MINISTRY OF RESEARCH AND INNOVATION

URBAN INCD INCERC

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CLUJ - NAPOCA BRANCH

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CERTIFICAT DE ACREDITARE
LI 320

APPROVED
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Director General V.M.

ISC Authorization. no. 3369/26.06.2018

TEST REPORT no. 1341 from 12.12.2018

Relevant product standard SR EN 13164+A1:2015

1. **Client order /Contract:** WN from 29.10.2018 / 3001 from 05.11.2018 / ctr. no. 9728/2018

2. **Product:**

EXTRUDED POLYSTYRENE BOARDS - XPS

3. **Client: Hangzhou Tyco Industrial Co.,Ltd.**
4th floor Shuyuan Building No.258 Moganshan Rd., Hangzhou, China

4. **Manufacturer: Hangzhou Tyco Industrial Co.,Ltd**
4th floor Shuyuan Building No.258 Moganshan Rd., Hangzhou, China,

5. **Identification of used method (Technical Procedure) / Standard:**
Determination of lengh and widh – SR EN 822:2013 / PTE -IME 13/05.01
Determination of thickness- SR EN 823:2013 / PTE -IME 13/05.13
Determination of squareness- SR EN 824:2013 /PTE -IME 13/05.14
Determination of flatness- SR EN 825:2013 /PTE -IME 13/05.15
Determination of compressive stress - SR EN 826: 2013 / PTE -IME 13/05.02
Stability at specified temperature T=+70° C - SR EN 1604:2013 / PTE -IME 13/05.05
Deformation under specified compressive load and temperature condition - SR EN 1605:2013 / PTE -IME 13/05.06
Tensile strength perpendicular to faces – SR EN 1607:2013 / PTE -IME 13/05.07
Long term water absorbtion by immersion SR EN 12087:2013/ PTE -IME 13/05.16
Thermal resistance and thermal conductivity - SR EN 12667:2002 / PTE -IME 57/01.04

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6. Description and identification of test item: extruded polystyrene boards XPS, 40 mm thickness.

Code: 567 **No. of specimens:** 5 extruded polystyrene boards XPS
Specimens (boards) size: 1000 x 500 x 40 mm

7. Date of sample receipt : 09.11.2018

8. Date of test: 12.11.2018 - 11.12.2018

9. Pre-test history and sampling: sampling according to customer procedures.
The test specimens were stored in the laboratory for at least 24 h at (23 ± 5) °C, according to the requirements of the relevant product standard.

10. Results:
Test conditions: Temperature T= (23±2)^{0}C and RH = (50±5)%

10.1. Determination of lengh and widh
Principle:
The plates are placed on a flat surface and measuring is done directly, using a ruler.

The interpretation of the results: the length and width, expressed in mm, is the average for a specimen, rounded to the nearest mm.

Results:

Specimen no.	Product Type	Lengh (mm)	Widh (mm)
1	XPS	1003	500
2		1003	499
3		1004	499
Average		**1003**	**499**

10.2. Determination of thickness

Principle:
For specimens with a length exceeding 600 mm but not exceeding 1500 mm. is performed four measurements with calipers accurate to 0.1 mm. It keeps the coverings insulation boards.

The interpretation of the results:
Specimen thickness is expressed in mm. and represents the average measurements in all positions on the specimen, rounded to the nearest mm.

Results:

Specimen no.	Product Type	Thickness (mm)
1	XPS	39,6
2		39,6
3		39,7
4		39,7
Average		**40.0**

10.3. Determination of squareness

Principle: Place a square metal with one of its arms on the side of the product and measure the distance between the other arm and the adjacent edge of the product.

The interpretation of the results:
1. Calculation of deviation from squareness on length or width:
It calculates the deviation from p squareness :

$$S_b = \frac{a_b}{c}$$

where a_b şi c – (mm).
Deviation is expressed in mm / m and rounded to the nearest millimeter per meter.

2. Calculation of deviation from squareness on thickness:
It calculates the deviation from p squareness:

$$S_d = a_d$$

where a_d– (mm).
Deviation is expressed in mm / m and rounded to the nearest millimeter per meter; it reports and records the thickness of the specimen.

Results:

Specimen no	Product Type	Max deviation from squareness	
		Length or Width. mm/m	Thickness. mm
		$S_b=a_b/c$	$S_d = a_d$
1	XPS	1	0
2		1	0
3		0	0
Average		**1,0**	**0**

10.4. Determination of flatness

Principlel: Measure the maximum distance between the product placed on a flat surface and the flat itself.

