



THERMOKAPA

External thermal
insulation system guide





The logo consists of the word "BAUER" in a bold, black, sans-serif font, centered within a yellow rectangular background.

55 years
experience
& safety



**Professional reliability
& trust in all our
products**



**Our products are designed
with a constant focus on
the real needs of people
and the environment.**

Our goal is simple

Instead of a series of redundant features, we want to offer real solutions. We believe that people should not be forced to adapt to the complex demands of technology. Technology should adapt to the needs of people. Our experience and expertise are supported by world-class industrial facilities for the production and quality control of our products.

BAUER products are designed and developed with meticulous care and attention to detail, and are produced in modern, fully automated facilities, implementing certified quality and environmental management systems at every stage, from design and production to distribution, under the supervision of **Deutsche Gesellschaft für Qualität**.

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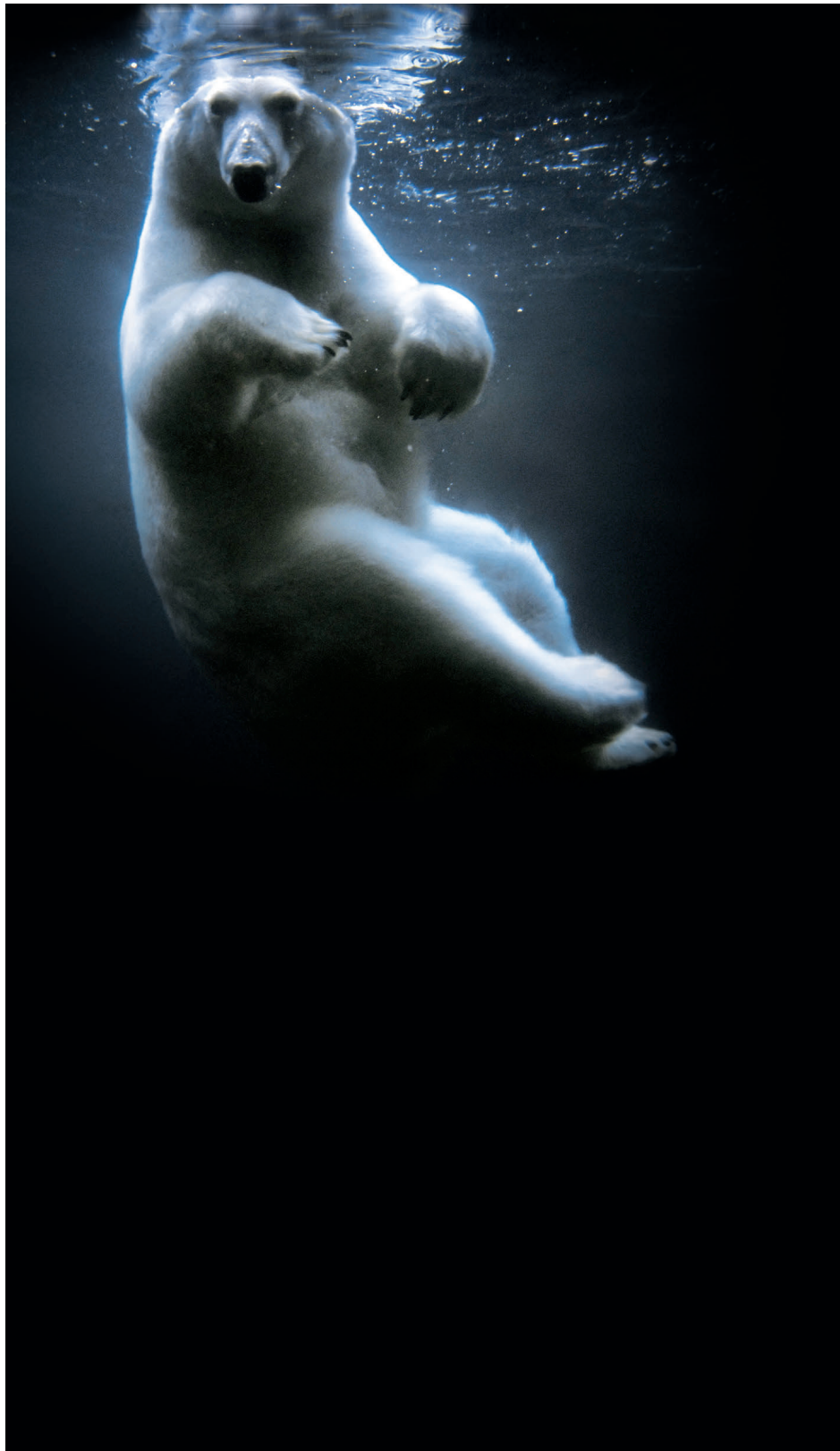
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Frankfurt, Reg. No 312310 QM
Qualitätsmanagementsystem
Zertifiziert nach DIN EN ISO 9001



