
Aeronavtika - Okoljski preskusi - Trajnost zaslonov za splošno uporabo

Aerospace series - Environmental testing - Durability of the displays by general usage

Luft- und Raumfahrt - Umweltprüfung - Beständigkeit der Displays bei allgemeiner Nutzung

Série aérospatiale - Essais d'environnement - Durabilité des affichages d'utilisation générale

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ICS:

31.120	Elektronske prikazovalne naprave	Electronic display devices
49.095	Oprema za potnike in oprema kabin	Passenger and cabin equipment

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Aerospace series - Environmental testing - Durability of the displays by general usage

Série aérospatiale - Essais d'environnement -
Durabilité des affichages d'utilisation générale

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der Displays bei allgemeiner Nutzung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ASD-STAN.

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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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 4876:2021) 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 document has received the approval of the National Associations and the Official Services of the member countries of ASD-STAN, prior to its presentation to CEN.

This document is currently submitted to the CEN Enquiry.

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1 Scope

This document provides a series of testing methods to determine the resistance of the digital display during general usage in an aircraft cabin. The document applies to any passive and interactive displays. It includes also dirt affinity and cleanability.

The testing methods include the determination of the durability of touchscreen surfaces, signing pads and general displays against human fingertip and hand abrasion, fingerprint and dirt affinity under the usage by humans as can occur during everyday operation inside an aircraft cabin. Additionally, the resistance against general abrasion, scratch and mar on the displays as well as the resistance study against the routine cleaning procedure conducted inside the aircraft is defined.

The test methods are also suitable to test the durability of a display surface against all low and high dynamic strains.

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.

prEN 4860, *Aerospace series — Environmental testing — Test Xb: Abrasion of markings, letterings, surfaces and materials caused by rubbing of fingertips and hands*¹

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 <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 General test description

4.1 General

The six tests scenarios for testing the durability of the displays in cabin interior are defined in 4.2 to 4.7.

4.2 Fingertips and hand abrasion test

The surface under test shall be repeatedly stressed by the impact and rubbing movement of a test piston. The tip of the test piston due to its elasticity shall be deformed in such a way as to fit the surface under test. The material, hardness, roughness and shape of the piston, the movement and the angle of action shall be chosen in such a way that the pressure and friction executed by a human fingertip or by the ball of a thumb are simulated.

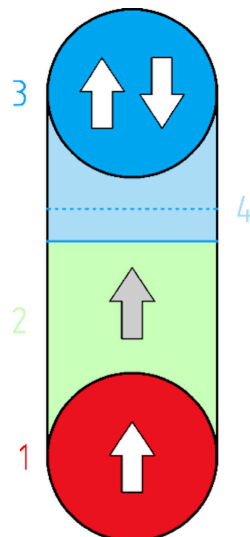
To obtain reproducible conditions of friction and wear, a piece of fabric shall be placed between the piston and the surface under test either as a cover of the piston or as a curtain, hanging between piston and surface. The testing fabric, depending on its specified property, can contain additional ingredients as a lubricant. Therefore, depending on the relevant specification, this fabric can either be used in a dry condition (dry test and semi dry test) or additionally wetted with a specified test liquid by means of an

¹ Published as ASD-STAN Standard at the date of publication of this document by AeroSpace and Defence industries Association of Europe — Standardization (ASD-STAN), <http://www.asd-stan.org/>.

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automatic feedthrough if the test is intended to cover the influence of fluid contamination as may occur in normal use (wet test).

Depending on the three different motions of human fingertips on the display, namely touch, swipe and zoom motions, the abrasion patterns are described in Figure 1, see [1].

**Key**

- 1 Impact on the sample surface = Putting on the fingertip when using display = short tap or touch motion
- 2 Friction path with defined force and speed/transition between static and sliding friction = Swipe movement
- 3 Reaching the end point of the friction movement, then the test cylinder moves back to the starting position = Finger stops the swipe movement
- 4 Short area where the test piston moves bidirectionally on the surface = Retraction of the piston

Figure 1 — Fingertip abrasion zone and movement pattern

The complete test procedure for testing the resistance against fingertip and hand abrasion for cabin touch screens shall be done according to prEN 4860. The complete test fabric options and test media options are described in Annex C and in prEN 4860.

