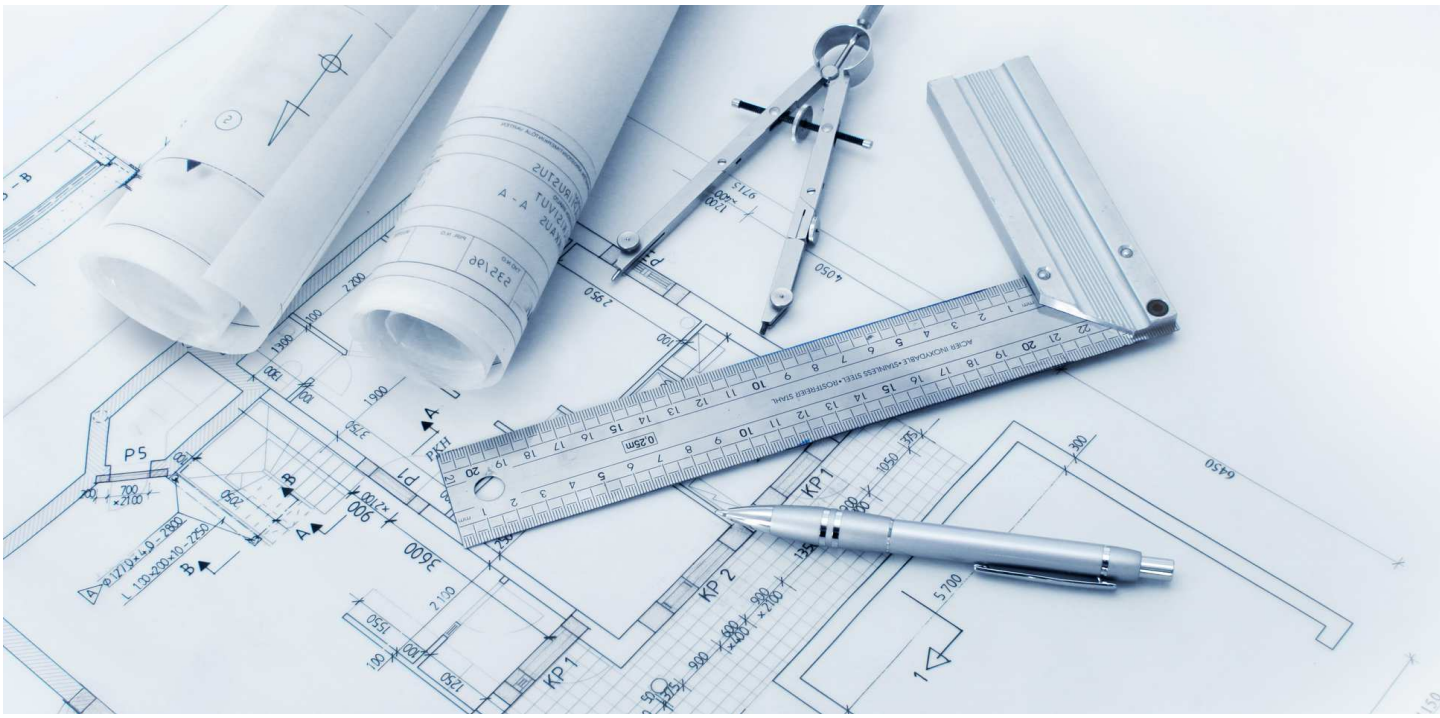
SATE
Beyem - Jafep

External Thermal Insulation Composite System



Constructive solutions guideline for
EXTERNAL THERMAL INSULATION
COMPOSITE SYSTEM (SATE)
Beyem-Jafep System

Table of Contents

SATE Beyem - Jafep

External Thermal Insulation Composite System

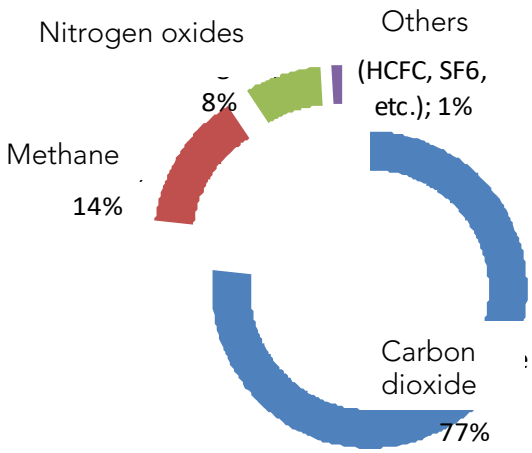
The context of insulation in construction

Global warming

Climate change is pervasive. Efficiency and energy savings are becoming rapidly crucial.

Carbon dioxide emissions are the main source of the so-called greenhouse effect.

Greenhouse gases due to human activity



These gases:

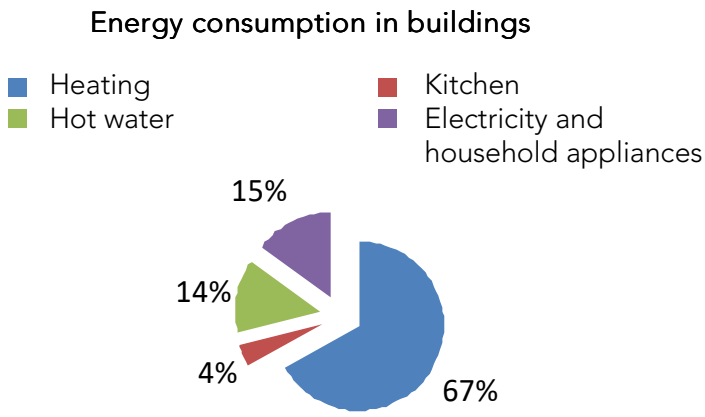
- Cause global warming
- Increase sea levels

Therefore, ambitious objectives as regards energy policy in Europe, the result of international agreements which were reached in successive summits (G8, Climate Summit, ...) are set.

In this situation, **residential buildings have significant potential for energy savings**.

The importance of insulation in construction

In Europe, heating accounts for approximately 2/3 of the total energy consumption of buildings



Thermal insulation can further reduce energy consumption of our buildings. Greater insulation entails less energy input.

Furthermore, **due to the depletion of natural resources, energy price increases will continue, leaving only one possible method to reduce costs: energy savings.**

The better the insulation, lower is the energy required to create an interior climate and which is turn is lasting.

Thermal insulation is the only material which pays for itself given the cost savings that it affo

External Thermal Insulation Composite System

As regards sustainability, insulation affords social, environmental and economic benefits as it enhances interior comfort, protects the environment and actively contributes to energy savings. Thus, the use of insulation in buildings is a powerful tool so as to combat climate change.

SATE Beyem - Jafep

External Thermal Insulation Composite System

Regulatory framework

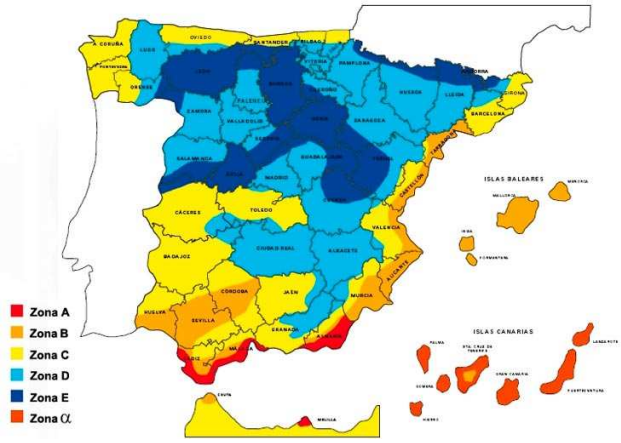
Technical Building Code (TBC or its Spanish initials CTE)

- Approved by Royal Decree 17/03/2007.
- Comprising of 6 Basic Documents (BD).
- DB-HE : Basic Energy Savings Document.

The update of the DB-HE Basic Document, complies with the obligations derivative from Directive 2010/31/EU on the energy performance of buildings, according to which Member States must set minimum energy efficiency requirements for buildings in order to reach optimal levels of efficiency. Furthermore, new buildings which are constructed from 2020 (2019 in public buildings) onwards must have an almost zero energy consumption.

This regulatory review is framed within the 20-20-20 European Community objective on climate and energy, including from among its measures the increased use of renewable energy sources, energy savings and energy efficiency, and supporting the shift towards a low-carbon economy. Its implementation shall be mandatory for all new construction and intervention works in existing buildings under a works licensed after 13 March 2014.

The 2013 DB-HE sets a limitation as regards energy consumption for newly constructed buildings and enlargement of existing buildings; to that end, the primary non renewable energy consumption indicator is used. In the case of Energy Demand (DB-HE1) demand for heating and cooling depending on the Climate Zone where the building is located is restricted.



In order to meet the energy demand, the DB-HE facilitates certain guideline (or approximate) values for thermal transmittance (U) which must be sufficient for compliance.

Climate Zone

Element Transmittance [W/m2 K]

	α	A	B	C	D	E
UM	0.94	0.50	0.38	0.29	0.27	0.25
US	0.53	0.53	0.46	0.36	0.34	0.31
UC	0.50	0.47	0.33	0.23	0.22	0.19

UM:Thermal transmittance of the façade walls and enclosures in contact with the ground.
US : Thermal transmittance of floors (floor structures in contact with exterior air).
UC: Thermal transmittance of roofs.

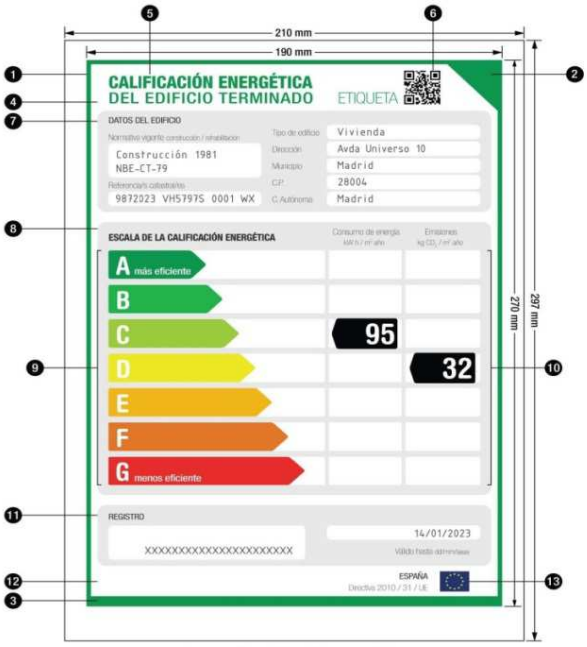
Regulatory framework

Energy efficiency certificate

Royal Decree 235/2013, of 5 April, wherein the basic Procedure for the energy efficiency certification of buildings was approved.

