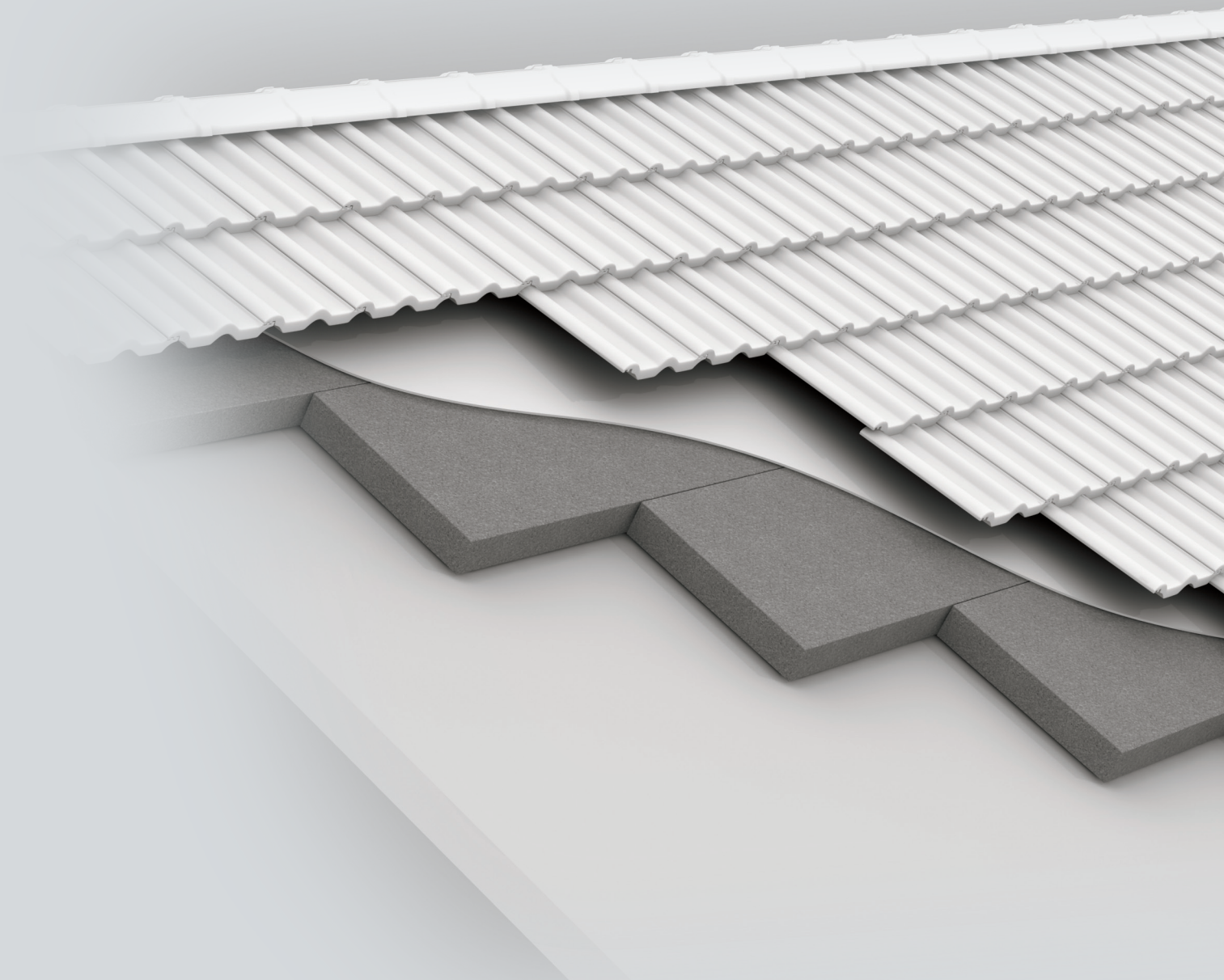


Roof Insulation



Neopor[®] in the web: www.neopor.de

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1930

Patent for the polymerization of monostyrene



1995

Neopor®

Patent for Neopor®



1920 1925 1930 1940 1950 1960 1970 1980 1990 2000 2005

1951

Styropor®

Patent for expandable polystyrene (EPS, Styropor®)



Quality Products from BASF—The Benchmark in Polystyrene 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 to 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®—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.



