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**RESEARCH LABORATORIES GROUP**  
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AB 023

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**BUILDING MATERIALS ENGINEERING CENTER**  
**BUILDING MATERIALS LABORATORY**

## TEST REPORT NO. LZM00-02171/18/Z00NZM

This test report contains test results covered by the scope of accreditation as well as results of non-accredited tests and non-accredited technical assessment. The results of the tests outside the scope of accreditation and the assessment are marked "out of accreditation scope"

This report has been issued in three copies, with two received by the Client and one remaining at the Building Research Institute.

**Client (Manufacturer):** VIVE INNOVATION Sp. z o.o.

**Client's address:** ul. K. Olszewskiego 6, 25-663 Kielce

### INFORMATION CONCERNING THE PRODUCT

**Manufacturer (Company name and address):** VIVE INNOVATION Sp. z o.o.

**Name and address of the Manufacturing**

**Plant:** No data available

**Product name:** Plastic and textile fibre boards, profiles and piles WOOTEX/ RETEXTILE

**Reference document for the product:** Tests to obtain a National Technical Assessment (KOT)

**Information concerning the product and the declared scope of application and the resulting system of assessment and verification of constancy of the utility properties.** For outdoor pavements of terraces, paths, footbridges, beach entrances, platforms, stairs, promenades, etc.

**Building product type designation:** System 4

**Building product type designation:** The client did not provide information about the unique product identification code

### Information concerning the test object

**Test object:** Plastic and textile fibre profiles WOOTEX/ RETEXTILE

**name, description, status and identification**

Smooth board 65x30mm, 80x20mm, 100x20mm, 120x40mm, 120x60mm and 140x60mm

Tongue-and-groove board 140x28mm

Pile with sharpening with a diameter of 70mm and 120mm and without sharpening with a diameter of 90mm

Beam (post) with sharpening 50x50mm and without sharpening 70x70mm and 90x90mm

Details of the test object can be found in section 2 of this report "Test materials"

**Date of acceptance of the test object:** 10.09.2018 and 18.10.2018

**No. of protocol of acceptance of the test object:** LZM02-02171/18/Z00NZM and LZM02-02171/18/Z00NZM

**Procedure of accepting the test object:** ZLB Management Procedure no. 18

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**Information concerning the tests**

Date of test commencement: 02.10.2018

Date of test completion: 25.01.2019

Other information concerning the tests: Working team:  
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Aneta Gajdowska, MSc, Eng, Cezary Strąk, MSc, Eng, Jarosław Sówka, MSc, Damian Wojnowski, MSc, Eng, Dariusz Sójka, Katarzyna Sobota, MSc

**TEST METHOD/PROCEDURE:**

PN-EN 1770:2000 *Products and systems for protection and repair of concrete structures. Test methods. Determination of thermal expansion coefficient*

PN-EN 15534-1:2014

*Composites made of cellulose-based materials / thermoplastics (commonly called WPCs or NFCs). Part 1: Test methods for characterizing mixtures and products*

PN-EN 15534-4:2014

*Composites made of cellulose-based materials / thermoplastics (commonly called WPCs or NFCs). Part 4: Floor profile and tile specifications*

PN-EN ISO 175:2010

*Plastics. Test methods used to determine the effects of immersion in liquid chemicals.*

PN-EN ISO 306:2014

*Plastics. Thermoplastics. Determination of softening temperature using the Vicat method (VST).*

PN-EN ISO 604:2006

*Plastics. Determination of the properties in compression.*

PN-EN ISO 845:2010

*Porous plastics and rubbers. Determination of apparent density.*

PN-EN ISO 4892-2:2013

*Plastics. Methods of exposure to laboratory light sources. Part 2: Xenon arc lamps.*

PN-ISO 7724-2:2003

*Paints and varnishes. Colorimetry. Part 2: Color measurement.*

PN-ISO 7724-3:2003

*Paints and varnishes. Colorimetry. Part 3: Calculating color differences.*

CEN/TS 15676

*Wood flooring. Slip resistance. Pendulum test.*

**1. Scope of tests**

The scope of tests included:

- dimensions and dimensional deviations (outside the scope of accreditation),
- edge straightness (outside the scope of accreditation),
- cross curvature (outside the scope of accreditation),
- PTV slip resistance (outside the scope of accreditation),
- apparent density,
- Vicat softening temperature (outside the scope of accreditation),
- coefficient of linear thermal expansion (outside the scope of accreditation),
- compressive strength and modulus of elasticity in compression (outside the scope of accreditation),
- bending strength and modulus of elasticity when bending the boards (outside the scope of accreditation),
- impact resistance at 23°C and -20°C (outside the scope of accreditation),
- resistance to artificial aging (300h) with the determination of the color difference,
- resistance to humid conditions:
  - swelling and water absorption (outside the scope of accreditation),
  - resistance to humid conditions under the influence of cyclic effects of changing conditions (outside the scope of accreditation),
  - cooking test (outside the scope of accreditation),
- chemical resistance to aggressive environment (outside the scope of accreditation).

**2. Test materials**

For the tests covered by this report, the Client provided:

- smooth boards with a cross-section of:
  - 65x30 and 1.2 m long - 82 pcs.

- 80x20 and 1.2 m long - 23 pcs.
- 100x20 and 1.2 m long - 23 pcs.
- 120x40 and 1.2 m long - 23 pcs.
- 120x60 and 1.2 m long - 23 pcs.
- 140x60 and 1.2 m long - 23 pcs.
- smooth tongue-and-groove boards with a cross-section of:
  - 140x28 and 1.2 m long - 41 pcs.
- piles with a diameter of:
  - 70mm and 1.2 m long (with sharpening) - 3 pcs.
  - 90mm and 1.2 m long (without sharpening) - 3 pcs.
  - 120mm and 1.2 m long (with sharpening) - 3 pcs.
- beams (posts) with a cross-section of:
  - 50x50 and 1.2 m long - 10 pcs. and 65mm, 80mm and 100mm long - 40 pcs. each
  - 70x70 and 1.2 m long - 3 pcs. and 120mm and 140mm long - 80 pcs. each
  - 90x90 and 1.2 m long - 13 pcs.
- screws 6x60mm - 500 pcs. and 6x80mm - 400 pcs.

The above profiles were selected from the assortment submitted for testing, verified with unavailable profiles (no production at the stage of submission for testing). The assortment of profiles is included in Appendix 1 to this report.

### 3. Test methods and results

NOTE: The uncertainty was determined on the basis of available data including the accuracy of the measurement system used. The result and its uncertainty applies to the tested samples only. The value of the uncertainty cannot be directly attributed to the level of the product characteristics, because the laboratory has no knowledge of the variability of its population, but only of the sample being tested.

#### 3.1 Dimensions and dimensional deviations (outside the scope of accreditation)

The dimensions of the selected profiles were checked in accordance with PN-EN 15534-1:2014. The results of measurements and calculations (dimensional deviations) are presented in Tables 1a and 1b.

**Table 1a.** Dimensions and dimensional deviations of boards and beams

No.	Measurement result, mm, in the direction of		
	length	width	height
1	2	3	4
Smooth board 65x30mm			
1	1195	67.43	29.44
2	1195	67.56	27.75
3	1195	67.52	27.57
Mean value:	1195	67.50	28.25
Nominal value:	1200	65	30
Dimensional deviation:	-5	+2.50	-1.75

cont. of Table 1a.

No.	Measurement result, mm, in the direction of		
	length	width	height
1	2	3	4
Smooth board 80x20mm			
4	1196	79.86	20.12
5	1208	80.60	20.00
6	1209	80.21	20.09
Mean value:	<b>1204</b>	<b>80.22</b>	<b>20.07</b>
Nominal value:	1200	80	20
Dimensional deviation:	+4	<b>+0.22</b>	+0.07
Smooth board 100x20mm			
7	1196	99.16	20.80
8	<b>1196</b>	<b>99.12</b>	<b>20.25</b>
9	1204	99.25	20.53
Mean value:	<b>1199</b>	<b>99.18</b>	<b>20.53</b>
Nominal value:	1200	100	20
Dimensional deviation:	-1	-0.82	+0.53
Smooth board 120x40mm			
10	1200	120.58	38.97
11	1207	<b>120.33</b>	<b>38.84</b>
12	1206	121.42	37.81
Mean value:	<b>1204</b>	<b>120.78</b>	<b>38.54</b>
Nominal value:	1200	120	40
Dimensional deviation:	+4	+0.78	-1.46
Smooth board 120x60mm			
13	1208	119.36	58.48
14	<b>1210</b>	<b>119.35</b>	<b>57.50</b>
15	1213	118.95	57.53
Mean value:	<b>1210</b>	<b>119.22</b>	<b>57.83</b>
Nominal value:	1200	120	60
Dimensional deviation:	+10	-0.78	-2.17
Smooth board 140x60mm			
16	1193	136.07	58.56
17	<b>1201</b>	136.66	<b>59.12</b>
18	1198	136.66	59.99
Mean value:	<b>1197</b>	<b>136.46</b>	<b>59.22</b>
Nominal value:	1200	140	60
Dimensional deviation:	-3	-3.54	-0.78
Smooth tongue-and-groove board 140x28mm			
19	1207	140.44	28.08
20	<b>1206</b>	<b>139.64</b>	<b>28.33</b>
21	1206	140.36	29.04
Mean value:	<b>1206</b>	<b>140.15</b>	<b>28.48</b>
Nominal value:	1200	140	28
Dimensional deviation:	+6	+0.15	+0.48

cont. of Table 1a.