Royal Decree stipulates the obligation to make available to purchasers or users of buildings an energy efficiency certificate which must include objective information on the energy efficiency of a building and reference values such as minimum energy efficiency requirements in order for the proprietors or lessees of the building or that of a unit of the latter may compare and assess its energy efficiency. In this fashion, assessing and comparing the energy efficiency of buildings, the promotion of high energy-efficient buildings and investments in energy savings will be facilitated. Furthermore, this Royal Decree will aid in reporting CO2 emissions due to the use of energy from emission sources in the residential sector, which will facilitate the adoption of measures in order to reduce emissions and improve the energy rating of buildings

Building energy efficiency is rated by means of a label in order to assign to each building an Energy Efficiency Class.



Etiqueta de calificación energética

MINISTERIO DE INDUSTRIA, ENERGÍA Y TURISMO
MINISTERIO DE FOMENTO

The energy efficiency rating assigned to the building will correspond to the energy efficiency ratings obtained by same, from a scale of seven letters, ranging from the letter A (the most efficient building) to G (the less efficient building).

Energy Audits

Royal Decree 56/2016 of 12 February, wherein Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency in relation to energy audits, accreditation of service providers and energy auditors and the promotion of the energy supply efficiency was transposed.

This royal decree stipulates the obligation to carry out an energy audit in companies other than SMEs, pursuant to that set forth in Title I of the Annex to the Recommendation 2003/361/ EC of 6 May 2003 on the definition of micro, small and medium sized companies, as regards the activities managed by the company.

SATE Beyem - Jafep

External Thermal Insulation Composite System

External thermal insulation composite system (SATE)

The external thermal insulation composite system, known as SATE or ETICS (External Thermal Insulation Composite System) in English terminology, are recognised nowadays as the most efficient procedure for the insulation of a building given that, as its very names suggests, a SATE is undertaken carrying out a cladding of a building, reducing the energy lost therein through heat channels (or heat bridges) and eliminating the risk of condensation.

Advantages of external thermal insulation composite system (SATE)

- Elimination of heat channels (or heat bridges). Continuous insulation, even in structure areas.
- Increased protection of structures against the effects of weather. Forged edge protection. Structure load reduction.
- Ideal solution for party walls, the forgotten part of the building.
- Water vapour permeable system. Reduction/elimination of the risk of condensation and interior mold.
- Increased thermal inertia in the building given that the wall is located in the interior of the insulation.
- Perfect solution for façade pathologies. Problems such as cracks, efflorescence, peeling paint etc. which are remedied by the mere installation of the system.
- Ideal for the refurbishment of inhabited buildings, given that the installation is carried out entirely on the exterior. Avoids the need for a double wall. No useful surface area is lost in the dwelling, given that its interior dimensions remain the same.
- Various aesthetic alternatives. Wide range of colours and different insulation and finish solutions. Gives a face lift to the façade and increases the building's value.

SATE Beyem - Jafep

External Thermal Insulation Composite System

Beyem-Jafep Systems

Intended use of the system

The Beyem-Jafep system is intended to be used an external thermal insulation for building walls. The walls may be made of masonry (bricks, blocks) or concrete (cast on site or as prefabricated panels) having an A1 to A2-s2, d0 reaction to fire classification, according to the UNE-EN 13501-1 or A1 Standard according to the Decision 96/603/EC. The system is designed to give the wall to which it is applied to satisfactory thermal insulation.

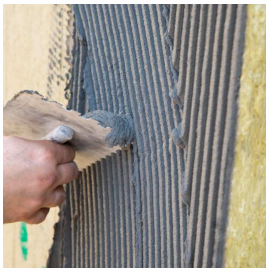
The Beyem-Jafep system is made up of non-bearing construction elements and contributes to the durability of the substrate by providing protection from, the effects of natural agents.

This system can be used on vertical walls, both in new construction as well as refurbishment (retrofit) works and it can be similarly used on horizontal or inclined surfaces which are not exposed to rainwater.

The **Beyem-Jafep** system has the European Technical Assessment **ETA (ETE** by its initials in Spanish) 16/0129, published by the **Eduardo Torroja Institute of Building Sciences (IETcc)** and updated under Article 29 of Regulation (EU) No. 305/2011.

Designated pursuant to Article 29 of Regulation (EU) No. 305/2011











Beyem-Jafep Systems

SATE Beyem - Jafep Configurations

Rodacal Beyem and Jafep have developed a product range of external thermal insulation composite systems under the generic name of **SATE Beyem-Jafep.**

SATE Beyem-Jafep has the following configurations:

Beyem-Jafep Classic System

The External thermal insulation system for façades based on the use of stabilised expanded polystyrene -EPS- and acrylic mortar type coating in various grain sizes and colours.

- Traditional SATE system.
- Excellent price/performance ratio.
- The lightest solution.
- EPS
- TBC compliant.
- Rainwater proof and permeable to water vapour.
- European Approval pursuant to **ETA (ETE by its Spanish initials) 16/0129**.

Beyem-Jafep Classic -Graphite System

The External thermal insulation system for façades based on the use of stabilised expanded polystyrene -EPS GRAPHITE- and acrylic mortar type coating in various grain sizes and colours.

- Traditional SATE system.
- Excellent price/performance ratio.
- The lightest solution.
- EPS Graphite: increased insulating capacity
- TBC compliant.
- Rainwater proof and permeable to water vapour.
- European Approval pursuant to ETA (ETE by its Spanish initials) 16/0129..

Beyem-Jafep Systems

SATE Beyem - Jafep Configurations

Rodacal Beyem and Jafep have developed a product range of external thermal insulation composite systems under the generic name of **SATE Beyem-Jafep**.

SATE Beyem-Jafep has the following configurations:

Beyem-Jafep Forte System

The External thermal insulation system for façades based on the use of extruded polystyrene - XPS - and acrylic mortar type coating in various grain sizes and colours.

- Reinforced and improved SATE System.
- Increased dimensional stability.
- Reduced water absorption.
- Increased insulating capacity.
- TBC compliant.
- Rainwater proof and permeable to water vapour.
- European Approval pursuant to ETA (ETE by its Spanish initials) 16/0129.

Beyem-Jafep Mineral System

The External thermal insulation system for façades based on the use of rockwool - MW - and acrylic mortar type coating in various grain sizes and colours.

- Mineral SATE system.
- Increased perspiration.
- Acoustic insulation.
- Excellent fire resistance.
- High dimensional stability.
- TBC compliant.
- Rainwater proof and permeable to water vapour.
- European Approval pursuant to ETA (ETE by its Spanish initials) 16/0129.

Adhesive, basecoat and finishing coats

Beyem Adheterm: Coating/basecoat

Beyem Adheterm is a polymer-modified, shrinkage compensated adhesive and basecoat mortar for the adhesion and fastening of expanded polystyrene, extruded polystyrene and mineral wool insulating panels in external thermal insulation composite systems (SATE/ETIC). **Beyem Adheterm** is formulated with high strength cement, selected aggregates, organic additives and synthetic resins to improve workability, water retentivity, open time and adhesion of the mortar. Fibre-reinforced.

- Manual or mechanical application. Projectable.
- Rainwater proof and permeable to water vapour.
- High deformability: Allows stress absorption. Differential in a hardened state.
- Excellent impact resistance.
- High water retentivity.
- Great workability.
- High bond strength on EPS, XPS, MW and substrate.
- Application thickness: adhesive, 2-5 mm; basecoat, 3-5 mm.
- Yield: ≈ 1.5-2.0 Kg/m2 mm thick.

Pétrex 5 Liso (Smooth Coating): Priming/Basecoat

Pétrex 5 Liso (Smooth Coating) is an acrylic copolymer emulsion based stone protector for exterior walls. It is waterproof and washable. Highly weather, salt and abrasion resistant. The quality of waterproof emulsion allows the façade to keep the correct transpiration. Having good coverage and yield.

- Ready to use.
- Extraordinary smoothness.
- Micronized gritty loads.
- Rainwater proof and permeable to water vapour.
- Water vapour permeable (breathable).
- Can be applied using a brush, roller or spray gun (airless or compressor).
- Yield: ≈ From 7 to 12 m2/L and coat.

Pétrex 5 Mortero Acrílico (Acrylic Mortar): Acrylic mortar finishing coat

Pétrex 5 Mortero Acrílico (Acrylic Mortar) is a gritty mortar type coating having a special thick layer for façades, based on a combination of acrylic resins and highly resistant and light fastness pigments, which affords resistant, semi-elastic, waterproof and high coverage and filling power.
Incorporating in its formulation a selected aggregate particle size guide to facilitate its application whenever an exact thickness is required.
There are two finishes:

Thick (with aggregates of up to 2 mm)
Fine (with aggregates of up to 1 mm).

- Ready to use.
- Semi-elastic (resistant and anti-cracking).
- Impervious to rainwater.
- Water vapour permeable (breathable).
- Rough texture which hides imperfections
- Yield: Fine: 0.5 m²/kg (2 kg/m²)/Thick: 0.4 m²/kg (2.5 kg/m²).
- Can be applied using a trowel or spray gun (airless or compressor).
- Anti-mold preserving agent.

Insulating Panels

EPS Panel

- EN 13163/EN 13499 stabilised expanded polystyrene plate.
- 1000x500mm (0.5 m2) Format.
- Thicknesses: 40-200.
- Thermal conductivity: 0.037 W/mK.
- Density: 15-20 Kg/m3.
- Water vapour permeability coefficient, µ: 30-70.
- Short term 24 hr water absorption: ≤ 0.5 kg/m2 .
- Perpendicular tear resistance to the sides: 150 kPa.
- Reaction to fire: European Class E –Self extinguishable.

