Wall Insulation

Neopor® in the web: www.neopor.de
Quality Products from BASF—The Benchmark in Thermal Insulation for Over 50 Years

**Styropor®**—Behind this name lies a success story that is everyone’s goal. BASF discovered a classic over 50 years ago in expandable polystyrene (EPS). Under the tradename Styropor, EPS is now the solution for efficient insulation and safe packaging worldwide.

**With Neopor®,** BASF has taken the classic Styropor a step further. This new material for modern insulating materials is foamed just like Styropor and processed into boards and molded parts.

**The vital difference** can be seen with the naked eye in the silver-gray color. In Neopor, graphite is added to the material, absorbing and reflecting heat radiation and improving the insulating performance of EPS by up to 20 percent.

**Products made from BASF’s Neopor** are an economic investment in the future and add to the value of a property.
Small, Round, Black—
One Material, Many Applications

Neopor® is composed of small black beads of polystyrene (EPS) containing blowing agent, which makes it expandable. BASF produces this unique material, which is processed by foam manufacturers into insulating materials for a wide range of different applications.

These black beads are foamed by converters on conventional EPS machines and processed into silver-gray foam blocks and molded parts with up to 20 percent better insulating performance than conventional EPS. The blocks are then cut into boards of different thicknesses.

Neopor insulating materials offer greater insulating performance and up to 50 percent lower use of materials than conventional EPS, helping environmental conservation and saving money. Environmentally friendly Neopor insulating materials contain air as cell gas, which guarantees the preservation of the thermal conductivity throughout the life of the construction.

Neopor insulating materials therefore represent a modern, environmentally aware lifestyle. We call it: "Innovation in Insulation."
Exterior Walls with Insulating Materials Made of Neopor®—Promoting Comfort and a Good Living Climate

Neopor® insulating boards are the most used gray facade insulating boards in Europe. More than ten million square meters per year are testimony to the success of this quality product from BASF.

Exterior walls should keep heat inside the building when exterior temperatures are low, and protect against the penetration of summer heat at the same time. The exterior insulation provides for sufficient thermal insulation within the wall structure and protects against runoff and penetrating warmth, and makes the wall construction a thermally active component.

**Promoting comfort and a good living climate**

Well-insulated exterior walls can actually raise the surface temperature on the inside. This is how insulation makes a contribution to the comfort and well-being of the inhabitants. In the case of exterior wall constructions with U-values of up to 0.35 W/(m²·K), the surface temperature is only one degree lower than the room temperature. At a room temperature of 0°C [68°F], the temperature on the wall surface is 19°C [66.2°F] and about 14°C to 15°C [57°F to 59°F] in the outer corners. As a result, no condensation is formed, even if the humidity is high at times.

**Exterior Wall Construction**

The type of exterior wall construction employed can be a function of architectural, functional, financial, or cultural considerations. In principle, it is possible to insulate a building from the outside or from the inside.

Two of the most widespread methods are thermal insulation composite systems in the case of single-leaf walls, and core insulation in the case of cavity masonry. Interior insulation is used in buildings with facades that have to be retained or in which exterior insulation is not possible. In back-ventilated curtain walls, the thermal insulation contributes to the functional reliability. Alternative construction systems, such as formwork elements and post and beam constructions, combine optimal thermal insulation properties with shorter construction times for the carcass of the building.

For new constructions and for renovation work, Neopor® insulating materials can be used in virtually any wall structure.
Ecoefficiency with Neopor®

The ecoefficiency analysis looks at products and processes from both the economic and the ecological point of view. The result of an evaluation of this nature, in the example of the thermal insulation composite system (ETICS) with a U-value of 0.29 W/(m²·K), is shown in the diagram. The major advantage of Neopor® insulating boards lies in the reduction of up to 50 percent in the use of raw materials, generating savings in terms of costs and resources, which in turn reduces the impact on the environment. Compared with alternative products, Neopor insulating materials bear economic advantages with lower environmental impact and therefore offer ecoefficient insulating solutions for up-to-date thermal insulation.
Exterior Insulation (ETICS)

Thermal insulation composite systems are a highly suitable and cost-effective type of thermal insulation for new construction and renovation projects. This type of insulation protects the load-bearing inner shell or the existing exterior wall against thermal loads and it also provides protection against the weather. Moreover, thinner exterior walls in new buildings can provide more living space.

