



SLOVENSKI STANDARD
SIST EN 2064:2001
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Aerospace series - Bearings, spherical plain in corrosion resisting steel with self-lubricating liner - Technical specification

Aerospace series - Bearings, spherical plain in corrosion resisting steel with self-lubricating liner - Technical specification

Luft- und Raumfahrt - Gelenklager aus nichtrostendem Stahl mit selbstschmierender Beschichtung - Technische Spezifikation

Série aérospatiale - Rotules en acier résistant a la corrosion a garniture autolubrifiante - Spécification technique

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ICS:

49.035	Sestavni deli za letalsko in vesoljsko gradnjo	Components for aerospace construction
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EUROPEAN STANDARD

EN 2064:1992

NORME EUROPÉENNE

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Descriptors: Aircraft industry, ball joints, corrosion resistant steels, linings, selflubrication parts, specifications, characteristics, inspection, tests

English version

**Aerospace series - Bearings spherical plain in
corrosion resisting steel with self lubricating liner
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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Foreword

This European Standard has been prepared by the European Association of Aerospace Manufacturers (AECMA).

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

According to the Common CEN/CENELEC Rules, the following countries are bound to implement this European Standard :

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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1 Scope

This standard specifies the required characteristics, inspections and tests, qualification, acceptance and delivery conditions for bearings with self lubricating liners, designed to be subjected under load to slow rotations and oscillations only.

2 Field of application

These bearings are intended to be used between fixed and moving components of the aircraft structure, such as control surfaces, flaps, doors etc. and their control mechanisms.

They are designed to be used in the temperature range of $- 55\text{ °C}$ to $+ 150\text{ °C}$.

The requirements of this standard may also be applied to other bearings, not listed in clause 3, provided that they are conditions of procurement of such bearings.

3 Normatives References

- EN 2022, Aerospace series - Bearings, spherical plain, in corrosion resisting steel with self lubricating liner - Light series - Dimensions and loads
- EN 2023, Aerospace series - Bearings, spherical plain, in corrosion resisting steel with self lubricating liner - Normal series - Dimensions and loads
- EN 2501, Aerospace series - Bearings, spherical plain, in corrosion resisting steel with self lubricating liner and wide inner ring - Dimensions and loads

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4 Definitions and symbols

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4.1 Definitions

4.1.1 Description

Bearings with self lubricating liners are composed of two concentric rings in corrosion resisting steel, between which there is a self lubricating liner bonded to the spherical surface of the outer ring.

The inner ring is wider than the outer ring which permits a rocking movement, in addition to rotation.

The outer ring does not contain any engagement slot.

This outer ring may be provided with swaging grooves for direct fitting to the structure.

4.1.2 Loads

- Permissible static loads

The permissible static load is 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.

- Permissible static radial load C_s

The permissible static radial load corresponds to a unit pressure of 410 MPa.

- Permissible static axial load C_a

The permissible static axial load corresponds to a unit pressure of 205 MPa.

- Ultimate static load

The ultimate static radial or axial load is 1,5 times the value of the permissible static loads and is defined as being the highest load the bearing can support, without failure occurring.

- Permissible dynamic radial load C_{25}

The permissible dynamic radial load C_{25} is the load that a bearing can withstand, when subjected to an oscillation of $\pm 25^\circ$ (total amplitude 50°) for 25000 cycles, at the rate of 10 cycles per minute, without the wear of the self lubricating liner exceeding the value specified in 6.4.6.

It is equal to : $\frac{C}{2,5}$

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4.1.3 Starting torque

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The starting torque at zero load is the maximum torque recorded, when the inner ring starts to revolve, whilst the outer ring is stationary.

4.2 Symbols

C_s = permissible static radial load

C_a = permissible static axial load

C_{25} = permissible dynamic radial load at 25000 cycles

5 Materials

The prescribed materials are specified in the dimensional standards.

6 Required characteristics

6.1 Dimensions, tolerances and mass

These shall comply with the values specified in the dimensional standards, see 7.2.

6.2 Chemical characteristics of the material

The chemical composition of the materials shall comply with the specifications listed in the dimensional standards, see 7.3.

