

Background report – bitumen membrane

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1. General description

Bitumen roll roofing or membrane is a waterproofing product which consists of bitumen, a support layer, fillers and is covered with mineral granules. In Finland, as well as in the other Nordic countries, the manufacturing of bitumen waterproofing almost exclusively uses bitumen modified with SBS (styrene-butadiene-styrene). Using SBS makes the bitumen elastic which increases its resistance to temperature changes, and most importantly in Finnish climate, cold. Globally, different copolymers are also used in modifying bitumen (APP, SBR and SEBS) but in Finland these are not commonly used.¹

In Finland, the supporting structure is generally made of polyester or glass fibre. Organic fibres have also been used but now most of the bitumen roofing is made with polyester or glass fibre.

Bitumen roofing products are divided into three different main categories: bottom layer membranes, top layer membranes and single-ply roofing system. The bottom and top layer membranes are generally used together as part of a two-ply roofing system, which provides better waterproofing than single-ply roofing, but is more material intensive. The single-ply system can function on its own as an effective waterproofing if the pitch of the roof is sufficient.

According to the Roof systems manual², the roofing membranes are divided into three product classes TL1, TL2 and TL3. The classes are defined by the mechanical and chemical durability, as well as the specific weight of the membrane.³

- TL1: Only consists of single-ply systems, i.e. products which can function on their own to form a sufficient water proofing. Can also be used as part of a two-ply or even three-ply systems as top layer.
- TL2: Contains most of the bitumen membranes in use. Includes both top layers and bottom layers.
- TL3: Only used as bottom layers in lighter roofing systems and as vapor barriers on roof slabs.

The manufacturing is done by heating the raw materials (bitumen and copolymers) to a specific temperature and mixing them. After this the mix is applied to the reinforcing structure (polyester or glass fibre). The resulting sheet is cooled and then faced with mineral granules. The bitumen is

¹ https://www.rakennustieto.fi/rtnet/muistilistat_25.1.08/10799.pdf

² In Finnish: Toimivat katot 2019

³ <https://www.kattoliitto.fi/kaikki-julkaisut/>

generally delivered as hot from the petroleum refinery to the manufacturing site, where it's heated further.

Most of the emissions of bitumen waterproofing come from the manufacturing of raw materials, specifically bitumen, SBS and the supporting polyester or glass fibre. Manufacturing electricity and heat used in the heating of bitumen and other production processes also have a significant impact on the emissions of the products.

Significant differences arise mainly from the amounts of bitumen and the SBS used in the products. As SBS has a large share of emission, using alternative copolymers to modify the bitumen would also change the carbon footprint.

Along with polyester and glass fibre, organic fibres have been used as the support structure of the bitumen sheets. Using organic matter instead of would decrease the emissions of the structure. Similarly, alternative binder materials could lead to similar results.

2. Market description

In Finland BMI Icopal, Nordic Waterproofing Suomi (product name Kerabit), and Katepal Oy manufacture bitumen sheets for water proofing. The market is largely domestic. Roughly estimated share of imports is <20% in the market.

3. Selected typical values

The following sources (see Annex 1) were used to compare the values of indicators and select the typical values:

- EPDs issued by European Waterproofing Association

The generic items and values are based on the market's largest manufacturers products for bitumen roofing. The values below are calculated with data gathered from said manufacturers and represent the common products. These manufacturers represent over 95 % of the Finnish bitumen roofing market. The import market was small enough so that the data from these Finnish manufacturers can be said to be well representative of the currently used products in Finland.

Following generic items are defined based on the most common types of products on the Finnish market:

- *Top layer membrane TL2:*
 - Mineral granule faced torchable SBS rubber bitumen top layer membrane, reinforced with a polyester structure. Thickness about 3.6 mm, nominal weight 5 kg / m².
- *Single-ply roofing system TL1:*
 - Mineral granule faced torchable SBS rubber bitumen single-ply roofing sheet, reinforced with a polyester structure. Thickness about 3.9 mm, nominal weight 5,5 kg / m².
- *Bottom layer TL2/TL3:*
 - Sand faced torchable SBS rubber bitumen bottom layer, reinforced with a polyester structure. Thickness about 3 mm, nominal weight 4 kg / m².
- *Roofing shingle:*
 - Self-adhesive SBS rubber bitumen roofing shingle, reinforced with a glass fibre structure with a heavy granulate layer from nickel manufacturing slag (which constitutes a significant portion of the product). Thickness about 3,1 mm, nominal weight 4 kg / m².
- *Continuous roofing system:*

- Mineral granule faced SBS rubber bitumen continuous roofing system with self-adhesive edges, reinforced with a polyester structure. Thickness about 2,9 mm, nominal weight 4 kg / m².