Frankfurt, Reg. No 312310 UM
Umweltmanagement
Zertifiziert nach DIN EN ISO 14001



Conforms to ETAG 004
Conforms to EAD 040083 - 00 - 0404



Save energy. Build with efficiency

With high-performance products based on natural raw materials developing sustainable innovations, BAUER offers outstanding performance and environmental compatibility.

The building sector accounts for 40% of total energy consumption and is responsible for 45% of national carbon dioxide emissions.

Depending on the use of the building, the financial benefits of thermal insulation system become visible within a very short period of time.

Our products respond to today's growing demand for better environmental protection and higher energy efficiency.

Energy saving, for the protection of the environment and the improvement of the energy and environmental performance of buildings, is a core principle of BAUER's philosophy. By using natural insulating renders and breathable insulating mortars, optimum thermal insulation is achieved

Energy savings in heating and cooling dramatically reduce the effective cost of installing the system. The full payback period may be as short as 2 to 3 years, depending on the condition and

while the wall's vapour permeability is maintained, improving indoor comfort. Buildings become less costly to heat and cool, healthier, and more environmentally friendly.

use of the building, while BAUER product technology guarantees the full functionality of the system for decades.

Outstanding durability over time and resistance to environmental exposure

All THERMOKAPA system materials are the result of continuous research, combining the highest quality raw materials with BAUER's know-how and production capabilities in order to ensure outstanding durability and quality.

1 KAPA 11 / ECOFLEX

Adhesive materials for the installation of the boards, with particularly high adhesion and bonding strength for maximum safety.

2 BAUTHERM WHITE & GRAPHITE

Expanded polystyrene boards certified for use in dedicated external thermal insulation systems.

White ($\lambda=0,036 \text{ W / m} \cdot \text{k}$)

Graphite ($\lambda=0,032 \text{ W / m} \cdot \text{k}$)

3 KAPA 11 / ECOFLEX ORGANIC

Organic and inorganic reinforcing base coats for embedding fiberglass mesh.

4 BAUMESH 160

High-strength reinforcing fiberglass mesh specially designed for the THERMOKAPA system, resistant to alkalis and moisture.

5 MONOKAPA F / MONOKAPA R / KAPAFLEX F / KAPAFLEX COARSE / KAPASIL F / GRANULATO

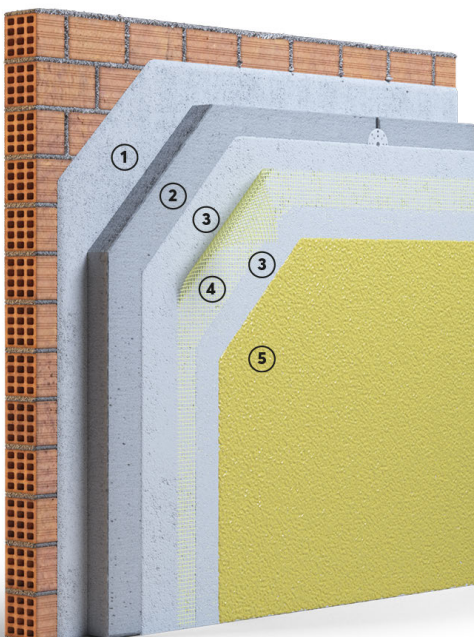
Ready-to-use decorative organic elastic acrylic-based renders with outstanding resistance to cracking, moisture, dirt and fungi.

