



ALL ABOUT EPS SIP PANELS



WHAT IS EPS?

Expanded Polystyrene (EPS) is a rigid cellular plastic found in a multitude of shapes and applications.

Most commonly, EPS is used to make things like fish boxes, packaging for electrical consumer goods, and insulation panels in buildings.



Did You Know:

Over a building's lifetime, our SIP homes have a significantly smaller carbon footprint than traditional timber-framed buildings!

THE MANUFACTURING PROCESS

Expanded polystyrene is made from expandable polystyrene, which is a rigid cellular plastic containing an expansion agent. It is obtained from oil then put through a chemical process. The conversion of expandable polystyrene to expanded polystyrene is carried out in three stages:

1st stage Pre-expansion:

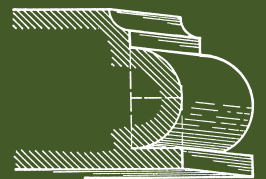
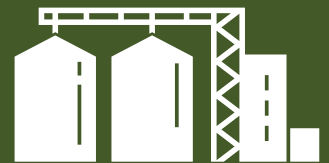
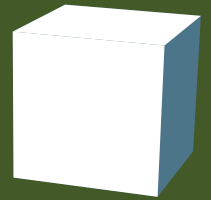
The raw material is heated using steam in special machines called pre-expanders at temperatures of between 80-100°C. The material density falls from some 630kg/m³ to values of between 10 and 35kg/m³. During this pre-expansion process, the raw material's compact beads turn into cellular plastic beads with small closed cells that hold air in their interior.

2nd stage Intermediate Maturing and Stabilisation:

On cooling, the recently expanded particles form a vacuum in their interior must be compensated for by air diffusion. This process is carried out during the material's intermediate maturing in aerated silos. The beads are dried simultaneously, which is how greater mechanical elasticity and improved expansion capacity is achieved - vital in the following transformation stage.

3rd stage Expansion and Final Moulding:

During this stage, the stabilised pre-expanded beads are transported to moulds, where they are again subjected to steam so that the beads bind together. In this way, moulded shapes or large blocks are obtained (and later sectioned to the required forms, such as boards, panels, cylinders, etc.)



Steam is used as energy in the manufacturing of EPS. The steam itself is produced in boilers, mainly using natural gas as fuel. Water consumption used in the manufacture of EPS is very low, and the water can be reused many times throughout the process.

There is no solid waste generated during the EPS manufacturing process. Waste and off-cuts are put back into the production process. In addition, all clean, used EPS packaging can be recycled into new products using this method. Best of all? Surface and underground water supplies near an EPS plant are free from pollution because atmospheric and liquid emissions are very low during the manufacture of EPS.

Q. WHY AREN'T YOU USING POLYURETHANE FOR YOUR SIPS?

We have chosen to go with the SIP core material that has the longest track record and is used by most SIP manufacturers in North America (where approximately 93% of all SIP builds use EPS-core SIPs).

A. For NZ conditions, we believe EPS is the right material choice. EPS is fully recyclable and completely non-toxic, with none of the off-gassing associated with other types of materials.

Thermal Performance

EPS has a stable R-value that doesn't drop like polyurethane (PUR). Polyurethane foam is typically rated with a 6-month value because its ability to resist the flow of thermal energy may change in the first few months after production. PUR has a higher initial R-value for SIPs, but for NZ conditions, the R values of EPS are still very high, particularly when combined with the inherent air-tightness achieved by SIP construction. (Airtightness trumps R-value.)

Workability

EPS is easier to work with on-site. Cutting PUR often produces vapours that irritate, while EPS does not. Adding wire chases and other site work can be performed more readily with EPS.

Availability

EPS is more readily available than PUR, and the manufacturing process is less specialised.





Spans

PUR has higher creep deflection than EPS, so it cannot span as far. Creep deflection is where a loaded member moves gradually over time; something all plastics are prone to. While initially providing higher strength values, the gradual movement in PUR means engineers cannot specify as long a span with PUR SIPs.

Cost

PUR SIPs are more expensive than EPS SIPs.

Fire

PUR is a thermosetting plastic, so it doesn't melt. EPS does melt when it gets hot enough.

The beauty of any SIP is that the skins protect the core for a period of time, and because there is no free air in the panel, they tend to extinguish any flames by choking their air supply.

The EPS used in our panels contain a flame-retardant, meaning they won't propagate

fire. Instead, they pull back from the heat source and form a hard skin. SIPs have a good fire record and can be used where fire-rated walls are required.

Eco

PUR is a thermosetting plastic, which means once it has been used in a panel, that's it. An EPS core, on the other hand, can be recycled for other uses later, should the need ever arise.

Our panels do not contain any VOCs or other harmful chemicals that can affect occupant health. The components used to make SIPs (foam, oriented strand board, and adhesive) meet some of the most stringent standards for indoor air quality.

EPS uses pentane, a non-CFC blowing agent that dissipates shortly after production. EPS has no offgassing. SIP homes made using identical components to our panels have qualified under the American Lung Association's Health House® indoor air quality standard.



The adhesives used in our panel production do not contain measurable amounts of volatile organic compounds (VOCs) that can be harmful to occupants. Oriented strand board (OSB) does not contain urea-formaldehyde adhesives and meets the world's leading formaldehyde emissions standards, including the U.S. HUD, Manufactured Housing Standard, the California Air Resources Board (CARB) Air Toxic Control Measure for Composite Wood Products and the European EN-300 Standard.

You can rest assured your new SIP home will provide safe, healthy indoor spaces!

Seismic

Another advantage gained by choosing our panels is how well they withstand earthquakes. Bracing tests have proved they have more capacity than concrete hold-downs! (Formance has had to downgrade the BU/m used in their Design Guide to reflect this.) Our SIPs are the safe choice when it comes to resisting damage from earthquakes. They are light, strong, and impact resistant.

