

B-EPD .BE  
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# DERBIGUM DERBIGUM NT 4



ISSUED 04.05.2024  
VALID UNTIL 04.05.2024

**THIRD PARTY VERIFIED**  
in accordance with EN 15804+A2  
and BE-PCR version 18.10.2022

#### MODULES DECLARED

Ensure the waterproofing of 1m<sup>2</sup> of roof with bituminous membrane with activities needed for a study period of 60 years for building

Cradle-to-grave

A123	A4	A5	B2 B4	C	D
•	•	•	•	•	•



The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings. This EPD is only valid when registered on [www.b-epd.be](http://www.b-epd.be). The FPS Public Health cannot be held responsible for the information provided by the owner of the EPD.

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# 1 PRODUCT DESCRIPTION

## 1.1 Product name

Derbigum NT 4

The product is declared "as installed" - "fully torched by use of flame" (torched with flame) (module A5 declared), with ancillary material (propane).

## 1.2 Product description and intended use

Derbigum NT is a bituminous waterproofing membrane modified by plastomeric polymers. Derbigum NT partly consists of bitumen extracted from recycled cutting waste and used bituminous roofing membranes (Derbitumen). The upper side of the Derbigum NT membrane is fitted with two reinforcements, one glass-fibre and one non-woven polyester (both with a recycled content). This gives the membrane dimensional stability, and tear and puncture resistance.

The reference product has a thickness of 4 mm (Derbigum NT4 – noted DG4). The alternative thickness is 3 mm (Derbigum NT3 – noted DG3).

Derbigum NT 4 is a product.

This is a specific EPD from a single company.

Intended use :

- reinforced bituminous sheet for roof waterproofing

The product can be used on different types of substrates: wood, concrete, and sheet steel

## 1.3 Reference flow / Functional unit

FUNCTIONAL UNIT (FU): "ENSURE THE WATERPROOFING OF 1 M<sup>2</sup> OF ROOF WITH BITUMINOUS MEMBRANE, FROM CRADLE-TO-GRAVE, WITH ACTIVITIES NEEDED FOR A STUDY PERIOD OF 60 YEARS FOR THE BUILDING".

THE FU INCLUDES THE OVERLAP NECESSARY TO ENSURE A CORRECT INSTALLATION. THE OVERLAP IS 10.5%, AND THE FU CORRESPOND TO 1.105 M<sup>2</sup> OF MEMBRANE.

Packaging is included.

The weight per reference flow is 4,976 kg/FU  
(4,503 kg/m<sup>2</sup> net area)

The density of the product is 1126 kg / m<sup>3</sup>.



## 1.4 Installation

Materials for fixation and installation are included. It consists in propane for fully torch installation.

This EPD includes the necessary overlap of two strips of membrane to ensure the tightness (10,5%), and the installation losses (2%),

Detailed information on this scenario can be found in the chapter "Data of the underlying scenario's".

You can find more detailed information helping to develop alternative scenarios in the chapter "Technical information for scenario development at building level" (cold bonded with bituminous cold glue, mechanical fixing with screw, loose lay under ballast).



## 1.5 Composition and content

The main product components are shown in the table below.

Components	Composition / content / ingredients	Quantity
Product	<ul style="list-style-type: none"><li>- Bitumen</li><li>- Polymers</li><li>- Reinforcement (support)</li><li>- Others (charge, minerals, finishing)</li></ul>	<ul style="list-style-type: none"><li>- 50-60%</li><li>- 13-20%</li><li>- 4-6%</li><li>- 20-30%</li></ul>
Fixation materials	<ul style="list-style-type: none"><li>- Propane</li></ul>	<ul style="list-style-type: none"><li>- 0,150 kg/FU</li></ul>
Jointing materials	<ul style="list-style-type: none"><li>- <i>None</i></li></ul>	
Treatments	<ul style="list-style-type: none"><li>- <i>None</i></li></ul>	
Packaging	<ul style="list-style-type: none"><li>- Pallet</li></ul>	<ul style="list-style-type: none"><li>- 0,1381 kg/FU</li></ul>

The product does not contain materials listed in the "Candidate list of Substances of Very High Concern for authorization".

## 1.6 Reference service life

The reference service life of the building is set to 60 years, in compliance with TOTEM rules.

The Derbigum NT 4 has a reference service life of 40 years. One replacement is accounted in order to maintain the function during the 60 years of life of the building.

In practice, the existing layer is left in place and an additional layer of Derbigum NT 4 is added on it.

The conditions under which this RSL is valid are the following: normal use of a correctly installed roof water-proofing coating system, with proper maintenance/replacement.

The installation is supposed to be carried out according to the rules of the art, and in accordance with the installation instructions issued by the manufacturer, and in compliance with the applicable standards.

## 1.7 Description of geographical representativity

The B-EPD is representative for the Belgian market for A123, A4, A5, B, C and D.

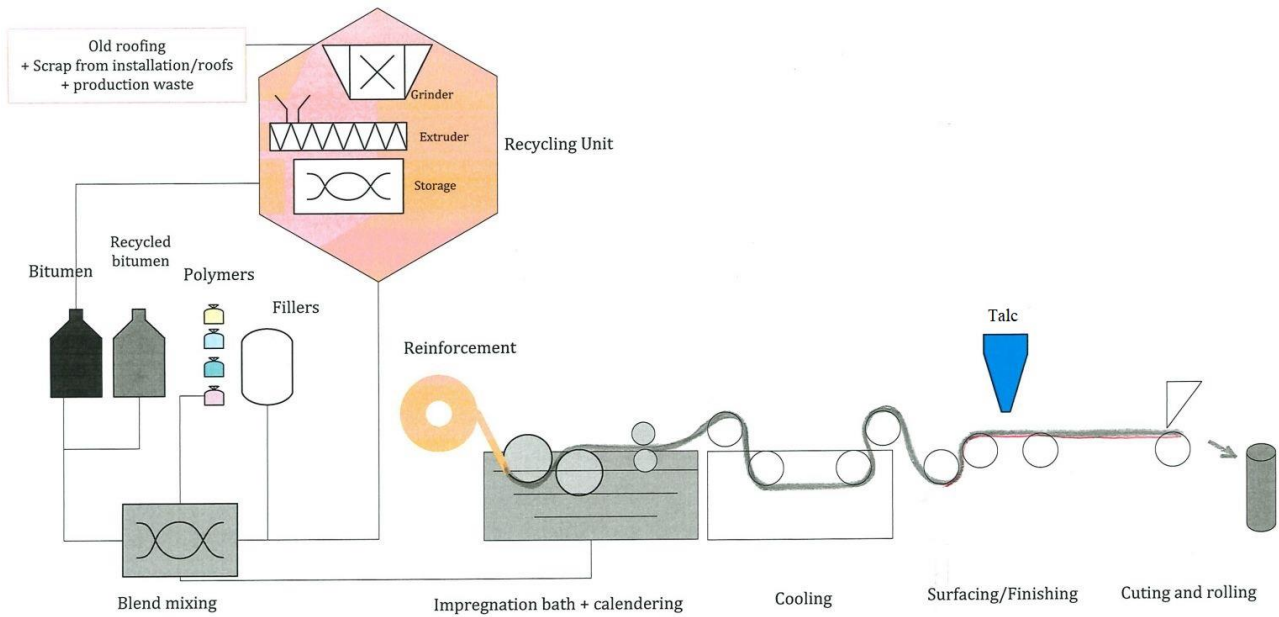
The assumed market for the installation, the use phase and the end-of-life is Belgium.



