SLOVENSKI STANDARD
SIST EN 4854-3:2020

01-januar-2020

Aeronavtika - Kroglasti drsni ležaj iz korozijsko odpornega jekla s samomazalno oblogo, z majhnim začetnim navorom in majhnim tornim količnikom, povišanimi delovnimi cikli pri nizkih oscilacijah v različnih obratovalnih pogojih - 3. del: Tehnična specifikacija

Aerospace series - Bearing, spherical plain, in corrosion resisting steel with self-lubricating liner, low starting torque and low friction coefficient, elevated duty cycles under low oscillations at different operating conditions - Part 3: Technical specification

Luft- und Raumfahrt - Gelenklager aus korrosionsbeständigem Stahl mit selbstschmierender Beschichtung, geringem Losbrechmoment und niedrigem Reibungskoeffizienten, hohe Anzahl an gering oszillierenden Belastungszyklen bei unterschiedlichen Einsatzbedingungen - Teil 3: Technische Lieferbedingungen

Série aérospatiale - Rotules en acier résistant à la corrosion à garniture autolubrifiante, faible couple de démarrage et faible coefficient de frottement, cycles d'endurances élevés sous faibles oscillations à différentes conditions de fonctionnement, série large - Partie 3 : Spécification Technique

Ta slovenski standard je istoveten z: **EN 4854-3:2019**

ICS:

21.100.10	Drsni ležaji	Plain bearings
49.060	Letalska in vesoljska električna oprema in sistemi	Aerospace electric equipment and systems

SIST EN 4854-3:2020 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 4854-3

October 2019

ICS 49.035

English Version

Aerospace series - Bearing, spherical plain, in corrosion resisting steel with self-lubricating liner, low starting torque and low friction coefficient, elevated duty cycles under low oscillations at different operating conditions - Part 3: Technical specification

Série aérospatiale - Rotules en acier résistant à la corrosion à garniture autolubrifiante, faible couple de démarrage et faible coefficient de frottement, cycles d'endurances élevés sous faibles oscillations à différentes conditions de fonctionnement, série large - Partie 3 : Spécification Technique

Luft- und Raumfahrt - Gelenklager aus korrosionsbeständigem Stahl mit selbstschmierender Beschichtung, geringem Losbrechmoment und niedrigem Reibungskoeffizienten, hohe Anzahl an gering oszillierenden Belastungszyklen bei unterschiedlichen Einsatzbedingungen - Teil 3: Technische Lieferbedingungen

This European Standard was approved by CEN on 12 November 2018.

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.

CEN members are the national standards bodies of 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

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

Ref. No. EN 4854-3:2019 E

Contents

European foreword

This document (EN 4854-3:2019) 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 April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the required characteristics, inspection and test methods, qualification and acceptance conditions for spherical plain bearings in corrosion resisting steel with self-lubricating liner, low starting torque and low friction coefficient, elevated duty cycles under low oscillations at different operating conditions.

This standard applies whenever referenced.

These self-lubricating spherical plain bearings are intended for use in fixed or moving parts of the aircraft structure especially for control mechanism and operating systems. The bearings are designed subjected under low dynamic radial loads and slow rotations in the temperature range of −55 °C to 120 °C (−67 °F to 248 °F).

The liner may be of a fabric or composite material bonded to the inside diameter of the outer ring or in a composite material moulded into a pre-formed cavity between the inner and outer rings.

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 4854-1, *Aerospace series — Bearing, spherical plain, in corrosion resisting steel with self-lubricating liner, low starting torque and low friction coefficient, elevated duty cycles under low oscillations at different operating conditions, narrow series — Part 1: Dimensions and loads*

EN 4854-2, *Aerospace series — Bearing, spherical plain, in corrosion resisting steel with self-lubricating liner, low starting torque and low friction coefficient, elevated duty cycles under low oscillations at different operating conditions, wide series — Part 2: Dimensions and loads*

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

MIL-PRF-87257B, *Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile*

NSA307110, *Fluid — Hydraulic Phosphate Ester — Base Fire Resistant*

TR 4475, *Bearings and mechanical transmissions for airframe applications — Vocabulary*[1]

ASTM D 1655, *Specification for Aviation Turbine Fuels*

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).

