinuous claddings as exterior skin

Manufacturer

GECOL ADHESIVOS Y REVESTIMIENTOS, S.L.
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This European Technical report contains

8 pages

This European Technical report issued in accordance with Regulation (EU) No 305/2011, on the basis of

040287-00-0404:
External Thermal Insulation Composite System with discontinuous claddings as exterior skin

INTRODUCTION

This Evaluation Report describes the methods and results to assess the fitness for the intended use of the External Thermal Insulation Composite System “GECOL TERM SATE CERAMICO”, introduced by GECOL in accordance with EAD 040287-00-0404 External Thermal Insulation Composite System with discontinuous claddings as exterior skin.

1. DESCRIPTION OF THE ETICS

The GECOL TERM SATE CERAMICO, according to definition given in in EAD 040287-00-0404, can be defined as «Bonded system with supplementary mechanical fixings on EPS or XPS, the minimum number of fasteners per square metres are 6. The ETICS comprises the components described in the following tabla of the related ETA, which are factory-produced by the ETA holder or by suppliers. The system is made of the following components (adhesive, insulation, base coat, reinforcement and finishing coats) described below.

| | Components (trade names) | Coverage Aprox [(kg/m ²)] | Thickness Aprox [mm] | | |
|---|--|--|----------------------------|--------------------------|---------------------------------|
| Insulation material with associated method of fixing | GECOL TERM SATE/ETICS Panel SOPRA EPS/SOPRA EPS NEO. Bonded Board of Expanded polystyrene (EPS) (EN 13163) with supplementary mechanical fixings (minimum 6 fasteners/m ²). With a water absorption, Wp ≤ 1 kg/m ² (EN ISO 29767:2020) | 0,2- 6 | 10 - 300 | | |
| | GECOL TERM SATE/ETICS PANEL SOPRA XPS CB. Bonded Board of Extruded polystyrene (XPS) (CE marking EN 13164) with supplementary mechanical fixings (minimum 6 fasteners/m ²). With a water absorption, Wp ≤ 1 kg/m ² (EN ISO 29767:2020) | 7,5- 30 | 50 - 200 | | |
| Adhesive | Adhesive: GECOL TERM. Minimum bonded surface: 80 % for EPS – XPS (cement based mortar in powder requiring addition and mixing with 20 ± 1,0% water. | 1,2-1,5 (per mm thickness) | 5,0 | | |
| Base coat | GECOL TERM + Malla GECOL TERM ETICS (glass fibre mesh) | | 5,0 (two hands) | | |
| Glass fibre mesh | Malla GECOL TERM ETICS. Glass fibre mesh resistant to the alkalis | | | | |
| | Characteristics | | Values | | |
| | Mesh size (mm) | | 3 - 6 | | |
| | Tensile strength (N/mm) | | 30 - 60 | | |
| | Elongación after ageing (%) | | ≥ 1.5 | | |
| | Mass per unit area (g/m ²) | | ≥ 140 | | |
| | Thickness (mm) | | ≤ 1 | | |
| Organic content | | ≤ 23 | | | |
| Adhesive for tile | G100 SUPER FLEX (C2 TES2) (EN 12004) Cement based mortar in powder requiring addition and mixing with 19,0 ± 2,% water. | 6 | 5 | | |
| Discontinuous cladding | Tiles Group I, according to EN 14411. | | | | |
| | Characteristics | | Values | | |
| | Maximum dimensions | | 2400 cm ² | | |
| maximum weight | | 40 kg/m ² | | | |
| Grout | GECOLOR JUNTAS PREMIUM (CG 2 W A) (EN 13888). The thickness of the grout joint is between 3 mm to 15 mm. Hydraulic ligant based mortar in powder requiring addition and mixing with 28 ± 2 % water. | 0.75 | | | |
| Fasteners | Plastic anchors (expansion element and sleeve) for insulation material with different lengths in relation with thickness of insulation board | | | | |
| | Fasteners | ETA n.º | Diameter Plate (mm) | Stiffness (kN/mm) | Minimum tension load (N) |
| | GECOL Taco fijación A anclaje mecánico clavo mixto acero poliamida | ETA 04/0076. | 60 | 0.5 | 100* |
| | *These values show the minimum pull out of the fastener in the weakest support (enclosed in its ETA). Other higher values appear in their ETAs. | | | | |
| Other plastic fasteners can be used with CE marking (EAD 330196-00-0604, they have to have a plate dimension ≥ 60 mm diameter and Stiffness ≥ 0,5 kN/mm | | | | | |
| Ancillary elements | Base, corners, top and window sills, and its fixing devices | | | | |

The insulation EPS-XPS, fastener, external cladding and internal reinforcement are manufactured by external companies.

