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Republic Floor GmbH
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59494 Soest

Dresden, 28/08/2023
MPET

Test Report
Order No. 2722561_A2

Client:	Republic Floor GmbH Ferdinand-Gabriel-Weg 4-8 59494 Soest
Order:	Performance of selected tests according to EN 16511:2014+A1:2019-04
Contractor:	EPH - Laboratory Unit Surface Testing
Engineer in charge:	Dipl.-Ing. (FH) M. Peter

Dipl.-Ing. Andreas Möschner
Head of Laboratory Unit Surface Testing

The test report contains 11 pages. Any duplication of extracts requires the written permission of EPH. The test results refer exclusively to the material tested.

1 Task

The accredited Entwicklungs- und Prueflabor Holztechnologie GmbH (EPH) was instructed by Republic Floor GmbH in Soest to carry out testing of selected properties according to EN 16511:2014+A1:2019-04.

NOTE: All numerical values within this document are given with a comma as decimal.

This test report replaces test report Order No. 2722561_A1 dated 06/03/2023, which is hereby invalidated.

2 Test material

For testing, the following samples were selected by the client and sent to the contractor with receipt at EPH laboratory on: 20/01/2023 and 21/08/2023.

„Bigger 5 Collection“

Variant	Product	Thicknesses in mm	Wear layer in mm	length and width in mm	Nominal Usage Class
1	Wolf SPC	4,5 (3,5 + 1 IXPE)	0,30	1218 x 181	31
2	Grizzly SPC	5,5 (4,0 + 1,5 EVA)	0,50	1218 x 228	33
3	Lion SPC	7,0 (5,5 + 1,5 EVA)	0,50	592 x 148	unknown
4	Tiger SPC	6,0 (4,5 + 1,5 EVA)	0,50	1800 x 228	unknown
5	Crocodile SPC ABA	7,5 (6,0 + 1,5 EVA)	0,50	1218,0 x 228	33
„Element Collection“					
6	20+	4,5 (3,5 + 1 IXPE)	0,20	1219 x 181	unknown

3 Test performance

3.1 Determination of the resistance against abrasion according to EN 15468:2016-03 (Falling Sand Method)

The determination of the resistance against abrasion was carried out according to EN 15468:2016-03 Annex A with a Taber Abraser Type 5151 (test equipment OF-41) with Grit Feeder, model 155 (test equipment OF-98), under effect from “falling sand”.

Performance of the tests: 13/02/2023 - 17/02/2023

3.2 Determination of the impact resistance (big ball) according to EN 13329:2006+A1:2008-08, Annex F

The determination of the impact resistance with the big ball was carried out in accordance with the test conditions of EN 13329:2006+A1:2008-08, Annex F. The test was performed using the big ball impact loading device (test equipment OF-44) described in EN 438-2:2016+A1:2018-12, chapter 22. The tests were carried out with the integrated underlays.

Performance of the tests: 09/02/2023

3.3 Determination of microscratch resistance according to EN 16094:2021-06

The microscratch resistance was determined out according to EN 16094:2021-06, Methods A and B, with a Martindale test device (test equipment OF-51).
3 test specimens (TP) were claimed as follows:

Test parameters according to EN 16094:2021-06	Method A	Method B
Cycles: Lissajous movements (LB)*	5 LB	10 LB
Friction material	7447 (very smooth)	7440 (medium smooth)
Test load	6 N	4 N
Assessment	gloss variation with 60° geometry	Classification of the scratch image

* The Lissajous movement corresponds to 16 cycles of defined friction disc movements.

Performance of the tests: 16/02/2023 - 17/02/2023

3.4 Determination of the effect of the simulated movement of a furniture leg according to EN ISO 16581:2019-06

The determination of the effect of the simulated movement of a furniture leg was carried out according to EN ISO 16581:2019-06. The test device used was a test device constructed at the IHD according to the above-mentioned regulation with foot type 0 (test equipment OF-23).