No.	Measurement result, mm, in the direction of		
	length	width	height
1	2	3	4
Beam (post) 50x50mm			
22	1218	53.39	52.04
23	1220	52.43	53.06
24	1219	53.04	53.33
Mean value:	<b>1219</b>	<b>52.95</b>	<b>52.81</b>
Nominal value:	1200	50	50
Dimensional deviation:	+19	+2.95	+2.81
Beam (post) 70x70mm			
25	1201	68.38	69.48
26	1210	69.13	69.04
27	1207	69.17	69.42
Mean value:	<b>1206</b>	<b>68.89</b>	<b>69.31</b>
Nominal value:	1200	70	70
Dimensional deviation:	+6	-1.11	-0.69
Beam (post) 90x90mm			
28	1214	87.85	88.16
29	1173	88.36	87.46
30	1178	89.41	88.69
Mean value:	<b>1188</b>	<b>88.54</b>	<b>88.10</b>
Nominal value:	1200	90	90
Dimensional deviation:	-12	-1.46	-1.90

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_{\text{length}}=1.3\text{mm}$ ,  $U_{\text{other dimensions}}=0.04\text{mm}$

Table 1b. Dimensions and dimensional deviations of piles

No.	Measurement result, mm	
	length	diameter
1	2	3
Pile with a diameter of 70mm		
1	1205	68.74
2	1205	68.87
3	1206	67.94
Mean value:	<b>1205</b>	<b>68.52</b>
Nominal value:	1200	70
Dimensional deviation:	+5	-1.48
Pile with a diameter of 90mm		
4	1225	93.94
5	1205	<b>92.52</b>
6	1210	93.50
Mean value:	<b>1213</b>	<b>93.32</b>
Nominal value:	1200	90
Dimensional deviation:	+13	+3.32

cont. of table 1b.

No.	Measurement result, mm	
	length	diameter
1	2	3
Pile with a diameter of 120mm		
7	1192	123.57
8	1205	123.56
9	1208	123.86
Mean value:	<b>1202</b>	<b>123.66</b>
Nominal value:	1200	120
Dimensional deviation:	+2	+3.66

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_{p \text{ length}}=1.3\text{mm}$ ,  $U_{p \text{ diameter}}=0.04\text{mm}$

### 3.2 Edge straightness (outside the scope of accreditation),

The edge straightness of profiles was checked in accordance with PN-EN 15534-1:2014. Measurements were taken for one cross-section from each profile type. The measurement results are shown in Table 2.

**Table 2.** Results of checking the edge straightness of profiles

No.	Deviation from edge straightness, mm/m		Deviation from edge straightness, mm/m	
	left	right	left	right
	flat		on end	
1	2	3	4	5
Smooth board 120x40mm				
1	1.00	0.80	0.95	1.00
2	1.15	1.15	0.75	0.35
3	0.75	0.75	0.40	0.55
Maximum value	<b>1.15</b>	<b>1.15</b>	<b>0.95</b>	<b>1.00</b>
Smooth tongue-and-groove board 140x28mm				
4	1.00	1.25	0.35	0.35
5	0.35	0.20	0.40	0.35
6	0.85	1.00	0.50	0.60
Maximum value	<b>1.00</b>	<b>1.25</b>	<b>0.50</b>	<b>0.60</b>
Beam (post) 50x50mm				
7	0.45	0.30	0.40	0.50
8	0.55	<b>0.20</b>	0.35	0.30
9	0.80	0.45	0.25	0.45
Maximum value	<b>0.80</b>	<b>0.45</b>	<b>0.40</b>	<b>0.50</b>

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.06 \text{ mm}$

### 3.3 Cross curvature (outside the scope of accreditation)

The cross curvature of profiles was checked in accordance with PN-EN 15534-1:2014. Measurements were taken for one cross-section from each profile type. The measurement results are shown in Table 3.

**Table 3.** Results of checking the cross curvature of profiles

No.	Cross curvature, mm, of	
	top surface	bottom surface
1	2	3
Smooth board 120x40mm		
1	2.173	2.738
2	2.164	2.254
3	2.952	2.891
Maximum value	<b>2.952</b>	<b>2.891</b>
Smooth tongue-and-groove board 140x28mm		
4	2.005	2.105
5	0.745	0.970
6	1.290	1.482
Maximum value	<b>2.005</b>	<b>2.105</b>
Beam (post) 50x50mm		
7	0.451	0.487
8	0.415	0.378
9	0.501	0.425
Maximum value	<b>0.501</b>	<b>0.430</b>

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.004$  mm

### 3.4 Slip resistance (outside the scope of accreditation)

The determination of the slip resistance of the boards was carried out in accordance with PN-EN 15534-1:2014 and CEN/TS 15676, using the English pendulum method, using the variant of the test conditions most susceptible to slipping, i.e. wet surface, measurement along the board. Due to a similar way of finishing the surface of smooth boards, the test was carried out for one cross-section of the board.

The test was carried out at 22°C, with a 25mm long and 76mm wide CEN slider.

The test results are shown in Table 4.

**Table 4** Results of the determination of the slip resistance of the boards

No.	Slip resistance PTV for wet surface along the 100 x 20mm board
1	2
1	57
2	57
3	58
4	58
5	58
6	57
7	59
8	58
9	57
10	57
Average:	<b>58</b>

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 3$

### 3.5 Apparent density

Determination of apparent total density of profiles was performed in accordance with PN-EN ISO 845:2010, on 100mm long samples and on their full cross-section. The measurements were taken for:

- the minimum and maximum cross-section of the smooth board,
- the minimum and maximum pile diameter,
- the intermediate cross-section of the beam (post).

Right before testing, the samples were air-conditioned under laboratory conditions ( $23\pm 2^{\circ}\text{C}$  and  $50\pm 5\%$ ) for 24 hours.

The results of the determination are given in Table 5.

**Table 5.** Results of the determination of the apparent total density of profiles

No.	Apparent total density, $\text{kg/m}^3$				
	smooth board with a cross-section of		pile with a diameter of		Beam (post) with a cross-section of 70x70mm
	65x30mm	140x60mm	70mm	120mm	
1	2	3	4	5	6
1	987.1	1052.3	2079.6	2057.9	1047.8
2	989.2	1062.9	2066.0	2041.2	1058.7
<b>3</b>	992.3	<b>1047.0</b>	2046.5	1996.4	1058.5
<b>4</b>	1008.6	<b>1042.9</b>	2063.5	2039.8	<b>1054.2</b>
5	999.9	1055.5	2061.0	2020.0	1044.1
Average:	<b>995.4</b>	<b>1052.1</b>	<b>2063.3</b>	<b>2032.1</b>	<b>1052.7</b>
Standard deviation:	<b>8.8</b>	<b>7.7</b>	11.8	<b>23.6</b>	<b>6.5</b>

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p - 0.8\text{kg/m}^3$

### 3.6 Vicat softening temperature (outside the scope of accreditation)

Determination of the Vicat softening temperature (VST/B50) of the profile material was performed in accordance with PN-EN ISO 306:2014, using method B50, on samples with the tested layer thickness of:

- 4.16 + 4.33 mm, for a smooth board 65x30 mm,
- 4.42 + 4.64 mm, for a pile with a diameter of 70 mm.

Plastic samples were cut out of finished products. The test was carried out in the Vicat apparatus using silicone oil as a heating medium. The results of the determination are given in Table 6.