2. RESULTS AND ASSESMENT OF PERFORMED TESTS

2.1 Tests on system

Reaction to fire (2.2.1).

Based on the respective reaction to fire tests reports (according to and EN ISO 11925-2 (1), EN 1716-2 (2), EN 13823 (3) N.º 3473t18 and 3473t18 carried out by AFITI LICOF Spanish accredited laboratory) the corresponding classification reports referenced have been issued, according to EN 13501-1 (4).

| System composition | | Finishing coat | Maximum declared organic content of the rendering system | Test Report/ Classification Report | Euroclas | Minimum declared flame retardant of rendering system |
|--|-----------------------------------|----------------|--|------------------------------------|----------|--|
| Adhesive + insulation+ base coat“ + One of these finishing layers | EPS/XPS boards (thickness 200 mm) | Ceremic tile | ≤ 20 % | | B-s1,d0 | 0 % |

| System composition | Maximum declared organic content | Minimum declared flame retardant |
|----------------------|----------------------------------|----------------------------------|
| Adhesive/ base coat“ | < 5 % | |
| Insulation | 99,9 % | ----- |
| Glass fibre mesh | ≤ 20 % | 0 % |
| Adhesive tile | < 8 % | |
| grout | < 5 % | |
| Cladding element | ≤ 20 % | |

Façade fire performance (2.2.2). NPA

Water absorption by capillarity (2.2.3)

| EPS + Base coat with and without base coat finishing coat | After 1 h: < 1(kg/m ²) | After 24 h <0.5(kg/m ²) |
|--|------------------------------------|-------------------------------------|
| Base coat. GECOL TERM | 0.04 | 0.24 |
| Base coat + adhesive tile + cladding 30 x 30 + grout One piece of ceramic | 0.03 | 0.07 |
| Base coat + adhesive tile + cladding 30 x 30 + grout The sample show four pieces of ceramic and grout | 0.08 | 0.2 |
| Base coat + adhesive tile + cladding 24 x 12 + grout One piece of ceramic | 0.02 | 0.04 |
| Base coat + adhesive tile + cladding 24 x 12 + grout The sample show four pieces of ceramic and grout | 0.07 | 0.2 |

Water vapour permeability of the rendering system (2.2.4). The water vapour permeability test was carried out on samples made of insulation faced with the two base coats and finishing coat. According to the following table, the system fulfils the required value.

| Base coat and base coat finishing coat | g /m ² |
|--|-------------------|
| GECOL TERM . | NPA |
| Adhesive tile | NPA |
| Grout | NPA |
| Cladding | NPA |

The tabulated values obtained from EN ISO 10456

Water vapour permeability of the insulation panel. The values of the thermal insulations were taken from their DoP (CE marking):

PANEL EPS: EN 12086: μ = 30 - 70

PANEL XPS: EN 12086: μ = 80 - 100

(1) EN ISO 11925-2 Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2:
 (2) EN 1716-21 Reaction to fire tests for building products - Determination of the heat of combustion. (ISO 1716:2002).
 (3) EN 13823 Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item.
 (4) EN 13501-1 Fire classification of construction products and building elements-Part 1: Classification using data from reaction to fire tests.

Hygrothermal behaviour (2.2.5.1). It has been assessed on one rig. None of the following defects occurs during testing:

- deterioration such as cracking or delamination of the cladding elements that allows water penetration to the internal layers;
- deterioration or cracking of grout between the cladding elements;
- detachment of the skin;
- irreversible deformation

Minimum value of bond strength tests (see section after combined hygrothermal cycles shall be given.

The ETICS can be considered resistant to the hygrothermal cycles.

Preparation of one walls:

Substrate: Load bearing brick wall.

Adhesives

Rig 1: GECOL TERM 80% of surface of the insulation panels

Insulation product:

Rig 1:

½ rig with Panel XPS, GECOL TERM SATE/ETICS Panel XPS: 120 x 60 x 6 cm

½ rig Panel EPS PANEL AISLANTE WALL-TERM EPS. GECOL TERM SATE/ ETICS Panel EPS of 100 x 60 x 6 cm.