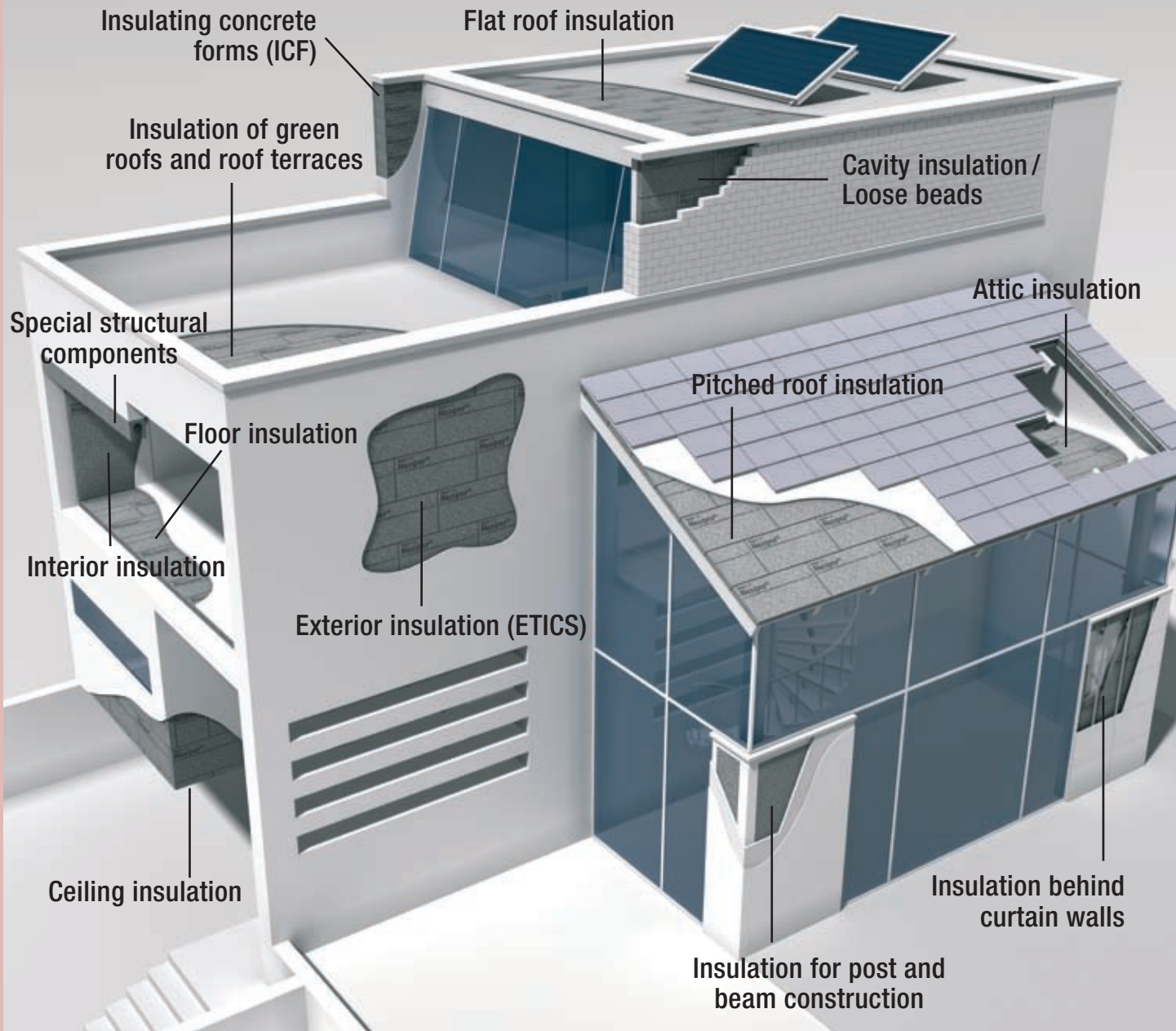
These **black beads** are foamed by converters on conventional EPS machines and processed to silver-gray foam blocks and molded parts with up to 20 percent better insulating performance than conventional EPS. The blocks are then cut to boards of different thicknesses.

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 do not contain CFCs, HCFCs, HFCs, or other halogenated cell gases. They 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."



Neopor® — Innovation in Insulation



Insulation for the Future

Before the backdrop of climate and environmental protection aspects as well as exploding energy prices, thermal protection of buildings has become indispensable.

Excellent thermal insulation of roofs, exterior walls, floors, and basements is the cornerstone of low energy consumption.

When it comes to new construction and the renovation of existing buildings, Neopor® offers ideal insulation solutions for almost all components.



Roof and Ceiling Insulation Using Neopor®

The primary function of roofs is to protect buildings from the effects of weathering. They differ in terms of shape and building or construction type. The type and design of roofs depends on the architecture and purpose.

Improved insulation in the roof

Thermal insulation of external structural components plays a key role in areas of the house, for example, the attic. The quality of the thermal insulating material and the wind- and airtightness of structural components affect energy savings and CO₂ reduction.

New buildings

The type and design of thermal insulation in new buildings depend on the construction and subsequent use of the building. Different levels of thermal insulation for the shell of the building are required based on the purpose of the building and must be fulfilled. They can be implemented simply and economically as a result of the excellent properties of Neopor® insulating materials.

Existing buildings and renovation

Structural extensions or changes associated with floor additions or attic conversions are subject to thermal insulation requirements, depending on the extent of the building activity. Here again, the low thermal conductivity of Neopor insulating materials provides extremely good results.

Roof structures

Pitched or flat roofs can be built in various designs, irrespective of the shape of the roof. A distinction is made between light and heavy styles. Pitched roofs are usually built in light wooden structures and flat roofs in heavy concrete or light metal designs.

Pitched roof

Pitched roofs can generally be fitted with over-rafter or between-rafter insulation, or a combination, as under-rafter insulation.

Flat roof

In conventional flat roofs, insulation is added over the supporting roof construction. The insulating material must be able to permanently withstand the load of the sealing, gravel layers or terracing, green roof systems, and wind suction or snow.

Attic

Energy savings regulations have legally obliged many home owners to carry out insulation improvements on the top floor because these measures always make economic sense. Depending on how the attic is used, the thermal layer can be designed with or without a surface capable of withstanding foot traffic.