## 1.8 Description of the production process and technology

Virgin bitumen, recycled mix and plastomer/elastomer are mixed and stored in liquid phase at 180°C in 16-tonne tanks. The mixture is impregnated with a double reinforcement of glass cloth and nonwoven polyester (for Derbigum NT membranes), then laminated by calendaring. Once cooled, the bottom and top side of the membrane are then treated with chalk or talc, then cut into 7,27 m lengths and rolled up. Finally, it is packaged. Any waste as a result of the production is collected and internally recycled.

Water is used to cool the bitumen during the process in a closed-circuit.



## 2 TECHNICAL DATA / PHYSICAL CHARACTERISTICS

The modified bituminous roofing membrane is covered by harmonized technical specification EN 13707:2004+A2:2009 (Flexible sheets for waterproofing - Reinforced bitumen sheets for roof waterproofing - Definitions and characteristics). Declaration of performance according to EU regulation 305/2011 is available for the declared product.

Further technical information can be obtained by contacting the manufacturer or on the manufacturers.  
Website: [www.derbigum.be](http://www.derbigum.be) / [www.derbigum.com](http://www.derbigum.com)

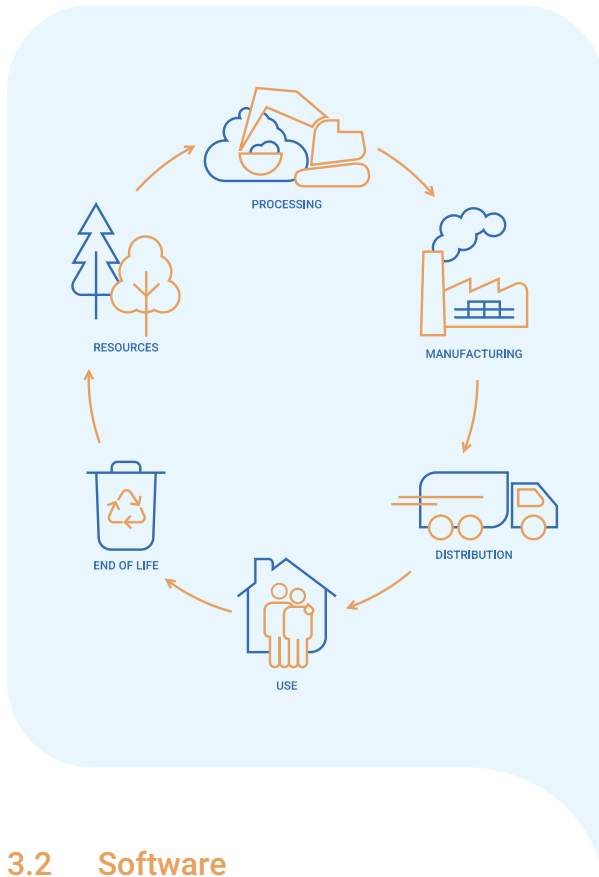
Technical property	Standard	Value	Unit	Comment
Thickness		4	mm	also available in 3 mm
Thermal conductivity $\lambda$		0,23	W/m.K	Not measured - TOTEM value for roof waterproofing bitumen sheet
Thermal resistance R		0,017	m <sup>2</sup> .K/W	Calculated from $\lambda$ value for 4 mm thickness
Flow resistance	EN 1110	$\geq 140$	°C	
Cold bending	EN 1109	-15	°C	
Tensile strength L/T	EN 12311-1	750 x 650	N/50 mm	
Elongation at break L/T	EN 12311-1	45 x 45	%	
Resistance to static loading method A		20	kg	
Resistance to impact method A and B		1250	mm	
Dimensional stability	EN 1107-1	$\leq 0,2$	%	
Tear resistance	EN 12310-1	$\geq 150$	N	
Dynamic seizure (B)		$\geq 1250$	mm	
Static seizure (A)		$\geq 20$	kg	
Density		1126	kg/m <sup>3</sup>	
External fire performance		FRoof (t1, t2, t3, t4)	-	
Reaction to fire		E		



## 3 LCA-STUDY

### 3.1 Date of LCA-study

March 2024.



### 3.2 Software

For the calculation of the LCA results, the software program SimaPro 9.5.0.2 has been used.

### 3.3 Information on allocation

Allocation was avoided as far as possible by dividing unit processes into more detailed sub-processes. When allocation had to be made, it was done in accordance with EN 15804+A2 section 6.4.3.

Different bituminous products are produced at the Derbigum site, and the site data (energy use, generation of waste and emissions) have been allocated to the products based on the relative weight (mass allocation).

The processing of the products at the site are similar, consequently this allocation was judged to be a good approximation.

In line with the system boundaries, secondary raw materials are included with no environmental impacts from its previous lifecycle allocated to the material. However, the environmental burden of reprocessing/recycling the material to the state in which it is used at the Derbigum site in Perwez is included.

Similarly, Derbigum uses old roofs as raw material in new roofs. Derbigum has specific data concerning the reprocessing of the bitumen roof to replace virgin bitumen in the product. The reprocessing step is allocated to module A where old roofs are used as input material and is reprocessed to secondary material replacing bitumen. Consequently, to not double count, the end of waste state in module C occurs when the old roof has been transported back to Derbigum production facility in Perwez. LCA of the recycled materials is realised with primary data (and ecoinvent background data)

Furthermore, allocation has been applied to bituminous material from Eurobitume-members. The allocation between these bitumen and other co-products made from crude oil is based on mass balances at the crude oil extraction and the transport stages. At the refining level, the allocation is based on relative economic values (Eurobitume, 2020, 2022).

