„MEŽA UN KOKSNES PRODUKTU PĒTNIECĪBAS UN ATTĪSTĪBAS INSTITŪTS" SIA
VAT No. LV 43603022749
Dobeles iela 41, Jelgava, LV-3001, Latvia
Phone +371 63010605 * E-mail meka@e-koks.lv * Web www.e-koks.lv

Test Report
No. 8751/2023

Forest and Wood Products Research and Development Institute
Testing Laboratory

Customer: "TopDeck" SIA.
Customer's address: Cēsu street 3. K-4, dz.5A, Rīga, LV-1012.
Date of the order: 05.10.2023.
Testing was done in conformity with contract No.: 120-10/23MM.
Test performed at: SIA "Meža un koksnes produktu pētniecības un attīstības institūts" (Forest and Wood Products Research and Development Institute Ltd), (Dobeles iela 41, Jelgava, LV-3001, Latvia)

Order content:

Wood-plastic composite (WPC) material joists (type 1 and 2) mechanical testing was carried out according to Table 1 specification and wood-plastic composite (WPC) material decking specimens (type 3 and 4) physical and mechanical testing was carried out according to Table 2 specification.

Table 1

Test parameters and test methods for joists

Test No.	Sample type	Test parameter	Test standard	Pre-treatment	Dimensions of specimens (support span), mm	Number of specimens, pcs.
1.	1	Bending strength, modulus of elasticity in bending, maximum load and deflection at 500 N load.	EN 15534-1:2014+A1:2017, p. 7.3.2 and annex A	Reference conditioning (23°/50%)	40x60x700 (600)	8
	2				40x60x1100 (1000)	8

Table 2

Test parameters and test methods for decking

Test No.	Sample Type	Test parameter	Test standard	Pre-treatment	Dimensions of specimens (support span), mm	Number of specimens, pcs.
1	**2**	**3**	**4**	**5**	**6**	**7**
1.	3	Bending strength, modulus of elasticity in bending, maximum load and deflection at 500 N load.	EN 15534-1:2014+A1: 2017, p. 7.3.2 and annex A	Reference conditioning (23°/50%)	20x135x500 (400)	8
	4				25x150x500 (400)	8
	3			Cold climate (-20°/50%) acc. to EN 15534-1:2014+A1:2017 Annex A p. A4	20x135x500 (400)	8
	4				25x150x500 (400)	8
	3			Warm climate (-50°/50%) acc. to EN 15534-1:2014+A1:2017 Annex A p. A4	20x135x500 (400)	8
	4				25x150x500 (400)	8

End of Table 2

1	2	3	4	5	6	7
2.	3	Water absorption (after 24 h hours immersion in water).	EN 15534-1:2014+A1:2017, p.8.3.1	Reference conditioning (23°/50%)	20x135x100	8
	4				25x150x100	8
3.	3	Swelling in thickness, width and length (after 24 h immersion in water).	EN 15534-1:2014+A1:2017, p.8.3.1	Reference conditioning (23°/50%)	20x135x100	8
	4				25x150x100	8
4.	3	Water absorption – moisture resistance (after boiling in water).	EN 15534-1:2014+A1:2017, p.8.3.3	Reference conditioning (23°/50%)	20x135x100	
	4				25x150x100	8
5.	3	Resistance to indentation of the material (Brinell hardness).	EN 15534-1:2014+A1:2017, p.7.5	Reference conditioning (23°/50%)	16x50x50	10
	4				6x50x50 (x2 layers)[1)]	10

[1)] superposition of two samples were used for hollow decking.

Information provided by customer about delivered test specimen:

Type of material:

Sample type 1 – Joist 40x60x700 mm, hollow, support span 600 mm;
Sample type 2 – Joist 40x60x1100 mm, hollow, support span 1000 mm;
Sample type 3 – Decking 20x135 mm, solid, dimensions and support span for bending test acc. to Table 2;
Sample type 4 – Decking 25x150 mm, hollow, dimensions and support span for bending test acc. to Table 2.

Manufacturer: “TopDeck” SIA.
Nominal cross section dimensions of joists and decking: acc. to Table 1 and 2.
Scope of the test: factory product control.
No. of decking elements involved in test specimen preparation: not given.
Application of joists and decking: one sided.
Distance between joist supports during installation: 600 or 1000 mm.
Distance between decking supports during installation: 400 mm.
Composition of material:
Specimens were manufactured, sampled and delivered by: “TopDenck” SIA.
Place of production of specimen: “Lejzemnieks”, Iecava, Bauskas region.
Specimen manufacturing and sampling date: 20.09.2023.
Dimensions and the number of specimens involved in testing: acc. to Table 1 for joists and acc. to Table 2 for decking.
Profile of joists and decking presented in Figure 1.

