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Tubolit DG Plus

polyethylene insulation for heating and plumbing installations



EPD Program Operator

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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 impacts of the declared construction materials on the environment. 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, D modules in accordance with EN 15804 (Cradle to Gate with options (A1-A3, C2, C4, D and additional modules A4-A5)

The year of preparing the EPD: 2018

Declared durability: for standard product – 50 years

Product standard: EN 14313:2015

PCR: ITB-PCR A (PCR based on EN 15804)

Functional unit: 1 tone

Reasons for performing LCA: B2B

Representativeness: Polish product

MANUFACTURER AND PRODUCT INFORMATION

Armacell International GmbH is a producer of flexible insulation foams for the equipment insulation market and a provider of engineered foams.

Armacell International GmbH 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.



Fig. 1. The view of Armacell Poland Sp. z o.o. factory in Środa Śląska.

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

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 CO₂ 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 downstream 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	$\lambda_{40^{\circ}\text{C}} \leq 00.4 \text{ W(m}^{\circ}\text{K)}$ $\lambda \vartheta_m = (34 + 0.15 * \vartheta_m + 0.0015 * (\vartheta_m - 40)^2) / 1000$
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	63.3	%
Flame retardant	23.6	%
Blowing agent	8.2	%
Additives	4.9	%

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.

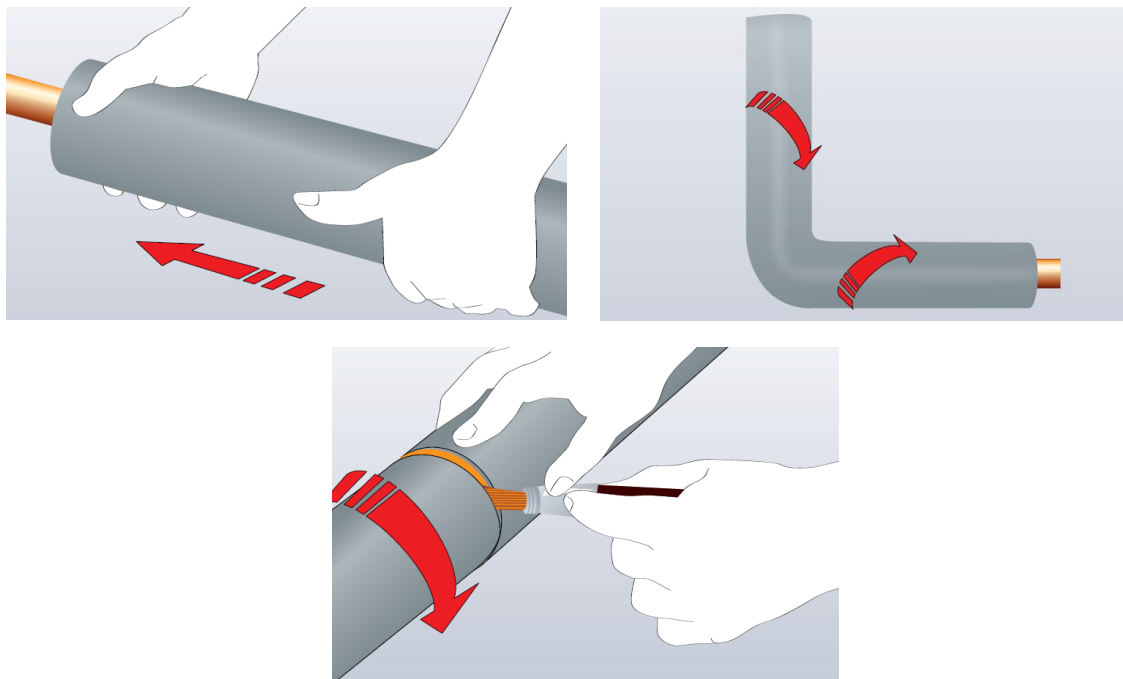


Fig. 3. Mounting procedure of Tubolit DG Plus insulation.

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 0.318% 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

Raw materials such as polymers and additives i.a. fire retardants, nucleating agent come from both Polish and foreign suppliers whereas other ancillary items come from local Polish suppliers. Data on transport of the different products to the manufacturing plants is collected and modelled for factory by assessor. Means of transport include trucks and Polish and European fuel averages are 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

Average values for the transport from factory gate to a construction site are assumed.

A5: Construction-installation process

The installation considers use of the tools and adhesives recommended by Armacell Poland Sp. z o.o. (see the producer's manual).

C2, C4: End of Life

Disposal and recycling scenario for used and demolished product including transport to disposal or recycling facility is covered.

