Spherical plain bearings
Part 1: Radial spherical plain bearings
(ISO 12240-1 : 1998)

DIN ISO 12240-1

ICS 21.100.20

This standard, together with DIN ISO 12240-4, July 1999 edition, supersedes DIN 648, August 1987 edition.

Gelenklager – Teil 1: Radial-Gelenklager (ISO 12240-1 : 1998)

This standard incorporates International Standard
ISO 12240-1 Spherical plain bearings – Part 1: Radial spherical plain bearings.

A comma is used as the decimal marker.

National foreword

This standard has been prepared by ISO/TC 4.

The responsible German body involved in its preparation was the Technical Committee *Wälzlager*.

The DIN Standards corresponding to the International Standards referred to in clause 2 of the ISO Standard are as follows:

ISO Standard	DIN Standard
ISO 582	DIN 620-6
ISO 1132	DIN ISO 1132
ISO 6811	DIN ISO 6811
ISO 12240-4	DIN ISO 12240-4

Amendments

DIN 648, August 1987 edition, has been superseded by the specifications of DIN ISO 12240-1 and DIN ISO 12240-4.

Previous editions

DIN 648: 1972-01, 1987-08.

National Annex NA

Standards referred to

(and not included in **Normative references**)

DIN 620-6	Chamfer dimension limits for rolling bearings
DIN ISO 12240-4	Spherical plain bearings – Part 4: Angular contact radial spherical plain bearings

ISO Standard comprises 14 pages.

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Spherical plain bearings

Part 1: Radial spherical plain bearings

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standard 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 12240-1 was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 7, *Spherical plain bearings*.

This first edition cancels and replaces ISO 6124-1:1987, ISO 6124-2:1982, ISO 6124-3:1982 and ISO 6125:1982 of which it constitutes a technical revision.

ISO 12240 consists of the following parts, under the general title *Spherical plain bearings*:

— *Part 1: Radial spherical plain bearings*

— *Part 2: Angular contact radial spherical plain bearings*

— *Part 3: Thrust spherical plain bearings*

— *Part 4: Spherical plain bearing rod ends*

1 Scope

This part of ISO 12240 specifies dimension series, tolerances and radial internal clearances for radial spherical plain bearings.

The dimensions and tolerances specified in this part of ISO 12240 have been selected to permit the design of radial spherical plain bearings using a wide choice of sliding material combinations.

The specified tolerance values apply to finished, radial spherical plain bearings before any coating, plating, ring splitting or ring fracturing.

In the case of surface treated radial spherical plain bearings, there may be slight deviations from the specified tolerance values.

Radial spherical plain bearings need not conform to the designs illustrated but compliance is required as regards the dimensions, tolerances and radial internal clearances specified.

NOTE — Spherical plain bearings for airframe applications are not covered by this part of ISO 12240.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 12240. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 12240 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 582:1995, *Rolling bearings – Chamfer dimensions – Maximum values.*

ISO 1132-1: —[1], *Rolling bearings – Tolerances – Part 1: Terms and definitions.*

ISO 6811:1998, *Spherical plain bearings – Vocabulary.*

ISO 12240-4:1998, *Spherical plain bearings – Part 4: Spherical plain bearing rod ends.*

3 Definitions and symbols

For the purposes of this part of ISO 12240, the definitions given in ISO 1132-1 and ISO 6811 apply. The symbols (except those for tolerances) shown in the figures and the values given in the tables denote nominal dimensions unless specified otherwise.

