



WATERPROOFING

# PROTECTED MEMBRANE ROOF (PMR)

TECHNICAL BULLETIN

181102SCANE



(Supersedes -)



## PROTECTED MEMBRANE ROOF (PMR)

Protected membrane roofs provide a durable waterproofing solution. The insulation and ballast protect the waterproofing membrane – whether it is an SBS-modified bitumen or a hot rubberized asphalt membrane – from direct exposure to weather. Therefore, the membrane is not exposed to UV rays, heat, rain, or foot traffic, and the useful life of the roof assembly is maximized.

Only extruded polystyrene (XPS) insulation is recognized in the roofing industry as insulation that can be repeatedly exposed to water and moisture. **SOPRA-XPS** by **SOPREMA** is a complete range of extruded polystyrene insulation panels. They are available in a variety of sizes and densities to meet the requirements of various types of protected membrane roofs.

To ensure the good performance and longevity of all elements of the roof, especially the insulation, it is essential to design a vapour diffusion-open assembly. The positioning of the drainage and insulation panels as well as the type and weight of ballast used to hold the insulation in place must also be considered. Also, when compliant to specific criteria, protected membrane roofing systems allow to design efficient green roofs.

### OPEN DIFFUSION

The long-term performance of the insulation is directly related to the design of the protected membrane roof system. **SOPRA-XPS** insulation absorbs very little water and evacuates it quickly if the elements on top of it allow open diffusion of vapour. There are various solutions to ensure vapour diffusion depending on the type of ballast. When the ballast used is river bottom stone, a layer of filter cloth, such as **SOPRAFILTRE**, will ensure the diffusion of vapour (Figure 1).