Now, following generic values are determined for each item according to this:

- GWP A1-A3 fossil
- Conversion factor
- Content of renewable materials
- Content of recycled materials
- Content and type of harmful substances (SVHC)

Waste processing (C3) emissions and carbon handprints are declared as stand-alone items within other database sections. See those sections⁴, including background reports, for more information.

⁴ [Rakentamisen päästötietokanta](#) (see sections: waste process & carbon handprint)

Annex 1. Reference values

EWA

Following items represents average plastomeric/elastomeric bitumen sheets commonly used in Europe and complying with local national requirements. The participating production locations gave data for the most important product produced for this intended use. Following this a mathematical average was made per group of countries (cluster) producing similar products. Based on an estimated production quantity per country a weighted average was calculated.

NEPD00271E Single layer fully torched modified bitumen roof waterproofing system

Carbon footprint fossil (A1 – A3) (kg/kg)	0,68
Products content/ Renewables (%)	0
Product content/Share of recycled materials (%)	0
Share (%) and type of harmful substances	<0.1
End of life scenario	recycling 8 % disposal 92 %
Carbon handprint (kg/kg)	-0,55

Functional unit: 1 m². Thickness: 4,3 mm. Product mass: 5,4 kg/m².

Generic composition: bitumen, fillers (e.g. limestone), Polymers (SBS, PP, etc.), Reinforcement (PET + glass), mineral surfacing.

NEPD00268E Single layer mechanically fastened modified bitumen roof waterproofing system

Carbon footprint fossil (A1 – A3) (kg/kg)	0,65
Products content/ Renewables (%)	0
Product content/Share of recycled materials (%)	0
Share (%) and type of harmful substances	<0.1
End of life scenario	recycling 8 % disposal 92 %
Carbon handprint (kg/kg)	-0,57

Functional unit: 1 m². Thickness: 4,4 mm. Product mass: 5,5 kg/m².

Generic composition: bitumen, fillers (e.g. limestone), Polymers (SBS, PP, etc.), Reinforcement (PET + glass), mineral surfacing.

NEPD00269E Multi-layer fully torched modified bitumen roof waterproofing system

Carbon footprint fossil (A1 – A3) (kg/kg)	0,60
Products content/ Renewables (%)	0
Product content/Share of recycled materials (%)	0
Share (%) and type of harmful substances	<0.1
End of life scenario	recycling 8 % disposal 92 %
Carbon handprint (kg/kg)	-0,39

Functional unit: 1 m². Top layer: Thickness: 3,8 mm. Product mass: 4,8 kg/m². Bottom layer: Thickness: 3,1 mm. Product mass: 3,7 kg/m².

Generic composition: bitumen, fillers (e.g. limestone), Polymers (SBS, PP, etc.), Reinforcement (PET + glass), mineral surfacing.

NEPD00269E Multi-layer fully torched modified bitumen roof waterproofing system

Carbon footprint fossil (A1 – A3) (kg/kg)	0,63
Products content/ Renewables (%)	0
Product content/Share of recycled materials (%)	0
Share (%) and type of harmful substances	<0.1
End of life scenario	recycling 8 % disposal 92 %
Carbon handprint (kg/kg)	-0,39

Functional unit: 1 m². Top layer: Thickness: 3,8 mm. Product mass: 4,8 kg/m². Bottom layer: Thickness: 3 mm. Product mass: 3,7 kg/m².

Generic composition: bitumen, fillers (e.g. limestone), Polymers (SBS, PP, etc.), Reinforcement (PET + glass), mineral surfacing.