



SLOVENSKI STANDARD

SIST EN 2311:2012

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Nadomešča:
SIST EN 2311:2001

Aeronavtika - Puše s samomazalno oblogo - Tehnična specifikacija

Aerospace series - Bushes with self-lubricating liner - Technical specification

Luft- und Raumfahrt - Buchsen mit selbstschmierender Beschichtung - Technische Lieferbedingungen

Série aérospatiale - Bagues avec garniture autolubrifiante - Spécification technique

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ICS:

49.030.99 Drugi vezni elementi Other fasteners

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EUROPEAN STANDARD
NORME EUROPÉENNE
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Aerospace series - Bushes with self-lubricating liner - Technical specification

Série aérospatiale - Bagues avec garniture autolubrifiante -
Spécification technique

Luft- und Raumfahrt - Buchsen mit selbstschmierender
Beschichtung - Technische Lieferbedingungen

This European Standard was approved by CEN on 23 December 2011.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 2311:2012) 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 September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

This document supersedes EN 2311:1987.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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EN 2311:2012 (E)**1 Scope**

This European Standard specifies the required characteristics, inspections and tests, quality assurance and qualification, acceptance and delivery conditions for bushes, designed to be subjected under load, to slow sliding movements, rotations and small oscillations only for aerospace applications.

This standard applies to all bushes when referred to in respective product standards or in a design documentation.

The liner is designed to be used in the temperature range of – 50 °C to 163 °C. Aluminium bushes are limited to – 55 °C to 121 °C.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2285, *Aerospace series — Bushes, plain aluminium alloy with self-lubricating liner — Dimensions and loads*

EN 2286, *Aerospace series — Bushes, flanged aluminium alloy with self-lubricating liner — Dimensions and loads*

EN 2287, *Aerospace series — Bushes, plain corrosion resisting steel with self-lubricating liner — Dimensions and loads*

EN 2288, *Aerospace series — Bushes, flanged corrosion resisting steel with self-lubricating liner — Dimensions and loads*

EN 2755, *Aerospace series — Bearings, spherical plain in corrosion resisting steel with self-lubricating liner — Elevated load at ambient temperature — Technical specification*

EN 4534-2, *Aerospace series — Bushes, plain in aluminium alloy with self-lubricating liner, elevated load — Part 002: Dimensions and loads — Inch series*

EN 4535-2, *Aerospace series — Bushes, flanged in aluminium alloy with self-lubricating liner, elevated load — Part 002: Dimensions and loads — Inch series*

EN 4536-2, *Aerospace series — Bushes, plain in corrosion resisting steel with self-lubricating liner, elevated load — Part 002: Dimensions and loads — Inch series*

EN 4537-2, *Aerospace series - Bushes, flanged, corrosion-resisting steel with self-lubricating liner, elevated load - Dimensions and loads - Inch series*

EN 9100, *Quality management systems — Requirements for Aviation, Space and Defense Organizations*

EN 9133, *Aerospace series — Quality management systems — Qualification procedure for aerospace standard parts*

EN 10204, *Metallic products — Types of inspection documents*

ISO 11078, *Aircraft — De-icing/anti-icing fluids — ISO types II, III and IV*

EN ISO 8785, *Geometrical Product Specification (GPS) — Surface imperfections — Terms, definitions and parameters (ISO 8785)*

TR 4475, *Aerospace series — Bearings and mechanical transmissions for airframe applications — Vocabulary*¹⁾

3 Terms and definitions

For the purpose of this standard the terms and definitions given in TR 4475 and the following definitions apply.

3.1 Description

Bushes with self-lubricating liner are composed of a ring in corrosion resisting steel or aluminium alloy with a self-lubricating liner bonded to the bore. As regards flanged bushes, the self-lubricating material is bonded to the outer face of the flange as well as the bore.

3.2 Loads

3.2.1

permissible static radial load C_s or permissible static axial load C_a (flanged bushes only)

the maximum permissible load (without safety factor), which can be applied statically

It is defined as a unit pressure multiplied by the effective projected area (radial or axial), for deformations that are compatible with correct operational behaviour.

3.2.2

ultimate static load (radial or axial)

1,5 times the value of the permissible static load and defined as being the highest load the bush will support without failure occurring

3.2.3

permissible dynamic radial load C_{25}

the load that a bush can withstand, when subjected to an oscillating movement for 25 000 cycles, at the rate of (12 ± 2) cycles/min

3.2.4

cycle

an angular displacement of the shaft in relation to the lined bush of 0° to 25° , then of 25° to -25° and finally -25° to 0°

1) Published as ASD-STAN Technical Report at the date of publication of this standard by Aerospace and Defence Industries Association of Europe-Standardization (ASD-STAN), (www.asd-stan.org).