Pitched roof insulation



Flat roof insulation

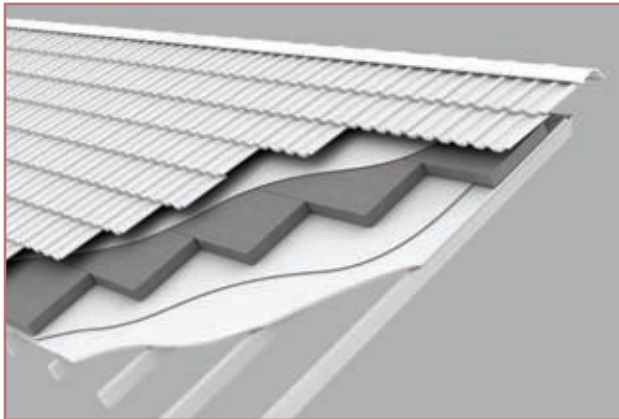


Loft insulation

Applications:

- Above-rafter insulation
- Between-rafter insulation
- Under-rafter insulation
- Insulation of solid pitched roofs
- Insulation on solid flat roofs
- Sloping roof insulation
- Insulation of green roofs and roof terraces
- Insulation of industrial roofs
- Insulated roofing elements

Above-rafter insulation

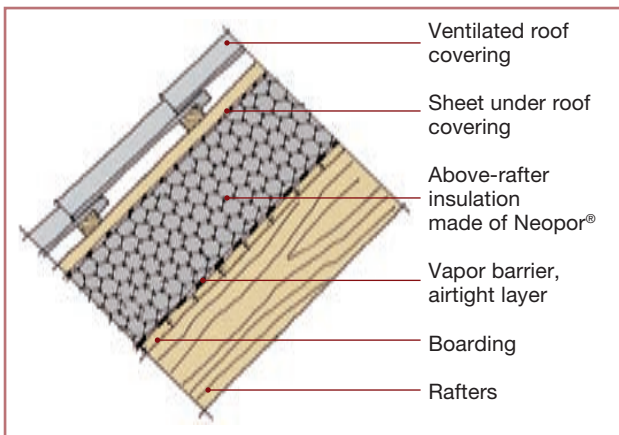


Above-rafter insulation implies that the insulation is laid over the roof rafters. Neopor® insulation boards form a homogeneous, full-surface thermal insulation layer free of thermal bridges.

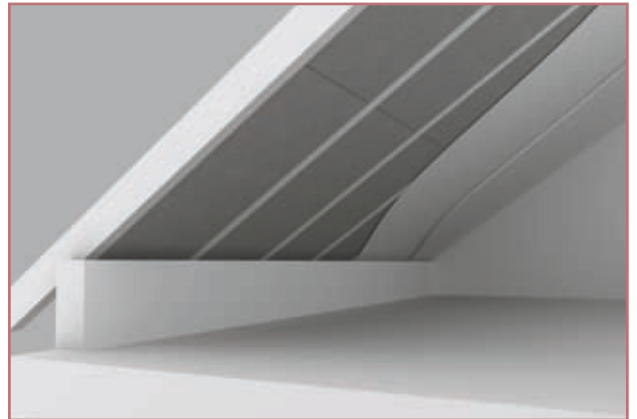
- Excellent insulating performance
- Low weight
- Simple design
- Can be used for new and existing buildings

In new buildings, rafters and boarding on the underside can remain exposed. An airtight plane (vapor barrier) can be installed underneath the insulation layer with relative ease.

In the case of renovations, above-rafter insulation is a good idea if a new roof covering becomes necessary and the rooms in the attic have already been constructed or are inhabited. In above-rafter insulation using Neopor insulating material, the supporting roof construction is protected from major temperature fluctuations.



Between-rafter insulation



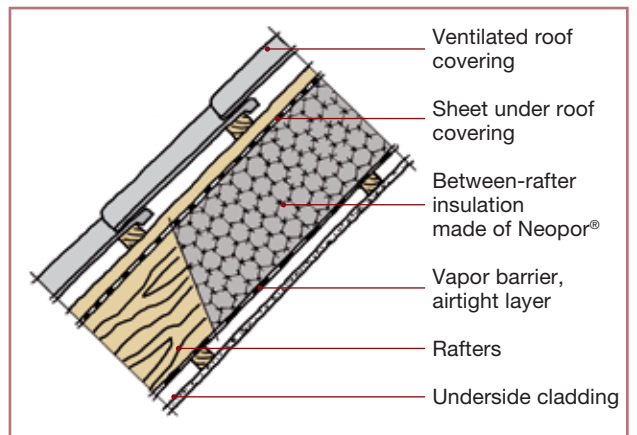
In between-rafter insulation, the Neopor insulating material is wedged between the rafters. This type of insulation provides an efficient solution for energy savings, particularly for a subsequent roof conversion where the thickness of the insulation is restricted by the height of the existing rafters.

- Best insulating effect
- Dust-free installation
- No skin irritation
- Can be installed under existing roofs

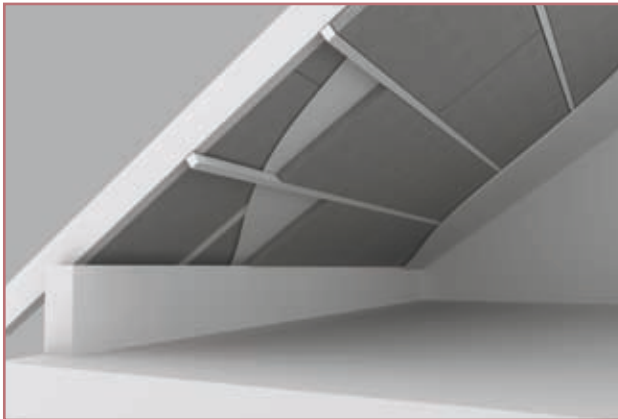
Special longitudinal slits make the Neopor insulation boards flexible and elastic. Accurate fitting between the rafters is thus made possible even if the rafter spacing varies considerably.

Blow-in insulation

In the case of inaccessible hollow spaces in roofs or spaces along the long side, blow-in insulation is a useful option. The foamed Neopor beads are blown into the air space and form durable thermal insulation without any gaps.



