International Standard 1002

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Rolling bearings — Airframe bearings — Characteristics, boundary dimensions, tolerances, static load ratings

Roulements — Roulements utilisés dans la structure des aéronefs — Caractéristiques, dimensions d'encombrement, tolérances, charges statiques de base

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Descriptors : bearings, rolling bearings, airframe bearings, characteristics, dimensions, dimensional tolerances, static loads.

ISO 1002-1983 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1002 was developed by Technical Committee ISO/TC 4, *Rolling bearings*, and was circulated to the member bodies in December 1981.

It has been approved by the member bodies of the following countries :

Austria	India	Romania
Brazil	Ireland	Spain
Canada	Italy	Sweden
China	Japan	Switzerland
Czechoslovakia	Korea, Dem. P. Rep. of	United Kingdom
Egypt, Arab Rep. of	Korea, Rep. of	USA
Germany, F.R.	Poland	USSR

The member body of the following country expressed disapproval of the document on technical grounds :

France

This International Standard cancels and replaces ISO Recommendation R 1002-1969, of which it constitutes a technical revision.

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Contents

Rolling bearings — Airframe bearings — Characteristics, boundary dimensions, tolerances, static load ratings

1 Scope and field of application

This International Standard specifies characteristics, boundary dimensions, tolerances and static load ratings of rolling bearings, other than tapered roller bearings, used in airframes, as distinct from those used in connection with power plants, auxiliary drives, accessories and instruments in aircraft. For the purposes of this International Standard, an airframe is defined as the general structure of an aircraft and includes its control surfaces, all flaps and doors and their respective mechanisms. Both metric and inch series bearings are included because of established usage in the aircraft industry.

The bearings included in this International Standard are usually full complement bearings (no cage and full complement of rolling elements) with basically cylindrical bore and outside surface and are sealed or shielded. The bearings have an extended inner ring, except for those in table 3. The bearings are normally supplied adequately charged with suitable grease, and the external surfaces of the bearings may be protected by the same grease.

In view of the design requirements, it is generally not possible to select standard bearings from ISO 15 for airframe applications, but for metric series bearings the boundary dimensions given in ISO 15 have been used where possible.

The fact that a bearing is not included in this International Standard does not exclude the possibility that it may be used to advantage in airframe applications.

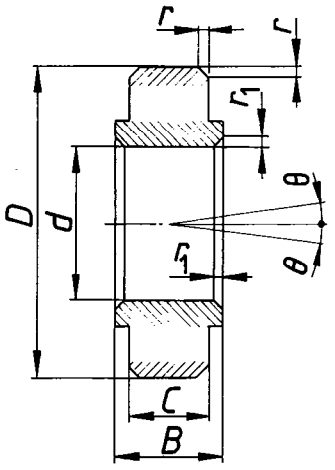
2 References

ISO 15, *Rolling bearings — Radial bearings — Boundary dimensions — General plan.*

ISO 76, *Rolling bearings — Static load ratings.*

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

3 Symbols



(angle θ applies only to self-aligning bearings)

Figure 1

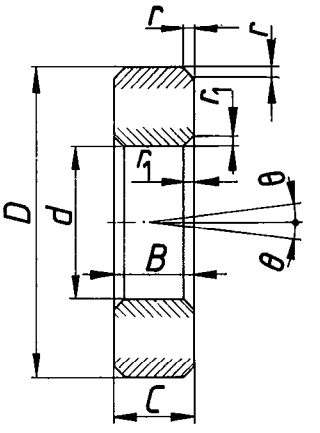


Figure 2

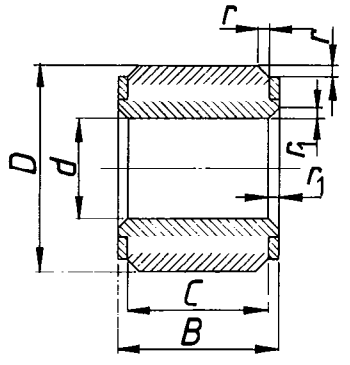


Figure 3

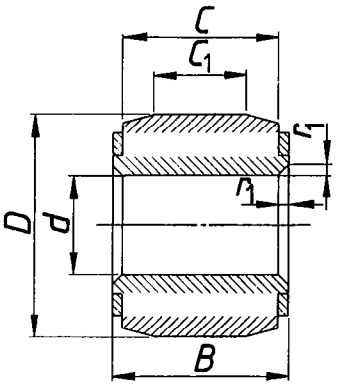


Figure 4

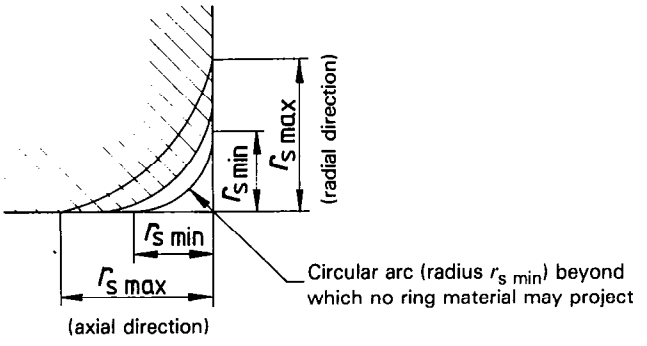


Figure 5

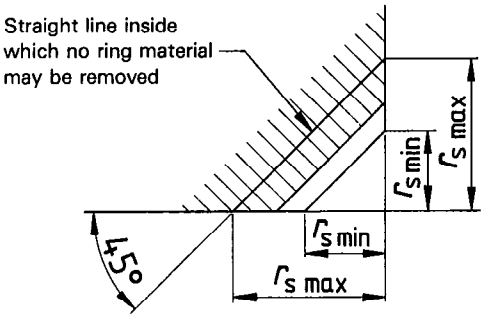


Figure 6

NOTE — Figures 5 and 6 apply equally to chamfers denoted as r (shown) and as r_1.