Graphite EPS Panel

- EN 13163/ES 13499 stabilised expanded polystyrene plate.
- 1000x500 mm (0.5 m2) Format.
- Thicknesses: 40-200.
- Thermal conductivity: 0.032 W/mK .
- Density: 15-20 Kg/m3.
- Water vapour permeability coefficient, µ: 20-40.
- Short term 24 hr water absorption: ≤ 0.5 kg/m2.
- Perpendicular tear resistance to the sides: 100 kPa.
- Reaction to fire: European Class E –Self extinguishable.

Insulating Panels

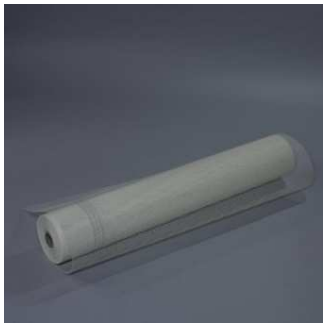
XPS Panel

- EN 13164 Extruded polystyrene plate.
- 1250x600 mm (0.75 m2) Format
- Thicknesses: 30-200.
- Thermal conductivity: 0.034-0-036 W/mK.
- Density: 30-40 Kg/m3.
- Water vapour permeability coefficient, µ: 80-250.
- Total water immersion absorption: ≤ 0.7%.
- Perpendicular tear resistance to the sides: 200 kPa.
- Reaction to fire: European Class E –Self extinguishable.

MW Panel

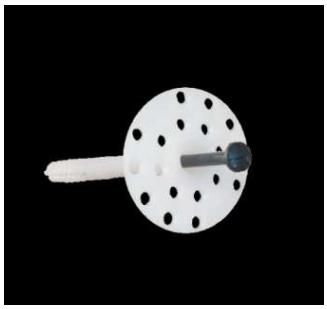
- EN 13162/EN 13500 Rockwool plate .
- 1200x600 mm (0.72 m2) Format.
- Thicknesses: 40-160.
- Thermal conductivity: 0-036 W/mK.
- Density: 95-150 kg/m3.
- Water vapour permeability coefficient, µ: 1.0.
- Short term 24 hr water absorption : ≤ 1.0 kg/m2.
- Perpendicular tear resistance to the sides: 10 kPa.
- Reaction to fire: European Class A1 – Does not propagate flames.

Reinforcement mesh, anchors, profiles and auxiliary elements



Mesh 160

- Fibreglass specified alkali resistant mesh, for Beyem Adheterm basecoat reinforcement.
- Thread composition: 100% fibreglass.
- Mesh size: 3.5 x 3.8 mm-
- Weight: 160 g/m2.
- Thickness: ± 0.52 mm.
- Tensile Strength: ≥ 2200 N/5 cm.
- Elongation: 3.8 %.
- Roll Format: 1 m wide x 50 m long. 4 rolls per box.



PVC Anchoring blow block

- Mechanical fastening block with 60 mm plate for 10 mm diameter holes (drill). Circular head. Suitable for mechanical anchoring of the insulation plates.
- Composition: Polypropylene.
- Minimum 50 mm anchoring depth.
- Wide range of sizes depending on the thickness of insulation used.
- Format: 200 units per box.
- ETAG (Guideline for European Technical Approval) 014 Technical Assessment.

Reinforcement mesh, anchors, profiles and auxiliary elements

PVC Anchor blow block

- Mechanical fastening block with 60 mm plate for 10 mm diameter holes (drill). Circular head. Suitable for mechanical anchoring of the insulation plates.
- Composition: Polypropylene anchoring body. Galvanised steel nail.
- Rapid placement. Greater security.
- Minimum 25 mm anchoring depth.
- Wide range of sizes depending on the thickness of insulation used.
- Format: 200 units per box.
- ETAG (Guideline for European Technical Approval) 014 Technical Assessment.

140 additional washer disc

- Extension for conventional 60 mm plate for anchoring and fastening of the MW.
- 140 mm diameter.
- Format: 200 units/box.

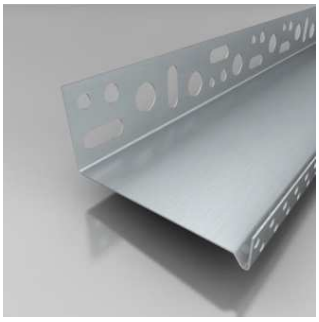
PVC cutting insert

- PVC cutting insert for making the cavity in the insulating panel. Enables the placement of the anchor inside the panel.

EPS Plugs

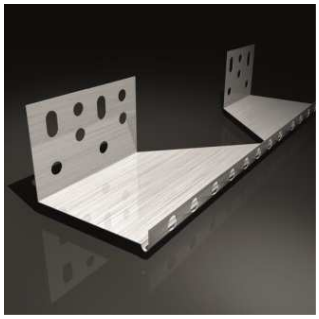
- Insulating plugs used for filling the cavity resulting from inserting the anchor for the mechanical fastening of the panel.
- 70 mm diameter.
- Format: 200 units/box.

Reinforcement mesh, anchors, profiles and auxiliary elements



Aluminium start up profile

- Start up profile for the SATE system manufactured in 0.7 mm thick aluminium. It is placed horizontally at the lower limit of the area to be coated, anchored to the substrate by means of screws, spacers and connectors. Includes counter flashing which ensures vertical water drainage.
- Wide range of sizes depending on the thickness of insulation used.
- Format: 2.5 m/unit. 10 units per box.



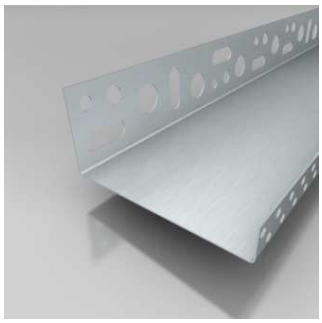
Aluminium corner start up profile

- Start up profile for the SATE system manufactured in 0.7 mm thick aluminium. It is placed horizontally at the lower limit of the area to be coated, anchored to the substrate by means of screws, spacers and connectors. Includes counter flashing which ensures vertical water drainage. Adjusted to the corners of the façade.
- Wide range of sizes depending on the thickness of insulation used.
- Format: 2.5 m/unit. 10 units per box.

Framework assembly set

- Assembly set for the fastening of the start up, lateral and crown profile with zinc-plated or stainless steel screws and plugs suitable for the substrate, connectors for joining profiles and spacers to save the unevenness or irregularities of the substrate.
- Format: kit of 10 connectors, 50 spacers and 75 screws.

Reinforcement mesh, anchors, profiles and auxiliary elements

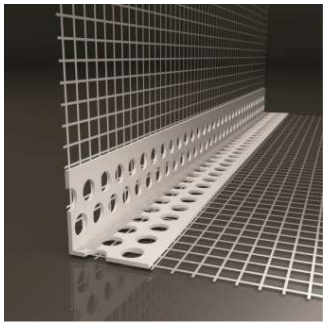


Lateral profile

- Lateral profile manufactured from 0.8 mm aluminium to be positioned in the vertical limits of the area to be coated, facilitating closing of the system.
- Format: 2.5 m/unit. 10 units per box.

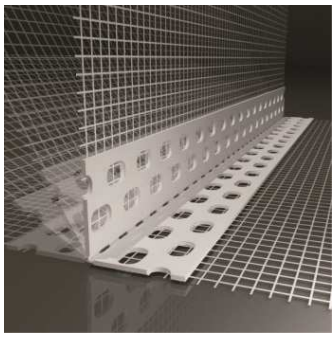
Start up clip profile

- PVC start up clip profile with alkali-resistant fibreglass mesh to be embedded into the start up profile. Includes counter flashing which ensures vertical water drainage.
- Format: 2.5 m/unit. 30 units per box.



Angle iron profile with mesh

- Angle iron PVC profile with alkali-resistant fibreglass mesh, suitable for any mortar thickness. Protects horizontal and vertical angles in edges, windows, doors ... helping the formation of perfect edges, both aligned as well as perpendicular edges.
- Format: 8x12 Profile. 2.5 m/unit. 50 units per box.
  10x15 Profile. 2.5 m/unit. 50 units per box.



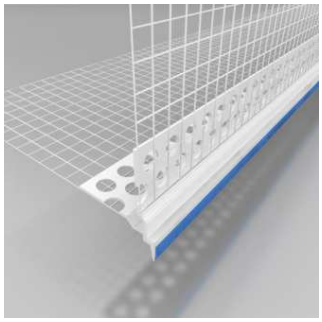
Angle iron profile with variable angle mesh

- Angle iron PVC profile with alkali-resistant fibreglass mesh, suitable for any mortar thickness. Protects horizontal and vertical angles in corners, windows, doors ... helping the formation of perfect edges, both aligned as well as perpendicular in angles other than 90º.
- Format: 8x12 Profile. 2.5 m/unit. 50 units per box.
  10x15 Profile. 2.5 m/unit. 50 units per box.

Reinforcement mesh, anchors, profiles and auxiliary elements

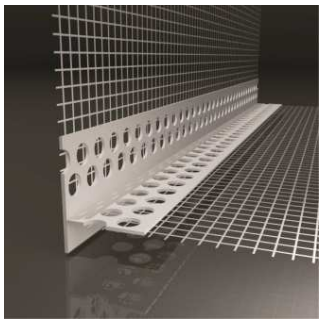
Ledge profile

- Self-adhesive PVC ledge profile leg with alkali-resistant fibreglass mesh for implementing the ledge, creating a flexible connection between it with the SATE set.
- Format: 2.0 m/unit. 40 units per box.



Gutter profile with mesh

- PVC gutter profile with alkali-resistant fibreglass mesh used in the formation of gutters of the SATE.
- Format: 2.5 m/unit. 20 units per box.



