VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETO
STATYBOS FAKULTETO
STATYBINIŲ MEDŽIAGŲ INSTITUTO
TERMOIZOLIACINIŲ MEDŽIAGŲ IR AKUSTIKOS LABORATORIJA

(VILNIUS GEDIMINAS TECHNICAL UNIVERSITY, FACULTY OF CIVIL ENGINEERING, INSTITUTE OF BUILDING MATERIALS, LABORATORY OF THERMAL INSULATING MATERIALS AND ACOUSTICS)
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LIETUVOS NACIONALINIS AKREDITACIJOS BIURAS
BANDYMAI
ISO/IEC 17025 Nr. LA. 01.004

TEST REPORT
No. 1688-CPR-1864

13 November 2018
Valid for the tested testing object

1. CUSTOMER: TechnoNIKOL-Strojitělnyje Sistěmy, odštěpný závod, Sokolovská 100/94 Prague 8, 186 00 Czech Republic. Order dated on 8th of August, 2018.
2. MANUFACTURER: Zavod Logicroof PIR LLC, Vostochny promuzel 21, 390047, Ryazan, Russia.
3. PRODUCT: Polyisocyanuret foam boards **PIR F/F**. Produced according to *EN 13165:2012+A2:2016. Thermal insulation products for buildings – Factory made rigid polyurethane foam (PU) products – Specification.*
   Production dates: 2018-08-10, 2018-08-11, 2018-08-12 for 30 mm thickness, 2018-08-13, 2018-08-14, 2018-08-15 for 50 mm thickness, 2018-08-25, 2018-08-26 for 100 mm thickness and 2018-08-27, 2018-08-28 for 150 mm thickness.
4. RECEIVING DATE: 16th of August, 2018.
5. TESTING DATE: From 16th of August, 2018 to 25th of September, 2018.
6. TEST LOCATION: Laboratory.
7. SAMPLES SELECTED BY: The samples were selected by customer. 10 samples representing 10 production dates were selected and presented to the laboratory. Information about sampling was given in Sampling report/order dated on 8th of August, 2018. Boards were wrapped into polyethylene.
8. BASE OF TESTING: *EN 13165:2012+A2:2016. Thermal insulation products for buildings – Factory made expanded polystyrene (EPS) products – Specification.*
9. TESTS WERE CARRIED OUT IN ACCORDANCE WITH:
   EN 1602:2013. Thermal insulating products for building applications – Determination of the apparent density.
   EN 1609:2013. Thermal insulating products for building applications - Determination of short term water absorption by partial immersion.
   EN 826:2013. Thermal insulating products for building applications – Determination of compression behaviour.
   ISO 8301:1991. Thermal insulation – Determination of steady-state thermal resistance and related properties – Heat flow meter apparatus.
   EN 12085:2013. Thermal insulating products for building applications – Determination of linear dimensions of test specimens.
   EN 12667:2001. Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance.
   EN 12939:2000. Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance.
10. TEST RESULTS: Tests results are presented in Annexes. Annex A – 1 page, Annex B – 1 page, Annex C – 1 page and Annex D – 1 page.
11. OTHER INFORMATION: After tests, all samples were destroyed.

Head of Laboratory of Thermal
Insulating Materials and Acoustics — **Dr. G. Balčiūnas**

Technically responsible for tests, chief researcher
of Laboratory of Thermal Insulating Materials and Acoustics — **Dr. S. Vaitkus**

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Annex A
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Table A.1 Test results of thermal conductivity of polyisocyanurate foam **PIR F/F**