Better thermal insulation
External thermal insulation composite systems (ETICS) with the high-performance insulation material Neopor® achieve an insulation level up to 20 percent higher than conventional EPS. Depending on the design, savings of up to 50 percent on heating costs can be achieved.

Reduced space requirements
In the day-to-day working environment, thinner insulation boards mean smaller transport volumes and smaller storage areas at the building site and on the scaffolding.

Thinner wall construction
Older buildings often front directly onto sidewalks or streets, which means that the permissible wall thickness or thickness of the insulation material in a renovation may be limited to a certain size. Neopor allows ETICS with the same insulation level to be constructed at a lesser thickness level.

Less material used
Because of the smaller thickness of an external thermal insulation composite system (ETICS) with insulation boards made of Neopor, it is not necessary to use special long wall plugs or extra-wide baseboards and windowsills. This saves costs on expensive special fixings for thick insulation layers.

Easy to use
Thinner insulation boards made of Neopor can be cut to size more easily and quickly. Because of the comparably low weight, the panels can be installed more easily by hand.

Glare-free working
People who work with classic external thermal insulation composite systems (ETICS) will be familiar with the problem of heavy sun glare from the bright white EPS panels. The silver-gray insulation boards made of Neopor reflect the sun’s rays significantly less and eliminate sun glare for construction workers.

Permanently secure
Insulation materials made of the expandable polystyrene (EPS) granulate Neopor are resistant to aging and decay, and also extremely firm and dimensionally stable. Thanks to these material properties, the ETICS with Neopor provides long-lasting and permanently secure thermal insulation.

Sustainability
ETICS conserve fossil fuels by saving heat energy. They also reduce emissions of CO₂, which is harmful to the environment. In comparison with conventional EPS, 50 percent less raw materials are used for the production of insulation boards made of Neopor.

Short payback period
The material and processing costs for an external thermal insulation composite system (ETICS) always pay for themselves. The payback periods for the additional costs amount to just a few years, depending on the building type and ETICS. The higher the energy costs, the shorter the calculation periods. With the efficient high-performance insulation material Neopor, the potential savings increase accordingly.

Higher real estate value
An external thermal insulation composite system (ETICS), specifically one with Neopor, increases the resale value of a property and, in general, increases the chances of sale or leasing.
General Instructions for Application and Processing—Exterior Insulation (ETICS)

Preliminary work
Before the exterior insulation with insulating materials made of Neopor® is installed, the load-bearing capacity of the substrate has to be checked. The wall must be dry. The existing stucco has to be free of cavities, and any loose pieces must be removed. Highly absorbent or sandy substrates must be primed.

Bonding and installation
The insulating panels made of Neopor are fastened to the masonry by means of adhesives, dowels, or rail mounts. The panels should be installed from the bottom to the top so as to be tightly abutting and arranged in a masonry bond (avoid intersecting joints). Dovetail joints should be made in the panels at all corners of the building. Care must be taken to ensure that the surface is vertically and horizontally flat. Small irregularities can be corrected by applying adhesive, and protruding panel edges can be subsequently smoothed.

Cutting
Fitted pieces for soffits or cut pieces for windowsills can be dimensioned precisely and quickly using a hot wire.

Reinforcement and stucco
In order to avoid cracks and to mechanically protect the facade, a reinforcement of the surface is needed on inside as well as outside areas. It consists of a reinforcement compound and a corresponding reinforcement fabric. After sufficient drying, the outer coating is applied in the form of a suitable and system-compatible finishing plaster or final coat.

