INTERNATIONAL STANDARD

ISO 13412

First edition
1997-12-15

Aerospace — Airframe needle track roller, yoke type, single-row, sealed — Inch series

Aéronautique et espace — Galets de came à aiguilles pour étrier, à une rangée, avec joints, pour cellule d'aéronef — Série «inch»

Reference number
ISO 13412:1997(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 13412 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 15, *Airframe bearings*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

Introduction

At the time this International Standard was developed, the imperial units sizes of airframe needle roller bearings were dominant in world application. The basis for this International Standard is the imperial units provided in annex B.

Aerospace — Airframe needle track roller, yoke type, single-row, sealed — Inch series

1 Scope

This International Standard specifies the characteristics, boundary dimensions, tolerances, internal clearances and permissible static radial loads of inch series, single-row, yoke type, needle track rollers used in airframe applications.

The airframe needle track rollers covered by this International Standard are designed to operate in the temperature range –54 °C to +121 °C.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 683-17:—[1], *Heat-treated steels, alloy steels and free-cutting steels — Part 17: Ball and roller bearing steels.*

ISO 1132:1980, *Rolling bearings — Tolerances — Definitions.*

ISO 2082:1986, *Metallic coatings — Electroplated coatings of cadmium on iron or steel.*

ISO 2859-1:—[2], *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

ISO 4520:1981, *Chromate conversion coatings on electroplated zinc and cadmium coatings.*

ISO 5593:1997, *Rolling bearings — Vocabulary.*

ISO 6158:1984, *Metallic coatings — Electroplated coatings of chromium for engineering purposes.*

ISO 13411:1997, *Aerospace — Airframe needle roller, cylindrical roller and track roller bearings — Technical specification.*

AMS 2417E:1993, *Plating, zinc-nickel alloy.*[3]

[1] To be published. (Revision of ISO 683-17:1976)
[2] To be published. (Revision of ISO 2859-1:1989)
[3] Available from: SAE International
400 Commonwealth Drive
Warrendale, PA 15096-0001
USA

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5593 apply.

4 Symbols

4.1 For the purposes of this International Standard, the symbols given in ISO 1132 apply. The symbols (except those for tolerances) shown in the figures and the values given in the tables denote nominal dimensions unless specified otherwise.

4.2 The following additional symbols for bearings covered by this International Standard also apply.

B overall width (over faces of end washers)

C_s permissible static radial load

d_a clamping face diameter

R crown radius of outer ring

5 Required characteristics

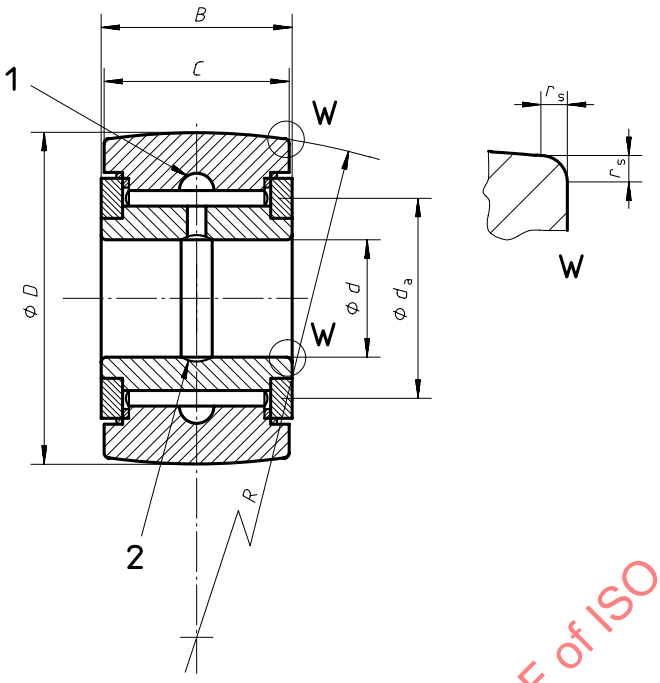
5.1 Dimensions — Tolerances — Internal clearances — Loads

For values, see table 1. For configuration, see figure 1.

