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Tubolit DG Plus

polyethylene insulation for heating and plumbing installations

EPD Program Operator
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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the environmental impacts of the declared construction materials. Their aspects were verified by the independent body according to ISO 14025. Basically. a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A5, C2, C4 and D according to EN 15804 (Cradle to Gate with options)
The year of preparing the EPD: 2018
The year of validation of input data: 2023
Product standard: EN 14313
Service Life: 50 years for standard products
PCR: ITB-PCR A (PCR based on EN 15804)
Declared unit: 1 m^3 of the Tubolit insulation products
Reasons for performing LCA: B2B
Representativeness: Polish products, 2021

MANUFACTURER AND PRODUCT INFORMATION

Fig 1. A view of Armacell Poland Sp. z o.o. factory in Środa Śląska (Poland).

Armacell Poland Sp. z o.o. factory in Środa Śląska is one of 20 owned by Armacell GmbH and is specialized in production of technical insulation systems (ArmaFlex, Armafix, Tubolit), protective systems (Arma-Check), metallic protective systems (Okabell), acoustic insulation systems (ArmaFlex and Tubolit), fire protection systems (ArmaFlex), adhesives and accessories.

Armacell International GmbH is a producer of flexible insulation foams for the equipment insulation market and a provider of engineered foams which operates two main businesses:

- Advanced Insulation develops flexible foams for the insulation of technical equipment utilised for the transport of energy - such as heating. ventilation & air conditioning (HVAC) and heating & plumbing (H&P) in residential and commercial construction, process lines in the heavy- and oil & gas industry, equipment in transportation, as well as, acoustics.
- Engineered Foams develops high-performance foams for the use in a broad range of end markets including transportation, automotive. wind energy, sports and construction.

Base materials and Applications

Tubolit DG Plus is a closed cell polyethylene insulation for heating and plumbing installations. Due to its low thermal conductivity, Tubolit DG Plus minimizes energy losses and reduces CO_2 emissions thus contributing to the positive energy performance of the building. Tubolit DG Plus protects pipes against aggressive building materials and prevents condensation on cold water pipes.

According to the European Chemicals regulation (REACH) manufacturer, importers and downstreamer users must register their chemicals and are responsible for their safe use on their own. For its production Armacell uses registered and approved substances/mixtures. Tubolit DG Plus does not contain substances to be mentioned according to EU regulation No 1907/2006 (REACH) annex II.

Fig. 2. Tubolit DG Plus insulation.

The complete range includes sizes for plastic pipes. Specific data is shown in tables 1-3.

Special Features:

- Meets European Energy Regulations
- Euroclass B_L-s1,d0

Table 1. Tubolit DG Plus technical data:

Brief description	Flexible, closed-cell extruded insulation material to reduce heat losses and noise on heating and plumbing installations
Material type	Foam material based on polyethylene; factory made polyethylene foam (PEF) according to EN 14313
Colour	Grey
Applications	Insulation / protection of pipes (heating system pipes, domestic hot and cold water pipes) and other parts of heating and plumbing installations (incl. elbows, fittings, flanges, etc)
Remarks	After installation linear shrinkage of approx. 2% (or more in particular cases) may occur during the initial and even later phase of system operation; Under certain conditions (e.g. high humidity, main distribution pipes, pipes with constant or almost constant flow) cold water pipelines must be insulated with Armaflex, just the same as chilled water pipes in air-conditioning systems; Declaration of Performance is available in accordance with Article 7(3) of Regulation (EU) No 305/2011 on website: www.armacell.com

Table 2. Tubolit DG Plus performance data:

Temperature range	max. service temperature min. service temperature		+100˚C as is in plumbing and heating installations
Thermal conductivity	Protection of pipes	d_N=5-25mm	$\lambda_{40^oC} \leq 00.4$ W(m*K) $\lambda(\vartheta_m) = (34 + 0.15 * \vartheta_m + [0.0015 * (\vartheta_m - 40)^2]/1000$
Reaction to fire	Protection of pipes	d_N=5-25mm	B_L-s1,d0
Durability of thermal resistance against aging/ degradation	Dimension stability/thermal conductivity of PEF products is stable in reference service life		
Durability in terms of fire reaction and aging	Stability/Performance properties in terms of reaction to fire of PEF products is stable in reference service life		
Durability in terms of fire reaction and high temperature	Stability/Performance properties in terms of reaction to fire of PEF products is stable in reference service life		
Water permeability	No Performance Declared		
Dangerous substances release	No Performance Declared		

Table 3. Composition of Tubolit DG Plus

Component	Value	Unit
Polymers	69.6	%
Flame retardant	2.6	%
Blowing agent	12.3	%
Additives	10.6	%

