ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	RBS Germany GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-RAV-20230375-CBD1-EN
Issue date	31/10/2023
Valid to	30/10/2028

RAVATHERM™ XPS (X) extruded polystyrene foam insulation with non-halogenated blowing agents

Ravago Building Solutions

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com

General Information

Ravago Building Solutions

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-RAV-20230375-CBD1-EN

This declaration is based on the product category rules:

Insulating materials made of foam plastics, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

31/10/2023

Valid to

30/10/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

RAVATHERM™ XPS (X) extruded polystyrene foam insulation with non-halogenated blowing agents

Owner of the declaration

RBS Germany GmbH
Value Park Y51
06258 Schkopau
Germany

Declared product / declared unit

The EPD applies to 1 m3 of XPS board, with an average density of 34.4 kg/m^3.
RAVATHERMTM XPS (X) extruded polystyrene foam boards produced by Ravago Building Solutions with a non-halogenated blowing agent system.

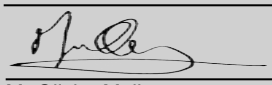
Scope:

The data have been provided by the seven ISO 14001 certified factories of Ravago Building Solutions producing these products in France, Germany, Greece, Hungary and the UK for the year 2021.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR			
Independent verification of the declaration and data according to ISO 14025:2011			
	☐	internally	☒ externally



Mr Olivier Muller,
(Independent verifier)

Product

Product description/Product definition

RAVATHERM(TM) XPS and XPS X extruded polystyrene foams (XPS) are thermoplastic insulation foams produced according to *EN 13164* Building insulation, *EN 14307* Equipment insulation.

They are available in blue or grey board shape with a density range from 25 to 50 kg/m^3. The boards can be delivered in various compressive strength values from 150 to 700 kPa.
To meet the need of various applications the boards are produced with different surfaces: with the extrusion skin, planed, grooved or with thermal embossing.
These XPS boards are supplied with different edge treatments such as butt edge, shiplap and tongue and groove. The EPD is related to unfaced XPS products only; Heat lamination of several XPS layers is included. Additional product treatment is not considered.
For the placing on the market of the construction product in the European Union/ European Free Trade Association (EU/EFTA) (with the exception of Switzerland) *Regulation (EU) No. 305/2011 (CPR)* applies. The product needs a declaration of performance taking into consideration the EN XPS standards (*EN 13164* Building insulation, *EN 14307* Equipment insulation).
For the application and use the respective national provisions apply.

Application

The variety of the performance properties of RAVATHERM XPS and XPS X thermal insulation foams make them suitable for use in a large number of applications such as: perimeter insulation, inverted insulation for terrace roofs, insulation of pitched roofs, floor insulation including insulation of highly loaded industrial floors, insulation of thermal bridges for exterior walls, External Thermal Insulation Composite System (ETICS), insulation of cavity walls, agricultural building ceiling insulation, prefabricated elements e.g. building sandwich panels, insulation for building equipment and industrial installations (pipe sections, …).

Technical Data

Acoustic properties are not relevant for XPS foams.
For fire performance, these products usually achieve the fire classification Euroclass E according to *EN 13501-1*.

Constructional data

Name	Value	Unit
Gross density	25 - 50	kg/m^3
Compressive strength acc. to EN 826	0.2 - 0.7	N/mm^2
Tensile strength acc. to EN 826	0.2 - 1	N/mm^2
Modulus of elasticity acc. to EN 826	10 - 50	N/mm^2
Calculation value for thermal conductivity EN 12667 and EN 13164 Annex C	0.03 - 0.035	W/(mK)
Water vapour diffusion resistance factor acc. to EN 12088	50 - 250	-
Creep behaviour or permanent compressive strength acc. to EN 1606	=< 0.25	N/mm^2
Water absorption after diffusion acc. to EN 12088	1 - 3	Vol.-%
Freeze-thaw resistance acc. to EN 12091	=< 1	Vol.-%

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 13164:2012+A1:2015* - Thermal Insulation products for buildings *EN 14307:2015* Thermal Insulation products for building equipment and industrial installations.

Base materials/Ancillary materials

RAVATHERMTM XPS and XPS X are mostly made of polystyrene (CAS 9003-53-6), blown with carbon dioxide and non-halogenated co-blowing agents altogether up to 8 % by weight in relation to the material input.