Sample type 1 and 2

Sample type 3

Sample type 4

Figure 1. Profiles of joists and decking.

Joist sample types 1 and 2 were made from one profile with black pigment and deck profiles 3 and 4 both with four colours of pigment, see Figure 2.

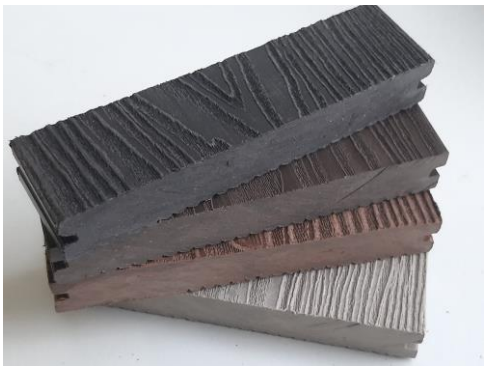

Figure 2. Decking colours.

Laboratory description of the specimen and test method:
Date of specimen delivery: 04.10.2023.
Specimen condition at the delivery: without visual defects.
Marking of specimens: in the laboratory individual specimens were marked with test order No. 8651, sample type from 1 to 4 acc. to customer, test type marking (B – bending, Q – water absorption and swelling, M – water absorption / moisture resistance (after boiling) and H – resistance to indentation / hardness), index ($_S$ – test after reference conditioning, $_C$- test at cold climate, $_W$- test at warm climate) and specimens No. from 1 to 8 (10) within the sample group.
Conditioning of specimens before testing: all specimens before testing were conditioned in a standard atmosphere at a temperature of 23 ± 2 °C and a relative humidity of 50 ± 10 % to constant mass in accordance with standard EN 15534-1:2014 + A1:2017 p.5.2.
Conditioning period: 06.10.-26.10.2023.
Test period: 24.10.-26.10.2023.
Test carried out by: J. Iejavs head of the mechanical testing sector of "Forest and Wood Products Research and Development Institute" Ltd testing laboratory.

Test results:

The values of bending strength, modulus of elasticity in bending, breaking force and deflection at 500 N load determined in accordance with the methodology of the standard EN 15534-1:2014+A1:2017 Annex A for Sample type 1 (Joist 40x60x700 mm, support span 600 mm) are summarized in Table 3 and for Sample type 2 (Joist 40x60x1100 mm, support span 1000 mm) summarized in Table 4 (after reference conditioning).

Note: support distance of 600 mm and 1000 mm declared by customer, a loading speed of 11,1 mm/min for Sample type 1, 30,8 mm/min for sample type 2 and a test device with a force reading accuracy greater than 1%.

Table 3

Bending test results
Sample type 1
(Joist 40x60x700 mm, support span 600 mm),
after reference conditioning

Specimen marking	Thickness h, mm	Width b, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-1-Bs-1	59,8	39,6	1,00	2435	15,5	2957
8651-1-Bs-2	59,8	39,7	0,99	2529	16,0	2973
8651-1-Bs-3	60,3	40,3	0,83	2839	17,4	3244
8651-1-Bs-4	60,3	40,2	0,91	2762	17,0	3275
8651-1-Bs-5	60,1	39,9	0,95	2633	16,5	2928
8651-1-Bs-6	60,2	40,0	0,86	2756	17,1	3237
8651-1-Bs-7	59,9	39,9	0,95	2371	14,9	3043
8651-1-Bs-8	60,0	40,0	0,98	2308	14,4	3026
Average value	**60,1**	**39,9**	**0,93**	**2579**	**16,1**	**3085**
Minimum value	-	-	-	**2308**	-	-
Maximum value	-	-	**1,00**	-	-	-

Table 4

Bending test results
Sample type 2
(Joist 40x60x1100 mm, support span 1000 mm),
after reference conditioning

