

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 104

ROLLING BEARINGS
THRUST BEARINGS WITH FLAT SEATS
BOUNDARY DIMENSIONS

2nd EDITION
December 1966

This second edition supersedes section 5 of ISO Recommendation R 15-1955 and section 2 of ISO/Recommendation R 104-1959. Section 1 of ISO Recommendation R 104-1959 will be replaced by ISO Recommendation R ..., *Radial Bearings — Boundary Dimensions — General Plan* (at present Draft ISO Recommendation No. 358).

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BRIEF HISTORY

The ISO Recommendation R 104 (2nd Edition), *Rolling Bearings – Thrust Bearings with Flat Seats – Boundary Dimensions*, was drawn up by Technical Committee ISO/TC 4, *Rolling Bearings*, the Secretariat of which is held by the Sveriges Standardiseringskommission (SIS).

Work on this question by the Technical Committee began in 1958 and led, in 1963, to the adoption of a Draft revision of Recommendation ISO/R 104-1959 section 2 and to the adoption of Draft ISO Recommendation (No. 361) concerning revision of Recommendation ISO/R 15-1955 section 5.

In March 1963, this Draft ISO Recommendation (No. 361) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Australia	Greece	Sweden
Austria	Hungary	Switzerland
Belgium	India	Turkey
Brazil	Italy	United Kingdom
Canada	Japan	U.S.A.
Chile	Netherlands	U.S.S.R.
Czechoslovakia	Poland	Yugoslavia
France	Romania	
Germany	Spain	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in December 1966, to accept it as an ISO RECOMMENDATION.

This ISO Recommendation supersedes section 5 of ISO Recommendation R 15-1955, *Ball and Roller Bearings*, and section 2 of ISO Recommendation R 104-1959, *Ball and Roller Bearings – Boundary Dimensions*.

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ROLLING BEARINGS**THRUST BEARINGS WITH FLAT SEATS****BOUNDARY DIMENSIONS****1. SINGLE DIRECTION THRUST BEARINGS WITH FLAT SEATS
GENERAL PLAN****1.1 Introduction**

1.1.1 The object of the General Plan is to reduce the number of thrust bearing sizes enough to afford economic production and yet to provide a sufficient number of sizes to satisfy present and future needs of bearing users. These needs are very comprehensive and varying. Therefore the Plan should embrace a wide range of numerically determined sizes and proportions and may even be extended by ISO, in accordance with the general rules given below.

1.1.2 The General Plan should be considered as a guide for the national standardizing organizations. National standards can with advantage cover a restricted range of sizes, but refer to this ISO Recommendation as the rational source of any extension. Especially, when standardizing sizes of particular bearing types, the national organizations should very carefully consider their standard with a view to keeping the number of bearing sizes as small as compatible with a good overall national economy, and excluding sizes not manufactured and not required for the time being.

Bearing manufacturers should select from the national standard the sizes and proportions appropriate to the bearing type and the purpose under consideration. Bearing users should select bearing types and sizes from the manufacturers specifications, giving preference to bearings whose dimensions conform to the national standard. As all bearings may not be in current production at any particular time, it is advisable for user designers to approach bearing manufacturers during the early stages of design for information regarding the availability of the bearings.

1.1.3 The General Plan comprises:

- (a) Numerically determined nominal boundary dimensions (see clause 1.2, pages 9 to 14),
- (b) General rules for the extension of the Plan (see clause 1.3, page 15).

The General Plan does not contain any directions pertaining to the internal design of bearings or any indication as to the availability of bearings.