Basic material Mass portion
Polystyrene 89 - 93 %
Blowing agents 5 - 8 %
.Carbon Dioxide 55 - 75 %
.Co-blowing Agents 25 - 45 %
Flame retardant 0 - 2 %
Additives (e.g. pigments) Less than 1%

Information that the product does not contain substances listed in the Candidate List of substances of very high concern (*REACH* Regulation) exceeding 0.1%: This product contains substances listed in *the candidate list* (date:17.01.2023) exceeding 0.1 percentage by mass: no

This product contains other Carcinogenic, Mutagenic, Reprotoxic (CMR) substances in categories 1A or 1B which are not on *the candidate list*, exceeding 0.1 percentage by mass: no

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the *Regulation (EU) No 528/2012 on biocidal products*): no

Reference service life

The durability of XPS foam is normally at least as long as the lifetime of the building/equipment in/with which it is used or at least 50 years. This is explained by the superior mechanical and water resistance properties of this product.

LCA: Calculation rules

Declared Unit
The declared unit is 1 m³ of the XPS insulation product. The declared product reflects the average of seven of Ravago's sites weighted by production volume share:

- Balaton (HU); 33.07 kg/m^3 (18%)
- Rheinmuenster (DE): 34.75 kg/m^3 (18%)
- Lavrion (GR): 33.60 kg/m^3 (17%)
- Schkopau (DE): 35.23 kg/m^3 (17%)
- Drusenheim (FR): 35.35 kg/m^3 (16%)
- Artix (FR): 33.63 kg/m^3 (9%)
- King's Lynn (GB): 38.08 kg/m^3 (5%)

The weighted average density of the product is 34.4 kg/m³.

Declared unit

Name	Value	Unit
Gross density	34.4	kg/m^3
Declared unit	1	m^3

For XPS products with densities or thicknesses different from the reference density of 34.4 kg/m³, the environmental impacts may be calculated by linear scaling using the following formula.

$$I_{adap} = I_{ref} \times \frac{\rho_{adap}}{\rho_{ref}} \times \frac{d_{adap}}{d_{ref}}$$

Iadap – adapted LCIA indicator or LCI parameter
Iref – LCIA indicator or LCI parameter for reference density of 34.4 kg/m^3
ρadap – adapted density
ρref – reference density of 34.4 kg/m^3
dadap – adapted board thickness
dref – thickness of reference board

System boundary
Type of EPD according to *EN 15804*: "cradle to gate with options, modules C1–C4, and module D". The following modules are declared: A1–A3, C, D and additional modules: A4 + A5.

Production - Modules A1-A3
The product stage includes:

- Raw material supply including secondary materials (A1)
- Transport to the manufacturer (A2): Transport is considered for all the input raw materials
- Manufacturing (A3), including provision of all materials, products and energy, as well as waste processing up to the end-of-waste state.

Construction stage - Modules A4-A5
The construction process stage includes:

- Transport to the construction site (A4)
- Treatment of packaging material (A5)

End-of-life stage– Modules C1-C4 and D
The end-of-life stage includes

- Manual dismantling (Load free) (C1)
- Transport to EoL (C2)
- Waste processing & disposal (C) with two 100 % scenarios (scenario 1: Incineration (C3 and D); scenario 2: Landfill (C4))
- Reuse, recovery or recycling potential (D) - beyond system boundary.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

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.
Background database: Sphera LCA FE (*GaBi ts),* CUP 2022.2

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	0.00375	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following technical scenario information is required for the declared modules and optional for non-declared modules. The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND). The values refer to the declared unit of 1 m^3 XPS product.

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel (per declared unit - 1m3)	0.2	l/100km
Transport distance (weighted average based on production volumes)	495	km
Capacity utilisation (including empty runs)	61	%
Gross density of products transported	34.4	kg/m^3

The transport distance can be modified to project-specific criteria if required by linear scaling.

Installation into the building (A5)
The thermal treatment of the packaging is considered in this module. The following quantities are produced per 1 m^3 of XPS product (weighted average based on production volume

shares):

Name	Value	Unit
Packaging film (LDPE)	0.68	kg
EPS Beams	0.29	kg
Wooden Pallet	0.01	kg

End of life (C1-C4)

For the End-of-Life stage, two different scenarios are considered. One scenario with 100 % incineration (scenario 1: C3/1, D1) and one scenario with 100 % landfill (scenario. 2: C4/2, D2) are calculated. The incineration of XPS results in benefits beyond the system boundary (module D) due to energy substitution of electricity and thermal energy under European conditions.