Fastening procedure of Tubolit DG Plus

- The surface of Tubolit DG Plus, pipes and other system components must be clean, degreased and dry. Otherwise, clean the surface with a proper cleaning agent.
- In order to avoid longitudinal shrinkage of the material, Tubolit DG Plus must always be mounted on the clamp. Therefore, the length of the installed lagging should be increased by 2-3%.
- For best adhesion, the ambient temperature must not be below +5°C. The proper adhesive must be thoroughly mixed before use. Apply the adhesive on two glued surfaces and let it dry. Drying time depends on the thickness of the adhesive layer, ambient temperature and airflow. After the adhesive has dried, stick the edges firmly pressing.
- If the ambient temperature is between +10 and +35°C, it is possible to use self-adhesive coverings. The two strips of protective paper should be removed gradually. Stick the edges together firmly.
- Never install insulation while the installation is in operation mode. The installation can be started 36 hours after the assembly is completed.
- After sticking the Tubolit DG Plus with other products from Tubolit family it is recommended to use bonding clips. The use of clips is absolutely necessary in places where stresses in the insulation material can occur.

Mounting procedure during pipes assembly is shown in Fig. 3. For more instructions see the producer's manual.

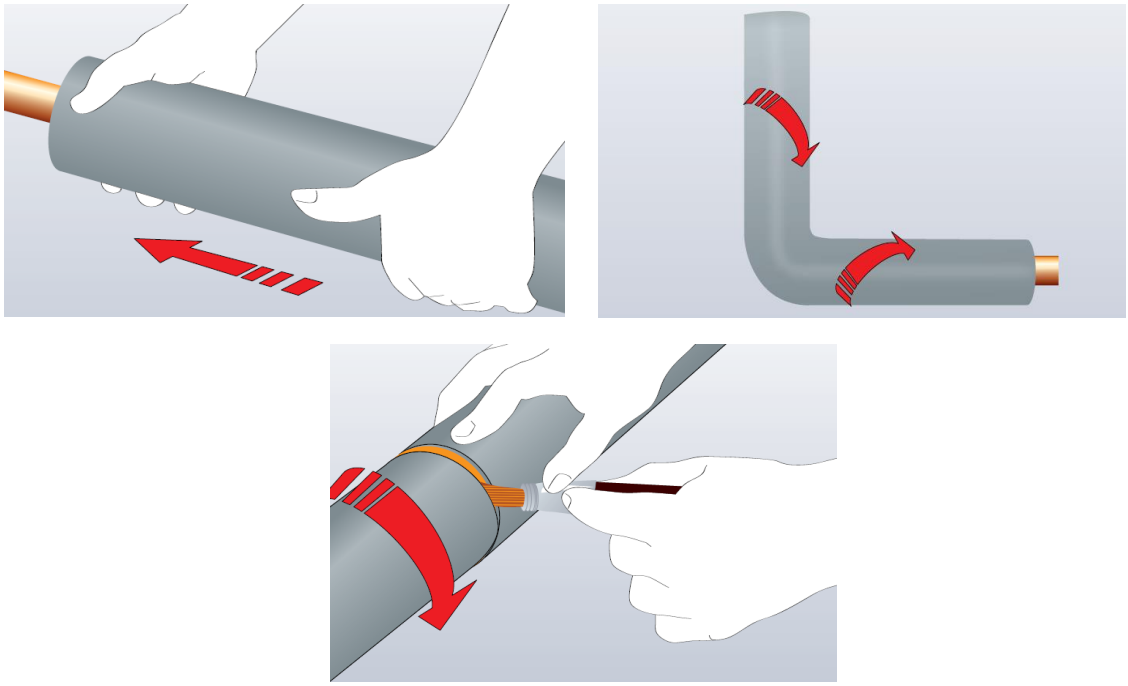

Fig. 3. Mounting procedure of Tubolit DG Plus insulation.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Allocation

The allocation rules used for this EPD are based on general ITB PCR A. Production of Tubolit DG Plus insulation is settled in one factory of Armacell Poland Sp. z o.o. in Środa Śląska. Allocation was done on product mass basis. All impacts from raw materials extraction are allocated in A1 module of EPD**.** Armacell's Poland Sp. z o.o. total production was inventoried and 2.25% of impacts are allocated to Tubolit DG Plus production. Municipal waste and waste water associated with the production of Tubolit DG Plus were allocated to module A3. Energy supply was inventoried for whole production process. Emissions in Armacell Poland Sp. z o.o. are measured and were allocated to module A3.