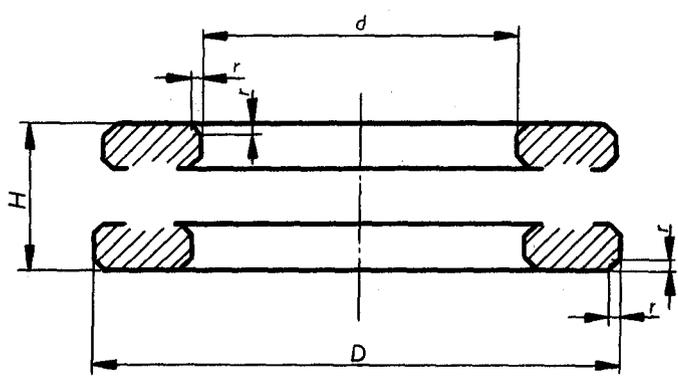


FIG. 1

d = bore diameter of shaft washer

D = outside diameter of housing washer

H = bearing height

r = chamfer dimension of bore corner of shaft washer and outside corner of housing washer

r_{nominal} = nominal chamfer dimension *

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* Nominal chamfer dimensions do not control the shape of the bearing corner, i.e. the profile of the bearing corner created by the chamfering or rounding-off.

1.2 Numerically determined nominal boundary dimensions

1.2.1 Diameter series 0

Dimensions in millimetres

Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nominal	Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nominal
		70	90	10				70	90	10	
		Height <i>H</i>						Height <i>H</i>			
4	12	4	—	6	0.5	360	400	18	24	30	1.5
6	16	5	—	7	0.5	380	420	18	24	30	1.5
8	18	5	—	7	0.5	400	440	18	24	30	1.5
10	20	5	—	7	0.5	420	460	18	24	30	1.5
12	22	5	—	7	0.5	440	480	18	24	30	1.5
15	26	5	—	7	0.5	460	500	18	24	30	1.5
17	28	5	—	7	0.5	480	520	18	24	30	1.5
20	32	6	—	8	0.5	500	540	18	24	30	1.5
25	37	6	—	8	0.5	530	580	23	30	38	2
30	42	6	—	8	0.5	560	610	23	30	38	2
35	47	6	—	8	0.5	600	650	23	30	38	2
40	52	6	—	9	0.5	630	680	23	30	38	2
45	60	7	—	10	0.5	670	730	27	36	45	2.5
50	65	7	—	10	0.5	710	780	32	42	53	2.5
55	70	7	—	10	0.5	750	820	32	42	53	2.5
60	75	7	—	10	0.5	800	870	32	42	53	2.5
65	80	7	—	10	0.5	850	920	32	42	53	2.5
70	85	7	—	10	0.5	900	980	36	48	63	3
75	90	7	—	10	0.5	950	1030	36	48	63	3
80	95	7	—	10	0.5	1000	1090	41	54	70	3.5
85	100	7	—	10	0.5	1060	1150	41	54	70	3.5
90	105	7	—	10	0.5	1120	1220	45	60	80	3.5
100	120	9	—	14	1	1180	1280	45	60	80	3.5
110	130	9	—	14	1	1250	1360	50	67	85	4
120	140	9	—	14	1	1320	1440	—	—	95	4
130	150	9	—	14	1	1400	1520	—	—	95	4
140	160	9	—	14	1	1500	1630	—	—	105	5
150	170	9	—	14	1	1600	1730	—	—	105	5
160	180	9	—	14	1	1700	1840	—	—	112	5
170	190	9	—	14	1	1800	1950	—	—	120	5
180	200	9	—	14	1	1900	2060	—	—	130	6
190	215	11	—	17	1.5	2000	2160	—	—	130	6
200	225	11	—	17	1.5	2120	2300	—	—	140	6
220	250	14	—	22	1.5	2240	2430	—	—	150	6
240	270	14	—	22	1.5	2360	2550	—	—	150	6
260	290	14	—	22	1.5	2500	2700	—	—	160	6
280	310	14	—	22	1.5						
300	340	18	24	30	1.5						
320	360	18	24	30	1.5						
340	380	18	24	30	1.5						

