THERMAL PHYSICS, ACOUSTICS AND ENVIRONMENT DEPARTMENT
THERMAL PHYSICS, ACOUSTICS AND ENVIRONMENT LABORATORY

TEST REPORT Nº LZF01-2182/17/Z00NZF

Client:	*Armacell Poland Sp. z o. o.*
Client address:	*ul. Targowa 2, 55-300 Środa Śląska*
INFORMATION ABOUT PRODUCT	
Manufacturer (name and address):	*Armacell Poland Sp. z o. o.* *ul. Targowa 2, 55-300 Środa Śląska*
Name and address of factory:	*Armacell Poland Sp. z o. o.* *ul. Targowa 2, 55-300 Środa Śląska*
Product:	*Construction products of chemical origin:* *AF/Armaflex – thermal and anti-freeze insulation for refrigeration installations*
Technical specification:	-
Information about product, intended use, and the number of the applicable system of assessment and verification of constancy of performance	*N/A*
Unique identification code of the product-type:	*Information about unique identification code of the product-type has not been provided by client.*
Information about test item	
Test item: **name, description, condition, identification**	*AF/Armaflex – thermal and anti-freeze insulation for refrigeration installations.* *The thermal insulation AF/Armaflex. with dimensions: 4 m x 1 m, was delivered in a cardboard package;* *lot number: SR00117337* *date of production: 03.10.2017*
Date of receipt /sampling:	*20.10.2017*
Receipt /sampling procedure	Procedure Nº 18

N^{o} of receipt /sampling protocol	*LZF01-2182/17/Z00NZF*
Further information about test item:	-

Information about tests:

Test commencement date:	*23.10.2017*
Test completion date:	*29.11.2017*
Further information about tests:	The area of sample: 0.1125 m^2 Date of sample preparation: 23.10.2017 Date of sample placement in the laboratory chamber: 23.10.2017

CHARACERISTICS EXAMINED

Determination of emissions of volatile organic compounds from the thermal insulation AF/Armaflex in the test chamber.

TEST CONDITIONS

Laboratory chamber made of stainless steel, cap. 0.225 m^3,
Loading factor: 0.5 m^2/m^3
Temperature: (23 ± 1) ° C,
Relative humidity: (50 ± 5)%
Multiplicity of air exchange: 0.05 m^3/h.

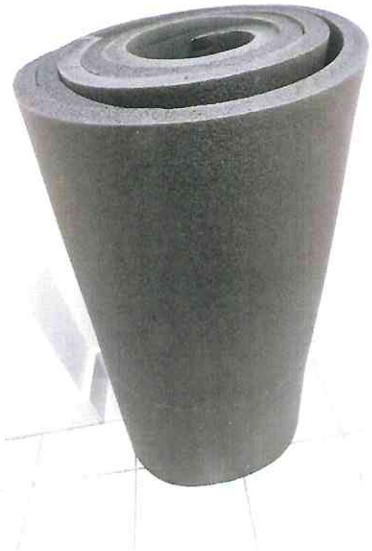
EMISSION TEST

Volatile organic compounds were collected on the tube filled with Tenax and analyzed by thermal desorption using a gas chromatograph/mass spectrometer (GC-MS). The compounds were identified by mass spectra library. The limit of quantification of applied method equals 2 $\mu g/m^3$.

Volatile aldehydes were collected on the cassette with an absorbent solid – a silica gel with 2,4-dinitrophenylhydrazine (2,4-DNPH) and analyzed by high performance liquid chromatography (HPLC /UV). This limit of quantification of applied method equals 1 $\mu g/m^3$.

TEST METHODS

ISO 16000-3:2011 Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method.
ISO 16000-6:2011 Indoor air – Part 6: Determination of volatile organic compounds in indoor air and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS/FID
PN-EN ISO 16000-9:2009 Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method



Pho. no. 1 The sample of the thermal insulation AF/Armaflex – provided for the test.

TEST RESULTS

Table 1. Emissions of volatile organic compounds from the thermal insulation AF/Armaflex, after 3 days since the beginning of test.

Identified substances	CAS No.	Concentration in the test chamber air [µg/m^3]		
		nr 1	nr 2	Average value
Volatile Organic Compounds (C_6-C_{16})				
Ethyl acetate (Toluene)	[141-78-6]	13	14	14 ± 2
Formamide (Toluene)	[75-12-7]	6	3	5 ± 1
Dimethylcyanamide (Toluene)	[1467-79-4]	6	6	6 ± 1
Toluene	[108-88-3]	22	24	23 ± 3
Dimethylformamide (Toluene)	[68-12-2]	10	8	9 ± 1
D-limonene	[5989-27-5]	18	21	20 ± 3
2-buthyl-1-octanol (Toluene)	[3913-02-8]	5	6	6 ± 1
Decamethylcyclopentasiloxane (Toluene)	[541-02-6]	14	16	15 ± 2
Unidentified substances (Toluene)		85	85	85 ± 13
TVOC (Toluene)				**168 ± 25**
Volatile Organic Compounds (> C_{16})				
TSVOC (Toluene)				**<2**
Volatile aldehydes (C_1 – C_4)				
Formaldehyde	[50-00-0]	<1	<1	<1
Acetaldehyde	[75-07-0]	<1	<1	<1
Propionic aldehyde	[123-38-6]	<1	<1	<1
Butyraldehyde	[123-72-8]	1	1	1 ± 1
Volatile carcinogens of categories CARC 1A and CARC 1B				Unidentified
The expanded uncertainty calculated using a factor of k = 2, which corresponds to the level of confidence of approximately 95%.				

Table 2. Emissions of volatile organic compounds from the thermal insulation AF/Armaflex, after 28 days since the beginning of test.

