Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

**Flexible sheet for waterproofing - Alkorplan L (1,5 mm)**

*Renolit*

Programme: The International EPD® System
Programme operator: EPD International AB
EPD registration number: S-P-01181
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An EPD should provide current information, and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at [www.environdec.com](http://www.environdec.com).

ECO EPD reference number: 00000635
Geographical scope: Europe
1. General Information

This document applies to Renolit Alkorplan L plastic sheet for roof waterproofing manufactured by Renolit in Sant Celoni, Spain. This Environmental Product Declaration is in accordance with ISO 14040 [1], 14025 [2] and 14044 Standards [3]. In addition to the general requirements for LCAs, this assessment is in accordance with the general programme instructions from the International EPD® System [4], and more specifically the requirements and structure of the Product Category Rules (PCR) for "Construction products and construction services (v2.2) " [5].

2. Company and product information

2.1 Company description

‘Renolit Waterproofing’ is the second largest manufacturer of synthetic single ply membrane in Europe. The brand name ALKOR, which is the subject of this EPD, is a thermoplastic membrane based on PVC-P.

The production plant of Renolit Iberica is externally verified for its environmental management system in accordance with ISO 14001. Health and safety of the workers are furthermore subject to monitoring and external control according national legislation.


2.2 Product specification

Renolit’s plastic sheets are used for roof waterproofing. Renolit Alkorplan L is a single ply multi-layer plastic sheet for roof waterproofing based on polyvinyl chloride (PVC) with embedded glass fleece reinforcing. Renolit Alkorplan L plastic sheets are available in different thicknesses. This EPD focuses on the 1.5mm thickness and 2050mm width variant.

Renolit’s sheets have been used throughout the world for almost 40 years, waterproofing flat roofs in both new construction and renovation projects for nearly all building types. The roofing membranes can be grouped in the European Standards for plastic and rubber sheets: the EN-13956 [6] and EN-13707 [7]. The UN CPC code of this group is 36390: plates, sheets, film, foil and strip, of plastics.

This EPD describes the environmental impacts of 1 square meter of flexible sheet for roof waterproofing with a thickness of 1.5 mm.

<table>
<thead>
<tr>
<th>Declaration of Performance</th>
<th>Unit</th>
<th>Alkorplan L</th>
</tr>
</thead>
<tbody>
<tr>
<td>External fire performance</td>
<td></td>
<td>F Roof</td>
</tr>
<tr>
<td>Reaction to fire (EN 13501-1)</td>
<td>E</td>
<td>F Roof</td>
</tr>
<tr>
<td>Water tightness (EN 1928)</td>
<td></td>
<td>Pass</td>
</tr>
<tr>
<td>Tensile force (EN 12311-2/A)</td>
<td>N/50 mm</td>
<td>n.r.</td>
</tr>
<tr>
<td>Elongation (EN 12311-2/A)</td>
<td>%</td>
<td>n.r.</td>
</tr>
<tr>
<td>Tensile stress (EN 12311-2/B)</td>
<td>N/mm²</td>
<td>&gt;= 9</td>
</tr>
<tr>
<td>Elongation (EN 12311-2/B)</td>
<td>%</td>
<td>&gt;= 180</td>
</tr>
<tr>
<td>Resistance to static loading (EN 12730/B and C)</td>
<td>kg</td>
<td>&gt;= 20</td>
</tr>
<tr>
<td>Resistance to impact (EN 12691/A)</td>
<td>mm</td>
<td>&gt;= 500</td>
</tr>
<tr>
<td>Resistance to impact (EN 12691/B)</td>
<td>mm</td>
<td>&gt;= 2000</td>
</tr>
<tr>
<td>Tear resistance (EN 12310-2)</td>
<td>N</td>
<td>&gt;= 110</td>
</tr>
<tr>
<td>Joint peel resistance (EN 12316-2)</td>
<td>N/50 mm</td>
<td>&gt;= 200</td>
</tr>
<tr>
<td>Joint shear resistance (EN 12317-2)</td>
<td>N/50 mm</td>
<td>&gt;= break</td>
</tr>
<tr>
<td>Artificial ageing (EN 1297)</td>
<td></td>
<td>Grade 1</td>
</tr>
<tr>
<td>Foldability at low temperature (EN 495-5)</td>
<td>^°C</td>
<td>&lt;= - 25 ^°C</td>
</tr>
<tr>
<td>Dangerous substances</td>
<td>Conform</td>
<td></td>
</tr>
<tr>
<td>Dimensional stability (EN 1107-2)</td>
<td>%</td>
<td>&lt;= 0,1</td>
</tr>
<tr>
<td>Bitumen compatibility (EN 1548)</td>
<td>n.r.</td>
<td></td>
</tr>
<tr>
<td>Resistance to root penetration (for green roofs; EN 13948)</td>
<td>pass</td>
<td></td>
</tr>
<tr>
<td>Ozone resistance (EN 1844)</td>
<td>pass</td>
<td></td>
</tr>
</tbody>
</table>