Performance of the tests: 08/02/2023

3.5 Determination of the residual indentation according to EN ISO 24343-1:2012-01

The determination of the residual indentation was carried out according to DIN EN ISO 24343-1:2012 (Resilient and laminate floor coverings - Determination of indentation and residual indentation - Part 1: Residual indentation (ISO 24343-1:2007-06)).
The test specimens (3 specimens with the dimensions 60 mm × 60 mm) were stored before the test at 23 °C and 50 % relative humidity until the mass constancy.
After extraction from the air conditioning, the initial thickness t_0 was measured with an accuracy of 0,01 mm. After installation in the tester, the test mass of 500 N was applied and the load was held for 150 min. Then the test specimen was removed and stored unloaded. After a further 150 min,

the final thickness t_1 was measured. The residual indentation t_0-t_1 was calculated for each specimen. The mean value was formed from the three values.

Performance of the tests: 14/02/2023 - 16/02/2023

3.6 Determination of the resistance against staining according to EN 438-2:2016+A1:2018-12

The determination of the resistance against staining was carried out according to EN 438-2:2016+A1:2018-12, chapter 26, with the 5 test agents (with cover) marked in Table 4.

Performance of the tests: 07/02/2023 - 08/02/2023

3.7 Determination of the dimensional stability and curling after exposure to heat according to EN ISO 23999:2021-11

The dimensional stability and curling after exposure to heat was carried out according to EN ISO 23999:2021-11.

The dimensional stability was measured at initial state and after 6 hours of exposure to heat (80 ± 2) °C and subsequent 24 hours of conditioning at 23 °C and 50 % relative humidity with the measuring device shown in figure 1 and figure 2 at each 3 test specimens per variant. The curling was determined on the same specimens using a laser measuring device.

Fig. 1: Dimensional stability in MD

Fig. 2: Dimensional stability in AMD

Performance of the tests: 21/02/2023 - 24/02/2023

24/08/2023 – 25/08/2023

4 Results

4.1 Abrasion resistance according to EN 15468:2016-03, Annex A (Falling-Sand-Method)

Variant	Number of revolutions according to EN 15468:2016-03, Annex A (without calibration factor)			
	TP 1	TP 2	TP 3	Mean value
1	> 8500	> 8500	> 8500	> 8500
2	> 8500	> 8500	> 8500	> 8500
6	> 8500	> 8500	> 8500	> 8500

The determination of the calibration factor was carried out according EN 15468:2016-03, Annex A chapter 5.4.2.

Calibration factor = average of mass loss in g / 0,145 g
Calibration factor = 0,125 g / 0,145 g
Calibration factor = 0,862

Variant	Number of revolutions according to EN 15468:2016-03, Annex A (with calibration factor)				Class according to EN 16511:2014+A1:2019-04
	TP 1	TP 2	TP 3	Mean value	
1	> 7328	> 7328	> 7328	**> 7300**	34
2	> 7328	> 7328	> 7328	**> 7300**	34
6	> 7328	> 7328	> 7328	**> 7300**	34

Requirements according to EN 16511:2014+A1:2019-04, Table 2

Class	Revolutions
21/22	≥ 500
23	≥ 1000
31	≥ 1500
32	≥ 3000
33	≥ 5000
34	≥ 7000

4.2 Impact resistance according to EN 13329:2006+A1:2008-08 annex F (big ball)

Variante	Impact resistance (big ball) in mm according to EN 13329:2006+A1:2008-08						Class according to EN 16511:2014 +A1:2019-04
	Single values					Mean value	
1	> 1800	> 1800	> 1800	> 1800	> 1800	**> 1800**	34
3	> 1800	> 1800	> 1800	> 1800	> 1800	**> 1800**	34
5	> 1800	> 1800	> 1800	> 1800	> 1800	**> 1800**	34

Requirements according to EN 16511:2014+A1:2019-04, Table 2

Class	Impact resistance (big ball) in mm
21/22	≥ 400
23	≥ 600
31	≥ 800
32	≥ 1200
33	≥ 1600
34	≥ 1800

4.3 Microscratch resistance according to DIN EN 16094:2021-06

Assessment according to method A:

Variant	Reflectometer value at a measuring geometry of 60°		Change of gloss after 5 LB in %		Classification of the microscratch resistance class according to method A
	initial	after 5 LB	Single values	Mean value	
1	3,2	4,1	-28,1	33	MSR-A3
	3,3	4,3	-30,3		
	3,0	4,2	-40,0		
2	3,1	3,7	-19,4	21	MSR-A2
	3,0	3,7	-23,3		
	3,1	3,7	-19,4		