### 3.4 Information on cut off

The general rules for exclusion of inputs and outputs in the LCA follows the rules of in EN 15804+A2, section 6.3.6, where the cut-off criterion is 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows per module shall be maximum of 5% of energy usage and mass.



### 3.5 Information on excluded processes

Following processes were excluded for the inventory:

- Lighting, heating and cleaning of production sites,
- Administrative department,
- Employee transport,
- Manufacture of production tools and transport systems (where these were not directly included in the life cycle inventories used),
- Consumables required for the operation of the process (lubricating oil)
- Infrastructure
- Long-term emissions.

The following processes are considered below cut-off and excluded:

- Production and waste management of packaging materials used for incoming raw materials.
- The polyethylene edge on the upper side (0,03% of FU weight).
- Production and waste management of packaging materials accompanying the product which are small (0,25% of FU weight), these are:
  - Corrugated board
  - Plastic packaging
  - Tape



### 3.6 Information on biogenic carbon modelling

There are no significant biogenic carbon flows in the products however the wooden pallets that are used for packaging contain biogenic carbon.

Biogenic carbon is calculated as in EN16449:2014.

**Pallet:**

Humidity : 12 %

Carbon content: 0,494 kg C/kg wood (source ecoinvent 3.9.1 documentation for the "softwood" used in pallets)

Biogenic carbon: 0,1381 kg pallet/FU

$$0,1381 \times 0,494 \times 1 / (1 + 12 / 100) = 6,092 \text{ E-02 kg C/FU}$$

$$\times 44 / 12 = 0,2234 \text{ kg CO}_2 \text{ /FU}$$

Biogenic carbon content	(kg C / FU)
Biogenic carbon content in product (at the gate)	0
Biogenic carbon content in accompanying packaging (at the gate)	6,092 E-02 kg C/FU (0,2234 kg CO <sub>2</sub> /FU)

### 3.7 Information on carbon offsetting

Carbon offsetting is not allowed in the EN 15804 and hence not taken into account in the calculations.

### 3.8 Additional or deviating characterisation factors

For EN 15804+A2, the characterisation factors of EC-JRC were applied.

The method for the characterisation for the indicators corresponds to the CF of EN 15804+A2:2019 (adapted 1.00) as implemented in SimaPro 9.5.0.2, with adaptations made by PRé Sustainability to match the substances used in the SimaPro libraries (EN15804 reference package based on the EF 3.1 reference package).

For energy resources, the "Cumulative energy demand (LHV)" method is used. It was created by PRé Sustainability from the data published by ecoinvent for the raw materials available in the SimaPro database. The method calculates the lower heating values (LHV).

Waste flows are calculated using the EDIP 2003 method (Hauschild 2003) (version of the Danish EDIP97 method adapted for SimaPro - <http://www.lca-center.dk/cms/site.aspx?p=4441>).

All characterisation factors are in accordance with EN 15804:2012+A2:2019.

In accordance with BE-PCR, when infrastructure data is available in generic data (e.g. ecoinvent) used for up-stream or downstream processes, it should be included (A17); the effects of long-term emissions are excluded (A22).

### 3.9 Description of the variability

Not relevant, the B-EPD corresponds to a single production site.

### 3.10 Specificity

The data used for the LCA are specific for this product which is manufactured by a single manufacturer in a single production site.



### 3.11 Period of data collection

Manufacturer specific data have been collected for the year 2021.

### 3.12 Information on data collection

The data for consumption (materials and energy), origin of materials; average transport (A4), recycling process, are primary data transmitted directly by Derbigum.

### 3.13 Database used for background data

The database used is ecoinvent 3.9.1, except for bitumen which is modelled by specific data transmitted by Eurobitume (update 2021).

The reinforcement is modelled from the corresponding EPD (validity 2026).

In accordance with EN 15804:2012+A2:2019 and the BE-PCR supplement, when generic data from ecoinvent v3 is used, the system model "allocation, cut-off by classification" is used.

Update date: ecoinvent 3.9.1: January 2023.

The background data are less than ten years old: either they are updated in the database, or they have been adjusted according to direct information about the Belgian situation (e.g. electricity mix).

A time period of 100 years is used for the assessments.

The recycling process data comes from a previous study. The first version was based on 2018 data, and an update has been done data from year 2021. The study is realised in accordance with standard EN 15804:2012+A2:2019<sup>1</sup>.

### 3.14 Energy mix

#### 1. Belgian grid mix:

The ecoinvent database version 3.9.1 integrates the Belgian mix for 2019.

The 2021 Belgian mix is modelled on the basis of the distribution of energy sources available at national level (Statbel , SPF Économie , ELIA , FEBEG ) (background data Ecoinvent 3.9.1).

Energy sources 2021: 50,25% nuclear, 24,4% fossil (natural gas 22,5%), 22,9% renewable, other 2,5% (pumped hydro, Q recovery, non-renewable waste, others)

Renewable: 0,4% non-pumped hydro, 5,6% solar, 11,9% wind, 0,9% renewable urban waste, 3,1% solid biomass, 1,0% biogas.

#### 2. Derbigum/Imperbel mix: (2021)

The electricity invoiced by Engie to Derbigum for the reference period corresponds to a 100% renewable electricity mix. The corresponding mix has been modelled according to the data provided by Engie and the Walloon Region (background data Ecoinvent 3.9.1).

Energy sources: 0,7% biogas, 35,34% biomass, 3,8% waste, 26,64% wind, 33,52% hydropower.

<sup>1</sup> No direct verification document available, but implicit validation by acceptance of the report results and information to produce EPD (DK) and FDES (FR).



## 4 PRODUCTION SITES

The B-EPD is specific to one production site:

Imperbel – Derbigum - Chaussée de Wavre 67, 1360 Perwez, Belgium

## 5 SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End of life stage				Beyond the system boundaries	
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

X = included in the EPD

□ = module not declared














All known use of resources and emissions to air, water and soil are included. The environmental impacts of the various activities in the life cycle are included regardless of geographic location. The sensitivity of the recipient environment in question has not been considered.

The system boundary with nature is set, in accordance with EN 15804 Section 6.3.4.2, to include those processes that provide the material and energy inputs into the system and the following manufacturing, and transport processes up to the grave as well as the processing of any waste arising from those processes.

With regards to recycling or other recovery of waste, impacts are borne by the product and included in the system until the waste is managed to the end-of-waste state. Benefits and credits of recovery are inside the system boundaries in module D. The environmental impact of the processing/recycling of secondary raw materials is included in the system boundaries, however the environmental burden from its previous lifecycle is excluded in line with the Polluter Pays Principle.