The Froof is a European Union code to indicate the External fire performance that is in accordance with the EN13956. Tensile stress and elongation norms can be subdivided into two categories: homogeneous sheets (B) and reinforced sheets (A). This distinction is also included in the table above.

The abbreviation n.r. indicates that the declaration of performance category is not relevant for the product.
2.3 **Base materials**
The base raw materials for Renolit Alkorplan L plastic sheet for roof waterproofing are:
- Polyvinyl chloride (PVC) – 50-65%
- Plasticiser (Phthalate plasticiser) – 25-35%
- Stabilisers (UV/heat) – 1-3%
- Reinforcing material, embedded glass fleece – 1-2%
- Thermic stabiliser – 1-3%
- Color pigments - <1%

The recipe contains no hazardous substances. In accordance with current knowledge, this product contains no substances of very high concern (SVHC) on the /REACH Candidate List/ published by the European Chemicals Agency in a concentration exceeding 0.1 % (by unit weight).

2.4 **Manufacturing**
Renolit Alkorplan L plastic sheet for roof waterproofing are manufactured in the following steps:
- Dosing and mixing of various raw materials in powder and liquid form in a dry blend
- Plastification of this dry blend in an extruder
- Inserting this plasticised melt between a system of rolls (calender process) to obtain a layer or inserting this plasticised melt through a die (extrusion process) to obtain a layer
- Heat fusing of several layers obtained by the previous process with inserting of a polyester scrim, on a lamination machine
- Cutting on width and roll length and winding onto cardboard core
- Labelling and palletising

Production waste is recycled back into the manufacturing process. Production waste is treated like a normal raw material as described in the externally verified quality management.

The waterproofing sheets are manufactured in continuous processes as illustrated below:

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**Figure 1: Process tree of one m² of Alkorplan L.**
2.5 Product Application
Renolit Alkorplan L plastic sheet for roof waterproofing is used as an exposed sheet in a single ply ballasted roofing system. The slope of the roof is limited by the required external fire performance of the roof system.

In order to withstand wind uplift, single ply Alkorplan L sheets are are loose laid and ballasted by gravel (80kg/m2).

2.6 Delivery status
Individual rolls on cardboard core are partially wrapped in PE foil and palletised. A protection PE foil is laid over the pallet and held together with PE straps. All packaging material can be sorted and collected for recycling.