Class according to EN 16094:2021-06

MSR-A1 | Gloss change ≤ 10 % |
MSR-A2 | 10 % < Gloss change ≤ 30 % |
MSR-A3 | 30 % < Gloss change ≤ 50 % |
MSR-A4 | 50 % < Gloss change ≤ 70 % |
MSR-A5 | Gloss change > 70 % |

Assessment according to method B

Variant	Classification of the scratch image according to EN16094:2021-06 in scratch grade after 10 LB
1	MSR-B1
2	MSR-B2

Class according to EN 16094:2021-06
MSR-B1 No visible scratches
MSR-B2 Only few scratches
MSR-B3 Many well visible scratches
MSR-B4 A great many well visible raw and fine scratches, Lissajous figure partly visible
MSR-B5 Mix of Lissajous figure and great many scratches, mat abrasion like area in the middle

Requirements according to EN 16511:2014+A1:2019-04, Table 2

Class	microscratch resistance class
32	≤ MSR-A3
33-34	≤ MSR-A2

4.4 Effect of the simulated movement of a furniture leg according to EN ISO 16581:2019-06

Variante	Description of the damages / changes
1	no visible change / damages
2	no visible change / damages

4.5 Residual indentation according to EN ISO 24343-1:2012-01

Variante	Residual indentation in mm			
	Single values			Mean value1
1	0,15	0,14	0,13	**0,14**
5	0,10	0,15	0,10	**0,12**

Requirements according to EN 16511:2014+A1:2019-04, Table 2

Class	Residual indentation in mm
21/22-31	≤ 0,3
32-33	≤ 0,2
34	≤ 0,15

4.6 Resistance against staining according to EN 438-2:2016+A1:2018-12

Test agent		**Group 1**	**Group 2**	**Group 3**		
		Acetone	**Coffee**	**Sodium hydroxide (NaOH)**	**Hydrogen peroxide (H_2O_2)**	**Carbon black suspension in paraffin oil (Shoe polish replica)**
Duration of exposure		**10 min**	**16 h**	**10 min**	**10 min**	**10 min**
Requirements for class according to EN 16511	**32-34**	Grade 5	Grade 5	Grade 4	Grade 4	Grade 4
	31	Grade 4	Grade 4	Grade 3	Grade 3	Grade 3
Results	**Variant 1**	Grade 5	Grade 4	Grade 4	Grade 5	Grade 5
	Variant 5	Grade 4	Grade 5	Grade 4	Grade 5	Grade 5

Rating scale according to EN 438-2:2016+A1:2018-12 Table 8 (comparison of the tested and the surrounding area)

5 No change
test area indistinguishable from adjacent surrounding area

4 Minor change
test area distinguishable from adjacent surrounding area, only when the light source is mirrored on the test surface and is reflected towards the observer's eye, e. g. discoloration, change in gloss and colour

3 Moderate change
test area distinguishable from adjacent surrounding area, visible in several viewing directions, e. g. discoloration, change in gloss and colour

2 Significant change
test area clearly distinguishable from adjacent surrounding area, visible in all viewing directions, e. g. discoloration, change in gloss and colour, and / or structure of the surface slightly changed, e.g. cracking, blistering

1 Strong change
the structure of the surface being distinctly changed and / or discoloration, change in gloss and colour, and / or the surface material being totally or partially delaminated

4.7 Dimensional stability and curling after exposure to heat according to EN ISO 23999:2021-11

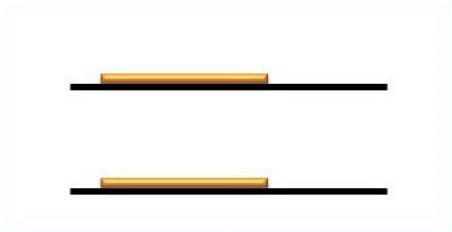
Variant	Mean value of the dimensional stability after exposure to heat in %	
	MD (manufacturing direction)	AMD (across manufacturing direction)
1	-0,05	0,05
2	-0,05	0,05
5	-0,05	0,05

Requirements according to EN 16511:2014+A1:2019-04, Table 2

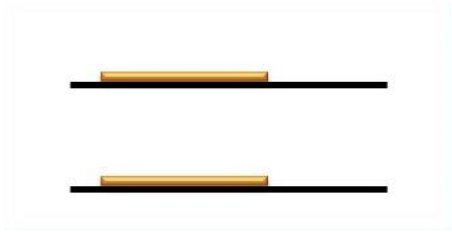
Class	Dimensional stability in %
21-23	0,5
31-34	0,25