6.3 Physical characteristics

6.3.1 Physical appearance

6.3.1.1 Bearing

Bearings shall be free from scoring, cracks, splits, burrs and any other defects likely to impair their characteristics and their durances, see 7.1.1.

6.3.1.2 Self lubricating liner

The liner shall be free from all traces of contaminating products and shall not show signs of any tearing or stripped portions, see 7.1.2.

6.3.2 Hardness

Inner ring : $55 \leq \text{HRC} \leq 62$.

Outer ring : $23 \leq \text{HRC} \leq 35$.

See 7.4.1.

6.3.3 Surface roughness

Outer diameter of inner ring : $R_a : 0,2 \mu\text{m}$

Bore and faces of inner ring, outer diameter of outer ring : $R_a : 0,8 \mu\text{m}$

Other surfaces : $R_a : 3,2 \mu\text{m}$

See 7.4.2.

6.3.4 Lubrication

No lubrication is permitted.

6.3.5 Compatibility with fluids

The bearing shall retain its integrity in the presence of the following fluids:

- aircraft engine fuel ;
- de-icing fluid (denatured isopropyl alcohol);
- hydraulic fluids :
 - . mineral based ;
 - . phosphate ester;
- synthetic sea-water.

See 7.4.3 and annex A.

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6.3.6 Static performance at low temperatures

The starting torque of the bearings shall be equal to or less than twice those recorded at ambient temperature (20 °C) and specified in the dimensional standards, when they are exposed to a temperature of $(- 55 \pm 2)$ °C in the test conditions specified in 7.4.4.

6.3.7 Resistance to thermal shock

The starting torques of the bearings shall lie within the ranges specified in table 1 when the bearings are subjected to the extreme alternations of temperature of $- 55$ °C and $+ 150$ °C in the test conditions specified in 7.4.5.

Table 1

Torques specified in EN 2022 and EN 2023 (N.m)	Permissible torques checked after thermal shock tests ¹⁾ (N.m)
0,08 to 0,50	0,048 to 0,50
0,12 to 0,80	0,072 to 0,80
0,25 to 1,00	0,150 to 1,00
0,40 to 2,00	0,240 to 2,00
0,60 to 3,50	0,360 to 3,50
1) Calculated values based on 60 % of the minimum values prior to testing.	

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6.3.8 Bond integrity

The condition of the liner edge shall comply with the requirements specified in the dimensional standards. The liner shall not contain any contaminating substances.

It shall adhere tightly to the metallic substrate over at least 90 % of the contact area. No void shall be allowed which cannot be circumscribed within a circle with a diameter equal to 25 % of the ring width or 6 mm, whichever is the smallest, see 7.4.3.2 and 7.5.6.4.

6.4 Mechanical characteristics

See 7.5.

6.4.1 Behaviour during rotation and rocking

Bearings shall be capable of normal functioning within the temperature range prescribed.

They shall not reveal any friction points when revolving or rocking, within the limits of the angle specified in the dimensional standards, see 7.5.1.

6.4.2 Permissible static radial loads C_s

The permissible static radial loads C_s are specified in the dimensional standards.

These shall be maintained in the test conditions defined in 7.5.2, without any higher deformations occurring than indicated in table 2, in respect of the maximum total deformations, and in table 3, in respect of the maximum residual deformations.

Table 2

Dimensions in millimetres

Nominal bore d	< 10	10 to 12	15 to 17	20 to 25	30 to 40	45 to 50
Max. total deformation	0,25	0,37	0,43	0,50	0,75	1

Table 3

Dimensions in millimetres

Nominal bore d	Maximum residual deformation ¹⁾					
	Light series subjected to		Normal series, narrow subjected to		Normal series, wide subjected to	
	C_s	C_a	C_s	C_a	C_s	C_a
5	—	—	—	—	—	—
6	—	—	0,08	0,10	0,08	0,10
8	—	—	—	—		
10	—	—	—	—		
12	—	—	0,08	0,10		
15	0,08	0,10	—	—	0,10	—
17	—		—	—		
20	0,09	—	—	—	0,10	—
22	—	—	0,10	0,10	—	—
25	0,11	0,11	0,12	0,12	0,14	0,14
30	0,12	0,12	0,14	0,14	0,16	0,16
35	0,14	0,14	—	—	0,17	0,17
40	0,16	0,16	—	—	0,18	0,18
45	0,18	0,18	—	—	0,20	0,20
50	0,20	0,20	—	—	0,22	0,22