d = bearing bore diameter, nominal

Δ_{dmp} = single plane mean bore diameter deviation

Δ_{ds} = deviation of a single bore diameter

V_{dp} = bore diameter variation in a single radial plane

D = bearing outside diameter, nominal

Δ_{Dmp} = single plane mean outside diameter deviation

Δ_{Ds} = deviation of a single outside diameter

V_{Dp} = outside diameter variation in a single radial plane

C = outer ring width, nominal

Δ_{Cs} = deviation of a single width of the outer ring

V_{Cs} = outer ring width variation

C_1 = nominal width of track contact (cylindrical)

C_{1s} = single width of track contact (cylindrical)

B = inner ring width, nominal

Δ_{Bs} = deviation of a single width of the inner ring

V_{Bs} = inner ring width variation

r = outer ring radial and axial chamfer dimension
(Nominal values are not given in this International Standard; only minimum ($r_{s\ min}$) and maximum ($r_{s\ max}$) are listed in tables.)

r_s = outer ring single chamfer dimension

r_1 = inner ring radial and axial chamfer dimension
(Nominal values are not given in this International Standard; only minimum ($r_{1s\ min}$) and maximum ($r_{1s\ max}$) are listed in tables.)

r_{1s} = inner ring single chamfer dimension

K_{ia} = radial runout of assembled bearing inner ring

K_{ea} = radial runout of assembled bearing outer ring

S_{ia} = assembled bearing inner ring face runout with raceway (groove)

θ = angular displacement permissible between inner and outer ring axes of a self-aligning bearing

C_{or} = basic static radial load rating

NOTE — Definitions of tolerance terms are given in ISO 1132.

4 Essential characteristics

The lubricant and seals shall be capable of withstanding temperatures in the range of −55 to + 120 °C without losing their effectiveness.

NOTE — The operational conditions may necessitate wider extremes of temperature, in which case other greases and/or sealing materials may be required.

Bearings shall be capable of withstanding repeated loads of variable intensity, normally without making a complete revolution.

NOTE — The bearings are generally made with an extended inner ring in order to simplify bearing installation by making the addition of washers unnecessary.

5 Seals and shields

Bearings in tables 1 to 6, 11, 13, 14 and 16 shall be sealed or shielded, bearings in tables 12, 15, 17 and 18 shall be sealed, and bearings in tables 19, 20 and 21 shall be shielded.

NOTE — Sealed bearings are bearings in which the rolling elements and raceways are enclosed by contact seals, i.e., seals fitted to one ring and extending to the other ring with which they make sliding contact.

Shielded bearings are bearings in which the rolling elements and raceways are enclosed by shields fitted to one ring and extending towards the other ring with which they have a small clearance.

The choice of seals or shields is governed by the nature of the particular application since a sealed bearing gives improved protection at the expense of a friction torque increase.

6 Protection against corrosion

For bearings in tables 1 to 6, whether made of conventional rolling bearing steel or corrosion resisting steel, plating or coating shall be subject to agreement between the user and manufacturer.

Bearings in tables 11 to 19, if made of conventional rolling bearing steel, shall have all external surfaces except the inner ring bore surface cadmium plated. If made from corrosion resisting steel, plating shall be subject to agreement between the user and the manufacturer.

Track rollers in tables 20 and 21, if made of conventional rolling bearing steel, shall have the external surface of the outer ring chromium plated, and all other external surfaces except the inner ring bore surface cadmium plated. If made from corrosion resisting steel, plating shall be subject to agreement between the user and the manufacturer.

Where cadmium plating is specified, the thickness of the plating shall not be less than 0,005 mm (0.000 2 in) and not more than 0,012 mm (0.000 5 in).

Where chromium plating is specified, the thickness of the plating shall not be less than 0,012 mm (0.000 5 in) and not more than 0,025 mm (0.001 0 in).

7 Boundary dimensions

The boundary dimensions of the bearings and track rollers are given in tables 1 to 6 (metric series) and tables 11 to 21 (inch series).

NOTES

1 The diameter series noted in tables 1 to 6 are in accordance with ISO 15.

2 The controlling dimensions in tables 11 to 21 and controlling tolerances in table 22 are the inch values.

The contour of the corner shall be either a 45° straight line, as shown in figure 6, or curvilinear, as illustrated in figure 5, for inch series bearings in tables 11 to 21. Metric series bearings in tables 1 to 6 shall have straight line chamfers as shown in figure 6.

8 Tolerances

The tolerances for boundary dimensions (except chamfer dimensions) and running accuracy are given in table 7 for metric series bearings, and in table 22 for inch series bearings. Chamfer dimension limits are given in tables 1 to 6 and 11 to 21. Where plating is specified, tolerances are applicable after plating.

Radial internal clearance, as defined in ISO 1132, shall be as given in tables 8 to 10 for metric series bearings, and in tables 23 to 28 for inch series bearings.

Values of permissible angular displacement are indicated under tables 5, 6, 16, 17 and 18. Bearing manufacturers shall regard these values as minima, so that, in service, the angles shown may be achieved without causing any damage to the bearing.

NOTE — The bearing users should regard the values of permissible angular displacement as maxima.

9 Basic static radial load ratings

Bearings shall have a basic static radial load rating C_{or} equal to or exceeding the minimum values given in tables 1 to 6 and 11 to 21.

NOTE — Definitions, symbols and methods of evaluating basic static load ratings of bearings made of hardened conventional rolling bearing steel are given in ISO 76. The use of other materials, such as corrosion resisting steels, or of special heat stabilization may affect the load carrying capacity and call for special tests. Such tests should be agreed between the purchaser and the manufacturer.