Under-rafter insulation

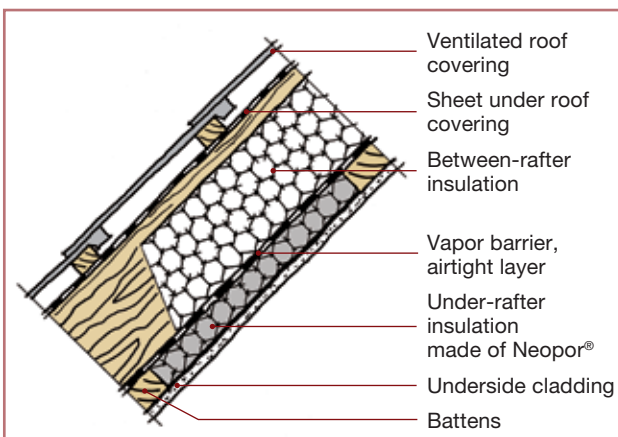


An inexpensive and simple solution for additional attic conversion is under-rafter insulation. In combination with between-rafter insulation, the energy loss through the roof surfaces is significantly reduced.

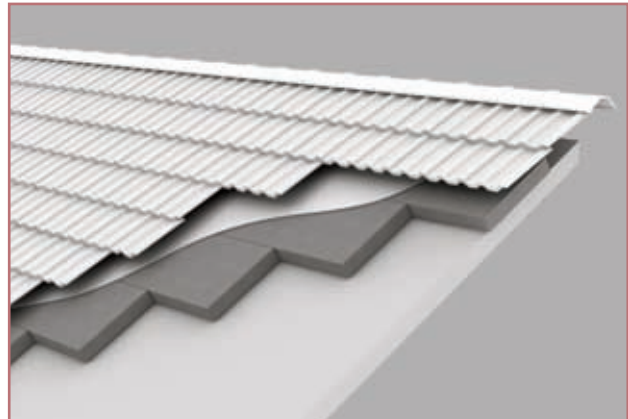
- **Best insulating effect**
- **Dust-free installation**
- **No skin irritation**
- **Reduces heat bridges**

With this type of insulation, the Neopor® insulation boards are installed between transverse laths under the rafters. In under-rafter insulation, the vapor retarder and air-tight layer is fitted between the two layers of insulation.

In this way, Neopor insulation materials create an additional space-saving insulation that, at the same time, eliminates any thermal bridges.



Insulation of solid pitched roofs

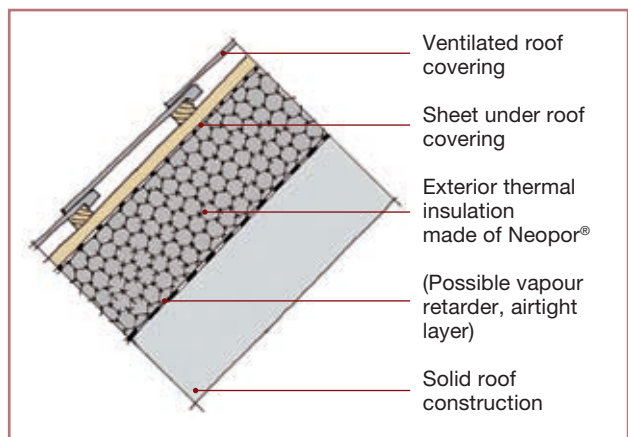


Solid pitched roofs generally consist of concrete or foam concrete. This roof construction with external thermal insulation has a much greater thermal inertia, higher fire resistance class, and better sound insulation properties, compared with other roof constructions.

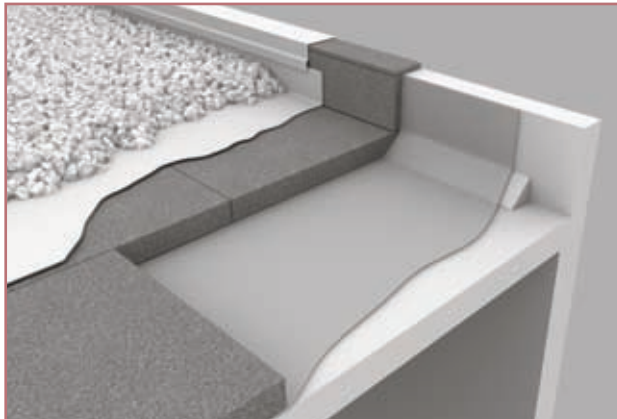
- **Thermalbridge-free external components**
- **High heat storage**
- **Improved acoustic insulation**
- **Good room environment due to external insulation**

Due to the good thermal insulation properties at a comparatively small thickness, excellent thermal insulation results can be achieved by using Neopor insulation materials.

The excellent heat storage of the solid roof ensures an even environment both day and night, especially during the warm summer months.



Insulation on solid flat roofs

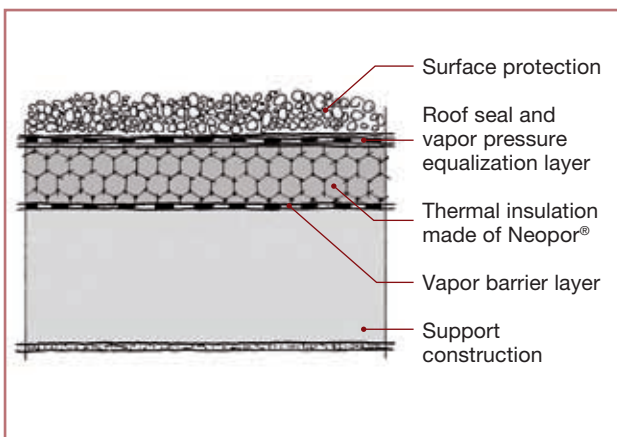


Nowadays, industrial and office buildings, schools, supermarkets, or hospitals are generally constructed with flat roofs. Depending on their construction, a distinction is made between a hot roof (unventilated) or a cold roof (ventilated). The structure and configuration are dependent on its future use.

