

TEST REPORT No. 082 SF/23 U

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Date: 03 of May 2023

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**Determination of declared thermal resistance of reflective insulation product according LST
EN 16012:2012+A1:2015 and LST EN ISO 8990:1999**

(test title)

Test method: LST EN 16012:2012+A1:2015: Thermal insulation for buildings-Reflective insulation products-Determination of the declared thermal performance;
LST EN ISO 8990:1999 Thermal insulation - Determination of steady-state thermal transmission properties - Calibrated and guarded hot box (ISO 8990:1994).

(number of normative document or test method, description of test procedure, test uncertainty)

Specimen description: **Type of product: reflective insulation product (Type 3)**

Names of product:

ATI PRO BASIC P

Thickness of product installed in the „Hot box” – 62 mm;

Declared thickness of product – 53 mm +/- 10 mm*

*Declaration numbers: 230310 ATI PRO BASIC P-1 épaisseur; 230310 ATI PRO BASIC P-2 épaisseur; 230310 ATI PRO BASIC P-3 épaisseur; 230310 ATI PRO BASIC P-4 épaisseur; 230421 ATI PRO BASIC P-5 épaisseur; 230421 ATI PRO BASIC P-6 épaisseur

(name, description and identification details of a specimen)

Customer: SAS ATI FRANCE, 146 avenue du bicentenaire 01120 Dagneux, France

(name and address)

Manufacturer: SAS ATI FRANCE, 146 avenue du bicentenaire 01120 Dagneux, France

(name and address)

Test results:

Name of the indicator and unit	Test method reference no.	Test result
Declared thermal resistance of the core of product ATI PRO BASIC P $R_{core 90/90}$, (m ² ·K)/W	LST EN ISO 16012:2012+A1:2015	1.91
Declared thermal resistance of system with 2 air gaps $R_{sys 90/90}$, (m ² ·K)/W		2.60
Declared thermal resistance values determined according to EN ISO 10456:2008 Position of specimen: vertical (direction of heat flow – horizontal)		

Tested at: Building Physics Laboratory, Institute of Architecture and Construction of Kaunas University of Technology

(name of the test laboratory)

Specimen delivery dates: 2023-03-23; 2023-04-24

Date of testing: 2023-04-08 ÷ 2023-04-28

Production date: 2023-02-02 ÷ 2023-04-19

Sampling: The test specimens sampled by customer. Description of the sample 2023-03-10

Additional information: Application 2023-03-10; 2023-04-21. This report is prepared according to tests reports: 082-1 SF/23 U; 082-2 SF/23 U; 082-3 SF/23 U; 082-4 SF/23 U; 082-5 SF/23 U; 082-6 SF/23 U.

(any deviations, complementary tests, exceptions and any information related with particular test)

Annexes: **Annex 1.** Parameters of Guarded Hot Box measurement and $R_{sys 90/90}$;

Annex 2. Specimen air gaps thermal properties;

Annex 3. $R_{core 90/90}$ thermal resistance value according to LST EN 6012:2012+A1:2015.

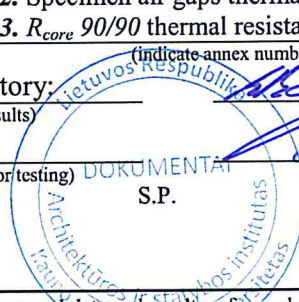
(indicate annex numbers and titles)

Head of Laboratory:

(approves the test results)

Tested by:

(technically responsible for testing)



K. Banionis

(n., surname)

A. Burlingis

(n., surname)

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Annex 1. Parameters of Guarded Hot Box measurement and R_{sys} 90/90

Table 1. ATI PRO BASIC P insulation system's specimen measured at 20°C/10°C temperature regime

Guarded Hot Box measurement. Parameters of "ATI PRO BASIC P" insulation system's specimen:						
Specimen's area A , m ²	1.831	Actual mean thickness of specimen, mm		≈ 121*		
Position of a specimen	vertical	Length of specimen perimeter L , m		5.44		
	Linear thermal transmittance of perimeter zone Ψ_L , W/(m·K)		0.00854			
Measurement data:						
Insulation system with product "ATI PRO BASIC P":						Result:
Sample No.	Hot side surface temperature t_h , °C	Cold side surface temperature t_c , °C	Temperature difference $\Delta t = (t_h - t_c)$, °C	Measured heat flow density q , W/m ²	Corrected heat flow density q_c , W/m ²	R-value of insulation system, m ² ·K/W
082-1/23	19,9258	9,8573	10,0685	4,0357	3,7805	2,663±0,0817
082-2/23	19,9670	9,8447	10,1223	3,9706	3,7140	2,725±0,0836
082-3/23	20,0018	9,8255	10,1763	3,8940	3,6360	2,799±0,0859
082-4/23	20,0303	9,8278	10,2025	3,9495	3,6909	2,764±0,0844
082-5/23	19,9578	9,8480	10,1098	3,9603	3,7040	2,729±0,0838
082-6/23	20,0645	9,8490	10,2155	4,0602	3,8012	2,687±0,0814
Average:						2,728±0,0835