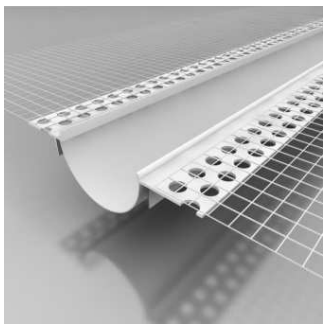
Hidden counter flashing profile with mesh

- PVC gutter profile with alkali-resistant fibreglass mesh used in the formation of counter flashings of the SATE. Format: 2.5 m/unit. 50 units per box.

Window frame profile

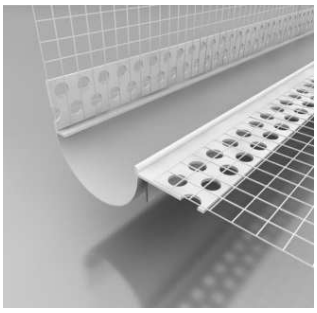
- Self-adhesive PVC window frame profile with Alkali-resistant fibreglass mesh which allows the SATE to be connected to the frames of the openings of doors and windows structures without leaving gaps or spaces. Thanks to its tab with adhesive interlayer paper, once removed, its execution is clean and perfect.
- Format: 2.4 m/unit. 50 units per box.

Reinforcement mesh, anchors, profiles and auxiliary elements



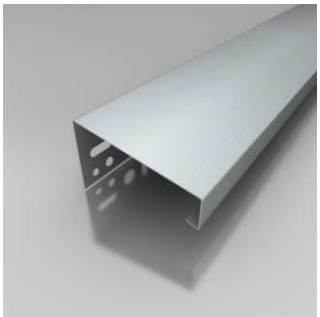
Flat expansion joint profile

- PVC expansion joint profile with alkali-resistant fibreglass mesh for expansion joints of 5-25 mm wide. Waterproof and resistant to UV rays.
- Format: 2.5 m/unit. 25 units per box.



Angled expansion joint profile

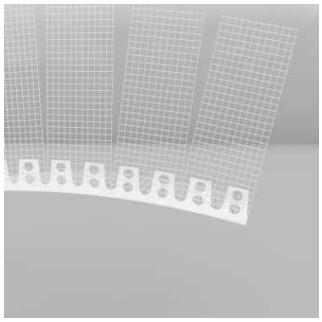
- PVC expansion joint profile with alkali-resistant fibreglass mesh for expansion joints of 5-25 mm wide. Waterproof and resistant to UV rays.
- Format: 2.5 m/unit. 25 units per box.



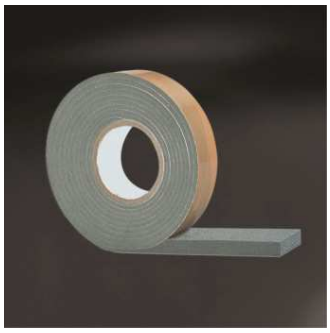
Crown profile

- Protection profile manufactured from aluminium for the upper part of the SATE system.
- Wide range of sizes depending on the thickness of insulation used.
- Format: 2.5 m/unit. 10 units per box.

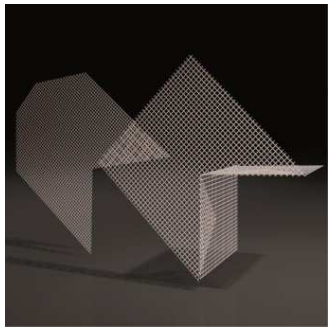
Other elements



Arched corner profile



Expansion tape

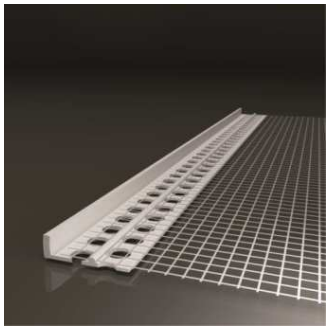


Reinforced mesh in corners

Reinforcement mesh, anchors, profiles and auxiliary elements

Other elements

Light load spiral anchor



Stop/Quartered Profile

SATE Beyem - Jafep

External Thermal Insulation Composite System

General installation conditions

- Do not apply Beyem Adheterm or Pétrex below 5°C or above 30°C.
- Do not use the system on horizontal or inclined surfaces at an inclined angle of less than 45º.
- Do not use the system on horizontal or inclined surfaces at an inclined angle of less than 45º.
- Avoid direct sunlight when applying the Beyem Adheterm and Pétrex 5.
- When installing the system, it is recommended to protect the façade by using protective tarps placed on the scaffolding. It is especially important to protect the upper part of the façade in order to avoid the occurrence of water leakage between the substrate and the insulating panel, during and after installation.
- To respect the existing expansion joints on the façade and to fix those joints using the expansion joint profile.
- The age of the substrates in a new construction must be at least 1 month for ceramic brick masonry (ex-works) and 2 months in concrete block ex-works.
- The use of compatible materials and components recommended and supplied by Rodacal Beyem and Jafep in order to ensure the quality of the system is essential.
- The work must be undertaken by qualified personnel with appropriate guidance and supervision.

Preparation of substrate

The durability of an external thermal insulation composite system is directly related to the preparation of the substrate to which it will be applied to.

The standard substrates are as follows:

In **new work:**

- Brick wall or ceramic block and thermal block wall.
- Mortar rendering.
- Concrete block.
- Concrete (treated with Beyem Unión bonding interphase type mortars).

In **refurbishment:**

- Mortar rendering.
- Single cladding.
- Clinker brick wall.

The abovementioned substrates must be sound, clean, free of paint residues, poorly adhered parts or substances which may hinder adhesion. All substrates must have an adequate flatness and a suitable porosity and surface roughness. The substrate should not have apparent problems of dampness and, where applicable, having finished its curing retraction by having abided by its curing period. Weak, damaged or deteriorated concrete must be removed and, whenever it is necessary to remove sound it must be done so using suitable manual or mechanical means which do not cause vibrations or impacts. Badly damaged substrates must be treated via sandblasting or similar method so as to obtain a surface with minimum roughness and tensile strength guarantees.

Preparation of substrate

In case of heat, wind or over absorbent substrates, it is recommended to dampen the substrate and wait until the layer of water disappears.
In refurbishment works, the substrates must be verified from the point of view of its consistency, aging and cracking, those areas which are not in a good state of repair and condition must be removed and subsequently repaired.
In general, in refurbishment, the substrates must have adequate strength to withstand the coating (minimum adhesion of 0.15 MPa in pull-off type test).

The admissible tolerances of the substrates are as follows:

Variable	Situation	Tolerance, mm
Collapse	Between floors Total building height	20 50
Axiality	Max. horizontal distance between the axes of the upper and lower walls	20
Flatness	In 1 m In 10 m	5 20

The following table contemplates certain treatments to be considered, depending on the condition of the substrate

Substrate condition	Treatment
Unevenness ≥ 10 mm	Adjustment of the substrate using a mortar resistance compatible with the enclosure
Dusty, crumbling	Clean and apply Beyem Pro or Jafep Sellacryl
Efflorescence	Sweeping, brushing
Paint, peeling	Clean using chemical stripper or sandblasting (mechanical means)
Presence of mortar burrs	Remove
Absence of mortar in brick slots	Fill the slot again with Beyem M-5 or Beyem M-15

Preparation of substrate

Substrate condition	Treatment
Presence of moss, mold or algae	Use mold cleaner or bleach and subsequently brush
Smooth substrate	Generate porosity and roughness via mechanical means
Very absorbent substrate	Beyem Pro or Jafep Sellacryl priming
Weathered concrete	Remove the damaged parts and repair using Beyem R3T or Beyem R4T
Coating or superficially fissured mortar	Treat with Beyem R1T Renodur
Peeling coating or mortar falling off substrate	Remove damaged coating and replace using a resistant mortar coating compatible with the enclosure