# 6 POTENTIAL ENVIRONMENTAL IMPACTS PER REFERENCE FLOW

	Production			Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
 GWP total (kg CO2 equiv/FU)	3,20E+00	2,50E-01	4,67E-01	1,20E-01	9,50E-01	0,00E+00	0,00E+00	0,00E+00	4,99E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,35E-01	4,88E-04	6,40E-02	-4,54E-01
 GWP fossil (kg CO2 equiv/FU)	3,20E+00	2,50E-01	6,90E-01	1,20E-01	7,26E-01	0,00E+00	0,00E+00	0,00E+00	4,98E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,35E-01	4,87E-04	6,40E-02	-3,18E-01
 GWP biogenic (kg CO2 equiv/FU)	0,00E+00	0,00E+00	-2,23E-01	0,00E+00	2,23E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,36E-01
 GWP luluc (kg CO2 equiv/FU)	2,35E-03	1,26E-04	3,87E-04	5,82E-05	1,86E-04	0,00E+00	0,00E+00	0,00E+00	3,10E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,14E-04	5,40E-07	4,58E-06	2,13E-04
 ODP (kg CFC 11 equiv/FU)	1,20E-07	5,32E-09	3,23E-08	2,61E-09	1,54E-08	0,00E+00	0,00E+00	0,00E+00	1,76E-07	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,12E-09	1,45E-11	1,40E-10	-3,96E-08
 AP (mol H+ eq/FU)	1,47E-02	1,26E-03	1,41E-03	3,91E-04	1,06E-03	0,00E+00	0,00E+00	0,00E+00	1,89E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,67E-04	3,57E-06	7,69E-05	-2,32E-03
 EP - freshwater (kg (PO4)3- equiv/FU)	1,58E-04	1,93E-06	8,43E-06	9,59E-07	6,86E-06	0,00E+00	0,00E+00	0,00E+00	1,76E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,88E-06	5,89E-09	9,77E-08	4,74E-06
 EP - marine (kg (PO4)3- equiv/FU)	3,04E-03	3,84E-04	4,16E-04	1,33E-04	2,25E-04	0,00E+00	0,00E+00	0,00E+00	4,20E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,61E-04	1,39E-06	6,40E-05	-2,58E-04
 EP - terrestrial (kg (PO4)3- equiv/FU)	3,34E-02	4,15E-03	5,25E-03	1,42E-03	2,50E-03	0,00E+00	0,00E+00	0,00E+00	4,67E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,79E-03	1,53E-05	1,70E-04	-5,98E-04
 POCP (kg Ethene equiv/FU)	1,22E-02	1,51E-03	2,01E-03	5,84E-04	1,44E-03	0,00E+00	0,00E+00	0,00E+00	1,78E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,15E-03	4,57E-06	7,53E-05	-1,53E-03
 ADP Elements (kg Sb equiv/FU)	1,29E-05	7,64E-07	2,50E-06	3,85E-07	1,63E-06	0,00E+00	0,00E+00	0,00E+00	1,81E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,56E-07	5,17E-09	1,34E-08	7,13E-06
 ADP fossil fuels (MJ/FU)	1,68E+02	3,51E+00	1,04E+01	1,70E+00	1,17E+01	0,00E+00	0,00E+00	0,00E+00	1,95E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,34E+00	1,43E-02	1,29E-01	-1,82E+02
 WDP (m³ water eq deprived /FU)	4,56E-01	1,39E-02	7,24E-02	6,93E-03	3,02E-02	0,00E+00	0,00E+00	0,00E+00	5,79E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,36E-02	1,17E-04	5,38E-03	-3,97E-02

GWP TOTAL = TOTAL GLOBAL WARMING POTENTIAL (CLIMATE CHANGE); GWP-LULUC = GLOBAL WARMING POTENTIAL (CLIMATE CHANGE) LAND USE AND LAND USE CHANGE; ODP = OZONE DEPLETION POTENTIAL; AP = ACIDIFICATION POTENTIAL FOR SOIL AND WATER; EP = EUTROPHICATION POTENTIAL; POCP = PHOTOCHEMICAL OZONE CREATION; ADPE = ABIOTIC DEPLETION POTENTIAL – ELEMENTS; ADPF = ABIOTIC DEPLETION POTENTIAL – FOSSIL FUELS; WDP = WATER USE (WATER (USER) DEPRIVATION POTENTIAL, DEPRIVATION-WEIGHTED WATER CONSUMPTION)

# 7 RESOURCE USE







	Production			Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
PERE (MJ/FU, net calorific value)	2,38E+00	5,26E-02	6,12E+00	2,64E-02	9,50E-01	0,00E+00	0,00E+00	0,00E+00	9,52E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,18E-02	1,25E-03	2,84E-03	7,39E+00
PERM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	1,69E+00	0,00E+00	-1,69E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,07E+00
PERT (MJ/FU, net calorific value)	2,38E+00	5,26E-02	7,81E+00	2,64E-02	-7,41E-01	0,00E+00	0,00E+00	0,00E+00	9,52E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,18E-02	1,25E-03	2,84E-03	9,46E+00
PENRE (MJ/FU, net calorific value)	1,65E+02	3,51E+00	1,04E+01	1,70E+00	1,17E+01	0,00E+00	0,00E+00	0,00E+00	1,92E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,34E+00	1,43E-02	1,29E-01	-1,82E+02
PENRM (MJ/FU, net calorific value)	1,57E+02	0,00E+00	-5,16E+00	0,00E+00	1,37E-01	0,00E+00	0,00E+00	0,00E+00	1,52E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,88E+02	0,00E+00	2,36E+02
PENRT (MJ/FU, net calorific value)	3,22E+02	3,51E+00	5,24E+00	1,70E+00	1,18E+01	0,00E+00	0,00E+00	0,00E+00	3,44E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,34E+00	-2,88E+02	1,29E-01	5,37E+01
SM (kg/FU)	1,06E+00	0,00E+00	0,00E+00	0,00E+00	1,91E-02	0,00E+00	0,00E+00	0,00E+00	1,07E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m³ water eq/FU)	1,04E-02	5,65E-04	1,87E-03	2,82E-04	9,51E-04	0,00E+00	0,00E+00	0,00E+00	1,40E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,52E-04	3,00E-06	1,40E-04	-8,37E-04