**Table 6.** Results of the determination of the plastic softening temp. according to Vicat

No.	Softening temperature according to Vicat, $^{\circ}\text{C}$ , plastics	
	with minimum density (65x30mm board)	with a maximum density (70mm pile)
1	2	3
1	40.4	53.3
2	42.8	48.0
3	43.4	49.7
4	47.8	<b>48.3</b>
5	48.8	49.0
6	29.5	—
Mean value	<b>42.0</b>	<b>48.7</b>

The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.4^{\circ}\text{C}$



**3.7 Determination of linear thermal expansion coefficient** (outside the scope of accreditation)

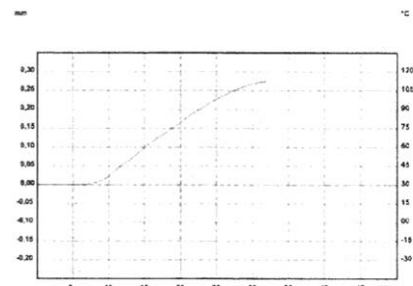
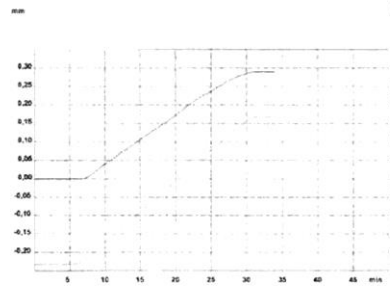
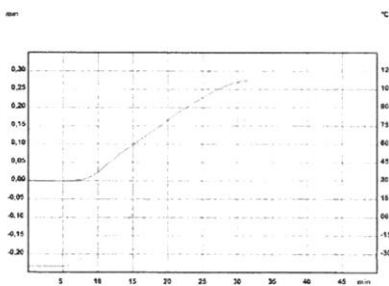
The determination of the coefficient of linear thermal expansion in the temperature range -20 - 70°C was performed in accordance with PN-EN 1770:2000, on 50mm long samples, cut out of material with minimum (65 x 30mm boards) and maximum density (70mm pile).

Equipment in line with section 3.2 of PN-EN 1770:2000 standard was used for the testing. Silicone oil SIL 180 was used as a coolant. The temperature rise rate was 5°C/min.

The results of the test are presented in Tables 7a and 7b and in diagrams 1-5-6.

**Table 7a.** Results of the determination of the coefficient of linear thermal expansion of the material cut from 65 x 30mm boards, in the temperature range -20 - 70°C

No.	Initial sample length, mm	Coefficient of linear thermal expansion, 1/°C
1	2	3
1	49.37	5.15·10 <sup>-5</sup>
2	49.12	5.18·10 <sup>-5</sup>
3	49.43	5.19·10 <sup>-5</sup>
Mean value:		5.17·10 <sup>-5</sup>



Prepared by 1. Sample 1 elongation curve

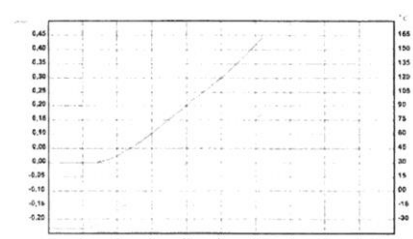
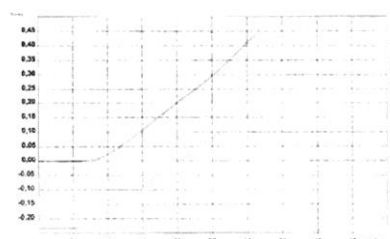
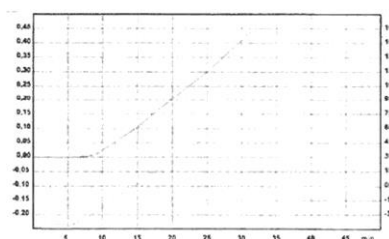
Prepared by 2. Sample 2 elongation curve

Prepared by 3. Sample 3 elongation curve

**65x30mm boards material elongation curves**

**Table 7b.** Results of the determination of the coefficient of linear thermal expansion of the material cut from 70mm piles, in the temperature range -20 - 70°C

No.	Initial sample length, mm	Coefficient of linear thermal expansion, 1/°C
1	2	3
1	48.07	7.86·10 <sup>-5</sup>
2	48.33	7.91·10 <sup>-5</sup>
3	48.50	8.02·10 <sup>-5</sup>
Mean value:		7.93·10 <sup>-5</sup>



Prepared by 4. Sample 1 elongation curve

Prepared by 5. Sample 2 elongation curve

Prepared by 6. Sample 3 elongation curve

**70mm piles elongation curves**

### 3.8 Compressive strength and modulus of elasticity in compression (outside the scope of accreditation)

The determination of the compressive strength and modulus of elasticity of the material of the profiles was performed in accordance with PN-EN ISO 604:2006, using the following test conditions:

- fittings: type A, with dimensions (50 x 10 x 4) mm (for compression strength), or type B, with dimensions (10 x 10 x 4) mm (for modulus of elasticity in compression), cut out of the outer layer of the finished product,
- seasoning time of the samples after cutting out: 24 hours in laboratory conditions (temp. 23±2°C and 50±5% relative humidity),
- test speed: 1 mm/min (compressive strength) or 5 mm/min (modulus of elasticity in compression),  
accuracy class of the testing machine: 1.

As a result of the compressive strength test, some of the samples were not damaged, so compressive stress at 10% deformation was additionally recorded. The results of the determination are given in Tables 8a and 8b.

**Table 8a.** Results of the compressive strength and compressive stress determination at 10% deformation

No.	Compressive strength / compressive stress at 10% deformation, MPa, materials	
	with a minimum density (70x70mm post)	with a maximum density (70mm pile)
1	2	3
1	35.9 / 26.2	22.6 / 17.6
2	49.3 / 26.1	- / 18.6
3	27.9 / 23.4	- / 18.7
4	- / 21.7	- / 22.2
5	46.5 / 25.7	- / 22.0
6	- / 22.6	- / 19.7
Mean value	<b>39.9* / 24.3**</b>	<b>-* / 19.8**</b>
Standard deviation:	<b>9.9 / 2.0</b>	<b>- / 1.9</b>
* Compressive strength		
** Compressive stress at 10% deformation		

The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.1$  MPa

**Table 8b.** Results of the determination of modulus of elasticity in compression

No.	Modulus of elasticity in compression, MPa, materials	
	with a minimum density (70x70mm post)	with a maximum density (70mm pile)
1	2	3
1	744.8	626.0
2	683.9	610.2
3	417.2	362.2
4	726.9	580.0
5	1047.0	568.5
6	575.3	644.0
Mean value	<b>699.2</b>	<b>565.2</b>
Standard deviation:	<b>209.2</b>	<b>103.3</b>

The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.1$  MPa

### 3.9 bending strength and modulus of elasticity when bending (outside the scope of accreditation)

The bending strength and modulus of elasticity when bending the boards were checked in a three-point bending test according to PN-EN 15534-1:2014, Annex A.

The boards were mounted rigidly to square joists using screws supplied by the Client (6x60mm or 6x80mm).

The test was performed under the following conditions:

- cylindrical load thrust with diameter of: 30 mm,
- support/joist with square section and side length of: 50 mm or 70 mm

Test results are presented in table 9.

**Table 9.** Results of the determination of the bending properties of the board

No.	Object and test conditions	Deflection at 500 N, mm	Destructive force, N	Bending strength, MPa	Modulus of elasticity when bending, MPa
1	2	3	4	5	6
1	Smooth board with cross section of 65x30 mm and 400 mm long Spacing of supports 300 mm Supports 50x50mm Screws 6x60mm	1.67	3884	66.0	11074
2		1.90	3743	62.0	9083
3		2.14	3801	62.6	8076
4		1.70	3578	57.9	9984
5		1.51	3494	56.9	11204
6		1.58	3433	56.2	10756
7		1.68	3765	61.2	9669
8		2.03	3349	53.6	8293
Mean value:		1.78	3631	59.6	9767
Single value		maximum 2.14	minimum 3349	-	-
9	Smooth board with cross section of 80x20 mm and 350 mm long Spacing of supports 250 mm Supports 50x50mm Screws 6x60mm	1.27	2913	33.8	2260
10		1.60	2499	29.2	1880
11		1.58	2578	30.0	1971
12		1.84	2607	30.4	1662
13		1.32	2281	26.3	2267
14		1.65	2675	30.6	1794
15		1.40	2137	24.7	2158
16		1.54	2501	28.8	1939
Mean value:		1.52	2524	29.2	1991
Single value		maximum 1.84	minimum 2137	-	-

