

TEST REPORT No. 045 SF/22 U

Date: 6 of April 2022

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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:

- TETRIS SUPER 8 / TETRIS SUPER 8 NF / TRISO BARDAGE (ACTIS SA)
- TOP BARDAGE / TETRIS BARDAGE (ISO 2000 SAS)

Declared thickness – 12±1 cm*

*according to the manufacturer declaration: ACTIS 220204-Declared thickness EN 823 (3 Pa)

(name, description and identification details of a specimen)

Customer: SA Orion financement – Avenue de la Gare – FR-11230 CHALABRE, France

(name and address)

Manufacturer: ACTIS SA : 30 Avenue de Catalogne - 11300 LIMOUX, France

(name and address)

Test results:

Name of the indicator and unit	Test method reference no.	Test result
Declared corrected $R_{core90/90}$ thermal resistance of product TETRIS SUPER 8, (m²·K)/W	LST EN ISO 16012:2012+A1:2015	4.25
Declared thermal resistance of system with 2 air gaps $R_{TOTAL 90/90}$, (m ² ·K)/W		5.10
Declared thermal resistance values determined according to EN ISO 10456:2008** Position of specimen: vertical (direction of heat flow – horizontal) **not accredited activity		

Building Physics Laboratory, Institute of Architecture and Construction of Kaunas

Tested at: University of Technology

(name of the test laboratory)

Specimen delivery date: 2022-03-14

Date of testing: 2022-03-25 – 2022-04-03

Production date: 2022-01-04 – 2022-01-28

Sampling: The test specimens sampled by customer. Description of the sample 2022-03-10

Additional information: Application 2021-11-24. This report is prepared according to tests reports 045-1 SF/22 U, 045-2 SF/22 U, 045-3 SF/22 U, 045-4 SF/22 U, 045-5 SF/22 U, 045-6 SF/22 U.

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

Annexes: **Annex 1.** Parameters of Guarded Hot Box measurement;
Annex 2. Specimen air gaps thermal properties;
Annex 3. $R_{core 90/90}$ and $R_{TOTAL 90/90}$ thermal resistance values according to LST EN 16012:2012+A1:2015

(indicate annex numbers and titles)

Head of Laboratory:

(approves the test results)

DOKUMENTAI

(signature)

K. Banionis

(n., surname)

Tested by:

(technically responsible for testing)

S.P.

(signature)

A. Burlingis

(n., surname)

Validity – the named data and results refer exclusively to the tested and described specimens.

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Annex 1. Parameters of Guarded Hot Box measurement.

Table 1. TETRIS SUPER 8 insulation system's specimen measured at 20°C/10°C temperature regime

<i>Guarded Hot Box measurement. Parameters of "TETRIS SUPER 8" insulation system's specimen:</i>						
Specimen's area A, m ²	1.831	Actual mean thickness of specimen, mm			≈ 180*	
Position of a specimen	vertical	Length of specimen perimeter L, m			5.44	
	Linear thermal transmittance of perimeter zone Ψ _L , W/(m·K)			0.004935		
<i>Measurement data:</i>						
<i>Insulation system with product "TETRIS SUPER 8":</i>						<i>Result:</i>
Sample No.	Hot side surface temperature τ _h , °C	Cold side surface temperature τ _c , °C	Temperature difference Δτ = (τ _h - τ _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
045-1	20.0938	9.8610	10.2328	2.1311	1.9812	5.165±0.2061
045-2	20.1078	9.8358	10.2720	2.0164	1.8659	5.505±0.2258
045-3	20.1335	9.8490	10.2845	2.0119	1.8613	5.526±0.2268
045-4	20.1120	9.8453	10.2668	2.0208	1.8704	5.489±0.2249
045-5	20.1078	9.8387	10.2690	2.0213	1.8708	5.489±0.2249
045-6	20.1065	9.8443	10.2623	2.0220	1.8717	5.483±0.2247
Average:						5.443

* 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.

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

$$S_{R-sys} = 0.137003 ;$$

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

$$R_{90/90-sys} = 5.1017 = 5.10 \text{ m}^2 \cdot \text{K/W}$$

Table 2. TETRIS SUPER 8 insulation specimen products

Specimen product	Specimen surface layer	Test method reference No.	Declared emissivity, ε
TETRIS SUPER 8	EXTERNAL FILM (Triplex part)	EN 16012:2012+A1:2015	0.06*
	EXTERNAL FOIL WHITE		0.94**

*according to the manufacturer declaration ACTIS 161027 – Emissivity EN 16012.

**according to the manufacturer declaration ACTIS 220214 – Emissivity EN 126012.

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Table 3. TETRIS SUPER 8 insulation specimen air gaps 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, $m^2 \cdot K/W$
045-1	Air gap #1	30	1.1418	0.3389	1.25	0.6294
	Air gap #2	30	0.5063	4.3873	1.25	0.1774
045-2	Air gap #1	30	1.0845	0.3390	1.25	0.6293
	Air gap #2	30	0.4623	4.3851	1.25	0.1775
045-3	Air gap #1	30	1.1288	0.3390	1.25	0.6293
	Air gap #2	30	0.4810	4.3862	1.25	0.1774
045-4	Air gap #1	30	1.1243	0.3390	1.25	0.6293
	Air gap #2	30	0.4803	4.3860	1.25	0.1774
045-5	Air gap #1	30	1.0565	0.3390	1.25	0.6293
	Air gap #2	30	0.4935	4.3860	1.25	0.1774
045-6	Air gap #1	30	1.0955	0.3390	1.25	0.6293
	Air gap #2	30	0.4680	4.3857	1.25	0.1774

Annex 3. $R_{core90/90}$ and $R_{TOTAL90/90}$ thermal resistance values according to EN 16012:2012+A1:2015

Table 4. TETRIS SUPER 8 R-core thermal resistance value according to LST EN 16012:2012+A1:2015

Sample No.	R-core thermal resistance value according to LST EN 16012
045-1	4.3582 $m^2 \cdot K/W$
045-2	4.6982 $m^2 \cdot K/W$
045-3	4.7193 $m^2 \cdot K/W$
045-4	4.6823 $m^2 \cdot K/W$
045-5	4.6823 $m^2 \cdot K/W$
045-6	4.6763 $m^2 \cdot K/W$
Average: 4.6361 $m^2 \cdot K/W$	

Standard deviation of derived R-value of insulation product:

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

$$S_{R-prod} = 0.137034 ;$$

Declared derived R-value of insulation product

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

$$k_2 = 2.49;$$

$$R_{90/90-prod} = 4.2949 = 4.25 m^2 \cdot K/W$$

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