Identified substances	CAS No.	Concentration in the test chamber air [µg/m^3]		
		nr 1	nr 2	Average
Volatile Organic Compounds (C_6-C_{16})				
Ethyl acetate (Toluene)	[141-78-6]	<2	<2	<2
Formamide (Toluene)	[75-12-7]	<2	<2	<2
Dimethylcyanamide (Toluene)	[1467-79-4]	<2	<2	<2
Toluene	[108-88-3]	3	3	3 ± 1
Dimethylformamide (Toluene)	[68-12-2]	2	2	2 ± 1
D-limonene	[5989-27-5]	<2	<2	<2
2-buthyl-1-octanol (Toluene)	[3913-02-8]	2	2	2 ± 1
Decamethylcyclopentasiloxane (Toluene)	[541-02-6]	<2	<2	<2
Unidentified substances (Toluene)		<2	<2	<2
TVOC (Toluene)				**7 ± 1**
Volatile Organic Compounds (> C_{16})				
TSVOC (Toluene)				**<2**
Volatile aldehydes (C_1 – C_4)				
Formaldehyde	[50-00-0]	<1	<1	<1
Acetaldehyde	[75-07-0]	<1	<1	<1
Propionic aldehyde	[123-38-6]	<1	<1	<1
Butyraldehyde	[123-72-8]	<1	<1	<1
Volatile carcinogens of categories CARC 1A and CARC 1B				Unidentified
The expanded uncertainty calculated using a factor of k = 2, which corresponds to the level of confidence of approximately 95%.				

OTHER INFORMATION ON THE TEST

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OPINION (outside the scope of accreditation)

The test of emissions of volatile organic compounds from the thermal insulation AF/Armaflex, showed that it is a source of emissions of the following volatile organic compounds: ethyl acetate, formamide, dimethylcyanamide, toluene, dimethylformamide, d-limonene, 2-buthyl-1-octanol, decamethylcyclopentasiloxane and butyraldehyde. After 3 days since the beginning of the test the highest concentration was determined for toluene, which was amounted 23 $\mu g/m^3$ and the total concentration of volatile organic compounds equaled 168 $\mu g/m^3$. After 28 days since the beginning of the test, the concentration of toluene vapours reduced to the level of 3 $\mu g/m^3$ and the total concentration of volatile organic compounds equaled 7 $\mu g/m^3$.

Tables 3, 4 and 5 present a comparison of the obtained test results with the requirements adopted in Germany, France and USA (California).

- *Germany: Scheme AgBB - Health-related Evaluation Procedure for Volatile Organic Compounds Emissions (VOC and SVOC) from Building Products.*

Table 3. Evaluation of the AF/Armaflex product according to Scheme AgBB.

Day of the test	Parameter	Concentration [mg/m^3]	Requirements [mg/m^3]
3	TVOC	0.168	< 10
	Carcinogenic VOCs	-	< 0.01
28	TVOC	0.007	< 1
	TSVOC	<0.002	< 0.1
	Carcinogenic VOCs	-	< 0.001
	Assessable compounds: All VOCs with an LCI	-*	≤1
	Non-assessable compounds: sum of VOCs with unknown LCI	-*	< 0.1

*The assessment is not possible due to too low concentrations of detected compounds in the air of the chamber (<5 $\mu g/m^3$).

Product AF/Armaflex complies with requirements stated in the Scheme AgBB in the tested range.

- *France - Arrêté du 19 avril 2011 relatif a l'étiquetage des produits de construction ou de revêtement de mur ou de sol et des peintures et vernis sur leurs émissions de polluants volatils (Ministére de l'écologie, du développement durable, des transports et du logement, Journal officiel de la Republique Francaise, Texte 15 sur 192, 13 mai 2011).*

Table 4. Evaluation of the AF/Armaflex product according to the French requirements.

Identified substances	No Cas	Concentration in the test chamber air-average value [µg/m^3]		Requirements [µg/m^3]
		after 3 days	after 28 days	Class A+
Formaldehyde	50-00-0	<1	<1	<10
Acetaldehyde	75-07-0	<1	<1	<200
Toluene	108-88-3	23 ± 3	3 ± 1	<300
Tetrachloroethylene	127-18-4	<2	<2	<250
Xylene	1330-20-7	<2	<2	<200
1,2,4-Trimethylobenzene	95-63-6	<2	<2	<1000
1,4-Dichlorobenzene	106-46-7	<2	<2	<60
Ethylbenzene	100-41-4	<2	<2	<750
2-butoxyethanol	111-76-2	<2	<2	<1000
Styrene	100-42-5	<2	<2	<250
TVOC		168 ± 25	7 ± 1	<1000

Product AF/Armaflex complies with the French requirements class A+ in the tested range.

- *USA (California) - Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 (California Department of Public Health, February 2010).*

Table 5. Evaluation of the AF/Armaflex product according to the US (California) requirements.

Identified substances	Concentration in the test chamber air-average value [µg/m^3]		Requirements [µg/m^3]
	after 3 days	after 28 days	
Ethyl acetate	14 ± 2	<2	-
Formamide	5 ± 1	<2	-
Dimethylcyanamide	6 ± 1	<2	-
Toluene	23 ± 3	3 ± 1	150
Dimethylformamide	9 ± 1	2 ± 1	40
D-limonene	20 ± 3	<2	-
2-buthyl-1-octanol	6 ± 1	2 ± 1	-
Decamethylcyclopentasiloxane	15 ± 2	<2	-
Butyraldehyde	1 ± 1	<1	-

Product AF/Armaflex complies with the US (California) requirements in the tested range.

Responsible for the test

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Warsaw, 03.01.2018