3 Terms and definitions

For the purposes of this document, the terms and definitions given in TR 4475 and the following apply.

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/

3.1
self-lubricated spherical plain bearing, self-aligning in corrosion resistant steel with and without staking groove
bearing consisting of two concentric rings, between which is interposed a self-lubricating liner which is bonded or moulded on the spherical surface of the outer ring (race)

Note 1 to entry: The width of the inner ring (ball) is greater than the width of the outer ring (race), so that a tilting movement is possible in addition to the rotational movement.

Note 2 to entry: The outer ring (race) has no assembly slot but may have staking grooves for mechanical swaging.

3.2
surface discontinuities
see TR 4475 (surface imperfections)

3.3
starting torque without load
torque required to start the rotation of the inner ring (ball) with the outer ring (race) held stationary

3.4
friction coefficient
coefficient of the torque moment and the product of the load on the bearing and the inner spherical ring (ball) radius

Note 1 to entry: The friction coefficient of the bearing under load is given by the following formula:

$$\mu = \frac{C}{FR} \tag{1}$$

where

μ is the friction coefficient;

C is the torque moment in Nm;

F is the load on the bearing in N;

R is the inner spherical ring (ball) radius in m.

3.5
permissible [limit] static radial load
C_s
load corresponding to a permissible unit pressure multiplied by the effective projected area in the radial direction, the inner ring (ball) being able to take any position within the limits of the tilting angle indicated in the product standard

Note 1 to entry: The direction of the load remains in the centre plane of the outer ring (race).

Note 2 to entry: The definition for the effective projected area in radial direction is given by following simplified calculation:

$$A_{\mathrm{r}} = K(C_{\mathrm{min.}} - 2T_{\mathrm{max.}}) \tag{2}$$

where

A_{r} is the effective radial projected area in mm^2;

K spherical diameter in mm [in];

C_{min} minimum width of the outer ring (race) in mm [in];

T_{max} maximum liner set back in mm [in].

Dimensions are given in the appropriate product standards.

3.6
permissible [limit] static axial load
C_a

load corresponding to a permissible unit pressure multiplied by the effective projected area in the axial direction

Note 1 to entry: The effective projected area in axial direction is given by following calculation:

$$A_{\mathrm{a}} = A_{\mathrm{øK}} - A_{\mathrm{øK-h}} \tag{3}$$

$$A_{\mathrm{a}} = \pi \left(\frac{\mathrm{ø}K}{2}\right)^2 - \pi \left[\left(\frac{\mathrm{ø}K}{2}\right) - h\right]^2 \tag{4}$$

$$h = \frac{\mathrm{ø}K}{2} - \frac{1}{2}\sqrt{4\left(\frac{\mathrm{ø}K}{2}\right)^2 - (C_{\mathrm{min.}} - 2T_{\mathrm{max.}})^2} \tag{5}$$

$$A_{\mathrm{a}} = \frac{\pi}{4}(C_{\mathrm{min.}} - 2T_{\mathrm{max.}})^2 \tag{6}$$

where

A_{a} is the effective axial projected area in mm^2;

K spherical diameter in mm [in];

h is the theoretical dimension, can be subjected to the liner thickness (difference between the spherical diameter and minimum diameter of the inner ring after swaging,), in mm [in];

C_{min} minimum width of the outer ring (race) in mm [in];

T_{max} maximum liner set back in mm [in].

Dimensions are given in the appropriate product standards. See also Figure 1.