The BAUER system is based on expanded polystyrene or graphite-expanded polystyrene insulation boards, providing excellent thermal insulation, very good breathability of the building envelope, outstanding resistance to stress, and long-term stability for many decades. All products are designed to withstand the daily stresses placed on exterior walls, offering maximum resistance to cracking and impact.

Through the use of special self-extinguishing polystyrene, completely non-combustible inorganic adhesives and base coats, and finish coats that do not contribute to fire spread, classified A2-s1,d0 according to EN 13501-1, the system provides a very high level of safety and is ideal both for new buildings and for the renovation of existing ones.



ΑΚΑΥΣΤΟΣ



BAUER Guarantee

BAUER expertise

55 years of experience

The highest material quality
and technical excellence

CE marking on the system
and the products

ETA certification
(European Technical
Approval)

Outstanding durability,
unique elasticity, exception-
al resistance to impact and
cracking

Complete freedom in final
colour shades and surface
texture

Continuous development of
materials and construction
methods for greater durabil-
ity and economy



All the advantages in one system

OUTSTANDING STRENGTH AND LONG SERVICE LIFE

Designed by BAUER to
protect the building from
all environmental factors
for many decades.

ENERGY SAVING

The most reliable in-
vestment, with guaran-
teed long-term benefit
throughout the life of the
building.

OUTSTANDING PRO- TECTION AGAINST MOISTURE AND MOULD

High water resistance
and excellent breath-
ability ensure walls free
from condensation and
mould.

MAXIMUM PROTEC- TION AGAINST CRACK- ING

Maximum elasticity,
strength and protec-
tion for many decades,
reducing the expansion
and contraction of
building elements and
limiting crack forma-
tion.

Types of thermal insulation

INTERNAL WALL INSULATION

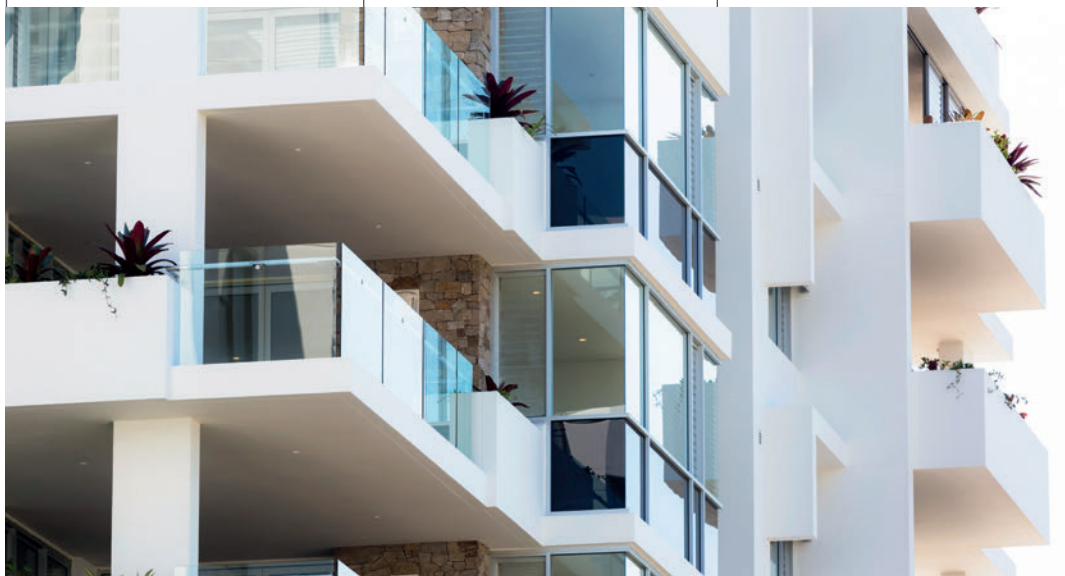
This type of insulation does not alter the external structure of the building, but is installed by placing thermal insulation boards on the internal side of the walls. This solution results in a building which, for example during winter, heats up quickly when the heating system is operating, because only the indoor air is heated and not the building walls. However, the building cools down equally quickly when the heating system is switched off, and therefore it must remain in continuous operation in order to keep the rooms warm. This is due to the low thermal mass of the space, since the walls