1.2.2 Diameter series 1

Dimensions in millimetres

Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nominal	Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nominal
		71	91	11				71	91	11	
		Height <i>H</i>						Height <i>H</i>			
10	24	6	—	9	0.5	320	400	36	48	63	3
12	26	6	—	9	0.5	340	420	36	48	64	3
15	28	6	—	9	0.5	360	440	36	48	65	3
17	30	6	—	9	0.5	380	460	36	48	65	3
20	35	7	—	10	0.5	400	480	36	48	65	3
25	42	8	—	11	1	420	500	36	48	65	3
30	47	8	—	11	1	440	540	45	60	80	3.5
35	52	8	—	12	1	460	560	45	60	80	3.5
40	60	9	—	13	1	480	580	45	60	80	3.5
45	65	9	—	14	1	500	600	45	60	80	3.5
50	70	9	—	14	1	530	640	50	67	85	4
55	78	10	—	16	1	560	670	50	67	85	4
60	85	11	—	17	1.5	600	710	50	67	85	4
65	90	11	—	18	1.5	630	750	54	73	95	4
70	95	11	—	18	1.5	670	800	58	78	105	5
75	100	11	—	19	1.5	710	850	63	85	112	5
80	105	11	—	19	1.5	750	900	67	90	120	5
85	110	11	—	19	1.5	800	950	67	90	120	5
90	120	14	—	22	1.5	850	1000	67	90	120	5
100	135	16	21	25	1.5	900	1060	73	95	130	6
110	145	16	21	25	1.5	950	1120	78	103	135	6
120	155	16	21	25	1.5	1000	1180	82	109	140	6
130	170	18	24	30	1.5	1060	1250	85	115	150	6
140	180	18	24	31	1.5	1120	1320	90	122	160	6
150	190	18	24	31	1.5	1180	1400	100	132	175	8
160	200	18	24	31	1.5	1250	1460	—	—	175	8
170	215	20	27	34	2	1320	1540	—	—	175	8
180	225	20	27	34	2	1400	1630	—	—	180	8
190	240	23	30	37	2	1500	1750	—	—	195	8
200	250	23	30	37	2	1600	1850	—	—	195	8
220	270	23	30	37	2	1700	1970	—	—	212	10
240	300	27	36	45	2.5	1800	2080	—	—	220	10
260	320	27	36	45	2.5	1900	2180	—	—	220	10
280	350	32	42	53	2.5	2000	2300	—	—	236	10
300	380	36	48	62	3	2120	2430	—	—	243	10
						2240	2570	—	—	258	12
						2360	2700	—	—	265	12
						2500	2850	—	—	272	12

1.2.3 Diameter series 2

Dimensions in millimetres

Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nomi- nal	Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nomi- nal
		72	92	12				72	92	12	
		Height <i>H</i>						Height <i>H</i>			
4	16	6	—	8	0.5	180	250	32	42	56	2.5
6	20	6	—	9	0.5	190	270	36	48	62	3
8	22	6	—	9	0.5	200	280	36	48	62	3
10	26	7	—	11	1	220	300	36	48	63	3
12	28	7	—	11	1	240	340	45	60	78	3.5
15	32	8	—	12	1	260	360	45	60	79	3.5
17	35	8	—	12	1	280	380	45	60	80	3.5
20	40	9	—	14	1	300	420	54	73	95	4
25	47	10	—	15	1	320	440	54	73	95	4
30	52	10	—	16	1	340	460	54	73	96	4
35	62	12	—	18	1.5	360	500	63	85	110	5
40	68	13	—	19	1.5	380	520	63	85	112	5
45	73	13	—	20	1.5	400	540	63	85	112	5
50	78	13	—	22	1.5	420	580	73	95	130	6
55	90	16	21	25	1.5	440	600	73	95	130	6
60	95	16	21	26	1.5	460	620	73	95	130	6
65	100	16	21	27	1.5	480	650	78	103	135	6
70	105	16	21	27	1.5	500	670	78	103	135	6
75	110	16	21	27	1.5	530	710	82	109	140	6
80	115	16	21	28	1.5	560	750	85	115	150	6
85	125	18	24	31	1.5	600	800	90	122	160	6
90	135	20	27	35	2	630	850	100	132	175	8
100	150	23	30	38	2	670	900	103	140	180	8
110	160	23	30	38	2	710	950	109	145	190	8
120	170	23	30	39	2	750	1000	112	150	195	8
130	190	27	36	45	2.5	800	1060	118	155	205	10
140	200	27	36	46	2.5	850	1120	122	160	212	10
150	215	29	39	50	2.5	900	1180	125	170	220	10
160	225	29	39	51	2.5	950	1250	136	180	236	10
170	240	32	42	55	2.5	1000	1320	145	190	250	12
						1060	1400	155	206	265	12