10 Dimensions and tolerances — Tables

10.1 Index to tables

Table description	Dimensions	Tolerances	Radial internal clearance
	Table No.		
Metric series			
Ball bearings, sealed or shielded			
— single row, rigid, diameter series 0, figure 1	1	7	8
— single row, rigid, diameter series 2, figure 1	2	7	8
— single row, rigid, diameter series 8 and 9, figure 2	3	7	8
— double row, rigid, diameter series 2, figure 1	4	7	8
— double row, self-aligning, diameter series 2, figure 1	5	7	9
Roller bearings, sealed or shielded			
— single row, spherical, diameter series 3, figure 1	6	7	10
Inch series			
Ball bearings			
— single row, rigid, sealed or shielded, figure 1	11	22	23
— single row, rigid, sealed, figure 1	12	22	23
— single row, rigid, torque tube type, extra light, sealed or shielded, figure 1	13	22	24
— single row, rigid, torque tube type, light, sealed or shielded, figure 1	14	22	24
— double row, rigid, angular contact, sealed, figure 1	15	22	23
— double row, self-aligning, sealed or shielded, figure 1	16	22	25
Roller bearings			
— single row, spherical, sealed, figure 1	17	22	26
— double row, spherical, sealed, figure 1	18	22	26
Needle roller bearings			
— single row, shielded, figure 3	19	22	27
— single row, track roller, yoke type, shielded, figure 4	20	22	28
— double row, track roller, yoke type, shielded, figure 4	21	22	28

10.2 Dimension tables — Metric series

Table 1 — Single row rigid ball bearings (figure 1), sealed or shielded, diameter series 0*

Dimensions in millimetres

d	D	B	C	r_s and r_{1s}		C_{or}, N
				min.	max.	min.
8	22	9	7	0,3	0,8	2 120
10	26	10	8	0,3	0,8	3 050
12	28	10	8	0,3	0,8	3 450
15	32	11	9	0,3	0,8	4 150
17	35	12	10	0,3	0,8	4 800
20	42	14	12	0,3	0,8	7 350
25	47	14	12	0,3	0,8	8 300
30	55	15	13	0,3	0,8	11 200

NOTE — All external surfaces except the inner ring bore surface may be plated (see clause 6).

* See ISO 15.

Dimension tables — Metric series *(continued)*

Table 2 — Single row rigid ball bearings (figure 1), sealed or shielded, diameter series 2*

Dimensions in millimetres

d	D	B	C	r_s and r_{1s}		C_{or}, N
				min.	max.	min.
5	16	7	5	0,3	0,8	1 220
6	19	8	6	0,3	0,8	1 660
10	30	11	9	0,3	0,8	3 600
12	32	12	10	0,3	0,8	4 800
15	35	13	11	0,3	0,8	5 700
17	40	14	12	0,3	0,8	7 200
20	47	16	14	0,3	0,8	10 000
25	52	17	15	0,3	0,8	12 500
30	62	18	16	0,3	0,8	16 600

NOTE — All external surfaces except the inner ring bore surface may be plated (see clause 6).

Table 3 — Single row rigid ball bearings (figure 2), sealed or shielded, diameter series 8 and 9*

Dimensions in millimetres

d	D	B	r_s and r_{1s}		C_{or}, N
			min.	max.	min.
10**	22	6	0,3	0,8	1 900
12**	24	6	0,3	0,8	2 200
15**	28	7	0,3	0,8	2 900
17**	30	7	0,3	0,8	3 150
20	32	7	0,3	0,8	3 100
25	37	7	0,3	0,8	3 800
30	42	7	0,3	0,8	4 400
35	47	7	0,3	0,8	5 100
40	52	7	0,3	0,8	5 700
50	65	7	0,3	0,8	7 650
60	78	10	0,3	0,8	12 500

NOTE — All external surfaces except the inner ring bore surface may be plated (see clause 6).

Table 4 — Double row rigid ball bearings (figure 1), sealed or shielded, diameter series 2*

Dimensions in millimetres

d	D	B	C	r_s and r_{1s}		C_{or}, N
				min.	max.	min.
6	19	12	10	0,3	0,8	3 250
8	24	14	12	0,3	0,8	4 250
10	30	16	14	0,3	0,8	8 150
12	32	16	14	0,3	0,8	9 000
15	35	16	14	0,3	0,8	10 400
17	40	18	16	0,3	0,8	13 700
20	47	20	18	0,3	0,8	18 600

NOTE — All external surfaces except the inner ring bore surface may be plated (see clause 6).

* See ISO 15.

** These bearings are diameter series 9, remainder are diameter series 8.

Dimension tables — Metric series *(concluded)*

Table 5 — Double row self-aligning ball bearings (figure 1), sealed or shielded, diameter series 2*

Dimensions in millimetres

d	D	B	C	r_s and r_{1s}		C_{or}, N
				min.	max.	min.
5	16	12	8	0,3	0,8	475
6	19	14	10	0,3	0,8	710
7	22	14	10	0,3	0,8	915
8	24	15	10	0,3	0,8	1 140
9	26	16	12	0,3	0,8	1 160
10	30	20	14	0,3	0,8	1 760
12	32	20	14	0,3	0,8	2 000
15	35	20	14	0,3	0,8	2 360
17	40	22	16	0,3	0,8	3 050
20	47	24	18	0,3	0,8	4 050

NOTES

1 Permissible angular displacement $\theta = 6°$.

2 All external surfaces except the inner ring bore surface may be plated (see clause 6).

Table 6 — Single row spherical roller bearings (figure 1), sealed or shielded, diameter series 3*

Dimensions in millimetres

d	D	B	C	r_s and r_{1s}		C_{or}, N
				min.	max.	min.
8**	30	17	14	0,3	0,8	7 350
10	35	21	17	0,3	0,8	10 800
12	37	21	17	0,3	0,8	12 000
15	42	21	17	0,3	0,8	14 000
17	47	23	19	0,3	0,8	19 000
20	52	26	21	0,3	1,0	22 800
25	62	29	24	0,3	1,0	32 500
30	72	34	27	0,3	1,0	43 000

NOTES

1 Permissible angular displacement $\theta = 6°$.

2 All external surfaces except the inner ring bore surface may be plated (see clause 6).

* See ISO 15.

