SLOVENSKI STANDARD
oSIST prEN 4860:2020

01-julij-2020

Aeronavtika - Okoljski preskusi - Preskus Xb: obraba oznak, črk, površin in materialov zaradi drgnjenja s prsti in dlanmi

Aerospace series - Environmental testing - Test Xb: Abrasion of markings, letterings, surfaces and materials caused by rubbing fingertips and hands

Luft- und Raumfahrt - Umweltprüfung - Abrasiver Verschleiß von Bedruckungen, Beschriftungen, Oberflächen und Materialien verursacht durch die Reibung der Fingerkuppe oder der Hand

Série aérospatiale - Essais d'environnement - Essai Xb : Abrasion de marques, lettres, surfaces et matériaux par cause de frottement de doigts et de mains

Ta slovenski standard je istoveten z: **prEN 4860**

ICS:

19.040	Preskušanje v zvezi z okoljem	Environmental testing
49.020	Letala in vesoljska vozila na splošno	Aircraft and space vehicles in general

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EUROPEAN STANDARD

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ICS

English Version

Aerospace series - Environmental testing - Test Xb: Abrasion of markings, letterings, surfaces and materials caused by rubbing fingertips and hands

Série aérospatiale - Essais d'environnement - Essai Xb : Abrasion de marques, lettres, surfaces et matériaux par cause de frottement de doigts et de mains

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If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 4860:2020) 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 document is currently submitted to the CEN Enquiry.

1 Scope

This document provides a series of standard testing methods to determine the resistance of markings, letterings, surfaces and materials on flat or curved surfaces against abrasion as may occur for example by manually operating actuators, buttons, materials and surfaces in aerospace. The method is also suitable to test the resistance against fluids, pastes, particles and other materials and also in combination.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60068-1:2014, *Environmental testing - Part 1: General and guidance*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at http://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

4 General description

Marking and lettering on the product surface is a communication feature between the product and human beings. This communication feature often affects its usability and diminishes the value of the product. Therefore, testing of the abrasion resistance to the environmental load on the surface generated by human physical contact is of great importance.

5 Description of the test apparatus, test piston, test fabric and test media

5.1 General description

A suitable test apparatus shall comprise all the parts and generate the motion which are described in the drawing in Annex A.

A dynamic pneumatic drive shall move the test piston via a connecting rod towards the surface under test and then over it. The tip of the test piston due to its viscoelasticity is deformed in such a way as to fit the surface under test. This is to simulate the motion of human fingertip including its hand and arm muscles. This motion shall be repeated cyclically. A viscoelastic test piston shall be used to simulate the characteristics of the human fingertip, ball of a thumb and hand. The material property, hardness, the shape and the surface topography of the test piston shall be chosen in such a way that the pressure and friction executed by a human finger or by the ball of a thumb are simulated. To obtain reproducible conditions for impact and friction, a piece of fabric is placed between the piston and the surface under test (either as a cover of the piston or as a curtain, hanging between piston and surface). The test fabric shall be chosen according to the real simulation condition. Depending on the relevant specification, this fabric may either be dry (dry test) or wetted with a specified test liquid by means of an automatic feedthrough if the test is intended to cover the influence of fluid contamination as may occur in normal use (wet test).

The test specimen shall be positioned on a solid, rigid frame being able to hold a range of samples with various dimensions and geometries and withstand all forces specified in this document. For non-rigid test specimens, additional sample support shall be used.

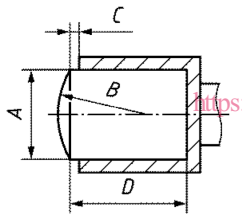
5.2 Motion of the test piston

A single cycle of the test piston shall comprise: movement of the piston towards the test specimen at an angle of 45 ° ± 5 ° to the surface of the specimen and at a velocity of 60 mm/s ± 5 mm/s. After the test piston impacts the surface of the specimen, it shall move parallel over the surface of the specimen for a specified distance (referred to as the rubbing path). During this portion of the movement the test piston shall apply a specified force and the longitudinal axis of the test piston shall remain normal to the test specimen. The test piston shall then retract and separate from the surface of the specimen and return to its start position. This motion shall be repeated cyclically as many times as prescribed by the relevant specification and the duration of the cycle set so that the “piston pressing on the surface” and “piston lifted times” are approximately equal. The period of each pressing unidirectional movement cycle is set based upon the force applied by the test piston and the rubbing path. The length of the rubbing movement shall be set to that specified in the relevant specification, which shall be between 4 mm and 40 mm. The applied force shall be set to that specified in the relevant specification and shall be between 1 N and 20 N. The test specimen shall be firmly mounted on an adjustable, solid and rigid frame.