1.2.4 Diameter series 3

Dimensions in millimetres

Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nominal	Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nominal
		73	93	13				73	93	13	
		Height <i>H</i>						Height <i>H</i>			
4	20	7	—	11	1	180	300	54	73	95	4
6	24	8	—	12	1	190	320	58	78	105	5
8	26	8	—	12	1	200	340	63	85	110	5
10	30	9	—	14	1	220	360	63	85	112	5
12	32	9	—	14	1	240	380	63	85	112	5
15	37	10	—	15	1	260	420	73	95	130	6
17	40	10	—	16	1	280	440	73	95	130	6
20	47	12	—	18	1.5	300	480	82	109	140	6
25	52	12	—	18	1.5	320	500	82	109	140	6
30	60	14	—	21	1.5	340	540	90	122	160	6
35	68	15	—	24	1.5	360	560	90	122	160	6
40	78	17	22	26	1.5	380	600	100	132	175	8
45	85	18	24	28	1.5	400	620	100	132	175	8
50	95	20	27	31	2	420	650	103	140	180	8
55	105	23	30	35	2	440	680	109	145	190	8
60	110	23	30	35	2	460	710	112	150	195	8
65	115	23	30	36	2	480	730	112	150	195	8
70	125	25	34	40	2	500	750	112	150	195	8
75	135	27	36	44	2.5	530	800	122	160	212	10
80	140	27	36	44	2.5	560	850	132	175	224	10
85	150	29	39	49	2.5	600	900	136	180	236	10
90	155	29	39	50	2.5	630	950	145	190	250	12
100	170	32	42	55	2.5	670	1000	150	200	258	12
110	190	36	48	63	3	710	1060	160	212	272	12
120	210	41	54	70	3.5	750	1120	165	224	290	12
130	225	42	58	75	3.5	800	1180	170	230	300	12
140	240	45	60	80	3.5	850	1250	180	243	315	15
150	250	45	60	80	3.5	900	1320	190	250	335	15
160	270	50	67	87	4	950	1400	200	272	355	15
170	280	50	67	87	4						

1.2.5 Diameter series 4

Dimensions in millimetres

Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nomi- nal	Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series			Chamfer <i>r</i> nomi- nal
		74	94	14				74	94	14	
		Height <i>H</i>						Height <i>H</i>			
25	60	16	21	24	1.5	200	400	90	122	155	6
30	70	18	24	28	1.5	220	420	90	122	160	8
35	80	20	27	32	2	240	440	90	122	160	8
40	90	23	30	36	2	260	480	100	132	175	8
45	100	25	34	39	2	280	520	109	145	190	8
50	110	27	36	43	2.5	300	540	109	145	190	8
55	120	29	39	48	2.5	320	580	118	155	205	10
60	130	32	42	51	2.5	340	620	125	170	220	10
65	140	34	45	56	3	360	640	125	170	220	10
70	150	36	48	60	3	380	670	132	175	224	10
75	160	38	51	65	3	400	710	140	185	243	10
80	170	41	54	68	3.5	420	730	140	185	243	10
85	180	42	58	72	3.5	440	780	155	206	265	12
90	190	45	60	77	3.5	460	800	155	206	265	12
100	210	50	67	85	4	480	850	165	224	290	12
110	230	54	73	95	4	500	870	165	224	290	12
120	250	58	78	102	5	530	920	175	236	308	12
130	270	63	85	110	5	560	980	190	250	335	15
140	280	63	85	112	5	600	1030	195	258	335	15
150	300	67	90	120	5	630	1090	206	280	365	15
160	320	73	95	130	6	670	1150	218	290	375	18
170	340	78	103	135	6	710	1220	230	308	400	18
180	360	82	109	140	6	750	1280	236	315	412	18
190	380	85	115	150	6	800	1360	250	335	438	18

