



Łukasiewicz
Institute of Ceramics
and Building Materials

Łukasiewicz Research Network – Institute of Ceramics and Building Materials
31-983 Krakow, Cementowa 8 Str., Poland

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BUILDING CHEMISTRY AND FIRE SAFETY RESEARCH GROUP
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Total numbers
of pages: 3

Test report No. 761/24/KG

Page 1

SPONSOR

LLC „Thermopanel”, Ternopilsk Region, Ternopilskyy District, Misto Ternopil, Denysa Lukiianovycha St, 8, build 5H

ORDER

5L0088G4

SAMPLE

(Data based on the Customer's statement)

Sample
description

The insulation system consists of:

- Styrofoam ¹⁾
- Single-component polyurethane adhesive
- Ceramic tiles (thickness 7 mm, low water absorption) ²⁾

Manufacturer

LLC „Thermopanel”

Data on the sampling plan

N/A

Method of sampling

N/A

Date and place of sampling

N/A

Sampling by

N/A

Structure of the surface layer in the study of the behavior under self-weight

Ceramic tiles 7 mm thick, grouting mortar (polyurethane adhesive) 7 mm thick and 10 mm wide

Sample ID

426/24, 427/24

Date of delivered samples

04.06.2024

Date of testing

09.09.2024 – 23.09.2024

TEST METHOD:

EAD 040914-00-0404 "Veture kits – prefabricated units for external wall insulation and their fixing devices".

RESEARCH RESULTS

No 1	Characteristics 2		Results 3			Test method 5
1.	Behavior under self-weight [N]	Sample dimensions [mm]	Length		250	EAD 040914-00-0404 p. 2.2.14
			Width		250	
			Thickness		305	
		Maximum deflection [mm]	73,8	117,0	148,0	
		Maximum force F_{u_test} [N] ³⁾	1001	1001	1001	
		Reference force F_{ref} [N]	983			
		Maximum load without causing destruction [N]	1,0 F_{ref}		983	

Total numbers of pages: 3	Test report No. 761/24/KG	Page 2
Attachments: 1. Breaking force determined using a testing machine 2. Deflection vs. time graph for sample 1 3. Deflection vs. time graph for sample 2 4. Deflection vs. time graph for sample 3		
UWAGI: 1) The polystyrene foam called EPS 80, manufacturer: Termopanel 46400, TERNOPIL reg. TERNOPIL DISTRICT, STREET LUKIANOVYCHA DENISA, BUILDING 8, 5G with a thickness of 30 cm was used for the tests. 2) thickness 7 mm, low water absorption 3) Breaking force determined by testing machine/equation. Joint application width: 10 mm The result uncertainty values given are extended uncertainty calculated for the 95 % confidence level and the expansion factor $k=2$ and do not take into account the sampling stage. Test results refer only to the samples tested. The test report without the written consent of the research laboratory may not be reproduced except in its entirety.		
Krakow, 19.11.2024		

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mgr inż. Karolina Czekaj

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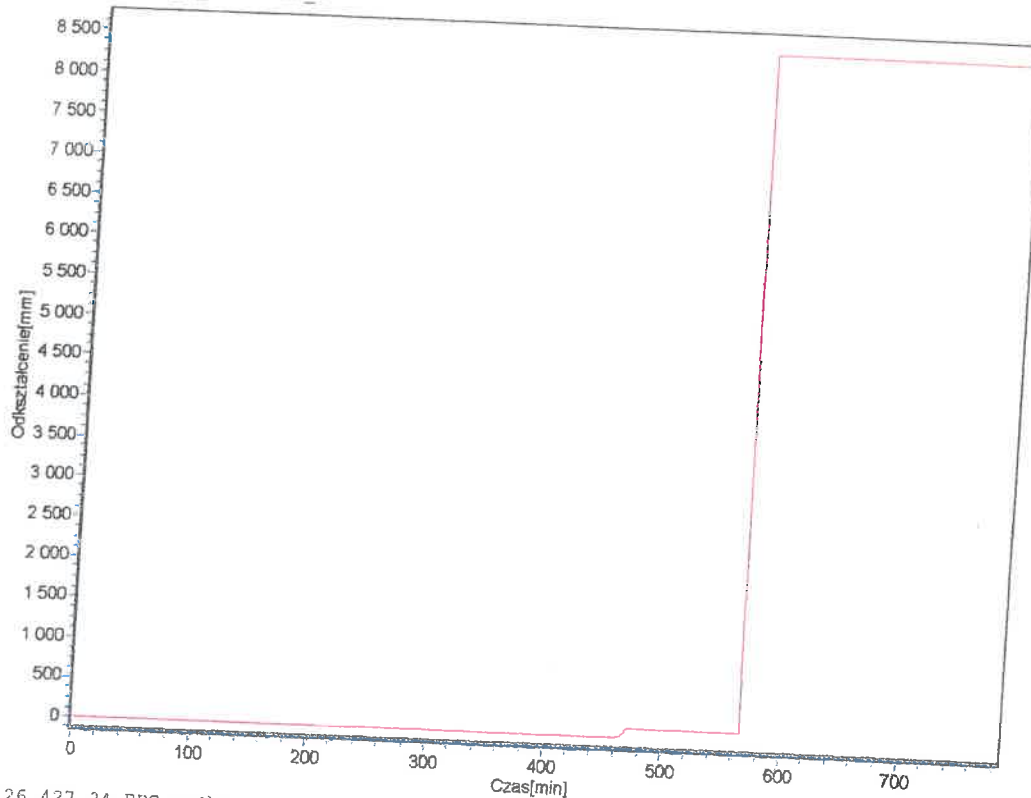
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Kraków, 24-09-10 09:50:58