* Previous test has shown that when installed on real building the average thickness of product is slightly larger than its nominal value. To keep surfaces of test sample as parallel as possible in the test setup, it is decided to install the product in a frame. After internal validation, the thickness of the frame is representative of the average thickness of an installed product, as requested by LST EN ISO 8990.

$$S_{R-sys} = \sqrt{\frac{\sum (R_i - R_{average})^2}{n - 1}};$$

$$S_{R-sys} = 0.049503;$$

$$R_{90/90-sys} = R_{average} - k_2 \cdot S_{R-sys}; \quad k_2 = 2.49;$$

$$R_{90/90-sys} = 2.6046 = 2.60 \text{ m}^2 \cdot \text{K/W}$$

Annex 2. Specimen air gaps thermal properties

Table 2. ATI PRO BASIC P insulation specimen products

Specimen product	Specimen surface layer	Test method reference No.	Declared emissivity, ϵ
ATI PRO BASIC P	External reflective perforated layer	EN 16012:2012+A1:2015	0.15*
	External grey membrane		0.75**

* Declaration number: 230310 Emissivité Film armé micro-perforé; 230421 Emissivité Film armé micro-perforé

** Declaration number: 230310 Emissivité Ecran HPV gris; 230421 Emissivité Ecran HPV gris

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Table 3. ATI PRO BASIC P insulation specimen air gaps for corrected R-core values calculation results according to LST EN 16012:2012+A1:2015 and LST EN ISO 6946:2017

Sample No.	Air gap number	Thickness d, mm	Measured temperature differences of surfaces, $\Delta\tau$, °C	Radiative heat transfer coefficient, h_r	Convective heat transfer coefficient, h_a	Air gap R- core value, $m^2 \cdot K/W$
082-1/23	Air gap #1	30	2.071	0.8335	1.25	0.4800
	Air gap #2	30	0.913	3.5763	1.25	0.2072
082-2/23	Air gap #1	30	2.082	0.8338	1.25	0.4799
	Air gap #2	30	0.844	3.5745	1.25	0.2073
082-3/23	Air gap #1	30	2.034	0.8343	1.25	0.4798
	Air gap #2	30	0.838	3.5737	1.25	0.2073
082-4/23	Air gap #1	30	2.048	0.8345	1.25	0.4797
	Air gap #2	30	0.852	3.5740	1.25	0.2073
082-5/23	Air gap #1	30	2.227	0.8331	1.25	0.4801
	Air gap #2	30	0.828	3.5743	1.25	0.2073
082-6/23	Air gap #1	30	2.331	0.8335	1.25	0.4800
	Air gap #2	30	0.832	3.5745	1.25	0.2073

Annex 3. $R_{core90/90}$ thermal resistance value according to EN 16012:2012+A1:2015

Table 4. ATI PRO BASIC P R-core thermal resistance values according to LST EN 16012:2012+A1:2015

Sample No.	Thickness of sample d, mm	R-core thermal resistance value according to LST EN 16012
082-1/23	62	1.976 $m^2 \cdot K/W$
082-2/23	62	2.038 $m^2 \cdot K/W$
082-3/23	62	2.112 $m^2 \cdot K/W$
082-4/23	62	2.077 $m^2 \cdot K/W$
082-5/23	62	2.042 $m^2 \cdot K/W$
082-6/23	62	2.000 $m^2 \cdot K/W$
Average: 2.041 $m^2 \cdot K/W$		

Standard deviation of derived R-value of insulation product:

$$S_{R-core} = \sqrt{\frac{\sum (R_i - R_{average})^2}{n - 1}};$$

$$S_{R-sys} = 0.049503 ;$$

Declared derived R-value of insulation product

$$R_{90/90-core} = R_{average} - k_2 \cdot S_{R-core}$$

$$k_2 = 2.49;$$

$$R_{90/90-prod} = 1.9176 = 1.91 m^2 \cdot K/W$$

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