Specimen No.	Production date	Thermal conductivity*)									
		Initial thermal conductivity value when the thickness of specimen is nominal			Initial thermal conductivity value when the thickness of core specimen is 20 mm			Thermal conductivity value after ageing when the thickness of core specimen is 20 mm			Calculated thermal conductivity value after ageing (after evaluation of increment), W/(m·K)****
		Thickness, mm	Density, kg/m^3	λ_{10}, W/(m·K)	Thickness, mm	Density, kg/m^3	λ_{10}, W/(m·K)	Thickness, mm	Density, kg/m^3	λ_{10}, W/(m·K)	
1	2018-08-10	29.7	43.9	0.0187	21.4	31.5	0.0182	21.6	31.0	0.0232	0.0202
2	2018-08-11	30.0	42.9	0.0182	20.4	30.1	0.0180	20.5	29.8	0.0231	0.0197
3	2018-08-12	29.8	43.9	0.0187	21.4	31.3	0.0182	21.5	30.9	0.0232	0.0202
4	2018-08-13	49.6	39.3	0.0188	21.6	31.3	0.0187	21.6	31.1	0.0240	0.0203
5	2018-08-14	49.8	38.7	0.0189	21.9	30.8	0.0185	21.9	30.6	0.0238	0.0204
6	2018-08-15	49.9	38.9	0.0187	21.5	31.1	0.0183	21.6	30.9	0.0237	0.0202
7	2018-08-25	98.0	39.5	0.0184	21.9	35.3	0.0185	22.0	35.6	0.0235	0.0199

*) Tests of thermal conductivity were carried out by heat flow meter apparatus FOX 304 with a single-specimen symmetrical configuration and with the linear gradient guard for sample edges. The size of specimens was of (300x300) mm. The temperature difference through the specimen was 20°C and the mean temperature during the test was 10°C. Apparatus FOX 304 was calibrated using reference material IRMM-440 A No. 460 on 27th of June, 2018. FOX 304 is additionally calibrated according to IRMM-440, No. 21 parameters, which are set in an internal memory of the apparatus, before each measurement of thermal conductivity. Test objects were stored at (70±2)°C temperature until the constant mass is achieved. Ambient temperature of the environment surrounding the apparatus during the test was (10±2)°C. The main surfaces of specimens were grinded using grinding wheel before testing in accordance with EN 12667, 6.3.2. Test was carried out by junior researcher Agnė Kairytė.
**) Test specimens surface were cut and grinded using grinding wheel due to uneven surface.
***) Specimens, based on the thickness, were cut into two pieces according to EN 12939:2000.
****) The blowing agent used for the production of polyisocyanurate foams with aluminium foil coating was pentane; therefore, the increment is 0.0015 W/(m·K) (EN 13165:2012+A2:2016, C 5.3., Table C.2).

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Table A.1 (continued). Test results of thermal conductivity of polyisocyanurate foam **PIR F/F**

Specimen No.	Production date	Thermal conductivity*)									
		Initial thermal conductivity value when the thickness of specimen is nominal			Initial thermal conductivity value when the thickness of core specimen is 20 mm			Thermal conductivity value after ageing when the thickness of core specimen is 20 mm			Calculated thermal conductivity value after ageing (after evaluation of increment), W/(m·K)****
		Thickness, mm	Density, kg/m³	λ_{10}, W/(m·K)	Thickness, mm	Density, kg/m³	λ_{10}, W/(m·K)	Thickness, mm	Density, kg/m³	λ_{10}, W/(m·K)	
8	2018-08-26	74.3 75.3 149.6***	38.3 37.9 38.1***	0.0174 0.0175 0.0175***	20.7	35.2	0.0174	20.9	34.8	0.0226	0.0190
9	2018-08-27	98.3	39.9	0.0182	20.6	35.5	0.0187	20.7	35.7	0.0237	0.0197
10	2018-08-28	77.4 71.8 149.2***	39.5 41.0 40.3***	0.0178 0.0182 0.0180***	21.4	35.2	0.0174	21.7	35.5	0.0226	0.0195
Average value		-	**40.5**	**0.0184**	-	**32.7**	**0.0182**	-	**32.6**	**0.0233**	**0.0199**
Experimental standard deviation		-	**2.19**	**0.000438**	-	**2.25**	**0.000472**	-	**2.46**	**0.000486**	**0.000438**
Declared thermal conductivity											**0.021**