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 = NET USE OF FRESH WATER

# 8 WASTE CATEGORIES & OUTPUT FLOWS

	Production			Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed (kg/FU)	5,96E-05	2,20E-05	4,63E-05	1,08E-05	4,04E-05	0,00E+00	0,00E+00	0,00E+00	1,79E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,12E-05	4,20E-08	6,34E-07	2,68E-06
Non-hazardous waste disposed (kg/FU)	4,80E-01	1,62E-01	3,95E-02	8,30E-02	4,58E-02	0,00E+00	0,00E+00	0,00E+00	8,10E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,63E-01	3,25E-05	4,99E-01	4,98E-02
Radioactive waste disposed (kg/FU)	1,05E-03	1,09E-06	3,68E-06	5,52E-07	2,05E-05	0,00E+00	0,00E+00	0,00E+00	1,07E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,08E-06	1,02E-07	6,19E-08	-2,07E-03
Components for re-use (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,81E-02	0,00E+00	0,00E+00	0,00E+00	2,81E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (kg/FU)	0,00E+00	0,00E+00	1,69E-01	0,00E+00	1,42E-01	0,00E+00	0,00E+00	0,00E+00	3,31E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,45E+00	0,00E+00	0,00E+00
Materials for energy recovery (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,63E-02	0,00E+00	0,00E+00	0,00E+00	5,63E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,96E-01	0,00E+00	0,00E+00	0,00E+00	4,96E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy - Heat (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,44E-01	0,00E+00	0,00E+00	0,00E+00	3,44E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy - Electricity (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,52E-01	0,00E+00	0,00E+00	0,00E+00	1,52E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

# 9 IMPACT CATEGORIES ADDITIONAL TO EN 15804

	Production			Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
 PM (disease incidence)	1,83E-07	1,89E-08	1,59E-08	9,51E-09	1,17E-08	0,00E+00	0,00E+00	0,00E+00	2,39E-07	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,87E-08	7,97E-11	9,20E-10	5,41E-08
 IRHH (kg U235 eq/FU)	9,54E-01	1,70E-03	4,81E-03	8,52E-04	1,98E-02	0,00E+00	0,00E+00	0,00E+00	9,81E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,67E-03	1,25E-04	9,24E-05	-1,26E+00
 ETF (CTUe/FU)	1,45E+01	1,73E+00	1,23E+00	0,00E+00	1,06E+00	0,00E+00	0,00E+00	0,00E+00	1,93E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,65E+00	2,78E-03	1,32E-01	1,30E+00
 HTCE (CTUh/FU)	1,04E-08	1,13E-10	4,25E-10	5,44E-11	3,10E-10	0,00E+00	0,00E+00	0,00E+00	1,13E-08	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,07E-10	4,37E-13	3,57E-12	2,22E-10
 HTnCE (CTUh/FU)	6,54E-08	2,38E-09	4,53E-09	1,20E-09	3,53E-09	0,00E+00	0,00E+00	0,00E+00	7,71E-08	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,35E-09	6,47E-12	1,17E-10	9,74E-09
 Land Use Related impacts (dimensionless)	1,93E+01	1,98E+00	2,41E+01	1,01E+00	1,39E+00	0,00E+00	0,00E+00	0,00E+00	4,77E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,99E+00	9,67E-03	2,89E-01	7,31E+00

HTCE = HUMAN TOXICITY – CANCER EFFECTS; HTNCE = HUMAN TOXICITY – NON CANCER EFFECTS; ETF = ECOTOXICITY – FRESHWATER; (POTENTIAL COMPARATIVE TOXIC UNIT)

PM = PARTICULATE MATTER (POTENTIAL INCIDENCE OF DISEASE DUE TO PM EMISSIONS);

IRHH = IONIZING RADIATION – HUMAN HEALTH EFFECTS (POTENTIAL HUMAN EXPOSURE EFFICIENCY RELATIVE TO U235);

## 9.1 Environmental impact categories explained

The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.

It is split up in 4:

- Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc
- Global Warming Potential fossil fuels (GWP-fossil) : The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc).
- Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO<sub>2</sub>, CO and CH<sub>4</sub>) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO<sub>2</sub> uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.
- Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO<sub>2</sub>, CO and CH<sub>4</sub>) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).



Global Warming Potential



Ozone Depletion

Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.



Acidification potential

Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.



Eutrophication potential

The potential to cause over-fertilization of water and soil, which can result in increased growth of biomass and following adverse effects.

It is split up in 3:

- Eutrophication potential - freshwater: The potential to cause over-fertilization of freshwater, which can result in increased growth of biomass and following adverse effects.
- Eutrophication potential - marine: The potential to cause over-fertilization of marine water, which can result in increased growth of biomass and following adverse effects.
- Eutrophication potential - terrestrial: The potential to cause over-fertilization of soil, which can result in increased growth of biomass and following adverse effects.



Photochemical ozone creation

Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.



Abiotic depletion potential for non-fossil resources

Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimony (Sb).

The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.



Abiotic depletion potential for fossil resources

Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ).

The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.



	Ecotoxicity for aquatic fresh water	<p>The impacts of chemical substances on ecosystems (freshwater).</p> <p>The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.</p>
	Human toxicity (carcinogenic effects)	<p>The impacts of chemical substances on human health via three parts of the environment: air, soil and water.</p> <p>The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.</p>
	Human toxicity (non-carcinogenic effects)	<p>The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.</p>
	Particulate matter	<p>Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NOx, SOx, NH3)</p>
	Resource depletion (water)	<p>Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not.</p> <p>The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.</p>
	Ionizing radiation - human health effects	<p>This impact category deals mainly with the eventual impact on human health of low dose ionizing radiation of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.</p>
	Land use related impacts	<p>The indicator is the "soil quality index" which is the result of an aggregation of following four aspects:</p> <ul style="list-style-type: none"> <li>- Biotic production</li> <li>- Erosion resistance</li> <li>- Mechanical filtration</li> <li>- Groundwater</li> </ul> <p>The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use.</p> <p>The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.</p>



# 10 DETAILS OF THE UNDERLYING SCENARIOS USED TO CALCULATE THE IMPACTS

## 10.1 A1 – raw material supply

Module A1 comprises impacts from extraction and processing of raw materials including bitumen, polymers, reinforcements (glass- and polyester fibre), fillers, etc. The recycling process of secondary raw materials used in the product is also included in module A1.

## 10.2 A2 – transport to the manufacturer

The raw materials are transported to the manufacturing site. Primary data are provided by Derbigum.