remain permanently cold. The main disadvantage of this type of insulation is that it does not eliminate thermal bridges from the external environment. In addition, a careful hygrothermal analysis must be carried out in order to avoid aggravating the problem of moisture condensation on walls exposed to external conditions. This type of insulation requires the rooms to be completely vacated for its installation. Moreover, if a layer is added to the internal surface of the rooms, the usable space is reduced and the position of electrical fittings and radiators must be modified accordingly. A similar type of insulation is achieved by inserting insulation boards within the wall,

where a cavity is formed between a double-leaf wall assembly, namely the external wall and the internal wall. This type increases the thermal mass of the building compared to the previous solution, but produces similar results to the installation of insulation on internal walls; that is, thermal bridges and the associated problems of moisture condensation on the walls are not eliminated.

EXTERNAL THERMAL INSULATION

With the insulation of a building's external walls, all thermal bridges are eliminated and the building's thermal storage capacity is maximised. The walls warm up, accumulate heat and then release it back into the rooms. Similarly, during summer, the walls cool down and subsequently return coolness to the interior space by absorbing heat. This means that the heating and air-conditioning system needs to operate for fewer hours, resulting in lower fuel and electricity consumption and lower pollutant emissions. One of the main advantages of insulating the external walls is that thermal bridges are completely



Proper planning is the basis of a perfect result

eliminated.

In addition, external thermal insulation can be installed without causing disruption to those living or working in the building, and the rooms do not need to be vacated, since the works are carried out on the external wall of the building. It is an ideal solution for facade renovation works, because the creation of thermal equilibrium in the structure reinforces the building against the natural stresses it has undergone, covers and renews the appearance of the building, and prevents the formation of new cracks. Every insulation system must be properly designed in order to perform effectively.

New buildings should be constructed in accordance with the latest building regulations and standards, as well as the geographical conditions. Likewise, the thermal upgrading of an existing building should not be carried out without the assistance of a specialist, who will determine the correct type and dimensions of the thermal insulation system, according to the specific requirements of the building, while complying with the thermal transmittance levels imposed by the applicable regulations. The assistance of authorised experts also allows the

energy certification of buildings. If the required values are calculated during the design stage, the building can be classified according to its energy performance and the actual energy consumption of the heating system during winter and the air-conditioning system during summer, and can be certified accordingly. The European Community has instructed the European Organisation for Technical Approvals to establish guidelines for the verification of the technical aspects of insulation systems through the issued European Technical Approval Guideline ETAG 004, which contains the reference standards for the testing of the

materials constituting the systems. It is important to point out that the design of the system and the expertise of the installation company play a decisive role in the performance of the system, because certain installation details often affect its service life.



Proper installation

1. Substrate

The substrate must be clean, even and capable of bearing loads, and the required curing time of concrete surfaces and renders must have elapsed. In cases where the substrates are unsound, do not have load-bearing capacity, or in multi-storey buildings, full or partial mechanical fixing may be required. In all cases, the flatness of the substrates must also be checked with string lines and the building facade must be levelled at the beginning of the external thermal insulation works, since material consumption, correct installation of the system and the quality of the final appearance depend to a great extent on this factor.