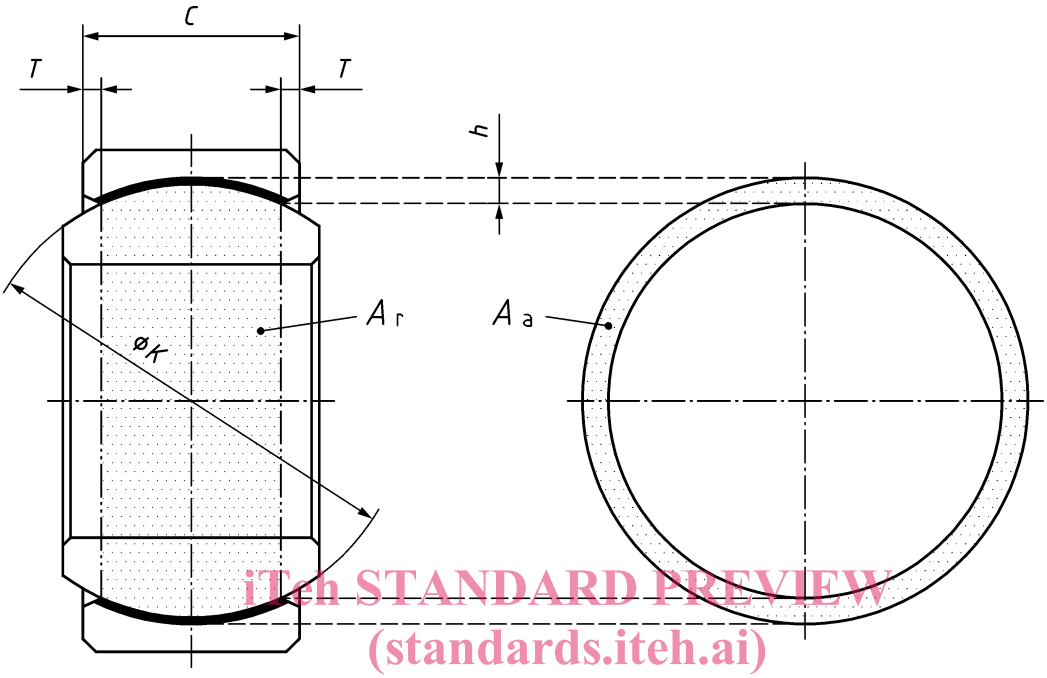

Figure 1 — Effective projected areas (radial and axial)

3.7
dynamic radial load
oscillatory duty cycles
load which may be withstood by a bearing submitted to an oscillatory movement for a defined number and rate of oscillation cycles without the dimensional or other characteristics deviating from the values permitted by this technical specification

Note 1 to entry: The number and rate of oscillation cycles to be considered for this technical specification are defined in Annex B.

3.8
ultimate static load
load defined as being the highest load that a product can accept without fractures and cracks; the ultimate static load is equivalent to the permissible (limit) static load (radial or axial) multiplied by 1,5

3.9
duty cycle
series of oscillating cycles under constant or varying load applied to a bearing

3.10
oscillating cycle
sequence of alternate angular displacements (φ °) of one ring in relation to the other

Note 1 to entry: The oscillating cycle has the following composition:

— from 0° to $+\varphi$°;

— then from $+\varphi$° to $-\varphi$°;

— and finally from $-\varphi$° to 0°.

The angular displacement (see Figure 2) to be considered for this technical specification is defined in Annex B.

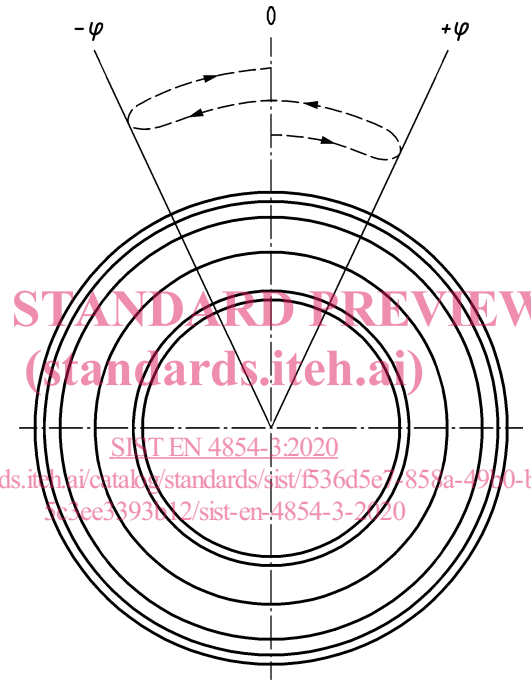

Figure 2 — Angular displacement (oscillating cycles)

3.11
delivery batch
batch consisting of bearings with the same identity block, which may come from different production batches

4 Requirements, inspection and test methods

For required characteristics, inspection and test methods see Table 1.

