# SLOVENSKI STANDARD
# SIST EN 4158:2009

**01-junij-2009**

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**Aeronavtika - Barve in laki - Preskusne metode za merjenje električne površinske odpornosti pri prevodnih plasteh**

Aerospace series - Paints and varnishes - Test method for measurement of electrical surface resistance of conductive layers

Luft- und Raumfahrt - Beschichtungsstoffe - Messung des elektrischen Oberflächenwiderstandes von elektrisch leitfähigen Schichten



Série aérospatiale - Peintures et vernis - Mesure de la résistance de surface électrique des couches conductrice



**Ta slovenski standard je istoveten z:** **EN 4158:2006**

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**ICS:**

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|---|---|---|
| 49.040 | Prevleke in z njimi povezani postopki, ki se uporabljajo v letalski in vesoljski industriji | Coatings and related processes used in aerospace industry |

**SIST EN 4158:2009** **en,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 4158

December 2006

ICS 49.040

English Version

# Aerospace series - Paints and varnishes - Test method for measurement of electrical surface resistance of conductive layers

Série aérospatiale - Peintures et vernis - Mesure de la résistance de surface électrique des couches conductrice

Luft- und Raumfahrt - Anstrichstoffe - Messen des elektrischen Oberflächenwiderstandes von elektrisch leitfähigen Schichten

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Ref. No. EN 4158:2006: E

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# Foreword

This document (EN 4158:2006) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

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# 1 Scope

This standard describes a method of measurement of the electrical resistance of electrically conducting surface coatings on non-conductive parts and samples for aerospace applications.

If electrical contact areas are provided, the method is also applicable on electrical conducting layers over coated with non-conducting layers.

# 2 Principle

The principle of the method involves applying a known voltage $U$ to the conductive layer, measuring the current I, and calculating the resistance $R_{\text{measured}}$ according to Ohm's law:

$$R_{\text{measured}} = \frac{U}{I}$$

The resistance of the layer $R_L$ can be calculated under the following assumptions (see Figure 1):

— homogeneous distribution of conducting particles in the layer

— layer thickness < 1 mm

— diameters $d$ of contact areas of electrodes are equal

— distance a between centers of electrodes > $3{,}5 \times d$

— dimensions of sample under test > $5 \times a$

— inner resistance of electrodes, cables, and contact resistance between electrodes and surface of the sample are negligible.



Then

$$R_L = \frac{\pi}{In\frac{2a}{d}} \times R_{\text{measured}} \qquad (1)$$

# 3 Apparatus

## 3.1 Fixed – Electrode – Set up

The assembly of electrodes consists of an electrode support made from an insulate, made up of two electrodes of conductive silicone elastomer as well as the connections to the measuring apparatus (see Figure 1).

Data to the assembly of electrodes according to Figure 1:

— Material: silicone elastomer, conductive

— Diameter ($d$): 4 mm

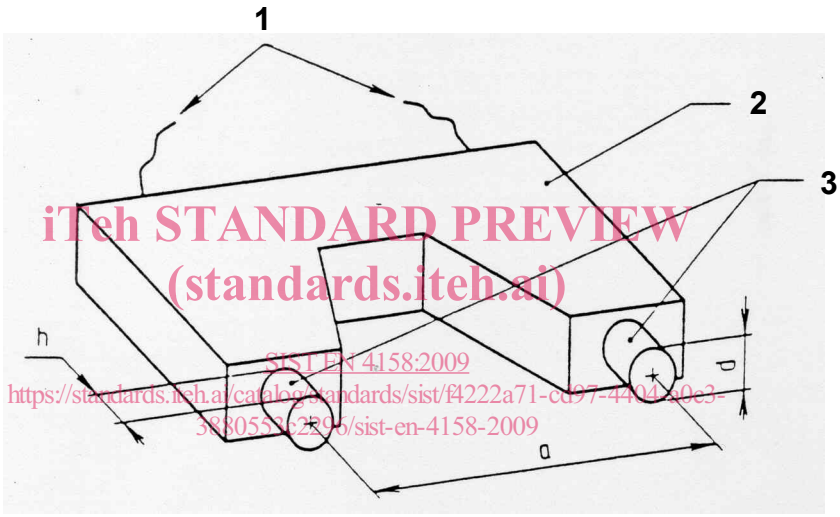
— Distance from centre to centre of the electrodes ($a$): $(50\ ^{0}_{-0,5})$ mm

— Protrusion to the support ($h$): (4 ± 1) mm

— Supporting surface: plane

— Contact resistance: ≤ 0,2 Ω

— Insulating resistance of the electrode support: minimum $10^{10}$ Ω






**Key**

1 Cable connections towards measuring apparatus
2 Electrode support in dielectric material
3 Electrodes made from conductive elastomer

**Figure 1 — Assembly of electrodes**

NOTE The result of equation (1) is with this geometry:

$$R_L = \frac{\pi}{In\frac{100}{4}} \times R_{\text{measured}} = \frac{\pi}{3,2} \times R_{\text{measured}} = R_{\text{measured}}$$

## 3.2 Electrical instruments

Ohmmeters or multimeters with the ohmic measuring range at least corresponding to the expected value shall be used. These instruments are customary in trade from several companies:

The instruments shall be controlled and calibrated regularly.

