



**TOTAL ESD SOLUTIONS**  
**ESD CONSULTANCY, AUDITING, TRAINING & TESTING**

Title: Material analysis report Bofloor ESD PVC tile

Company: Bofloor BV, Landgraaf (NL)

Date of audit: August 21<sup>st</sup>, 2019  
Version: 1.0  
Status: Released  
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### Version history

1.0 Creation



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### 1. Introduction

This document contains the results of the performed analysis of the electrical resistance properties of the provided materials, specifically:

Amount (pieces)	Material type
1	PVC floor tile (ESD)

*Table 1 Investigated materials*

The dimensions of the sample were: (LxWxH): 507x507x7mm

As per order of the company: BoFloor BV

The analysis has been performed with reference to -see paragraph 2.6- and was conducted through the physical performance of electrical resistance measurements.

Chapter 2 contains measurement and investigation details, where chapter 3 holds the results of the analysis. The conclusion is found in chapter 4.



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## 2. Analysis details

### 2.1 Location of the analysis

The analysis location is:

Company name:	Total ESD solutions
Address:	Tuulshoek 38
Zip Code:	6093CR
City:	Heythuysen
Country:	The Netherlands

### 2.2 Type of analysis

The type of analysis is a measurement of the electrical resistance parameters of the selected materials for product qualification purposes as listed in chapter 1.

1 type of electrical resistance measurements was performed:

- Volume resistance

The measurements are done using a Direct current (DC) voltage supply as voltage/ current source.

### 2.3 Applied test method and limit reference standard

The applied test methods are in conformity with: **NEN-EN-IEC 61340-4-1:2004**

Important notice ! → Please be advised that the usage of the (DIN) EN 1081 standard for measurement of the volume resistance is not allowed during product qualification measurements.

The applied limit reference standard is: **NEN-EN-IEC 61340-5-1:2016**

The limit for maximum (volume) resistance of flooring materials is specified in table 3 on page 17 of this reference standard. See next page.



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Table 3 – EPA requirements

EPA requirements	ESD control item	Product qualification <sup>a</sup>		Compliance verification <sup>b</sup>	
		Test method	Limits <sup>c</sup>	Based on test method	Limits <sup>c</sup>
	Working surfaces, storage racks and trolley <sup>g</sup>	IEC 61340-2-3	$R_{gp} < 1 \times 10^9 \Omega$ $R_{p-p} < 1 \times 10^9 \Omega^f$	IEC 61340-2-3	$R_g < 1 \times 10^9 \Omega$
	Wrist strap bonding point				$R_g < 5 \times 10^6 \Omega$
	Flooring	IEC 61340-4-1 <sup>d,e</sup>	$R_{gp} < 1 \times 10^9 \Omega$	IEC 61340-4-1	$R_g < 1 \times 10^9 \Omega$
	Ionization	IEC 61340-4-7	Decay (1 000 V to 100 V and –1 000 V to –100 V) < 20 s Offset voltage < ± 35 V	IEC 61340-4-7	Decay (1 000 V to 100 V and –1 000 V to –100 V) < 20 s or user defined Offset voltage < ± 35 V
	Seating	IEC 61340-2-3 (resistance to groundable point measurements)	$R_{gp} < 1 \times 10^9 \Omega$	IEC 61340-2-3 (resistance to ground measurements)	$R_g < 1 \times 10^9 \Omega$
	Static control garments	IEC 61340-4-9 or user defined method	$R_{p-p} < 1 \times 10^{11} \Omega$ or user defined limit	IEC 61340-4-9 or user defined method	$R_{p-p} < 1 \times 10^{11} \Omega$ or user defined limit
	Groundable static control garments	IEC 61340-4-9	$R_{gp} < 1 \times 10^9 \Omega$	IEC 61340-4-9	$R_{gp} < 1 \times 10^9 \Omega$

<sup>a</sup> For product qualification, the environmental conditions for testing should be (12 ± 3) % RH and 23 °C ± 2 °C. When not specified in the referenced IEC standard, the minimum environmental conditioning time for product qualification should be 48 hours.

<sup>b</sup> The test methods in the compliance verification column refer to the basic test procedure only. It is not expected that the test method will be followed in its entirety.

<sup>c</sup> Symbols used in this table:  $R_{p-p}$  refers to point to point resistance.  $R_g$  refers to resistance to ground and  $R_{gp}$  refers to resistance to groundable point.

<sup>d</sup> The maximum test voltage allowed for measuring ESD flooring that should be used for an ESD program complying with this standard is 100 V.

<sup>e</sup> If flooring is used for grounding personnel that handle ESDs refer to the system requirements in Table 2.

<sup>f</sup> In situations where charged device model (CDM) damage is a concern, a minimum point to point resistance limit of  $1 \times 10^4 \Omega$  is recommended.

<sup>g</sup> Worksurfaces are defined as any surface on which an unprotected ESD sensitive item is placed.

Figure 1 Volume resistance limit according to NEN-EN-IEC 61340-5-1:2016

Note! Please be advised that it was agreed with the requestor to perform the product qualification methods under different environmental conditions as noted in the table above (table foot note a).

## 2.4 Measurement principle

The measurement principles shown here are in accordance with the test methods as mentioned in paragraph 2.3.