cont. of table 9

No.	Test object and test conditions	Deflection at 500 N, mm	Destructive force, N	Bending strength, MPa	Modulus of elasticity when bending, MPa
1	2	3	4	5	6
17	Smooth board with cross section of 100x20 mm and 350 mm long Spacing of supports 250 mm Supports 50x50mm Screws 6x60mm	1.90	3197	28.5	1304
18		1.76	2865	26.7	1321
19		2.07	2814	26.4	1215
20		1.74	3193	28.6	1384
21		1.95	2889	26.8	1289
22		2.42	2728	24.8	981
23		2.00	2798	26.0	1220
24		1.91	2799	26.4	1245
Mean value:		1.97	2910	26.8	1245
Single value		maximum 2.42	minimum 2728	-	-
25	Smooth board with cross section of 120x40 mm and 500 mm long Spacing of supports 400 mm Supports 70x70mm Screws 6x80mm	0.39	10509	32.2	1585
26		0.92	8657	26.8	1075
27		0.40	8108	25.1	1642
28		0.57	9401	29.2	1420
29		0.42	8975	27.5	1040
30		0.25	9778	29.9	1221
31		0.91	9076	27.9	860
32		0.62	8101	25.0	866
Mean value:		0.56	9076	28.0	1214
Single value		maximum 0.92	minimum 8101	-	-
33	Smooth board with cross section of 120x60 mm and 750 mm long Spacing of supports 650 mm Supports 70x70mm Screws 6x80mm	1.14	11318	26.2	1214
34		0.99	11349	26.2	1338
35		1.24	11245	25.8	1098
36		1.22	10420	24.0	1098
37		1.13	11103	25.4	1196
38		1.28	11820	26.9	1059
39		0.49	10953	25.1	1258
40		0.86	11879	27.2	1281
Mean value:		1.04	11261	25.8	1193
Single value		maximum 1.28	minimum 10420	-	-

cont. of table 9

No.	Test object and test conditions	Deflection at 500 N, mm	Destructive force, N	Bending strength, MPa	Modulus of elasticity when bending, MPa
1	2	3	4	5	6
41	Smooth board with cross section of 140x60 mm and 800 mm long Spacing of supports 700 mm Supports 70x70mm Screws 6x80mm	1.43	9032	19.2	982
42		1.25	8500	18.0	1242
43		1.26	9476	20.0	1123
44		1.48	9985	21.2	958
45		1.14	9842	21.0	1245
46		1.15	9453	20.0	1120
47		0.45	9908	20.9	1149
48		1.32	9252	19.4	953
Mean value:		<b>1.18</b>	<b>9431</b>	<b>20.0</b>	<b>1096</b>
Single value		maximum <b>1.48</b>	minimum <b>8500</b>	-	-
49	Smooth tongue-and-groove board with cross section of 140x28 mm and 500 mm long Spacing of supports 400 mm Supports 70x70mm Screws 6x80mm	1.56	4953	26.4	1585
50		1.36	5021	27.0	1563
51		1.64	4712	26.0	1479
52		1.44	4845	25.1	1477
53		1.45	3979	20.4	1460
54		1.27	4752	24.8	1553
55		1.39	5429	27.6	1453
56		1.55	5151	27.7	1633
Mean value:		<b>1.46</b>	<b>4855</b>	<b>25.6</b>	<b>1525</b>
Single value		maximum <b>1.64</b>	minimum <b>3979</b>	-	-

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95%, with a coverage factor of  $k=2$ ,  $U_{p \text{ destructive force}} = 37 \text{ N}$ ,  $U_{p \text{ deflection}} = 0.01 \text{ mm}$

### 3.10 Resistance to hard body impact (outside the scope of accreditation)

The boards' resistance to impacts with a hard body was checked in accordance with PN-EN 15534-1:2014.

The test was carried out after the seasoning at 23°C and after 1 h at -20°C. The impact energy was 7 J. Due to the declared double-sidedness of the boards, the test was performed for each surface separately.

The results of the determination are given in Tables 10.1 and 10.2.

Table 10.1. Results of the check for resistance to impact with a hard body of 65x30mm boards

No.	Sample no.	Surface condition at the point of impact		
		visual evaluation	indentation depth, mm	crack length, mm
1	2	3	4	5
Temp. 23°C, impact energy 7 J - impact on the top				
1	1	indentation	0.095	—
2	2	indentation	0.076	—
3	3	indentation	0.094	—
4	4	indentation	0.091	—
5	5	indentation	0.054	—
6	6	indentation	0.077	—
7	7	indentation	0.151	—
8	8	indentation	0.091	—
9	9	indentation	0.080	—
10	10	indentation	0.102	—
Test result:		No damage*		
Temp. 23°C, impact energy 7 J - impact on the bottom				
11	1	indentation	0.066	—
12	2	indentation	0.058	—
13	3	indentation	<b>0.074</b>	—
14	4	indentation	0.089	—
15	5	indentation	0.092	—
16	6	indentation	0.081	—
17	7	indentation	<b>0.161</b>	—
18	8	indentation	0.067	—
19	9	indentation	0.059	—
20	10	indentation	0.095	—
Test result:		No damage*		
Temp. -20°C, impact energy 7 J - impact on the top				
21	1	indentation	0.049	—
22	2	indentation	0.076	—
23	3	indentation	0.091	—
24	4	indentation	0.076	—
25	5	indentation	0.054	—
26	6	indentation	<b>0.067</b>	—
27	7	indentation	<b>0.052</b>	—
28	8	indentation	0.097	—
29	9	indentation	0.039	—
30	10	indentation	0.072	—
Test result:		No damage*		

cont. of table 10.1

No.	Sample no.	Surface condition at the point of impact		
		visual evaluation	indentation depth, mm	crack length, mm
1	2	3	4	5
Temp. -20°C, impact energy 7 J - impact on the bottom				
31	1	indentation	0.058	—
32	2	indentation	0.042	—
33	3	indentation indentation	0.088	—
34	4		0.082	
35	5	indentation	0.090	—
36	6	indentation	0.069	—
37	7	indentation	0.086	—
38	8	indentation	0.075	—
39	9	indentation	0.052	—
40	10	indentation	0.084	—
Test result:			No damage*	
* A delamination or crack > 10 mm in length and an indentation > 0.5 mm are considered a damage				

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_{p_{depth}} = 0.004\text{mm}$

**Table 10.2.** Results of the check for resistance to impact with a hard body of 140x28mm tongue-and-groove boards

No.	Sample no.	Surface condition at the point of impact		
		visual evaluation	indentation depth, mm	crack length, mm
1	2	3	4	5
Temp. 23°C, impact energy 7 J - impact on the top				
1	1	indentation	0.047	—
2	2	indentation	0.092	—
3	3	indentation	0.080	—
4	4	indentation	0.076	—
5	5	indentation	0.079	—
6	6	indentation	0.072	—
7	7	indentation	0.061	—
8	8	indentation	0.078	—
9	9	indentation	0.071	—
10	10	indentation	0.067	—
Test result:			No damage*	
Temp. 23°C, impact energy 7 J - impact on the bottom				
11	1	indentation	0.062	—
12	2	indentation	0.086	—
13	3	indentation	0.089	—
14	4	indentation	0.049	—
15	5	indentation indentation	0.091	-
16	6		0.079	
17	7	indentation	0.082	—
18	8	indentation	0.092	—
19	9	indentation	0.063	—
20	10	indentation	0.059	—
Test result:			No damage*	

cont. of table 10.2

No.	Sample no.	Surface condition at the point of impact		
		visual evaluation	indentation depth, mm	crack length, mm
1	2	3	4	5
Temp. -20°C, impact energy 7 J - impact on the top				
21	1	indentation	0.088	—
22	2	indentation	0.073	—
23	3	indentation	0.081	—
24	4	indentation	0.053	—
25	5	indentation	0.074	—
26	6	indentation	0.099	—
27	7	indentation	0.078	—
28	8	indentation	0.066	—
29	9	indentation	0.072	—
30	10	indentation	0.093	—
Test result:		No damage*		
Temp. -20°C, impact energy 7 J - impact on the bottom				
31	1	indentation	0.091	—
32	2	indentation	0.065	—
33	3	indentation	0.087	—
34	4	indentation	0.077	—
35	5	indentation	0.095	—
36	6	indentation	0.090	—
37	7	indentation	0.062	—
38	8	indentation	0.089	—
39	9	indentation	0.093	—
40	10	indentation	0.090	—
Test result:		No damage*		

\* A delamination or crack > 10 mm in length and an indentation > 0.5 mm are considered a damage

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_{p_{depth}} = 0.004\text{mm}$

### 3.11 Durability after aging with xenon lamps

Aging with xenon lamps was performed under the following conditions:

- exposure: according to PN-EN ISO 4892-2:2013, method A (rain shower cycle 18/102, BST  $65\pm 3^\circ\text{C}$ , RH  $50\pm 10\%$ , radiation intensity  $60\pm 2\text{ W/m}^2$ ),
- exposure time: 300h,
- type of equipment: BETA camera (with xenon arc lamp as light source and an external filter).

The durability of the material of which the tested boards are made was determined by the color difference between the samples before and after aging.

#### Color difference

The color difference between the material of boards aged under artificial conditions (see section 3.11) and non-aged boards was determined according to PN-ISO 7724-2:2003 and PN-ISO 7724-3:2003, using a spectrophotometer and at the following measurement conditions:

- measurement surface and mirror component: M/SCI,
- lighting: D65,
- observer:  $10^\circ$ .



The results of the determination of the color difference are given in Table 11.