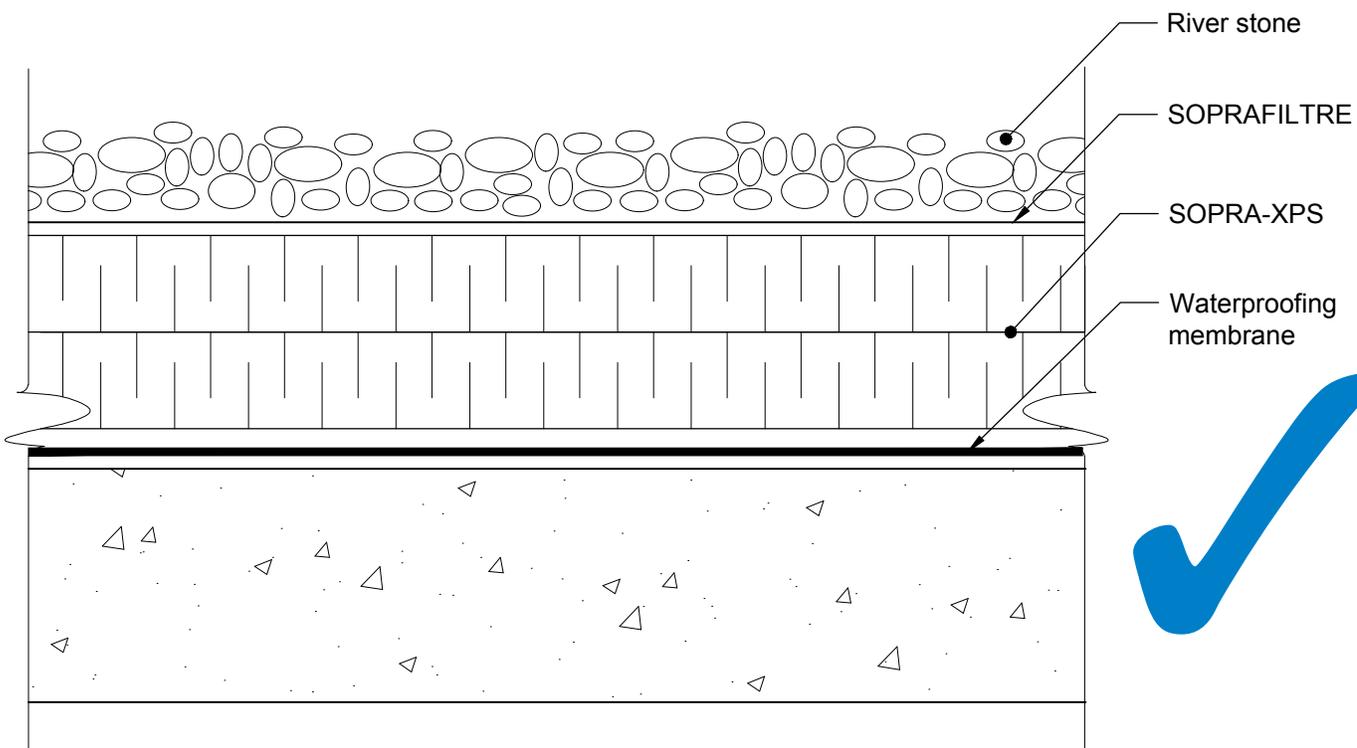


Figure 1

## PROTECTED MEMBRANE ROOF (PMR)

On the other hand, if the ballast consists of a non-diffusing continuous surface, such as concrete pavers, an open flow drainage panel like **SOPRADRAIN ECO-VENT** must be used (Figure 2).