## 10.3 A3 – manufacturing

Module A3 includes the manufacturing of the final product, production and transport of larger packaging materials (pallets), combustion of fuels on site (natural gas, diesel, and propane), as well as end-of-life treatment of waste generated during manufacturing. It also includes the production of electricity (Derbigum mix).

Default B-PCR distances for delivery are used, completed with specific data provided by Derbigum for the repartition of the transport. The following transport steps apply:

- 20% directly to the construction site over 100 km with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U)
- 80% to a supplier over 100 km with a 16 -32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U)
- 100% of these 80% is transported over 35 km from supplier to construction site with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U)

## 10.4 A4 – transport to the building site

Fuel type and consumption of vehicle or vehicle type used for transport	Truck 16-32 ton 0,256 l diesel / km	Truck 16-32 ton 0,256 l diesel / km
Distance	100 km	100 km+ 35 km
Capacity utilisation (including empty returns)	Default ecoinvent	Default ecoinvent
Bulk density of transported products	Default ecoinvent	Default ecoinvent
Volume capacity utilisation factor	Default ecoinvent	Default ecoinvent



## 10.5 A5 – installation in the building

The product can be used on different types of substrates: wood, concrete, and sheet steel.

It can also be installed on a vapour- barrier layer such as Derbigum NT 2.5 (see B-EPD 24.0156.01- 01.00.00) to form a double-layer roof waterproofing coating solution.

The installation includes an overlap of the layers (10.5%) for complete waterproofing. It is integrated in the in the FU (in modules A1, A2, A3, and A4) of the present B-EPD.

The installation mode is "fully torched by use of flame" (torched with flame). The production and combustion of propane for torching are counted (+ associated CO<sub>2</sub> emissions). The amount of propane for 1 m<sup>2</sup> is 0,150 kg/m<sup>2</sup> (= kg/FU) (prEN 17388 by use of flame:2022).

Waste from the installation (trimming waste, 2%) is classified as material for recycling (95%)- and waste for landfill (5%). This waste is measured for 1 m<sup>2</sup> "net installed" (0,02 m<sup>2</sup>/FU).

At the construction site, packaging materials are released.

The impacts from waste management processes are included in module A5, whereas potential benefits from material reuse/recycling and energy recovery from incineration are reported in module D.

Parts of the installation	quantity	Description
Processes necessary for the installation of the product	-	Manual installation
Fixation materials	0,150 kg/FU	Propane for torching
Joining materials		
Treatments		
Material losses	9,006 E-02 kg/FU	Trimming waste (2%) (0,02 m <sup>2</sup> /FU)
Packaging	0,1406 kg/FU	Pallet waste (including installation waste and overlap)
Others	10,5%	Additional sheet for overlap on the layers for complete waterproofing (already included the FU)



Ancillary materials for installation (specified by material)	Insert information		
Water use			
Other resource use	Propane	0,150 kg/FU	
Quantitative description of energy type (regional mix) and consumption during the installation process			
Waste materials on the building site before waste processing, generated by the product's installation (specified by type)	Trimming waste	9,006 E-02 kg/FU	2% (0,02 m <sup>2</sup> /FU)
	Packaging waste: pallet	0,1406 kg/FU	
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Trimming waste	9,006 E-02 kg/FU	95% recycled by Derbigum 5% "non sorted waste: landfill
Direct emissions to ambient air, soil and water	None		
Distance	Derbigum recycling facility	128 km*	8,555 E-2 kg/FU
	Sorting centre	30 km	4,503 E-03 kg/FU** 1,406 kg/FU***
	Landfill	50 km	4,503 E-03 kg/FU**
	Incineration	100 km	5,625 E-02 kg/FU***

\* Corresponding to the average A4 transport distance

\*\* 5% installation waste

\*\*\* Pallet waste



## 10.6 B – use stage (excluding potential savings)

### B1 – Use

No information could be collected on the emissions of the products to air or water during their use.

### B2 – Maintenance

No product maintenance takes place during the reference service life.

### B3 - Repair

No product repair takes place during the reference service life. Planned replacement is accounted in module B4.

### B4 – Replacement

The Derbigum NT 4 has to be replaced after 40 years to ensure a correct waterproofing. In practice, the existing layer is left in place and an additional layer of Derbigum NT 4 is added.

The inventory included the amount of Derbigum NT 4 for 1 m<sup>2</sup> including overlap (10,5%), the installation losses (2%), and the propane for fully torched installation on the existing layer.

The waste includes the installation losses and the packaging waste.

The scenario is identical to the installation A5:

#### Materials:

- Derbigum NT 4: production and transport of 1 m<sup>2</sup> + overlapping 10,5%, + 2% losses [A1,A2,A3,A4]

#### Installation:

- Ancillary material: 0,150 kg propane/m<sup>2</sup> + associated CO<sub>2</sub> emissions
- Derbigum NT 4 waste: 95% of the installation losses are recycled as Gumix APP and 5% are landfilled
- Pallet waste: the BE-PCR scenario for pallet end of life is respected
- Transport of the waste: as in A5

The impacts from waste management processes are included in module B4, whereas potential benefits from material reuse/recycling and energy recovery from incineration are reported in module D.

### B5 - Refurbishment

No product refurbishment takes place during the reference service life.

### B6 – Operational energy use

The product does not use energy during its use.

### B7 – Operational water use

The product does not use water during its use.

## 10.7 C: End of life

The amount of material to consider includes the overlap, and the second layer added as replacement in module B4 (and its overlap). It corresponds to 2 x 1 FU.

**C1:** The waterproofing layer is removed manually, and no impacts are readily attributed to the product whereby no emissions arise from the deconstruction

**C2:** Comprises impacts from transportation of the deconstructed products after 60 years to the waste processing (sorting centre and landfill, or recycling site).

**C3:** Derbigum roofs sold in Belgian (or foreign) market come with a "take back" guarantee, which means all losses during installation are collected and transported back to Derbigum recycling facility in Belgium. It is assumed that 95% of the Derbigum NT 4 waste are recovered and recycled.

The burden for recycling process and the benefits from replacing bitumen are recorded in Module D.

The remaining 5% are considered to be mixed with the other "non sorted" waste of the deconstruction site. They go to the sorting centre where they are handled or moved once. Default values for BE-PCR are applied.