**Table 11.** Results of determination of color difference of the surfaces of aged and non-aged boards

No.	Color components of aged surface	Psychometric brightness difference $\Delta L^*$	Coordinate difference		Color difference $\Delta E^*_{ab}$
			$\Delta a^*$	$\Delta b^*$	
1	2	3	4	5	6
Grey color - smooth board 65x30mm					
1	$L^*=38.41, a^*=-1.15, b^*=-1.38$	4.40	-1.57	-2.06	5.11
2	$L^*=37.66, a^*=-1.28, b^*=-1.76$	3.06	-1.45	-2.06	3.96
3	$L^*=36.72, a^*=-0.58, b^*=-1.36$	3.77	-2.19	-2.02	4.81
Mean value:		<b>3.75</b>	<b>-1.74</b>	<b>-2.04</b>	<b>4.63</b>
Brown color - smooth board 120x40mm					
6	$L^*=29.62, a^*=0.26, b^*=0.40$	0.18	-0.33	-0.50	0.63
7	$L^*=29.61, a^*=0.14, b^*=0.13$	0.14	-0.28	-0.49	0.58
8	$L^*=28.63, a^*=0.35, b^*=1.43$	-0.49	-0.43	-1.51	1.64
Mean value:		<b>-0.06</b>	<b>-0.35</b>	<b>-0.83</b>	<b>0.95</b>

Expanded uncertainty of color difference measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.30$

### 3.12 Resistance to humid conditions

#### 3.12.1. Swelling and water absorption (outside the scope of accreditation)

Determination of board swelling and water absorption was performed according to PN-EN 15534-1:2014, on samples of full width and length of approx. 100 mm. Intermediate measurements were recorded during the test (after 24 hours and after 2, 4, 7, 14 and 28 days of immersion in water).

The results of the determination are presented in tables 12.1 a and 12.1b.

**Table 12.1a.** Results of the determination of swelling of the boards

No.	Measurement direction	Swelling, %, after soaking in water for:					
		24 h	2 days	4 days	7 days	14 days	28 days
1	2	3	4	5	6	7	8
		Smooth		board	65x30mm		
1	length	0.00	0.00	0.00	0.01	0.05	0.05
	width	0.00	0.00	0.01	0.03	0.03	0.03
	thickness	0.03	0.07	0.07	0.07	0.07	0.07
2	length width	0.05	0.07	0.08	0.09	0.10	0.10
		0.01	0.01	0.03	0.03	0.04	0.09
	thickness	0.03	0.03	0.07	0.07	0.10	0.10
3	length	0.00	0.01	0.01	0.03	0.03	0.03
	width	0.03	0.04	0.04	0.06	0.06	0.07
	thickness	0.07	0.07	0.07	0.07	0.07	0.07
4	length	0.02	0.02	0.03	0.03	0.03	0.03
	width	0.01	0.01	0.03	0.04	0.04	0.06
	thickness	0.07	0.07	0.07	0.10	0.10	0.14
5	length	0.00	0.01	0.02	0.02	0.02	0.02
	width	0.01	0.03	0.03	0.04	0.06	0.07
	thickness	0.03	0.14	0.17	0.17	0.17	0.17

cont. of table 12.1 a

No.	Measurement direction	Swelling, %, after soaking in water for:					
		24 h	2 days	4 days	7 days	14 days	28 days
1	2	3	4	5	6	7	8
						Mean value:	0.05 (in length) 0.07 (in width) 0.11 (in thickness)
						Maximum single value:	0.10 (in length) 0.09 (in width) 0.17 (in thickness)
Smooth board 120x40mm							
6	length	0.01	0.01	0.01	0.01	0.02	0.02
	width	0.05	0.05	0.05	0.05	0.06	0.06
	thickness	0.05	0.11	0.16	0.19	0.24	0.27
7	length	0.00	0.00	0.00	0.01	0.02	0.04
	width	0.00	0.00	<b>0.01</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>
	thickness	0.13	0.13	0.13	<b>0.13</b>	0.16	0.16
8	length	0.00	0.01	0.01	0.02	0.04	0.04
	width	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.02</b>	<b>0.02</b>
	thickness	0.00	0.03	0.03	0.03	0.08	0.16
9	length	0.00	0.01	0.01	0.01	0.03	0.05
	width	0.00	0.00	<b>0.01</b>	<b>0.02</b>	0.02	0.03
	thickness	0.22	0.24	0.24	0.24	0.24	0.30
10	length	0.00	0.00	0.01	0.01	0.02	0.02
	width	<b>0.18</b>	<b>0.19</b>	0.21	<b>0.21</b>	<b>0.21</b>	<b>0.22</b>
	thickness	0.03	0.03	0.03	0.08	0.16	0.22
						Mean value:	0.03 (in length) 0.07 (in width) 0.22 (in thickness)
						Maximum single value:	0.05 (in length) 0.22 (in width) 0.30 (in thickness)
Smooth board 140x60mm							
11	length	0.01	0.02	0.02	0.04	<b>0.05</b>	0.08
	width	0.00	0.00	0.00	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>
	thickness	0.00	0.02	0.02	0.02	0.02	0.05
12	length	0.00	0.01	0.01	0.01	0.01	0.02
	width	0.01	0.01	0.01	<b>0.01</b>	0.01	0.03
	thickness	0.00	0.00	0.00	0.02	0.02	0.02
13	length	0.00	0.00	0.00	0.00	0.01	0.04
	width	<b>0.00</b>	0.00	<b>0.00</b>	0.00	<b>0.01</b>	<b>0.02</b>
	thickness	0.03	0.05	0.05	0.05	0.07	0.07
14	length	0.00	0.00	0.00	0.01	0.01	0.03
	width	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	0.03
	thickness	0.02	0.02	0.02	0.02	0.02	0.05
15	length	0.00	0.00	0.00	0.00	0.01	0.01
	width	0.01	0.01	0.01	0.01	0.01	0.01
	thickness	0.09	0.10	0.10	0.10	0.14	0.14

cont. of table 12.1 a

No.	Measurement direction	Swelling, %, after soaking in water for:					
		24 h	2 days	4 days	7 days	14 days	28 days
1	2	3	4	5	6	7	8
Mean value:							0.04 (in length) 0.02 (in width) 0.07 (in thickness)
Maximum single value:							0.08 (in length) 0.03 (in width) 0.14 (in thickness)
Smooth tongue-and-groove board 140x28mm							
	length	0.01	0.01	0.01	0.02	0.04	0.05
	width	0.00	0.00	0.00	0.00	0.01	0.01
	thickness	0.00	0.00	0.00	0.04	0.07	0.07
	length	0.01	0.01	0.01	0.02	0.03	0.05
	width	0.01	0.01	0.01	0.01	0.03	0.04
	thickness	0.04	0.04	0.07	0.11	0.11	0.18
	length	0.00	0.00	0.00	0.00	0.00	0.02
	width	0.01	0.01	0.01	0.02	0.04	0.04
	thickness	0.07	0.07	0.07	0.10	0.10	0.14
	length	0.01	0.01	0.01	0.03	0.03	0.03
	width	0.03	0.04	0.05	0.06	0.08	0.11
	thickness	0.00	0.00	0.00	0.00	0.00	0.11
	length	0.01	0.01	0.08	0.08	0.08	0.14
	width	0.01	0.01	0.01	0.01	0.01	0.05
	thickness	0.04	0.04	0.04	0.07	0.07	0.25
Mean value:							0.06 (in length) 0.05 (in width) 0.15 (in thickness)
Maximum single value:							0.14 (in length) 0.11 (in width) 0.25 (in thickness)

Expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.04\text{mm}$

Table 12.1 b. Results of the determination of water absorption of the boards

No.	Absorption, %, after soaking in water for:					
	24 h	2 days	4 days	7 days	14 days	28 days
1	2	3	4	5	6	7
Smooth board 65x30mm						
1	0.36	0.39	0.42	0.48	0.68	1.01
2	0.29	0.37	0.38	0.43	0.51	0.69
3	0.37	0.40	0.43	0.57	0.72	0.92
4	0.27	0.33	0.34	0.38	0.47	0.64
5	0.34	0.37	0.41	0.52	0.96	1.78
Mean value:						1.01
Maximum single value:						1.78

cont. of table 12.1b

No.	Absorption, %, after soaking in water for:					
	24 h	2 days	4 days	7 days	14 days	28 days
1	2	3	4	5	6	7
Smooth board 120x40mm						
6	0.68	0.82	0.91	1.02	1.18	1.37
7	0.84	1.01	1.10	1.32	1.58	1.83
8	0.60			0.77		
9	0.38	0.47	0.51	0.61	0.67	0.92
10	0.46	0.56	0.59	0.65	0.86	0.95
Mean value:						1.25
Maximum single value:						1.83
Smooth board 140x60mm						
11	0.13	0.16	0.17	0.21	0.26	0.34
12	0.16	0.17	0.18	0.22	0.26	0.34
13	0.21	0.39	0.43	0.49	0.71	0.82
14	0.15		0.21			
15	0.17	0.20	0.21	0.27	0.43	0.60
Mean value:						0.54
Maximum single value:						0.82
Smooth board 140x28mm						
16	0.38	0.46	0.50	0.54	0.59	0.68
17	0.37	0.44	0.46	0.48	0.55	0.69
18	0.28	0.29	0.31	0.38	0.41	0.50
19	0.51	0.51	0.52	0.65	0.70	0.78
20	0.41	0.56	0.59	0.73	0.83	1.00
Mean value:						0.73
Maximum single value:						1.00