1.2.6 Diameter series 5

Dimensions in millimetres

Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series		Chamfer <i>r</i> nomi- nal	Bore diameter <i>d</i>	Outside diameter <i>D</i>	Dimension series		Chamfer <i>r</i> nomi- nal
		95					95		
		Height <i>H</i>					Height <i>H</i>		
17	52	21		1.5	180	420	145		8
20	60	24		1.5	190	440	150		8
25	73	29		2	200	460	155		10
30	85	34		2	220	500	170		10
35	100	39		2	240	540	180		10
40	110	42		2.5	260	580	190		12
45	120	45		3	280	620	206		12
50	135	51		3	300	670	224		12
55	150	58		3.5	320	710	236		12
60	160	60		3.5	340	750	243		15
65	170	63		3.5	360	780	250		15
70	180	67		4	380	820	265		15
75	190	69		4	400	850	272		15
80	200	73		4	420	900	290		18
85	215	78		5	440	950	308		18
90	225	82		5	460	980	315		18
100	250	90		5	480	1000	315		18
110	270	95		6	500	1060	335		18
120	300	109		6	530	1090	335		18
130	320	115		6	560	1150	355		18
140	340	122		6	600	1220	375		18
150	360	125		8	630	1280	388		18
160	380	132		8	670	1320	388		18
170	400	140		8	710	1400	412		18

1.3 General rules for the extension of the Plan

1.3.1 For any new dimension not numerically determined in this ISO Recommendation, the following rules should serve as a guide. The formulae given for outside diameter and height cannot, however, be used for the definite determination of the boundary dimension values. They may often require to be modified in order to maintain the continuity of the Plan, to give bearing proportions equally suitable for small bearings and to permit selection of preferred dimensions already covered by the Plan.

It is therefore necessary that any new dimension be approved by ISO.

1.3.2 The bore diameters d of small bore washers, above $d = 500$ mm, should be taken from the preferred number series R 40.

1.3.3 The outside diameters D of large bore washers should be calculated, in millimetres, from the formula:

$$D = d + f_D d^{0.8}$$

Values of the factor f_D are as follows:

Diameter series	0	1	2	3	4	5
f_D	0.36	0.72	1.20	1.84	2.68	3.80

Outside diameter dimensions already appearing in the Plan should be chosen for preference.

New outside diameter dimensions should be rounded off as follows:

D		Rounded off to the nearest
from	to	
—	3	0.5 mm
3	80	1 mm
80	230	5 mm
230	—	10 mm

1.3.4 The bearing heights H should be calculated, in millimetres, from the formula:

$$H = f_H \frac{D - d}{2}$$

Values of the factor f_H are as follows:

Height series	7	9	1
f_H	0.9	1.2	1.6

New height dimensions should be rounded off as follows:

<i>H</i>		Rounded off to the nearest
from	to	
—	3	0.1 mm
3	4	0.5 mm
4	500	1 mm
500	—	5 mm

1.3.5 The nominal chamfer dimension *r* should as a rule exceed neither 10 per cent of the bearing height *H* nor 10 per cent of the sectional width $\frac{D - d}{2}$ and should be rounded off as follows:

<i>r</i>		Rounded off to the nearest
from	to	
—	0.3	0.05 mm
0.3	0.5	0.1 mm
0.5	4	0.5 mm
4	—	1 mm

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