Neopor®

Innovation for Insulation

Neopor®

Expandable Polystyrene (EPS)

Impact-sound Insulation

BASF Plastics
key to your success

BASF
The Chemical Company

The problem: noise

Peace and quiet equals quality of life
Noise causes stress, and might even be harmful to one's health. This is why peace and quiet at home are of the essence when it comes to a good quality of life.

Noise pollution can be reduced at its source such as, for example, equipment, machinery, cars, airplanes, etc. In addition, sound transmission has to be cut back in the buildings themselves. This is a very crucial task for architects and engineers as well as for contractors.

But industry is also being called upon to develop excellent insulating products: with its insulating material Neopor® BASF has brought such a product to the market.

Impact-sound insulation with Neopor® is child's play.

When the neighbors have a party, impact-sound insulating panels made with Neopor® keep the other residents of the building from being annoyed by the noise.

Impact-sound insulating panels made of Neopor® with enhanced thermal insulation performance

The solution: impact-sound insulation with Neopor®

Better insulation with Neopor®
Neopor® is a further development of that well-known BASF "classic", Styropor®, thus constituting a new generation of expandable polystyrene (EPS).

BASF makes the raw material Neopor®, which processing companies then render into ready-to-use silver-gray panels. Through special processing, these panels effectively diminish the transmission of annoying impact sounds.

An innovative new technique has succeeded in improving the insulation capacity of the foam panels made of Neopor® in comparison to the already outstanding properties of Styropor® panels.

Raw material Neopor® and pre-foamed beads made of Neopor®

Applications for Neopor® in construction

- composite thermal insulation system
- insulation between walls
- interior insulation
- impact-sound insulation
- insulation towards the attic
- thermal insulation above the rafters
- insulation between the rafters
- thermal insulation for the basement
- molded parts for modular construction

Especially when it comes to the renovation of old buildings, where the height available for structuring the floor is usually limited. Impact-sound insulating panels made of Neopor® having an enhanced thermal insulation capability, in comparison to Styropor®, offer improved insulation against heat as well as impact-sound muffling.

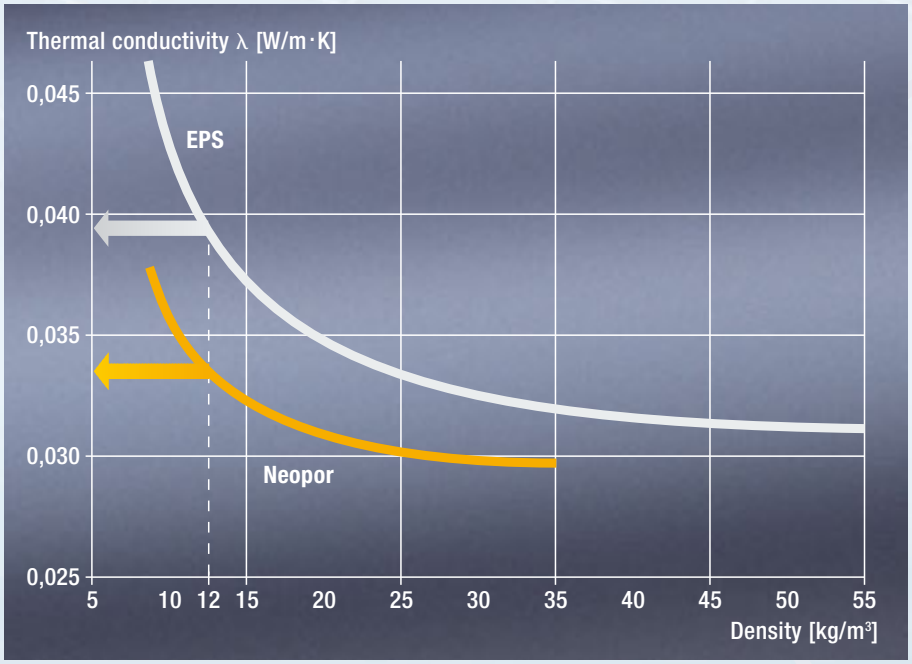


Fig. 1:
The thermal conductivity depends on the density. At the same density, Neopor® displays a thermal-insulation capacity that is 20% better than that of white EPS.