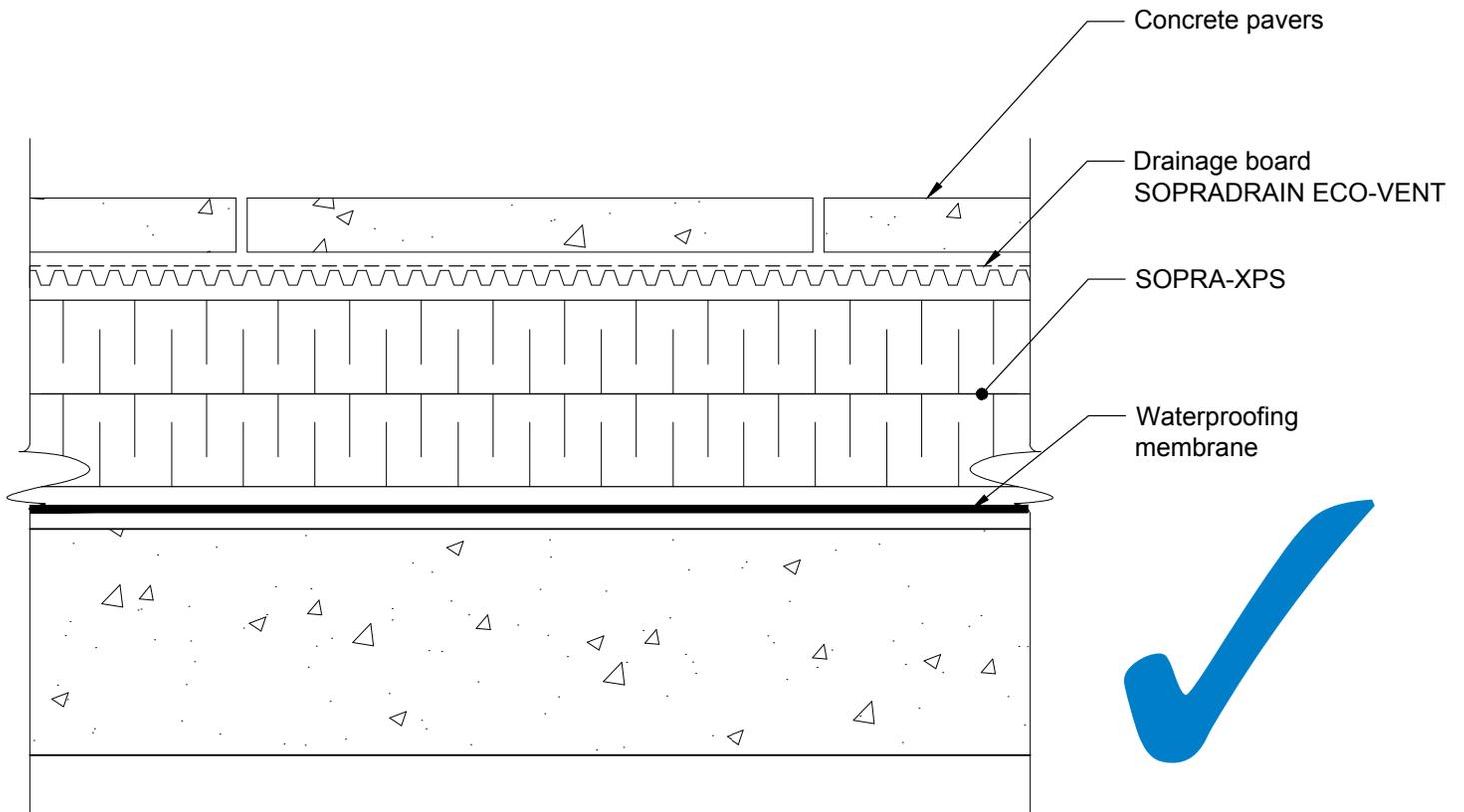


Figure 2

**Warning:** When the insulation and the drainage panels are laid down and exposed to direct sunlight, the air between them can become very hot. This accumulated heat can damage the insulation panels. The ballast, whether it is made of stones, pavers or a vegetated substrate, helps diffuse the heat. Therefore, it is very important to cover the drainage panels with ballast as they are being installed to prevent heat from damaging the integrity of the insulation panels.

## SHOULD A DRAINAGE PANEL BE USED UNDER THE INSULATION?

Drainage installation under the insulation, although promoting the flow of water, may compromise the R-value of the roof system by creating a convection phenomenon caused by the passage of air under the panels (Figure 3). Water entering the assembly up to the membrane level under the XPS insulation will evacuate effectively if the substrate has a minimum slope of 2%.

In conclusion, the long-term performance of the insulation will be ensured if the concept of open diffusion is respected and the insulation is placed directly on a surface with a minimum slope of 2%.