Moisture

EPS contains excellent mechanical and thermal properties that do not absorb water, moisture or water vapour. They are unaffected by humidity which makes them a smart option for housing.

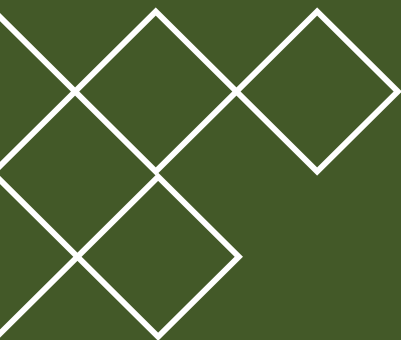
Oriented Strand Board (OSB) is a timber product, so it is subject to the effects of moisture ingress. It is a very durable material and is used as the mainstream sheathing and flooring product widely throughout the rest of the world.

Our SIPs are okay in the weather for up to four weeks before needing to be wrapped. (Of course, this depends on the weather - more wet days brings back the allowable time, more dry days increases it.)

Ageing Resistance

All of the properties listed above are retained over the whole of the materials' life and will last as long as the building itself.

EPS is not altered by external agents such as fungi or parasites because they find no nutritional value in the material.



Did You Know:

Our bodies produce more formaldehyde than what is in our panels!
Plus, the Oriented Strand Board (OSB) on the outside of our EPS panels has half the level typically found in plywood.



HOW CAN SIPS BE ECO-FRIENDLY IF YOU USE EPS?



EPS is recyclable, and it's the only rigid foam product that is. Choosing any other rigid foam product for your building material will leave a legacy of ecological issues as buildings are replaced or modified down the track. With no way of recycling them, other foams will go straight to the landfill.

The OSB/EPS SIP is one of the most environmentally friendly building materials.

- OSB used in our panels comes from Sustainable Forestry Initiative (SFI) managed forests.
- OSB used in our panels utilises 90% of the useable timber from the source tree. Compare this to under 25% utilisation in timber framing.
- Whenever possible, any offcuts or waste EPS is sent directly for recycling from the factory, thereby reducing waste from the supply chain.
- A small amount of extra EPS is sent to the building site as packaging to protect the panels during transport. Where possible, this additional EPS gets sent back to our supplier in large wool bales. From there, the supplier sends it to waste management for recycling.
- Both the factory and the extra transport EPS waste is treated the same. It is fed into a mechanical shredder which breaks it up into small chunks. These small chunks are then compacted into dense blocks of polystyrene.
- These blocks are sent to a plastic processing factory, where the blocks are granulated and fed into a plastic extrusion machine. This machine heats the plastic and extrudes it into thin streams of plastic. These streams are cut into beads and bagged up for sale. These bags of plastic beads are sold to factories that use an injection moulding machine to manufacture all sorts of plastic products (e.g., plastic picture frames).

If any EPS cutting is required on-site, our builders use hot wires/knives to melt the EPS to ensure the tiny beads don't blow around and enter the environment.

LET'S TALK ABOUT THE BOARDS

The timber used on the outside of our panels is Oriented Strand Board (OSB) which is manufactured from natural wood fibres. All the OSB used in our panels comes from Sustainable Forestry Initiative managed forests. In the process of making these panels, 90% of the useable timber is utilised from the source tree. Compare this to under 25% utilisation in timber-framed homes!

When it comes to cladding, you can clad your Formance home in whatever material you prefer, as long as it meets the requirements of the New Zealand Building Code. All SIPs require a cavity system to ensure full compliance with E2 of the code.

R-VALUES

R values are the measure most commonly used to determine a material's ability to resist the transfer of heat. The higher the "r value", the better thermal resistance the product will provide. This is what to use when looking for the best insulation products or, in our case, the best structural insulated panels for your home.

The following are the r values for our EPS panels:

Total Panel Thickness	EPS Thickness	R Value	Width (mm)	Standard Lengths (mm)
115	93	2.8	1200	2440, 2740, 3050, 6100
165	143	4.2	1200	2440, 2740, 3050, 6100
215	193	5.5	1200	2440, 2740, 3050, 6100
265	243	6.9	1220	2440, 2740, 3050, 6100
315	293	8.3	1220	2440, 2740, 3050, 6100



CONCLUSION:

- EPS is an excellent example of the efficient use of natural resources – it is 98% air.
- The manufacture and use of EPS does not generate any risk to health or the environment.
- The EPS manufacturing process (steam-expanded polystyrene beads) has a 25% smaller CO₂ footprint per R-value than fibreglass insulation.
- EPS does not damage the ozone layer since it does not use CFCs or HCFCs in the manufacturing process.
- The transformation process consumes little energy and does not generate waste.
- The use of EPS for thermal insulation in the construction industry contributes significant savings on heating and cooling buildings and a drastic reduction in polluting gases CO₂ and SO₂).
- EPS packaging protects products, helping to reduce wastage and its lightweight nature helps to reduce fuel consumption.
- Fungi and bacteria cannot easily grow on EPS.
- EPS makes up only a tiny part of Municipal Solid Waste (0.1%).
- EPS holds a high calorific value. 1kg of EPS is equivalent to 1.3 litres of liquid fuel, making it an ideal material for energy recovery.
- As it does not biodegrade, EPS does not contaminate the air or water with gases or hydro soluble substances.
- The EPS used in our panels is completely harmless and fully recyclable.
- The OSB panels are made of natural wood fibre and are sustainably sourced.



Did You Know?

EPS meets all food contact regulatory standards! It is often used for packaging fruit, fish and also for hot drink cups.



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