The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.04g$

### 3.12.2. Resistance to humid conditions under the influence of cyclic effects of changing conditions (outside the scope of accreditation)

Resistance of boards to humid conditions with the use of cyclic effects:

- Cycle 1: 28 days soaking in water, 24 h freezing at  $-20^{\circ}\text{C}$ , 72 h drying at  $+70^{\circ}\text{C}$ .
- Cycles 2 and 3: 72 h soaking in water, 24 h freezing at  $-20^{\circ}\text{C}$ , 72 h drying at  $+70^{\circ}\text{C}$ .

performed in accordance with PN-EN 15534-1:2014, sec. 8.3.2.

After the cycles were completed, the samples were stored for 72 hours under laboratory conditions (temp.  $+23\pm 2^{\circ}\text{C}$  and  $50\pm 5\%$  relative humidity), and then the bending strength was tested according to the conditions given in section 3.9 of the report (PN-EN 15534-1:2014, Annex A).

The results are shown in Table 12.2.

**Table 12.2.** Results of the determination of the bending strength of the boards after cyclical effects of humid conditions

No.	Bending strength, MPa, of	
	smooth boards 65x30mm	smooth tongue-and-groove boards 140x28mm
1	2	3
1	28.4	24.2
2	27.8	<b>23.7</b>
3	<b>28.0</b>	<b>24.1</b>
4	28.8	23.9
5	28.4	28.3
6	<b>27.6</b>	<b>25.4</b>
7	<b>28.6</b>	<b>25.8</b>
8	25.7	26.5
Mean value:	<b>27.9 (53.2% drop)</b>	<b>25.2 (1.6% drop)</b>
Weakest single value	<b>25.7 (54.3% drop)</b>	<b>23.7 (16.2% rise)</b>

*The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.1$  MPa*

### 3.12.3. Cooking test (outside the scope of accreditation)

The cooking test was carried out in accordance with PN-EN 15534-1:2014, sec. 8.3.3, on approx. 100mm long samples obtained from smooth tongue-and-groove boards with a cross-section of 140x28mm.

As a result, the change in weight between the samples before and after the cooking test was determined. The results are shown in Table 12.3.

**Table 12.3.** Results of the determination of the weight change after the smooth board cooking test

No.	Change in weight, % (by weight)
1	2
1	0.33
2	<b>0.32</b>
3	<b>0.40</b>
4	<b>0.54</b>
5	0.71
Average:	<b>0.46</b>
Maximum single value	<b>0.71</b>

*The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.04g$*

### 3.13 Chemical resistance to aggressive environment (outside the scope of accreditation)

The chemical resistance of the boards was tested in accordance with PN-EN ISO 175:2010, on samples with dimensions (60 X 60)mm and thickness of  $1.4 \pm 0.1$ mm, obtained from the outer layer of the finished product (70x70mm post). A 10% NaCl solution was used as the aggressive environment.

The resistance of the boards was determined on the basis of the change in weight and linear dimensions, after 7 days in NaCl environment.

The test results are given in tables 13a and 13b.

**Table 13a.** Results of weight change determination after the activity of NaCl solution

No.	Change in weight, % (by weight), after 7 days in a 10% NaCl solution	
	measurement immediately after extraction from the solution	measurement after drying to constant mass at 50°C
1	2	3
1	+4.0	+0.2
2	+5.5	+0.3
3	+3.3	+0.3
Average:	+4.3	+0.3

Note: the '+' sign indicates weight gain of the sample

The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.04g$

**Table 13b.** Results of dimensions change determination after the activity of NaCl solution

No.	Change in dimensions, %, after 7 days in a 10% NaCl solution					
	measurement immediately after extraction from the solution, in the direction of			measurement after drying to constant mass at 50°C		
	length	width	thickness	length	width	thickness
1	2	3	4	5	6	7
1	+0.4	+0.3	-1.4	+0.4	+0.1	-2.1
2	+0.2	-0.3	-1.5	-0.2	+0.4	0.0
3	+0.1	+0.4	-1.3	0.0	+0.5	0.0
Average:	+0.2	+0.4; -0.3	-1.4	+0.4; -0.2	+0.3	-2.1

Note: the "+" sign indicates elongation of the sample, "-" indicates its shrinkage

The expanded uncertainty of measurement (related to the accuracy of the equipment used) at a confidence level of 95% and with a coverage factor of  $k=2$ ,  $U_p = 0.04g$

#### 4. TECHNICAL ASSESSMENT - outside the scope of accreditation

The test results obtained (mean values) are presented in Table 14 and compared with the requirements specified for floorboards of similar application according to PN-EN 15534-4:2014 standard.

**Table 14.** Summary of the results for WOOTEX/RETEXTILE profiles with the requirements of PN-EN 15534-4:2014

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
1	Dimensions and dimensional deviations, mm, of smooth board 65x30mm, on:	Dimensional deviations calculated from the declared value are given in brackets 1195 (-5) 67,50 (+2.50)	as declared by the manufacturer
	- length		±5
	- width		±2
	- height	28.25 (-1.75)	
	smooth board 80x20mm, on:		
	- length	1204 (+4)	±5
	- width	80.22 (+0.22)	±2
	- height	20.07 (+0.07)	
	smooth board 100x20mm, on:		
	- length	1199 (-1)	±5
- width	99.18 (-0.82)	±2	
- height	20.53 (+0.53)		

cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
	<b>smooth board 120x40mm, on:</b>		
	- length	1204 (+4)	±5
	- width	120.78 (+0.78)	±2
	- height	38.54 (-1.46)	
	<b>smooth board 120x60mm, on:</b>		
	- length	1210 (+10)	±5
	- width	119.22 (-0.78)	±2
	- height	57.83 (-2.17)	
	<b>smooth board 140x60mm, on:</b>		
	- length	1197 (-3)	±5
	- width	136.46 (-3.54)	±2
	- height	59.22 (-0.78)	
	<b>smooth tongue-and-groove board 140x28mm, on:</b>		
	- length	1206 (+6)	±5
	- width	140.15 (+0.15)	±2
	- height	28.48 (+0.48)	
	<b>beam (post) 50x50mm, on:</b>		
	- length	1219 (+19)	±5
	- width	52.95 (+2.95)	±2
	- height	52.81 (+2.81)	
	<b>beam (post) 70x70mm, on:</b>		
	- length	1206 (+6)	±5
	- width	68.89 (-1.11)	±2
	- height	69.31 (-0.61)	
	<b>beam (post) 90x90mm, on:</b>		
	- length	1188 (-12)	±5
	- width	88.54 (-1.46)	±2
	- height	88.10 (-1.90)	
	<b>piles with a diameter of 70mm, in the direction of:</b>		
	- length	1205 (+5)	±5
	- diameter	68.52 (-1.48)	±2
	<b>piles with a diameter of 90mm, in the direction of:</b>		
	- length	1213 (+13)	±5
	- diameter	93.32 (+3.32)	±2
	<b>piles with a diameter of 120mm, in the direction of:</b>		
	- length	1202 (+2)	±5
	- diameter	123.66 (+3.66)	±2

cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
2	Maximum deviation from the edge straightness, mm/m (max value), <b>of smooth board (cross-section 120x40mm):</b> - left - flat	1.15	as declared by the manufacturer
	- left - on end	0.95	
	- right - flat	1.15	
	- right - on end	1.00	
	<b>smooth tongue-and-groove board (cross-section 140x28mm):</b>		as declared by the manufacturer
	- left - flat	1.00	
	- left - on end	0.50	
	- right - flat	1.25	
	- right - on end	0.60	
	<b>beam (post) (cross-section 50x50mm):</b>		as declared by the manufacturer
	- left - flat	0.80	
	left - on end	0.40	
	- right - flat	0.45	
	- right - on end	0.50	
3	Cross curvature, mm, <b>smooth board 120x40mm:</b> top surface	2.952	as declared by the manufacturer
	- bottom surface	2.891	
	<b>smooth tongue-and-groove board (cross-section 140x28mm):</b>		as declared by the manufacturer
	- top surface	2.005	
	- bottom surface	2.105	
	<b>beam (post) (cross-section 50x50mm):</b>		as declared by the manufacturer
	- top surface	0.501	
	- bottom surface	0.430	
4	PTV slip resistance of the boards for the harshest conditions, i.e. for a wet surface along the <b>smooth board with a cross-section of 100x20mm:</b>	58	≥36
5	Apparent density (total), kg/m <sup>3</sup> :		no requirements
	- smooth board 65x30mm (minimum cross-section)	995.4	
	- smooth board 140x60mm (maximum cross-section)	1052.1	
	- pile 70mm (minimum diameter)	2063.3	
	- pile 120mm (maximum diameter)	2032.1	
	- beam (post) 70x70mm (intermediate cross-section)	1052.7	



cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
6	Softening temperature according to Vicat, °C, plastics - with a minimum density (smooth board 65x30mm)	42.0	no requirements
	- with a maximum density (70mm pile)	48.7	
7	Coefficient of linear thermal expansion in the temperature range -20 + 70°C, 1/°C - with a minimum density (smooth board 65x30mm)	5.17·10 <sup>-5</sup>	<5·10 <sup>-5</sup>
	- with a maximum density (70mm pile)	7.93·10 <sup>-5</sup>	
8	Compressive strength / compressive stress at 10% deformation, MPa, materials - with a low density (70x70mm post)	<b>39.9 / 24.3</b>	no requirements
	- with a maximum density (70mm pile)	- / 19.8	
9	Modulus of elasticity in compression, MPa, materials - with a low density (70x70mm post)	699.2	no requirements
	- with a maximum density (70mm pile)	565.2	
10	Bending properties: <b>of a smooth board 65x30mm</b> (spacing of supports 300mm): - destructive force, N:	3631 (mean value) 3349 (min. single value)	≥ 3300 (mean value) ≥ 3000 (min. single value)
	- deflection, mm, at 500 N, at bending:	1.78 (mean value) 2.14 (max. single value)	≥ 2.0 (mean value) ≤ 2.5 (max. single value)
	- bending strength, MPa	59.6 (mean value) 53.6 (min. single value)	no requirements
	- modulus of elasticity when bending, MPa	9767 (mean value) 8076 (min. single value)	no requirements
	<b>of a smooth board 80x20mm</b> (spacing of supports 250 mm): - destructive force, N:	2524 (mean value) 2137 (min. single value)	≥ 3300 (mean value) ≥ 3000 (min. single value)
	- deflection, mm, at 500 N, at bending:	1.52 (mean value) 1.84 (max. single value)	≥ 2.0 (mean value) ≥ 2.5 (max. single value)

cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
	- bending strength, MPa	29.2 (mean value) 24.7 (min. single value)	no requirements
	- modulus of elasticity when bending, MPa	1991 (mean value) 1662 (min. single value)	no requirements
	<b>of a smooth board 100x20mm</b> (spacing of supports 350 mm):		
	- destructive force, N:	2910 (mean value) 2728 (min. single value)	$\geq 3300$ (mean value) $\geq 3000$ (min. single value)
	- deflection, mm, at 500 N, at bending:	1.97 (mean value) 2.42 (max. single value)	$\leq 2.0$ (mean value) $\leq 2.5$ (max. single value)
	- bending strength, MPa	26.8 (mean value) 24.8 (min. single value)	no requirements
	- modulus of elasticity when bending, MPa	1245 (mean value) 981 (min. single value)	no requirements
	<b>of a smooth board 120x40mm</b> (spacing of supports 400 mm):		
	- destructive force, N:	9076 (mean value) 8101 (min. single value)	$\geq 3300$ (mean value) $\geq 3000$ (min. single value)
	- deflection, mm, at 500 N, at bending:	0.56 (mean value) 0.92 (max. single value)	$\leq 2.0$ (mean value) $\leq 2.5$ (max. single value)
	- bending strength, MPa	28.0 (mean value) 25.0 (min. single value)	no requirements
	- modulus of elasticity when bending, MPa	1214 (mean value) 860 (min. single value)	no requirements
	<b>of a smooth board 120x60mm</b> (spacing of supports 650 mm):		
	- destructive force, N:	11261 (mean value) 10420 (min. single value)	$\geq 3300$ (mean value) $\geq 3000$ (min. single value)
	- deflection, mm, at 500 N, at bending:	1.04 (mean value) 1.28 (max. single value)	$\leq 2.0$ (mean value) $\leq 2.5$ (max. single value)
	- bending strength, MPa	25.8 (mean value) 24.0 (min. single value)	no requirements
	- modulus of elasticity when bending, MPa	1193 (mean value) 1098 (min. single value)	no requirements
	<b>of a smooth board 140x60mm</b> (spacing of supports 700 mm):		
	- destructive force, N:	9431 (mean value) 8500 (min. single value)	$\geq 3300$ (mean value) $\geq 3000$ (min. single value)
	- deflection, mm, at 500 N, at bending:	1.18 (mean value) 1.48 (max. single value)	2.0 (mean value) 2.5 (max. single value)
	- bending strength, MPa	20.0 (mean value) 18.0 (min. single value)	no requirements

cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
	- modulus of elasticity when bending, MPa	1096 (mean value) 953 (min. single value)	no requirements
	<b>smooth tongue-and-groove board 140x28mm</b> (spacing of supports 400mm):		
	- destructive force, N:	4855 (mean value) 3979 (min. single value)	$\geq 3300$ (mean value) $\geq 3000$ (min. single value)
	- deflection, mm, at 500 N, at bending:	1.46 (mean value) 1.64 (max. single value)	$\leq 2.0$ (mean value) $\leq 2.5$ (max. single value)
	- bending strength, MPa	25.6 (mean value) 20.4 (min. single value)	no requirements
	- modulus of elasticity when bending, MPa	1525 (mean value) 1453 (min. single value)	no requirements
11	Hard body impact resistance, of <b>smooth board (cross-section 65x30mm)</b>		
	- at 23°C - impact in the upper side	No damage at 7 J	no damage at 7 J
	- at 23°C - impact in the lower side	No damage at 7 J	
	- at -20°C - impact in the upper side	No damage at 7 J	
	- at -20°C - impact in the lower side	No damage at 7 J	
	<b>smooth tongue-and-groove board (cross-section 140x28mm)</b>		
	- at 23°C - impact in the upper side	No damage at 7 J	no damage at 7 J
	- at 23°C - impact in the lower side	No damage at 7 J	
	- at -20°C - impact in the upper side	No damage at 7 J	
	- at -20°C - impact in the lower side	No damage at 7 J	
12	Durability after aging with xenon lamps under artificial conditions after 300 h of irradiation: ■ smooth board (65x30mm), <b>gray in color</b> , determined by the difference of:		
	- psychrometric brightness $\Delta L^*$	3.75	$\Delta L^*$ , $\Delta a^*$ , $\Delta b^*$ as declared by the manufacturer
	- color coordinate $\Delta a^*$	-1.74	
	- color coordinate $\Delta b^*$	-2.04	
	- color $\Delta E^*_{ab}$	4.63	no requirements

cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
	■ smooth board (120x40mm), <b>brown in color</b> , determined by the difference of		
	- psychrometric brightness $\Delta L^*$	-0.06	$\Delta L^*$ , $\Delta a^*$ , $\Delta b^*$ as declared by the manufacturer
	- color coordinate $\Delta a^*$	-0.35	
	- color coordinate $\Delta b^*$	-0.83	
	- color $\Delta E^*_{ab}$	0.95	no requirements
13	Swelling, %, after 28 days of immersion of the board in water: ■ <b>smooth board 65x30mm</b> , on: - thickness	0.05 (mean value) 0.10 (max. single value)	$\leq 4$ (mean value) $\leq 5$ (max. single value)
	- width	0.07 (mean value) 0.09 (max. single value)	$\leq 0.8$ (mean value) $\leq 1.2$ (max. single value)
	- length	0.11 (mean value) 0.17 (max. single value)	$\leq 0.4$ (mean value) $\leq 0.6$ (max. single value)
	■ <b>smooth board 120x40mm</b> , on: - thickness	0.03 (mean value) 0.05 (max. single value)	$\leq 4$ (mean value) $\leq 5$ (max. single value)
	- width	0.07 (mean value) 0.22 (max. single value)	$\leq 0.8$ (mean value) $\leq 1.2$ (max. single value)
	- length	0.22 (mean value) 0.30 (max. single value)	$\leq 0.4$ (mean value) $\leq 0.6$ (max. single value)
	■ <b>smooth board 140x60mm</b> , on: - thickness	0.04 (mean value) 0.08 (max. single value)	$\leq 4$ (mean value) $\leq 5$ (max. single value)
	- width	0.02 (mean value) 0.03 (max. single value)	$\leq 0.8$ (mean value) $\leq 1.2$ (max. single value)
	- length	0.07 (mean value) 0.14 (max. single value)	$\leq 0.4$ (mean value) $\leq 0.6$ (max. single value)
	■ <b>smooth tongue-and-groove board 140x28mm</b> , on: - thickness	0.06 (mean value) 0.14 (max. single value)	$\leq 4$ (mean value) $\leq 5$ (max. single value)
	- width	0.05 (mean value) 0.11 (max. single value)	$\leq 0.8$ (mean value) $\leq 1.2$ (max. single value)
	- length	0.15 (mean value) 0.25 (max. single value)	$\leq 0.4$ (mean value) $\leq 0.6$ (max. single value)