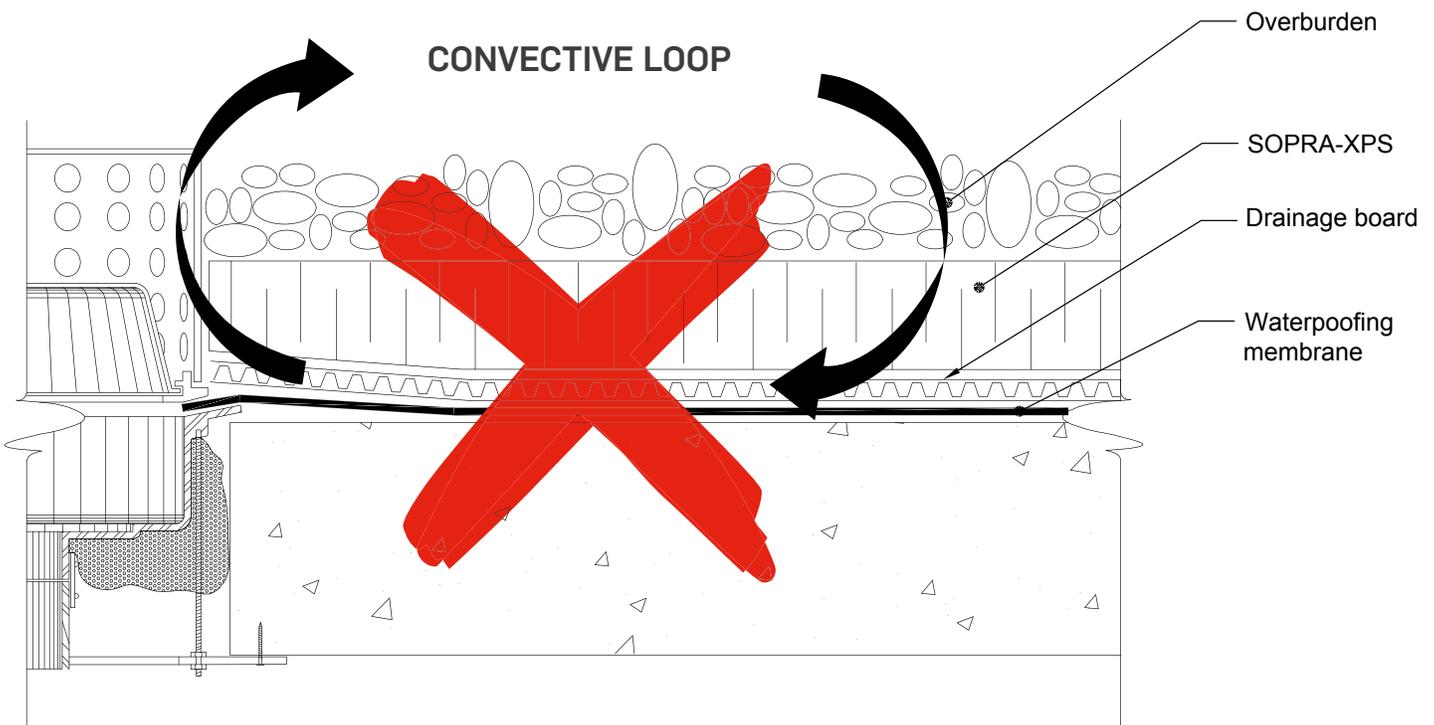


Figure 3

## POSITION OF THE INSULATION

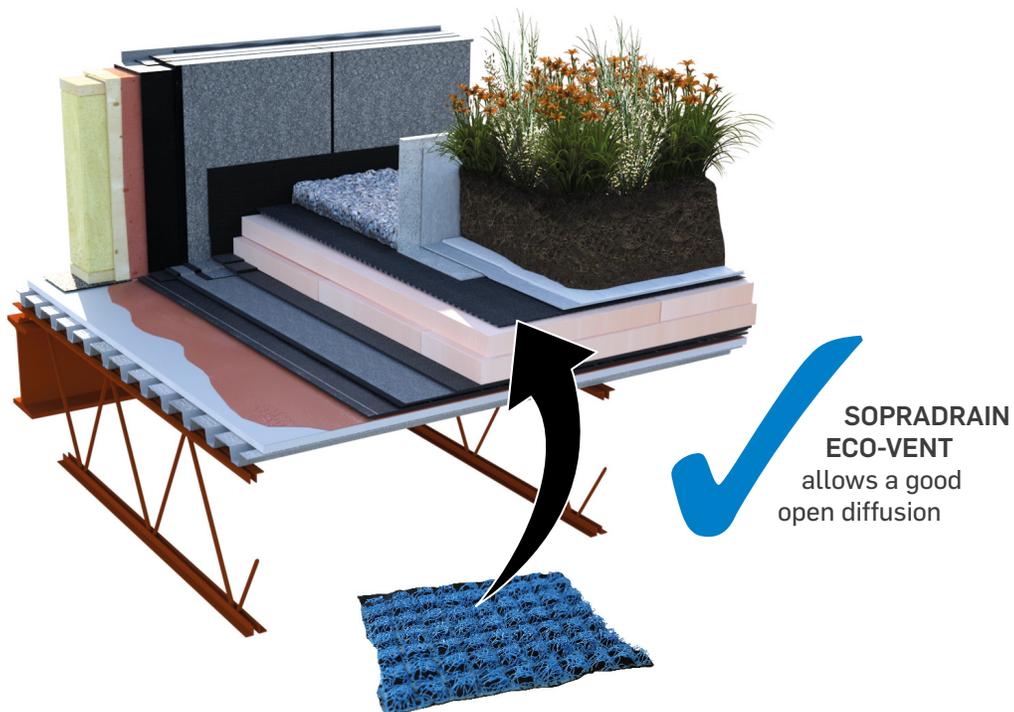
Insulation panels with shiplap edges on four sides can be installed in a single layer, as panels with straight edges can be installed in more than one layer. In all cases, the joints of the panels must be staggered. When the installation is done in two layers, the joints of the upper layer must be staggered with those of the lower layer.

## GREEN ROOF

The choice of insulation under a green roof system depends on the type of substrates, plants and ornamental elements selected. Insulation must be chosen based on the weight of the components to comply with the insulation's compressive strength limits.

