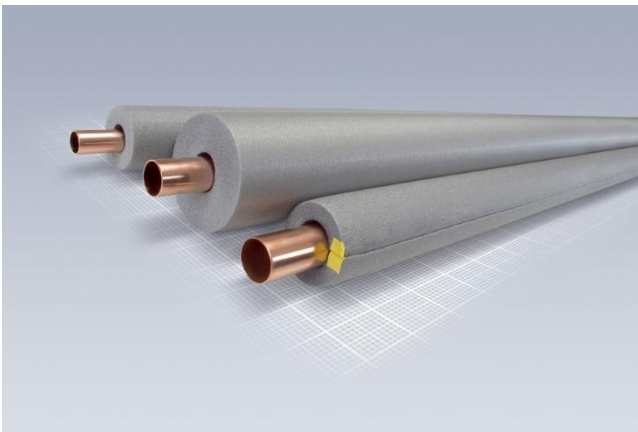




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Tubolit insulation products

Tubolit AR Fonoblok. Tubolit AR Fonowave.
Tubolit S Plus. Tubolit DG and Tubolit DG B1



Owner of the EPD

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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: 2021

Product standard: EN 14313

Service Life: 50 years for standard products

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

Declared unit: 1 m³ of the Tubolit insulation products

Reasons for performing LCA: B2B

Representativeness: Polish products

MANUFACTURER



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.

PRODUCT DESCRIPTION AND APPLICATION

Tubolit insulation products are flexible, closed-cell extruded materials made of polyethylene. The specification and application of the Tubolit insulation products are listed in Tables 1 and 2.

Table 1. Specification of the Tubolit insulation products manufactured by Armacell Poland Sp. z o. o.

Product name	Features: T: thickness D: density W: weight C: conductivity	Material information	Colour	Declaration of performances	Certificate of conformity
Tubolit AR Fonoblok	T: 5 mm D: 32.8 kg/m ³ W: 0.261 kg/m C: 0.045 W/mK	Foam material based on polyethylene. Factory made polyethylene foam (PEF) according to EN 14313. Self-adhesive coating on tapes: pressure-sensitive adhesive coating on modified acrylate basis with mesh structure. covered with polyethylene foil.	blue	0551-CPR-2013-041	0551-PEF-12-1-R6-F.e
Tubolit AR Fonowave	T: 9 mm D: 53 kg/m ³ W: 0.130 kg/m C: 0.045 W/mK	Foam material based on polyethylene. Factory made polyethylene foam (PEF) according to EN 14313. Foil coating on outer surface for additional protection of insulation surface. Specially wave-shaped inner surface provides excellent acoustical performance on plastic pipes.	blue	0543-CPR-2013-047	0551-PEF-12-1-R5-F.e

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Tubolit S Plus	T: 0.4 mm D: 44.8 kg/m ³ W: 0.0245 kg/m C: 0.045 W/mK	Foam material based on polyethylene. Factory made polyethylene foam (PEF) according to EN 14313. Foil coating on outer surface for additional protection of insulation surface. Foil coating on inner surface for better sleeve-on installation.	foam: grey; foil: blue	0551-CPR-2013-035	0551-PEF-12-1-R5-F.e
Tubolit DG	T: 0.5-30 mm D: 21-42 kg/m ³ W: 0.035 kg/m C: 0.04 W/mK	Foam material based on polyethylene. Factory made polyethylene foam (PEF) according to EN 14313. 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).	grey	0551-CPR-2013-035	0551-PEF-12-1-R5-F.e
Tubolit DG B1	T: 0.5-27 mm D: 21-42 kg/m ³ W: 0.052 kg/m C: 0.04 W/mK	Foam material based on polyethylene. Factory made polyethylene foam (PEF) according to EN 14313.	grey	0551-CPR-2013-036	0551-PEF-12-1-R5-F.e

Table 2. Applications of the Tubolit insulation products manufactured by Armacell Poland Sp. z o. o.