In the ½ top part of the wall the insulation panels were fixed with additional fasteners (6 per m²)

In the ½ below part, the fasteners are applied through the first coat of the base coat and the reinforcement.

Base coat:

Rig 1:

½ top GECOL TERM of 4-5 mm of thickness in two layers (2 mm per layer) with glass fibre mesh.

½ below: 1 GECOL TERM of 4-5 mm of thickness in two layers (2 mm per layer) with glass fibre mesh, the fasteners are fixed through the first coat and reinforcement + other base coat of GECOL TERM of 4-5 mm of thickness in two layers, On the first coat with the mesh is fixed an additional fastener (1 per m²).

Glass fiber mesh:

Single land double layer of standard mesh with reinforcement strips of standard mesh placed turned 45° at window borders.

Adhesive tiles. Applied in one coat of 5 mm on the whole surface of the wall.

Finishing coats: The discontinuous cladding was done by :

½ rig ceramic pieces of 30 x 30 cm, thickness of 0,8 cm, and a grout of 1 cm of widthness.

½ rig ceramic pieces of 12 x 24 cm, thickness of 0,8 cm, and a grout of 1 cm of widthness



Freeze-thaw performance (2.2.5.2). As It is shown above of this Evaluation Report, the water absorption of the whole system is less than 0.5 kg/m² after 24 hours and so the system can be assessed as freeze/thaw resistant without any further testing.

Impact resistance (2.2.7)

Hard body impacts are:

H1 and H2 (1 J and 3 J respectively), carried out with the steel ball weighing 0,5 kg and from a height of 0,20 m and 0,61 m respectively (at least in three locations).

H3 (10 J), carried out with the steel ball weighing 1,0 kg and from a height of 1,02 m (at least in three locations).

Soft body impacts are:

Small soft body S1 and S2 (10 J and 60 J respectively), carried out with the soft ball weighing 3,0 kg and from a height of 0,34 m and 2,04 m respectively (at least in three locations).

Large soft body S3 and S4 (100 J and 400 J respectively), carried out with the spherical bag weighing 50,0 kg and from a height of 0,61 m and 0,82 m respectively (at least in the space between two profiles).

| System: The Whole ETICS | | Hard Impact | | Soft Impact | |
|-------------------------|----------------|------------------|---|------------------|------------------|
| | | 3J (H2) | 10J (H3) | S2 | S4 |
| GECOL TERM on XPS | Results Impact | Not deteriorated | Superficial cracking (no penetration) Mark: 2 mm | Not deteriorated | Not deteriorated |
| | Category | I | | | |
| GECOL TERM on EPS* | Results Impact | Not deteriorated | Superficial cracking (no penetration) Mark: 2 mm | Not deteriorated | Not deteriorated |
| | Category | I | | | |

+This test was perform in samples of 60 x 70 cm after hydrothermal cycles

Bond strength (2.2.8). Annex H

Between the external layers (skin and reinforced base coat) and the insulation panel. The tests were developed on samples of EPS/ XPS boards faced with base coat and were subjected to the following tests. The rupture is cohesive of the EPS and adhesive on the XPS.

| Bond strength between the external layers (skin and reinforced base coat) and the insulation panel (kPa) ≥ 80 kPa | | | | |
|--|---------------|-------------------------------|-------------------------------|---|
| Samples | Initial state | Immersion 48 h and 2 h drying | Immersion 48 h and 7 d drying | After hydrothermal cycles (on the rigs) |
| GECOL TERM XPS With ceramic 30 x 30 | | | | |
| Failure mode: Adhesive between XPS and adhesive | | | | |
| 1 | 266 | 90 | 129 | 228 |
| 2 | 292 | 125 | 134 | 165 |
| 3 | 188 | 766 | 225 | 162 |
| 4 | 142 | 89 | 106 | 267 |
| 5 | 144 | 96 | 97 | 212 |
| Average | 206 | 95 | 138 | 207 |
| GECOL TERM XPS With ceramic 12 x 24 | | | | |
| 1 | 266 | 90 | 129 | 181 |
| 2 | 292 | 125 | 134 | 102 |
| 3 | 188 | 95 | 225 | 157 |
| 4 | 142 | 89 | 106 | 173 |
| 5 | 144 | 96 | 97 | 178 |
| Average | 206 | 95 | 138 | 154 |
| GECOL TERM EPS With ceramic 30 x 30 | | | | |
| Failure mode: Cohesive support EPS | | | | |
| | Initial state | Immersion 48 h and 2 h drying | Immersion 48 h and 7 d drying | After hydrothermal cycles (on the rigs) |
| 1 | 130 | 138 | 145 | 141 |
| 2 | 125 | 129 | 140 | 165 |
| 3 | 148 | 144 | 153 | 173 |
| 4 | 146 | 144 | 156 | 157 |
| 5 | 144 | 148 | 150 | 110 |
| Average | 140 | 140 | 150 | 149 |
| GECOL TERM EPS With ceramic 12 x 24 | | | | |
| 1 | 130 | 138 | 145 | 181 |
| 2 | 125 | 129 | 140 | 149 |
| 3 | 148 | 144 | 153 | 173 |
| 4 | 146 | 144 | 156 | 165 |
| 5 | 144 | 148 | 150 | 173 |
| Average | 140 | 140 | 150 | 168 |