Raport: TS3_D_24-09-10_1



426 427 24 EPS próba 1
Wykres Czas-odkształcenie

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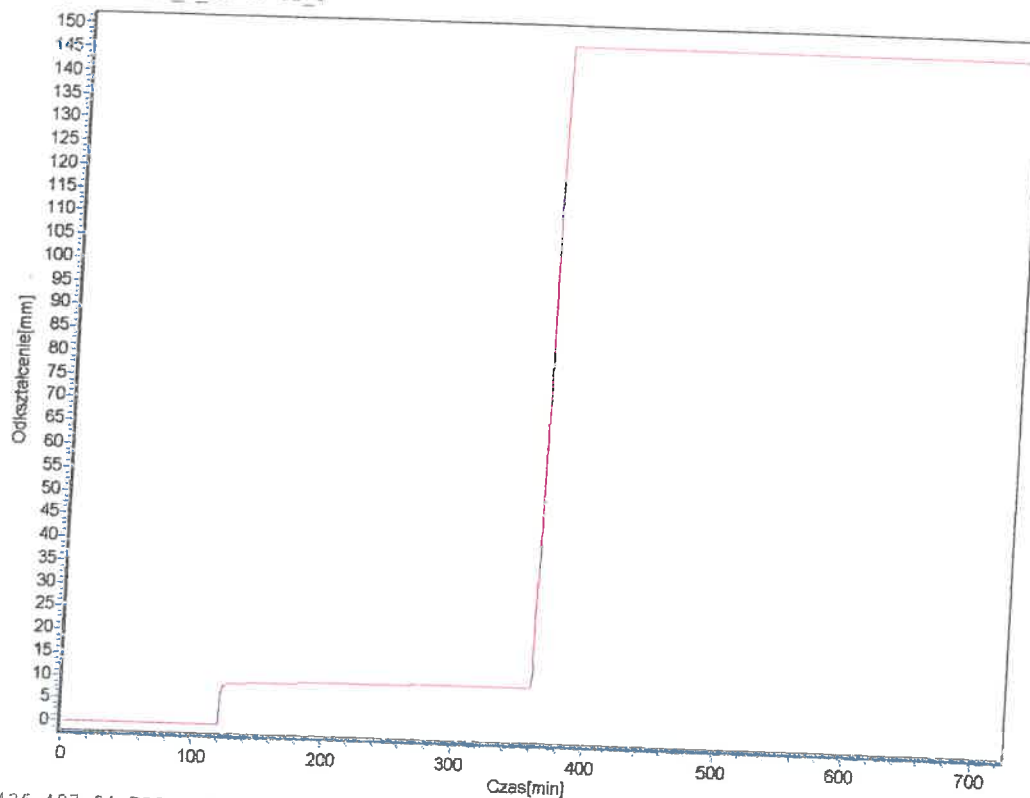
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Kraków, 24-09-12 14:51:23