Product name	Grades		Applications		
Tubolit AR Fonoblok	ITDAR05050000 ITDAR05060000 ITDAR05070000 ITDAR05090000 ITDAR05100000 ITDAR05125000 ITDAR05150000	TL-50/5-AR TL-60/5-AR TL-70/5-AR TL-90/5-AR TL-100/5-AR TL-125/5-AR TL-150/5-AR	Acoustical and thermal insulation of internal waste water, rain water and sewage pipes in residential and non-residential buildings. For complex and large diameter rain collecting and (roof-) drainage pipes, to provide optimal protection against the risk of condensation, we recommend using Armaflex insulation.		
Tubolit AR Fonowave	IZNAW09050000 IZNAW09070000 IZNAW09090001 IZNAW09100000 IZNAW09125000	CO-50/9-ARW CO-70/5-ARW CO-90/5-ARW CO-100/5-ARW CO-125/5-ARW	Acoustical and thermal insulation of internal waste water, rain water and sewage pipes in residential and non-residential buildings. For complex and large diameter rain collecting and (roof-) drainage pipes, to provide optimal protection against the risk of condensation, we recommend using Armaflex insulation.		
Tubolit S Plus	ITDSS04015000 ITDSS04018000 ITDSS04020000 ITDSS04022000 ITDSS04024000 ITDSS04028000 ITDSS04030000 ITDSS04035000 ITDSS04042000	TL-12/15/4-S+ TL-18/4-S+ TL-20/4-S+ TL-22/4-S+ TL-24/4-S+ TL-28/4-S+ TL-30/4-S+ TL-35/4-S+ TL-42/4-S+	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.).		
Tubolit DG	ITDAA05012009 ITDAA05015009 ITDAA05018009 ITDAA05020009 ITDAA05022009 ITDAA05025009 ITDAA05028009 ITDAA05032009	TL-12/5-DG TL-15/5-DG TL-18/5-DG TL-20/5-DG TL-22/5-DG TL-25/5-DG TL-28/5-DG TL-32/5-DG	ITDAA13064000 TDAA13067009 ITDAA13076009 ITDAA13089009 ITDAA13110009 ITDAA13114000 ITDAA13125000 ITDAA20012000	TL-64/13-DG TL-67/13-DG TL-76/13-DG TL-89/13-DG TL-110/13-DG TL-114/13-DG TL-125/13-DG TL-12/20-DG	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.).