Approval and quality assurance
Only external thermal insulation composite systems (ETICS) approved in accordance with the European Technical Approval Guideline - ETAG 004 may be used. Certificates for the use and application of these systems are available from the relevant system manufacturers.

Fire protection
Neopor insulating materials are produced in accordance with the requirements of European standard EN 13163 and are categorized in Euroclass E in accordance with EN 13501-1 and B1 in accordance with DIN 4102.

Insulation boards made of Neopor meet the fire safety guidelines for the window lintel even without protective strips. The material in the lintel area does not need to be changed.

Note
Do not place facade insulation boards in direct sunlight, particularly when still in their packaging. If this is unavoidable, the top panel must be set aside and you must continue working with the panels stored below. Do not affix insulation boards to hot exterior walls—it is common practice to affix the boards in the opposite direction to the movement of the sun. Safety or shading nets can also be used to prevent the wall construction from becoming too hot. Always follow the manufacturer’s specifications for adhesives (correct binding agent and quantity)!
Internal thermal insulation achieves very good insulation results for new construction or renovation work wherever external thermal insulation is not an option. Spaces that have to be heated up quickly or only for brief periods of time definitely benefit from interior thermal insulation.

- **Rooms heat up quickly**
- **Simple and cost-effective implementation**
- **Improved thermal and sound insulation**

Because of the outstanding thermal insulation properties of Neopor® insulating boards, better insulation performance is achieved with smaller thicknesses than with conventional EPS. This means less valuable interior space is lost.

The additional elasticity brought about by insulating materials made of Neopor can also improve sound insulation.

Two-leaf masonry structures represent a rainproof wall structure even when subjected to heavy loading from driving rain. Insulating materials made of Neopor® can be employed for frost-resistant, back-ventilated masonry as well as purely for cavity insulation that is not back-ventilated.

- **Best thermal insulation effect**
- **Water-repellent without hydrophobing**
- **Low setting behavior with Neopor beads**

In double-wall masonry, the space between the outer frost-resistant masonry shell and the inner load-bearing structure is limited. Owing to the low thermal conductivity of insulating materials made of Neopor, a relatively higher insulating effect can be achieved.

A wall can be retrofitted with cavity insulation by blowing expanded beads made of Neopor into the existing cavities. This provides complete and lasting thermal insulation.
Insulating Concrete Forms (ICF)

Formwork elements made of Neopor® are suitable for all kinds of components that require thermal insulation and ease of processing. They are employed as wall and floor elements for single-family houses as well as high-rise buildings. Enormous potential savings are available to do-it-yourselfers.

- **No thermal bridges**
- **High degree of thermal insulation**
- **Simple and fast handling**

Formwork elements made of Neopor make it possible to build and insulate exterior walls at the same time. The elements are available in various wall thicknesses and designs—for example, lintel elements that are free of thermal bridges, floor surrounds, roller shutter housings, or cantilevers.

Thanks to their good thermal-insulating properties, formwork elements made of Neopor are well-suited for the construction of low-energy and passive houses.

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Insulation behind Curtain Walls

Back-ventilated curtain walls consist of a substructure, insulating material, an air layer, and facade covering. They are used for design reasons and also because of safety considerations of a technical nature. The exterior walls can be tailor-made to match the characteristics of a given building.

- **Outstanding insulation performance**
- **Permanently dry thermal insulation**
- **Licensed systems**

The two-layer system of a back-ventilated curtain wall systematically separates the functions of weather protection and insulation. The insulation can be used in any desired insulating material thickness. U-values are thus achieved that are suited to low-energy and passive houses and comply with the current energy saving regulations.

Thanks to its outstanding insulating capacity, Neopor® is the material of choice for use in this facade system.
Passive Houses with Exterior Insulation Made of Neopor®

It is possible to combine modern architecture, high comfort, and low energy consumption. This has been demonstrated by Anliker AG based in Lucerne, Switzerland. In the Konstanz neighborhood of Rothenburg/Lucerne, this company built the first multi-family houses in Switzerland that meet the passive house standard, winning first prize in the Swiss Building Competition awarded by the Solar Agency Foundation. With its contribution of the Neopor® insulating material, BASF is part and parcel of this success.