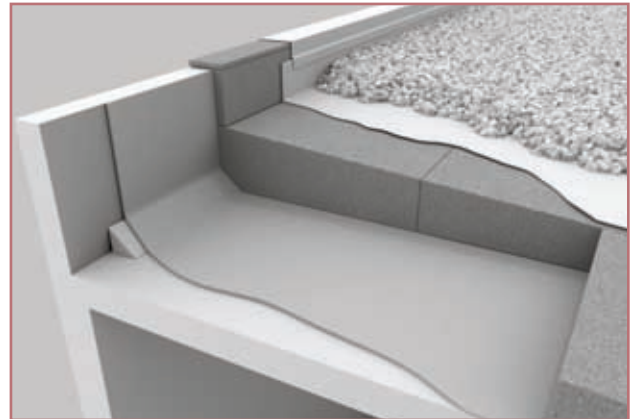
- **Statically advantageous due to low board weight**
- **Good thermal insulation in summer and winter**
- **Long-lived, does not rot**
- **Easy handling**

In the case of flat roof insulation, the insulation material has to meet demanding requirements. The flat roof is subjected to extreme temperature fluctuations because of exposure to the sun's rays and low temperatures. In addition, mechanical stresses occur due to wind, rain, ice, or snow.

To fulfill the exacting requirements that have to be met by qualified thermal insulation for flat roofs, Neopor® insulation boards offer an optimal solution.



Sloping roof insulation

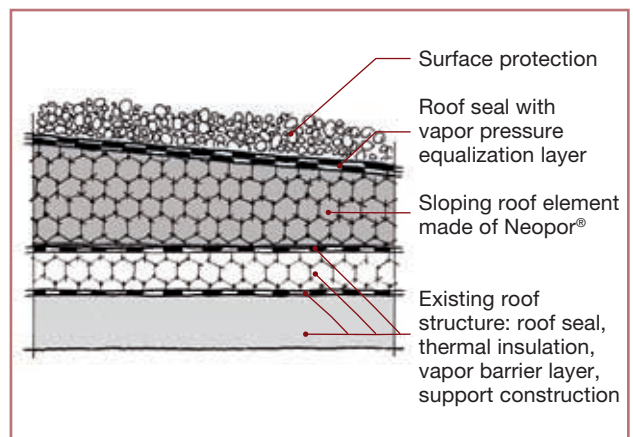


Sloping roof systems ensure that rainwater drains from flat roofs. Roofs without a slope, which retain water over a prolonged period of time, are subjected to considerable loads. As a result, the lifespan of the roof can be significantly shortened.

- **Individually prefabricated roof elements**
- **High compressive strength**
- **Uncomplicated laying**
- **Removal of water from the roof ensured in the long term**

Flat roofs should have a minimum slope of two percent to allow water to run off without causing any damage.

The wedge-shaped Neopor insulation boards enable the incorporation of slopes in newly constructed roofs or in the renovation of flat roofs sloping, while at the same time ensuring efficient thermal insulation. The calculation and cutting to size of the slope boards (wedges and ridges) is processed in the factory with the help of computer control.



Insulation of green roofs and roof terraces

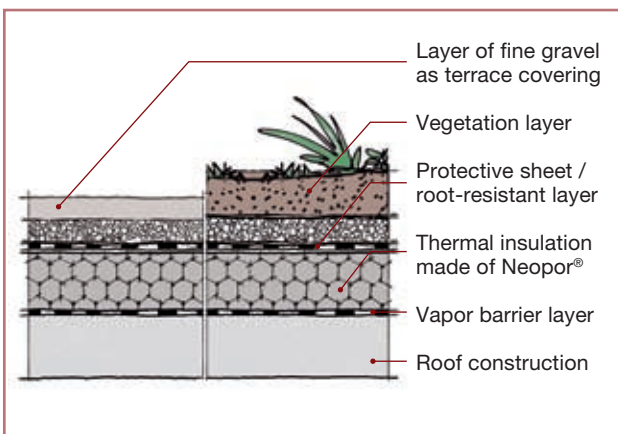


Owing to the diminishing natural areas in cities, vegetated roofs or roof terraces are becoming increasingly popular. The vegetation of green roofs can be divided into extensive vegetation, i. e., vegetation with low-growing plants such as mosses, herbaceous plants, or grasses, and intensive vegetation in the form of roof gardens with shrubs or trees.

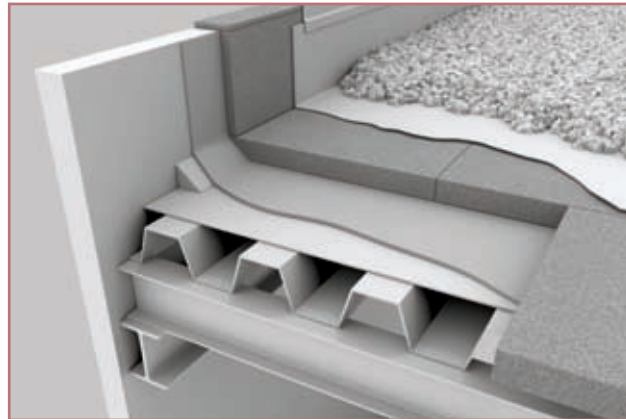
- Resistant to rotting and mold
- Load-bearing and able to be walked on
- Dimensionally stable and aging resistant
- Biologically compatible

In the case of utilized green roof areas, the insulation material is subject to demanding requirements and high stresses. To ensure durability, the boards should be resistant to compressive stress, rotting, and mold, as well as to aging.