For starting torques at zero load see Table 2.

For maximum permanent deflection and deformation see Table 3.

For maximum starting torques at different surface pressure levels see Table 4.

Table 1 — Characteristics, inspections and test methods

Clause	Characteristics	Requirements	Inspection and test methods	Q[a]	A[b]
4.1	**Materials**	Shall conform to the product standards or design documentation.	Chemical analysis or certificate issued by semi-finished product manufacturer	X	X
4.2	**Dimensions and tolerances**	Shall conform to the product standards or design documentation. Dimensions not shown shall be at manufacturer's option.	Suitable calibrated measuring instruments Measurement of bore and outer diameter: — rings with a width of ≤ 10 mm: in the centre plane; — rings with a width of > 10 mm: in two planes parallel to the outer faces and at a distance from these faces of twice the maximum value of the ring chamfer. The minimum and maximum diameters shall be determined in each measuring plane. Measurement of ring width: — the width of each ring (distance between the two faces) shall be verified at a minimum of four points.	X	X
4.3	**Masses**	Shall conform to the product standards or design documentation.	Suitable methods	X	
4.4	**Marking**	Shall conform to the product standards or design documentation. It shall be legible and shall not adversely affect the material or the functioning of the bearing.	Visual examination	X	X
4.5	**Surface appearance**	— the bearings shall be free of surface discontinuities liable to have an adverse effect on their characteristics and endurance; — the liner shall not contain contaminant products and shall not show broken or voided areas; — lubrication shall not be permitted.			
4.5.1	**Assembled bearings**		Visual inspection using suitable methods	X	X
4.5.2	**Unassembled rings**		Magnetic or dye penetrant inspection	X	X

Clause	Characteristics	Requirements	Inspection and test methods	Q[a]	A[b]
4.6	**Hardness**	Shall conform to the product standards or design documentation.	Suitable processes and measuring instruments	X	X
4.7	**Surface roughness**	Shall conform to the product standards or design documentation.	Suitable measuring instruments or visual-tactile samples	X	X
4.8	**Surface treatment**	Shall conform to the product standards or design documentation.	— Visual inspection; — as per surface treatment standard.	X	X
4.9	**Movability and clearances**	—	—	—	—
4.9.1	**Behaviour in rotation and tilt**	Bearings shall be able to move freely within the angular limits specified in the product standards or design documentation.	Manual inspection	X	X
4.9.2	**Internal clearances (radial and axial)**	The internal radial and axial clearances shall conform to the product standards.	— Suitable measuring instruments; — test load: ±13,3 N (±3 lbs)	X	X
4.10	**Starting torque without load**	—			
4.10.1	— **at ambient temperature** 23^{+2}_{-10} °C	Shall conform to Table 2 and product standards.	Suitable processes and measuring instruments: — measurement of the starting torque shall be preceded by some rotations and a few turning movements by hand; — measure the torque, applied gradually to the inner ring, in both directions, with the outer ring held stationary. Read off the maximal value required to start up the inner ring.	X	X
4.10.2	— **at low temperature** -55^{+5}_{-10} °C	Starting torque must be ≤ 2 times that listed in Table 2 and product standards.	— Subject the bearing, during 4 h at the low temperature; — immediately after, measure the torque following 4.10.1.	X	
4.10.3	— **after limit tempera-tures.** -55^{+5}_{-10} °C 85^{+10}_{-5} °C	Shall conform to Table 2 and product standards.	— Subject the bearing during 1 h at the low temperature °C, then 1 h at the high temperature; — repeat successively × 10 this test; — 4 h after these tests, measure the torque, at ambient temperature, following 4.10.1.	X	