B	Inner ring width
C	Outer ring width
D	Outside diameter
d	Bore diameter
d_1	Outside diameter of inner ring face
d_k	Sphere diameter
$r_{s\ min}$[2]	Smallest single chamfer dimension, inner ring
$r_{1s\ min}$[2]	Smallest single chamfer dimension, outer ring
V_{Dmp}	Variation of mean outside diameter
V_{dmp}	Variation of mean bore diameter
V_{Dp}	Variation of outside diameter in a single radial plane
V_{dp}	Variation of bore diameter in a single radial plane
α	Angle of tilt
Δ_{Bs}	Deviation of a single inner ring width
Δ_{Cs}	Deviation of a single outer ring width
Δ_{Dmp}	Deviation of mean outside diameter in a single plane
Δ_{dmp}	Deviation of mean bore diameter in a single plane

1) To be published. (Revision of ISO 1132:1980)

2) The corresponding maximum chamfer dimensions are given in table 1 of ISO 582:1985.

4 Angles of tilt, α

The specified angles of tilt (approximate values) represent the angles by which the axes of the inner ring and of the outer ring may be inclined in relation to each other without reducing the projected theoretical contact area of the two bearing rings when the two ring axes are parallel to each other.

NOTE — Attention is drawn to the fact that after mounting a radial spherical plain bearing on a shaft and into a housing, the angle through which the bearing can tilt may be restricted by the design of the adjacent components.

5 Dimensions, tolerances and radial internal clearances

5.1 Dimensions

See figures 1 and 2, and tables 1 to 6.

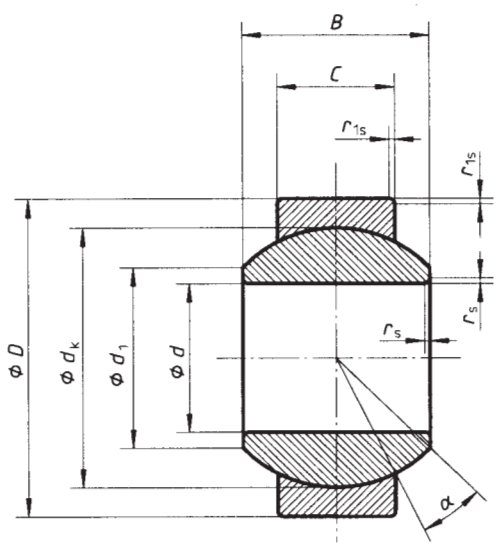


Figure 1 — Radial spherical plain bearings, dimension series E, G, C, K, H

Table 1 — Radial spherical plain bearings, dimension series E

d mm	D mm	B mm	C mm	d_1 ≈ mm	d_k [1] mm	r_s min. mm	r_{1s} min. mm	α ≈ °
4	12	5	3	6	8	0,3	0,3	16
5	14	6	4	8	10	0,3	0,3	13
6	14	6	4	8	10	0,3	0,3	13
8	16	8	5	10	13	0,3	0,3	15
10	19	9	6	13	16	0,3	0,3	12
12	22	10	7	15	18	0,3	0,3	10
15	26	12	9	18	22	0,3	0,3	8
17	30	14	10	20	25	0,3	0,3	10
20	35	16	12	24	29	0,3	0,3	9
25	42	20	16	29	35	0,6	0,6	7
30	47	22	18	34	40	0,6	0,6	6
35	55	25	20	39	47	0,6	1	6
40	62	28	22	45	53	0,6	1	7
45	68	32	25	50	60	0,6	1	7
50	75	35	28	55	66	0,6	1	6
55	85	40	32	62	74	0,6	1	7
60	90	44	36	66	80	1	1	6
70	105	49	40	77	92	1	1	6
80	120	55	45	88	105	1	1	6
90	130	60	50	98	115	1	1	5
100	150	70	55	109	130	1	1	7
110	160	70	55	120	140	1	1	6
120	180	85	70	130	160	1	1	6
140	210	90	70	150	180	1	1	7
160	230	105	80	170	200	1	1	8
180	260	105	80	192	225	1,1	1,1	6
200	290	130	100	212	250	1,1	1,1	7
220	320	135	100	238	275	1,1	1,1	8
240	340	140	100	265	300	1,1	1,1	8
260	370	150	110	285	325	1,1	1,1	7
280	400	155	120	310	350	1,1	1,1	6
300	430	165	120	330	375	1,1	1,1	7

1) Reference only.