This expandable polystyrene insulates the facades of all buildings in this neighborhood. In the loft houses, a 30 cm thick layer of Neopor is applied onto the 15 cm thick masonry. In the case of the apartment complexes, the more compact building design means that a 24 cm thick layer of insulating material is sufficient. Using this and other measures, the heating energy consumption was lowered by 90 percent in comparison with conventionally built houses.
## Technical Data Neopor®

<table>
<thead>
<tr>
<th>Properties</th>
<th>Unit</th>
<th>Key EN 13163</th>
<th>Key Features of Neopor® Insulating Materials</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity, $\lambda_{\text{D}}$</td>
<td>W/(m·K)</td>
<td>–</td>
<td>EPS 70: $\geq 0.031$</td>
<td>EPS 100: $\geq 0.030$</td>
</tr>
<tr>
<td>Thermal conductivity, rated value</td>
<td>W/(m·K)</td>
<td>–</td>
<td>EPS 70: $\geq 0.032$</td>
<td>EPS 100: $\geq 0.031$</td>
</tr>
<tr>
<td>Compressive stress at 10% compression</td>
<td>kPa</td>
<td>CS(10)</td>
<td>EPS 70: $\geq 70$</td>
<td>EPS 100: $\geq 100$</td>
</tr>
<tr>
<td>Tensile strength perpendicular to panel surface</td>
<td>kPa</td>
<td>TR</td>
<td>EPS 70: $\geq 100$</td>
<td>EPS 100: $\geq 150$</td>
</tr>
<tr>
<td>Flexural strength</td>
<td>kPa</td>
<td>BS</td>
<td>EPS 70: $\geq 115$</td>
<td>EPS 100: $\geq 150$</td>
</tr>
<tr>
<td>Shear strength</td>
<td>kPa</td>
<td>$\tau$</td>
<td>EPS 70: $\geq 35$</td>
<td>EPS 100: $\geq 60$</td>
</tr>
<tr>
<td>Dimensional stability 48 h, 70°C</td>
<td>%</td>
<td>DS(70,-)</td>
<td>EPS 70: $\leq 1$</td>
<td>EPS 100: $\leq 1$</td>
</tr>
<tr>
<td>Deformation behavior 48 h, 20 kPa, 80°C</td>
<td>%</td>
<td>DLT(1)5</td>
<td>EPS 70: $\leq 5$</td>
<td>EPS 100: $\leq 5$</td>
</tr>
<tr>
<td>Deformation behavior 168 h, 40 kPa, 70°C</td>
<td>%</td>
<td>DLT(2)5</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Water vapor diffusion resistance index $\mu$</td>
<td>–</td>
<td>–</td>
<td>20–40</td>
<td>30–70</td>
</tr>
<tr>
<td>Thermal linear deformation coefficient $K^1$</td>
<td>–</td>
<td>–</td>
<td>$60–80 \times 10^6$</td>
<td>$60–80 \times 10^6$</td>
</tr>
<tr>
<td>Fire behavior</td>
<td>Euroclass</td>
<td>–</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Chemical resistance</td>
<td></td>
<td></td>
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<tr>
<td>Insensitive to water, the majority of acids and alkalis, sensitive to organic solvents.</td>
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<tr>
<td>Biological behavior</td>
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<tr>
<td>Insensitive to microorganisms. Does not rot or decompose. Chemically neutral, not water-soluble. No harmful effects on health known.</td>
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</table>

**Note**

The technical and physical key data given in the table are standard values for insulation materials made of Neopor®. The values and properties may vary depending on the processing. Neopor P is not provided with flame retardant.

* NTA = national technical approval
Information on Neopor®:

- Brochure: Neopor—Innovation in Insulation
- Brochure: Building and Modernizing with Neopor
- Brochure: Wall Insulation
- Website: www.neopor.de
- Neopor: Product sample folder

Note
The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (December 2011)