** This bearing belongs to diameter series 4*.

10.3 Tolerance and radial clearance tables — Metric series

Table 7 — Tolerances for ball and roller bearings

Tolerance values in micrometres

d mm		Inner ring							
		Δ_{dmp}		Δ_{ds} [1]		K_{ia}	Δ_{Bs}		V_{Bs}
over	incl.	high	low	high	low	max.	high	low	max.
2,5	10	0	−8	+2	−10	25	0	−120	20
10	18	0	−8	+3	−11	25	0	−120	20
18	30	0	−10	+3	−13	25	0	−120	20
30	50	0	−12	+3	−15	25	0	−120	20
50	100	0	−15	+4	−19	25	0	−120	20

Tolerance values in micrometres

D mm		Outer ring							
		Δ_{Dmp}		Δ_{Ds} [1]		K_{ea}	Δ_{Cs}		V_{Cs}
over	incl.	high	low	high	low	max.	high	low	max.
6	18	0	−8	+2	−10	40	0	−120	20
18	30	0	−9	+2	−11	40	0	−120	20
30	50	0	−11	+3	−14	40	0	−120	20
50	80	0	−13	+4	−17	40	0	−120	20
80	120	0	−15	+5	−20	40	0	−120	20

1) No values have been established for diameter series 8 and 9*.

Table 8 — Radial internal clearance — Rigid ball bearings (dimensions in tables 1 to 4)

Clearance values in micrometres

d mm		Normal group	
over	incl.	min.	max.
2,5	10	2	13
10	18	3	18
18	30	5	20
30	40	6	20
40	50	6	23
50	60	8	28

Table 9 — Radial internal clearance — Double row self-aligning ball bearings (dimensions in table 5)

Clearance values in micrometres

d mm		Normal group		Group 3	
over	incl.	min.	max.	min.	max.
2,5	10	2	13	10	20
10	18	3	18	13	23
18	24	5	20	15	25

Table 10 — Radial internal clearance — Single row spherical roller bearings (dimensions in table 6)

Clearance values in micrometres

d mm		Group 2		Normal group	
over	incl.	min.	max.	min.	max.
7	24	10	20	20	35
24	30	15	25	25	40

* See ISO 15.

10.4 Dimension tables — Inch series

Table 11 — Single row rigid ball bearings (figure 1), sealed or shielded

d	D	B	C	r_{1s}		r_s		C_{or}
				min.	max.	min.	max.	min.
mm				mm				N
4,826	15,875	7,544	5,944	0,127	0,508	0,406	0,787	1 220
6,350	19,050	7,137	5,563	0,127	0,508	0,406	0,787	1 460
7,938	20,638	7,544	5,944	0,381	0,762	0,406	0,787	1 730
9,525	22,225	7,950	6,350	0,381	0,762	0,406	0,787	1 960
12,700	28,575	9,525	7,950	0,381	0,762	0,406	0,787	3 100
15,875	34,925	10,312	8,738	0,381	0,762	0,813	1,194	5 300
19,050	41,275	11,125	9,525	0,381	0,762	0,813	1,194	7 350
25,400	50,800	12,700	11,125	0,381	0,762	0,813	1,194	9 300
31,750	57,150	12,700	11,125	0,381	0,762	0,813	1,194	10 800
in				in				lbf
0.190 0	0.625 0	0.297	0.234	0.005	0.020	0.016	0.031	275
0.250 0	0.750 0	0.281	0.219	0.005	0.020	0.016	0.031	335
0.312 5	0.812 5	0.297	0.234	0.015	0.030	0.016	0.031	390
0.375 0	0.875 0	0.313	0.250	0.015	0.030	0.016	0.031	450
0.500 0	1.125 0	0.375	0.313	0.015	0.030	0.016	0.031	695
0.625 0	1.375 0	0.406	0.344	0.015	0.030	0.032	0.047	1 200
0.750 0	1.625 0	0.438	0.375	0.015	0.030	0.032	0.047	1 660
1.000 0	2.000 0	0.500	0.438	0.015	0.030	0.032	0.047	2 120
1.250 0	2.250 0	0.500	0.438	0.015	0.030	0.032	0.047	2 450

NOTE — All external surfaces except the inner ring bore surface are plated (see clause 6).

Table 12 — Single row rigid ball bearings (figure 1), sealed

d	D	B	C	r_{1s}		r_s		C_{or}
				min.	max.	min.	max.	min.
mm				mm				N
4,826	19,746	7,544	6,858	0,127	0,508	0,559	0,940	1 400
6,350	22,896	12,294	8,509	0,127	0,508	0,813	1,194	2 120
7,938	31,750	14,173	9,525	0,381	0,762	0,813	1,194	4 500
9,525	36,512	15,748	11,913	0,381	0,762	0,813	1,194	6 300
12,700	42,862	15,748	12,700	0,381	0,762	1,118	1,499	9 300
15,875	49,212	15,478	12,700	0,381	0,762	1,118	1,499	11 200
in				in				lbf
0.190 0	0.777 4	0.297	0.270	0.005	0.020	0.022	0.037	335
0.250 0	0.901 4	0.484	0.335	0.005	0.020	0.032	0.047	480
0.312 5	1.250 0	0.558	0.375	0.015	0.030	0.032	0.047	1 000
0.375 0	1.437 5	0.620	0.469	0.015	0.030	0.032	0.047	1 400
0.500 0	1.687 5	0.620	0.500	0.015	0.030	0.044	0.059	2 120
0.625 0	1.937 5	0.620	0.500	0.015	0.030	0.044	0.059	2 500

NOTE — All external surfaces except the inner ring bore surface are plated (see clause 6).