Between the insulation panel and the base adhesive. The tests were performed on samples of EPS and XPS insulation boards faced with base coat, and were subjected to the following tests. The rupture is cohesive of the EPS and adhesive on the XPS

| Adhesive onto concrete (kPa) | | | |
|--|---------------|-------------------------------|-------------------------------|
| Samples | Initial state | Immersion 48 h and 2 h drying | Immersion 48 h and 7 d drying |
| Failure mode: Adhesive between XPS and adhesive | | | |
| XPS | | | |
| 1 | 266 | 90 | 129 |
| 2 | 292 | 125 | 134 |
| 3 | 188 | 95 | 225 |
| 4 | 142 | 89 | 106 |
| 5 | 144 | 96 | 97 |
| Average | 206 | 95 | 138 |
| Failure mode: Cohesive support EPS | | | |
| EPS | | | |
| 1 | 130 | 138 | 145 |
| 2 | 125 | 129 | 140 |
| 3 | 148 | 144 | 153 |
| 4 | 146 | 144 | 156 |
| 5 | 144 | 148 | 150 |
| Average | 140 | 140 | 150 |

Bond strength between adhesive and substrate. The test was developed on solid units of concrete on its surface were applied the adhesive. The rupture is cohesive of adhesive.

| Adhesive onto concrete (kPa) | | | |
|---|--------------------|------------------------------------|-------------------------------------|
| Samples | Initial state >250 | Immersion 48 h and 2 h drying ≥ 80 | Immersion 48 h and 7 d drying ≥ 250 |
| Failure mode: Cohesive of the adhesive | | | |
| 1 | 1200 | 220 | 772 |
| 2 | 1610 | 321 | 740 |
| 3 | 1527 | 340 | 900 |
| 4 | 1592 | 226 | 582 |
| 5 | 1500 | 420 | 740 |
| Average | 1487 | 305 | 750 |

Tensile strength of the thermal insulation panel (2.2.9) (EN 1607). The test was carried out in the following conditions:

Condition 1: on dry conditions (without any supplementary conditioning);

Condition 2: after exposed to heat-moisture actions at $(70 \pm 2) ^\circ\text{C}$ and $(95 \pm 5) \% \text{RH}$ in a climatic chamber for 7 days and followed by a drying period at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$ until constant mass is achieved.

Condition 3: after exposed to heat-moisture actions at $(70 \pm 2) ^\circ\text{C}$ and $(95 \pm 5) \% \text{RH}$ in a climatic chamber for at least 28 days and followed by a drying period at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$ until constant mass is achieved.

| Samples | Condition 1 (kPa) | Condition 2 (kPa) | Condition 3 (kPa) | Condition 1 (kPa) | Condition 2 (kPa) | Condition 3 (kPa) |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | XPS | | | EPS | | |
| 1 | 826 | 649 | 214 | 154 | 144 | 150 |
| 2 | 958 | 575 | 114 | 154 | 143 | 141 |
| 3 | 936 | 648 | 606 | 144 | 152 | 140 |
| 4 | 702 | 672 | 633 | 166 | 150 | 157 |
| 5 | 785 | 640 | 538 | 132 | 139 | 153 |
| Average | 850 | 640 | 420 | 150 | 139 | 148 |

Shear strength and shear modulus of the thermal insulation panel (2.2.10) (EN 12090). The test was performing in the same conditions of the above point.