The products are delivered palletised.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Width</th>
<th>Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,5 mm</td>
<td>2,05 m</td>
<td>P9RL15</td>
</tr>
</tbody>
</table>

P9RL15 : 9 rolls of 15 running meters on a pallet

3. Functional unit

3.1 Functional Unit
The functional unit has been defined as follows: the production, installation - including fasteners & losses - and waste processing of 1 m² plastic sheet for roof waterproofing, with a reference building service life of 90 years.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>m²</td>
</tr>
<tr>
<td>Thickness</td>
<td>1,5</td>
<td>mm</td>
</tr>
<tr>
<td>Final weight</td>
<td>1,80</td>
<td>kg/m²</td>
</tr>
</tbody>
</table>

The reference service life (RSL) of Renolit’s plastic sheets for roof waterproofing is set at 30 years. This reference service life is based on internal and external accelerated testing and audits of installed projects. The British Board of Agrément confirmed this reference service by granting Technical approval, providing that the quality of the project and in-use conditions of use are respected. The latter is relevant, since the RSL is dependent on the properties of the product and in-use conditions. This also means that 2 renewals will be necessary during the reference building service life of 90 years.

3.2 System boundary
Type of EPD: Cradle to gate (with options)

The system boundaries of the EPD follow the modular construction system described by EN 15804. The LCA takes into account the following modules:

3.2.1 Production stage (A1-A3)
This includes three modules, A1, A2 and A3, concerning the extraction and processing of raw materials, transport and manufacturing, respectively.

3.2.2 Construction stage (A4-A5)
A4. This includes transportation from the manufacturing plant in Sant Celoni to the construction site. A distance of 800km, by road, has been assumed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle type</td>
<td>Truck</td>
<td>-</td>
</tr>
<tr>
<td>Fuel type and consumption</td>
<td>0,03</td>
<td>liter / tkm</td>
</tr>
<tr>
<td>Capacity use (including empty returns)</td>
<td>50</td>
<td>%</td>
</tr>
<tr>
<td>Bulk density of transported products (packaging included)</td>
<td>2,05</td>
<td>Kg per m² (thickness 1.5mm)</td>
</tr>
</tbody>
</table>

A5. Alkorplan L sheets are loose laid and ballasted by gravel. A total of 80kg is used per m² of roof waterproofing sheet. Additional material consumption due to overlaps (1%) and installation losses (3%) during the installation process is accounted for.

Together with the installation losses, packaging materials are for 100% collected and processed for energy recovery. For these materials a distance of 50 km is estimated from the construction site to the nearest municipal waste incineration facility.

3.2.3 Replacement stage (B4)
In order to conform to the building service life of 90 years, each roofing membrane with a
service life of 30 years requires two renewals. This means that the environmental impact related to production (A1-A3), transportation to the production site (A4) and installation (A5) of two additional roofing membranes is reported in this module. Simply put, the replacement phase (B4) consists of the environmental impact as a result of the modules A1-A5 times two, with everything that it implies:

- Product manufacturing
- Manufacturing of the components and ancillary materials
- Transport to the customer
- Energy consumption, installation losses and additional materials during installation
- Management of waste from packaging and installation losses.

The subsequent end-of-life stage is also declared for a reference service life of 90 years.

### 3.2.4 End of life stage (C2-C4)

**C2.** A transport distance of 800 km from the building site to the recycler was taken into account [8].

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle type</td>
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<td>0.03</td>
<td>liter / tkm</td>
</tr>
<tr>
<td>Capacity use (including empty returns)</td>
<td>50</td>
<td>%</td>
</tr>
<tr>
<td>Bulk density of transported products</td>
<td>1.80</td>
<td>Kg per m² (thickness 1.5mm)</td>
</tr>
</tbody>
</table>

**C3/C4.** Loose laid sheets are easily removed, and are therefore relatively straightforward to recycle during the waste treatment stage (100% recyclable). It is, however, assumed that 10% of the sheet is lost during the -granulation process. This 10% loss is transported to a landfill (50km).

### 3.2.5 Benefits and loads beyond the system boundary (D)

Based on the PVC and PES content of the sheet, the amount of avoided virgin material has been determined at:

<table>
<thead>
<tr>
<th>Alkorplan L</th>
<th>Unit (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final weight</td>
<td>1.80</td>
</tr>
<tr>
<td>Avoided PES</td>
<td>0.00</td>
</tr>
<tr>
<td>Avoided PVC</td>
<td>0.92</td>
</tr>
</tbody>
</table>

### 3.3 Data quality and allocation

To simulate the product stage, data recorded by Renolit from production year 2014 were used. All other relevant background data sets were taken from generic data not older than 10 years.