## 4 Test specimens

The specimens or parts shall be coated with an electrically conductive paint.

The size of the parts shall be not smaller than 300 mm × 300 mm.

If measurements on samples additionally coated with non-conducting paints are required, contact areas have to be provided.

For that purpose areas with a diameter of 10 mm and with a center–to-center distance of 50 mm must be protected with a foil which cannot be penetrated by components of the non-conductive paints.

## 5 Procedure

### 5.1 Measuring conditions

Measurements shall be performed after complete curing of the electrically conductive paint. The ambient temperature and relative air humidity should be between 15 °C and 35 °C and less than 70 % respectively.

### 5.2 Examination of the assembly of electrodes

The assembly of electrodes is connected to the measuring apparatus. Depending on the electrical surface resistance to be measured, the measuring range and the corresponding direct voltage of measurement are to be adjusted.



The functioning of the assembly of electrodes is controlled by pressure on an uncoated piece of metal (i.e. copper sheet with an electrical surface resistance < 1 Ω).



When using an ohmmeter, a measured value of 0 Ω shall be indicated on the measuring apparatus. If necessary, the measuring apparatus is adjusted to 0, otherwise the indicated value should be deducted.

After having removed the assembly of electrodes from the metallic surface, the ohmmeter should be adjusted to ∞.

### 5.3 Measuring of the electrical surface resistance on components

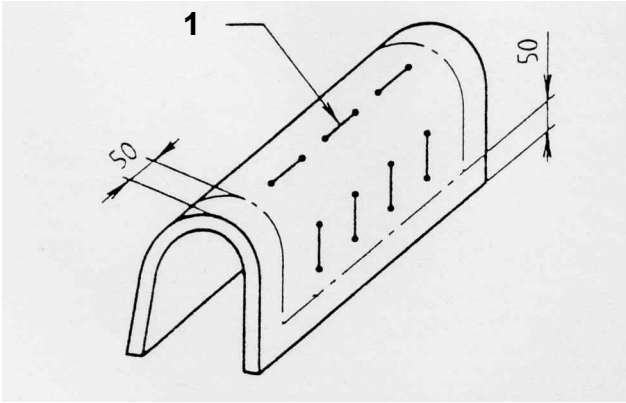
After commissioning of the assembly of electrodes and the measuring instrument, the measuring on components can be carried out, as described under 5.2. The electrical surface resistance is indicated directly.

Number and position of the measuring points depending on the component geometry.

If the components reveal one or several sections of those represented hereafter (Figures 2 and 3), the number and position of the measuring points would be determined according to the examples, i.e. a sufficient number of measuring points should be allocated to each surface.

NOTE The minimum distance between the measuring points and the edge of the component shall amount to 50 mm. If this distance is interior, incorrect higher values are measured.

Dimensions in millimetres




**Key**

1 Test point

**Figure 2 — Strongly bent components with bending radii < 100 mm**



Dimensions in millimetres

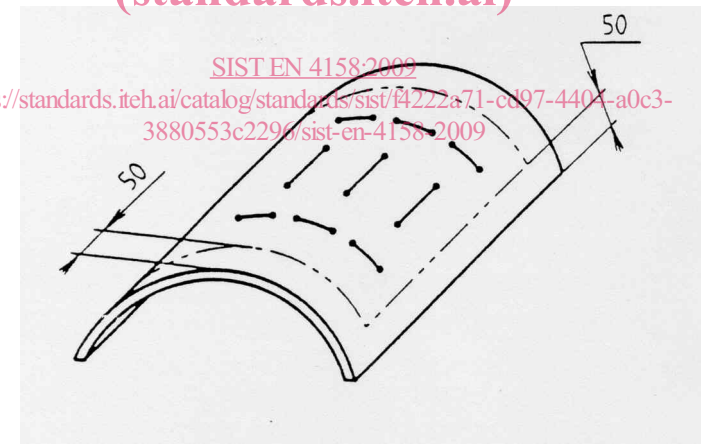





**Figure 3 — Slightly bent with radii > 100 mm and flat components**