How impact-sound insulation functions

Thinner floors with Neopor®

The impact-sound muffling effect of single-shell floors, for instance, a solid floor, increases as a function of its weight and flexural strength. Adequate impact-sound insulation could be achieved by installing floors that are thicker and heavier. This approach, however, would not be cost-efficient.

In contrast, however, it has proven its worth to install a second shell, that is to say, an additional layer, on the impact-sound insulating panels (made, for example, of Neopor®), at an appropriate distance from the floor. This second shell, the so-called floating floor screed, effectively prevents structure-borne sound from penetrating into the floor structure and into the surrounding construction elements.

Types of sound in building construction:

- Air-borne sound is propagated in the air.
- Structure-borne sound is propagated in solid bodies.
- Impact sound is generated in the form of structure-borne sound as a result of walking, moving chairs and other such activities on the floors or stairs and is partially emanated as airborne sound into rooms underneath.

Floating floor screed

When professionally installed, floating floor screed enhances impact-sound insulation on floors effectively and permanently.

Floating floor screed is applied onto an insulating layer (for instance, impact-sound insulating panels made of Neopor®). An important aspect is that the floating floor screed should consistently be kept separated from all adjacent and penetrating construction elements such as installation lines, radiator supports and the like, since otherwise the impact-sound muffling effect will be considerably impaired.

It is often the case with floating floor screed that sound bridges are created because the requisite leveling compound is applied improperly onto the screed. By the same token, hard baseboards, door frames and the like must not come into contact with the screed and with a hard floor covering such as ceramic tiles, stoneware or wood.

The extent to which floating sub-flooring reduces the transmission of impact sounds is expressed in terms of the impact-sound improvement parameter $\Delta L_{w,R}$.

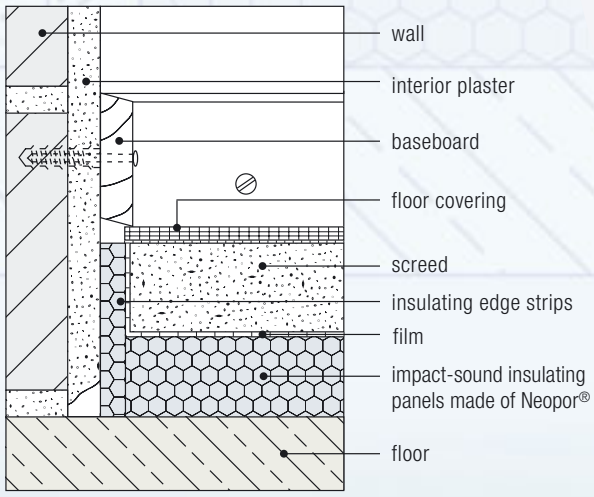


Fig. 2:
Example of a wall joint with floating floor screed.