Neopor® insulation boards can be installed under terrace coverings as well as in extensively or intensively vegetated flat roof constructions.



Insulation of industrial roofs

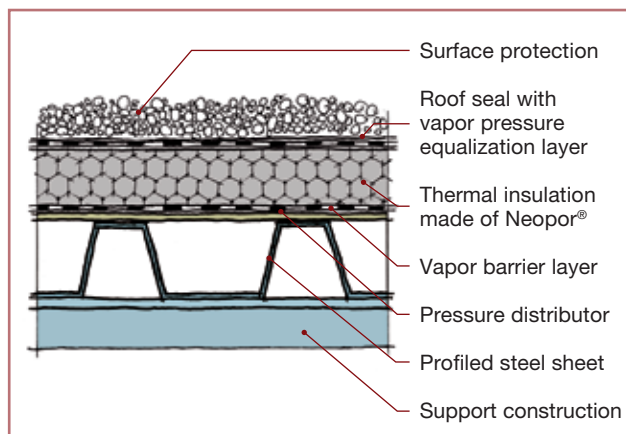


Industrial buildings, commercial buildings, warehouses, sports and exhibition halls, and barns are generally fitted with profiled sheet steel roofs. Their features are low intrinsic weight, low roof pitch, and large spans.

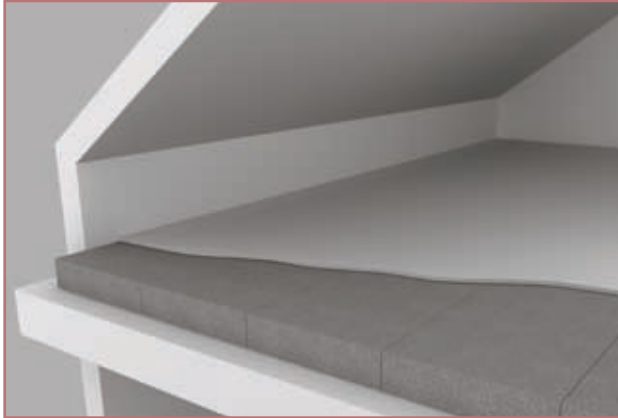
- Low intrinsic weight of the insulation boards
- Low thicknesses with high insulation performance
- High strength
- Long-lived and safe

These lightweight industrial roofs with external insulation are generally unutilized and are walked on only for maintenance purposes. The actual stresses on the roof are limited to snow, rain, and wind.

Neopor insulating materials are well-suited for flat roof coverings because of their physical properties, such as dimensional stability, compressive strength, and low weight, in addition to their excellent insulating performance.



Attic insulation



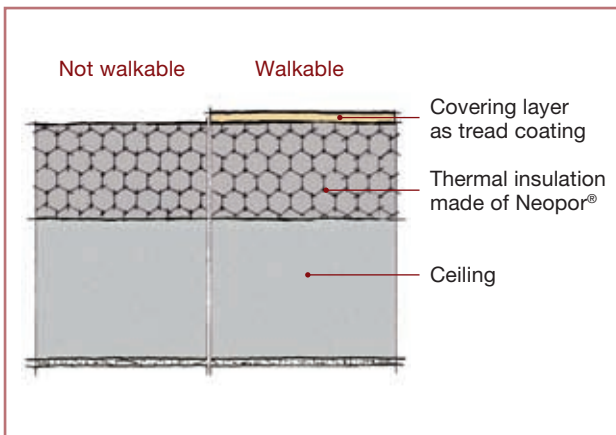
In the case of in addition to insulation of the top floor ceiling can be implemented and effectively with Neopor® insulation materials. The attic is thus thermally separated from the heated part of the building.

- Prevents heat loss through ceiling
- Ease of handling
- Inexpensive installation
- Easy cutting and processing

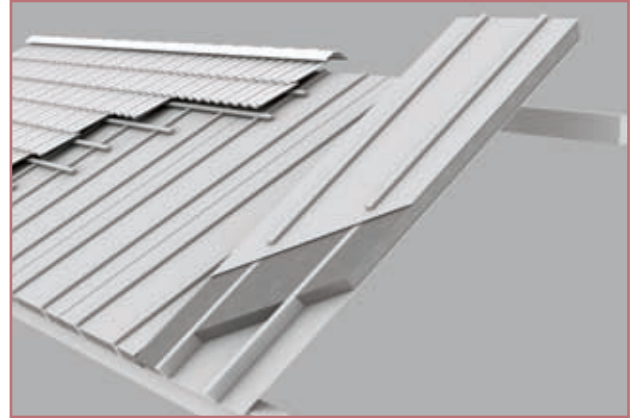
To prevent cold air from flowing under the Neopor insulation boards, close fitting has to be ensured. If the ceiling is to be walked on for storage or maintenance purposes, it is possible to install a covering layer on top, such as loosely laid sheets of chipboard.

Blow-in insulation

For ceilings constructed with wood beams, the hollow spaces between the beams can be insulated by blowing in foamed beads of Neopor.