The interpretation of the results: For specimens showing a flatness deviation in terms of a single dimension. is considered as the maximum measured deviation. in mm.
In the case of crooked. samples, it calculates the deviation from flatness Smax, in mm, with the equation: $S_{max} = Y_{max} - Y_{min}$
Results:

Specimen no.	Product Type	Max deviation from flatness (mm)	
		On Length	On Width
1	XPS	0.3	0,3
2		0.2	0,3
3		0.4	0,4
Average		**0.3**	**0,3**

10.5. Compressive stress

Principle:
Applying a compressive force to a deformation of 10% relative to the specimen, with a given speed, in an axial direction, perpendicular to the main faces of the square section of the specimen and it calculates the maximum stress borne by the specimen. Products are tested in their original state.
The interpretation of the results: Compressive stress

$$\sigma_{10} = 10^3 \frac{F_{10}}{A_0} (kPa)$$

F_{10} – force corresponding to a relative deformation of 10% (N).

Results:

Specimen no	A_0 (mm^2)	F_{10} (N)	σ_{10} (kPa)
1	100x100	6255	625,5
2	100x100	6072	607,2
3	100x100	5937	593,7
4	100x100	5911	591,1
5	100x100	6126	612,6
Average			**606,0**

10.6 Dimensional stability under specified temperature condition T=+70° C

Principle:
Determination of linear dimensions variations that occur when the test specimens were conditioned in a specified atmosphere (T=+70°C). for 48 hours and then are reconditioned in a standard laboratory atmosphere (23±2°C and 50±5% RH). Products are tested in their original state.

The interpretation of the results: It calculates dimensional variations in percentages for individual measurements. using the equation:

$$\Delta\varepsilon_l = 100\frac{l_t - l_0}{l_0}$$

$$\Delta\varepsilon_b = 100\frac{b_t - b_0}{b_0}$$

$$\Delta\varepsilon_d = 100\frac{d_t - d_0}{d_0}$$

l_0. b_0. d_0 – initial size of specimens. mm;
l_t. b_t. d_t - size of the conditioned specimens under specified conditions. mm.
Calculate the average value of each dimensional variation of individual results.

Results: **48 hours at T=+70°C**

Specimen no	l_o (mm)	l_t (mm)	Δεl Dimensional variation (%)	
			Individual values	Individual values
1	200,08	201,96	0,9	**0,9**
2	200,12	201,89	0,9	
3	200,34	202,01	0,8	
4	200,12	202,04	1,0	

Specimen no	b_o (mm)	b_t (mm)	$\Delta\varepsilon_b$ Dimensional variation (%)	
			Individual values	Individual values
1	200,31	202,13	0,9	0,9
2	200,15	202,06	1,0	
3	200,36	202,20	0,9	
4	200,46	202,36	0,9	

Specimen no	d_o (mm)	d_t (mm)	$\Delta\varepsilon_d$ Dimensional variation (%)	
			Individual values	Individual values
1	39,96	40,38	1,1	1,3
2	39,76	40,27	1,3	
3	39,68	40,19	1,3	
4	39,73	40,28	1,4	

10.7. Deformation under specified compressive load and temperature condition

Principle:
A specified compressive load (40 kPa) is applied to the test piece and measure the relative deformation in two stages, each stage having different temperature conditions.
Test conditions are the following:
T_1 = 23°C, 48 hours - for stage A and T_2 = +70°C, 48 h - for Stage B.

The interpretation of the results:
The relative deformation after the test Stage A. in%, with the equation:

$$\varepsilon_1 = 100\frac{d_s - d_1}{d_s}$$

d_s - specimen thickness before applying the selected load. mm
d_1 - thickness of the specimen after loading the application selected. mm.

The relative deformation after the test Stage B. in%, with the equation:

$$\varepsilon_2 = 100\frac{d_s - d_2}{d_s}$$

d_s - specimen thickness before applying the selected load. mm
d_2 - specimen thickness after applying the selected load and temperature conditions. mm.