*) Before the tests, the whole products were conditioned for 16 h at (23±3)°C temperature and (50±10)% relative humidity conditions. Tests of thermal conductivity were carried out by heat flow meter apparatus FOX 304 with a single-specimen symmetrical configuration and with the linear gradient guard for sample edges. The size of specimens was of (300x300) mm. The temperature difference through the specimen was 20°C and the mean temperature during the test was 10°C. Apparatus FOX 304 was calibrated using reference material IRMM-440 A No. 460 on 9th of August, 2018. Additionally, IRMM-440 parameters are set in an internal memory of the apparatus before each measurement of thermal conductivity. Ambient temperature of the environment surrounding the apparatus during the test was (10±2)°C. Ageing procedure was carried out at (70±2)°C temperature for (21±1) days. After ageing, all test specimens were reconditioned for 16 h at (23±3)°C temperature and (50±10)% relative air humidity. Test was carried out by junior researcher Agnė Kairytė.

**) Test specimens surface were cut and grinded using grinding wheel due to uneven surface.

***) Specimens, based on the thickness, were cut into two pieces according to EN 12939:2000.

****) The blowing agent used for the production of polyisocyanurate foams with aluminium foil coating was pentane; therefore, the increment is 0.0015 W/(m·K) (EN 13165:2012+A2:2016, C 5.3., Table C.2).

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Annex B
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Table B.1 Test results of compressive strength/compressive stress at 10% deformation of polyisocyanurate foam **PIR F/F**

PIR F/F									
Production date	Nominal thickness d, mm	Specimen No.	Compression*)		Production date	Nominal thickness d, mm	Specimen No.	Compression*)	
			Density of specimen, kg/m³	Compressive stress at 10% deformation, kPa				Density of specimen, kg/m³	Compressive stress at 10% deformation, kPa
2018-08-10	30	1	43.5	183	2018-08-13	50	1	38.4	144
		2	43.1	171			2	38.8	173
		3	43.0	151			3	38.2	175
Mean value			**43.2**	**168**	**Mean value**			**38.5**	**164**
Production date	Nominal thickness d, mm	Specimen No.	Compression*)		Production date	Nominal thickness d, mm	Specimen No.	Compression*)	
			Density of specimen, kg/m³	Compressive stress at 10% deformation, kPa				Density of specimen, kg/m³	Compressive stress at 10% deformation, kPa
2018-08-25	100	1	39.1	238	2018-08-28	150	1	38.1	183
		2	39.1	253			2	38.2	181
		3	39.2	252			3	38.1	186
Mean value			**39.1**	**248**	**Mean value**			**38.1**	**183**

*) Dimensions of specimens were (50x50xd) mm. Before the test, specimens were conditioned for ≥6 hours at (23±5) °C temperature.

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Annex C
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Table C.1 Test results of short-term water absorption by partial immersion* of polyisocyanurate foam **PIR F/F**

Sample No.	Production date	Nominal thickness, mm	Density of specimen, kg/m^3	Test results, kg/m^2
PIR F/F				
1	2018-08-10	30	43.8 43.7	0.06 0.06
		Mean value	**43.8**	**0.06**
2	2018-08-13	50	38.9 38.5	0.06 0.06
		Mean value	**38.7**	**0.06**
3	2018-08-25	100	39.7 39.5	0.06 0.06
		Mean value	**39.6**	**0.06**
4	2018-08-28	150	38.4 38.6	0.06 0.07
		Mean value	**38.5**	**0.07**

*) Before the test, specimens were conditioned for ≥ 6 hours at (23±5) °C temperature. Test was carried out in accordance with A method for specimens having the size of (200x200) mm from 24th of September. 2018 to 25th of September, 2018.

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Annex D
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The results are valid for the tested testing object only

Table D.1 Evaluation of conformity of polyisocyanurate foam **PIR F/F**

Characteristics	**PIR F/F**
Declared thermal conductivity value, W/(m·K) λ_D	0.021
Compressive strength, kPa $CS(10)_i$	CS(10/Y)150 ≥150
Short-term water absorption, kg/m^2 $WS(P)_i$	WS(P)0.1