2. Installation of thermal insulation boards

The thermal insulation boards are always installed in a staggered pattern, as in brickwork, including at the corners of the building, and always from bottom to top, ensuring that no open joints remain. The insulation boards are bonded to the substrate using special cement-based adhesives mixed with water. If the substrate is even, a layer of adhesive is applied over the entire back face of the insulation board. If the surface is uneven, the adhesive mortar is applied onto the boards, usually around the perimeter and at spots in the centre of the board, so that it can accommodate irregularities in the substrate. The adhesive must guarantee the fixing of the system for many decades. Proper adhesion can only be achieved if the properties of the adhesive have been correctly specified, if the selected raw materials are of high quality, if the manufacturer uses a certified high-quality production process and, above all, if the adhesive is correctly applied on site using proper techniques and application methods.



3. Mechanical fixing of thermal insulation boards

The mechanical fixing of the insulation boards in position by means of anchors is necessary when they are applied to substrates that are not capable of bearing loads or are weak, deteriorated and not sufficiently bonded to the wall. The arrangement and number of anchors average 4-8 anchors/m² and depend on the substrate, the height of the building and the type of wall. In systems with expanded polystyrene, due to their relatively low weight, the bonding capacity of the adhesive is sufficient. In the rock wool system, mechanical fixing is necessary due to the greater weight of the system.



4. Reinforcement base coat and Mesh installation

The intermediate reinforcing layer, or reinforcing render, is an inorganic- or organic-based coating, using acrylic resins or cement respectively as the binder. Fiberglass mesh is used as reinforcement in order to reduce cracking caused by the high stresses exerted on facades due to thermal variations and the resulting temperature difference between the two sides of the wall. BAUER mesh has an anti-alkaline coating for protection against the high pH levels of the material in which it is embedded. The reinforcing mesh also improves the system's resistance to impact loads. The reinforcing-levelling coat should be applied when the adhesion of the boards has become sufficiently stable. The time required depends on weather conditions and, as a rule, is at least 24 h. A uniform first layer of material, 2-3 mm thick, is applied with a trowel over the installed boards and, while it is still fresh, the fiberglass mesh is placed and embedded into the still-wet render so that it is fully covered.

The fiberglass mesh layers must overlap by approximately 10 cm at the sides and edges in order to ensure stress distribution across the thermal insulation boards and continuity of the system's reinforcement. The quality of the fiberglass mesh, its strength properties and the correct installation method are of vital importance for the durability and service life of the systems. No part of the system should remain unreinforced. After 24 h, a second layer, again 2 mm thick, is applied to smooth and level the surface, forming an additional layer that fully covers and embeds the mesh. At corners and around openings for doors, windows, etc., where stresses from the system are concentrated, additional reinforcement must be provided in order to prevent crack formation, by placing additional mesh pieces diagonally at the openings.

5. Finishing coat

When the levelling coat is completely dry, a primer coat is applied in order to regulate the absorbency of the substrate (only in cases where a cement-based reinforcing coat is used). The finishing coat is then applied using a stainless steel trowel, and the surface is finished by gently rubbing with a plastic float so as to create a uniform texture on the surface of the material.

It should be noted that the colour of the render should have a light reflectance value of at least 20%, because building facades exposed to solar radiation can reach temperatures above 50 °C during the summer, and the use of dark colours should therefore be avoided in order to prevent further aggravation of this condition.



The adhesive is the key component of the system

The ability of the adhesive to resist shear stresses is the property that ensures the long-term safety of the system over many decades.

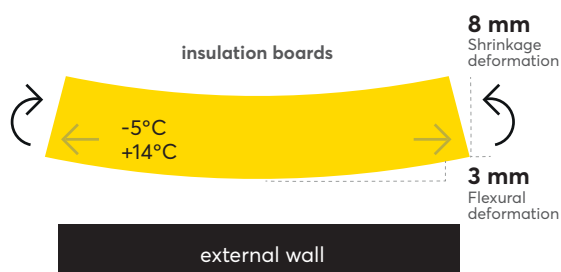
The self weight of the system and the pressure caused by wind usually generate low stresses, which can be easily determined by applying a simple force-balance analysis. However, the higher stresses that develop are due to the deformations caused by the large temperature differences and thermal contrast between the two faces of the insulation board. The figures below provide a graphical illustration of the central role of the adhesive. What occurs on a facade in winter and then in summer is that, during winter, when the external temperature is -5°C and the room temperature is 20°C , the temperature difference between the



two faces of the board exceeds 15°C . These conditions generate forces equivalent to nearly $800\ \mu$ of shrinkage strain and more than 3 mm of bowing deformation, which must be fully accommodated by the adhesive. Similar