Raport: TS3_D_24-09-12_1



426 427 C4 EPS próba 3
Wykres Czas-odkształcenie

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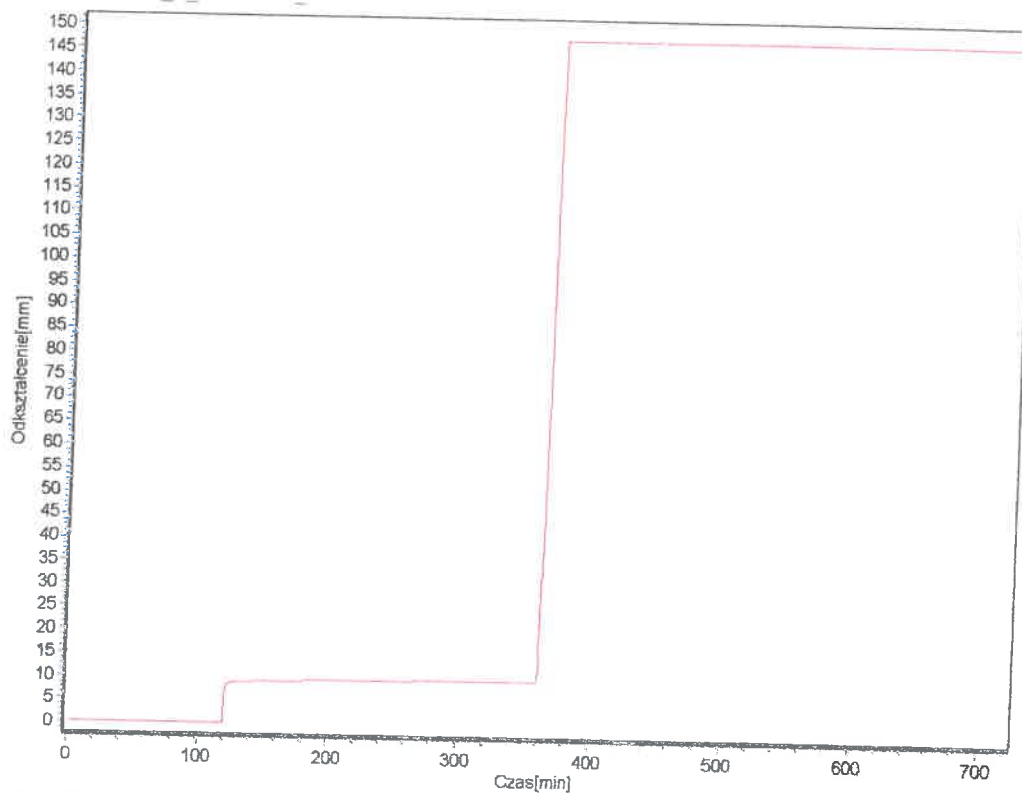
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Raport: TS3_D_24-09-12_1



426 427 24 EPS próba 3
Wykres Czas-odkształcenie

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END OF ANNEX 3

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Total numbers of
pages: 2

Test report No. 762/24/KG

Page 1

SPONSOR

LLC „Thermopanel”, Ternopilskyy District, Misto Ternopil,
Denysa Lukianovycha St, 8, build 5H

ORDER

5L0088G4

TEST SAMPLE (Data based on a statement Customer)	Tested sample	Insulation system, consisting of: - Thermal insulation material *) - Single-component polyurethane adhesive - Ceramic tiles (thickness 7 mm, low water absorption)
	Manufacturer	LLC „Thermopanel”
	Data on the sampling plan	N/A
	Method of sampling	N/A
	Date and place of sampling	N/A
	Sampling by	N/A
Sample ID		426/24, 427/24
Date of delivered samples		04.06.2024
Date of testing		29.07.2024 – 23.09.2024

TEST METHOD:

EAD 040914-00-0404 “Veture kits – prefabricated units for external wall insulation and their fixing devices”

RESULTS

No.	Characteristics		Test results		Test method
1	2		3		4
1.	Water absorption capacity of the surface layer [kg/m²]	after 3 min	0,1 ± 0,1		EAD 040914-00-0404 p. 2.2.5
		after 1 h	0,1 ± 0,1		
		after 24 h	0,2 ± 0,1		
2.	Relative diffusion resistance of the surface layer [m]		1,0 ± 0,1		EAD 040914-00-0404 p. 2.2.6
3.	Adhesion of the surface layer [MPa]	Dry conditions	0,166	average 0,160 ± 0,01 desctruction in styrofoam	EAD 040914-00-0404 p. 2.2.10
			0,149		
			0,161		
			0,166		
			0,159		

Total number of pages: 2		Test report No. 762/24/KG				Page 2	
1	2			3		4	
4.	Impact resistance	H1 1 [J]	indentation diameter [mm]	0	Category II	EAD 040914-00-0404 p. 2.2.17	
			presence of damages	No			
			presence of punctures	No			
		H2 3 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		H3 10 [J]	indentation diameter [mm]	0			
			presence of damages	Yes			
			presence of punctures	No			
		S1 10 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		S2 60 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		S3 300 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		S4 400 [J]	indentation diameter [mm]	0			
presence of damages	No						
presence of punctures	No						
Comments: *) Thermal insulation material used in the study: EPS 80, Termopanel 46400, TERNOPIL reg. TERNOPIL DISTRICT, STREET LUKIANOVYCHA DENISA, BUILDING 8, 5G, thickness 50 mm							
Joint application width: 10 mm							
Provided values of uncertainty are calculated based on the standard deviation.							
Test results refer only to the samples tested. The test report without the written consent of the research laboratory may not be reproduced except in its entirety..							
Krakow, 19.11.2024							