5.3 Test piston

The size and the type of the test piston shall be selected from Table 1 according to the shape and dimension of the test specimen and the kind of lettering. The test piston shall consist of viscoelastic material which shall be chemically inert against the test liquids and shall be characterized by a Shore-A-hardness of 48 ± 5, measured on the flat side of the viscoelastic material.

Table 1 — Information about size of the test piston

	Dimensions mm			
Size	*A* ±0,1	*B* ±0,1	*C* ±0,1	*D* ±0,15
1	10	20	1	32
2	20	20	3	35
3	30	20	2	32

If necessary other dimensions for the test piston more suited to the test specimen may be chosen. They shall then be prescribed by the relevant specification. The load-displacement charts shall be documented by the manufacturer and provided upon request.

The test piston shall be replaced regularly to obtain the reproducible test results. The normal lifetime of the test piston is no more than 1 (one) year or 2 000 000 test cycles, whichever occurs first. It could wear out before reaching the maximum lifetime depending on the usage (e.g. test media, forces) which can drastically change this behaviour. Wear signs include divergent hardness, loss of the contour of the contact surface, damages on the surface, and discoloration and gloss change of the viscoelastic test piston material. If one of the latter occurs, the test piston shall be replaced.

5.4 Test fabric

Between the test specimen and the test piston there shall be an easily replaceable piece of fabric which also can be a cover for the test piston.

EN ISO 12947-1:1998, Table 1 gives an example of specifications of the test fabric.

Abrasion side, machine direction and cross direction of the fabric shall be specified. Additionally, they shall be marked. The movement direction of the test piston shall be parallel to the machine direction of the fabric to maintain reproducibility. To ensure this, a guide for the fabric is recommended. The fabric

has to be free from folds, wrinkles and creases. Any post processing to remove those artefacts is not permitted.

In case the test piston is covered by the fabric directly, an additional mark on the fabric is recommended before the use.

Annex D gives a recommendation for technical specification of the fabric. For the “dry test”, the fabric shall be changed or moved such as to bring an unused part of it into contact with the test specimen after a maximum of 250 cycles in order to avoid wear of the fabric. The fabric feed can be realized automatically or manually.

For the “wet test” (see 5.3), at the start of a new test and after a maximum of 250 cycles, the fabric shall be renewed to avoid stray results due to encrustation and wear. The automatically moistening of the fabric shall be repeated parallel to the fabric feed in order to wet the newly used areas of the fabric. The fabric shall be fully wettened, especially on the area of the fabric facing the specimen. The moistening can be achieved by a periodic dripping of the test media on to the fabric (Annex A).

If mentioned in the relevant specification, other test fabrics can be used. In Annex B, other suitable fabrics are listed.

The abrasive dust produced during the test shall not influence the result of the test. Therefore, it shall be removed periodically from the area between the test piston and the test specimen.

NOTE The accumulation of abrasive dust can be avoided by mounting the test surface vertically (the dust will fall down) or by blowing it off by means of compressed air free of oil and any pollution at room temperature.

5.5 Test media

When a “wet test” is specified in the relevant specification the test media shall be specified.

Specified test media (e.g. particles, fluids and pastes) shall be added by an automatic feed due to a pump from a closed container. The automatic dripping system will moisten the textile at the abrasion point/area directly.

Specified test media may be:

a) artificial sweat;

b) oil and grease;

c) caffeine-containing liquid;

d) sun cream;

e) other relevant media.

A list of suitable test media can be found in Annex C. The media can be solid, liquid, pasty or mixed.

If more than one test media is specified, different specimens shall be used for each media unless otherwise specified by the relevant specification.

6 Severity

The load is given by the force with which the test piston acts on the specimen and by the number of cycles. It shall be chosen from the following values. The chosen values shall be prescribed in the relevant specification.

Force: 1 N ± 0,2 N; 2 N ± 0,4 N; 4 N ± 0,8 N; 5 N ± 1 N; 8 N ± 1,6 N; 10 N ± 2 N; 15 N ± 3 N; 20 N ± 4 N.

The rubbing path length shall be selected from the following values.

Rubbing path length: 4 mm; 5 mm; 10 mm; 15 mm; 20 mm; 25 mm; 30 mm; 35 mm; 40 mm.