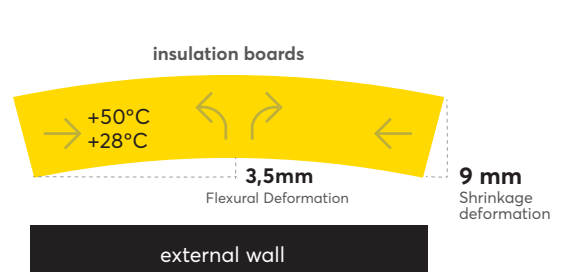
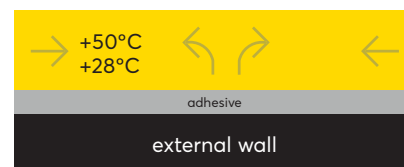
Winter

insulation boards



Summer

insulation boards





assessments can be made when summer conditions are considered, where even higher temperature differentials are observed. BAUER adhesives have been designed and manufactured for such conditions and are capable of guaranteeing adequate levels of performance. A continuous layer of adhesive, applied after careful examination of the flatness of the substrate, can prevent serious problems; however, the widely used method of applying adhesive around the perimeter and at spots creates a high level of stress where the adhesive is present, and it is therefore even more important, for effective installation, to use adhesives with excellent performance characteristics that will provide long-lasting bonding. Particular attention must be paid to the working time of the mixes, in order to

ensure optimum adhesion of the boards, as well as to the environmental conditions under which the application is carried out. The installation of the boards, and especially graphite polystyrene boards, which absorb solar radiation because of their colour, must be carried out under shaded conditions in order to minimise, as far as possible, deformation of the boards due to surface temperature differences during the first hours after bonding, when the adhesive has not yet fully developed its bonding strength. Any gaps and joints must be filled either with pieces of insulation material or with special polyurethane foam. After completion of the installation of the expanded polystyrene boards, the surface is levelled using special rasping tools so that it is finally rendered perfectly smooth and even.

Impact resistance, breathability, long-term durability

1. EPS insulation boards

The quality of the insulation material is of particular importance for the dimensional stability of the boards and for the reliability of the thermal insulation coefficient.

Only boards that have been declared by the manufacturer as suitable for the intended use should be used. The CE certification of thermal insulation materials must specifically refer to their use in External Thermal Insulation Composite Systems (ETICS), since, according to the ETA (European Technical Approval) certification of the systems, only these boards are safe for use as part of a certified system.

2. Why expanded polystyrene?

Expanded polystyrene boards are the No. 1 most widely used thermal insulation material worldwide. International experience from markets with a long history and extensive knowledge of the technical requirements for the use of external thermal insulation systems worldwide clearly shows that expanded polystyrene is the No. 1 most widely used thermal insulation material. It is used in more than 80% of external thermal insulation systems worldwide, while in Europe in particular, the market share of expanded polystyrene in external thermal insulation systems for buildings exceeds 85% on average, followed by rock wool boards, which account for approximately 12%.

3. Greater impact resistance and durability of external thermal insulation systems

A major issue for building users is the strength and durability of the external surface of external thermal insulation systems. The technical and mechanical properties required of the thermal insulation material for safe, easy and reliable use in external thermal insulation systems are fully met by expanded polystyrene boards and, in fact, due to the increased elasticity of the material, their use reduces the risk of cracking in renders caused by the expansion and contraction of materials and structural elements. In addition, the superior elasticity of EPS, combined with the excellent adhesion that expanded polystyrene boards provide to the renders of external thermal insulation systems, ensures excellent compatibility between the insulation material and the renders, so that even under extreme mechanical stresses (heavy impacts, expansion and contraction due to severe thermal shock, etc.), adhesion remains strong and the insulation-render system performs optimally and elastically, absorbing severe impacts without detachment or cracking. This protective behaviour could not be achieved with the use of rigid insulation materials such as extruded polystyrene boards (XPS), because, due to the increased stiffness and hardness of the material, impacts and expansion-contraction stresses are transferred more violently to the renders, owing to the inability of the thermal insulation material to absorb the mechanical energy.