Open diffusion is critical in the design of a vegetated system for protected membrane roofs. The sections with plants require the use of antiroot barriers that block the diffusion of vapour. Therefore, they must be installed directly over the membranes under the insulation boards.

Sections adjacent to plants may include concrete pavers or other continuous materials intended for pedestrian traffic that may also restrict open diffusion. As a result, an open flow drainage panel, such as **SOPRADRAIN ECO-VENT**, must be installed directly on the insulation prior to the installation of any components that do not allow the open diffusion of vapour. Please refer to **SOPREMA's SOPRANATURE** vegetated system documentation for details on appropriate solutions.



**SOPRADRAIN  
ECO-VENT**  
allows a good  
open diffusion

## RECOMMENDATIONS ABOUT BALLAST

The ballast on the insulation provides the wind resistance to protected membrane roofs. This weight also keeps the insulation in place during heavy rain.

Before placing the ballast material, a filter layer or a drainage panel must always be installed. Finally, to ensure the strength of the structure, the load capacity must be evaluated by an engineer.

There is no standard or test protocol for assessing the wind resistance of roofing systems with ballast. The ANSI/SPRI RP-4 standard proposes a theoretical calculation method for the required weight, but it does not include a wind speed chart for the various regions of Canada. However, in order to use the Canadian climatic informations in the ANSI/SPRI RP-4 standard, the Canadian Roofing Contractors Association (CRCA) published in their Volume 40 Technical Bulletin, a mathematical formula to convert the wind pressures, written in the National Building Code (NBC), to wind speeds. Therefore, to ensure that the roof assembly adequately withstands the wind loads, the minimum criteria as recommended by the Canadian Roofing Contractors Association (CRCA) in their Volume 35 Technical Bulletin should be followed.

### Summary of CRCA recommendations:

**Note:** The following weights are recommendations from the CRCA. It is the responsibility of the Project Designer and/or the General Contractor to determine the required weight and to choose the type of ballast material.

#### System with regular drain:

Common surface: Minimum of 50 kg/m<sup>2</sup> (10 lb/ft<sup>2</sup>) on the roof regardless of the amount of insulation.

Perimeter and corners: Minimum of 60 kg/m<sup>2</sup> (12 lb/ft<sup>2</sup>) for the first 50.8 mm (2 in) and then add 1 kg/m<sup>2</sup> (0.2 lb/ft<sup>2</sup>) per millimetre of additional insulation thickness.

#### System with controlled flow drain:

Common surface, perimeter and corners: Minimum of 60 kg/m<sup>2</sup> (12 lb/ft<sup>2</sup>) for the first 50.8 mm (2 in) and then add 1.6 kg/m<sup>2</sup> (0.33 lb/ft<sup>2</sup>) per millimetre of additional insulation thickness.

**Note:** At the perimeter of projections, on a strip of 1.20 m (4 ft), it is required that the same quantity of ballast as required for perimeters and corners be installed.

## REQUIRED QUANTITY OF BALLAST DEPENDING ON INSULATION THICKNESS

Thickness of SOPRA-XPS insulation panel mm (in)	MINIMAL BALLAST WEIGHT			
	REGULAR DRAIN		CONTROLLED FLOW DRAIN	
	Field Surface kg/m <sup>2</sup> (lb/ft <sup>2</sup> )	Perimeters, Coners and Penetrations kg/m <sup>2</sup> (lb/ft <sup>2</sup> )	Field Surface kg/m <sup>2</sup> (lb/ft <sup>2</sup> )	Perimeters, Coners and Penetrations kg/m <sup>2</sup> (lb/ft <sup>2</sup> )
51 (2) ET MOINS	50 (10)	60 (12)	60 (12)	
76 (3)		84 (17)	101 (20)	
101 (4)		108 (22)	141 (29)	
127 (5)		132 (27)	182 (37)	
152 (6)		156 (32)	222 (45)	
178 (7)		180 (37)	263 (54)	
203 (8)		204 (42)	304 (62)	

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