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	ITDAA05035009	TL-35/5-DG	ITDAA20015009	TL-15/20-DG	
	ITDAA09015009	TL-15/9-DG	ITDAA20018009	TL-18/20-DG	
	ITDAA09018009	TL-18/9-DG	ITDAA20022009	TL-22/20-DG	
	ITDAA09020009	TL-20/9-DG	ITDAA20028009	TL-28/20-DG	
	ITDAA09022009	TL-22/9-DG	ITDAA20035009	TL-35/20-DG	
	ITDAA09025000	TL-25/9-DG	ITDAA20042009	TL-42/20-DG	
	ITDAA09028009	TL-28/9-DG	ITDAA20048009	TL-48/20-DG	
	ITDAA09032009	TL-32/9-DG	ITDAA20054000	TL-54/20-DG	
	ITDAA09035009	TL-35/9-DG	ITDAA20057000	TL-57/20-DG	
	ITDAA09040000	TL-40/9-DG	ITDAA20060000	TL-60/20-DG	
	ITDAA09042000	TL-42/9-DG	ITDAA20064009	TL-64/20-DG	
	ITDAA09048009	TL-48/9-DG	ITDAA20076009	TL-76/20-DG	
	ITDAA09050000	TL-50/9-DG	ITDAA20089009	TL-89/20-DG	
	ITDAA09050009	TL-50/9-DG	ITDAA20110009	TL-110/20-DG	
	ITDAA09054009	TL-54/9-DG	ITDAA20114009	TL-114/20-DG	
	ITDAA09060009	TL-60/9-DG	ITDAA25048000	TL-48/25-DG	
	ITDAA09064809	TL-64/9-DG	ITDAA25054000	TL-54/25-DG	
	ITDAA09067009	TL-67/9-DG	ITDAA25060009	TL-60/25-DG	
	ITDAA09076000	TL-76/9-DG	ITDAA25076000	TL-76/25-DG	
	ITDAA09089000	TL-89/9-DG	ITDAA25089009	TL-89/25-DG	
	ITDAA13015009	TL-15/13-DG	ITDAA25114000	TL-114/25-DG	
	ITDAA13018009	TL-18/13-DG	ITDAA30018000	TL-18/30-DG	
	ITDAA13020009	TL-20/13-DG	ITDAA30018009	TL-18/30-DG	
	ITDAA13022008	TL-22/13-DG	ITDAA30022000	TL-22/30-DG	
	ITDAA13022009	TL-22/13-DG	ITDAA30028009	TL-28/30-DG	
	ITDAA13025009	TL-25/13-DG	ITDAA30035009	TL-35/30-DG	
	ITDAA13028009	TL-28/13-DG	ITDAA30042009	TL-42/30-DG	
	ITDAA13032009	TL-32/13-DG	ITDAA30048000	TL-48/30-DG	
	ITDAA13035009	TL-35/13-DG	ITDAA30054000	TL-54/30-DG	
	ITDAA13040009	TL-40/13-DG	ITDAA30060000	TL-60/30-DG	
	ITDAA13042009	TL-42/13-DG	ITDAA30064009	TL-64/30-DG	
	ITDAA13048009	TL-48/13-DG	ITDAA30076009	TL-76/30-DG	
	ITDAA13050009	TL-50/13-DG	ITDAA30089000	TL-89/30-DG	
	ITDAA13054009	TL-54/13-DG	ITDAA30114000	TL-114/30-DG	
	ITDAA13060000	TL-60/13-DG			
Tubolit DG B1	ITDBA05012000	TL-12/5-DG-B1	ITDBA13089009	TL-89/13-DG-B1	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.).
	ITDBA05015000	TL-15/5-DG-B1	ITDBA13110009	TL-110/13-DG-B1	
	ITDBA05022000	TL-22/5-DG-B1	ITDBA13114009	TL-114/13-DG-B1	
	ITDBA05028000	TL-28/5-DG-B1	ITDBA13125009	TL-125/13-DG-B1	
	ITDBA05035000	TL-35/5-DG-B1	ITDBA20015009	TL-15/20-DG-B1	
	ITDBA09010009	TL-10/9-DG-B1	ITDBA20018009	TL-18/20-DG-B1	
	ITDBA09012000	TL-12/9-DG-B1	ITDBA20020009	TL-20/20-DG-B1	
	ITDBA09015009	TL-15/9-DG-B1	ITDBA20022009	TL-22/20-DG-B1	
	ITDBA09018009	TL-18/9-DG-B1	ITDBA20028009	TL-28/20-DG-B1	
	ITDBA09020009	TL-20/9-DG-B1	ITDBA20035009	TL-35/20-DG-B1	
	ITDBA09022009	TL-22/9-DG-B1	ITDBA20042009	TL-42/20-DG-B1	
	ITDBA09025009	TL-25/9-DG-B1	ITDBA20048009	TL-48/20-DG-B1	
	ITDBA09028009	TL-28/9-DG-B1	ITDBA20054009	TL-54/20-DG-B1	
	ITDBA09032009	TL-32/9-DG-B1	ITDBA20060009	TL-60/20-DG-B1	
	ITDBA09035009	TL-35/9-DG-B1	ITDBA20076009	TL-76/20-DG-B1	
	ITDBA09040009	TL-40/9-DG-B1	ITDBA20089009	TL-89/20-DG-B1	
	ITDBA09042000	TL-42/9-DG-B1	ITDBA20110009	TL-110/20-DG-B1	
	ITDBA09048009	TL-48/9-DG-B1	ITDBA20114009	TL-114/20-DG-B1	
	ITDBA09050009	TL-50/9-DG-B1	ITDBA25028000	TL-28/25-DG-B1	
	ITDBA09054009	TL-54/9-DG-B1	ITDBA25035000	TL-35/25-DG-B1	
	ITDBA09060009	TL-60/9-DG-B1	ITDBA25042000	TL-42/25-DG-B1	
	ITDBA09064009	TL-64/9-DG-B1	ITDBA25048009	TL-48/25-DG-B1	
ITDBA09070009	TL-70/9-DG-B1	ITDBA25054009	TL-54/25-DG-B1		
ITDBA09076000	TL-76/9-DG-B1	ITDBA25060009	TL-60/25-DG-B1		
ITDBA09089000	TL-89/9-DG-B1	ITDBA25076009	TL-76/25-DG-B1		
ITDBA13010009	TL-10/13-DG-B1	ITDBA25089009	TL-89/25-DG-B1		
ITDBA13012000	TL-12/13-DG-B1	ITDBA25110009	TL-110/25-DG-B1		