Dimension tables — Inch series *(continued)*

Table 13 — Single row rigid ball bearings (figure 1), torque tube type, extra light, sealed or shielded

d	D	B	C	r_s and r_{1s}		C_{or}
				min.	max.	min.
mm				mm		N
15,875	26,988	7,137	6,350	0,381	0,762	2 600
19,050	30,163	7,137	6,350	0,381	0,762	3 000
22,225	33,338	7,137	6,350	0,381	0,762	3 350
26,988	38,100	7,137	6,350	0,381	0,762	4 000
33,338	44,450	7,137	6,350	0,381	0,762	4 750
39,688	50,800	7,137	6,350	0,381	0,762	5 400
46,038	57,150	7,137	6,350	0,381	0,762	6 300
52,388	66,675	7,137	6,350	0,381	0,762	7 350
58,738	73,025	7,137	6,350	0,381	0,762	8 000
in				in		lbf
0.625 0	1.062 5	0.281	0.250	0.015	0.030	585
0.750 0	1.187 5	0.281	0.250	0.015	0.030	670
0.875 0	1.312 5	0.281	0.250	0.015	0.030	750
1.062 5	1.500 0	0.281	0.250	0.015	0.030	900
1.312 5	1.750 0	0.281	0.250	0.015	0.030	1 060
1.562 5	2.000 0	0.281	0.250	0.015	0.030	1 220
1.812 5	2.250 0	0.281	0.250	0.015	0.030	1 430
2.062 5	2.625 0	0.281	0.250	0.015	0.030	1 630
2.312 5	2.875 0	0.281	0.250	0.015	0.030	1 800

NOTE — All external surfaces except the inner ring bore surface are plated (see clause 6).

Table 14 — Single row rigid ball bearings (figure 1), torque tube type, light, sealed or shielded

d	D	B	C	r_s and r_{1s}		C_{or}
				min.	max.	min.
mm				mm		N
19,050	38,100	11,125	9,525	0,610	0,991	5 000
22,225	41,275	11,125	9,525	0,610	0,991	5 600
25,400	44,450	11,125	9,525	0,610	0,991	6 100
27,000	46,038	11,125	9,525	0,610	0,991	6 700
33,350	52,388	11,125	9,525	0,610	0,991	7 800
36,525	55,562	11,125	9,525	0,610	0,991	8 300
39,700	58,738	11,125	9,525	0,610	0,991	9 000
46,050	65,088	11,125	9,525	0,610	0,991	10 000
52,400	71,438	11,125	9,525	0,610	0,991	11 400
58,750	77,788	11,125	9,525	0,610	0,991	12 500
74,625	98,425	13,487	11,913	0,991	1,372	19 600
77,800	101,600	13,487	11,913	0,991	1,372	21 600
in				in		lbf
0.750 0	1.500 0	0.438	0.375	0.024	0.039	1 120
0.875 0	1.625 0	0.438	0.375	0.024	0.039	1 250
1.000 0	1.750 0	0.438	0.375	0.024	0.039	1 370
1.063 0	1.812 5	0.438	0.375	0.024	0.039	1 500
1.313 0	2.062 5	0.438	0.375	0.024	0.039	1 760
1.438 0	2.187 5	0.438	0.375	0.024	0.039	1 900
1.563 0	2.312 5	0.438	0.375	0.024	0.039	2 000
1.813 0	2.562 5	0.438	0.375	0.024	0.039	2 240
2.063 0	2.812 5	0.438	0.375	0.024	0.039	2 500
2.313 0	3.062 5	0.438	0.375	0.024	0.039	2 800
2.938 0	3.875 0	0.531	0.469	0.039	0.054	4 500
3.063 0	4.000 0	0.531	0.469	0.039	0.054	4 900

NOTE — All external surfaces except the inner ring bore surface are plated (see clause 6).

Dimension tables — Inch series *(continued)*

Table 15 — Double row rigid angular contact ball bearings (figure 1), sealed

d	D	B	C	r_{1s}		r_s		C_{or}
				min.	max.	min.	max.	min.
mm				mm				N
4,826	19,746	12,573	12,014	0,127	0,508	0,559	0,940	3 600
6,350	22,896	15,748	12,471	0,127	0,508	0,813	1,194	4 000
7,938	31,750	18,923	17,450	0,381	0,762	0,813	1,194	9 000
9,525	36,512	22,098	20,168	0,381	0,762	0,813	1,194	11 800
12,700	42,862	23,673	21,742	0,381	0,762	1,118	1,499	17 600
15,875	49,212	25,273	23,368	0,381	0,762	1,118	1,499	21 200
in				in				lbf
0.190 0	0.777 4	0.495	0.473	0.005	0.020	0.022	0.037	815
0.250 0	0.901 4	0.620	0.491	0.005	0.020	0.032	0.047	900
0.312 5	1.250 0	0.745	0.687	0.015	0.030	0.032	0.047	2 040
0.375 0	1.437 5	0.870	0.794	0.015	0.030	0.032	0.047	2 650
0.500 0	1.687 5	0.932	0.856	0.015	0.030	0.044	0.059	4 000
0.625 0	1.937 5	0.995	0.920	0.015	0.030	0.044	0.059	4 750

NOTE — All external surfaces except the inner ring bore surface are plated (see clause 6).