Specimen marking	Thickness h, mm	Width b, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-2-Bs-1	59,7	39,9	3,76	1622	17,1	3596
8651-2-Bs-2	59,9	39,8	3,93	1361	14,3	3419
8651-2-Bs-3	59,8	40,1	3,97	1576	16,5	3574
8651-2-Bs-4	60,0	40,2	3,51	1763	18,3	3669
8651-2-Bs-5	59,9	39,8	3,68	1618	17,0	3600
8651-2-Bs-6	60,3	40,1	3,57	1676	17,3	3640
8651-2-Bs-7	59,9	39,9	3,61	1681	17,6	3648
8651-2-Bs-8	59,9	39,9	3,55	1726	18,1	3672
Average value	**59,9**	**39,9**	**3,70**	**1628**	**17,0**	**3602**
Minimum value	-	-	-	**1361**	-	-
Maximum value	-	-	**3,97**	-	-	-

The values of bending strength, modulus of elasticity in bending, breaking force and deflection at 500 N load determined in accordance with the methodology of the standard EN 15534-1:2014+A1:2017 Annex A for Sample type 3 (Decking 20x135x500 mm, solid, support span 400 mm) are summarized in Table 5 (after reference conditioning); Table 6 (at cold climate) and Table 7 (at warm climate).

Note: support distance of 400 mm declared by customer, a loading speed of 14,8 mm/min and a test device with a force reading accuracy greater than 1%.

Table 5

Bending test results
Sample type 3
(Decking 20x135x500 mm, solid, support span 400 mm),
after reference conditioning

Specimen marking	Thickness h, mm	Width b, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-3-Bs-1	20,8	135,9	1,60	2171	22,1	3951
8651-3-Bs-2	20,9	134,5	1,45	1749	18,0	4076
8651-3-Bs-3	21,6	136,0	1,58	1717	16,3	3344
8651-3-Bs-4	20,5	134,8	1,44	2206	23,4	4200
8651-3-Bs-5	20,8	135,4	1,64	2047	20,9	3602
8651-3-Bs-6	20,9	135,5	1,61	2111	21,4	3614
8651-3-Bs-7	20,7	134,4	1,56	2190	22,8	3881
8651-3-Bs-8	20,6	135,7	1,70	2014	20,9	3558
Average value	**20,9**	**135,3**	**1,57**	**2026**	**20,7**	**3778**
Minimum value	-	-	-	**1717**	-	-
Maximum value	-	-	**1,70**	-	-	-

Table 6

Bending test results
Sample type 3
(Decking 20x135x500 mm, solid, support span 400 mm),
at cold climate

Specimen marking	Thickness h, mm	Width b, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-3-Bc-1	20,7	135,9	1,05	2993	30,8	5864
8651-3-Bc-2	21,0	135,1	1,05	2667	26,8	5621
8651-3-Bc-3	21,2	135,7	1,10	2324	23,0	5252
8651-3-Bc-4	20,7	134,6	0,99	3325	34,6	6227
8651-3-Bc-5	20,6	135,3	1,41	2846	29,8	5620
8651-3-Bc-6	20,8	135,3	1,14	3172	32,5	5421
8651-3-Bc-7	21,2	134,4	1,07	2984	29,8	5552
8651-3-Bc-8	20,7	135,2	1,10	2853	29,5	5533
Average value	**20,9**	**135,2**	**1,11**	**2896**	**29,6**	**5636**
Minimum value	-	-	-	**2324**	-	-
Maximum value	-	-	**1,41**	-	-	-

Table 7

Bending test results
Sample type 3
(Decking 20x135x500 mm, solid, support span 400 mm),
at warm climate

Specimen marking	Thickness h, mm	Width b, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-3-Bw-1	20,7	136,0	3,44	1146	11,8	2053
8651-3-Bw-2	20,5	134,5	2,98	1284	13,7	2323
8651-3-Bw-3	21,3	135,6	3,94	1062	10,4	1724
8651-3-Bw-4	21,0	134,5	2,97	1288	13,1	2143
8651-3-Bw-5	20,4	135,2	3,69	1121	11,9	1983
8651-3-Bw-6	20,7	135,3	3,57	1201	12,5	1963
8651-3-Bw-7	20,9	134,1	3,09	1223	12,5	2112
8651-3-Bw-8	20,8	135,0	3,64	1204	12,4	1836
Average value	**20,8**	**135,0**	**3,42**	**1191**	**12,3**	**2017**
Minimum value	-	-	-	**1062**	-	-
Maximum value	-	-	**3,94**	-	-	-

The values of bending strength, modulus of elasticity in bending, breaking force and deflection at 500 N load determined in accordance with the methodology of the standard EN 15534-1:2014+A1:2017 Annex A for Sample type 4 (Decking 25x150x500 mm, hollow, support span 400 mm) are summarized in Table 8 (after reference conditioning); Table 9 (at cold climate) and Table 10 (at warm climate).