Variant	Curling in mm	
	mean initial curling $C_{m,\ initial}$	mean value for final curling $C_{m,\ final}$
1	0,0	0,0
2	0,0	0,0
5	0,0	1,0

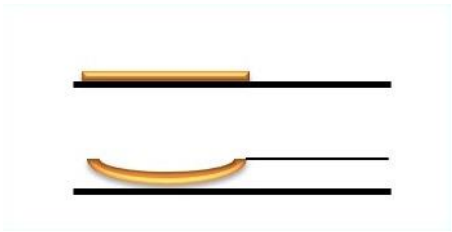
Variant 1

	**mean initial curling $C_{m,\ initial}$:** 0,0 mm
	mean value for final curling $C_{m,\ final}$: 0,0 mm

Variant 2

	**mean initial curling $C_{m,\ initial}$:** 0,0 mm
	mean value for final curling $C_{m,\ final}$: 0,0 mm

Variant 5

	**mean initial curling $C_{m,\ initial}$:** 0,0 mm
	mean value for final curling $C_{m,\ final}$: 1,0 mm

5 Evaluation

Tests according to EN 16511:2014+A1:2019-04

The tested floorings can be classified regarding to several properties according to EN 16511:2014+A1:2019-04 Table 2 as follows:

Variant	Property	Result		Classification* according to EN 16511:2014+A1:2019-04 Table 2
1	Abrasion resistance according to EN 15468:2016-03, Annex A (Falling Sand Method)	> 7300 revolutions		Classes 21-23 and 31-34 are fulfilled
2		> 7300 revolutions		Classes 21-23 and 31-34 are fulfilled
6		> 7300 revolutions		Classes 21-23 and 31-34 are fulfilled
1	Resistance against impact (big ball) according to EN 13329:2006+A1:2008-08, Annex F	> 1800 mm		Classes 21-23 and 31-34 are fulfilled
3		> 1800 mm		Classes 21-23 and 31-34 are fulfilled
5		> 1800 mm		Classes 21-23 and 31-34 are fulfilled
1	Microscratch resistance according to DIN EN 16094:2021-06	MSR-A3		Classes 21-23 and 31-32 are fulfilled
2		MSR-A2		Classes 21-23 and 31-34 are fulfilled
1	Effect of the simulated movement of a furniture leg according to EN ISO 16581:2019-06	no visible change / damages		Classes 21-23 and 31-34 are fulfilled
2		no visible change / damages		Classes 21-23 and 31-34 are fulfilled
1	Static indentation according to EN ISO 24343-1:2012-01	0,14 mm		Classes 21-23 and 31-34 are fulfilled
5		0,12 mm		Classes 21-23 and 31-34 are fulfilled
1	Resistance against staining according to EN 438-2:2016 +A1:2018-12	<u>Group 1:</u> Acetone <u>Group 2:</u> Coffee <u>Group 3:</u> NaOH H_2O_2 Carbon black suspension	Grad 5 Grad 4 Grad 4 Grad 5 Grad 5	Classes 21-23 and 31 are fulfilled

Variant	Property	Result		Classification* according to EN 16511:2014+A1:2019-04 Table 2
5	Resistance against staining according to EN 438-2:2016 +A1:2018-12	Group 1: Acetone Group 2: Coffee Group 3: NaOH H_2O_2 Carbon black suspension	Grad 4 Grad 5 Grad 4 Grad 5 Grad 5	Classes 21-23 and 31 are fulfilled
1	Dimensional stability after exposure to heat according to EN ISO 23999:2021-11 MD / AMD	-0,05 / 0,05		Classes 21-23 and 31-34 are fulfilled
2		-0,05 / 0,05		Classes 21-23 and 31-34 are fulfilled
5		-0,05 / 0,05		Classes 21-23 and 31-34 are fulfilled

* Statements on conformity assessment/classification were made on the basis of the measurement results obtained. Measurement uncertainties were not included in the assessment (ILAC G8 03/2009 "Guidelines on the Reporting of Compliance with Specification" Section 2.7).

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