6.3.2020

Compliance Verification of ESD Control Flooring

Sikafloor ® MultiFlex PS-33 ESD

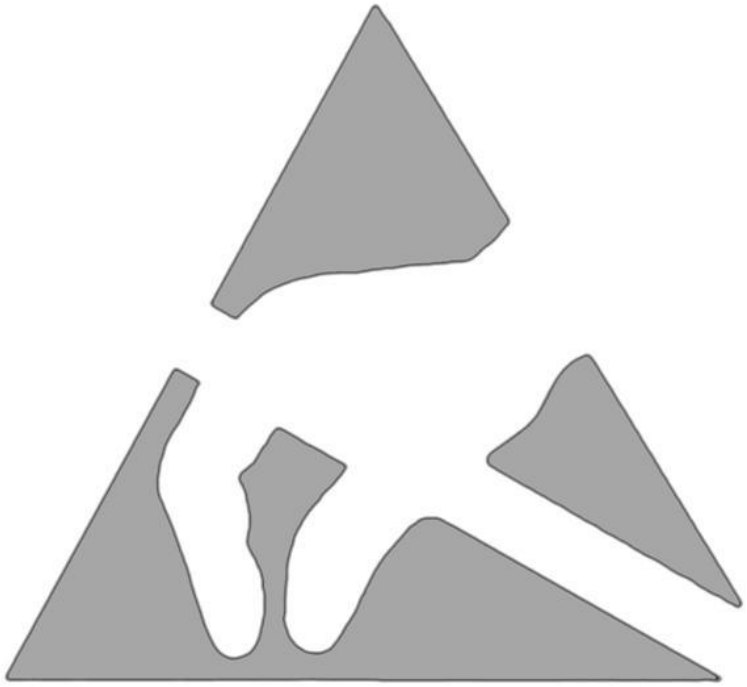

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Table 1: General information of the document

Document	**No: C671/2020**	**Version: 1.0**	**Date: 6.3.2020**
Date(s) of test	24.2.2020		
Place of test	Ahvenistontie 20, 13530 Hämeenlinna		
Client	Oy Sika Finland Ab, PL49, Koskelontie 23 C, 02921 Espoo		
Author(s)	Toni Viheriäkoski, ESD Engineer, Certified by NARTE, USA Cascade Metrology Oy, Electrostatics laboratory, Hakulintie 32, 08500 Lohja, Finland, GSM +358 44 5688 599		
Reviewer(s)	Ari Aro, Oy Sika Finland Ab		
Assessment criteria	IEC 61340-6-1: 2018, Electrostatic control for healthcare - General requirements for facilities [1] IEC 61340-5-1:2016, Protection of electronic devices from electrostatic phenomena [2]		
Notes	Technical information of the report is classified confidential		
Date and place Lohja 6.3.2020	Signature Toni Viheriäkoski		

2. Introduction and Scope

Electrostatic properties of the polyurethane flooring Sikafloor ® MultiFlex PS-33 ESD were measured and analysed February 24, 2020, at Kanta-Hämeen keskussairaala, Ahvenistontie 20, 13530 Hämeenlinna. Summary of results and conclusions are presented in Chapter 9. Suggestions for improvements are in Chapter 10.

3. Flooring under Test

Identification of the flooring under test is shown in Table 2.

Table 2: Product identification

Target	Test installation
Supplier	Sika Finland
Type of the product	Polyurethane ESD control flooring
Name of the product	Sikafloor® MultiFlex PS-33 ESD
Surface	Smooth, Mat, Grey
Area	Test area, approximately 12 m^2
Location	Kanta-Hämeen keskussairaala, Hämeenlinna
Installation date(s)	18.2.2020
Treatment	N/A, dry cleaning during measurements when necessary

4. Test Conditions and Instrumentation

Test conditions are shown in Table 3. Measurement equipment is presented in Table 4.

Table 3: Ambient test conditions

Area	Temperature	Relative Humidity
Test Room	24˚C ± 2˚C	20 % ± 3 %

Measurements are carried out, when applicable, in reference to ISO/IEC/EN 17025 “General Requirements for the Competence of Calibration and Testing Laboratories”.
Calibrations are traceable to national standards laboratories through the unbroken chain of stated uncertainties. Calibration periods are based on the periodic verifications and traceable history of the instruments.

Table 4: Measurement equipment

Manufacturer	Type	Model	Serial number
Tektronix	Oscilloscope	TDS 2022	C031701
Trek	Electrostatic sensor	541A-1	1265
Megger	Isolation multimeter	BMM2000ESD	6111-550/061106/1387
Megger	Isolation multimeter	MIT415/2	101489531
3M	*Rg* electrode	IEC	N/A
Vaisala	Humidity meter	HM 41	M1850876

5. Test Methods

Resistance to ground was measured in accordance with IEC 61340-4-1 [3] (Figure 1). Person footwear flooring system was measured in accordance with IEC 61340-4-5 [4] (Figures 2 and 3).