The transport to End of Life (C2) is calculated with a distance of 50 km (with 70 % utilization).

Name	Value	Unit
Collected separately waste type XPS	34.4	kg
Energy recovery (Scenario 1)	34.4	kg
Landfilling (Scenario 2)	34.4	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Module D includes the credits of the thermal and electrical energy generated in Modules A5 and C3/1 due to thermal treatment of packaging and product waste (XPS product). Avoided burdens have been calculated by the inversion of residual grid and thermal energy from natural gas, using European datasets.
A waste incineration plant with R1-value > 0.6 is assumed.

LCA: Results

The following tables display the environmentally relevant results according to *EN 15804* for 1 m^3 XPS board. The two EoL Scenarios are represented in modules C3/1, C4/2, D/1, and D/2. C3/1 and D/1 show the environmental results in the case of thermal treatment of XPS products. D/1 covers also the results of the packaging treatment from Module A5. Module C4/2 reflects the landfilling of XPS (for scenario 2, "landfilling" the values in Module D for XPS are 0). Hence, Module D/2 shows only the environmental results of the packaging treatment from Module A5.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m3 RAVATHERM™ XPS product

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3/1	C4/2	D/1	D/2
GWP-total	kg CO_2 eq	9.38E+01	3.01E+00	3.11E+00	0	2.79E-01	1.15E+02	2.44E+00	-3.68E+01	-1.56E+00
GWP-fossil	kg CO_2 eq	9.38E+01	2.98E+00	3.1E+00	0	2.77E-01	1.15E+02	2.44E+00	-3.68E+01	-1.56E+00
GWP-biogenic	kg CO_2 eq	3.13E-02	1.27E-02	8.17E-03	0	1.18E-03	3.44E-03	5.14E-03	-4.42E-02	-1.88E-03
GWP-luluc	kg CO_2 eq	2.85E-02	1.68E-02	3.42E-06	0	1.56E-03	1.35E-04	1.19E-03	-1.61E-03	-6.81E-05
ODP	kg CFC11 eq	1.94E-10	1.8E-13	1.33E-13	0	1.67E-14	4.82E-12	3.27E-12	-1.79E-10	-7.6E-12
AP	mol H^+ eq	1.47E-01	2.97E-03	2.99E-04	0	2.76E-04	1.01E-02	7.22E-03	-3.71E-02	-1.57E-03
EP-freshwater	kg P eq	1.5E-04	8.98E-06	3.11E-08	0	8.33E-07	1.13E-06	4.55E-04	-9.21E-06	-3.91E-07
EP-marine	kg N eq	3.82E-02	9.38E-04	6.37E-05	0	8.7E-05	2.22E-03	1.6E-03	-1.18E-02	-4.99E-04
EP-terrestrial	mol N eq	4.18E-01	1.13E-02	1.4E-03	0	1.05E-03	4.75E-02	1.75E-02	-1.28E-01	-5.41E-03
POCP	kg NMVOC eq	2.28E-01	2.57E-03	1.89E-04	0	2.39E-04	6.54E-03	5.14E-03	-3.39E-02	-1.44E-03
ADPE	kg Sb eq	1.47E-05	2.51E-07	3.23E-09	0	2.33E-08	1.17E-07	1.69E-07	-3.03E-06	-1.29E-07
ADPF	MJ	2.81E+03	4.02E+01	3.6E-01	0	3.73E+00	1.28E+01	3.46E+01	-6.83E+02	-2.9E+01
WDP	m^3 world eq deprived	1.69E+01	2.7E-02	2.78E-01	0	2.5E-03	0	-2.4E-02	-1.4E+00	-5.94E-02

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; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m3 RAVATHERM™ XPS product