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Total numbers of pages: 3		Test report No. 763/24/KG			Page 1	
SPONSOR		LLC „Thermopanel”, Ternopilsk Region, Ternopilskyy District, Misto Ternopil, Denysa Lukiiianovycha St, 8, build 5H				
ORDER		5L0088G4				
SAMPLE (Data based on the Customer's statement)		Sample description		The insulation system consists of: – XPS ¹⁾ – Single-component polyurethane adhesive – Ceramic tiles (thickness 7 mm, low water absorption) ²⁾		
		Manufacturer		LLC „Thermopanel”		
		Data on the sampling plan		N/A		
		Method of sampling		N/A		
		Date and place of sampling		N/A		
		Sampling by		N/A		
Structure of the surface layer in the study of the behavior under self-weight				Ceramic tiles 7 mm thick, grouting mortar (polyurethane adhesive) 7 mm thick and 10 mm wide		
Sample ID				426/24, 427/24		
Date of delivered samples				04.06.2024		
Date of testing				16.09.2024 – 30.09.2024		
TEST METHOD: EAD 040914-00-0404 "Veture kits – prefabricated units for external wall insulation and their fixing devices".						
RESEARCH RESULTS						
No	Characteristics		Results			Test method
1	2		3			5
1.	Behavior under self-weight [N]	Sample dimensions [mm]	Length		249	EAD 040914-00-0404 p. 2.2.14
			Width		249	
			Thickness		125	
		Maximum deflection [mm]	51,4	20,4	99,8	
		Maximum force F_{U_test} [N] ³⁾	2455	2455	2455	
		Reference force F_{ref} [N]	2411			
	Maximum load without causing destruction [N]	1,0 F_{ref}		2455		

Total numbers of pages: 3	Test report No. 763/24/KG	Strona 2
Attachments: 1. Breaking force determined using a testing machine 2. Deflection vs. time graph for sample 1 3. Deflection vs. time graph for sample 2 4. Deflection vs. time graph for sample 3		
UWAGI: 1) *) XPS called PENOBOARD XPS 300 EXTRUDED POLYSTYRENE, manufacturer: Elit Plast Ltd, 120 mm thick, was used for the tests. 2) thickness 7 mm, low water absorption 3) Breaking force determined by testing machine/equation. Joint application width: 10 mm The result uncertainty values given are extended uncertainty calculated for the 95 % confidence level and the expansion factor $k=2$ and do not take into account the sampling stage. Test results refer only to the samples tested. The test report without the written consent of the research laboratory may not be reproduced except in its entirety.		
Krakow, 19.11.2024		

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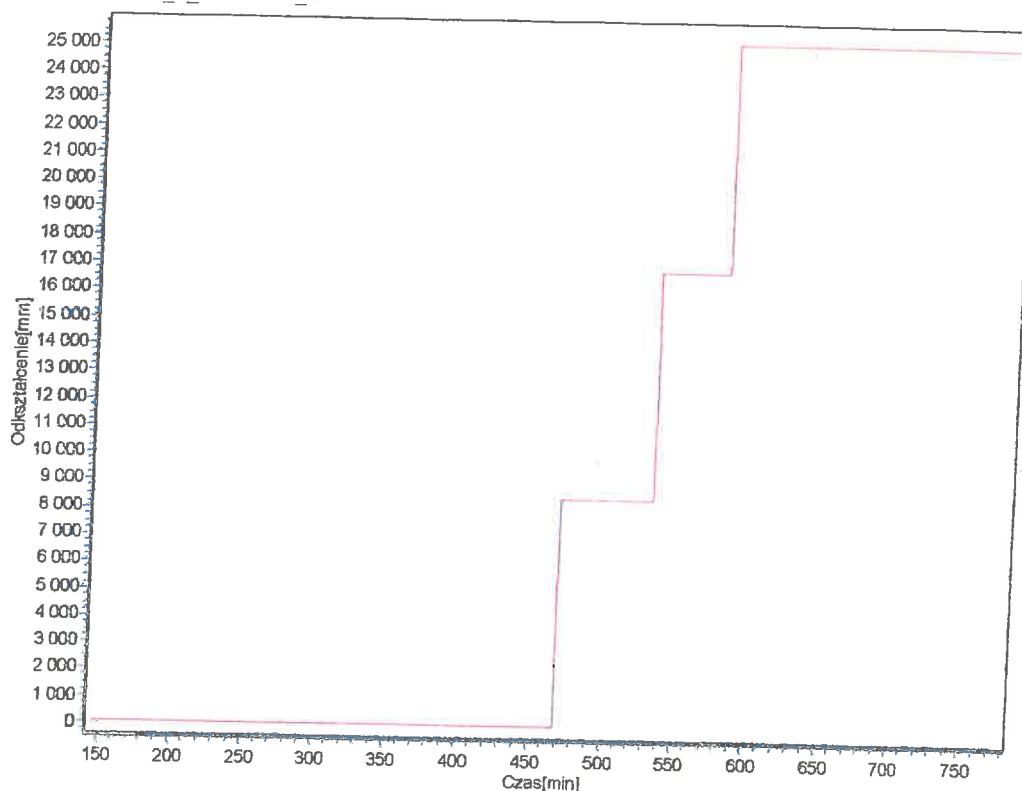
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Raport: TS3_D_24-09-16_2