4. Breathability

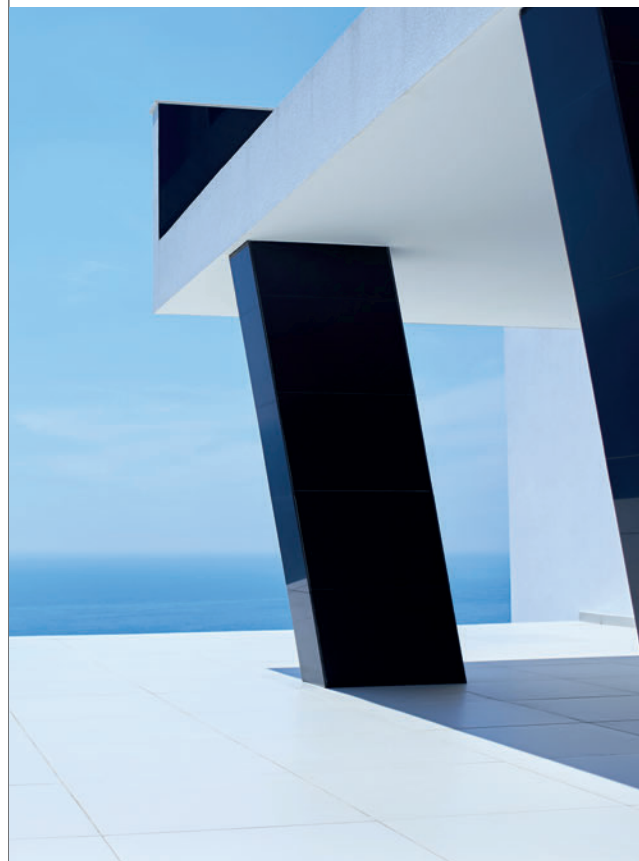
The breathability of a material is its ability to allow the diffusion of water vapour and is measured by the vapour diffusion resistance factor " μ ". The vapour diffusion resistance factor of air is $\mu = 1$. The lower the " μ " factor of a material, the better its breathability and, consequently, the lower the risk of dew point formation (moisture condensation) on the internal surface of the building. With the implementation of the new European Directive 31/2010/EU concerning the mandatory construction of buildings with controlled ventilation, the requirement for breathable materials has become particularly important.

Expanded polystyrene has a vapour diffusion resistance factor ranging from μ 20 to μ 70, depending on its density, making it the most suitable solution for external thermal insulation systems. Research carried out by the Joint Research Centre (JRC) of the European Commission on indoor air quality concluded that indoor air pollution may be from 2 to 3 times worse than outdoor air pollution. The indoor microclimate, in combination with chemical pollution, has

a significant impact on the quality of the spaces in which we live and, consequently, on our well-being. According to estimates by the World Health Organization, 20% of the population of the western world has been affected by Sick Building Syndrome (headaches, nausea, irritation, an increasing number of allergic reactions and cases of asthma among children and young adults), for which the low quality of chemically based building materials and the insufficient breathability of buildings are considered responsible. The use of environmentally friendly materials that do not release polluting substances and have a natural breathability capacity can contribute to an indoor microclimate with high energy performance, meeting the need for a living environment closer to nature and ensuring immediate comfort and good living conditions.

5. Retention of technical characteristics

According to European Standard EN 13164 concerning the durability of thermal resistance with regard to ageing and degradation, the thermal conductivity of EPS products does not change over time, whereas the thermal conductivity of XPS and rock wool products may change over time.





KAPA 11 / ECOFLEX

Fibre-reinforced, cement-based adhesives and reinforcing renders for the installation of thermal insulation boards of expanded and extruded polystyrene, rock wool, etc. on building facades and floors.