System limits

The life cycle analysis of the declared products covers "Product Stage" (modules A1-A3), Construction Processes (A4-A5), End of Life stages: C2 (transport of construction waste), C4 (Disposal) and Benefits and loads beyond the system boundary (module D) in accordance with EN 15804+A1 and ITB PCR A. The details of systems limits are provided in product technical report. All materials and energy consumption inventoried in factory were included in calculation. Office impacts were not taken into consideration. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation, utilised thermal energy, internal fuel and electric power consumption, direct production waste, and all available emission measurements. Wooden pallets used for storage and transportation were excluded from the calculations. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A1, machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees.

A1 and A2 Modules: Raw materials supply and transport

Polyethylene, wax, isobutane, copolymer and other chemicals. packaging materials (stretch foil, palettes, carton boxes) come from both Polish and foreign suppliers. Means of transport include trucks with load: <10t. 10 – 16t and >16t. For calculation purposes Polish and European fuel averages were applied.

A3: Production

The production of Tubolit DG Plus insulation is a single line process performed by four automated production lines in factory in Środa Śląska. Raw material (PE) and additives are weighed, mixed and then extruded with the addition of a blowing agent (isobutane). After cooling and cutting, product is being packed and transferred for seasoning. Afterwards ready-to-use product is prepared for transport to Customer. The production scheme of Tubolit DG Plus insulation is shown in Fig 4.

A4: Transport

The Tubolit insulation products are delivered to Polish as well as foreign construction sites. An average distance of 750 km from the factory gate to a construction site is assumed. Means of transport include 24t loaded lorry with 85% capacity utilization and fuel consumption of 35 L per 100 km.

A5: Construction-installation process

Considered environmental burdens are associated with the use of ancillary materials such as a cleaning agent. an adhesive and hand tools recommended by Producer (see the producer's manual). Generation of off-cuts amounting to 1% of the product is assumed.

C2, C4: End of Life

At the end-of-life the Tubolit insulation products are deconstructed with the use of electrical tools. It is assumed that 98% of the polyethylene foam is recovered, of which 30% undergo recycling. 30% is subjected to incineration while the remaining material is forwarded to landfill in the form of mixed construction and demolition wastes. In module C2 transport distance of 75 km on 16 t loaded lorry with 85% capacity utilization and fuel consumption of 25 L per 100 km is considered. Environmental burdens declared in module C4 are associated with waste-specific emissions to air and groundwater via landfill gas incineration and landfill leachate. Benefits resulting from the recycling of the polyethylene foam and thermal energy production (alternative for fuel oil) are included in module D. The caloric value of 42 MJ/kg has been adopted.

Table 4. End-of-life scenario for the Tubolit insulation products manufactured by Armacell Poland Sp.

Material	Material recovery	Recycling	Energy recovery	Landfilling
Polyethylene foam	98%	30%	30%	40%

Assumptions and estimates

Scenario assumptions

- ✓ A4: Transport to Customer – weighted distance is 350 km for both domestic and foreign markets
- ✓ A5: Installation – Parts of products can be joined with the use of simple, manual tools. A loss of 1% of insulation material is assumed
- ✓ C2, C4: End of Life – The transport from place of usage to a recycling/disposal facility is assumed as 30 km. 50% of demolished waste is set to be disposed and other 50% is going to be recycled of which 85% will be reused as a raw material for PE processing.
- ✓ D: Reuse-recovery-recycling potential – recovered polyethylene (in module C3) constitutes raw material for the production of Tubolit DG Plus. It is estimated that the amount of recovered polyethylene amounts to 42.5% of PE input.
  The value in module D is the amount of environmental impact of recycled PE, which is the input material in module A1.

The impacts of the representative Tubolit DG Plus products were aggregated using weighted average. Impacts were inventoried and calculated for all products of insulation materials produced by Armacell Poland Sp. z o.o. in Środa Śląska factory.

Data collection period

The data for manufacture of the declared product refer to period between 01.1.2021 – 31.12.2021 (1 year). The life cycle assessments were prepared for Poland as reference area.

Data quality

The values determined to calculate the LCA originate from verified Armacell Poland Sp. z o.o. inventory data.

Calculation rules

LCA was done in accordance with ITB PCR A document.

Databases

The data for the processes come from the following databases: Ecoinvent, specific EPDs, Ullmann's, ITB-Data. Specific data quality analysis was a part of external ISO 14001 audit.