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ITDBA13015009	TL-15/13-DG-B1	ITDBA25114009	TL-114/25-DG-B1
ITDBA13018009	TL-18/13-DG-B1	ITDBA26018000	TL-18/26-DG-B1
ITDBA13020009	TL-20/13-DG-B1	ITDBA26022009	TL-22/26-DG-B1
ITDBA13022009	TL-22/13-DG-B1	ITDBA27015009	TL-15/27-DG-B1
ITDBA13028009	TL-28/13-DG-B1	ITDBA30018000	TL-18/30-DG-B1
ITDBA13032009	TL-32/13-DG-B1	ITDBA30022000	TL-22/30-DG-B1
ITDBA13035009	TL-35/13-DG-B1	ITDBA30028000	TL-28/30-DG-B1
ITDBA13040009	TL-40/13-DG-B1	ITDBA30035000	TL-35/30-DG-B1
ITDBA13042009	TL-42/13-DG-B1	ITDBA30042000	TL-42/30-DG-B1
ITDBA13048009	TL-48/13-DG-B1	ITDBA30048000	TL-48/30-DG-B1
ITDBA13050009	TL-50/13-DG-B1	ITDBA30054000	TL-54/30-DG-B1
ITDBA13054009	TL-54/13-DG-B1	ITDBA30060000	TL-60/30-DG-B1
ITDBA13060000	TL-60/13-DG-B1	ITDBA30064000	TL-64/30-DG-B1
ITDBA13064009	TL-64/13-DG-B1	ITDBA30076000	TL-76/30-DG-B1
ITDBA13070009	TL-70/13-DG-B1	ITDBA30089000	TL-89/30-DG-B1
ITDBA13076009	TL-76/13-DG-B1	ITDBA30114000	TL-114/30-DG-B1

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Allocation

The allocation rules used for this EPD are based on product mass basis and net calorific value in accordance with ITB PCR A. Production of the Tubolit insulation products: Tubolit AR Fonoblok, Tubolit AR Fonowave, Tubolit S Plus, Tubolit DG and Tubolit DG B1 is a line process in the production plant of Armacell Poland Sp. z o.o. in Środa Śląska (Poland). Allocation of environmental burdens was done on product mass basis. All impacts from raw materials extraction and processing are allocated in module A1 of the LCA. Impacts from the global line production of the Tubolit insulation products were inventoried and were allocated to the production of the specific products as following: 1.19% Tubolit AR Fonoblok, 0.53% Tubolit AR Fonowave, 0.79% Tubolit S Plus, 16.57% Tubolit DG and 4.31% Tubolit DG B1. Module A2 includes transport of raw materials from their suppliers to Armacell Poland Sp. z o.o. factory in Środa Śląska. Water and energy consumption associated emissions and generated wastes are allocated to module A3.

System boundary

The life cycle analysis of the declared products covers A1-A5, C2, C4 and D modules (Cradle-to-Gate with options) in accordance with EN 15804:2012+A1:2013 and ITB PCR A. The details of the system limits are provided in the background report. Energy and water consumption, emissions to air, soil and water as well as information on generated wastes were inventoried and were included in 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 15804:2012+A1:2013, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

A1 and A2: Raw materials supply and transport

Polyethylene, wax, isobutane, copolymer and other chemicals, packaging materials (stretch foil, pallets, 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 the Tubolit insulation products is a line process performed by four automated production lines in factory in Środa Śląska what is presented in Fig. 2. Polyethylene and additives are weighed, mixed and then extruded with the addition of a blowing agent (isobutane). After cooling

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and cutting product is being packed and transferred for seasoning. Afterwards ready to use product is prepared for transport to Customer.