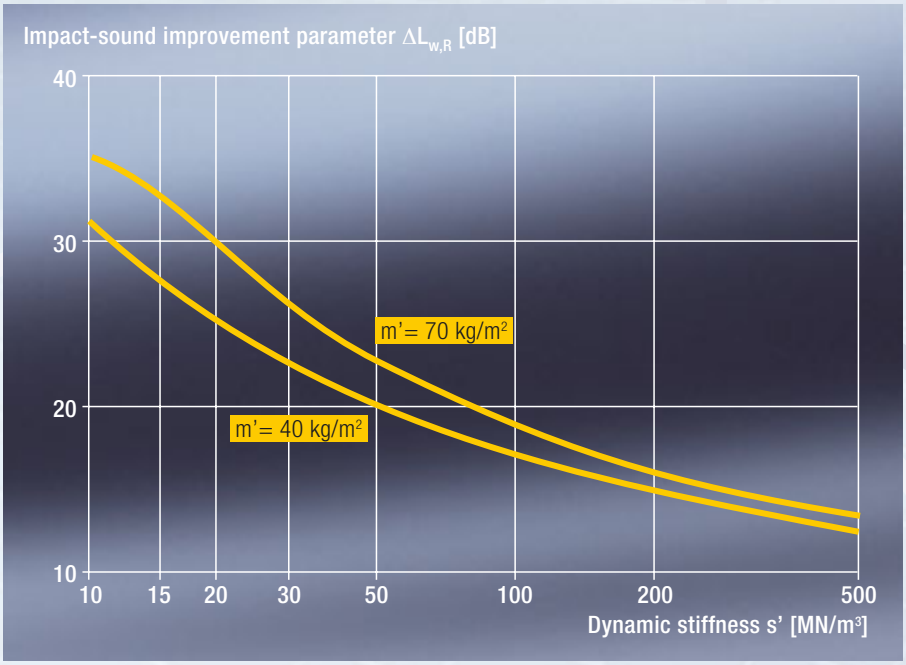


Fig. 3:
Relationship between the impact-sound improvement parameter $\Delta L_{w,R}$ of floating floor screed free of sound bridges and the dynamic stiffness s' of the insulating layer employed for screed having a weight per unit area m' of 40 kg/m² and 70 kg/m² according to Supplementary Sheet 2 of German Standard DIN 4109.

The impact-sound improvement parameter $\Delta L_{w,R}$

The impact-sound improvement parameter $\Delta L_{w,R}$ indicates the frequency-dependent reduction in impact sound of the tested flooring layer and expresses it as a figure in decibels (d_B).
Numerically, $\Delta L_{w,R}$ is the difference between the evaluated standard impact-sound level of a reference floor[1] with and without a flooring layer.

The impact-sound improvement parameter $\Delta L_{w,R}$ of a screed structure is influenced by the weight per unit area of the screed and by the dynamic stiffness of the impact-sound insulating panels used.

It is not cost effective to increase the weight per unit area of the screed.
A better solution is to install impact-sound insulating panels having a low dynamic stiffness.

The dynamic stiffness

The dynamic stiffness defines the resilience of an impact-sound insulating panel, including the air trapped in it.

Insulating materials used for impact-sound insulation are classified in stiffness groups according to their dynamic stiffness.

Stiffness stage	Requirement MN/m³
SD50	≤ 50
SD40	≤ 40
SD30	≤ 30
SD20	≤ 20
SD15	≤ 15
SD10	≤ 10
SD7	≤ 7
SD5	≤ 5

Table 1:
Stages of dynamic stiffness according to European Standard EN 13 163

[1] German standard 52210, Part 4

Stage	Useful load on the screed kPa	Requirement for the maximum compressibility (mm)	Limiting dimension mm
CP5	≤ 2,0	≤ 5	≤ 2mm für d_L ≤ 35 mm ≤ 3mm für d_L ≥ 35 mm
CP4	≤ 3,0	≤ 4	
CP3	≤ 4,0	≤ 3	
CP2	≤ 5,0	≤ 2	≤ 1mm für d_L ≤ 35 mm ≤ 2mm für d_L ≥ 35 mm

Table 2: Stages of compressibility CP according to European Standard EN 13 163.

Note:
The stages for the useful load on the screed have been taken from FNV 1991-2-1 Eurocode 1. ("Principles of stress in load-bearing structures and effects on load-bearing structures; specific gravity, intrinsic loads, useful loads").

The compressibility c

Apart from the dynamic stiffness, the stressability is also an important aspect of impact-sound insulating panels.
The panels have to reliably withstand the anticipated useful loads that will be exerted on the screed (traffic loads). This requirement is met by means of the compressibility.

The compressibility c is defined in European Standard EN 12 431 as the difference between d_L and d_B.

In this context, the thickness d_L is determined under a load of 250 Pa. The thickness d_B, in contrast, is the thickness under a load of 2 kPa after an additional load of 48 kPa – thus adding up to 50 kPa – has been exerted for a brief period of time (see Figure 4).

The requisite thickness of the screed has to be determined on the basis of the compressibility of the insulating layer and on the basis of the traffic load that can be expected.