426 427 24 EPS próba 4
Wykres Czas-odkształcenie

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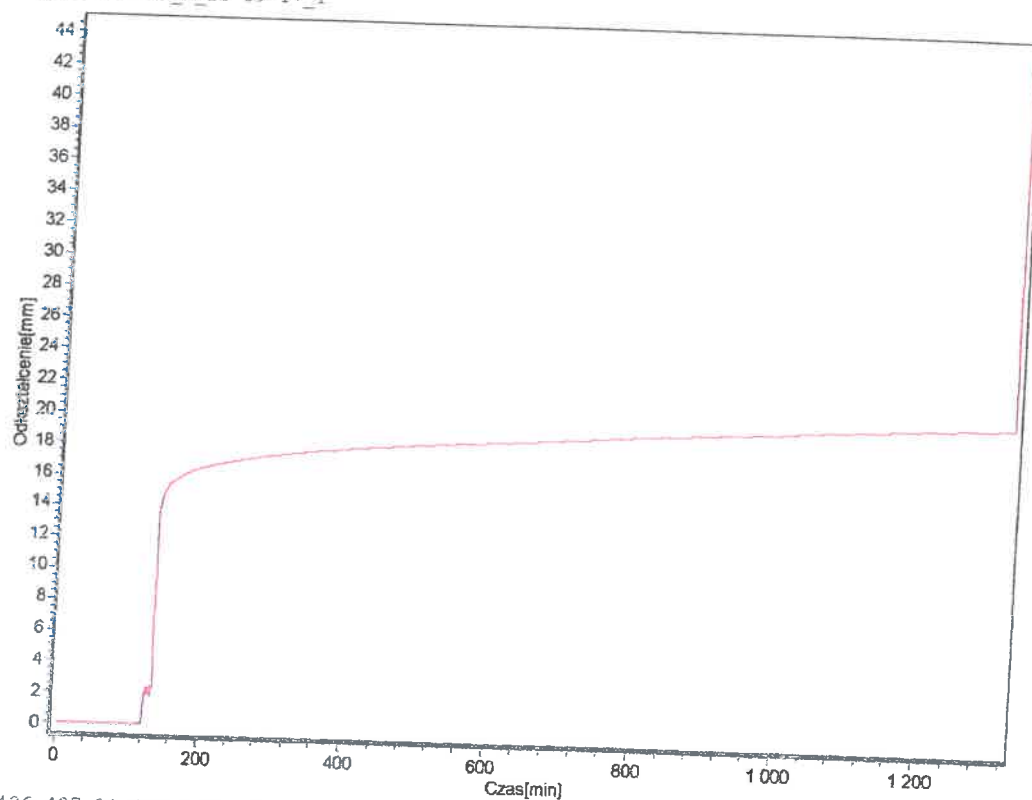
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Kraków, 24-09-17 14:29:32