### 2.4.1 Volume resistance

Measurements for volume resistance were performed using the following electric circuit:

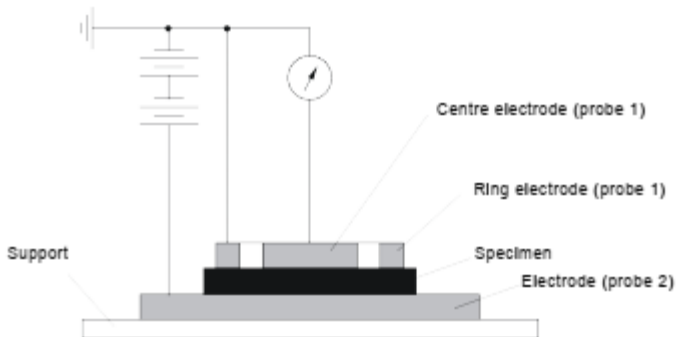


Figure 2 Volume resistance measurement principle

(For reference purposes only. See page 15 of NEN-EN-IEC61340-2-3:2016)

The measurement electrode is pressed down onto the sample using a dead weight of 2.27 kg +/- 0.25 kg. The Ohm meter is read out after a 15 second settling time period.

### 2.4.2 Applied test voltage

According to paragraph 9.3 of NEN-EN-IEC61340-4-1:2004, the impedance meter must have an adjustable test voltage, depending on the electric resistance range.

This voltage is:

Resistance range	Test voltage
$\geq 1 * 10^6$ Ohm	100 V +/- 0.5 V
$< 1 * 10^6$ Ohm	10 V +/- 5 V

## 2.5 Validity of the report

The report is valid for the investigated materials as long as the composition of the materials is not changed. The results recorded in this document are valid for the recorded climatic conditions only. No investigation was performed at other climatic conditions.

The same applies for the thickness and purity of the investigated materials.



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### 2.6 Environmental conditions during testing

All tests performed with environmental conditions:

Temperature: 21.7 °C

Relative humidity: 54.4 %RH





### 3. Inspection Results

#### 3.1 Test result electric resistance – volume resistance

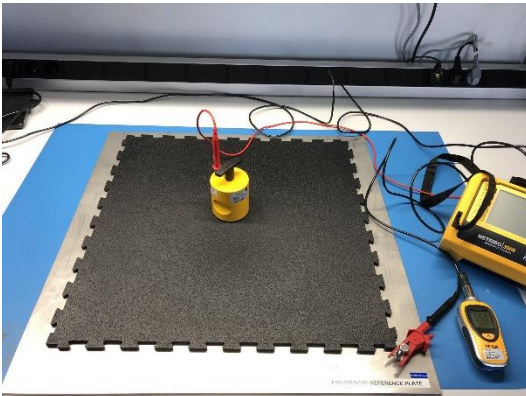


Figure 3 Material analysis – volume resistance – center position

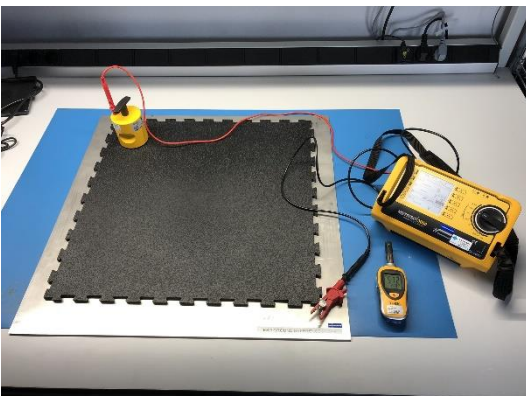


Figure 4 Material analysis – volume resistance – edge position

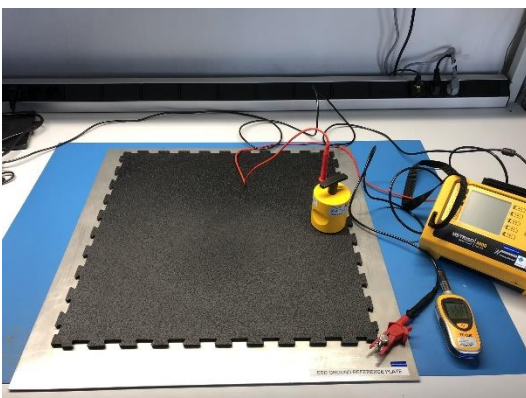


Figure 5 Material analysis – volume resistance – corner position





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Summarized:

Sample Position	Test voltage	Resistance (Ohm)		Limit (Ohm)
		Volume	Surface	Volume/ surface resistance
Center	10 V	$3,64 * 10^2$	Not tested	Max $1,0 * 10^9$
Edge	10 V	$5,57 * 10^2$		Max $1,0 * 10^9$
Corner	10 V	$3,69 * 10^2$		Max $1,0 * 10^9$

*Table 2 Electric resistance test results*



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## 4. Conclusion & recommendations

### 4.1 Conclusion

#### **Electric resistance**

The measured volume resistance on the sample material complies with the limit for electric volume resistance, as specified in NEN-EN-IEC-61340-5-1:2016 for flooring materials (product qualification).

### 4.2 Recommendations

This material is recommended for use in ESD safe environments build according to NEN-EN-IEC61340-5-1:2016.



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## 5. Used equipment

<b>Nr</b>	<b>Name</b>	<b>Type</b>	<b>Serial nr.</b>	<b>Last cal. date</b>	<b>Due date</b>
1	High impedance meter	Warmbier MetrISO 3000	CF1090	26-6-2018	26-6-2020
38	Temperature/ hygrometry meter	Warmbier TF530	1812-07532	24-1-2019	1-12-2020
27	Resistance probe	Warmbier model 870	15892	12-12-2018	12-12-2020

*Table 3 Used equipment*



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### Appendix A Details of the inspection company

#### Total ESD Solutions

Providing ESD Training, testing, Auditing & Consultancy services

- *ANSI ESDA TR53 Certified ESD specialist*
- *Member of the Dutch national standardization committee NEN-NEC-TC101 (Electrostatics)*
- *Member of the Dutch EMC/ ESD society (Nederlandse EMC/ ESD vereniging)*
- *Member of the American ESD association ANSI ESDA*

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