Insulated roofing elements

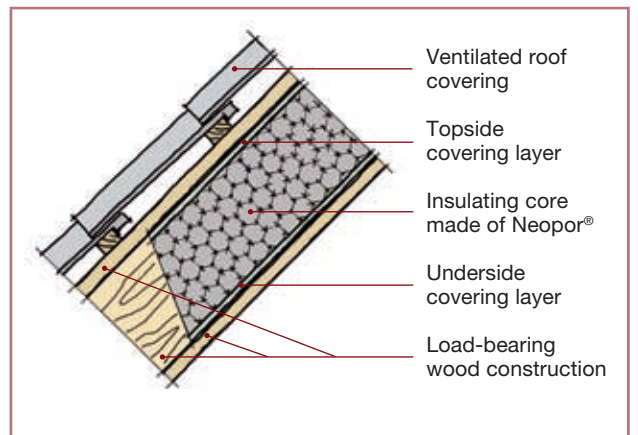


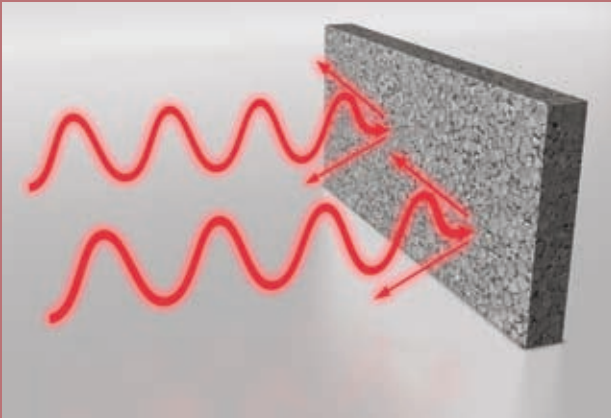
Self-supporting, large-area roofing elements offer a time-saving and economical solution for sloping roofs of dwellings and industrial buildings as well as large agricultural buildings and sports halls. The elements are mostly supplied in cut-to-measure, prefabricated form.

- Ready-to-install insulated roofing elements
- Suitable for large spans
- Quick and simple installation
- Underside with ready-to-inhabit appearance

The self-supporting elements with a core of Neopor insulation material can be produced with hard covering layers of chipboard sheets and finished surfaces on the underside as well as with additionally fitted distance laths. The combination of chipboard sheets, integrated wooden ribs, and an insulating core makes rafters superfluous.

Roof areas including insulation, vapor barrier, moisture protection, and an attractive interior appearance are installed in one operation. The roof is thus weatherproof within a few hours.



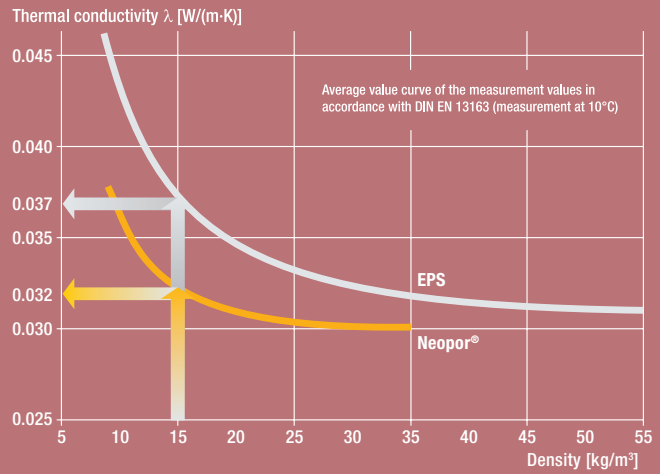


Thermal insulation

The excellent effect of Neopor® insulating materials offers architects, engineers, craftsmen, and builders significant advantages in building practice. The Neopor infrared absorbers or reflectors considerably reduce thermal conductivity, and the heat permeability of the material is lower compared to normal insulating boards.

Fire protection

Neopor insulating materials are produced in accordance with the requirements of European standard DIN EN 13163 and are categorized in Euroclass E in accordance with DIN EN 135011 and B1 in accordance with DIN 4102.



Thermal conductivity

Vastly improved insulating effects can be achieved with Neopor, particularly with very low bulk densities. The diagram shows that Neopor insulating materials with a bulk density of 15 kg/m³ achieve a thermal conductivity of 0.032 W/(m·K), for instance. For normal EPS with the same bulk density, the thermal conductivity is 0.037 W/(m·K).

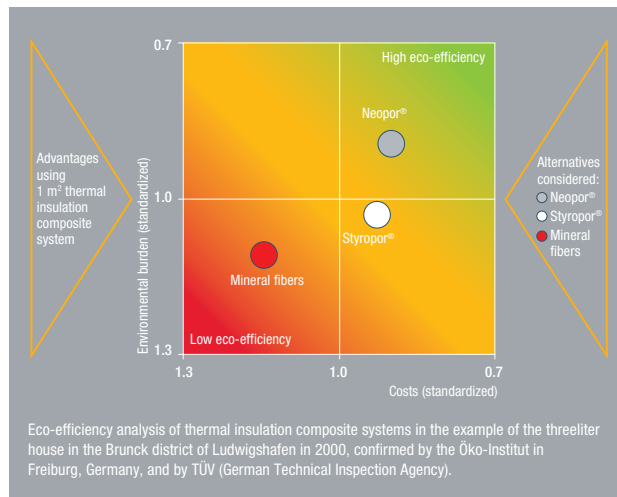
Neopor® insulating materials – sustainable and efficient

The starting material for expanded polystyrene is polymerized styrene. The bead-shaped granules are foamed in various stages to up to fifty times their original volume using water vapor.

Thermal insulation in comparison

The ecoefficiency analysis considers 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 reduced use of material of up to 50 percent, generating savings in terms of costs and resources, which in turn reduces the impact on the environment. Compared to alternative products, Neopor insulating materials bear economic advantages with lower environmental impact and therefore offer ecoefficient insulating solutions for up-to-date thermal insulation.