Raport: TS3_D_24-09-17_1



426 427 24 XPS próba 3
Wykres Czas-odkształcenie

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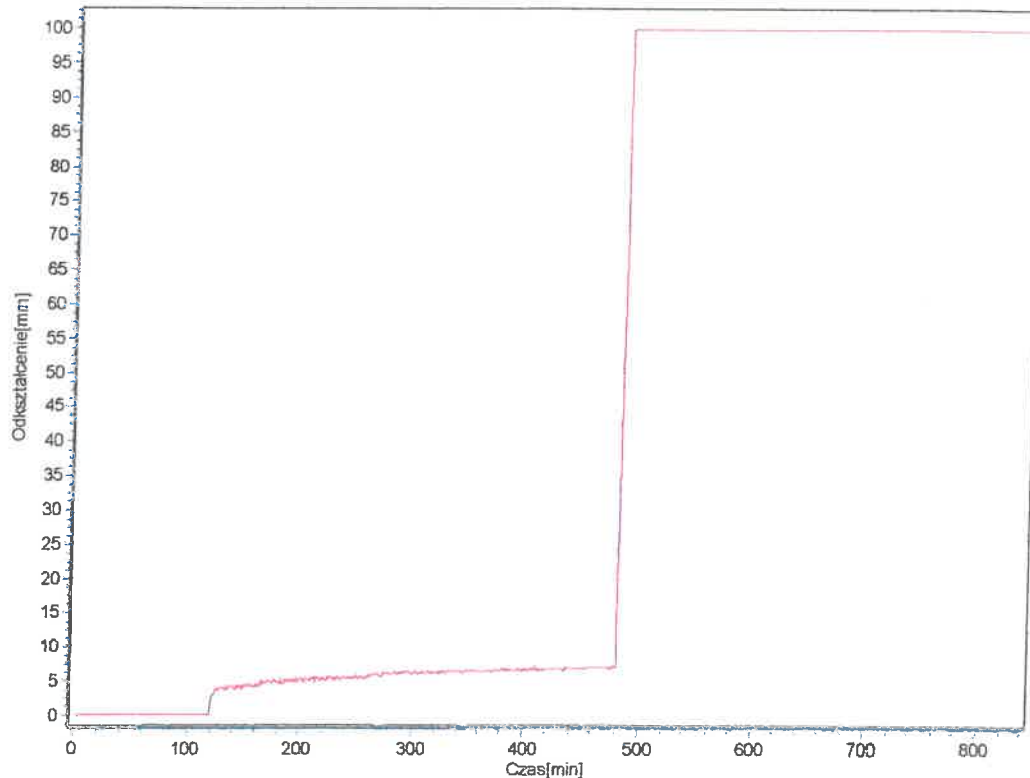
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Kraków, 24-09-18 14:06:11

Raport: TS3_D_24-09-18_1



426 427 24 XPS próba 3
Wykres Czas-odkształcenie

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Total numbers of
pages: 2

Test report No. 764/24/KG

Page 1

SPONSOR

LLC „Thermopanel”, Ternopil'ska Region, Ternopil'skyy District, Misto Ternopil,
Denysa Lukianovycha St, 8, build 5H

AGREEMENT

5L0088G4

PRÓBKA

(Dane na
podstawie
oświadczenia
Zleceńiodawcy)

Tested sample

Insulation system, consisting of:

- Thermal insulation material *)
- Single-component polyurethane adhesive
- Ceramic tiles (thickness 7 mm, low water absorption)

Manufacturer

LLC „Thermopanel”

Data on the sampling plan

N/A

Method of sampling

N/A

Date and place of sampling

N/A

Sample ID

N/A

Registration numbers

426/24, 427/24

Date of delivered samples

04.06.2024

Date of testing

29.07.2024 – 23.09.2024

TEST METHOD:

EAD 040914-00-0404 “Veture kits – prefabricated units for external wall insulation and their fixing devices”

RESULTS

No.	Characteristics		Test results		Test method
1	2		3		4
1.	Water absorption capacity of the surface layer [kg/m ²]	after 3 min	0,0 + 0,1		EAD 040914-00-0404 p. 2.2.5
		after 1 h	0,0 ± 0,1		
		after 24 h	0,3 ± 0,1		
2.	Relative diffusion resistance of the surface layer [m]		0,3 ± 0,1		EAD 040914-00-0404 p. 2.2.6
3.	Adhesion of the surface layer [MPa]	Dry conditions	0,264	average 0,230 ± 0,01 desctruction in styrofoam	EAD 040914-00-0404 p. 2.2.10
			0,214		
			0,242		
			0,210		
			0,220		

Total numbers of pages: 2		Test report No. 764/24/KG				Page 2	
1	2			3		4	
4.	Impact resistance	H1 1 [J]	indentation diameter [mm]	0	Category II	EAD 040914-00-0404 p. 2.2.17	
			presence of damages	No			
			presence of punctures	No			
		H2 3 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		H3 10 [J]	indentation diameter [mm]	0			
			presence of damages	Yes			
			presence of punctures	No			
		S1 10 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		S2 60 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		S3 300 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
		S4 400 [J]	indentation diameter [mm]	0			
			presence of damages	No			
			presence of punctures	No			
Comments: *) Thermal insulation material used in the study: XPS, PENOBORD XPS 300 EXTRUDED POLYSTYRENE, manufacturer: Elit Plast Ltd, thickness 50 mm							
Joint application width: 10 mm							
Provided values of uncertainty are calculated based on the standard deviation.							
Test results refer only to the samples tested. The test report without the written consent of the research laboratory may not be reproduced except in its entirety..							
Krakow, 19.11.2024							