Table 1

Dimensions in millimetres,
tolerance and clearance values in micrometres

Diameter code	d	D	B 0 − 254	C 0 − 381	Tolerance values				R	r_s	d_a	Internal clearance		C_s	Mass
					Δ_{dmp}	K_{ia} max.	Δ_{Dmp}	K_{ea} max.	min.	min.	min.	Radial, G_r max.	Axial, G_a max.	kN	kg ≈
03	4,826	19,05	7,93	7,12							11,2			5,34	0,01
04	6,35	22,225	9,53	8,77					254	0,55	13,2			8,49	0,02
06	9,525	26,988	12,7	11,56							17,1			16	0,05
08	12,7	33,338	15,88	14,74					318		21,5			25,7	0,08
10	15,875	38,1	19,05	17,91					444		24,3			37,8	0,13
12	19,05	44,45	25,4	24,13					635		28,2	46		63,1	0,24
14	22,225	50,8	28,58	27,31	0 − 18	25	+ 25 − 25	41	698		31		635	85,8	0,34
20	31,75	63,5	31,75	30,48					762		41,3			112,5	0,53
24	38,1	76,2								0,81	50,8			168,5	1,07
28	44,45	87,312									58			196,1	1,23
32	50,8	98,425	38,1	36,58					1524		65,1			217,5	1,55
36	57,15	109,538									72,7			244,6	1,92
40	63,5	120,65									79	51		266,4	2,33
44	69,85	127									85			288,2	2,49



Key

1 Lubrication groove
2 Lubrication groove and holes

Figure 1

5.2 Surface roughness

Rollers: R_a = 0,2 µm max.

Inner ring raceway: R_a = 0,4 µm max.

Outer ring raceway: R_a = 1,0 µm max.

End washers: R_a = 1,6 µm max. at roller contact area

6 Materials

Rings: bearing steel - ISO 683-17, type 1, raceway hardness 58 HRC to 66 HRC (670 HV to 860 HV).

Rollers: bearing steel - ISO 683-17, type 1, heat treated to 58 HRC to 66 HRC (670 HV to 860 HV).

End washers: steel heat treated to 51 HRC to 60 HRC (528 HV to 697 HV) at roller contact area.

Seals: acetal resin, nylon or equivalent.

7 Surface treatment

7.1 Bearings made of conventional rolling bearing steel, shall have the external surfaces of the outer ring chromium plated, and all other external surfaces, except the inner ring bore surface, shall be cadmium or zinc-nickel plated. Black oxide coating is a permissible alternate on all inner ring external surfaces (see annex A).

7.2 Where cadmium plating is specified (code letters D and M), it shall be in accordance with ISO 2082. The thickness of the plating shall not be less than 7 µm and not more than 15 µm. The bearing shall be embrittlement-relieved within

4 h of plating by heat treatment at (140 ± 10) °C for a minimum of 8 h followed by chromate treatment in accordance with ISO 4520 (code letter D only).

7.3 Where chromium plating is specified (code letters D, M and Z), it shall be in accordance with ISO 6158. The thickness of the plating shall be not less than 12 µm, 8 µm on faces and ring chamfers, and not more than 25 µm.

7.4 Where zinc-nickel plating is specified (code letter Z) it shall be in accordance with AMS 2417E, type 2. The thickness of the plating shall not be less than 7 µm and not more than 15 µm.

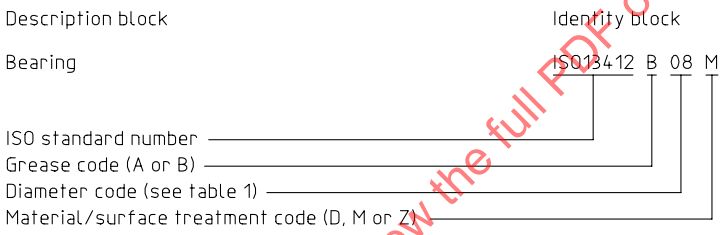
8 Lubrication

The bearing shall be prelubricated with either grease A or B, as specified by the customer.

NOTE — Descriptions of grease A and grease B are given in ISO 13411:1997, annex I.

9 Designation

Bearings covered by this International Standard shall be designated only in the manner shown in the following example:



where the following codes are applied:

— greases:

A = ester type grease;

B = synthetic hydrocarbon type grease;

— materials/surface treatments:

D = material: low alloy bearing steel;

surface treatment: outer ring - chromium plated;

washer - cadmium plated with chromate conversion coating;

inner ring - cadmium plated with chromate conversion coating, or black oxide coated;

M = material: low alloy bearing steel;

surface treatment: outer ring - chromium plated;

washer - cadmium plate without chromate conversion coating;

inner ring - cadmium plated without chromate conversion coating, or black oxide coated;

Z = material: low alloy bearing steel;

surface treatment: outer ring- chromium plated;

washer - zinc-nickel plated;

inner ring - zinc-nickel plated, or black oxide coated.

