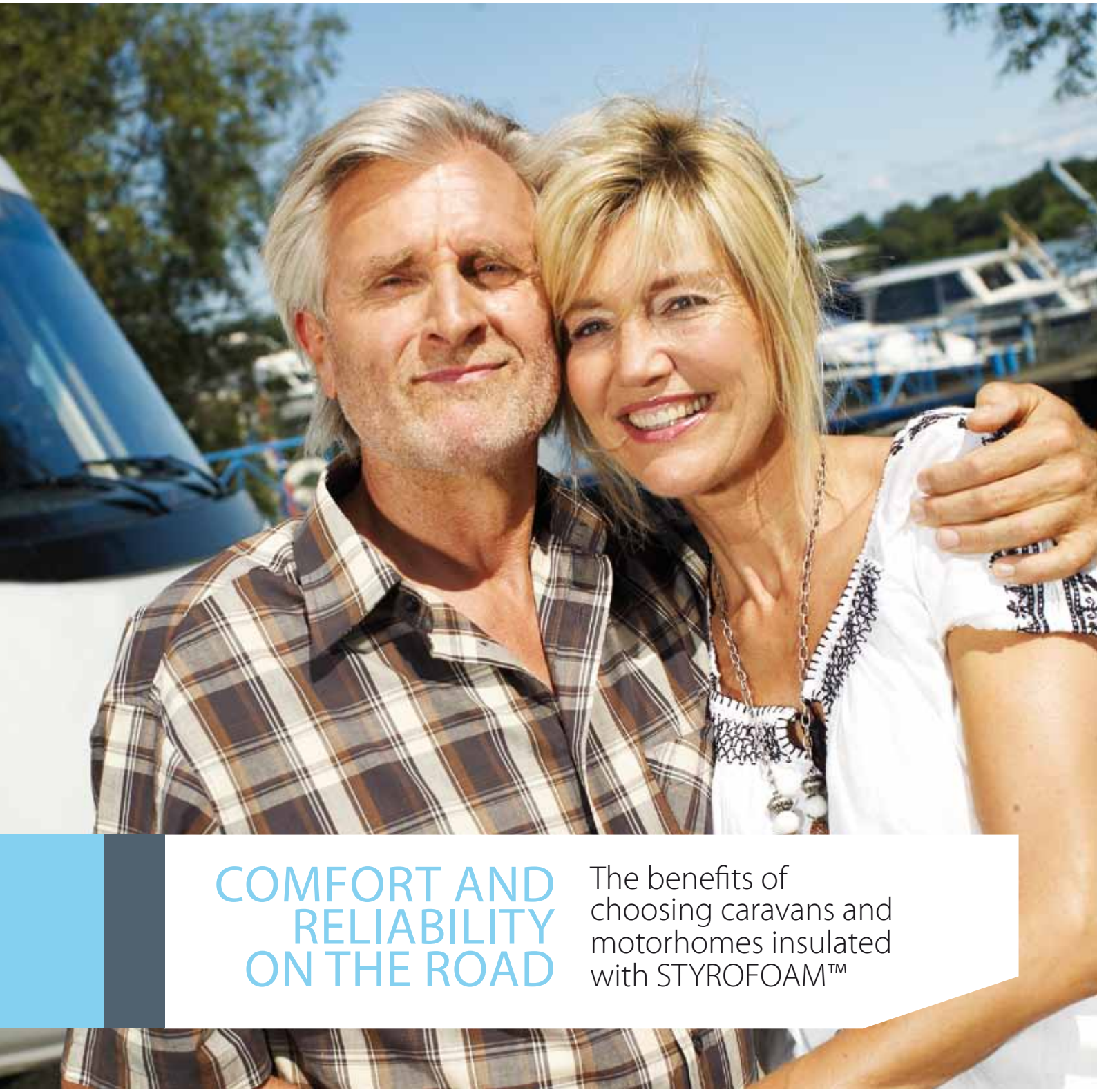


COMFORT AND RELIABILITY ON THE ROAD

The benefits of choosing caravans and motorhomes insulated with STYROFOAM™

An informed choice

Why materials make a difference

Buying the right motorhome or caravan is a major investment decision for any family. Whether you are choosing a vehicle for the annual holiday getaway, the long-haul trip of a lifetime or even live in, quality, comfort and reliability all count.