**C4:** The residual 5% of membrane waste are landfilled in this module.



Module C2 – Transport to waste processing

Type of vehicle (truck/boat/etc.)	Fuel consumption (litres/km)	Distance (km)	Capacity utilisation (%)	Density of products (kg/m <sup>3</sup> )	Assumptions
Lorry	16-32 t EURO5	128	EI	1126 kg / m <sup>3</sup>	Derbigum facility
Lorry	16-32 t EURO5	30	EI	1126 kg / m <sup>3</sup>	Sorting centre
Lorry	16-32 t EURO5	50	EI	1126 kg / m <sup>3</sup>	Landfill

EI: ecoinvent default value

End-of-life modules – C3 and C4

Parameter	Value (kg)
Wastes collected separately	9,454 kg/FU
Wastes collected as mixed construction waste	0,4976 kg/FU
Waste for re-use	
Waste for recycling	9,454 kg/FU
Waste for energy recovery	
Waste for final disposal	0,4976 kg/FU



## 10.8 D – Benefits and loads beyond the system boundaries

Module D is calculated in accordance with EN 15804:2012+A2:2019 and BE-PCR. All reported net benefits and loads resulting from net flows leaving the system of products that have not been assigned as co-products (there are none in this case) and have reached end-of-waste status are included in the Module D (reuse, recycling, direct energy recovery).

### Production, trimming and end of life waste of Derbigum NT 4

At end of life most of the product is recycled (patented process by Derbigum, and organised collection network).

- **A5, B4, C3:** Installation and demolition waste: 95% is recycled in Derbigum facility.
- **The load for recycling** is included (recycling unit is modelled with primary data)
- **Avoided material:** The net flow of recycled material is calculated according to BE-PCR, and the corresponding amount of virgin bitumen is evaluated taking the efficiency of the recycling process into account.

**Pallets: A5, B4:** 0,2813 kg/FU; PCI = 12,24 MJ/kg

- Reuse: 20%: 5,625 E-02 kg/FU; transport 20 km<sup>2</sup>.
- Recycling (wood chips): 40% 0,1125 kg/FU; transport 20 km + chipping.
- Incineration: 40%; 0,1125 kg/FU.

### Energy recovery: efficiency

- Pallet waste: incineration in a specific cogeneration unit, energy efficiency of 50% for thermal energy and 22% for electric energy<sup>3</sup>.

QUANTITATIVE DESCRIPTION OF THE LOADS BEYOND THE SYSTEM BOUNDARIES	<ul style="list-style-type: none"> <li>– Recycling process for bituminous membrane waste</li> <li>– Transport for reused pallets: 20 km</li> <li>– Transport for recycled pallets: 20 km</li> <li>– Wood chipping of pallets</li> </ul>
QUANTITATIVE DESCRIPTION OF THE BENEFITS BEYOND THE SYSTEM BOUNDARIES	<ul style="list-style-type: none"> <li>– Avoided virgin bitumen: 4,112 kg/FU</li> <li>– Pallet reused: 5,625 E-02 kg/FU</li> <li>– Wood chips (pallet recycled): 0,1125 kg/FU</li> <li>– Energy recovery:               <ul style="list-style-type: none"> <li>○ Heat: 0,6885 MJ/FU (substitution: thermal energy from natural gas)</li> <li>○ Electricity: 1,091 kWh/FU (or 0,3029 MJ/FU)(substitution: BE high voltage mix, excluding impact from the transmission network)</li> </ul> </li> </ul>

<sup>2</sup> Economically reasonable distance -validated by the high density of sorting centres in Belgium

<sup>3</sup> <https://monprojet.labiomasseenwallonie.be/download/file/fid/2449> (accessed on 01.12.2022)



# 11 RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL AND WATER DURING THE USE STAGE

## 11.1 Indoor air

This product does not come into contact with indoor air, so it has no impact on the health quality of indoor spaces.

## 11.2 Soil and water

The product is not in contact with drinking water but may be in contact with rainwater. No tests have been carried out.

# 12 DEMONSTRATION OF VERIFICATION

EN 15804+A2 serves as the core PCR

Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010

Internal  External

Third party verifier: Naeem Adibi,  
n.adibi@weloop.org  
WeLOOP S.A.R.L, <http://weloop.org>  
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## 13 LCA INTERPRETATION

This study leads to the realisation of a B-EPD for the bitumen waterproofing products of Derbigum: Derbigum NT 4.

The most impacted domain by the Derbigum NT 4 is the Resource use, fossils, but this issue is partly compensated by the important recycling of the membrane at its end of life.

The main impacts of this product come from the sourcing and processing of raw materials (bitumen, polyester reinforcement, and polymers), and in a lesser extent to the manufacture of the products (consumption of natural gas for heat, and electricity).

The impact of the raw material is "doubled" by the need of a replacement (i.e. addition of a new layer of Derbigum NT 4) on the existing one) during the lifespan of the building to ensure a proper function.

Although raw materials play a major role, their impact is limited, and the savings in virgin materials made by recycling membranes and the use of recycled bitumen limit the impact of the process.

Other ways of reducing environmental impact are to optimise energy consumption during manufacture and recycling, and to reduce the distance between the manufacturing and recycling sites (for example by duplicating the latter in a region closer to the target area). An extension of the RSL could also be an improvement.

The recycled content of the Derbigum NT 4 represents 20,5% of the raw materials.

Due to the implementation of a recycling chain to collect both installation trimming waste and demolition waste 95% of the membrane waste are recycled in the patented recycling process of Derbigum.

The production (A1-A3) of 1 FU of Derbigum NT 4 (1 m<sup>2</sup> installed, including an overlap of 10,5%) corresponds to the emission of 3,92 kg CO<sub>2</sub> eq/FU (3. in the Climate change category, and the consumption of 182 MJ for the Resource use, fossils.

The total "first life" cycle (A1-A5) of 1 FU of Derbigum NT 4 (1 m<sup>2</sup> installed – fully torched, including an overlap of 10,5%) corresponds to the emission of 4,99 kg CO<sub>2</sub> eq/FU in the Climate change category, and the consumption of 195 MJ for the Resource use, fossils. The replacement (B4) after 40 years shows the same values as the A1 to A5 modules.



# 14 TECHNICAL INFORMATION FOR SCENARIO DEVELOPMENT

Different installation mode can be used for the Derbigum NT 4 depending on its use.

**For installation as a single layer**, with the following ancillary materials

- fully torched by use of flame: propane
- mechanical fastening: stainless steel screw and plastic tubes/round washers in PP
- glued with bituminous cold adhesive: Derbibond NT
- loose lay (under ballast)

**For installation as a second layer** on a vapour-barrier Derbicoat NT 2.5 or on a first layer of Derbigum NT 4, with the following ancillary materials

- fully torched by use of flame: propane
- glued with bituminous cold adhesive: Derbibond NT



# 15 APPLICATION UNIT

Derbigum NT is a bituminous waterproofing membrane modified by plastomeric polymers. Derbigum NT partly consists of bitumen extracted from recycled cutting waste and used bituminous roofing membranes (Derbitumen).