Characterization factors are CML ver. 4.2 based on EN 15804:2013+A1 version (PN-EN 15804+A1:2014-04)

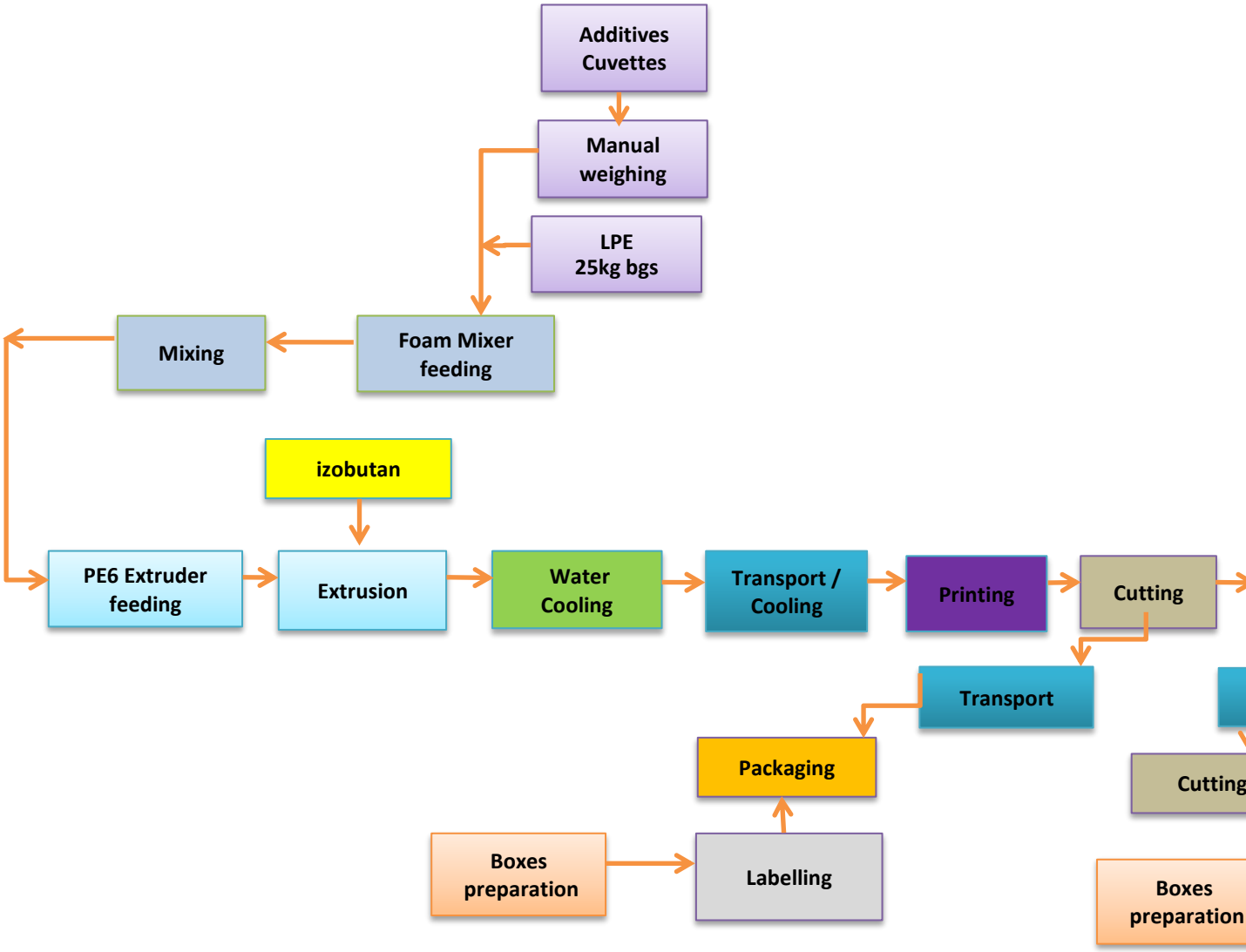

Fig. 4. A production scheme of Tubolit DG Plus in Armacell Poland Sp. z o.o. factory in Środa Śląska.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to functional unit (FU) - 1 m^3 Tubolit DG Plus insulation (average density 23.57 kg/m^3)

Table 5. System boundaries for environmental characteristic for Tubolit DG Plus insulation

Environmental assessment information (MNA – Module not assessed, MD – Module Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction 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
MD	MD	MD	MD	MD	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MD	MNA	MD	MD

Table 6. Tubolit DG+, LCA impacts (for 1 m³)