cont. of table 14

Item	Properties	Test results (mean values)	Requirement according to PN-EN 15534-4:2014
1	2	3	4
14	Water absorption, %, after 28 days of immersion of the board in water		
	- smooth board 65x30mm	1.01 (mean value) 1.78 (max. single value)	$\leq 7$ (mean value) $\leq 9$ (max. single value)
	- smooth board 120x40mm	1.25 (mean value) 1.83 (max. single value)	
	- smooth board 140x60mm	0.54 (mean value) 0.82 (max. single value)	
- smooth board 140x28mm	0.73 (mean value) 1.00 (max. single value)		
15	Resistance to humid conditions after cyclic effects, determined by the change in bending strength, % - of smooth board 65x30mm		
	- smooth tongue-and-groove board 65x30mm	-53.2 (mean value drop) -54.3 (single value drop)	$\leq 20$ (average drop) $\leq 30$ (single value)
16	Cooking test determined by change in weight, % (smooth tongue-and-groove board 140x28mm)	0.46 (mean value) 0.71 (max. single value)	
17	Chemical resistance to aggressive environment (10% NaCl solution), of outer layer of the 70x70mm post, determined by: ■ change in weight (by weight), %	+4.3 (immediately after taking out) +0.3 (after drying to constant mass at 50°C)	no requirements
	■ change in dimensions, % - on length  - on width  - on thickness	+0.2 (immediately after taking out) +0.4; -0.2 (after drying to constant mass at 50°C) +0.4; -0.3 (immediately after taking out) +0.3 (after drying to constant mass at 50°C) -1.4 (immediately after removal) - 2.1 (after drying to constant weight at 50°C)	

Analysis of test results shown in table 14:

- A. Dimensional deviations (item 1) and shape deviations (items 2 and 3) were checked for selected profiles considered to be representative of the product range submitted for testing, included in Appendix no. 1 to this report.
- for some of the profiles, dimensional deviations higher than the declared ones were found, especially for length deviations,
  - deviations from the straightness of boards and beams were small and are acceptable for this type of products,
  - the cross curvature of the boards at the level of 3mm is significantly high, in case of beams the deviation was much lower (<0.5mm).
- B. Slip resistance of the smooth board (item 4), tested at the least favorable position (along the board) and conditions (wet) meets the requirements of PN-EN 15534-4:2014. The result obtained can be applied to the remaining cross-sections of

boards with smooth surfaces.

- C. The apparent density (item 5) of the boards and piles was determined on the minimum and maximum cross-section, while for beams on the intermediate cross-section. The tests have shown that boards and beams (posts) have a similar density (approx.  $1000\text{kg/m}^3$ ), while the density of piles is 2 times higher.
- D. The properties of the material (items 6-9) of which the tested elements are made were made on the samples cut from the top surface of the profiles for which the lowest (65x30mm board) or low density (70x70mm post) and the highest density (70mm pile) were found.

The test results for:

- Vicat softening point,
- linear expansion coefficient,
- compressive strength or compressive stress at 10% deformation,
- modulus of elasticity in compression,

obtained from samples obtained from low density boards can be compared to other boards and beams (posts) of similar density, while the results obtained from samples obtained from high density piles can be compared to other piles of similar density.

- E. The bending properties (item 10) were checked for selected cross-sections of boards considered to be representative of the assortment submitted for testing. In the context of bending properties, the results obtained for a board with a smaller cross-section can be referred to a board with a higher cross-section.
- F. The resistance to impact with a hard body (item 11) was determined for the minimum cross-section of the smooth board (65x30mm) and the smooth tongue-and-groove board (140x28mm). In both cases, both in positive and negative temperature, full impact resistance of the boards at 7 J was found.
- G. In the test of resistance to aging in artificial conditions (item 12), after 300 hours of irradiation the following was found:
- a color difference  $\Delta E^*_{ab}$  in the surface of the gray boards of not more than 5 - such a result should be considered as a visible deviation, but in the context of the intended use, a difference at this level can be accepted,
  - a color difference  $\Delta E^*_{ab}$  in the surface of the brown boards of not more than 1 - such a change indicates a slight deviation from the original color, within the measurement tolerance.
- H. Swelling (item 13) and water absorption (item 14) were checked on 4 different cross-sections of the boards. Similar results were obtained, meeting the requirements of PN-EN 15534-4:2014.
- I. The cooking test (item 16), performed on samples obtained from a low density board, showed a small, acceptable weight gain (water absorption).
- J. Resistance to humid conditions after cyclic effects (item 15) was determined on the basis of the change in bending strength of smooth boards with the smallest cross-section (65x30mm and straight sides and 140x28mm and tongue-and-groove sides).

As a result of testing a board of 140x28mm cross-section and tongue-and-groove sides, a slight acceptable decrease in bending strength was obtained, while for a board of 65x30mm cross-section the decrease was significant (above 50%). A negative result obtained on the minimum cross-section of smooth boards does not allow a positive assessment of the resistance to cyclic effects of the remaining cross-sections of smooth boards.

- K. Chemical resistance of the material (item 17) was tested for the influence of one type of aggressive environment, i.e. A 10% NaCl solution, on samples obtained from the external surface of the low density profile (70x70mm post). As a result of the test, a slight increase in weight and changes in linear dimensions were obtained. Thus, the tested material can be considered as resistant to 10% NaCl solution.

When evaluating the results with the criteria given in PN-EN 15534-4:2014, a simple acceptance rule was applied, according to which a product is deemed to be compliant with regard to the result, if the result, without taking into account the variability resulting from the measurement uncertainty, meets the requirement. This is related to the risk of misassessment, resulting from not taking into account the uncertainty in the assessment. The risk also results from the fact that the laboratory has no knowledge about the variability of the product population, but only about the tested sample.

Person responsible for testing


**Iwona Komosa, MSc, Eng,**



**Signature**

Person authorizing the report

**Iwona Gałąska, Eng**



**Signature**

LZM Laboratory Manager

**Ewa Sudol, PhD, Eng**



**Signature**

**Warszawa, 18.02.2019**

*The Testing Laboratory declares that the test results refer only to the tested object. Without written consent of the Testing laboratory, the Report cannot be reproduced otherwise than in whole.*

*The test report shall not replace the documents required for the placing on the market and making available of construction products*

Assortment of boards, beams and piles submitted by the Client for testing.

Item	Type of element	Length, mm	Cross-section width, mm	Cross-section height, mm
1	2	3	4	5
1	Smooth board	600 - 3600	<b>65</b>	<b>30</b>
		600 - 3600	60	50
		600 - 3600	<b>80</b>	<b>20</b>
		600 - 3600	80	35
		600 - 3600	95	40
		600 - 3600	<b>100</b>	<b>20</b>
		600 - 3600	100	30
		600 - 3600	100	40
		600 - 3600	100	50
		600 - 3600	<b>120</b>	<b>40</b>
		600 - 3600	120	50
		600 - 3600	<b>120</b>	<b>60</b>
		600 - 3600	120	70
		600 - 3600	<b>140</b>	<b>60</b>
		600 - 3600	150	40
2	Smooth tongue-and-groove board	600 - 3600	<b>140</b>	<b>28</b>
		600 - 3600	140	32
		600 - 3600	140	40
3	Corrugated board* The boards were not completely produced at the stage of selecting test samples	<del>600 - 3600</del>	440	23
		600 - 3600	440	<b>32-</b>
		<del>600 - 3600</del>	440	40
		<del>600 - 3600</del>	4-70	<b>23</b>
		<del>600 - 3600</del>	470	32
		<del>600 - 3600</del>	430	40
4	Pile with or without sharpening	600 - 3600	<b>70 (diameter)</b>	
		600 - 3600	<b>90 (diameter)</b>	
		600 - 3600	<b>120 (diameter)</b>	
		600 - 3600	150	—
5	Beam/post with or without sharpening	600 - 3600	<b>50</b>	<b>50</b>
		600 - 3600	<b>70</b>	<b>70</b>
		600 - 3600	80	80
		600 - 3600	<b>90</b>	<b>90</b>
		600 - 3600	100	100

**Note:** The cross-sections marked by the Client as available at the stage of submission of profiles for testing are marked in green; the profiles selected for testing are marked in bold.