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Total numbers of pages: 2		Test report No. 765/24/KG				Page 1		
SPONSOR		LLC „Thermopanel”, Ternopilska Region, Ternopilskyy District, Misto Ternopil, Denysa Lukiiianovycha St, 8, build 5H						
AGREEMENT		5L0088G4						
TEST SAMPLE (Data based on a statement Customer)	Tested sample	Thermal insulation materials						
	Sample discription	Styrofoam EPS 80						
	Manufacturer	LLC „Thermopanel”						
	Data on the sampling plan	N/A						
	Method of sampling	N/A						
	Date and place of sampling	N/A						
	Sampling by	N/A						
Sample ID		655/24						
Date of delivered samples		03.10.2024						
Date of testing		03.10.2024 – 04.11.2024						
Details of conditioning		Testing of samples was conducted under standardized conditions: temperature (23 ± 2) / (50 ± 2) / (70 ± 2)°C, relative humidity (90 ± 5) / (50 ± 5) %; air flow rate in the working space less than 0,2 m/s.						
Information about the tested sample	Thickness [mm]	Density [kg/m ³]		Dimensions [mm]				
	50	-		50 x 50				
	Other	-						
TEST METHOD: EAD 040914-00-0404 "Veture kits – prefabricated units for external wall insulation and their fixing devices"								
RESULTS								
No.	Characteristics	Test results					Average	Test method
1	2	3					4	5
1.	Tensile strength of the thermal insulation material [kPa] After laboratory conditions	172,4	177,2	137,2	216,0	145,2	169,6 ± 31	EAD 040914-00-0404 p. 2.2.11
2.	Tensile strength of the thermal insulation material [kPa] After hydrothermal cycles for 7 days	184,0	218,4	206,0	211,6	178,8	199,8 ± 17	EAD 040914-00-0404 p. 2.2.11

Total number of pages: 2		Test report No. 765/24/KG						Page 2
1	2	3					4	5
3.	Tensile strength of the thermal insulation material [kPa] After hydrothermal cycles for 28 days	224,8	207,2	220,0	213,6	230,4	219,2 ± 9	EAD 040914-00-0404 p. 2.2.11
Comments: Measurement uncertainty expressed by standard deviation. The test results refer to average values. Test results concern average values and they only accord to tested samples. Test reports can not be duplicated on other way than as whole document without written permission of research laboratory.								
Krakow, 19.11.2024								

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mgr inż. Karolina Czekaj

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Total numbers of pages: 2		Test report No. 766/24/KG				Page 1		
SPONSOR		LLC „Thermopanel”, Ternopil'ska Region, Ternopil'skyy District, Misto Ternopil, Denysa Lukiiianovycha St, 8, build 5H						
AGREEMENT		5L0088G4						
TEST SAMPLE (Data based on a statement Customer)	Tested sample	Thermal insulation materials						
	Sample discription	Extruded styrofoam PENOBOARD XPS 300						
	Manufacturer	„Elit Plast” Ltd Ukraine						
	Data on the sampling plan	N/A						
	Method of sampling	N/A						
	Date and place of sampling	N/A						
	Sampling by	N/A						
Sample ID		656/24						
Date of delivered samples		03.10.2024						
Date of testing		03.10.2024 – 04.11.2024						
Details of conditioning		Testing of samples was conducted under standardized conditions: temperature (23 ± 2) / (50 ± 2) / (70 ± 2) °C, relative humidity (90 ± 5) / (50 ± 5) %; air flow rate in the working space less than 0,2 m/s.						
Information about the tested sample	Thickness [mm]	Density [kg/m ³]		Dimensions [mm]				
	50	-		50 x 50				
	Other	-						
TEST METHOD: EAD 040914-00-0404 "Veture kits – prefabricated units for external wall insulation and their fixing devices"								
RESULTS								
No.	Characteristics	Test results					Average	Test method
1	2	3					4	5
1.	Tensile strength of the thermal insulation material [kPa] After laboratory conditions	381,2	382,8	342,8	409,6	393,2	381,9 ± 25	EAD 040914-00-0404 p. 2.2.11
2.	Tensile strength of the thermal insulation material [kPa] After hydrothermal cycles for 7 days	455,2	472,8	448,4	397,2	452,8	445,3 ± 28	EAD 040914-00-0404 p. 2.2.11