Table 16 — Double row self-aligning ball bearings (figure 1), sealed or shielded

d	D	B	C	r_{1s}		r_s		C_{or}
				min.	max.	min.	max.	min.
mm				mm				N
4,826	19,746	12,700	9,957	0,127	0,508	0,559	0,940	780
6,350	22,896	17,450	11,786	0,127	0,508	0,813	1,194	980
7,938	31,750	20,625	16,662	0,381	0,762	0,813	1,194	2 080
9,525	36,512	23,800	19,050	0,381	0,762	0,813	1,194	2 800
12,700	42,862	25,400	20,625	0,381	0,762	1,118	1,499	4 000
15,875	49,212	28,575	23,800	0,381	0,762	1,118	1,499	5 000
in				in				lbf
0.190 0	0.777 4	0.500	0.392	0.005	0.020	0.022	0.037	176
0.250 0	0.901 4	0.687	0.464	0.005	0.020	0.032	0.047	220
0.312 5	1.250 0	0.812	0.656	0.015	0.030	0.032	0.047	465
0.375 0	1.437 5	0.937	0.750	0.015	0.030	0.032	0.047	630
0.500 0	1.687 5	1.000	0.812	0.015	0.030	0.044	0.059	900
0.625 0	1.937 5	1.125	0.937	0.015	0.030	0.044	0.059	1 140

NOTES

1 Permissible angular displacement $\theta = 10°$.

2 All external surfaces except the inner ring bore surface are plated (see clause 6).

Dimension tables — Inch series *(continued)*

Table 17 — Single row spherical roller bearings (figure 1), sealed

d	D	B	C	r_{1s}		r_s		C_{or}
				min.	max.	min.	max.	min.
mm				mm				N
6,350	22,896	15,875	11,786	0,127	0,508	0,813	1,194	3 900
7,938	31,750	20,625	16,662	0,381	0,762	0,813	1,194	10 000
9,525	36,512	23,800	19,050	0,381	0,762	0,813	1,194	13 400
12,700	42,862	25,400	20,625	0,381	0,762	1,118	1,499	16 300
15,875	49,212	28,575	23,800	0,381	0,762	1,118	1,499	24 000
19,050	60,325	33,325	28,575	0,381	0,762	1,118	1,499	35 500
in				in				lbf
0.250 0	0.901 4	0.625	0.464	0.005	0.020	0.032	0.047	880
0.312 5	1.250 0	0.812	0.656	0.015	0.030	0.032	0.047	2 240
0.375 0	1.437 5	0.937	0.750	0.015	0.030	0.032	0.047	3 000
0.500 0	1.687 5	1.000	0.812	0.015	0.030	0.044	0.059	3 650
0.625 0	1.937 5	1.125	0.937	0.015	0.030	0.044	0.059	5 400
0.750 0	2.375 0	1.312	1.125	0.015	0.030	0.044	0.059	8 000

NOTES

1 Permissible angular displacement θ = 10°.

2 All external surfaces except the inner ring bore surface are plated (see clause 6).

Table 18 — Double row spherical roller bearings (figure 1), sealed

d	D	B	C	r_{1s}		r_s		C_{or}
				min.	max.	min.	max.	min.
mm				mm				N
6,350	22,896	15,875	11,786	0,127	0,508	0,813	1,194	3 200
7,938	31,750	20,625	16,662	0,381	0,762	0,813	1,194	7 780
9,525	36,512	23,800	19,050	0,381	0,762	0,813	1,194	9 200
12,700	42,862	25,400	20,625	0,381	0,762	1,118	1,499	11 880
15,875	49,212	28,575	23,800	0,381	0,762	1,118	1,499	17 620
19,050	60,325	33,325	28,575	0,381	0,762	1,118	1,499	29 180
in				in				lbf
0.250 0	0.901 4	0.625	0.464	0.005	0.020	0.032	0.047	720
0.312 5	1.250 0	0.812	0.656	0.015	0.030	0.032	0.047	1 750
0.375 0	1.437 5	0.937	0.750	0.015	0.030	0.032	0.047	2 230
0.500 0	1.687 5	1.000	0.812	0.015	0.030	0.044	0.059	2 670
0.625 0	1.937 5	1.125	0.937	0.015	0.030	0.044	0.059	3 960
0.750 0	2.375 0	1.312	1.125	0.015	0.030	0.044	0.059	6 560

NOTES

1 Permissible angular displacement θ = 10°.

2 All external surfaces except the inner ring bore surface are plated (see clause 6).

Dimension tables — Inch series *(continued)*

Table 19 — Needle roller bearings (figure 3), shielded

d	D	B	C	r_s and r_{1s}		C_{or}
				min.	max.	min.
mm				mm		N
6,350	19,050	9,525	7,137	0,559	0,940	5 600
7,938	20,638	11,100	8,738	0,559	0,940	7 800
9,525	22,225	14,275	11,913	0,559	0,940	12 200
11,112	23,812	15,875	13,487	0,813	1,194	15 300
12,700	28,575	19,050	16,662	0,813	1,194	22 800
15,875	31,750	25,400	23,012	0,813	1,194	36 000
19,050	34,925	28,575	25,400	0,813	1,194	45 000
22,225	41,275	31,750	28,575	0,813	1,194	58 500
25,400	44,450	31,750	28,575	0,813	1,194	65 500
31,750	50,800	31,750	26,645	0,813	1,194	71 000
38,100	57,150	31,750	26,645	0,813	1,194	81 500
in				in		lbf
0.250 0	0.750 0	0.375	0.281	0.022	0.037	1 250
0.312 5	0.812 5	0.437	0.344	0.022	0.037	1 760
0.375 0	0.875 0	0.562	0.469	0.022	0.037	2 750
0.437 5	0.937 5	0.625	0.531	0.032	0.047	3 400
0.500 0	1.125 0	0.750	0.656	0.032	0.047	5 100
0.625 0	1.250 0	1.000	0.906	0.032	0.047	8 150
0.750 0	1.375 0	1.125	1.000	0.032	0.047	10 200
0.875 0	1.625 0	1.250	1.125	0.032	0.047	13 200
1.000 0	1.750 0	1.250	1.125	0.032	0.047	14 600
1.250 0	2.000 0	1.250	1.049	0.032	0.047	16 000
1.500 0	2.250 0	1.250	1.049	0.032	0.047	18 300

NOTE — All external surfaces except the inner ring bore surface are plated (see clause 6).