The primary data provided by Renolit Belgium derive from the production plant: Renolit Iberica. All background data records were retrieved from the Ecoinvent database (Version 3.2).

The average Spanish electricity mix with a medium voltage is used at Renolit’s production site in San Celoni (Spain), together with natural gas. Corresponding Ecoinvent records were used.

### 3.3.1 Cut-off criteria

All data was taken into account (e.g. recipe constituents, thermal energy used, electricity used). Transport expenses were considered for all inputs and outputs. The manufacturing of the production machines and systems and associated infrastructure was not taken into account in the LCA.

### 3.3.2 Allocation rules

Allocation issues occur within the cradle-to-gate and gate-to-cradle boundaries.

**Cradle-to-gate**
A mass allocation procedure regarding the roofing sheet under study and other products manufactured in the plant has been followed.

Within the cradle-to-gate system boundaries only closed-loop recycling takes place. That is: scrap materials from the production process are used as raw input materials, thereby avoiding the need for additional raw materials. Since the environmental burden of this production waste was already accounted for in the previous product, internally recycled (i.e. closed-loop) materials carry only the environmental loads of the reprocessing effort.
Gate-to-crade
Within the gate-to-cradle system boundary, some of the product (PVC content) is recycled at the end-of-life to an unknown destination, i.e. an open loop system. Because the products reach an end-of-waste status after being reprocessed, the environmental impact of the recycling process is allocated to the preliminary life cycle, i.e. the product under study.

3.3.3 Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Results
The results displayed below apply to 1 m² Renolit’s Alkorplan L, with a thickness of 1.5mm.

![Table of LCA results](image)

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

![Unit conversion table](image)
PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water.

| RW | kg | 2,68E-04 | 2,89E-05 | 8,42E-05 | 7,62E-04 | 7,82E-05 | 1,36E-03 | 8,93E-07 | -1,83E-06 |
| HW | kg | 2,58E-06 | 4,83E-05 | 7,17E-04 | 6,96E-06 | 2,24E-04 | 1,13E-07 | -8,55E-07 |
| NHW | kg | 2,05E-01 | 4,99E-01 | 2,82E-00 | 5,37E-01 | 5,76E-01 | 5,63E-01 | -2,52E-01 |

HW = Hazardous waste; NHW = Non-hazardous waste; RW = Radioactive waste.

5. LCA: Interpretation

As shown in Figure 2, the life cycle impact of the Alkorplan L roofing sheet is dominated by the replacement phase (B4). This stage determines between 46% (GWP), 57% (ODP) and 55% (POCP) of the total life cycle impact. The replacement stage (B4), in turn, is determined for approximately 90% for all environmental indicators by the production phase (A1-A3). In the production phase, energy use contributes most to GWP (54%), followed by the GWP emissions associated with PVC (20%) and plasticisers (11%).

![Contribution of life cycle stages on different impact categories (35177015)](image)

Figure 2: Contribution of the different life cycle stages to the environmental impact of one m² of Alkorplan L (35177015).

The figure additionally shows that many impact categories have a significant negative score (=impact benefits). This negative score is the result of avoided primary materials due to the ‘Roofcollect recycling system’.
# Programme-related information and verification

Product category rules (PCR):
- GENERAL PROGRAMME INSTRUCTIONS FOR THE INTERNATIONAL EPD® SYSTEM, 2015:11, version 2.5, International EPD® System
- CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES, 2012:01, version 2.2, International EPD® System

Independent verification of the declaration and data, according to ISO 14025:2006:
- □ EPD Process Certification (internal)
- ☑ EPD Verification (external)

Third party verifier:
Matthias Schulz, Schulz Sustainability Consulting, 70469 Stuttgart, Germany

Accredited by:
“Approved by the International EPD System”

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8. References