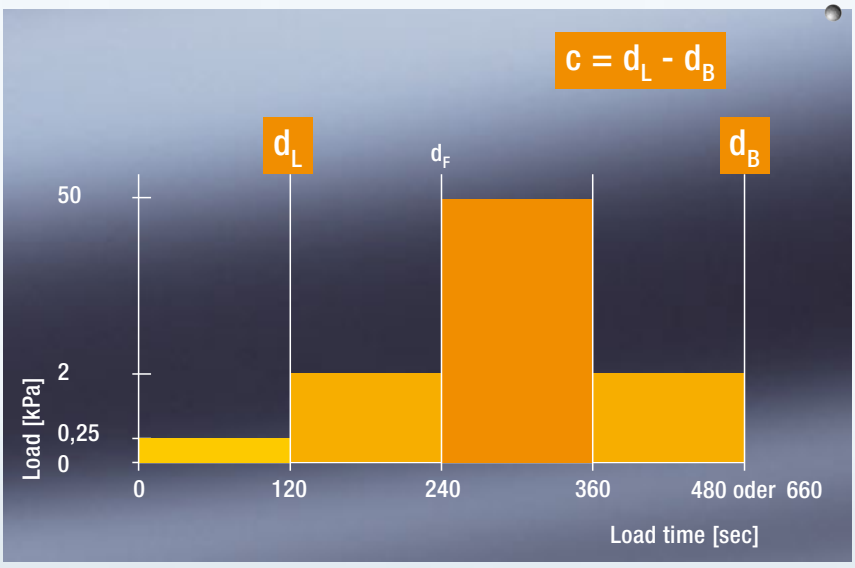


Fig. 4:
Depiction of the test increments (time spans and pressure loads) for determining the thicknesses – for a key to the abbreviations, see page 9.

Floating floor screed with Neopor® having the maximum dynamic stiffness s' of:	Stages according to EN 13 163	$\Delta L_{w,R}$ with a hard floor covering dB	$\Delta L_{w,R}$ with a soft springy floor covering dB	Remarks
30 MN/m³	SD30	26	27	
20 MN/m³	SD20	28	30	stiffness for an effective impact-sound improvement
15 MN/m³	SD15	29	33	
10 MN/m³	SD10	30	34	
7 MN/m³	SD7	–	–	

Table 3:
Impact-sound improvement parameter $\Delta L_{w,R}$ of floating floor screed having a weight per unit area ≥ 70 kg/m² on solid ceilings (calculation value derived from German Standard DIN 4109).

Impact-sound insulating panels made of Neopor® are available in the stiffness groups 20 MN/m³ to 10 MN/m³. These are the stiffness groups that are best suited for impact-sound insulation. These stiffness groups correspond to the impact-sound improvement parameters $\Delta L_{w,R}$ that have been determined on the basis of the applicable standards that are presented in Table 3 (see above).

Designation	Utilization	Examples	Traffic load kPa	Individual load kN
A1 A2 A3	residential buildings and public buildings	living areas stairwells balconies	2,0 3,0 4,0	2,0 2,0 2,0
B	offices		3,0	2,0
C1	buildings open to the public	schools, churches restaurants	3,0	4,0
C2		movie theaters	4,0	4,0
C3		exhibition halls	5,0	4,0
C4		exercise rooms stages	5,0	7,0
C5		concert halls gyms	5,0	4,0
D	shops		5,0 5,0	4,0 7,0

Table 4: Traffic loads set forth in European Standard EN 1991-2-1

Traffic loads and types of application for Neopor®

European Standard EN 1991 contains information about the traffic loads encountered in buildings used for various purposes. The types of application for Neopor® used in impact-sound insulation were laid down as a function of the traffic loads that can be expected.