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3/1	C4/2	D/1	D/2
PERE	MJ	9.9E+01	2.29E+00	2.2E-01	0	2.12E-01	3.06E+00	2.84E+00	-5.64E+01	-2.39E+00
PERM	MJ	1.35E-01	0	-1.35E-01	0	0	0	0	0	0
PERT	MJ	9.91E+01	2.29E+00	8.52E-02	0	2.12E-01	3.06E+00	2.84E+00	-5.64E+01	-2.39E+00
PENRE	MJ	1.48E+03	4.03E+01	4.32E+01	0	3.74E+00	1.3E+03	3.46E+01	-6.83E+02	-2.9E+01
PENRM	MJ	1.33E+03	0	-4.29E+01	0	0	-1.28E+03	0	0	0
PENRT	MJ	2.81E+03	4.03E+01	3.6E-01	0	3.74E+00	1.28E+01	3.46E+01	-6.83E+02	-2.9E+01
SM	kg	9.48E+00	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	4.68E-01	2.58E-03	6.5E-03	0	2.4E-04	2.2E-01	4.47E-04	-8.6E-02	-3.65E-03

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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m3 RAVATHERM™ XPS product

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3/1	C4/2	D/1	D/2
HWD	kg	1.52E-07	1.93E-10	3.38E-11	0	1.79E-11	1.2E-09	5.33E-09	-8.23E-08	-3.49E-09
NHWD	kg	7.61E-01	5.77E-03	1.42E-02	0	5.36E-04	6.62E-01	3.42E+01	-1.61E-01	-6.84E-03
RWD	kg	5.51E-02	4.96E-05	2.17E-05	0	4.6E-06	7.7E-04	4.25E-04	-6.38E-02	-2.71E-03

CRU	kg	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0
EEE	MJ	3.64E-01	0	6.33E+00	0	0	2.08E+02	0	0	0
EET	MJ	6.48E-01	0	1.13E+01	0	0	3.71E+02	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m3 RAVATHERM™ XPS product

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3/1	C4/2	D/1	D/2
PM	Disease incidence	1.13E-06	1.75E-08	1.75E-09	0	1.62E-09	5.9E-08	6.94E-08	-3.24E-07	-1.38E-08
IR	kBq U235 eq	8.34E+00	7.27E-03	3.56E-03	0	6.75E-04	1.26E-01	6.27E-02	-9.33E+00	-3.96E-01
ETP-fw	CTUe	1.61E+03	2.79E+01	1.69E-01	0	2.59E+00	6.26E+00	3.38E+01	-1.2E+02	-5.09E+00
HTP-c	CTUh	3.24E-08	5.62E-10	1.9E-11	0	5.22E-11	6.31E-10	1.52E-09	-4.47E-09	-1.89E-10
HTP-nc	CTUh	1.42E-06	2.91E-08	5.99E-10	0	2.7E-09	2.05E-08	1.27E-07	-2.05E-07	-8.7E-09
SQP	SQP	1.12E+02	1.38E+01	1.09E-01	0	1.28E+00	3.88E+00	2.49E+00	-3.58E+01	-1.52E+00

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

References

Standards

CPR
Regulation No. 305/2011: Construction Products Regulation of the European Parliament and of the European Council, 2011.

EN 12088
EN 12088:2013-06 Thermal insulating products for building applications. Determination of long term water absorption by diffusion

EN 12091
EN 12091:2013-06
Thermal insulating products for building applications - Determination of freeze-thaw resistance

EN 12667
EN 12667:2001 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance

EN 13164 + A1
EN 13164:2012 + A1:2015 Thermal insulation products for buildings - Factory-made extruded polystyrene foam (XPS) products - Specification

EN 13501
EN 13501-1:2019-05 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

ISO 14025
EN ISO 14025:2011, Environmental labels and declarations Type III environmental declarations — Principles and procedures.

EN 14307
EN 14307:2015 Thermal insulation products for building equipment and industrial installations - Factory-made extruded polystyrene foam (XPS) products - Specification

EN 1606
EN 1606:2013-05 Thermal insulating products for building applications - Determination of compressive creep

REACH
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

BPR
Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

EN 15804
EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations - Core rules for the product category of construction products.

Further References

GaBi ts
GaBi ts dataset documentation for the software-system and databases, LBP, University of Stuttgart and thinkstep, Leinfelden-Echterdingen, 2023 (https://www.gabi-software.com/support/gabi)

IBU 2021
Institut Bauen und Umwelt e.V.: General Instructions for the

EPD programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021 (www.ibu-epd.com)

PCR Part A
PCR - Part A: Calculation rules for the Life Cycle Assessment and Requirements on the Background Report, version 1.3, Institut Bauen und Umwelt e.V., 2021.

PCR Part B
PCR - Part B: Requirements of the EPD for Insulating materials made of foam plastics, v8, Institut Bauen und Umwelt e.V., 2023.
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