Additional speed options, differing from the 60 mm/s \pm 5 mm/s specified in prEN 4860, such as 200 mm/s shall be used to simulate realistic stress conditions.

4.3 Fingerprint affinity

This test method serves as securing of a consistent implementation for the attachment of a fingerprint on surfaces of displays.

The test medium shall be attached on the surface of a display surface fitting by the help of a silicon stamp, using a reproducible amount and film thickness of the testing medium. The intensity of the imprint, like a fingerprint, on the testing surface shall be documented and quantified depending on the quality and the property of the surface coatings on the displays.

4.4 Scratch and mar tests

This test method serves as a protocol for the general scratch and mar tests under both low and high dynamics. The surface of the display under test shall be once or repeatedly stressed by a scratch and mar movement of any counterpart which includes metal, digital writing instruments, plastic parts, leather and textiles. The display can be a digital display, a touchscreen, a signing pad or any other interactive display.

The scratch movement shall start with an impact motion by lowering the tip onto the surface automatically in a reproducible fashion, and a further slide motion with one direction, then the test tip shall be lifted and moved back to the initial impact point with a further one-direction slide, repeating this cyclic motion for certain times. Mar movement shall be a one directional movement followed by the controlled-speed initial impact with the tip on the surface.

Two scratch/mar damage areas occur and shall be evaluated accordingly as described in Figure 2 and Figure 3.

The test head/tip should be defined by the relevant specification in dependence of the specific test application, but should be defined in terms of material, hardness, roughness and concrete shape as well as the movement angle to obtain reproducible test conditions. Depending on the relevant specification, an additional fabric and/or test medium can be used for testing.

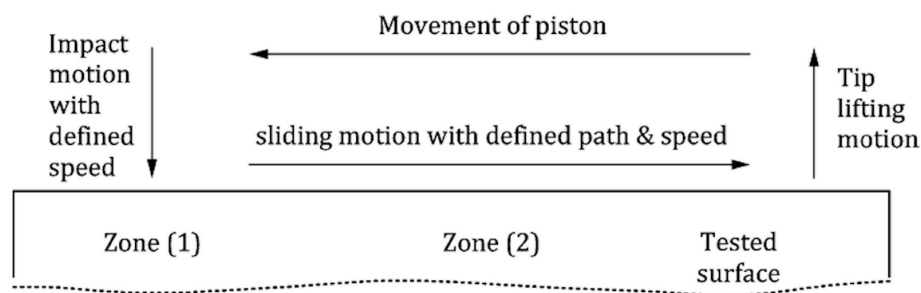


Figure 2 — Movement type 1: Cyclic uni-direction
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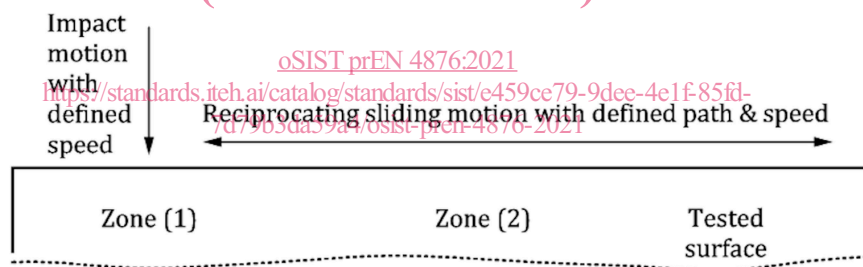


Figure 3 — Movement type 2: reciprocating movement

4.5 General abrasion tests

This test method serves as a protocol for the general abrasion tests under both low and high dynamics. The surface of the display under test shall be once or repeatedly stressed by an abrasion movement either one-direction or reciprocating motion. The abrasion counterpart and testing objects are described in 4.4.

The test head/tip should be defined by the relevant specification in dependence of the specific test application, but should be defined in terms of material, hardness, 3D roughness and 3D shape as well as the movement angle to obtain reproducible test conditions. Depending on the relevant specification, an additional fabric and/or test medium can be used for testing.