Table 20 — Needle roller bearings, track roller, yoke type (figure 4), single row, shielded

d	D	B	C	r_{1s}		C_{1s}	C_{or}
				min.	max.	min.	min.
mm				mm			N
4,826	19,050	7,925	5,537	0,559	0,940	3,048	3 550
6,350	22,225	9,525	7,137	0,559	0,940	5,588	5 600
9,525	26,988	12,700	9,525	0,559	0,940	7,874	10 200
12,700	33,338	15,875	12,700	0,813	1,194	11,176	17 000
15,875	38,100	19,050	15,875	0,813	1,194	14,224	24 500
19,050	44,450	25,400	22,225	0,813	1,194	19,050	40 500
22,225	50,800	28,575	25,400	0,813	1,194	22,352	51 000
in				in			lbf
0.190 0	0.750 0	0.312	0.218	0.022	0.037	0.12	800
0.250 0	0.875 0	0.375	0.281	0.022	0.037	0.22	1 250
0.375 0	1.062 5	0.500	0.375	0.022	0.037	0.31	2 280
0.500 0	1.312 5	0.625	0.500	0.032	0.047	0.44	3 800
0.625 0	1.500 0	0.750	0.625	0.032	0.047	0.56	5 500
0.750 0	1.750 0	1.000	0.875	0.032	0.047	0.75	9 000
0.875 0	2.000 0	1.125	1.000	0.032	0.047	0.88	11 600

NOTE — The external surfaces of the outer ring are chromium plated. All other external surfaces except the inner ring bore surface are cadmium plated (see clause 6).

Dimension tables — Inch series *(concluded)*

Table 21 — Needle roller bearings, track roller, yoke type (figure 4), double row, shielded

d	D	B	C	r_{1s}		C_{1s}	C_{or}
				min.	max.	min.	min.
mm				mm			N
9,525	28,575	25,400	22,225	0,559	0,940	19,050	20 400
12,700	34,925	31,750	28,575	0,813	1,194	25,400	36 000
15,875	41,275	38,100	34,925	0,813	1,194	28,448	56 000
19,050	47,625	44,450	41,275	0,813	1,194	35,052	80 000
22,225	53,975	50,800	47,625	0,813	1,194	41,148	106 000
in				in			lbf
0.375 0	1.125 0	1.000	0.875	0.022	0.037	0.75	4 500
0.500 0	1.375 0	1.250	1.125	0.032	0.047	1.00	8 150
0.625 0	1.625 0	1.500	1.375	0.032	0.047	1.12	12 700
0.750 0	1.875 0	1.750	1.625	0.032	0.047	1.38	18 000
0.875 0	2.125 0	2.000	1.875	0.032	0.047	1.62	24 000

NOTE — The external surfaces of the outer ring are chromium plated. All other external surfaces except the inner ring bore surface are cadmium plated (see clause 6).

10.5 Tolerance and radial clearance tables — Inch series

Table 22 — Tolerances for bearings

Bearings	Bore diameter range	Deviations				Radial runout		Face runout	Deviations	
		Δ_{dmp}		Δ_{Dmp}		K_{ia}	K_{ea}	S_{ia}	Δ_{Bs} and Δ_{Cs}	
		high	low	high	low	max.	max.	max.	high	low
Table no.	mm	μm								
11, 12, 15	All	0	−13	+2,5	−15	25	41	41	0	−127
16, 17, 18	All	0	−13	+2,5	−15	25	41	—	0	−127
13	15, 875 to 39, 688*	+18	−18	0	−25	51	41	51	0	−127
	46, 038 to 58, 738*	+25	−25	0	−38	51	41	51	0	−127
14	All	0	−25	0	−25	25	41	41	0	−127
19	All	0	−18	0	−15	25	—	—	0	−127
20, 21	All	0	−18	0	−25	25	—	—	0	−127
Table No.	in	0.000 1 in								
11, 12, 15	All	0	−5	+1	−6	10	16	16	0	−50
16, 17, 18	All	0	−5	+1	−6	10	16	—	0	−50
13	0.625 0 to 1.562 5*	+7	−7	0	−10	20	16	20	0	−50
	1.812 5 to 2.312 5*	+10	−10	0	−15	20	16	20	0	−50
14	All	0	−10	0	−10	10	16	16	0	−50
19	All	0	−7	0	−6	10	—	—	0	−50
20, 21	All	0	−7	0	−10	10	—	—	0	−50

* Range end values are included in each range.

Tolerance and radial clearance tables — Inch series (*continued*)

Table 23 — Radial internal clearance — Single and double row rigid ball bearings (dimensions in tables 11, 12 and 15)

d		Radial internal clearance			
		Normal group		Group 3	
over	incl.	min.	max.	min.	max.
mm		μm			
3,175	9,525	2	13	10	25
9,525	17,462	3	18	10	25
17,462	39,688	5	20	10	25
in		0.000 1 in			
0.125 0	0.375 0	1	5	4	10
0.375 0	0.687 5	1	7	4	10
0.687 5	1.562 5	2	8	4	10

Table 24 — Radial internal clearance — Single row rigid ball bearings, torque tube type (dimensions in tables 13 and 14)

d		Radial internal clearance					
		Normal group		Group 4*		Group 3**	
over	incl.	min.	max.	min.	max.	min.	max.
mm		μm					
9,525	17,462	0	18	20	46	10	25
17,462	39,688	0	20	20	46	10	25
39,688	49,212	0	23	20	46	10	25
49,212	63,500	0	28	20	46	10	25
63,500	79,375	0	30	20	46	10	25
in		0.000 1 in					
0.375 0	0.687 5	0	7	8	18	4	10
0.687 5	1.562 5	0	8	8	18	4	10
1.562 5	1.937 5	0	9	8	18	4	10
1.937 5	2.500 0	0	11	8	18	4	10
2.500 0	3.125 0	0	12	8	18	4	10

* Applies to table 13 bearings only.