Number of cycles: 101; 102; 103; 104; 105; 106; 107.

7 Preconditioning

The surface under test shall be in the condition of delivery after normal production. The relevant specification may prescribe preconditioning (for example aging, dusting and cleaning).

8 Initial measurements

The specimen shall be submitted to a visual check and if prescribed by the relevant specification to dimensional and functional checks. Additionally, an automated mobile 3D-scanning device can be used to determine the topography including visual impression.

9 Testing

Testing shall only commence after the specimen, test apparatus, test media and test fabric are all stabilized at the required ambient climatic conditions. Those conditions shall be maintained, with specified tolerances, throughout the test.

Unless specified otherwise in the relevant specification, the test shall be conducted at one of the ambient conditions set out in Table 2 (from EN 60068-1:2014, Table 1). The relevant specification may specify alternative ambient temperatures, within a range of −40 °C to +85 °C.

The surface of the specimens shall be stressed in the test apparatus with the prescribed severity.

Table 2 — Standard ambient conditions for test

Temperature		**Humidity** %	**Air pressure** KPa
Nominal value °C	**Tolerance** °K	**Range**	**Range**
20	±2	60 to 70	86 to 106
23	±2	45 to 55	
25	±2	45 to 55	
27	±2	60 to 70	

For high and low temperature test, other stamps shall be used according to the relevant specification.

The test piston shall be pressed against the surface with the force given for the chosen severity. The cycle frequency shall be 2,0 Hz ± 0,1 Hz (2 strokes per second). The frequency of 2 Hz is only valid for the standard rubbing path of 4 mm with a load of 1 N. For higher rubbing paths, the frequency will be lower. Also, the inserted test load will have an influence on the frequency. In Table 3, the proposed frequencies for different rubbing paths and loads are shown.

NOTE With higher frequencies it is possible that the temperature of the test specimen is unacceptably increased.

Table 3 — Frequencies for different rubbing paths and loads

Rubbing path length mm	1 N Hz	5 N Hz	10 N Hz	15 N Hz	20 N Hz
4	2,0	1,9	1,6	1,5	1,4
5	1,9	1,8	1,5	1,4	1,3
10	1,4	1,3	1,2	1,1	1,0
15	1,1	1,1	1,0	0,84	0,81
20	0,98	0,94	0,89	0,71	0,68
25	0,84	0,81	0,76	0,60	0,58
30	0,73	0,69	0,66	0,53	0,51
35	0,66	0,63	0,60	0,47	0,46
40	0,58	0,55	0,54	0,42	0,41

10 Intermediate measurements

The specimen surface shall be submitted to a visual check to compare with initial measurements. Any additional intermediate measurements may be required by the relevant specification.

11 Recovery

Recovery may be required by the relevant specification.

12 Final measurements

The specimen shall be submitted to a visual check to compare with the initial measurements and if prescribed by the relevant specification to dimensional and functional checks. Additionally, an automated mobile 3D-scanning device can be used to determine the topography including visual impression. The relevant specification shall provide the criteria upon which the acceptance or rejection of the specimen is to be based.

13 Relevant information to be given in the test report

When this test is included in a relevant specification, the details given in Table 4 shall be given in a test report, in so far as they are applicable. It shall supply information as required in the clauses listed below.

Table 4 — Information given in the test report

Numbering	Information	To be filled out with
A	Customer	Name and address
B	Test laboratory	Name and address
C	Test person	Name
D	Date of test	yyyy-mm-dd
E	Type of test	Xb
F	Purpose of test	Development, QM etc.
G	Test standard, date of publication	EN 4860:201X
H	Designation of test laboratory	Number and edition
I	Designation of test apparatus	Manufacturer, designation of model, device number, etc.
J	Date of last calibration	yyyy-mm-dd
K	Description of test specimen	Figure, amount, construction level
L	Description of certification stamp	1, 2, 3
M	Type of testing	Dry, wet
N	Test media	List of all media
O	Fabric feed/change	Automatic, manual, number of cycle, length of feed
P	Fabric humidification	Automatic, manual, number of cycle, amount
Q	Test force	Load in N
R	Number of strokes	
S	Rubbing path	length in mm
R	Test conditions	Temperature; relative humidity
U	Pre-treatment	Type of pre-treatment
V	Start measurement	—
W	Intermediate measurement	—
X	Post-treatment	—
Y	Final test	—
Z	Test result	Test result