4.6 Dirt affinity test

This test method serves as securing of a consistent implementation for the attachment of the dirt on surfaces of displays.

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The test medium shall be attached on the surface of a display fitting by the help of a silicon stamp, using a reproducible amount and film thickness of the testing medium. The dirt on the testing surface can be standardized dirt, ketchup or mustard. The intensity of the dirt on the testing surface shall be examined.

4.7 Cleanability test

This test method serves as a protocol for evaluation of the cleanability on the display surface with various contamination. The implementation of this test includes the cyclic cleansing of the fingerprint, dirt, soil and ketchup. The time period between the attachment of the fingerprint/dirt on the display sample and the cleansing lasts $24 \text{ h} \pm 2 \text{ h}$.

5 Description of the test apparatus**5.1 Fingertip and hand abrasion test****5.1.1 General**

For testing the fingertip and hand abrasion resistance of cabin displays, a test apparatus described in prEN 4860 shall be used.

5.1.2 Test fabric

Suitable test fabrics can be found in prEN 4860. For additional textile options, see Annex C.

5.1.3 Test media

Suitable test media can be found in prEN 4860. For additional test media options, see prEN 4860.

5.2 Fingerprint test for cabin touch screens**5.2.1 General**

A silicone stamp pad with a diameter of 40 mm and a grooved structure as the human papillary structure should be used to generate the imprint, see Figure 4.

Additionally, a traction/compression machine, with an adjustable force stop shall be used, see Annex A. By pressing the stamp pad with a defined load of 5 N to 30 N as specified for five seconds onto the test fabric with the infiltrated media, a reproducible fingerprint shall be generated.



Figure 4 — Fingerprint stamp

5.2.2 Test fabric

Wool felt H1 shall be used to absorb the test media and serves as a substrate material for step 1, see 9.3.

5.2.3 Test media

As standardized test gel or sebum with the defined ingredients should be used.

The media shall be spread onto the wool felt before pressing the stamp pad onto the felt, for step 1, see 9.3.

5.3 Scratch and mar tests

A different test apparatus shall be used.

An example of a suitable test apparatus is shown in Annex B, Figure B.1. The apparatus moves the scratch tip under an angle of $90^\circ \pm 5^\circ$ in a horizontal level over the surface.

For scratch test, the tip shall fall down on to the surface automatically with a certain momentum to simulate the first initial impact which often occurs, e.g. while signing on a touch pad by a digital pen. Then the testing tip shall slide at a defined speed one direction with the length between 15 mm to 120 mm on the surface. This procedure shall be repeated cyclically by lifting the tip to the initial impact point then followed with the uni-direction movement. Another scenario is the tip shall slide on the surface after the initial impact with reciprocating motion for certain times.

For mar test, the tip shall fall down on to the surface automatically with a momentum to simulate the first initial impact then shall follow by solely uni-direction movement at a defined speed. This two-step movement shall then be repeated many times as described by the relevant specification.

The velocity v shall be generated by a pneumatic cylinder in order to simulate the human load. The normal load shall be caused by adding weight disc onto the test head. The velocity of the cylinder and the normal force shall be given in the relevant specification.

The scratch and mar test shall be performed either with medium speed (0,15 m/s to 0,50 m/s) or high dynamic speed (0,51 m/s to 1,5 m/s) depending on the situation of the realistic simulation. Because of the universal approach for this test, the parameter shall be defined by the relevant specification.

Relevant scratch tips including metal, plastic and digital writing tip shall be used.

5.4 General abrasion tests

For the general abrasion test, the same test apparatus as described in 5.3 shall be used.

Relevant abrasion tips including leather and textile shall be used.

5.5 Dirt affinity test

5.5.1 General

For the dirt affinity test, the same test apparatus and test procedure as described in 5.2 shall be used.

5.5.2 Test fabric

Wool felt H1 shall be used to absorb the test media and serves as a substrate material, for step 1, see 9.3.

5.5.3 Test media

Standardized dirt, ketchup or mustard with the certain indigents should be used.

The media shall be spread onto the wool felt before pressing the stamp pad onto the felt, for step 1, see 9.3.