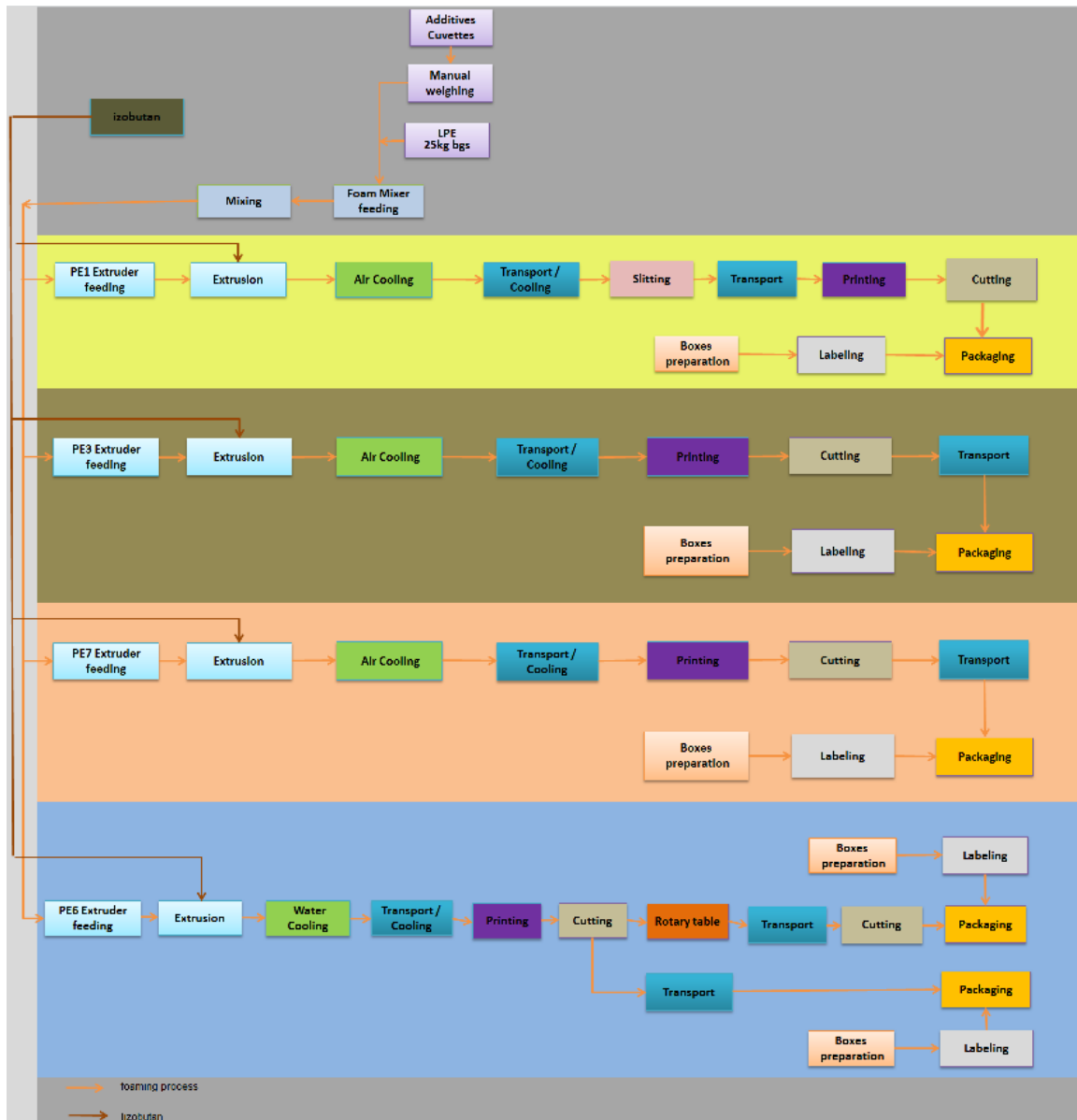


Fig. 2. A scheme of manufacturing Tubolit insulation products by Armacell Poland Sp. z o. o.

A4: Transport to construction site

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: 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 and D Modules: End-of-life scenario

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 3. End-of-life scenario for the Tubolit insulation products manufactured by Armacell Poland Sp. z o. o.

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

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2018 – 31.12.2018 (1 year). The life cycle assessments were prepared for Poland as reference area.

Data quality

The values used to calculate the LCA originate from verified Armacell Poland Sp. z o.o. inventory data and were audited by ITB.

Calculation rules

LCA was done in accordance with ITB PCR A document.

Databases

The data for the processes come from the following databases: Ecoinvent v.3.7. specific EPDs. ITB-Data. Specific data quality analysis was a part of external ISO 14001 audit.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 m³ of the Tubolit insulating products manufactured by Armacell Poland Sp. z o.o.

Table 4. System boundaries for the environmental characteristic of the Tubolit insulating products manufactured by Armacell Poland Sp. z o.o.

Environmental assessment information (MNA – Module not assessed. MD – Module Declared. INA – Indicator Not Assessed)																
Product stage			Construction press		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction	Construction-installation	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 AR Fonoblok