Note: support distance of 400 mm declared by customer, a loading speed of 14,8 mm/min and a test device with a force reading accuracy greater than 1%.

Table 8

Bending test results
Sample type 4
(Decking 25x150x500 mm, hollow, support span 400 mm),
after reference conditioning

Specimen marking	Thickness h, mm	Width b, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-4-Bs-1	25,0	150,3	0,91	3346	20,1	3489
8651-4-Bs-2	24,9	150,4	0,93	3345	20,2	3519
8651-4-Bs-3	24,9	150,6	0,90	3366	20,4	3570
8651-4-Bs-4	25,0	150,3	0,89	3388	20,4	3593
8651-4-Bs-5	25,0	150,4	0,91	3317	19,9	3532
8651-4-Bs-6	24,9	150,4	0,90	3380	20,4	3472
8651-4-Bs-7	24,8	150,3	0,93	3361	20,5	3554
8651-4-Bs-8	24,9	150,2	0,90	3359	20,3	3540
Average value	**24,9**	**150,3**	**0,91**	**3358**	**20,3**	**3534**
Minimum value	-	-	-	**3317**	-	-
Maximum value	-	-	**0,93**	-	-	-

Table 9

Bending test results
Sample type 4
(Decking 25x150x500 mm, hollow, support span 400 mm),
at cold climate

Specimen marking	Thickness *h*, mm	Width *b*, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-4-Bc-1	24,8	150,8	0,66	4958	32,2	5366
8651-4-Bc-2	24,8	150,2	0,67	5015	32,5	5373
8651-4-Bc-3	24,9	150,2	0,79	4893	31,6	5115
8651-4-Bc-4	24,9	150,2	0,70	5020	32,4	5201
8651-4-Bc-5	25,1	150,2	0,69	4853	30,7	4957
8651-4-Bc-6	24,8	150,2	0,80	4965	32,2	5306
8651-4-Bc-7	24,9	150,1	0,66	5114	33,0	5313
8651-4-Bc-8	24,9	150,2	0,64	5065	32,7	5401
Average value	**24,9**	**150,3**	**0,70**	**4985**	**32,2**	**5254**
Minimum value	-	-	-	**4853**	-	-
Maximum value	-	-	**0,80**	-	-	-

Table 10

Bending test results
Sample type 4
(Decking 25x150x500 mm, hollow, support span 400 mm),
at warm climate

Specimen marking	Thickness *h*, mm	Width *b*, mm	Deflection under load of 500 N a_{500}, mm	Maximum load F'_{Max}, N	Bending strength f_m, N/mm²	Modulus of elasticity E_m, N/mm²
8651-4-Bw-1	24,8	150,4	1,59	2597	12,3	1968
8651-4-Bw-2	24,6	150,3	1,60	2594	12,5	1991
8651-4-Bw-3	24,6	150,3	1,61	2539	12,1	1955
8651-4-Bw-4	24,8	150,4	1,57	2547	12,0	2020
8651-4-Bw-5	24,6	150,7	1,59	2580	12,4	1998
8651-4-Bw-6	24,9	150,4	1,50	2601	12,3	2092
8651-4-Bw-7	24,8	150,2	1,50	2615	12,4	2101
8651-4-Bw-8	24,9	150,3	1,50	2565	12,1	2116
Average value	**24,7**	**150,4**	**1,56**	**2580**	**12,3**	**2030**
Minimum value	-	-	-	**2539**	-	-
Maximum value	-	-	**1,61**	-	-	-

The individual and average values of water absorption, swelling in thickness, length and width after 24 hours in water determined in accordance with the requirements of the standard EN 15534-1 2014+A1:2017 p.8.3.1 are summarized in Table 11 for Sample type 3 (Decking 20x135x100 mm, solid) and Table 12 for Sample type 4 (Decking 25x150x100 mm, hollow).

