INSTITUTE OF ARCHITECTURE AND CONSTRUCTION OF KAUNAS UNIVERSITY OF TECHNOLOGY

BUILDING PHYSICS LABORATORY

LIETUVOS NACIONALINIS AKREDITACIJOS BIURAS

BANDYMAI ISO/IEC 17025 Nr. LA.01.031

TEST REPORT No. 113 SF/22 U

Date: 27 of June 2022

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:
- **ISO LIN HPV / TOP LIN HPV**

Declared thickness – 6.5±1 cm*
*according to the manufacturer declaration: ACTIS 220516-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: ISO 2000 SAS – 45 Allée du Lyonnais – 26300 BOURG DE PEAGE, France

(name and address)

Test results:

Name of the indicator and unit	Test method reference no.	Test result
Declared corrected R_{core}*90/90* thermal resistance of product **ISO LIN HPV**, $(m^2 \cdot K)/W$	LST EN ISO 16012:2012+A1:2015	**2.60**
Declared thermal resistance of system with 2 air gaps R_{TOTAL} 90/90, $(m^2 \cdot K)/W$		**3.60**
Declared thermal resistance values determined according to EN ISO 10456:2008** Position of specimen: vertical (direction of heat flow – horizontal) **not accredited activity		

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

(name of the test laboratory)

Specimen delivery date: 2022-05-23 **Date of testing:** 2022-06-13 – 2022-06-22

Production date: 2022-05-03 – 2022-05-06

Sampling: The test specimens sampled by customer. Description of the sample 2022-05-20

Additional information: Application 2022-05-25. This report is prepared according to tests reports 113-1 SF/22 U, 113-2 SF/22 U, 113-3 SF/22 U, 113-4 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) (signature) K. Banionis (n., surname)

Tested by: (technically responsible for testing) (signature) A. Burlingis (n., surname)

S.P.

Annex 1. ***Parameters of Guarded Hot Box measurement.***

Table 1. ISO LIN HPV insulation system's specimen measured at 20°C/10°C temperature regime

Guarded Hot Box measurement. Parameters of "ISO LIN HPV" insulation system's specimen:			
Specimen's area A, m^2	1.831	Actual mean thickness of specimen, mm	≈ **135***
Position of a specimen	vertical	Length of specimen perimeter L, m	5.44
	Linear thermal transmittance of perimeter zone Ψ_L, W/(m·K)		0.00462

Measurement data:						
Insulation system with product "ISO LIN HPV":						*Result:*
Sample No.	Hot side surface temperature τ_h, °C	Cold side surface temperature τ_c, °C	Temperature difference $\Delta t = (t_h - t_c)$, °C	Measured heat flow density **q**, W/m^2	Corrected heat flow density **qc**, W/m^2	**R-value** of insulation system, $m^2 \cdot K/W$
113-1	20.1383	9.8488	10.2895	2.8997	**2.7586**	**3.730**±0.1293
113-2	20.1035	9.7965	10.3070	2.9388	**2.7974**	**3.684**±0.1269
113-3	20.1718	9.8220	10.3498	2.9002	**2.7585**	**3.752**±0.1296
113-4	20.0623	9.8000	10.2623	2.8696	**2.7288**	**3.761**±0.1311
					Average:	**3.732**±0.1292

* 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.

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

$$S_{R-sys} = 0.03439;$$

$$R_{90/90-sys} = R_{average} - k_2 \cdot S_{R-sys};\ \ k_2 = 3.19;$$

$$\boxed{R_{90/90-sys} = 3.6220 = 3.60\ m^2 \cdot K/W}$$

Table 2. ISO LIN HPV insulation specimen products

Specimen product	*Specimen surface layer*	*Test method reference No.*	*Declared emissivity, ε*
ISO LIN HPV	PERFORATED EXTER ALU	EN 16012:2012+A1:2015	0.08*
	BOOST'R 5		0.22**

*according to the manufacturer report 18/03/05 – Emissivity EN 16012.
**according to the manufacturer report ACTIS 220211 – Emissivity EN 16012.

Table 3. ISO LIN HPV 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, $m^2 \cdot K/W$*
113-1	Air gap #1	30	1.6373	0.4499	1.25	0.5883
	Air gap #2	30	1.4423	1.1124	1.25	0.4233
113-2	Air gap #1	30	1.7788	0.4494	1.25	0.5884
	Air gap #2	30	1.4850	1.1120	1.25	0.4234
113-3	Air gap #1	30	1.6108	0.4501	1.25	0.5882
	Air gap #2	30	1.4470	1.1121	1.25	0.4234
113-4	Air gap #1	30	1.6503	0.4495	1.25	0.5884
	Air gap #2	30	1.5198	1.1122	1.25	0.4233

Annex 3. ***R_{core}90/90 and R_{TOTAL}90/90 thermal resistance values according to EN 16012:2012+A1:2015***

Table 4. ISO LIN HPV 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***
113-1	2.7184 $m^2 \cdot K/W$
113-2	2.6722 $m^2 \cdot K/W$
113-3	2.7404 $m^2 \cdot K/W$
113-4	2.7493 $m^2 \cdot K/W$
Average: 2.7201 $m^2 \cdot K/W$	

Standard deviation of derived R-value of insulation product:

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

$$S_{R-prod} = 0.034458;$$

Declared derived R-value of insulation product

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

$$k_2 = 3.19;$$

$$\boxed{R_{90/90-prod} = 2.6102 = 2.60\ m^2 \cdot K/W}$$