It's easy to fall for glitzy interiors and fashionable styling – but attention to the detail hiding beneath the glossy exterior could make the difference between a cosy night in and a complete washout during yet another wet summer…

Of course, making the right choice is easier when you've chance to brush up on your knowledge. Why not get to know a little more about one of the core materials used by the world's leading motorhome and caravan manufacturers and beat the salesman at his own game?

Introducing the composite structure

Some manufacturers of motorhomes and caravans build the walls, floors and ceilings of their vehicles using a type of construction known as 'composite construction'. They piece together so-called 'composite components', or panels, to create the overall structure – these panels generally consist of a rigid foam core (also known as the core layer material) and two outer layers, or facing materials.

Since these composite components act as structural elements in motorhomes and caravans - and need to support a wide variety of loads as well as operate in all weathers – the quality of the materials used to produce them is fundamental to the overall performance of the vehicle.

Additionally, the properties of the core material within the composite panels have specific impacts on:

- insulation performance
- damp and moisture resistance
- body strength.

STYROFOAM™ rigid polystyrene foam, produced by The Dow Chemical Company, has many benefits which make it the material of choice for many motorhome and caravan manufacturers.

The blue foam – which is also known as XPS (a shorter term for extruded polystyrene!) – has a closed cell structure which gives it excellent insulating properties, long-term resistance against moisture and high mechanical strength.

Why not taking a deeper look at how STYROFOAM™ matches up against the specific demands of the leaders in motorhome and caravan manufacturing.

motorhome section
(wall and roof simplified view illustrating the use of STYROFOAM™)

DRIVEN BY PERFORMANCE

Combining comfort and energy efficiency

We're all familiar these days with the phrase 'energy efficiency'. We also know that saving energy is good for our bank balances as well as the environment.

Architects understand that introducing effective insulation into buildings helps keep people warm in winter and cooler in summer – and that the best materials perform over the lifetime of a structure. Forward-thinking manufacturers of motorhomes and caravans can also embrace this trend and turn to products such as STYROFOAM™ to help insulate vehicles and make life on board more comfortable – for the long-term.

So what does this mean for you? Simply, by choosing a vehicle using STYROFOAM™ as a core material you could reduce energy consumption and save money. You may not need to turn up the heating to full in winter, and there might be no need to blast out air-conditioning all summer.

To give you an example, it's not just motorhomes and caravans that benefit from the insulating properties of STYROFOAM™. Imagine how tough it must be to transport frozen ice-cream from the depths of Italy to a supermarket shelf in England. Insulating materials for refrigerated trucks carrying perishable goods undergo the most stringent tests in terms of performance and longevity STYROFOAM™ meets the toughest requirements of such high level standards – so imagine what it could do for your caravan or motorhome!