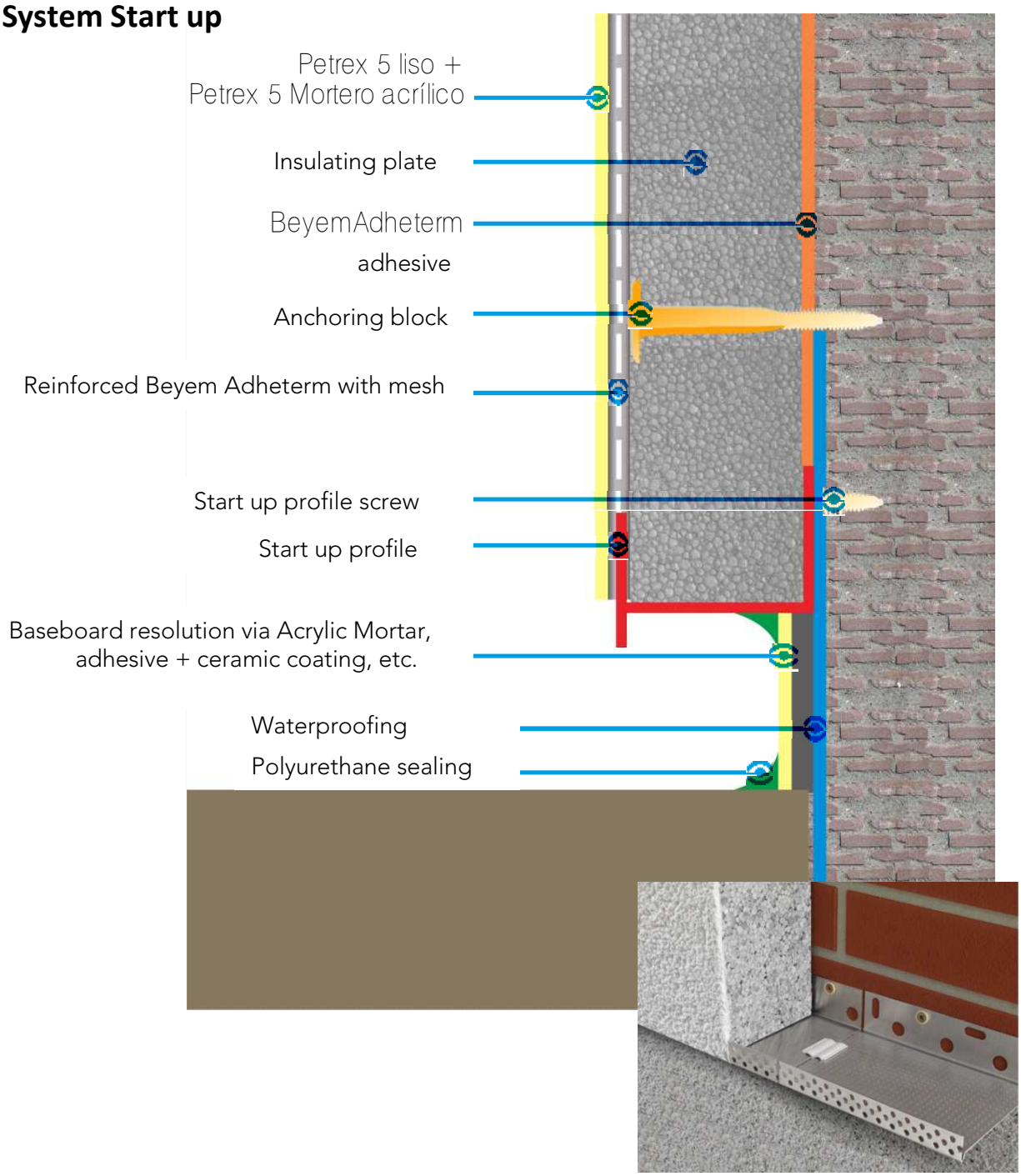
System Start up

The system can be started up above ground level or below ground level giving continuity to the thermal insulation system of the buried walls.

- System start up above ground level

  SATE BEYEM-JAFEP must be restricted in its contour by an aluminium start up suitable to the thickness of the insulating plate to be used. The start up profile serves as reference level for the commencement of the assembly of the system and at the same time serves as its bottom protection against the penetration of moisture and other external agents. The start up profile must be positioned at least ≥ 15 cm from the ground, so that the system is not in direct contact with it. Similarly, it must be waterproofed from ground level up to ≥ 30 cm in height, using Beyem Proof Flexible, in order to avoid humidities due to filtration or by capillarity from the exterior. Waterproofing must exceed at least 10 cm the start up profile level. Waterproofing from ground level up to the start up profile can be finished by using Pétrex 5 Mortero acrílico (Acrylic Mortar) or via the placement of a ceramic baseboard, natural stone… using the Rodacal Beyem adhesive cement range.

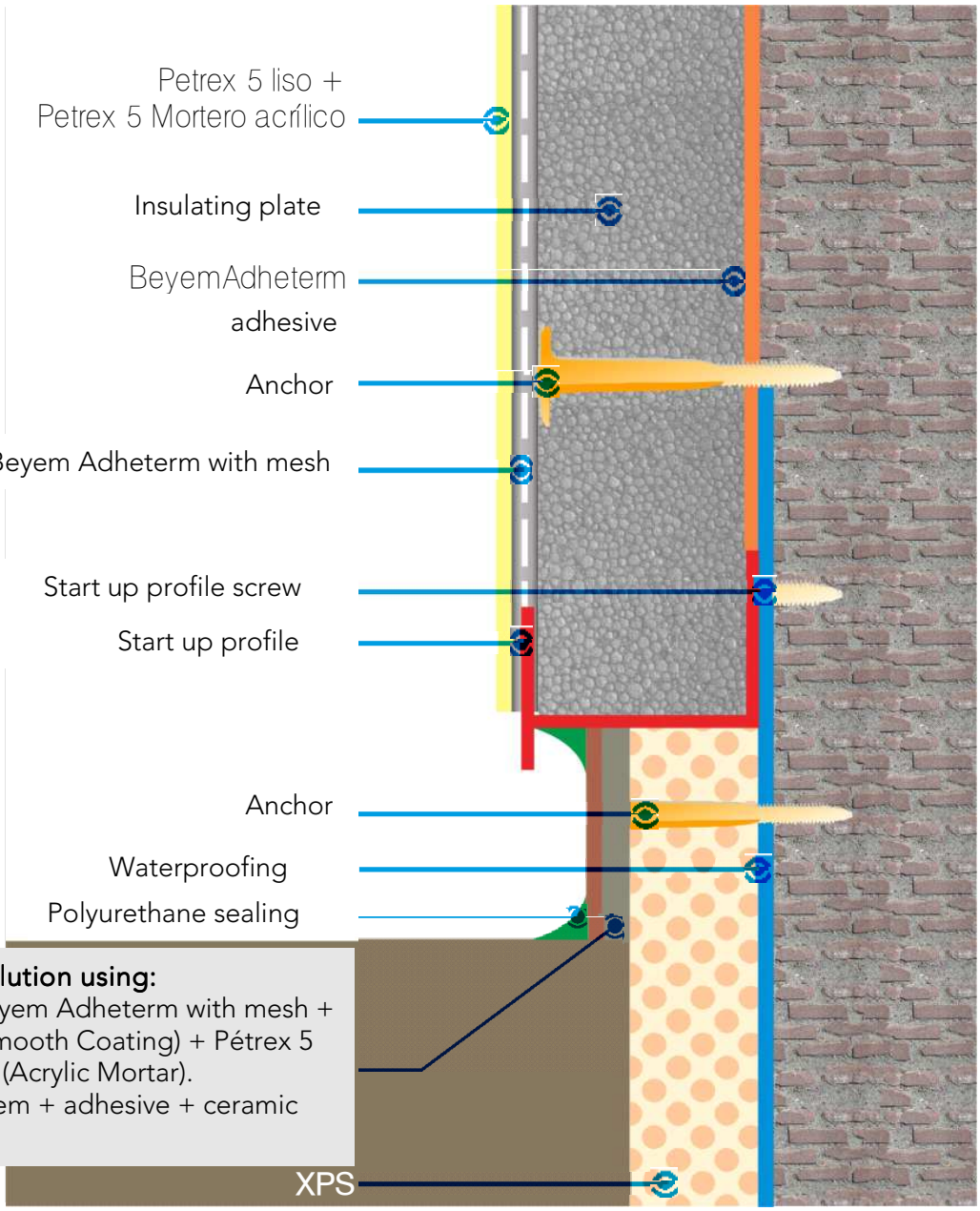
System Start up



- ## System start up below ground level

  In this case, an XPS insulating panel of a thickness less than that of the insulating panel of the system is placed initially. This insulating panel will remain buried and must protrude ≥ 15 cm above ground level. The start up profile will be placed above the XPS panel, leaving a separation joint between the start up profile and the XPS panel of approx. 2-5 mm to be sealed with polyurethane. Likewise, the above is taken into account as regards waterproofing – commencing same from ≥ 15 cm below the start up of the plates – and its finishing coats.

System Start up



Baseboard resolution using:
1. Reinforced Beyem Adheterm with mesh + Pétrex 5 Liso (Smooth Coating) + Pétrex 5 Mortero Acrílico (Acrylic Mortar).
2. Beyem Adhetem + adhesive + ceramic coating etc

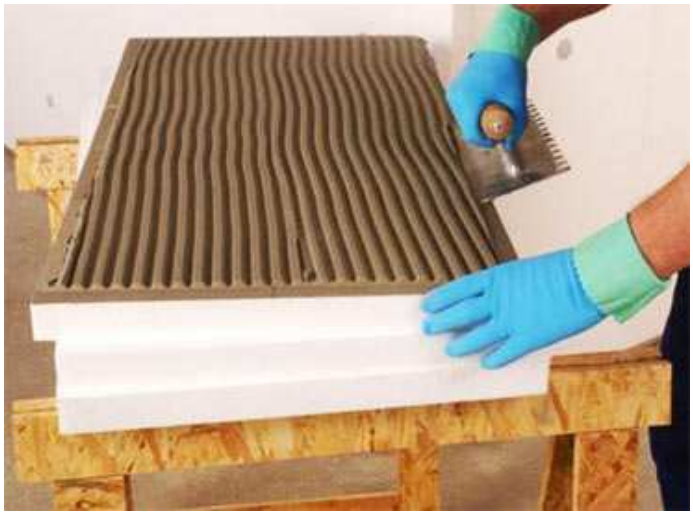
In the event of wishing to protect the sides of the system with the lateral closing profile, this will be installed after the installation of the start up profile. It must be borne in mind that the screws which are affixed to the start up profile of the substrate must be placed at a distance of 30 cm. The first screw is to be placed at a distance less than 5 cm from the edge of the profile.

Positioning of the insulating plates

The fastening of the EPS plates will be made using Beyem Adheterm adhesion mortar. The insulating plates must be assembled from the bottom up, piling each row of plates on top of each other, except for the first row, which rests directly on the start up profile. There are two different positioning techniques depending on the flatness of the substrate:

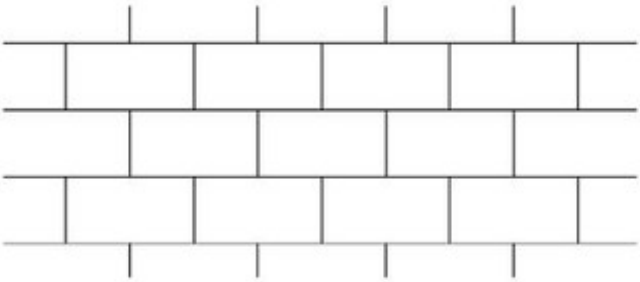
- Fastening of the edge and notch: is used on the substrates with irregularities up to 1 cm and for ≥ 40 mm plates. The amount of adhesive to be applied must be chosen so that, taking into account the tolerances of the substrate and the adhesive layer thickness, a bonded contact surface area with the substrate of at least 60% is obtained for the EPS and XPS and 80% for MW. To that end, proceeding to apply the adhesive mortar with a width of 5 cm around the entire perimeter of the plate and approximately 2 cm from its edges and also at the centre of the panel, where several trowelfuls of adhesive mortar are applied.