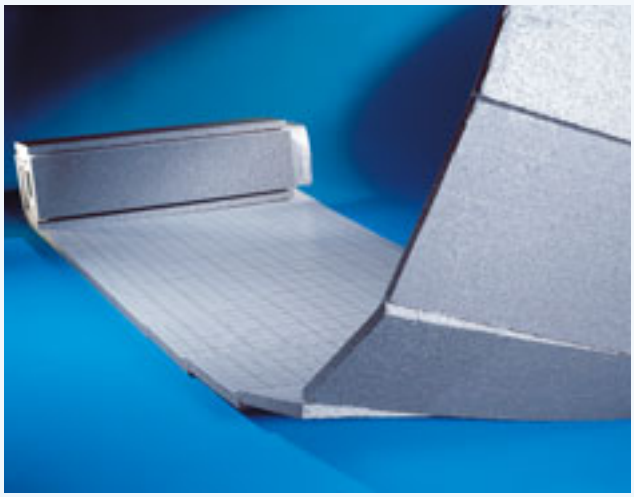
The right panel for every load

Forms of delivery

Neopor for impact-sound insulation can be delivered in the form of panels and sheeting, also in special forms of delivery as coated and profiled panels and sheeting.

The panels and sheeting can be provided ex factory with coatings consisting, for instance, of cardboard, paper, glass mats, films and additional support layers.

Installation of a Neopor® impact-sound insulating panel.



Types of application

The types of application for impact-sound insulation materials are differentiated in accordance with application standards. In Germany, this is done, for example, on the basis of German Standard DIN 18 164-2. This standard, in turn, is based on the European Material Standard EN 13 163.

Type of application	Utilization in building construction
T	Impact-sound insulation materials for floors requiring air borne and impact-sound insulation according to German Standard DIN 4109, for example, under floating floor screed according to German Standard DIN 18 560-2.
TK	Impact-sound insulation materials for floors requiring air-borne and impact-sound insulation according to German Standard DIN 4109, for example, under floating floor screed according to German Standard DIN 18 560-2, suitable for applicatons involving less compressibility (for instance, under pre-fabricated screed) or for high traffic loads.

Table 5: Types of application according to German Standard DIN 18 164-2.

System variants of the impact-sound insulation made of Neopor®

The application type T entails a higher level of compressibility. As a result, the screed is more stressed than with application type TK. In order to limit the stress to the screed and also to cover the entire spectrum of possible traffic and utilization loads, various stiffness classes (s') have been selected for the impact-sound insulating panels made of Neopor® for application type TK.

As a function of the various requirements encountered in actual building practice, the following system variants have been developed for the Neopor®-impact-sound insulation application.

Impact-sound insulating panels made of Neopor® are suitable for applications involving traffic loads of up to 5 kPa.

	System-variant s'20	System-variant s'15	System-variant s'10	System-variant s'20
Application type	TK	TK	TK	TK
Dynamic stiffness s'(MN/m³)	≤ 20	≤ 15	≤ 10	≤ 20
Maximum traffic load (kPa)	3,5	3,5	3,5	5,0
Panel thickness d_L (mm)	20 25	30 35	40 45 50 60	40 50
Compressibility c (mm)	≤ 2	≤ 3	≤ 3	≤ 2
Impact-sound improvement parameter $\Delta L_{w,R}$ in dB				
with a hard floor covering	28	29	30	28
with a soft, springy floor covering	30	33	34	30

Table 6: Types of application.

Key to the symbols

c	stands for the compressibility	mm
d_B	stands for the thickness under a load of 2 kPa after removal of an additional load of 48 kPa	mm
d_L	stands for the thickness under a load of 0,25 kPa	mm
SD	is the symbol for the specific stages of the dynamic stiffness	
CP	is the symbol for the specified stages of the compressibility	
CS (10)	is the symbol for the specified stages of the compressive stress at 10% compression	

Key to the symbols, units and abbreviations derived from DIN EN 13 163.

The installation of sound-impact insulation

Clean surface

The surface of the exposed floor has to be smooth and free of dirt such as mortar and concrete residues or the like. Uneven exposed floor surfaces should be leveled before the sound-impact insulating panels made of Neopor® are laid.

Sound-impact and thermal insulation

If Neopor® impact-sound insulating panels are employed together with Neopor® thermal insulating panels, the impact-sound insulating panels should be laid as the first layer.