Getting behind the scene

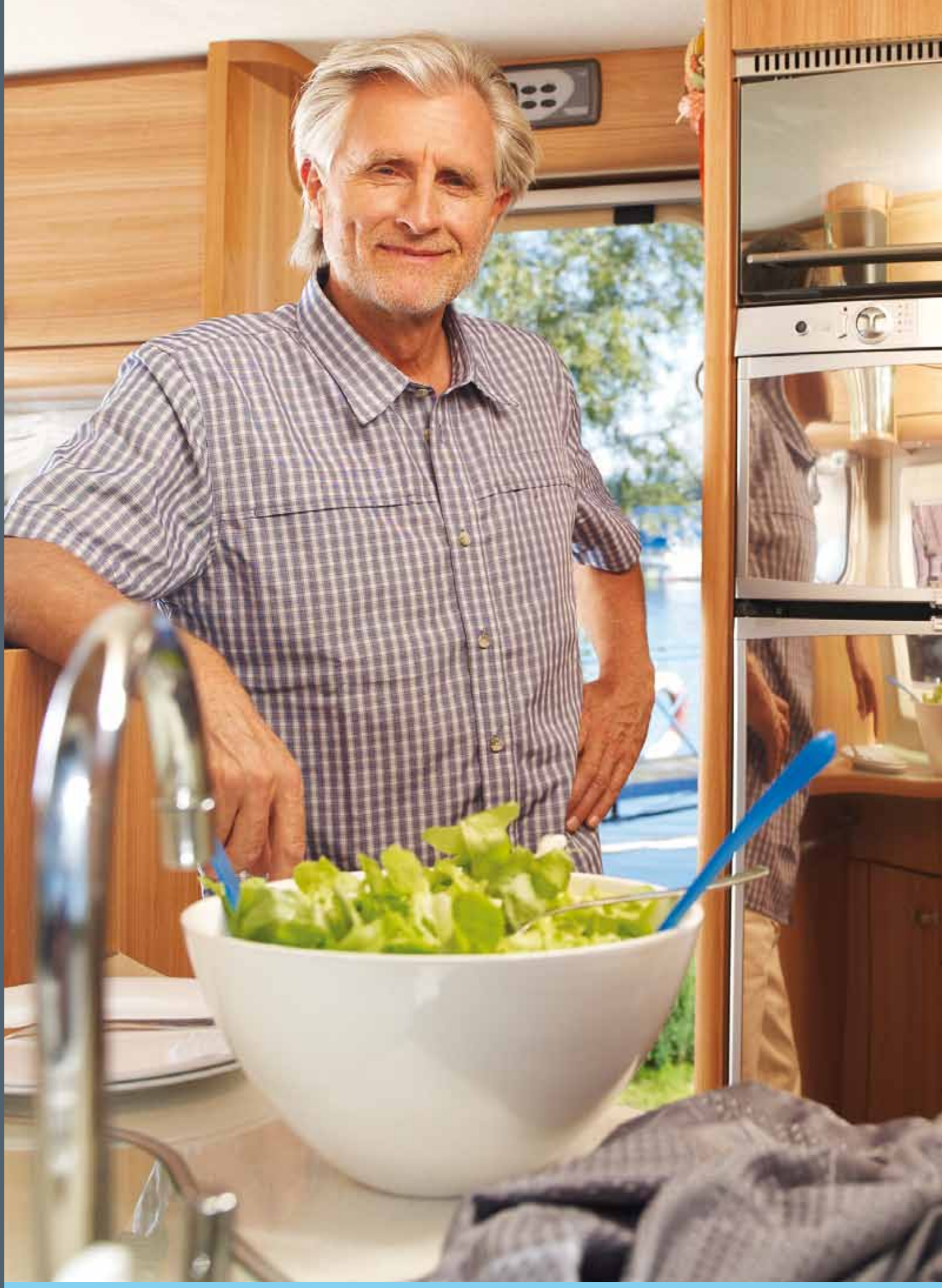
It may help to know more on how insulation material performances are evaluated when it comes to their thermal performance and ability to insulate.

Thermal transmittance, so called U-value, measures the heat flow through a square metre of material. There is a heat flow as soon as we have a difference of temperature between the two sides of the material. The lower the heat flow the lower the U-value.

Structures with a low U-value deliver better insulating performance because they lower the rate of heat loss. For example, a 3cm thick STYROFOAM™ panel will show the same U-value as a17cm thick plywood panel.

Comparative testing done in accordance with BS EN 1647 standard, shows that overall U-value of vehicle constructed with STYROFOAM™ core is about 10% lower than when typical alternative material is used.

Choosing STYROFOAM™, is the peace of mind of having selected the market best-performing insulation for your motorhome or caravan.



PROTECTING YOUR INVESTMENT

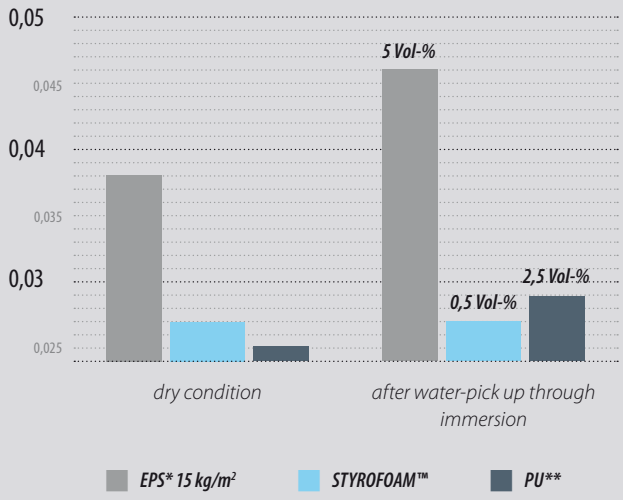
Where science plays a part …

Moisture is your enemy in a motorhome or caravan. No-one wants to see – or smell – mould on walls, floor or ceilings. Keeping moisture out is vital to protect the long-term performance and comfort of your precious investment.