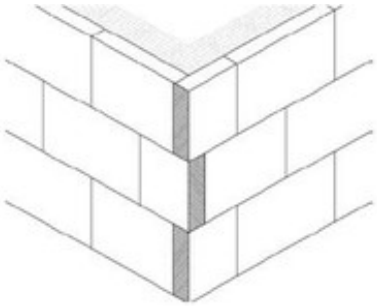
- Fastening via notched trowel: is used when the planimetry of the substrate is less than 5 mm which has been measured using a 2 m ruler and for plates <40 mm. The Beyem Adheterm is spread over the entire surface of the board, maintaining free approximately 2 cm of its edges and then combed with the aid of at least a No. 10 notched trowel.



Positioning of the insulating plates

The plates must be placed with off-set joints in relation to the previous row. Similarly, in the corners, the ends of the plates must be turned to improve the interlocking of the system.

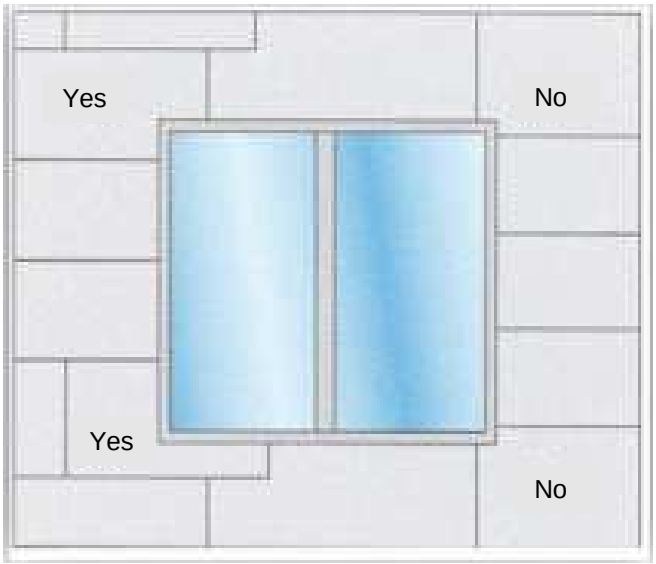




The plates will be placed by pressing down on the substrate with the aid of a trowel, with the objective that the bonding mortar is spread out, adjusting the edges and planimetry of the adjacent plates so that there are no clearances between the plates, whilst the residues of the material on the edges are removed.

The verticality and planimetry must be constantly verified by using a 2 metre ruler and the corresponding level. In the case of placement of the MW insulating panels, the planimetry is crucial, given that this panel does not permit a subsequent sanding in order to correct small unevenesses.

The plates in the corners of openings must be positioned so as to prevent the alignment of the edges of the plate with horizontal or vertical plane of the opening, and laying the edges in a "L" shape placement of the plate. In this fashion minimising the risk of cracking at this singular spot.



Positioning of the insulating plates

After a minimum of 24 hours have elapsed from the fastening of the insulating panels with Beyem Adheterm, will proceed to sand the existing unevenness between plates. This operation cannot be performed with MW panels, reason why extreme caution must be exercised in order to obtain perfect planimetry with this type of insulating material.
In the event of any expansion joints in the building, these joints must be respected and never coated with insulating plates. In order to fix the joint, the expansion joint profile must be used.

Mechanical fastening of the insulating plates

After a minimum of 24 hours have lapsed from the adhesion of the EPS plates, a supplementary mechanical fastening must be placed by using the anchor blocks in a minimum amount of 6 units per m2. This amount will be increased depending on the height and the wind exposure, in particular on the edge of the building. At least 8 units per m2 at heights greater than 25 metres will be used. The fastenings will be placed on the perimeter and in the centre of the plates. The dowels must be suitable to the type of substrate and the thickness of the insulating material. In the case of placing the MW plates, the fastenings will be placed on the perimeter and in the centre of the plates using the additional 140 mm washer disc. When using conventional 60 mm diameter dowels, these are placed approximately 150 mm from the edge of the plates.

In general, there are two types of anchor placement methods:

- Surface method: a hole is made with the aid of a drill, drilling through the insulating plate. The drill diameter must match the diameter of the anchor block. Strike the block or screw on the hole using the drill and press the circular head of the dowel so that it is between 1-2 mm below the surface of the insulating plate. Subsequently, this rabett is adjusted with the cladding mortar and Beyem Adheterm base coat.

- Interior insulation method: On the hole made using the PVC cutting insert in the drill, a cavity is made within the insulating material. Once the blocked is inserted, the corresponding insulating cover is placed.

Mechanical fastening of the insulating plates

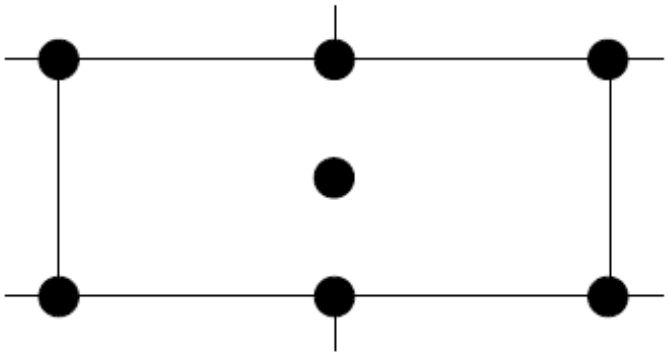
Surface method

Interior insulation method

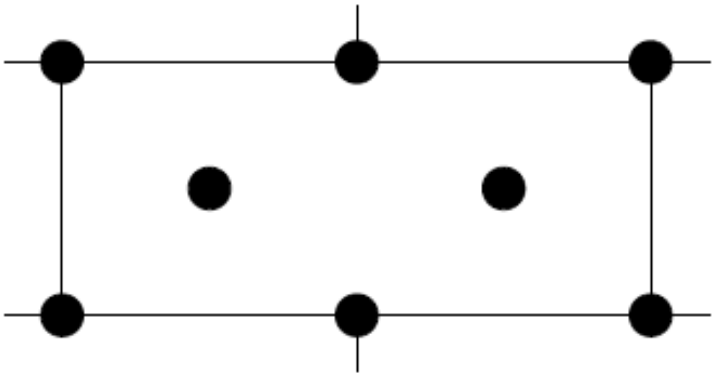
Mechanical fastening of the insulating plates

Configuration

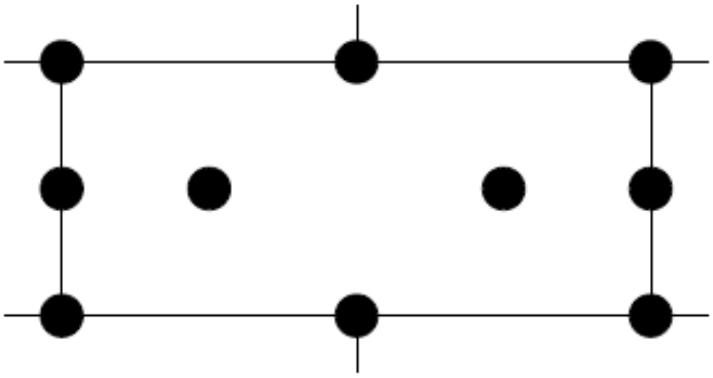
6 dowels /m²



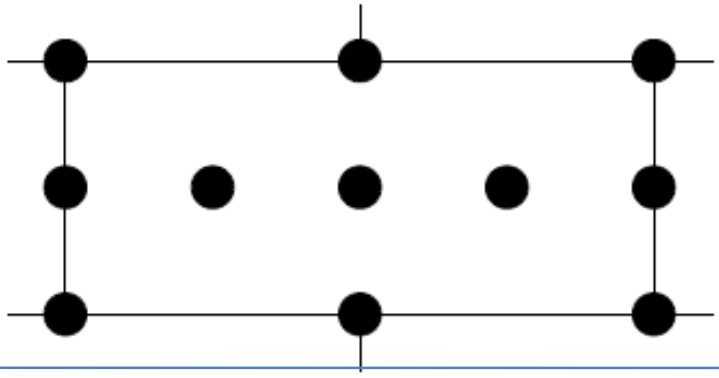
8 dowels /m²



10 dowels /m²

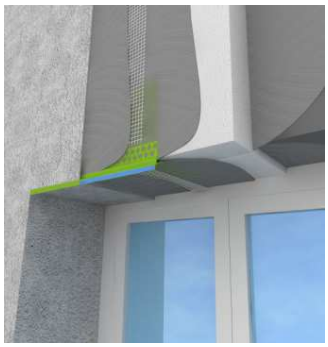


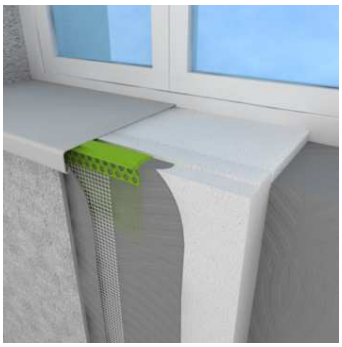
12 dowels /m²

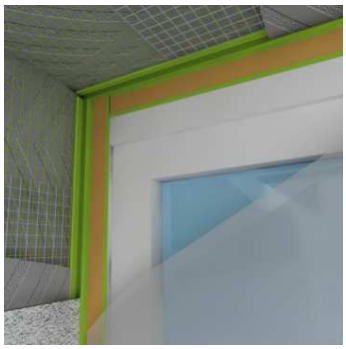


Placement of reinforcement profiles

Window sill and lintel: The window lintels must be reinforced with PVC corner flashing with mesh in order to prevent water runoff in the planes of the façade. The placement method is identical to that of the PVC angle iron profile with mesh. The windowsills must have a minimum slope of 10º outwards in order to ensure water runoff. Similarly they must have an overhang in the horizontal plane of approximately 3-4 cm with a corner flashing trim that protrudes from the plane of the façade wall. The self-adhesive PVC window frame profile with fibreglass mesh which allows the SATE to be connected to the frames of the openings of the window structures without leaving gaps or spaces.