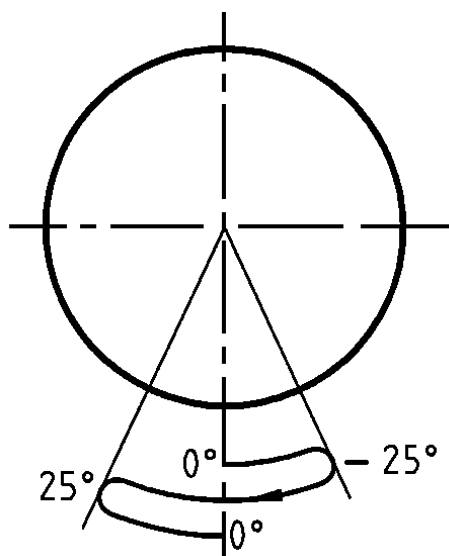


Figure 1

3.3 Friction torque under load at ambient temperature

The coefficient of friction is calculated as follows:

$$\mu = \frac{T}{C_{25} \cdot R}$$

where

μ is the coefficient of friction;

T is the dynamic rotational torque under load, expressed Newtonmeter (Nm);

R is the radius of shaft, expressed in metres (m);

C_{25} is the dynamic radial load, expressed in Newton (N);

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3.4 Surface discontinuities

3.4.1 crack

linear recession with a sharp bottom resulting from a disturbance of the integrity of the surface, and of the parent material of the workpiece

[SOURCE: EN ISO 8785]

3.4.2 score or scratch

surface defect which is a recession of irregular shape and unspecified direction

[SOURCE: EN ISO 8785]

3.4.3 lap

tongue-like raising of small thickness, often in the form of a seam, caused by folding over of material and forcing it into the surface when rolling, forging etc.

[SOURCE: EN ISO 8785]

3.4.4**seam**

non-welded fold which appears as an open defect in the material

3.5 Adhesion of the liner**void**

an area where the adhesive bond is broken or non-existent leaving a smooth and clean area on the metallic surface

3.6 Delivery batch**delivery batch**

consists of bushes bearing the same identity block although they may originate from different manufacturing batches

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EN 2311:2012 (E)

4 Required characteristics, inspection and test methods

See Table 1.

Table 1

Clause	Characteristics	Requirements	Inspection and test method	Q ^a	A ^a
4.1	Materials	In accordance with the product standards or design documentation	Chemical analysis and physical properties or a certificate of compliance according to EN 10204, 3.1B issued by the semi-finished product manufacturer.	X	X
4.2	Dimensions and tolerances	In accordance with the product standards or design documentation	Suitable measuring instruments Measurement of the bore^b and of the outer diameter — Rings having a width of < 10 mm: in the median plane. — Rings having a width of > 10 mm: in two planes parallel to the outer faces and placed at a distance from these faces twice the maximum chamfer value of these rings. Measurement of widths of rings: — A minimum four points check on the width of each ring (distance between the two faces).	X	X
4.3	Masses	In accordance with the product standards or design documentation	Suitable methods	X	
4.4	Marking	In accordance with the product standards or design documentation	Visual examination	X	X
4.5	Surface appearance	— The bushes shall be free of surface discontinuities liable to have a detrimental effect on the characteristics and durability. — The liner shall not contain contaminant products and shall not show broken or voided areas. — No lubrication allowed.	Visual monitoring using appropriate procedures.	X	X
4.6	Surface roughness	Shall conform to product standards	Suitable measuring instruments or visual tactile samples.	X	X
4.7	Static loads: — radial: C _s — axial: C _a	Shall conform to product standards With permissible static loads no maximum total deformations greater than those indicated in Table A.1. After removal of the loads, no permanent deformations greater than those indicated in Table A.1.	See Annex A.	X	

(continued)

Table 1 (continued)

Clause	Characteristics	Requirements	Inspection and test method	Q ^a	A ^a
4.8	Ultimate loads: — radial — axial	After removal of the loads, no rupture, or crack.	See Annex A.	X	
4.9 4.9.1	Dynamic load and friction coefficient Dynamic radial load C₂₅: — at ambient temperature — at low temperature — at high temperature	Shall conform to product standards. After removal of the loads: These shall be: no metal to metal contact between the shaft and bush. wear of the liner shall not exceed the values indicated in Table B.1. liners resistance to peeling and adhesion shall meet the requirements of 4.11 and 4.12.	See Annex B.	X	
4.9.2	Friction coefficient^c	After dynamic test and before removal of load, torque to rotate shaft shown in Figure B.1 shall be measured and the value of μ calculated. The value shall not exceed 0,05 at ambient temperature.	See Annex E.		
4.10	Compatibility between the liner and fluids	The bushes shall meet the requirements of 4.9 at ambient temperature after immersion in the specified fluids. Wear of the liner shall not exceed the values indicated in Table B.11.	Check one bush per fluid: — the bush shall be immersed for 24 h in the fluids stated in Annex C at the following temperatures: — (45 ± 3) °C for those defined in C.1 and C.2, — (70 ± 3) °C for those defined in C.3, — ambient temperature for those defined in C.4 Within ½ h after this test, proceed to the test defined in B.2.4.	X	
4.11	Resistance of the liner to peeling	The requirements and this test only be applied where there is an indication from the manufacturer that the liner is susceptible to peeling. Bushes smaller than 15 mm diameter shall be exempt from this requirement. It shall present a mean peeling resistance of > 0,35 N/mm of width of the outer ring reduced by 2 mm to eliminate the effects of edges and chamfers. Mean resistance shall be such that at least 75 % of the recording curve lies above 0,35 N/mm.	See Annex D. For acceptance, this test shall be carried out immediately after assembly and curing.	X	X

(continued)