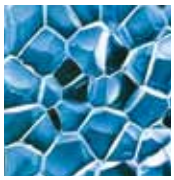
Water vapour released by showers, cooking, drying laundry, people and pets breathing can all increase moisture level in the air. Without regular ventilation, this moisture can condense on the surfaces of structural components causing odour and mould or – worse – diffuse in the form of water vapour within the composite panels and condense there, thus affecting their performance.

Insulation materials containing moisture will not perform as well, thus rising heating or air-conditioning costs. Wet insulation material with 10% moisture can lose up to 45% of its insulation performance. Indeed, trapped moisture conducts heat 25 times more than dry air.

This information can help you to make an enlightened choice when buying your motorhome or caravan. A glance at the bar chart below is self explanatory. It compares the thermal performance of core materials typically used in the leisure vehicle industry before and after exposure to water. (Water pick up done according to BS EN 12087).



Thermal conductivity depending on water absorption in accordance with EN ISO 10456



STYROFOAM™'s closed cell structure allows very marginal water up take, and thus, excellent thermal performance even when exposed to humid conditions.

Any additional dead load linked with water pick up would also affect fuel consumption of the vehicle; indeed the highest the weight to shuffle the highest the fuel consumption is.

Source: * EPS value – IosBouw EPS, IosBouw EPS, technical information (2005)
** PU value – IVPU, PUR for high performance insulation material (2005)

QUALITY WHERE IT MATTERS

Strength for the miles ahead

There's no better feeling than driving down that open road with the wind in the hair and a holiday ahead of you – but that great feeling won't last long if the structure of your motorhome or caravan starts to show signs of weakness.

Good quality motorhomes and caravans are designed and build to withstand high stresses from wind, induced vibrations from road conditions and cornering; all of which having an impact on the structure of the vehicle.

STYROFOAM™ HAS OUTSTANDING MECHANICAL PROPERTIES SUCH AS:

- excellent bending stiffness
- high shear strength
- excellent tensile strength
- high compressive strength

STYROFOAM™'s resilience and strength make it the ideal choice for the core layer material of composite panels, bringing positive effects to the overall structure's stability, and giving you peace of mind and comfort when driving.

THE SCIENTIFIC CORNER!

STYROFOAM™'s technical profile

The ones who really like to get into the details will appreciate a technical overview of everything you need to know about STYROFOAM™'s performance. Please take a look at the table – and happy journey!

Properties [1]	CE-Code	Standard	Unit	STYROFOAM™ LB-X	STYROFOAM™ LB-A	STYROFOAM™ RTM-X
Cell contents				HFC	Air	HFC
Thermal conductivity	–	DIN EN 12667/ DIN EN12939	W/(m·K)	0,027	0,033 (≤ 80 mm) 0,034 (81-120 mm) 0,036 (> 120 mm)	0,025 [2]
Compressive strength[3]	CS(10\Y) σm	DIN EN 826	N/mm^{2}, [4]	0,3		0,4
Compressive strength (E-Modulus (typical))[3]	–	DIN EN 826	N/mm^{2}	12 (≤ 30mm) 15 (31-80mm) 20 (> 80mm)		17 (≤ 30mm) 22 (31-80mm) 28 (> 80mm)
Water vapour diffusion resistance factor μ	–	DIN EN 12086	–	100		150
Water pick up by immersion	WL(T)1,5	DIN EN12087	Vol-%	<=1,5		
Water pick up by immersion	WL(T)0,7	DIN EN12087	Vol-%			<=0,7
Capillarity	–	–	–	0		
Reaction to fire Euroclass	–	EN 13501-01	–	E		
Service temperature	–	–	°C	–50/+75		
Thickness	–	EN 823	mm	20-180	20-120	20-140

1) The properties refer to thickness ranges mentioned in the table

2) Measured after 60 days

3) Measured in thickness direction

4) 1 N/mm^2 = 10^3 kPa; 1 kPa = 10 -3 Mpa

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***Niesmann+Bischoff GmbH**, Clou-Straße 1, Polch, Pages 3 and 4*

Dow Chemical Company Limited Dow
Diamond House, Lotus Park
Kingsbury Crescent, Staines,
TW18 3AG
Internet: www.styrofoamforcaravans.com

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291-70925-0112