| Samples | Condition 1 (MPa) | | Condition 2 (MPa) | | Condition 3 (MPa) | | Condition 1 (MPa) | | Condition 2 (MPa) | | Condition 3 (MPa) | |
|----------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|
| | S. Strength | S. Modulus | S. Strength | S. Modulus | S. Strength | S. Modulus | S. Strength | S. Modulus | S. Strength | S. Modulus | S. Strength | S. Modulus |
| XPS | | | | | | EPS | | | | | | |
| 1 | 0.2 | 5,8 | 0.2 | 6,3 | 0.2 | 5,6 | 0.09 | 6,5 | 0.05 | 3,9 | 0.06 | 4,1 |
| 2 | 0.2 | 4,9 | 0.2 | 5,9 | 0.2 | 5,8 | 0.09 | 5,3 | 0.06 | 4,3 | 0.07 | 6,4 |
| 3 | 0.2 | 5,5 | 0.2 | 5,3 | 0.2 | 6,4 | 0.09 | 6,1 | 0.05 | 5,0 | 0.07 | 5,4 |
| 4 | 0.2 | 4,8 | 0.2 | 5,5 | 0.2 | 5,7 | 0.09 | 6,6 | 0.07 | 4,2 | 0.07 | 9,6 |
| 5 | 0.2 | 5,2 | 0.2 | 5,1 | 0.2 | 5,8 | 0.08 | 4,9 | 0.07 | 4,8 | 0.07 | 3,6 |
| Average | 0.2 | 5,2 | 0.2 | 5,6 | 0.2 | 5,9 | 0.09 | 5,6 | 0.06 | 4,7 | 0.07 | 5,3 |

EAD requirements: shear strength: $f_k \geq 0.02 \text{ kPa}$, shear modulus: $G_m \geq 1 \text{ MPa}$

Dead load behavior (2.2.11)

The test is carried out without the fixings. The insulation EPS panel is TR 150 and XPS panel is TR 400. The test shall be carried out under normal environmental laboratory conditions (20 ± 10) °C and (50 ± 20) % relative humidity.

Five steps are necessary to carry out the test:

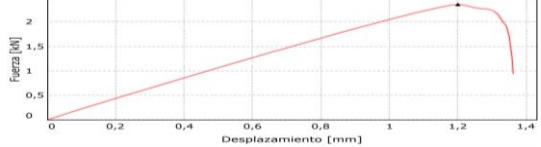
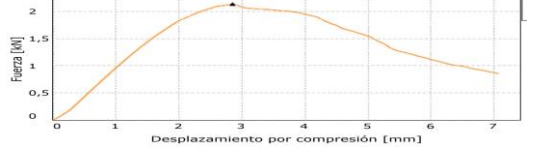
- Step 1: no additional dead load is added on the skin layer.
- Step 2: an additional dead load, $F_{ad} = 0.25 \times F_{ref}$ is added on the skin layer.
- Step 3: an additional dead load, $F_{ad} = 0,50 \times F_{ref}$ is added on the skin layer
- Step 4: an additional dead load, $F_{ad} = 0,75 \times F_{ref}$ is added on the skin layer
- Step 5: an additional dead load, $F_{ad} = 1.00 \times F_{ref}$ is added on the skin layer

The displacement at the skin layer shall be measured.

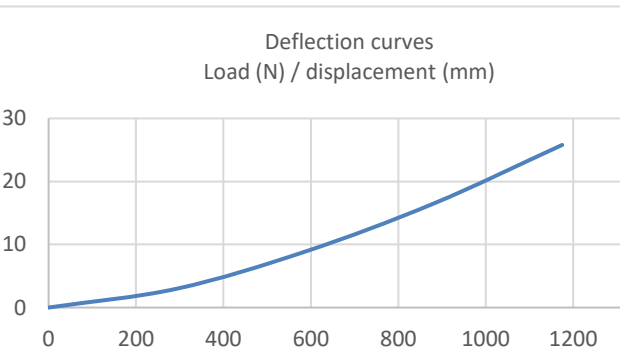
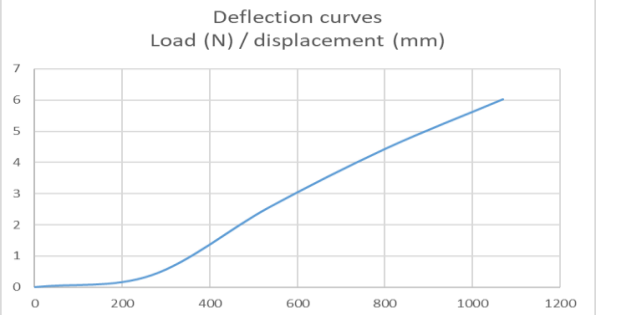
For each step, the test shall be carried out at least during 24 hours.