Environmental impacts: (DU) 1 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Global warming potential	kg CO ₂ eq.	2.08E+02	2.02E+00	8.63E+01	9.51E+00	6.34E+00	1.13E+00	2.22E+01	-4.02E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	5.00E-05	0.00E+00	0.00E+00	0.00E+00	8.89E-07	0.00E+00	2.58E-07	-5.47E-06
Acidification potential of soil and water	kg SO ₂ eq.	1.66E+00	2.74E-02	1.40E-01	1.40E-02	3.32E-02	9.52E-04	1.23E-02	-2.73E-01
Formation potential of tropospheric ozone	kg Ethene eq.	8.08E-02	1.99E-03	2.33E-07	1.02E-03	3.29E-03	6.10E-05	6.26E-03	-1.06E-02
Eutrophication potential	kg (PO ₄) ³⁻ eq.	2.50E-01	4.83E-03	1.20E-02	2.46E-03	7.63E-03	1.69E-04	4.10E-03	-1.51E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	8.70E-04	0.00E+00	3.20E-04	0.00E+00	4.65E-05	0.00E+00	1.82E-05	-1.86E-05
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4.38E+03	2.76E+01	8.00E+02	1.30E+02	1.46E+02	1.54E+01	4.40E+01	-5.14E+02
Environmental aspects on resource use: (DU) 1 m ³									
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	1.01E+03	1.93E+00	9.90E+01	9.08E+00	1.62E+01	1.08E+00	3.23E+00	-5.61E+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	4.60E+03	2.90E+01	8.40E+02	1.36E+02	1.45E+02	1.62E+01	4.29E+01	-5.45E+02
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	1.45E+00	0.00E+00	6.81E+00	1.45E-02	8.11E-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 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Hazardous waste disposed	kg	1.85E-02	3.26E-09	0.00E+00	1.10E-09	1.05E-03	7.86E-11	7.55E-05	-4.04E-04
Non-hazardous waste disposed	kg	1.00E+01	1.46E-06	5.66E-01	4.92E-07	3.45E-01	3.51E-08	1.42E+01	-1.49E+00
Radioactive waste disposed	kg	4.41E-03	8.41E-09	0.00E+00	2.84E-09	1.40E-04	2.03E-10	1.56E-04	-4.37E-04
Components for re-use	kg	0.00E+00	0.00E+00	2.29E-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	1.32E+00	0.00E+00	1.32E-02	0.00E+00	9.67E+00	0.00E+00
Materials for energy recover	kg	4.16E-03	0.00E+00	0.00E+00	0.00E+00	2.67E-03	0.00E+00	9.67E+00	0.00E+00
Exported energy	MJ per energy carrier	INA	INA	INA	INA	INA	INA	INA	INA

Tubolit AR Fonowave

Environmental impacts: (DU) 1 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Global warming potential	kg CO ₂ eq.	2.98E+02	3.49E+00	1.35E+02	9.37E+00	7.73E+00	1.22E+00	3.50E+01	-6.33E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	8.35E-05	0.00E+00	0.00E+00	0.00E+00	1.22E-06	0.00E+00	4.07E-07	-8.62E-06
Acidification potential of soil and water	kg SO ₂ eq.	3.06E+00	4.74E-02	2.12E-01	2.20E-02	4.81E-02	1.50E-03	1.94E-02	-4.31E-01
Formation potential of tropospheric ozone	kg Ethene eq.	1.24E-01	3.45E-03	5.87E-07	1.60E-03	3.74E-03	9.62E-05	9.86E-03	-1.67E-02
Eutrophication potential	kg (PO ₄) ³⁻ eq.	3.24E-01	8.36E-03	2.28E-02	3.88E-03	8.52E-03	2.66E-04	6.47E-03	-2.39E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.11E-03	0.00E+00	4.99E-04	0.00E+00	5.07E-05	0.00E+00	2.87E-05	-2.94E-05
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	7.12E+03	4.77E+01	1.25E+03	1.28E+02	1.78E+02	1.66E+01	6.94E+01	-8.10E+02
Environmental aspects on resource use: (DU) 1 m ³									
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	9.33E+02	3.34E+00	1.55E+02	8.95E+00	1.59E+01	1.16E+00	5.09E+00	-8.85E+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	7.47E+03	5.00E+01	1.31E+03	1.34E+02	1.78E+02	1.74E+01	6.75E+01	-8.59E+02
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	2.50E+00	0.00E+00	6.71E+00	2.50E-02	8.71E-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 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Hazardous waste disposed	kg	3.10E-02	2.53E-09	0.00E+00	1.73E-09	1.18E-03	1.24E-10	1.19E-04	-6.36E-04
Non-hazardous waste disposed	kg	1.08E+01	1.13E-06	8.40E-01	7.75E-07	3.56E-01	5.53E-08	2.24E+01	-2.34E+00
Radioactive waste disposed	kg	5.32E-03	6.53E-09	0.00E+00	4.48E-09	1.49E-04	3.20E-10	2.45E-04	-6.89E-04
Components for re-use	kg	0.00E+00	0.00E+00	3.61E-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	1.96E+00	0.00E+00	1.96E-02	0.00E+00	1.52E+01	0.00E+00
Materials for energy recover	kg	1.02E-02	0.00E+00	0.00E+00	0.00E+00	3.55E-03	0.00E+00	1.52E+01	0.00E+00
Exported energy	MJ per energy carrier	INA	INA	INA	INA	INA	INA	INA	INA