Exceptions to this are warranted if the Neopor® thermal insulating panels have the function of a leveling layer, for example, for installation lines.

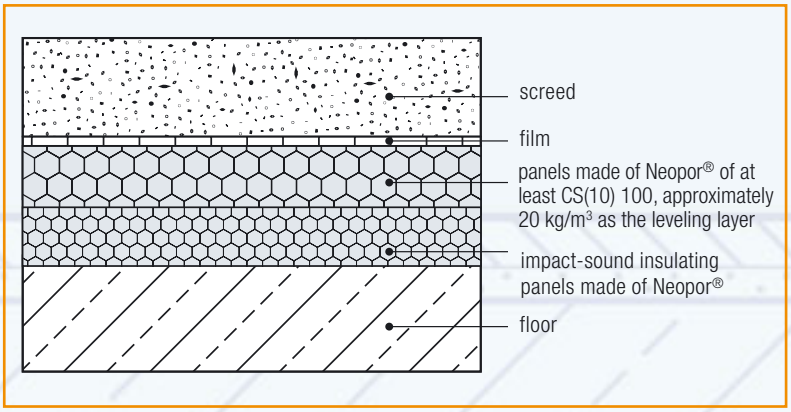


Fig. 5:
Impact-sound insulating panels and leveling layer made of Neopor®

Insulating edge strips without sound bridges.

Insulating edge strips without sound bridges

When the screed is installed, the insulating edge strips should be placed and secured in such a way that no sound bridges can be formed with the wall. Any protruding parts of the insulating edge strips should only be cut off once the floor covering has been installed.

Leveling layers for pipes

As a matter of principle, leveling layers are necessary whenever pipes are to be laid on the exposed floor. Here, it should be noted that the leveling layer has to extend beyond the fasteners of the pipes. Panels made of Neopor® can be used to make leveling layers in an environmentally sound manner, especially since the light-weight panels made of Neopor® also offer excellent thermal insulation. This is especially advantageous in the case of screed adjacent to unheated rooms.

Avoid gaps

The impact-sound insulating layers made of Neopor® have to be continuous. Gaps caused by pipes and the like considerably reduce the effectiveness.

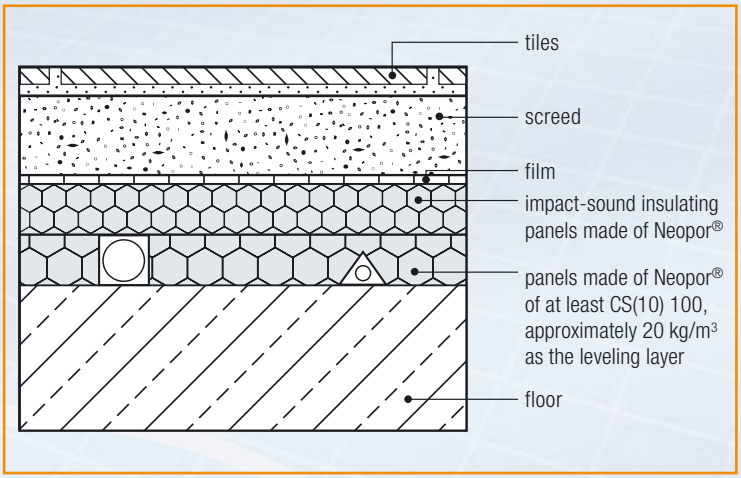


Fig. 6:
Impact-sound insulating panels and leveling layer made of Neopor®

Pay attention to the density

An important aspect for the bottom layer is that the installed panels made of Neopor® should be at least of compressive stress stage[1] CS(10) 100. This strength stage can be achieved with Neopor® having a density of about 20 kg per m³.

Select the right film

Smooth films without folds are well-suited for covering the insulating panels. The covering film should run all the way to the upper edge of the insulating edge strips.

Panels made of Neopor® as leveling laser for pipes laid on the floor

Laying panels made of Neopor®

[1] EN 13163: stages of compressive stress at 10% compression

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 their 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.

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