KAPA 11 and ECOFLEX provide outstanding adhesion, high resistance to shear stresses and guarantee adequate performance levels for many decades. The same materials are also used for covering the boards in combination with the application of the special fiberglass mesh, serving as an anti-cracking reinforcing render and as a base coat for the finishing render in external thermal insulation systems. They are characterised by zero slip and a long open time.

Form: Cement-based mortar

Consumption:

As adhesive $\approx 2,0 - 4,0 \text{ kg/m}^2$

As reinforcing render $\approx 1,3 - 1,5 \text{ kg/m}^2 / \text{mm}$

ECOFLEX ORGANIC

Fibre-reinforced, 100% acrylic, elastic anti-cracking reinforcing render for coating thermal insulation boards of expanded and extruded polystyrene, rock wool, etc. on building facades.

Ecoflex Organic is applied in combination with the special alkali-resistant BauMesh 160 fiberglass mesh and provides outstanding adhesion, high mechanical resistance to impact stresses, and guarantees adequate performance levels for many decades. It is an ideal base coat for the finishing render in external thermal insulation systems. It is characterised by high elasticity and resistance to moisture.

Form: Ready-to-use paste

Consumption: $\approx 1,5 \text{ kg/m}^2 / \text{mm}$

BAUTHERM WHITE

Expanded polystyrene

BAUTHERM GREY

Graphite expanded polystyrene

Certified boards for use specifically in External Thermal Insulation Composite Systems (ETICS), CE-marked and available in various thicknesses.

Consumption: $\approx 1 \text{ m}^2 / \text{m}^2$



BAUMESH 160

High-strength fiberglass mesh made of 100% glass fibre, with a protective coating of special polymers against alkaline attack, for the total or partial reinforcement of renders and waterproofing layers.

Specially designed for the external thermal insulation system. It provides significant structural reinforcement and prevents cracking caused by thermal expansion and contraction and impact stresses.

Mesh opening:

4,5 x 4,5 mm. ± 0.2

Weight (g/m²) :

Raw net 160 g/m² $\pm 5\%$

Coating (g/m²) :

26 g/m² $\pm 5\%$

Consumption: $\approx 1,1 \text{ m}^2 / \text{m}^2$

PRO 101

Primer for paints and coloured renders with high penetrating ability.

It provides an ideal substrate for coloured acrylic renders and elastic coatings such as Kapalux, Monokapa, Granulato and Plaster Fin. It is suitable for porous substrates such as base coat renders, concrete, bricks, aerated concrete, cement-based adhesive layers, cement mortars, etc.

Form: Acrylic emulsion

Consumption: $\approx 0,1 - 0,2 \text{ kg} / \text{m}^2$

MONOKAPA FLEX / KAPAFLEX

Elastic, decorative organic render. Ready for use, available in an unlimited range of colours and in various final surface texture options.

A 100% acrylic coating that provides excellent adhesion, outstanding resistance to solar exposure, high crack resistance, excellent resistance to water and moisture, and high resistance to dirt, algae and fungi, while allowing the building elements to breathe.

KAPASIL

Silicone-based, elastic, decorative render with pronounced hydrophobic and self-cleaning properties. Ready for use in an unlimited range of colours.

Kapasil render provides particularly high resistance to water and moisture, excellent adhesion, outstanding resistance to solar exposure, high crack resistance, and excellent resistance to dirt, algae and fungi, while allowing the building elements to breathe.

Consumption: $\approx 1,8 - 4 \text{ kg/m}^2/\text{mm}$ depending on grain size

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EN 998-1



EN 15824



EN 13163



EN 13249

The Technical Assessment Body issued the ETA designed according to Article 29 of Regulation EU No 305/2011 by the Evaluation Report and European Technical Assessment with the No ETA 14/0183, ETA 21/0237, ETA 21/028 under the trade name BAUER THERMOKAPA, BAUER THERMOKAPA G and BAUER THERMOKAPA MINERAL respectively.



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