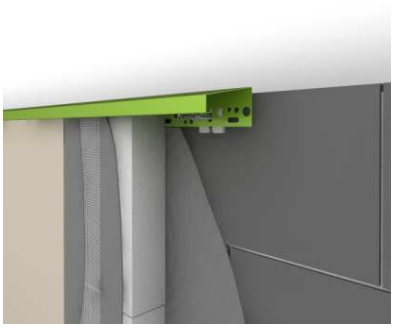


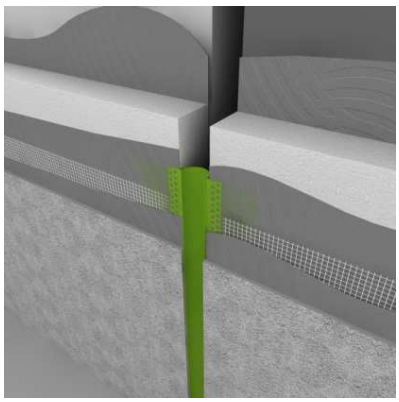




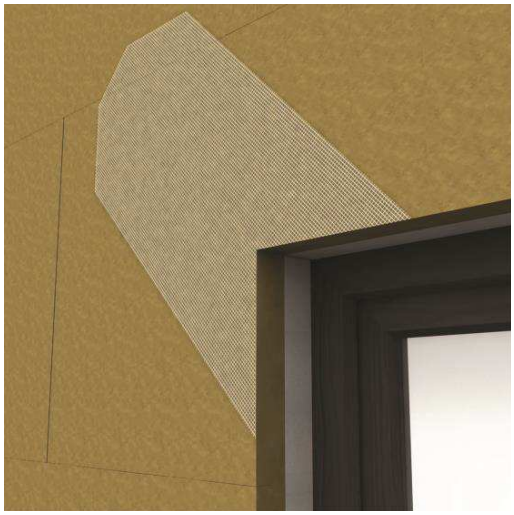
Upper trim and expansion joints: The upper trim of the façade should prevent water from running directly on it. To that end, the crown profile must be used, screwing it in the same manner as the start up profile. This profile must be placed before the last row of insulating panels and must hover 3-4 cm above the horizontal plane. The upper part of the rabetting of this profile and the substrate which is affixed should always be protected (by the eaves of the façade itself or projection, another polyurethane profile...)

The expansion joints are fixed by using the PVC expansion joint profile with fibreglass mesh. The placement method is identical to that of the PVC angle iron profile with mesh, but in this case there is a double edge. The band contained in the profile is inserted into the expansion joint after that the cover of that profile is inserted.





Reinforcement with fibreglass mesh



There are a number of singular points on the façade which must be reinforced with fibreglass mesh. The placement of these reinforcements will be made after a minimum of 24 hours having elapsed from the fastening of the insulating panels.

The singular spots to be reinforced are as follows:

- Corners of the façade openings (windows, doors, ...): 20x40 cm bands are cut and affixed using Beyem Adheterm in all corners (to 45o) or the use of a corner reinforcement mesh (precut mesh). Although the mesh is covered by mortar, the grids which make up same must be marked out.

- Accessible Areas exposed to impacts (baseboards): In the area to be reinforced, the Beyem Adheterm is spread over the insulating panels. Then the fibreglass mesh is extended horizontally and is embedded within the adhesive mortar. Although the mesh is covered by mortar, the grids which make up same must be marked out. The fixtures between rabbets must overlap by at least 10 cm. The placement of the reinforcement mesh will be in addition to the placement of the main mesh.

Application of the Adheterm base coat and mesh placement

Once a minimum of 24 hours have elapsed from the placement of the reinforcement profiles and reinforcement mesh, proceeding to the placement of the main mesh (Mesh 160), which is the one with which the entire surface of the facing wall and overlap is cladded with the remaining mesh reinforcements that have been installed previously. For its placement, Beyem Adheterm is spread over the EPS panels or on previously reinforced areas. The thickness will be adjusted using a 6 mm trowel.

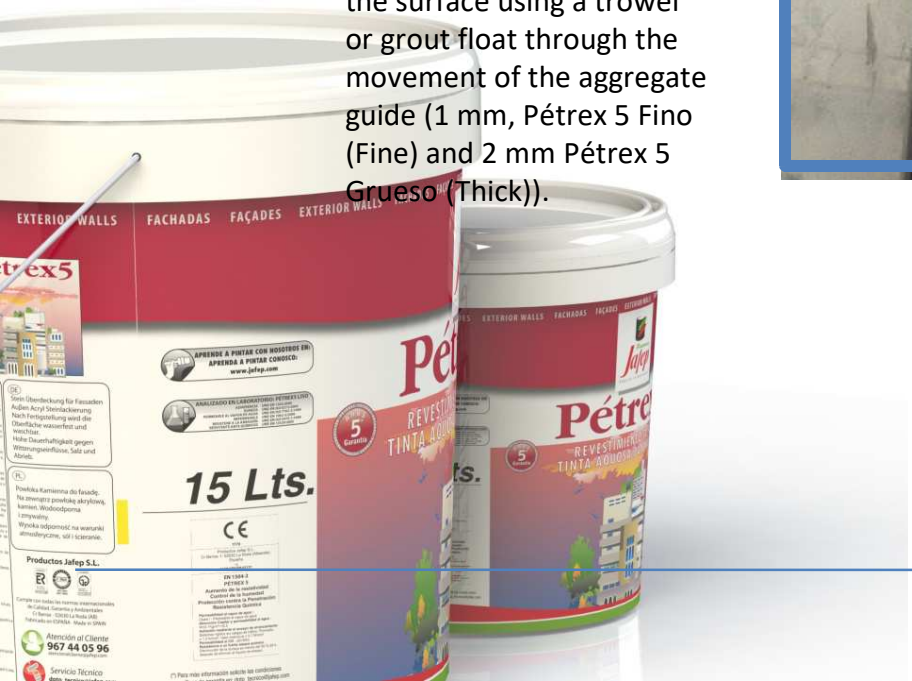
On the brushed surface, the mesh will be rolled out from top to bottom with an overlap of at least 10 cm between meshes. The mesh is pressed against the mortar furrows so that it remains embedded. Although the mesh is covered by mortar, the grids which make up same must be marked out. After 24 hours a second coat of Beyem Adheterm lisa (smooth coating) will be applied in order to prepare the coating prior to the finishing . The minimum thickness of the Adheterm Beyem coating layer on the plate must be 3 mm.

Pétrex 5 Mortero Acrílico (Acrylic Mortar) decorative finish:

The decorative finish consists of two stages:

- Pétrex 5 liso (Smooth coating) basecoat: A minimum of 48 hours having elapsed following the last coat of Beyem Adheterm smooth coat, a coat of Pétrex 5 liso (smooth coating) diluted with 10% of water is applied, letting it penetrate the surface. The Pétrex 5 liso (smooth coating) can be applied using a brush, roller or spray gun. This basecoat acts as an absorption equaliser and adhesion promoter of the subsequent finishing using Pétrex 5 mortero acrílico (acrylic mortar). If a quartering is planned in the application of the acrylic mortar, it is recommended to apply a second coat reinforcing the parts where the drawing will be stamped.

- Pétrex 5 Mortero Acrílico (Acrylic Mortar): At least 6 hours having elapsed from the previous stage, the Pétrex 5 Mortero Acrílico (Acrylic Mortar) will be applied using a stainless steel trowel or spray gun, spreading evenly on the surface. Once the adhesiveness on the tool is dissipates, one must proceed to the finishing of the surface using a trowel or grout float through the movement of the aggregate guide (1 mm, Pétrex 5 Fino (Fine) and 2 mm Pétrex 5 Grueso (Thick)).



Basic insulation concepts. Analysis and practical example of energy rehabilitation.

Thermal Conductivity (lambda) λ

Amount of heat flowing through a metre of the body under consideration, with a thickness of 1 metre per hour and a temperature difference of one degree between both sides.

Unit of measurement (λ): **W/m K (Kcal/hmºC)**

W = watts

m = metre

K = Kelvin

1 W = 0.860 Kcal /h	1 Kcal /h = 1.163 W

Thermal Resistance (r)

Inverse of conductivity

$$r = 1/\lambda$$

Unit of measurement (r): **m K/ W (h.m.ºC/Kcal)**

Thermal Resistance (R)

$$R = e/\lambda = e*r$$

It is the resistance which opposes a material to heat transfer, which is proportional to its thickness (e) and inversely proportional to the conductivity (λ). It is obtained by dividing the thickness between the conductivity.

Unit of measurement (R): **m2 K / W (m2hºC/Kcal)**

e = thickness in metres.

Practical example: What is the thermal resistance which a 8 cm EPS of λ= 0,037 W/(m*K) offers?

R= e/λ = 0.08/0.040 = 2.0 m2K/W

Thermal transmittance (U): Is the amount of heat transmitted per surface unit and per mperature degree difference between two considered environments (interior and exterior). Measures ergy loss. It is calculated from the inverse of the sum of the thermal resistances of the elements of the wall.

It is a measurement parameter of the thermal insulation of a wall.

U = 1/RTotal Unit of measurement (U): **W/m2 K** (Kcal/hm2ºC)

RTotal = Rse+R1+R2+...+Rsi

Rsi and Rse: surface thermal resistances of the wall in contact with the indoor air and exterior air (values given by the DB-HE tables).

Rse + Rsi = 0.17 m2 K / W

The lower is the value of U, the better the insulation

Basic insulation concepts. Analysis and practical example of energy rehabilitation.

The 2013 DB-HE sets a limitation of energy consumption for newly constructed buildings and expansion of existing buildings; to that end, the primary non renewable energy consumption indicator is used. In the case of Energy Demand (DB-HE1) demand for heating and refrigeration depending Climate zone where the building is located is limited.

Energy demand for heating: Energy demand for heating the building or the extended part where appropriate. Must not exceed the limit value Dcal,lim obtained by using the following formula:

Dcal,lim = Dcal,base + Fcal,sup / S

Dcal,lim: is the limit value of the energy demand for heating, stated as kW·h/m2·per year, taking into consideration the useful surface area of the living spaces.
Dcal,base: is the base value of the energy demand for heating, for each winter climate zone corresponding to the building, which takes the tabulated values according to climatic zone.
Fcal,sup: is the correction factor per surface of the Energy demand for heating, which takes the tabulated values according to climatic zone
S: is the useful surface area of the living spaces of the building, in m2.