Tubolit S Plus

Environmental impacts: (DU) 1 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Global warming potential	kg CO ₂ eq.	1.66E+02	2.45E+00	1.62E+02	9.40E+00	6.68E+00	1.18E+00	3.08E+01	-5.56E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	5.75E-05	0.00E+00	0.00E+00	0.00E+00	9.64E-07	0.00E+00	3.57E-07	-7.57E-06
Acidification potential of soil and water	kg SO ₂ eq.	2.93E+00	3.32E-02	3.05E-01	1.93E-02	4.76E-02	1.32E-03	1.70E-02	-3.78E-01
Formation potential of tropospheric ozone	kg Ethene eq.	1.04E-01	2.41E-03	1.03E-06	1.41E-03	3.53E-03	8.44E-05	8.65E-03	-1.47E-02
Eutrophication potential	kg (PO ₄) ³⁻ eq.	1.55E-01	5.85E-03	3.67E-02	3.41E-03	6.94E-03	2.33E-04	5.68E-03	-2.10E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.13E-04	0.00E+00	6.00E-04	0.00E+00	4.28E-05	0.00E+00	2.52E-05	-2.58E-05
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	5.46E+03	3.34E+01	1.50E+03	1.28E+02	1.64E+02	1.60E+01	6.09E+01	-7.11E+02
Environmental aspects on resource use: (DU) 1 m ³									
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	8.07E+02	2.34E+00	1.86E+02	8.98E+00	1.50E+01	1.12E+00	4.47E+00	-7.77E+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	5.73E+03	3.51E+01	1.57E+03	1.35E+02	1.63E+02	1.68E+01	5.93E+01	-7.54E+02
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	1.75E+00	0.00E+00	6.73E+00	1.75E-02	8.41E-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 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Hazardous waste disposed	kg	2.08E-02	2.61E-09	0.00E+00	1.52E-09	1.08E-03	1.09E-10	1.04E-04	-5.59E-04
Non-hazardous waste disposed	kg	4.98E+00	1.17E-06	7.54E-01	6.80E-07	2.97E-01	4.86E-08	1.97E+01	-2.06E+00
Radioactive waste disposed	kg	1.33E-03	6.74E-09	0.00E+00	3.93E-09	1.10E-04	2.81E-10	2.15E-04	-6.05E-04
Components for re-use	kg	0.00E+00	0.00E+00	3.17E-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	1.76E+00	0.00E+00	1.76E-02	0.00E+00	1.34E+01	0.00E+00
Materials for energy recover	kg	1.36E-02	0.00E+00	0.00E+00	0.00E+00	1.97E-03	0.00E+00	1.34E+01	0.00E+00
Exported energy	MJ per energy carrier	INA	INA	INA	INA	INA	INA	INA	INA

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Tubolit DG

Environmental impacts: (DU) 1 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Global warming potential	kg CO ₂ eq.	1.22E+02	1.22E+00	3.19E+01	9.46E+00	4.93E+00	1.20E+00	1.77E+01	-3.20E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	3.11E-05	0.00E+00	0.00E+00	0.00E+00	6.99E-07	0.00E+00	2.06E-07	-4.35E-06
Acidification potential of soil and water	kg SO ₂ eq.	1.54E+00	1.67E-02	4.09E-02	1.11E-02	3.09E-02	7.58E-04	9.80E-03	-2.18E-01
Formation potential of tropospheric ozone	kg Ethene eq.	6.39E-02	1.21E-03	1.01E-07	8.10E-04	3.12E-03	4.86E-05	4.98E-03	-8.43E-03
Eutrophication potential	kg (PO ₄) ³⁻ eq.	1.47E-01	2.94E-03	3.73E-03	1.96E-03	6.50E-03	1.34E-04	3.26E-03	-1.21E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.74E-04	0.00E+00	1.18E-04	0.00E+00	3.85E-05	0.00E+00	1.45E-05	-1.48E-05
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.27E+03	1.67E+01	2.98E+02	1.29E+02	1.30E+02	1.63E+01	3.51E+01	-4.09E+02
Environmental aspects on resource use: (DU) 1 m ³									
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	1.02E+03	1.17E+00	3.61E+01	9.03E+00	1.56E+01	1.14E+00	2.57E+00	-4.47E+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	3.43E+03	1.75E+01	3.13E+02	1.36E+02	1.27E+02	1.71E+01	3.41E+01	-4.34E+02
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	8.77E-01	0.00E+00	6.78E+00	8.77E-03	8.57E-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 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Hazardous waste disposed	kg	1.09E-02	2.75E-08	0.00E+00	8.75E-10	9.77E-04	6.25E-11	6.01E-05	-3.21E-04
Non-hazardous waste disposed	kg	6.61E+00	1.23E-05	2.46E+00	3.91E-07	3.30E-01	2.79E-08	1.13E+01	-1.18E+00
Radioactive waste disposed	kg	1.85E-03	7.10E-08	0.00E+00	2.26E-09	1.15E-04	1.61E-10	1.24E-04	-3.48E-04
Components for re-use	kg	0.00E+00	0.00E+00	1.10E-03	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	5.74E+00	0.00E+00	5.74E-02	0.00E+00	7.69E+00	0.00E+00
Materials for energy recover	kg	6.18E-03	0.00E+00	0.00E+00	0.00E+00	1.54E-03	0.00E+00	7.69E+00	0.00E+00
Exported energy	MJ per energy carrier	INA	INA	INA	INA	INA	INA	INA	INA