Environmental impacts: (DU) 1 m³									
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
Global warming potential	kg CO_2 eq.	7.96E+01	1.08E+00	3.10E+01	9.25E+00	5.13E+00	1.21E+00	1.74E+01	-3.16E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.21E-06	0.00E+00	2.00E-09	0.00E+00	7.32E-07	0.00E+00	2.02E-07	-4.27E-06
Acidification potential of soil and water	kg SO_2 eq.	3.84E-01	1.47E-02	3.61E-02	1.09E-02	3.11E-02	7.44E-04	9.62E-03	-2.14E-01
Formation potential of tropospheric ozone	kg Ethene eq.	1.24E-01	1.07E-03	8.93E-08	7.95E-04	3.12E-03	4.77E-05	4.89E-03	-8.28E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	1.23E-01	2.59E-03	3.30E-03	1.92E-03	6.70E-03	1.32E-04	3.20E-03	-1.18E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.08E-02	0.00E+00	1.04E-04	0.00E+00	4.06E-05	0.00E+00	1.42E-05	-1.46E-05
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.18E+03	1.47E+01	2.63E+02	1.27E+02	1.29E+02	1.65E+01	3.44E+01	-4.02E+02
Environmental aspects on resource use: (DU) 1 m³									
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.53E+02	1.03E+00	3.19E+01	8.87E+00	1.43E+01	1.15E+00	2.52E+00	-4.39E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.10E+03	1.55E+01	2.77E+02	1.33E+02	1.27E+02	1.73E+01	3.35E+01	-4.26E+02
Use of secondary material	kg	1.98E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03	0.00E+00	0.00E+00	2.50E-01
Use of renewable secondary fuels	MJ	0.00E+00	7.74E-01	0.00E+00	6.65E+00	8.94E-03	8.64E-01	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	INA	INA	INA	INA	INA	INA	INA	INA
Other environmental information describing waste categories: (DU) 1 m³									
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
Hazardous waste disposed	kg	7.15E-03	2.43E-08	0.00E+00	8.59E-10	9.70E-04	6.14E-11	5.90E-05	-3.15E-04
Non-hazardous waste disposed	kg	1.42E+00	1.08E-05	4.73E-02	3.84E-07	3.10E-01	2.74E-08	1.11E+01	-1.16E+00
Radioactive waste disposed	kg	6.08E-04	6.26E-08	0.00E+00	2.22E-09	1.22E-04	1.58E-10	1.22E-04	-3.41E-04
Components for re-use	kg	0.00E+00	0.00E+00	9.71E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	5.07E+00	0.00E+00	1.34E-03	0.00E+00	7.55E+00	0.00E+00
Materials for energy recover	kg	4.31E-03	0.00E+00	0.00E+00	0.00E+00	1.74E-03	0.00E+00	7.55E+00	0.00E+00
Exported energy	MJ per energy carrier	INA	INA	INA	INA	INA	INA	INA	INA

Verification

The process of this EPD verification is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after this validity period, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) [x] external [ ] internal
External verification of EPD: Ph.D. Halina Prejzner LCI audit and LCA: Ph.D. Eng. Michał Piasecki. m.piasecki@itb.pl

Normative references

- ITB PCR A (v 1.5) General Product Category Rules for Construction Products
- ISO 14025:2006 Environmental labels and declarations – Type III Environmental Declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- EN 15804:2012+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- EN 15942:2012 Sustainability of construction works - Environmental product declarations - Communication format business-to-business
- KOBiZE Wskaźniki emisyjności CO_2. SO_2. NO_x. CO i pyłu całkowitego dla energii elektrycznej. grudzień 2019
- PN-EN 14313+A1:2013-07 Wyroby do izolacji cieplnej wyposażenia budynków i instalacji przemysłowych -- Wyroby z pianki polietylenowej (PEF) produkowane fabrycznie -- Specyfikacja
- PN-EN 14313:2016-04 Wyroby do izolacji cieplnej wyposażenia budynków i instalacji przemysłowych -- Wyroby z pianki polietylenowej (PEF) produkowane fabrycznie – Specyfikacja
- EN 14313: 2009 Thermal insulation products for building equipment and industrial installations - Factory made polyethylene foam (PEF) products - Specification

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Thermal Physics, Acoustics and Environment Department

02-656 Warsaw, Ksawerów 21

CERTIFICATE № 072/2023
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Polyethylene flexible insulation

Tubolit DG Plus

Manufacturer:

Armacell Poland Sp z o.o.

ul. Targowa 2, 55-300 Środa Śląska, Poland

confirms the correctness of the data included in the development of Type III Environmental Declaration and accordance with the requirements of the standard

PN-EN 15804+A1

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 26th July 2018 is valid for 5 years or until amendment of mentioned Environmental Declaration

Acting Head of the Thermal Physic, Acoustics and Environment Department

Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation

Krzysztof Kuczyński, PhD

Warsaw, January 2023