Dcal,base and Fcal,sup are the tabulated values per climate zone.

Base value and correction factor per surface area of the energy demand for heating
Winter climate zone

α	A	B	C	D	E	
Dcal,base	15	15	15	20	27	40
Fcal,sup	0	0	0	1000	2000	3000

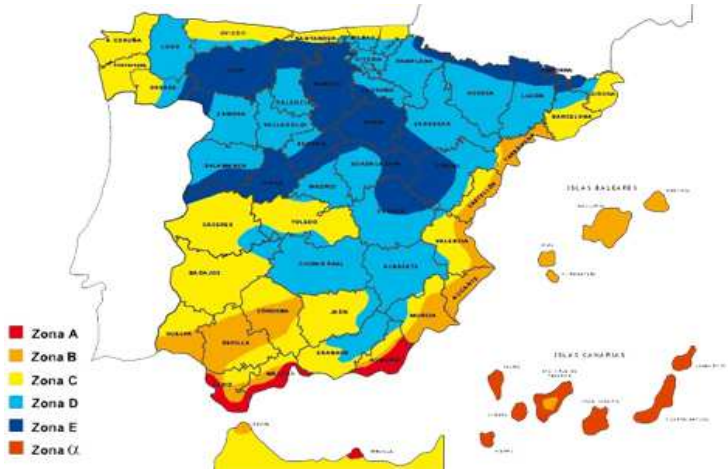
Energy demand for cooling: of the building or extended part, where appropriate, must not exceed:

The limit value **Dref, lim** = 15 per year for Summer climate zones 1, 2 and 3.
The limit value **Dref, lim** = 20 kW·h/m2·per year for Summer climate zone 4.

Basic insulation concepts. Analysis and practical example of energy rehabilitation.

Weather map according to TBC

Defined for each climate zone are certain Dcal,base, Fcal,sup and Dref,lim values which calculate the heating and cooling demand limits, and based on this limits, certain guideline (or approximate) values as regards U and insulation thicknesses which should be sufficient for compliance in roofs, walls and floors are recommended.



These tables enable to obtain the climate zone of a municipality according to its provincial capital and its altitude relative to sea level (h). For each province, the climate corresponding to the condition with the lowest comparison height will be taken.l

Iberian Peninsula Climate Zones

capital	Z.C.	Altitud	A4	A3	A2	A1	B4	B3	B2	B1	C4	C3	C2	C1	D3	D2	D1	E1
Albacete	**D3**	**667**										h<450			h<950			h<950
Alicante	B4	7					h<250					h<700			h<700			
Almería	A4	0	h<100				h<250	h<400				h<800			h<800			
Ávila	E1	1054														h<550	h<850	h<850
Badajoz	C4	168									h<400	h<450			h<450			
Barcelona	C2	1											h<250			h<450	h<750	h<750
Bilbao	C1	214												h<250			h<250	
Burgos	E1	861															h<600	h<600
Cáceres	C4	385									h<600				h<1050			h<1050
Cádiz	A3	0		h<150				h<450				h<600	h<850			h<850		
Castellón/castello	B3	18						h<50				h<500			h<600	h<1000		h<1000
Ceuta	B3	0						h<50										
Ciudad Real	D1	610									h<450	h<500			h<500			
Córdoba	B4	113					h<150				h<550				h<550			
Coruña La/A Coruña	C1	0												h<200			h<200	
Cuenca	D2	975													h<800	h<1050		h<1050
Gerona/Girona	D2	143											h<100			h<600		h<600
Granada	C3	754	h<50				h<350				h<600	h<800			h<1300			h<1300
Guadalajara	D3	708													h<950	h<1000		h<1000
Huelva	A4	50	h<50				h<150	h<350				h<800			h<800			
Huesca	D2	432										h<200			h<400	h<700		h<700
Jaén	C4	436					h<350				h<750				h<1250			h<1250
León	E1	346																h<1250
Lérida/Lleida	D3	131										h<100			h<600			h<600
Logroño	D2	379											h<200			h<700		h<700
Lugo	D1	412															h<500	h<500
Madrid	D3	589										h<500			h<950	h<1000		h<1000
Málaga	A3	0						h<300				h<700			h<700			
Melilla	A3	130																
Murcia	B3	25						h<100				h<550			h<550			
Orense/Ourense	D2	327										h<150	h<300			h<800		h<800
Oviedo	D1	214												h<50			h<550	h<550
Palencia	D1	722															h<800	h<800
Palma de Mayorca	B3	1						h<250				h<250						
Pamplona	D1	456											h<100			h<300	h<600	h<600
Pontevedra	C1	77												h<350			h<350	
Salamanca	D2	770														h<800		h<800
San Sebastian	D1	5															h<400	h<400
Santander	C1	1												h<150			h<650	h<650
Segovia	D2	1013														h<1000		h<100
Sevilla	B4	9					h<200				h<200							
Soria	E1	984														h<750	h<800	h<800
Tarragona	B3	1						h<50				h<500			h<500			
Teruel	D2	995										h<450	h<500			h<1000		h<1000
Toledo	C4	445									h<500				h<500			
Valencia/valénciia	B3	8						h<50				h<500				h<950		h<950
Valladolid	D2	704														h<800		h<800
Vitoria/Gasteiz	D1	512															h<500	h<500
Zamora	D2	617														h<800		h<800
Zaragoza	D3	207										h<200			h<650			h<650
capital	Z.C.	Altitud	A4	A3	A2	A1	B4	B3	B2	B1	C4	C3	C2	C1	D3	D2	D1	E1

Basic insulation concepts. Analysis and practical example of energy rehabilitation.

Canary Islands climate zones						
Capital	**Z.C.**	**Altitud**	**α3**	**A2**	**B2**	**C2**
Palmas de Gran Canaria, Las	α3	114	h < 350	h < 750	h < 1000	h ≥ 1000
Santa Cruz de Tenerife	α3	0	h < 350	h < 750	h < 1000	h ≥ 1000

In order to meet these requirements (limit values) in residential buildings, the 2013 DB-HE facilitates certain guideline (or approximate) values for thermal transmittance (U) which must be sufficient for compliance.

Climate Zone

Transmittance of the element [W/m2 K]

	α	A	B	C	D	E
UM	0.94	0.50	0.38	0.29	0.27	0.25
US	0.53	0.53	0.46	0.36	0.34	0.31
UC	0.50	0.47	0.33	0.23	0.22	0.19

UM:Thermal transmittance of the façade walls and enclosures in contact with the ground.
US :Thermal transmittance of floors (floor structures in contact with exterior air).
UC: Thermal transmittance of roofs.

Practical example: 150 m2, 590 metre high single family dwelling in Madrid

Climate Zone Table: **D3**
Dcal,lim = Dcal,base + Fcal,sup / S

	α	A	B	C	**D**	E
Dcal,base	15	15	15	20	**27**	40
Fcal,sup	0	0	0	1000	**2000**	3000

Dcal,lim = 27 + 2000 / 150 = **40.33** kW·h/m2·per year

So, for this dwelling heating demand must be below 40.33 kWh /m2 per year. As far as climate cooling demand is concerned, Madrid is a Summer climate zone 3. The limit value is ref, lim = 15 kW·h/ **m2** ·per year. So, for this dwelling cooling demand must be below 15 kWh kW·h/ **m2** ·per year.

Basic insulation concepts. Analysis and practical example of energy rehabilitation.

In order to meet this requirements in residential buildings, the DB-HE facilitates certain guideline (or approximate) values for **thermal transmittance (U)** which **must be** sufficient for that compliance, **in this case less than 0.27 W/m2·K.**

Climate Zone

Transmittance of the element [W/m2 K]

	α	A	B	C	D	E
UM	0.94	0.50	0.38	0.29	**0.27**	0.25
US	0.53	0.53	0.46	0.36	0.34	0.31
UC	0.50	0.47	0.33	0.23	0.22	0.19

UM:Thermal transmittance of the façade walls and enclosures in contact with the ground.
US : Thermal transmittance of floors (floor structures in contact with exterior air).
UC: Thermal transmittance of roofs.

An example of façade implementation using SATE Beyem-JAFEP alternatives. 0.27 W/m2·K requirement

1. 0 cm SATE BEYEM-JAFEP CLASSIC GRAPHITE on 19` thermoclay.
   λ thermoclay block= 0.29 W/(m*K) λ EPS Graphite= 0,032 W/(m*K)

   R= e/λ
   U = 1/RTotal
   RTotal= Rse+R1+R2+...+Rsi
   Rse + Rsi = 0.17 m2K/W

   Only the blind side of the enclosure is considered. Calculations on simplified enclosure.

   R Total= 0.17 + (0.19/0.29) + (0.10/0.032) = 3,950 m2K/W

   U = 1/ 3.950 **= 0.253 W/m2K ≤ 0.27 W/m2·K (Requirement)**

2. 12 cm SATE BEYEM ACOUSTIC on 19` thermoclay
   λ thermoclay block= 0.29 W/(m*K) λ MW= 0.036 W/(m*K)

   R= e/λ
   U = 1/RTotal
   RTotal= Rse+R1+R2+...+Rsi
   Rse + Rsi = 0.17 m2K/W

   Only the blind side of the enclosure is considered. Calculations on simplified enclosure.

   R Total= 0.17 + (0.19/0.29) + (0.12/0.036) = 4,159 m2K/W

   U = 1/ 4.159 **= 0.240 W/m2K ≤ 0.27 W/m2·K (Requirement)**

SATE
Beyem - Jafep

External Thermal Insulation Composite System

Constructive solutions guideline for
EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM (SATE)

Factory and Head Office
Ctra. Madrid-Alicante km 213 (Extramuro)
02630 La Roda (Albacete)
Spain
Tel: + 34 967 440 018
Fax: + 34 967 442 474
rodacal@rodacal.com
www.rodacal.com

Pinturas Jafep
Cr de Barrax nº 1
02630 La Roda (Albacete)
Spain
Tel. + 34 967 44 05 96
Fax + 34 967 44 26 12
atencionalcliente@jafep.com
www.jafep.com