Appendix 6

Chairs

1 Scope

This appendix defines test methods for ESD protective properties of chairs for use in an EPA. It also defines requirements of the same parameters for the "ESD-approval".

The requirements for "ESD-approval" correspond to requirements specified in IEC 61340-5-1.

The test method corresponds to IEC 61340-2-3.

2 References

[1]	IEC 61340-5-1, edition 1.0, 2007	Electrostatics – Protection of Electronic devices from electrostatic phenomena – General requirements
[2]	IEC 61340-2-3, first edition	Method of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic accumulation.

3 Definitions

The definitions in this document follow the definitions in ref [1] and IEC 61340-1-2.

4 Sampling

At least three test samples are required. If the product is manufactured in a series of different variants but with the same type of material and construction, the chosen test samples shall be representative of the series.

5 Test method

5.1 Principle

The test method corresponds to IEC 61340-2-3 section 8.6.3.1.

5.2 Equipment

- V/A-meter with uncertainty less than ± 1 %. Keithley 487 or two multimeters Fluke 187 for current and voltage measurements.
- One conductive electrode (2.5 kg; Ø 63.5) according to IEC 61340-2-3, figure 4. The electrode shall be provided with conductive rubber pad as contact surface material between the electrode and the test object.
- Stainless steel plate.
- Insulating support plate larger than the base of the chair (vertical resistance higher than 10^{14} Ω).
- Stop watch (SP inv. No.: 501336) with uncertainty less than 0,2 s (including manual operation).

5.3 Preparation

If needed the test samples shall be cleaned according to the manufacturer's recommendations.

The test samples shall be conditioned at least 48 h in 23 °C ± 2 °C and 12 %RH ± 3 %RH.

Measurements are performed in 23 °C ± 2 °C and 12 %RH ± 3 %RH.

The contact surface material shall be less than 10^3 Ω measured at 10 V according to IEC 61340-2-3, section 8.2.3.

5.4 Procedure

The stainless steel plate is placed on the insulating support plate and the chair is placed so that one foot/wheel has contact with the steel plate and the other wheels are on the insulating support plate. The steel plate forms one electrode for the measurement. For chairs with one separate groundable point, this point replaces the metal plate.

The conductive electrode (2,5 kg; Ø 63.5) is positioned at the back, seat and arm pads respectively.

The electrode is energized at 10 VDC. If the indicated resistance is less than 10^6 Ω the value is recorded after 15 s ± 2 s.
If the indicated resistance is higher or equal to 10^6 Ω the electrode assemblies are deenergized and again energized but now at 100 VDC. The resistance value is recorded after 15 s ± 2 s.

The measurement is repeated at different test points. Between each individual measurement the chair is moved so that different contact points on the same wheel or foot are used. 5 to 10 measurements shall be performed for each test item.

Keeping the conductive electrode (2,5 kg; Ø 63.5) in one position on the seat, all the other wheels (or feet), one at a time, are measured as described above.

5.5 Results

Maximum, minimum and average of measured values with reference to test point are recorded.

5.6 Uncertainty

In the calculation only the uncertainty of the instrument is presented. The uncertainty of the method depends on the test sample, which can be inhomogeneous.

5.6.1 Picoamperemeter Keithley type 487, inv. No. 501419 or 502589.

	Voltage	Current	Total instrument uncertainty (at k=2): $\pm 2 \times \sqrt{\Sigma(\frac{fel\%}{\sqrt{3}})^2}$
4 kΩ at 10 V	±0.14 %	±0.108 %	**±0.31 %**
100 kΩ at 10 V	±0.14 %	±0.3 %	**±0.45 %**
40 kΩ at 100 V	±0.19 %	±0.108 %	**±0.34 %**
1TΩ at 100 V	±0.19 %	±0.8 %	**±0.98 %**

5.6.2 Multimeter Fluke type 187, inv. No. 503380 or 503381

	Voltage	Current	Total instrument uncertainty (at k=2): $\pm 2 \times \sqrt{\Sigma(\frac{fel\%}{\sqrt{3}})^2}$
25 Ω at 10 V	±0.06 %	±0.16 %	**±0.31 %**
4 kΩ at 10 V	±0.06 %	±0.258 %	**±0.38 %**
250 Ω at 100 V	±0.12 %	±0.16 %	**±0.33 %**
40 kΩ at 100 V	±0.12 %	±0.258 %	**±0.40 %**

5.6.3 Monroe 244 (SP inv. No. 501 781)

Voltage	Instrument uncertainty
Electrostatic potential	± 3V in the range 0-100 V ± 3 % in the range 100-3500 V

5.7 Report

Test report according to IEC 61340-2-3, section 11.

5.8 ESD approval

ESD-approval certificate shall as an additional information state:
The ESD-approval does not include any requirements regarding electrical safety properties. If work will be performed close to live voltages, requirements according to national regulations shall be fulfilled.

6 Requirements

To be "ESD-approved" the test items shall fulfil all of the following requirements:

- Resistance to groundable point must be less than 10^{10} Ω.
- Compliance of requirement in IEC 61340-5-1 regarding electrostatic field of maximum 10000 V/m measured as a potential of maximum 100 V according to SP-Method 2472, section 7.3.
- Compliance of requirement in SP-Method 2472, section 6.3.