1) The maximum residual deformations in excess of 0,08 mm, when subjected to permissible static radial loads C_s , and in excess of 0,10 mm when subjected to permissible static axial loads C_a , have been based on 0,3 % of the spherical diameter of the inner ring.

6.4.3 Ultimate static radial loads

The ultimate static radial loads shall be 1,5 times the permissible static loads C_s specified in the dimensional standards.

There shall be no evidence of any crack, split portion or separation of the constituent components having occurred after these loads have been applied in the test conditions specified in 7.5.3.

6.4.4 Permissible static axial loads C_a

The permissible static axial loads C_a are specified in the dimensional standards.

They shall be maintained in the test conditions specified in 7.5.4, without giving rise to any residual deformations in excess of those specified in table 3.

6.4.5 Ultimate static axial loads

The ultimate static axial loads are 1,5 times the permissible static axial loads C_a quoted in the dimensional standards.

There shall be no evidence of any crack, split portion or separation of the constituent components having occurred after these loads have been applied in the test conditions specified in 7.5.5.

6.4.6 Permissible dynamic radial loads

The permissible dynamic radial loads correspond to loads of : $\frac{C}{2,5}$

When these loads have been applied in the test conditions specified in 7.5.6, the bearings shall satisfy the following requirements :

- a wear of less than 0,13 mm on the self lubricating liner, after test performed over 25000 cycles at ambient temperature (+ 20 °C) ;
- a wear of less than 0,20 mm on the self lubricating liner, after test performed over 25000 cycles at low temperature (− 55 °C) ;
- a wear of less than 0,15 mm on the self lubricating liner, after test performed over 25000 cycles at high temperature (+ 150 °C).

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6.4.7 Starting torque

The starting torque values at zero load, measured in the conditions specified in 7.5.7 shall comply with the values specified in the dimensional standards.

7 Inspections and tests

7.1 Visual inspection

7.1.1 Of the bearing

An inspection of the external condition shall confirm that :

- there are none of the defects specified in 6.3.1.1 ;
- there is no lubrication, as specified in 6.3.4 ;
- the marking conforms to the the provisions specified in 10.1.

7.1.2 Of the self lubricating liner and its bonding

The self lubricating liner shall not reveal any of the defects specified in 6.3.1.2.

7.2 Check on dimensions, tolerances and mass

The dimensions, tolerances and mass shall comply with those specified in the dimensional standards, when measured with conventional measuring instruments.

7.2.1 Measurement of bore and outer diameter

Measurements shall be made :

- in the centre plane for rings whose width is 10 mm or less ;
- in two planes parallel to the faces and twice the maximum chamfer distance away from the faces for rings wider than 10 mm.

The smallest and largest diameter shall be found in each plane scanned.

7.2.2 Measurement of width of rings

The width of each ring (distance between two faces) shall be checked at not less than four points.

7.3 Check on the chemical characteristics of the materials

A chemical analysis shall show that the material composition complies with that specified in the material standards.

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7.4 Physical inspection

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7.4.1 Hardness

A Rockwell hardness test C shall be performed on the inner and outer rings of the bearing.

The values recorded shall comply with those specified in 6.3.2.

7.4.2 Surface roughness

The surface roughness, measured with conventional instruments, shall comply with the characteristics and values specified in 6.3.3.

7.4.3 Compatibility with fluids

7.4.3.1 Test on compatibility with fluids at (70 ± 3) °C

This test shall be performed with the hydraulic fluids specified in 6.3.5 and with synthetic sea water.

7.4.3.2 Test on compatibility with fluids at (45 ± 3) °C.

This test shall be performed with aircraft engine fuel and with de-icing fluid.