Results:

Stage A – Stress 40 kPa, T= 23°C, time 48 h

Specimen no	d_s (mm)	d_1 (mm)	Relative deformation. Stage A (%) - ε_1	
			Individual values	Average value
1	40,01	39,88	0,3	0,3
2	39,92	39,83	0,2	
3	40,08	39,95	0,3	
4	39,88	39,67	0,5	

Stage B - Stress 40 kPa, T=+70°C, time 48 h

Specimen no	d_s (mm)	d_2 (mm)	Relative deformation. Stage B (%)- ε_2	
			Individual values	average value
1	40,01	39,45	1,4	1,4
2	39,92	39,34	1,5	
3	40,08	39,58	1,2	
4	39,88	39,33	1,4	

10.8 Tensile strength perpendicular to faces

Principle: the test specimen is fixed between two rigid plates. mounted in a tensile testing machine and subjected to traction force at a given speed. Record the maximum traction force and calculate the tensile strength of the test piece.

The interpretation of the results:
It calculates the tensile strength perpendicular to faces, kPa:

$$\sigma_{mt} = (F_m / A)$$

F_m – maximum traction force, kN;
A – cross-sectional area of the specimen. m^2;

Results:

Specimen no	L x b (m)	F_m (kN)	σ (kPa)	
			Individual values	Average values
1	0,1x0,1	9,65	965	956
2	0,1x0,1	9,10	910	
3	0,1x0,1	10,06	1006	
4	0,1x0,1	9,10	910	
5	0,1x0,1	9,87	987	

10.9 Long term water absorbtion by immersion

Partial immersion: long-term water absorption by partial immersion. is determined by measuring the change in mass of a test sample, whose lower part is in contact with water, for a period of 28 days.

Total Immersion: Water absorption by total immersion long term is determined by measuring the change in mass of the test sample immersioned total in water, for a period of 28 days.

The interpretation of the results:
It calculates long term water absorbtion through partial immersion. W_{lp} in kg/m^2.:

$$W_{lp} = \frac{m_{28} - m_0}{A_p} (kg/m^2)$$

m_0 - initial mass of the test sample, kg;
m_{28} - mass of the test sample after partial immersion for 28 days, kg;
A_p - lower surface area of the test sample, m^2.

It calculates long term water absorbtion through total immersion. W_h.:

$$W_h = \frac{m_{28} - m_0}{V} x \frac{100}{\rho_w} \ (\%)$$

m_0 - initial mass of the test piece. kg;
m_{28} - mass of the test piece after total immersion for 28 days. kg;
V - the initial volume of the specimen. m^3
ρ_w the density of water. considered 1000 kg/m^3.
W_h is rounded to the nearest 0.1 percentage volume

Results: - specimens 200 x 200 x 40 mm V=0.0016 m^3

Specimen no	m_0 (kg)	m_{28} (kg)	Long term water absorbtion through partial immersion W_{lp} (kg/m^2)	
			Individual values	Average value
1	0,05323	0,05585	0,07	0,06
2	0,05242	0,05496	0,06	
3	0,05312	0,05536	0,06	
4	0,05351	0,05579	0,06	

Specimen no	m_0 (kg)	m_{28} (kg)	Long term water absorbtion through total immersion W_h (%)	
			Individual values	Average value
1	0,05276	0,06675	0,9	0,8
2	0,05333	0,06463	0,7	
3	0,05220	0,06516	0,8	
4	0,05345	0,06464	0,7	

10.10 Thermal resistance and thermal conductivity

A. Apparent density.
Principle: Density is the ratio of mass and volume of the test piece. Conditioning is done in laboratory conditions. to constant mass.

The interpretation of the results:

The apparent density (ρ). in kg/m^3.: $\rho = \frac{m}{V} (kg/m^3)$

m = mass of test piece. kg
V = volume of the test piece. m^3
The result is the average of the individual values

- dry apparent density: ρ=32,6 kg/m^3

B. Thermal resistance - Determination method: using the thermofluxmeter

Principle:
It determines the heat transfer property of the sample. The sample is dried in an oven at constant mass. then is placed in the machine. Sample thickness is measured automatically by machine. It selects the average temperature of the plates at 10^0C. After the plates temperatures (hot and cold) stabilizes, the device displays the thermal conductivity of the specimen. The result is the average of the individual values.

Results:

Extruded polystirene -thickness (mm)	Thermal conductivity. λ_{10} W/mK	Thermal resistance m^2K/W
39,9	0,03235	1,23
39,8	0,03242	1,23
39,8	0,03291	1,21
39,9	0,03249	1,23
40,0	0,03252	1,23
Media	**0,03254**	**1,23**

11. Measurement uncertainty (-):

12*. Opinions and interpretations (-):

* Paragraph 12 is not covered by the RENAR accreditation

NOTE: *The test results refer only to the tested product.*

The test report must be reproduced entirely and only with the written approval of the laboratory which conducted the test.

Checked
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End of Test Report