Total number of pages: 2		Test report No. 766/24/KG					Page 2	
1	2	3					4	5
3.	Tensile strength of the thermal insulation material [kPa] After hydrothermal cycles for 28 days	350,0	176,0	446,4	324,8	303,2	320,1 ± 97	EAD 040914-00-0404 p. 2.2.11
Comments: Measurement uncertainty expressed by standard deviation. The test results refer to average values. Test results concern average values and they only accord to tested samples. Test reports can not be duplicated on other way than as whole document without written permission of research laboratory.								
Krakow, 19.11.2024								

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SPONSOR		LLC „Thermopanel”, Ternopilska Region, Ternopilskyy District, Misto Ternopil, Denysa Lukianovycha St, 8, build 5H		
ORDER		5L0088G4		
SAMPLE (Data based on the Customer's statement)	Sample description	The insulation system consists of: - Extruded polystyrene XPS* - Styrofoam ** - Single-component polyurethane adhesive - Ceramic tiles (thickness 7 mm, low water absorption)		
		Manufacturer		LLC „Thermopanel”
		Data on the sampling plan		N/A
		Method of sampling		N/A
		Date and place of sampling		N/A
		Sampling by		N/A
		Sample identifiers included in the system		426/24, 427/24
Date of delivered samples		04.06.2024		
Date of testing		06.09.2024 – 19.11.2024		
Wall description - samples of the insulation system were installed on the wall by the Client's employees. The installation process was carried out at the Łukasiewicz Research Network - ICiMB in Krakow. The system was applied at a temperature of 10-25°C and relative humidity above 50%. The materials used were prepared in accordance with the manufacturer's instructions. - PENOBOARD XPS 300 EXTRUDED POLYSTYRENE and EPS 80 boards manufactured by Termopanel 46400, TERNOPIL reg. TERNOPIL DISTRICT, STREET LUKIANOVYCHA DENISA, BUILDING 8, 5G were installed and glued to the substrate using Tytan Styrofoam Adhesive Elevations - A finished panel with clinker tiles and grout was mounted on the XPS and EPS boards.				

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The thickness of the Tytan Professional polyurethane glue layer for polystyrene was 8 mm
Consumption was 750 ml/8 m²

The total material consumption and technological breaks were in accordance with the detailed description and technical and operational properties of the individual components. The prepared test wall was conditioned for at least 28 days at a temperature of (10-25) °C and relative humidity above 50%. After conditioning, the sample was subjected to a series of hydrothermal cycles and then a series of tests was carried out, the results of which are presented below.

TEST METHOD:

EAD 040914-00-0404 "Veture kits – prefabricated units for external wall insulation and their fixing devices"

RESEARCH RESULTS

Visual evaluation:

Part 1 (reinforced layer): during 80 heating-spraying cycles, no cracks, micro-cracks or other damages were observed, including at the joints of the insulation boards.

Part 2 (facade cladding): during 80 heating-spraying cycles no cracks, micro-cracks or other damages were observed in the case of the facade cladding.

During the hydrothermal cycles or at the end of the tests, no:

- blisters or flaking of the surface,
- damage or cracks at the joints of the insulation boards,
- falling off of the plaster layers, cracks allowing water to penetrate into the system.

Physical tests

I.p	Characteristics	RESULTS				Test method
		EPS + tiles		XPS + tiles		
1.	Water resistance	No destruction		No destruction		EAD 040914-00-0404 p.2.2.7
2.	Adhesion of the top layer to the thermal insulation material, [MPa] after hydrothermal cycles	RESULTS	MEAN	RESULTS	MEAN	EAD 040914-00-0404 p.2.2.10
		155	149 ± 10 destruction in styrofoam	184	199 ± 10 destruction from XPS	
		159		200		
		134		206		
		148		199		
		150		204		

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Comments *) XPS called PENOBOARD XPS 300 EXTRUDED POLYSTYRENE, manufacturer: Elit Plast Ltd, 50 mm thick, was used for the tests. **) The polystyrene foam called EPS 80, manufacturer: Termopanel 46400, TERNOPIL reg. TERNOPIL DISTRICT, STREET LUKIANOVYCHA DENISA, BUILDING 8, 5G with a thickness of 50 mm was used for the tests. The result uncertainty values given are extended uncertainty calculated for the 95 % confidence level and the expansion factor $k=2$ and do not take into account the sampling stage. Test results refer only to the samples tested. The test report without the written consent of the research laboratory may not be reproduced except in its entirety.		
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