10 Identification marking

In addition to the manufacturer's name or trademark, each bearing shall be permanently and legibly marked, using the identity block as defined in clause 9. Marking position and method shall be at the manufacturer's option.

11 Technical specification

Airframe needle track rollers supplied to this International Standard shall conform to the requirements of ISO 13411.

Annex A
(normative)

Black oxide coating

A.1 Introduction

These requirements cover black oxide coatings applied to bearing rings.

A.2 Requirements

A.2.1 Materials

The materials for the blackening processes shall be selected by the contractor. The selected materials shall result in black coatings meeting all the applicable requirements of this annex.

A.2.2 Preparation of basis metal

Prior to the application of the black coatings, the basis metal shall be thoroughly cleaned with materials and methods at the option of the contractor. The cleaning process shall be performed without measurable abrasion or erosion. The cleaned surfaces shall be free of rust, scale, grease, oil, paint or other foreign matter.

A.2.2.1 Stress relief treatment

All rings which are cold formed or which contain residual tensile stress, such as may be produced by cold straightening, shall be given a stress relief. The stress relief may be conducted before or after cleaning and coating at the discretion of the contractor.

A.2.2.2 Coating as a final process

Unless otherwise specified, the black coatings shall be applied after all machining and heat treatment have been accomplished.

A.2.3 Application of black coatings

The specified black coating shall be applied under controlled time and temperature conditions. All equipment, together with solutions or baths, shall be properly maintained and kept free of dirt or possible contaminants.

A.2.3.1 Effect on mechanical properties

The selected process shall not reduce the hardness of the rings being processed or expose the rings to temperatures in the temper brittle range of the material, nor shall it cause embrittlement of the steel.

A.2.3.2 Surface attack

The process shall not result in any attack of the surface, either pitting or intergranular. During processing, daily determination for this behaviour shall be made using a microscopic method and examined at a magnification which will clearly establish the condition. Rings with pitted surfaces or showing intergranular attack shall be rejected.

A.2.4 Alkaline oxidizing solutions

Oxide coatings shall be formed from a boiling alkaline-oxidizing solution.

A.2.4.1 Rinsing

Black oxide coated rings shall be rinsed immediately after processing in a stagnant warm rinse at 60 °C to 88 °C followed by thorough cold water rinsing to effect complete removal of the blackening solution.

A.2.4.2 Chromic acid dip

After the cold rinse, the rings shall be dipped for a minimum of 30 s in a 0,06 percent solution of chromic acid (240 cc chromic acid per 380 l of water) maintained at a temperature of 66 °C to 88 °C and a pH of 2 to 3. After the chromic acid dip, parts shall be dried without further rinsing by using warm dry air.

A.2.4.3 Alternate dip

Due to hazardous waste resulting from the use of chromic acid, an alternate dip process may be used at the option of the contractor provided it sufficiently neutralizes any residuals from the coating process.

A.2.5 Coverage and colour

Coatings shall cover the basis metal completely and pass the smut test. Colour shall be a uniform black. A slight amount of smut, which is inherent in the process, shall not be cause for rejection. There shall be no indication of any reddish-brown or green smut when tested (see A.3.3.1). Smut "spottiness" shall be classified as unsatisfactory requiring reprocessing.

A.2.6 Quality of coating (oxalic acid spot test)

The black oxide coatings prior to the application of a preservative shall pass the oxalic acid spot test for good quality coating (see 3.3.2).

A.2.7 Treatment of high strength steel

When specified, rings shall be baked at (191 ± 14) °C for three hours or more or given an equivalent embrittlement relief treatment after application of the oxide coating. When specified by the procuring activity, high strength steel parts shall be tested for embrittlement relief (see A.3.3.3). If an embrittlement-relief bake is required, it shall follow the chromic acid dip or alternate dip.

A.3 Quality assurance

A.3.1 Responsibility for inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements of this annex. Except as otherwise specified, the supplier may utilize his own facilities or any commercial facility for inspections.

A.3.2 Sampling

The single sample plan for normal inspection of the classification of defects shall be in accordance with ISO 2859-1.

A.3.2.1 Sample for non-destructive tests (visual inspection, coverage, colour, smut and workmanship)

Samples shall be selected at random from each inspection lot in accordance with ISO 2859-1, inspection level II and acceptable quality level (AQL) equal to 1 % defective.

A.3.2.2 Sampling for destructive tests (oxalic acid spot test)

Samples shall be selected at random from each inspection lot in accordance with ISO 2859-1, inspection level II and acceptable quality level (AQL) equal to 1 % defective.