** Applies to table 14 bearings only.

Table 25 — Radial internal clearance — Double row self-aligning ball bearings (dimensions in table 16)

d		Radial internal clearance			
		Normal group		Group 3	
over	incl.	min.	max.	min.	max.
mm		μm			
—	9,525	2	13	10	25
9,525	17,462	3	18	10	25
in		0.000 1 in			
—	0.375 0	1	5	4	10
0.375 0	0.687 5	1	7	4	10

Tolerance and radial clearance tables — Inch series (*concluded*)

Table 26 — Radial internal clearance — Single and double row spherical roller bearings (dimensions in tables 17 and 18)

d		Radial internal clearance			
		Group 2		Normal group	
over	incl.	min.	max.	min.	max.
mm		μm			
4,762	15,875	5	25	15	36
15,875	50,800	10	30	20	41
in		0.000 1 in			
0.187 5	0.625 0	2	10	6	14
0.625 0	2.000 0	4	12	8	16

Table 27 — Radial internal clearance — Needle roller bearings (dimensions in table 19)

d		Normal group	
over	incl.	min.	max.
mm		μm	
4,762	7,938	8	43
7,938	12,700	10	46
12,700	19,050	13	48
19,050	22,225	15	56
22,225	38,100	25	66
in		0.000 1 in	
0.187 5	0.312 5	3	17
0.312 5	0.500 0	4	18
0.500 0	0.750 0	5	19
0.750 0	0.875 0	6	22
0.875 0	1.500 0	10	26

Table 28 — Radial internal clearance — Needle roller bearings, track roller, yoke type, single and double row (dimensions in tables 20 and 21)

d		Normal group	
over	incl.	min.	max.
mm		μm	
4,762	22,225	0	38
in		0.000 1 in	
0.1875	0.8750	0	15

Annex

Permissible load

(This annex does not form part of the standard.)

A.1 General

For airframe bearings, when rotation of the bearing is slow and requirements on smoothness and low friction are not exacting, a much greater total permanent deformation can be permitted than that on which the basic static radial load rating C_{or} is based.

Loads which may be applied depend on the type and design of the bearings, the nature of the application and the service conditions. Therefore, it should be determined by the airframe designer in consultation with the bearing manufacturer. Normally maximum loads should not exceed the limits given in table 29.

Normally maximum permissible operating loads, applicable where movement takes place in the bearing, are smaller than the static acceptance loads given in table 29.

A.2 Symbols

C_{or} = basic static radial load rating, newtons (or pounds-force)

F_r = bearing radial load = radial component of actual bearing load, newtons (or pounds-force)

F_a = bearing axial load = axial component of actual bearing load, newtons (or pounds-force)

α = nominal contact angle of a bearing

A.3 Static acceptance load

A static acceptance load, calculated according to table 29, is a load which a non-rotating bearing shall withstand for one minute without unacceptable deformation of the bearing, affecting its behaviour in operation after the acceptance load has been removed.

NOTE — The magnitude of the factors given in table 29 are under further consideration and may be changed in a future edition of this International Standard. Also the addition of more specific information regarding the maximum permissible operating loads applicable when movement takes place is under further consideration.

Table 29 — Static acceptance load

Bearing type	Table No.	Permissible loads		
		Radial load	Axial load	Combined load
Rigid radial contact ball bearings, single and double row	1—4 11—14	$F_r = 5{,}6\ C_{or}$	$F_a = 2{,}5\ C_{or}$	The maximum permissible radial and axial loads may be applied simultaneously
Rigid angular contact ball bearings, double row	15	$F_r = 5{,}6\ C_{or}$	$F_a = 2{,}0\ C_{or}$	$F_r + 2{,}8\ F_a = 5{,}6\ C_{or}$
Self-aligning ball bearings, double row	5 and 16	$F_r = 8\ C_{or}$	a) $F_a = 2{,}5\ C_{or}$ * b) $F_a = \dfrac{8\ C_{or}}{0{,}44 \cot \alpha}$	a) $F_r + 3{,}2\ F_a = 8\ C_{or}$ * b) $F_r + 0{,}44 \cot \alpha\ F_a = 8\ C_{or}$
Spherical roller bearings, single row	6 and 17	$F_r = 5\ C_{or}$	$F_a = 1{,}5\ C_{or}$ **	$F_r + 3{,}3\ F_a = 5\ C_{or}$ **
Spherical roller bearings, double row	18	$F_r = 5\ C_{or}$	a) $F_a = 2{,}0\ C_{or}$ * b) $F_a = \dfrac{5\ C_{or}}{0{,}44 \cot \alpha}$	a) $F_r + 2{,}5\ F_a = 5\ C_{or}$ * b) $F_r + 0{,}44 \cot \alpha\ F_a = 5\ C_{or}$
Needle roller bearings	19	$F_r = 3{,}3\ C_{or}$	This type of bearing is not suitable for supporting axial loads or combined loads	
Needle roller bearings, track roller	20 and 21	$F_r = 1{,}2\ C_{or}$		

* Applies for a small contact angle. More exact values are obtained with formula b).

** Applies for purely static conditions. Where movement takes place the permissible load may be smaller, i.e. it may be necessary to use a smaller factor than 1,5 and a larger factor than 3,3, respectively.