The samples were done:

- Insulation EPS: Thickness 100 mm, TR 100,
- Insulation XPS: Thickness 100 mm, TR 400,

| System with | Fu test (N) | Graphic load/displacement (kN/mm) |
|--|-------------|---|
| GECOL Taco fijación A anclaje mecánico clavo mixto acero poliamida + XPS | 2352 |  |
| GECOL Taco fijación A anclaje mecánico clavo mixto acero poliamida + EPS | 2139 |  |

For each step, the test shall be carried out at least during 24 hours. The load applied $F_{ref} = 0.5 \times F_u$ test

| Step | Deflection curves load (N) / displacement (mm) | Load (N) | Displacement (mm) | | | Average |
|--|---|----------|-------------------|----------|----------|---------|
| | | | Sample 1 | Sample 2 | Sample 3 | |
| GECOL Taco fijación A anclaje mecánico clavo mixto acero poliamida + XPS | | | | | | |
| 1 |  | 0 | 0 | 0 | 0 | 0,0 |
| 2 | | 294 | 2,78 | 3,34 | 2,77 | 3,0 |
| 3 | | 588 | 5,56 | 6,69 | 5,54 | 5,9 |
| 4 | | 881 | 7,19 | 7,93 | 7,57 | 7,6 |
| 5 | | 1175 | 8,91 | 9,23 | 9,86 | 9,3 |
| GECOL Taco fijación A anclaje mecánico clavo mixto acero poliamida + EPS | | | | | | |
| 1 |  | 0 | 0 | 0 | 0 | 0 |
| 2 | | 267 | 0,23 | 0,21 | 0,7 | 0,38 |
| 3 | | 535 | 1,66 | 3,33 | 2,65 | 2,55 |
| 4 | | 802,5 | 3,84 | 4,42 | 5,07 | 4,44 |
| 5 | | 1070 | 5,37 | 5,52 | 7,17 | 6,02 |

Adhesive and base coat (Annex A. DESCRIPTION OF THE COMPONENTS)

Adhesive and adhesive

| Characteristics (dust) | Base Coat | Adhesive tile | Grout |
|-------------------------------------|-----------|---------------|----------|
| Ratio water mixing (%) | 23 | 20 | 30 |
| Density (kg/m ³) | 1.50 | 1.55 | 1.4 |
| Ash content (residue) at 450 °C (%) | <4 | <8 | <4 |
| Ash content (residue) at 900 °C (%) | <5 | <9 | <5 |
| Water retention capability (%) | >80 | >90 | >80 |
| Shrinkage | 0.1 mm/m | <1 mm/m | 0.1 mm/m |

Insulation product. The performances of the CE marked EPS and XPS panels used are:

| Characteristics | Standard | EPS | XPS |
|--|------------------------|------------------|-------------------|
| Reaction to fire Euroclass | EN 13501-1 | E | E |
| Length (mm) / Tolerance type | EN 822 | 1000 / L2 | 1250 |
| Width (mm) / Tolerance type | EN 822 | 500/ W2 | 600 |
| Thickness (mm) / Tolerance type | EN 823 | 40 a 100 / T2 | 40-100 / T1 |
| Squareness | EN 824 | S2 | 5 mm/m |
| Flatness | EN 825 | P4 | 6 mm/m |
| Density (kg/m ³) | EN 1602 | 15- 20 | 30-35 |
| Thermal conductivity a 10 °C (W/m.K) | EN 12667 o EN 12939 | 0,032 | 0,033-0,037 |
| Dimensional stability under Temperature and humidity specific conditions | EN 1604 | DS(70) DS(N)2 | DS(70) DLT(2)5 |
| Tensile strength perpendicular to the faces in dry conditions (N/mm ²) | EN 1607 | TR 100 | TR 400 |
| Water absorption ((partial immersion) (kg/m ²) | EN 1609 | <1 | < 1 |
| Water vapour diffusion (μ) | EN 12086 | 30 a 70 | ≥ 50 |
| Shear strength (N/mm ²) | EN 12090 | ≥ 0,02 | ≥ 0,2 |
| Shear modulus (N/mm ²) | EN 12090 | ≥ 1 | ≥ 5 |

It is possible to use any other EPS with CE marking with a TR ≥ 100 and with XPS with TR ≥ 400.