The upper side of the Derbigum NT membrane is fitted with two reinforcements, one glass-fibre and one non-woven polyester (both with a recycled content).

The application unit is 1 m<sup>2</sup> installed (including 10,5% overlap necessary to ensure the full functionality).

Applications:

- Reinforced bituminous sheet for roof waterproofing
- Installation: fully torched by use of flame, mechanical fixing, loose laying (under ballast), or cold bonded.
- Specifically recommended when a high tear and puncture resistance is required.

Information on scalability. The membrane is available in two thickness: 4 mm (Derbigum NT 4) and 3 mm (Derbigum NT 3).

Since it is a homogeneous material, the rescaling will be automatically done in TOTEM, and the impacts will be calculated for the selected thickness: ratio  $3/4 = 0,75$ .

Commercial names:

- Derbigum NT 4 (4 mm thickness)
- Derbigum NT 3 (3 mm thickness)
- Roll: 1 m (width) x 8 m (length) = 8 m<sup>2</sup>
- Pallet: 25 rolls (200 m<sup>2</sup>)
- Ratio between application and the reference flow in the EPD.
  - 1 (10,5% overlap included)
  - For different overlap: ratio  $(1+overlap)/(1+0,105)$



# 16 ADDITIONAL INFORMATION ON REVERSIBILITY

Description	Type of fixing	Level of reversibility	Simplicity of disassembly	Speed of disassembly	Ease of handling (size and weight)	Robustness of material (material resistance to disassembly)	Comment
			–		–	–	
Flexible reinforced bitumen polymer membrane for roof waterproofing;	Welded Fully torched	Non reversible connections	Simple – requires the use of specific though common tools	Speed of disassembly varies from quick to slow depending on element dimensions and number of fixations per distance unit	Material easy to manipulate by hand, one to two workers required depending on dimensions	Disassembly is possible but will likely cause damage to the material due to the type of assembly or and tools used and the presence of additional layers	Bitumen waterproofing membrane
Flexible reinforced bitumen polymer membrane for roof waterproofing;	Loose laid	Non reversible connections	Simple – requires the use of specific though common tools	Speed of disassembly varies from quick to slow depending on element dimensions and number of fixations per distance unit	Material easy to manipulate by hand, one to two workers required depending on dimensions	Disassembly is possible but will likely cause damage to the material due to the type of assembly or and tools used and the presence of additional layers	Bitumen waterproofing membrane
Flexible reinforced bitumen polymer membrane for roof waterproofing;	Screwed	Non reversible connections	Simple – requires the use of specific though common tools	Speed of disassembly varies from quick to slow depending on element dimensions and number of fixations per distance unit	Material easy to manipulate by hand, one to two workers required depending on dimensions	Disassembly is possible but will likely cause damage to the material due to the type of assembly or and tools used and the presence of additional layers	Bitumen waterproofing membrane
Flexible reinforced bitumen polymer membrane for roof waterproofing;	Glued (Cold bonded)	Non reversible connections	Simple – requires the use of specific though common tools	Speed of disassembly varies from quick to slow depending on element dimensions and number of fixations per distance unit	Material easy to manipulate by hand, one to two workers required depending on dimensions	Disassembly is possible but will likely cause damage to the material due to the type of assembly or and tools used and the presence of additional layers	Bitumen waterproofing membrane

## 17 BIBLIOGRAPHY

ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.

ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.

ISO 14025:2006: Environmental labels and Declarations-Type III Environmental Declarations-Principles and procedures.

NBN EN 15804+A2:2019

BE-PCR: B-EPD Construction product category rules, Complementary to NBN EN 15804+A2, version 18.10.2022

EN 16449:2014: Wood and wood-based products - Calculation of the biogenic carbon content of wood and conversion to carbon dioxide

prEN 17388:2022: Flexible sheets for waterproofing - Environmental product declaration - Product Category Rules for reinforced bitumen, plastic and rubber flexible sheets for (roof) waterproofing (draft – not published)

Documentation Ecoinvent 3.9.1: EUR-Flat <https://ecoquery.ecoinvent.org/3.9.1/cutoff/dataset/2481/documentation>

DK-EPD: EPD Denmark: EPD and report for Derbigum NT – n° MD-21033-EN, issued 17.08.2021, valid to 17.08.2026. 3rd party verified (EN15804+A2:2019) - epddanmark. Authors: David Lindén, Niclas Silfverstrand and David Althoff Palm (Ramboll, Sweden)

EVEA - FDES report : Rapport de projet de 4 fiches de déclarations environnementales et sanitaires de systèmes d'étanchéité. 31 mai 2022. 3rd party verified (EN15804+A1). Authors: Benjamin Plat and Sylvain Cléder (EVEA, France).

Eurobitume (2020, 2022): The Eurobitume life-cycle inventory for bitumen v3.1 + 2021 update to The Eurobitume life-cycle inventory for bitumen. Published by the European Bitumen Association. D/2020/7512/31 and D/2022/7512/096

FDES Étanchéité bicouche bitumineuse avec matériaux revalorisés, recyclée en fin de vie Derbicoat NT + Derbigum NT3.

Numéro d'enregistrement INIES : 5-566:2021. Mai 2021.

Analyse du cycle de vie de l'unité de recyclage de membranes bitumineuses Derbigum – Perwez. A. Léonard and S.

Groslambert – ULiège, Department of Chemical Engineering. Update 02.2023.

R. N. Walters, S. M. Hackett and R. E. Lyon, "Heats of Combustion of High Temperature Polymers," Fire and Materials 24, 245 (2000)



## General information

### Owner of the EPD, Responsible for the data, LCA and information



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2021- Report for BEPD - Derbigum nt4 - vf.pdf



### Verifier

Naeem Adibi - WeLoop  
Date of verification: 29.04.2024  
External independent verification of the declaration and data  
according to EN ISO 14025 and relevant PCR documents

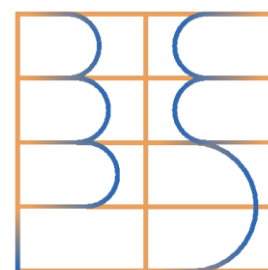
Comparing EPDs is not possible unless they are conform to the same PCR and taking into account the building context.  
The program operator cannot be held responsible for the information supplied by the owner of the EPD nor LCA practitioner.



B-EPD program operator  
**Federal Public Service (FPS) of Health,  
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