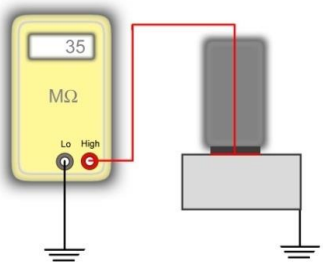

Figure 1: Resistance to ground

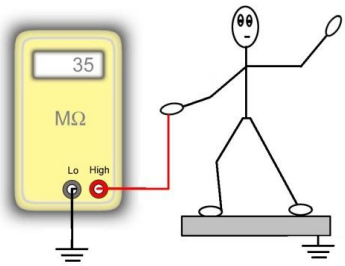

Figure 2: System resistance

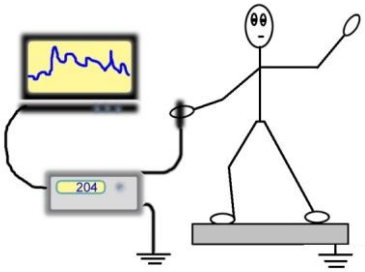

Figure 3: Body potential

6. Requirements

6.1 EPA Requirements [1, 2]

Flooring: R_g < 1 GΩ.

6.2 Personnel Grounding Requirements [2]

Person/footwear/flooring system: R_g < 1 GΩ and body voltage,
|*V*| < 100 V (average of 5 highest peaks).

7. Test Results

7.1 Flooring [3]

Resistance to Ground

Results of 10 measurements: 140 kΩ < R_g < 900 kΩ, Median was 400 kΩ. Measurements were recorded after 15 s electrification. Individual test results with 15 s electrification is shown in Table 5. Results measured at 100 V were > 1 MΩ at 10 V.

Table 5: Resistance to ground, series of 10 measurements

Measurement	Voltage (V)	Result (kΩ)
1	10	400
2	10	200
3	10	140
4	100	600
5	10	400
6	10	500
7	10	200
8	100	900
9	10	300
10	100	800
Minimum		140
Maximum		900
Median		400
Average		444
Geometric mean		**377**
Standard deviation		258

7.2 Person/Footwear/Flooring System [3]

Reference footwear: - Sievi Key (Person footwear system: R_g ~ 8 MΩ),
- Sievi Roller (Person footwear system: R_g ~ 10 MΩ).

Resistance to Ground

Sievi Key: (10 measurements): 11 MΩ < R_g < 18 MΩ, Median 15 MΩ (Table 6).
Sievi Roller (10 measurements): 13 MΩ < R_g < 20 MΩ, Median 16 MΩ.

Table 6: Resistance to ground, Sievi Key*, series of 10 measurements*

Measurement	Voltage (V)	Result (MΩ)
1	100	11
2	100	13
3	100	14
4	100	15
5	100	16
6	100	14
7	100	16
8	100	14
9	100	16
10	100	18
Minimum		11
Maximum		18
Median		15
Average		15
Geometric mean		**15**
Standard deviation		2

Body Voltage

Examples of six step walking pattern test results are shown in Figures 4 and 5.

Averages of the five highest peaks during 60 s measurement sequences:
- Sievi Key and Sievi Roller: $|V| < 100$ V.