Table 2 — Radial spherical plain bearings, dimension series G

d mm	D mm	B mm	C mm	d_1 ≈ mm	d_k [1] mm	r_s min. mm	r_{1s} min. mm	α ≈ °
4	14	7	4	7	10	0,3	0,3	20
5	14	7	4	7	10	0,3	0,3	20
6	16	9	5	9	13	0,3	0,3	21
8	19	11	6	11	16	0,3	0,3	21
10	22	12	7	13	18	0,3	0,3	18
12	26	15	9	16	22	0,3	0,3	18
15	30	16	10	19	25	0,3	0,3	16
17	35	20	12	21	29	0,3	0,3	19
20	42	25	16	24	35	0,3	0,6	17
25	47	28	18	29	40	0,6	0,6	17
30	55	32	20	34	47	0,6	1	17
35	62	35	22	39	53	0,6	1	16
40	68	40	25	44	60	0,6	1	17
45	75	43	28	50	66	0,6	1	15
50	90	56	36	57	80	0,6	1	17
60	105	63	40	67	92	1	1	17
70	120	70	45	77	105	1	1	16
80	130	75	50	87	115	1	1	14
90	150	85	55	98	130	1	1	15
100	160	85	55	110	140	1	1	14
110	180	100	70	122	160	1	1	12
120	210	115	70	132	180	1	1	16
140	230	130	80	151	200	1	1	16
160	260	135	80	176	225	1	1,1	16
180	290	155	100	196	250	1,1	1,1	14
200	320	165	100	220	275	1,1	1,1	15
220	340	175	100	243	300	1,1	1,1	16
240	370	190	110	263	325	1,1	1,1	15
260	400	205	120	283	350	1,1	1,1	15
280	430	210	120	310	375	1,1	1,1	15

1) Reference only.

Table 3 — Radial spherical plain bearings, dimension series C

d mm	D mm	B mm	C mm	d_1 ≈ mm	d_k [1] mm	r_s min. mm	r_{1s} min. mm	α ≈ °
320	440	160	135	340	375	1,1	3	4
340	460	160	135	360	390	1,1	3	3
360	480	160	135	380	410	1,1	3	3
380	520	190	160	400	440	1,5	4	4
400	540	190	160	425	465	1,5	4	3
420	560	190	160	445	480	1,5	4	3
440	600	218	185	465	515	1,5	4	3
460	620	218	185	485	530	1,5	4	3
480	650	230	195	510	560	2	5	3
500	670	230	195	530	580	2	5	3
530	710	243	205	560	610	2	5	3
560	750	258	215	590	645	2	5	4
600	800	272	230	635	690	2	5	3
630	850	300	260	665	730	3	6	3
670	900	308	260	710	770	3	6	3
710	950	325	275	755	820	3	6	3
750	1 000	335	280	800	870	3	6	3
800	1 060	355	300	850	915	3	6	3
850	1 120	365	310	905	975	3	6	3
900	1 180	375	320	960	1 030	3	6	3
950	1 250	400	340	1 015	1 090	4	7,5	3
1 000	1 320	438	370	1 065	1 150	4	7,5	3
1 060	1 400	462	390	1 130	1 220	4	7,5	3
1 120	1 460	462	390	1 195	1 280	4	7,5	3
1 180	1 540	488	410	1 260	1 350	4	7,5	3
1 250	1 630	515	435	1 330	1 425	4	7,5	3
1 320	1 720	545	460	1 405	1 510	4	7,5	3
1 400	1 820	585	495	1 485	1 600	5	9,5	3
1 500	1 950	625	530	1 590	1 710	5	9,5	3
1 600	2 060	670	565	1 690	1 820	5	9,5	3
1 700	2 180	710	600	1 790	1 925	5	9,5	3
1 800	2 300	750	635	1 890	2 035	6	12	3
1 900	2 430	790	670	2 000	2 150	6	12	3
2 000	2 570	835	705	2 100	2 260	6	12	3

1) Reference only.