Compared to conventional EPS, around 50 percent less raw material is used in the production of Neopor insulating boards, offering a demonstrably greater advantage with low environmental impact. Neopor achieves the best results in the ecoefficiency analysis.



Applications and Processing

Between-rafter insulation

Neopor® insulating materials are suitable for thermal insulation between rafters in new buildings and renovations. All areas between rafters can be fitted without any waste using one board size. The insulating board is simply wedged in between.

Cutting Neopor® insulating materials to size

The material is cut to size using a fret saw, crosscut saw, or incandescent wire cutting equipment. Allow approximately one percent of the clear gap between rafters for the "wedging effect" of the Neopor insulating boards.

Installing from bottom to top

The Neopor insulating boards bend easily and are packed between the rafters. They can be installed without generating dust or causing skin irritation.

Tongue-and-groove design for a smooth fit

The boards are tapped from below using a piece of squared timber and a hammer until the tongue and groove fit together smoothly.

Airtight fit

A vapor retarder film is fitted under the Neopor insulating boards on the room side to ensure that the roof is air- and wind-tight.

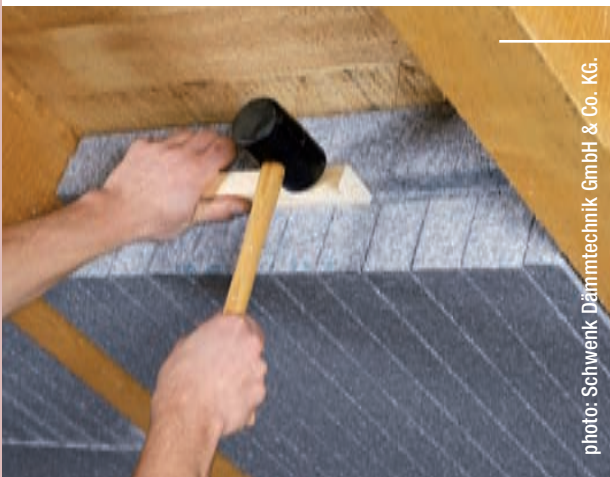


photo: Schwenk Dämmtechnik GmbH & Co. KG.

Install the boards to give a tight fit

A light tap with a hammer and the joints fit smoothly.

Wedge to give an accurate fit

Bend boards slightly and adjust to fit.



photo: Schwenk Dämmtechnik GmbH & Co. KG.

Above-rafter insulation or insulation of solid pitched roofs

External thermal insulation using Neopor® insulating materials can be designed as above-rafter insulation or as insulation of solid roofs.

Fit in formation

The Neopor insulating boards are fitted in formation, loosely on the shuttering or tightly packed on the solid pitched roof. No adhesive is needed. Any gaps can be filled with cut-to-fit strips of the insulating material.

Sarking membrane

A permeable sarking membrane guarantees a rain-proof layer over the insulating layer.

Distance and roofing battens

The distance battens are also used to secure the Neopor insulating boards and provide ventilation of the roof boarding. Timber battens are fitted as distance battens directly on the insulating boards parallel to the rafters and are expertly fastened on the rafters or in the solid roof. Various attachment systems are available for this purpose, which provides a continuous load transfer.



Sarking membrane and battens

The roof battens are fixed to the rafters or on a solid roof by means of the Neopor insulating boards.

Fit without thermal bridges

The easy-to-handle Neopor insulating boards are tightly fitted shuttering and a vapor retarder.

Practical advantages of Neopor® insulating materials

- Up to 20 percent better insulating performance.
- Dimensionally stable, weather- and ageing resistant.
- Working without glare in direct sunlight by reducing light reflection.
- Easier to handle due to weight and volume.
- Straightforward cutting to size and grinding.
- Reliable for planning and fitting due to homogeneous material.
- Lower impact on the environment as a result of up to 50 percent reduction in raw materials used, compared with conventional EPS.
- Proven fitting method, same as for conventional EPS.
- Versatile application options.
- Proven use in structural engineering over a number of years.
- Protects buildings from heat and cold.
- Protected brand quality.





Three-liter house in Rome, Italy

Marketable low-energy solution

The building design is in the Italian construction tradition, but with just three liters of oil or 30 kWh per square meter, it has an annual heat consumption of at least 80 percent below the Italian average. This was achieved by comprehensive insulation, using Styrodur® C in the perimeter insulation, and Neopor® insulating boards for the external thermal insulation composite system and the roof and footfall sound insulation. The Micronal® PCM plaster regulates the internal temperature, which remains pleasant even on the hottest days, without have to use a cooling system. The result is a marketable low-energy solution for Italy providing luxury conditions 365 days a year.



One-liter house in Ludwigshafen, Germany

Townhouses requiring 1 liter of heating oil

The heating requirement of new buildings is approximately seven liters per year per square meter of living area, where as the consumption for the new townhouses in the Brunck area is just one liter.

To achieve this low consumption rate, the property company LUWOGÉ uses proven and innovative energy saving concepts:

- External wall insulation (ETICS) with 30 cm-thick Neopor® boards.
- Pitched roof insulation using 60 cm-thick Neopor insulating boards.
- South-facing windows in living rooms and bedrooms.
- Triple-glazed windows filled with inert gas between the panes.





Further information on Neopor®

- **Brochure: Neopor® – Innovation in Insulation**
- **Brochure: Building and Modernizing with Neopor**
- **Brochure: Passive House**
- **Brochure: Fast & Easy Construction with Insulating Concrete Forms (ICF)**
- **Brochure: Wall Insulation**
- **Brochure: Roof Insulation**
- **Neopor film: Innovation in 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. (March 2010)

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