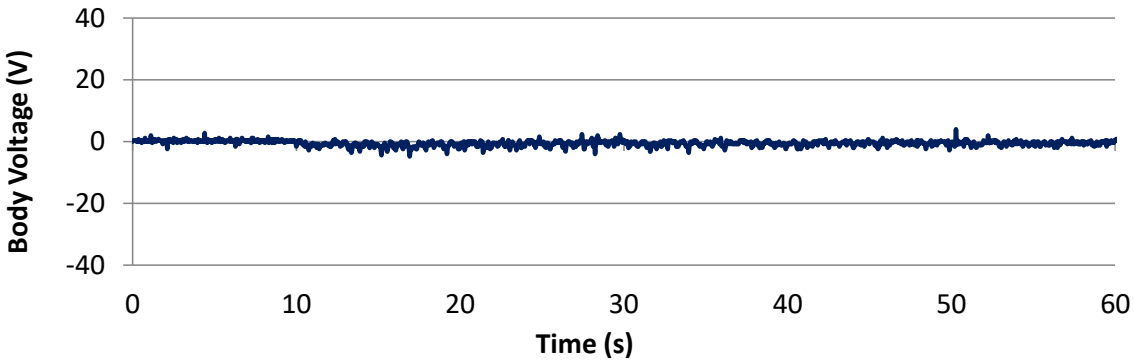

Figure 4: Example of human body potential measurement, Sievi Key

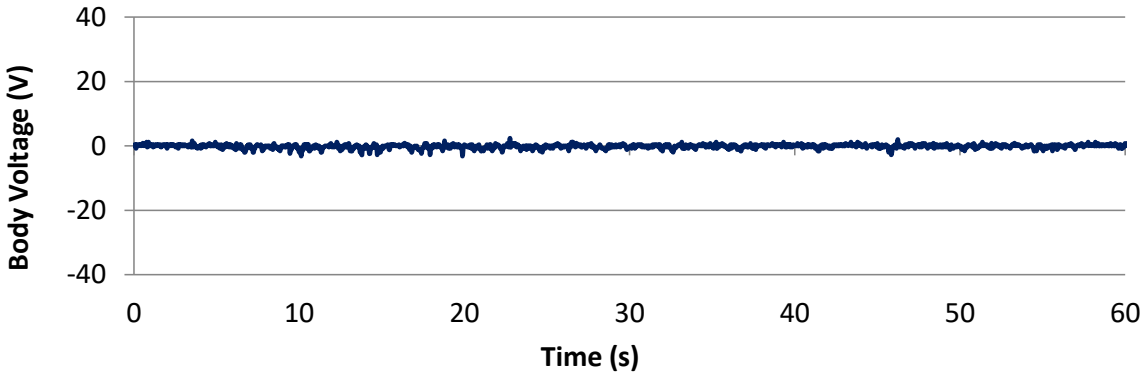

Figure 5: Examples of human body potentials, Sievi Roller

8. Observations

Test flooring had two groundable points. Resistance between the points without the earth connections was approximately 700 Ω.
The effect of abrasion resistance was demonstrated with the grinding test. A light grinding with the abrasive paper roughness of 240 increased the resistance with the factor of approximately four. An example of the resistance to ground measurement is shown in Figure 6.

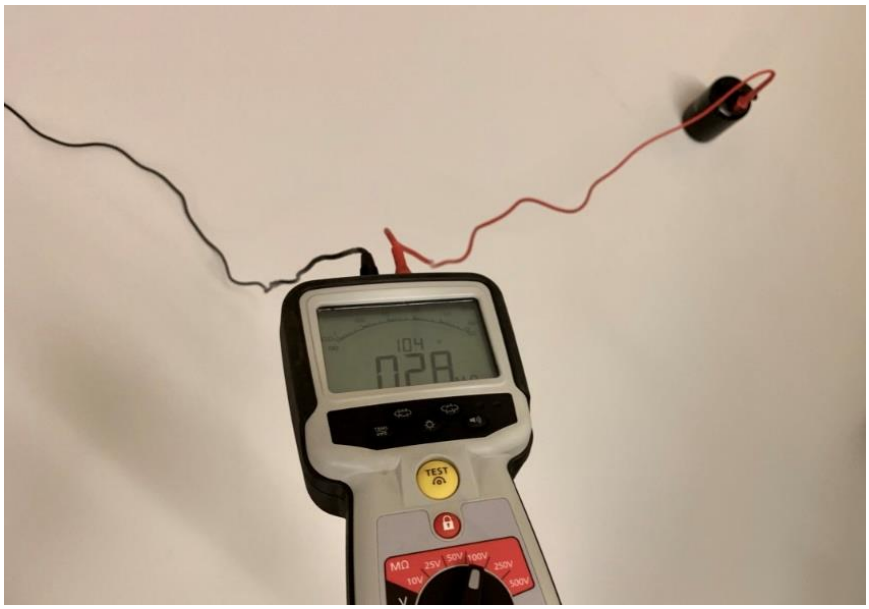

Figure 6: Resistance to ground measurement on the flooring under test

9. Summary and Conclusions

The flooring under test met the requirements of flooring used to ground personnel and equipment in reference to IEC 61340-6-1:2018 [1].

The flooring under test met the electrostatic protected area requirements in reference to IEC 61340-5-1:2016 [2].

Personnel grounding requirements of the person/footwear/flooring system were met with the tested person/footwear combinations (IEC 61340-5-1:2016).

10. Discussion and Suggestions

Ageing and treatment may affect the electrical conductivity of the flooring. Acceptance test and periodic compliance verification is recommended.

Resistivity and contact electrification between the flooring and footwear are reversely proportional to the moisture. In low humidity conditions charge generation will be more effective and dissipation slows down. When indoor humidity varies in seasons, compliance verification measurements shall be carried out in the conditions of low humidity.

11. References

[1] IEC 61340-6-1: 2018, Electrostatics - Part 6-1: Electrostatic control for healthcare - General requirements for facilities

[2] IEC 61340-5-1:2016, Electrostatics - Part 5-1Protection of electronic devices from electrostatic phenomena – General Requirements

[3] IEC 61340-4-1:2004+A1:2015: Standard test methods for specific applications - Electrical resistance of floor coverings and installed floors

[4] IEC 61340-4-5:2018: Standard test methods for specific applications - Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person