Table 4 — Radial spherical plain bearings, dimension series K

d mm	D mm	B mm	C mm	d_1 ≈ mm	d_k [1] mm	r_s min. mm	r_{1s} min. mm	α ≈ °
3	10	6	4,5	5,1	7,9	0,2	0,2	14
5	13	8	6	7,7	11,1	0,3	0,3	13
6	16	9	6,75	8,9	12,7	0,3	0,3	13
8	19	12	9	10,3	15,8	0,3	0,3	14
10	22	14	10,5	12,9	19	0,3	0,3	13
12	26	16	12	15,4	22,2	0,3	0,3	13
14	29	19	13,5	16,8	25,4	0,3	0,3	16
16	32	21	15	19,3	28,5	0,3	0,3	15
18	35	23	16,5	21,8	31,7	0,3	0,3	15
20	40	25	18	24,3	34,9	0,3	0,6	14
22	42	28	20	25,8	38,1	0,3	0,6	15
25	47	31	22	29,5	42,8	0,3	0,6	15
30	55	37	25	34,8	50,8	0,3	0,6	17
35	65	43	30	40,3	59	0,6	1	16
40	72	49	35	44,2	66	0,6	1	16
50	90	60	45	55,8	82	0,6	1	14

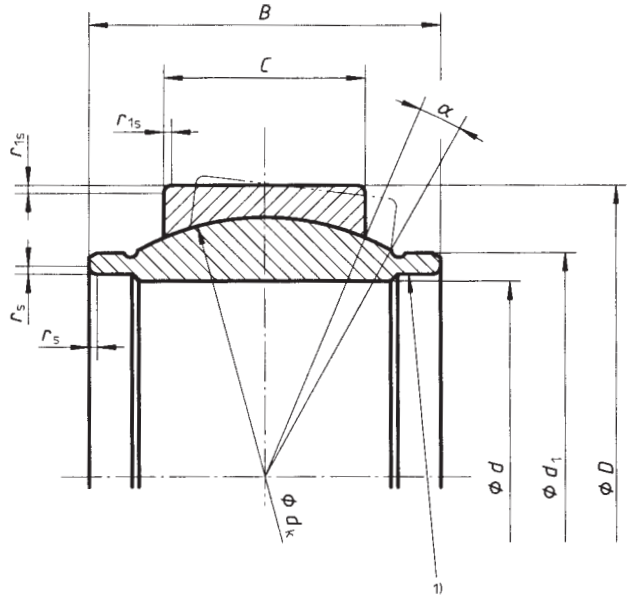
NOTE — Bearings of this series are incorporated in spherical plain bearing rod ends according to ISO 12240-4:1998, table 5.

1) Reference only.

Table 5 — Radial spherical plain bearings, dimension series H

d mm	D mm	B mm	C mm	d_1 ≈ mm	d_k [1] mm	r_s min. mm	r_{1s} min. mm	α ≈ °
100	150	71	67	114	135	1	1	2
110	160	78	74	122	145	1	1	2
120	180	85	80	135	160	1	1	2
140	210	100	95	155	185	1	1	2
160	230	115	109	175	210	1	1	2
180	260	128	122	203	240	1,1	1,1	2
200	290	140	134	219	260	1,1	1,1	2
220	320	155	148	245	290	1,1	1,1	2
240	340	170	162	259	310	1,1	1,1	2
260	370	185	175	285	340	1,1	1,1	2
280	400	200	190	311	370	1,1	1,1	2
300	430	212	200	327	390	1,1	1,1	2
320	460	230	218	344	414	1,1	3	2
340	480	243	230	359	434	1,1	3	2
360	520	258	243	397	474	1,1	4	2
380	540	272	258	412	494	1,5	4	2
400	580	280	265	431	514	1,5	4	2
420	600	300	280	441	534	1,5	4	2
440	630	315	300	479	574	1,5	4	2
460	650	325	308	496	593	1,5	5	2
480	680	340	320	522	623	2	5	2
500	710	355	335	536	643	2	5	2
530	750	375	355	558	673	2	5	2
560	800	400	380	602	723	2	5	2
600	850	425	400	645	773	2	6	2
630	900	450	425	677	813	3	6	2
670	950	475	450	719	862	3	6	2
710	1 000	500	475	762	912	3	6	2
750	1 060	530	500	814	972	3	6	2
800	1 120	565	530	851	1 022	3	6	2
850	1 220	600	565	936	1 112	3	7,5	2
900	1 250	635	600	949	1 142	3	7,5	2
950	1 360	670	635	1 045	1 242	4	7,5	2
1 000	1 450	710	670	1 103	1 312	4	7,5	2