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 01.1.2016 – 31.12.2016 (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)

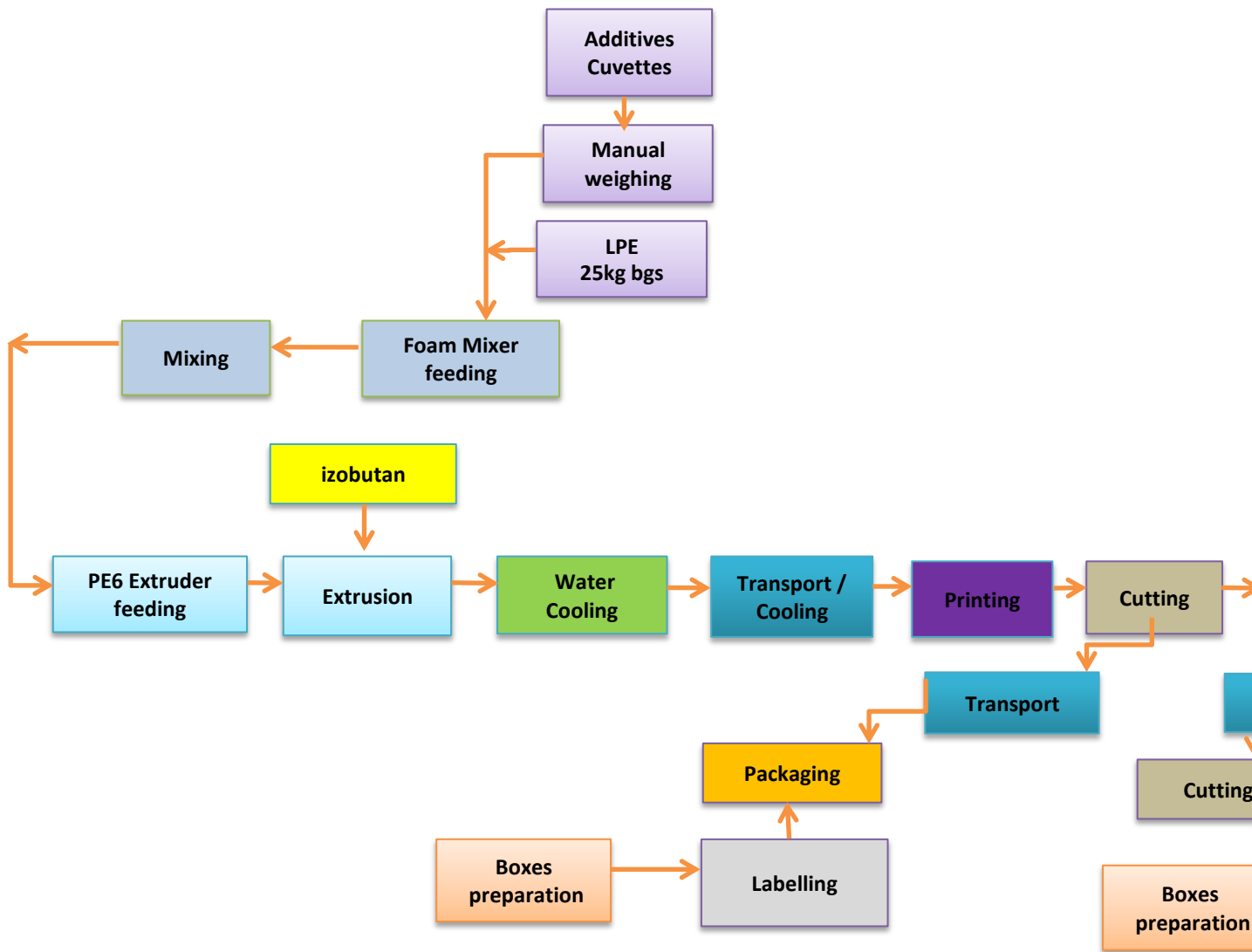


Fig. 4. A production scheme of Tubolit DG Plus in Armacell Poland Sp. z o.o. factory in Środa Śląska.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to functional unit (FU) - 1 tone of Tubolit DG Plus insulation

Table 2. 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

Tubolit DG Plus - modules A1-A3

Environmental impacts: (FU) 1 tone					
Indicator	Unit	A1	A2	A3	A1-A3
Global warming potential	[kg CO ₂ eq.] (100 years)	1.46E+04	1.40E+02	1.39E+03	1.62E+04
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	8.62E-05	0.00E+00	0.00E+00	8.62E-05
Acidification potential of soil and water	[kg SO ₂ eq.]	3.36E+01	1.02E+00	2.48E-06	3.46E+01
Formation potential of tropospheric ozone	[kg Ethene eq.]	6.44E+00	7.45E-02	2.50E+01	3.15E+01
Eutrophication potential	[kg (PO ₄) ³⁻ eq.]	5.96E+00	1.81E-01	4.60E-07	6.14E+00
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	6.04E+00	0.00E+00	5.15E-03	6.05E+00
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	2.04E+05	7.63E+03	1.22E-02	2.12E+05
Environmental aspects on resource use: (FU) 1 tone					
Indicator	Unit	A1	A2	A3	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	6.13E+01	5.34E+02	0.00E+00	5.96E+02
Use of renewable primary energy resources used as raw materials	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	6.10E+04	5.34E+02	0.00E+00	6.16E+04
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	3.48E+03	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	[MJ]	0.00E+00	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	2.46E+05	8.01E+03	1.28E-02	2.54E+05
Use of secondary material	[kg]	1.64E+03	0.00E+00	1.54E-01	1.64E+03
Use of renewable secondary fuels	[MJ]	0.00E+00	0.00E+00	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
Net use of fresh water	[m ³]	6.19E+01	6.96E+00	1.06E-03	6.89E+01
Other environmental information describing waste categories: (FU) 1 tone					
Indicator	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	[kg]	5.94E+00	6.28E-06	0.00E+00	5.94E+00
Non-hazardous waste disposed	[kg]	1.28E+03	5.83E-03	5.58E-01	1.28E+03
Radioactive waste disposed	[kg]	5.22E-04	0.00E+00	0.00E+00	5.22E-04
Components for re-use	[kg]	0.00E+00	0.00E+00	1.54E-01	1.54E-01
Materials for recycling	[kg]	6.16E+01	0.00E+00	9.04E+01	1.52E+02
Materials for energy recover	[kg]	0.00E+00	0.00E+00	8.90E-03	8.90E-03
Exported energy	[MJ per energy carrier]	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Tubolit DG Plus – modules A4, A5, C2, C4, D