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Tubolit DG B1

Environmental impacts: (DU) 1 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Global warming potential	kg CO ₂ eq.	1.36E+02	1.25E+00	3.81E+01	9.29E+00	5.13E+00	1.21E+00	1.74E+01	-3.14E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	3.43E-05	0.00E+00	0.00E+00	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.	1.56E+00	1.71E-02	4.80E-02	1.09E-02	3.11E-02	7.44E-04	9.62E-03	-2.14E-01
Formation potential of tropospheric ozone	kg Ethene eq.	6.40E-02	1.24E-03	1.17E-07	7.95E-04	3.12E-03	4.77E-05	4.89E-03	-8.28E-03
Eutrophication potential	kg (PO ₄) ³⁻ eq.	1.66E-01	3.01E-03	4.27E-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.	4.59E-04	0.00E+00	1.41E-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	3.15E+03	1.70E+01	3.56E+02	1.27E+02	1.29E+02	1.65E+01	3.44E+01	-4.02E+02
Environmental aspects on resource use: (DU) 1 m ³									
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	8.86E+02	1.19E+00	4.34E+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	3.31E+03	1.79E+01	3.74E+02	1.33E+02	1.27E+02	1.73E+01	3.35E+01	-4.26E+02
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	8.94E-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 m ³									
Indicator	Unit	A1	A2	A3	A4	A5	C2	C4	D
Hazardous waste disposed	kg	1.02E-02	7.30E-09	0.00E+00	8.59E-10	9.70E-04	6.14E-11	5.90E-05	-3.15E-04
Non-hazardous waste disposed	kg	7.00E+00	3.26E-06	5.73E-02	3.84E-07	3.10E-01	2.74E-08	1.11E+01	-1.16E+00
Radioactive waste disposed	kg	2.59E-03	1.88E-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	1.79E-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	1.34E-01	0.00E+00	1.34E-03	0.00E+00	7.55E+00	0.00E+00
Materials for energy recover	kg	5.63E-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

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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.) <input checked="" type="checkbox"/> external <input type="checkbox"/> internal
External verification of EPD: Ph.D. Halina Prejzner Input data verification. LCI audit. LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl Verification of LCA: Ph.D. Eng. Michał Piasecki. m.piasecki@itb.pl

Normative references

- ITB PCR A 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 CO₂, SO₂, 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
- BS EN 14313: 2009 Thermal insulation products for building equipment and industrial installations - Factory made polyethylene foam (PEF) products - Specification

p.o. KIEROWNIKA
Zakładu Fizyki Ciepłej, Akustyki i Środowiska
dr inż. Agnieszka Winkler-Skalna



Instytut Techniki Budowlanej

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Thermal Physics, Acoustics and Environment Department

02-656 Warsaw, Ksawerów 21

**CERTIFICATE No 150/2021
of TYPE III ENVIRONMENTAL DECLARATION**

Product:

**Tubolit insulation products:
Tubolit AR Fonoblok, Tubolit AR Fonowave,
Tubolit S Plus, Tubolit DG i Tubolit DG B1**

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.

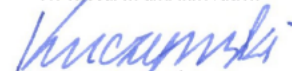
This certificate, issued for the first time on 9th February 2021 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Acting Head of the Thermal Physic, Acoustics
and Environment Department


Agnieszka Winkler-Skalna, PhD



Deputy Director
for Research and Innovation


Krzysztof Kuczyński, PhD

Warsaw, February 2021