1) Reference only.



1) With or without recess, at manufacturer's discretion

Figure 2 — Radial spherical plain bearing with relubrication facility and extended inner ring, dimension series W

Table 6 — Radial spherical plain bearings, dimension series W

d mm	D mm	B mm	C mm	d_1 ≈ mm	d_k 1) mm	r_s min. mm	r_{1s} min. mm	α ≈ °
12 2)	22	12	7	15,5	18	0,3	0,3	4
16	28	16	9	20	23	0,3	0,3	4
20	35	20	12	25	29	0,3	0,3	4
25	42	25	16	30,5	35	0,6	0,6	4
32	52	32	18	38	44	0,6	1	4
40	62	40	22	46	53	0,6	1	4
50	75	50	28	57	66	0,6	1	4
63	95	63	36	71,5	83	1	1	4
80	120	80	45	91	105	1	1	4
100	150	100	55	113	130	1	1	4
125	180	125	70	138	160	1	1	4
160	230	160	80	177	200	1	1	4
200	290	200	100	221	250	1,1	1,1	4
250	400	250	120	317	350	2,5	1,1	4
320	520	320	160	405	450	2,5	4	4

1) Reference only.

2) Relubrication facility only via outer ring or without relubrication facility, at manufacturer's discretion.

5.2 Tolerances

See tables 7 to 10.

Table 7 — Tolerances for inner ring, dimension series E, G, C, H

d mm		Δ_{dmp} µm		V_{dp} µm	V_{dmp} µm	Δ_{Bs} µm	
over	including	high	low	max.	max.	high	low
2,5	18	0	– 8	8	6	0	– 120
18	30	0	– 10	10	8	0	– 120
30	50	0	– 12	12	9	0	– 120
50	80	0	– 15	15	11	0	– 150
80	120	0	– 20	20	15	0	– 200
120	180	0	– 25	25	19	0	– 250
180	250	0	– 30	30	23	0	– 300
250	315	0	– 35	35	26	0	– 350
315	400	0	– 40	40	30	0	– 400
400	500	0	– 45	45	34	0	– 450
500	630	0	– 50	50	38	0	– 500
630	800	0	– 75	75	56	0	– 750
800	1 000	0	– 100	135	75	0	– 1 000
1 000	1 250	0	– 125	190	125	0	– 1 250
1 250	1 600	0	– 160	240	160	0	– 1 600
1 600	2 000	0	– 200	300	200	0	– 2 000

Table 8 — Tolerances for inner ring, dimension series K, W

d mm		Δ_{dmp} µm K, W		V_{dp} µm K, W	V_{dmp} µm K, W	Δ_{Bs} µm			
						K		W	
over	including	high	low	max.	max.	high	low	high	low
2,5	3	+10	0	10	6	0	– 120	0	– 100
3	6	+12	0	12	9	0	– 120	0	– 120
6	10	+15	0	15	11	0	– 120	0	– 150
10	18	+18	0	18	14	0	– 120	0	– 180
18	30	+21	0	21	16	0	– 120	0	– 210
30	50	+25	0	25	19	0	– 120	0	– 250
50	80	+30	0	30	22	–	–	0	– 300
80	120	+35	0	35	26	–	–	0	– 350
120	180	+40	0	40	30	–	–	0	– 400
180	250	+46	0	46	35	–	–	0	– 460
250	315	+52	0	52	39	–	–	0	– 520
315	400	+57	0	57	43	–	–	0	– 570