Environmental impacts: (FU) 1 tone						
Indicator	Unit	A4	A5	C2	C4	D
Global warming potential	[kg CO ₂ eq.] (100 years)	1.31E+01	1.72E+02	1.87E+00	6.86E+01	-3.49E+03
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	0.00E+00	3.21E-05	0.00E+00	1.68E-10	-3.49E-05
Acidification potential of soil and water	[kg SO ₂ eq.]	9.90E-02	4.47E-02	1.41E-02	1.89E-01	-8.59E+00
Formation potential of tropospheric ozone	[kg Ethene eq.]	6.39E-03	1.20E-02	9.13E-04	2.16E-02	-1.63E+00
Eutrophication potential	[kg (PO ₄) ³⁻ eq.]	1.75E-02	8.41E-03	2.50E-03	1.88E-01	-1.20E+00
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	0.00E+00	1.65E-01	0.00E+00	1.42E-05	-2.08E+00
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	1.47E+04	5.52E-01	7.02E+03	9.83E+02	-4.38E+04
Environmental aspects on resource use: (FU) 1 tone						
Indicator	Unit	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
Use of renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	9.91E+04	4.60E-02	4.72E+04	-2.35E+04	-1.31E+04
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	1.55E+04	5.79E-01	7.37E+03	-7.79E+03	-5.83E+04
Use of secondary material	[kg]	0.00E+00	4.65E-02	0.00E+00	0.00E+00	-3.45E+02
Use of renewable secondary fuels	[MJ]	0.00E+00	-3.32E-05	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	[MJ]	0.00E+00	-5.46E-04	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	[dm ³]	1.34E+01	6.13E-02	6.40E+00	0.00E+00	0.00E+00
Other environmental information describing waste categories: (FU) 1 tone						
Indicator	Unit	A4	A5	C2	C4	D
Hazardous waste disposed	[kg]	1.21E-05	5.44E-05	5.78E-06	3.96E-06	-2.48E+00
Non-hazardous waste disposed	[kg]	1.13E-02	6.60E-03	5.36E-03	9.54E+02	-2.78E+02
Radioactive waste disposed	[kg]	0.00E+00	1.23E-05	0.00E+00	1.55E-02	-1.10E-05
Components for re-use	[kg]	0.00E+00	1.13E-06	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	[kg]	0.00E+00	1.13E-06	0.00E+00	0.00E+00	-1.29E+01
Materials for energy recover	[kg]	0.00E+00	1.13E-06	0.00E+00	0.00E+00	0.00E+00
Exported energy	[MJ per energy carrier]	0.00E+00	1.48E-05	0.00E+00	0.00E+00	0.00E+00

Verification

The process of verification of this EPD 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 5 years, 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.) <input checked="" type="checkbox"/> external <input type="checkbox"/> internal
External verification of EPD: PhD. Eng. Halina Prejzner LCA LCI audit and input data verification: Justyna Tomaszewska. PhD. Eng. j.tomaszewska@itb.pl LCA report: MSc. Eng. Dominik Bekierski. d.bekierski@itb.pl Verification of LCA: Michał Piasecki PhD. Eng. m.piasecki@itb.pl

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 14313:2015 - Thermal insulation products for building equipment and industrial installations - Factory made polyethylene foam (PEF) products - Specification
- 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 in construction works – Environmental product declarations – Core rules for the product category of construction products
- EN 15942:2011 Sustainability of construction works – Environmental product declarations – Communication format business-to-business



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CERTIFICATE No 072/2018 of TYPE III ENVIRONMENTAL DECLARATION

Product:

Polyethylene flexible insulation

Tubolit DG Plus

Manufacturer:

Armacell Poland Sp. z o.o.

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+A1:2014-04

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

Head of the Thermal Physic, Acoustics
and Environment Department

Michał Piasecki, PhD



Deputy Director
for Research and Innovation

Krzysztof Kuczyński, PhD

Warsaw, July 2018