Table 11

**Water absorption and swelling test results
Sample type 3 (Decking 20x135x100 mm, solid),
after 24 hours in water**

Specimen marking	Swelling in thickness Q_b, %	Swelling in width Q_p, %	Swelling in length Q_g, %	Water absorption a, %
8651-3-Q-1	0,55	0,156	0,050	0,64
8651-3-Q-2	0,35	0,081	0,080	0,69
8651-3-Q-3	0,70	0,103	0,040	0,46
8651-3-Q-4	0,50	0,044	0,060	0,50
8651-3-Q-5	0,82	0,067	0,010	0,58
8651-3-Q-6	0,35	0,030	0,030	0,52
8651-3-Q-7	0,66	0,067	0,050	0,69
8651-3-Q-8	0,77	0,118	0,030	0,70
Average value	**0,59**	**0,083**	**0,044**	**0,60**
Maximum value	**0,82**	**0,156**	**0,080**	**0,70**

Table 12

**Water absorption and swelling test results
Sample type 4 (Decking 25x150x100 mm, hollow)
(after 24 hours in water)**

Specimen marking	Swelling in thickness Q_b, %	Swelling in width Q_p, %	Swelling in length Q_g, %	Water absorption a, %
7350-4-Q-1	0,24	0,020	0,148	0,74
7350-4-Q-2	0,61	0,093	0,090	0,71
7350-4-Q-3	0,57	0,080	0,079	0,69
7350-4-Q-4	0,32	0,107	0,030	0,66
7350-4-Q-5	0,45	0,027	0,080	0,65
7350-4-Q-6	0,20	0,066	0,099	0,67
7350-4-Q-7	0,41	0,113	0,040	0,67
7350-4-Q-8	0,16	0,053	0,039	0,65
Average value	**0,37**	**0,070**	**0,076**	**0,68**
Maximum value	**0,61**	**0,113**	**0,148**	**0,74**

Water absorption – water resistance (after boiling test) individual and average values determined in accordance with the requirements of the standard EN 15534-1:2014+A1: 2017 p.8.3.3 are summarized in Table 13 for Sample type 3 (Decking 20x135x100 mm, solid) and Table 14 for Sample type 4 (Decking 25x150x100 mm, hollow).

Table 13

**Water absorption – water resistance (after boiling test) test results
Sample type 3 (Decking 20x135x100 mm, solid)**

Specimen marking	Water absorption M, %
8651-3-M-1	1,9
8651-3-M-2	1,9
8651-3-M-3	2,6
8651-3-M-4	2,4
8651-3-M-5	1,8
8651-3-M-6	1,7
8651-3-M-7	3,0
8651-3-M-8	2,1
Average value	**2,2**
Maximum value	**3,0**

Table 14

Water absorption – water resistance (after boiling test) test results
Sample type 4 (Decking 25x150x100 mm, hollow)

Specimen marking	Water absorption *M*, %
8651-4-M-1	4,0
8651-4-M-2	4,0
8651-4-M-3	4,0
8651-4-M-4	4,0
8651-4-M-5	4,0
8651-4-M-6	3,8
8651-4-M-7	4,1
8651-4-M-8	4,1
Average value	**4,0**
Maximum value	**4,1**

The resistance to indentation (Brinell hardness) results of the decking material determined in accordance with the requirements of the standard EN 15534-1 :2014+A1:2017 p.7.5 and EN 1534:2020, p.7.3 are summarized in Table 15 for Sample type 3 (Decking 20x135x100 mm, solid) and Table 16 for Sample type 4 (Decking 25x150x100 mm, hollow). Resistance to indentation values were determined using apre-force of 20 N and a loading force of 2000 N, the samples being held for 25 ± 5 s under this load. Measurements were taken immediately after removal of the load.

Table 15

Resistance to indentation (Brinell hardness) test results
Sample type 3 (Decking 20x135x100 mm, solid)

Specimen marking	Resistance to indentation (Brinell hardness) *HB*, N/mm^2
8651-3-H-1	151
8651-3-H-2	151
8651-3-H-3	168
8651-3-H-4	140
8651-3-H-5	157
8651-3-H-6	168
8651-3-H-7	194
8651-3-H-8	178
8651-3-H-9	178
8651-3-H-10	182
Average value	**167**

Table 16

Resistance to indentation (Brinell hardness) test results
Sample type 4 (Decking 25x150x100 mm, hollow)

Specimen marking	Resistance to indentation (Brinell hardness) *HB*, N/mm^2
8651-4-H-1	119
8651-4-H-2	112
8651-4-H-3	118
8651-4-H-4	95
8651-4-H-5	133
8651-4-H-6	101
8651-4-H-7	107
8651-4-H-8	121
8651-4-H-9	113
8651-4-H-10	131

Average value		**115**

Date of issue: 30.10.2023

Prepared by	Reviewed by
J. Iejavs	K.Būmanis
	(signature and name)

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