Table 9 — Tolerances for outer ring, dimension series E, G, C, W, H

D mm		Δ_{Dmp} µm		V_{Dp} µm	V_{Dmp} µm	Δ_{Cs} µm	
over	including	high	low	max.	max.	high	low
6	18	0	– 8	10	6	0	– 240
18	30	0	– 9	12	7	0	– 240
30	50	0	– 11	15	8	0	– 240
50	80	0	– 13	17	10	0	– 300
80	120	0	– 15	20	11	0	– 400
120	150	0	– 18	24	14	0	– 500
150	180	0	– 25	33	19	0	– 500
180	250	0	– 30	40	23	0	– 600
250	315	0	– 35	47	26	0	– 700
315	400	0	– 40	53	30	0	– 800
400	500	0	– 45	60	34	0	– 900
500	630	0	– 50	67	38	0	– 1 000
630	800	0	– 75	100	56	0	– 1 100
800	1 000	0	– 100	135	75	0	– 1 200
1 000	1 250	0	– 125	190	125	0	– 1 300
1 250	1 600	0	– 160	240	160	0	– 1 600
1 600	2 000	0	– 200	300	200	0	– 2 000
2 000	2 500	0	– 250	380	250	0	– 2 500
2 500	3 150	0	– 320	480	320	0	– 3 200

Table 10 — Tolerances for outer ring, dimension series K

D mm		Δ_{Dmp} µm		V_{Dp} µm	V_{Dmp} µm	Δ_{Cs} µm	
over	including	high	low	max.	max.	high	low
5	18	0	– 11	18	18	0	– 240
18	30	0	– 13	21	21	0	– 240
30	50	0	– 16	25	25	0	– 240
50	80	0	– 19	30	30	0	– 300
80	120	0	– 22	35	35	0	– 400

5.3 Radial internal clearance

Radial internal clearance is the arithmetical mean of the radial distances through which one of the rings may be displaced relative to the other, from one eccentric extreme position to the diametrically opposite extreme position.

On account of the permissible form tolerances for the two rings, it is recommended to determine the actual radial internal clearance by several measurements in different angular directions.

It is necessary in the case of large radial spherical plain bearings (e.g. $d \geqslant 100$ mm) to determine the radial internal clearance by measuring the mean sphere diameter of the inner and outer rings before final bearing assembly.

See tables 11 to 17.

5.3.1 Radial spherical plain bearing with sliding contact surfaces: steel/steel

Table 11 — Radial internal clearance, dimension series E

d		Group 2		Group N		Group 3	
mm		µm		µm		µm	
over	including	min.	max.	min.	max.	min.	max.
2,5	12	8	32	32	68	68	104
12	20	10	40	40	82	82	124
20	35	12	50	50	100	100	150
35	60	15	60	60	120	120	180
60	90	18	72	72	142	142	212
90	140	18	85	85	165	165	245
140	200	18	100	100	192	192	284
200	240	18	110	110	214	214	318
240	300	18	125	125	239	239	353

Table 12 — Radial internal clearance, dimension series G

d		Group 2		Group N		Group 3	
mm		µm		µm		µm	
over	including	min.	max.	min.	max.	min.	max.
2,5	10	8	32	32	68	68	104
10	17	10	40	40	82	82	124
17	30	12	50	50	100	100	150
30	50	15	60	60	120	120	180
50	80	18	72	72	142	142	212
80	120	18	85	85	165	165	245
120	180	18	100	100	192	192	284
180	220	18	110	110	214	214	318
220	280	18	125	125	239	239	353

Table 13 — Radial internal clearance, dimension series C

d		Group N	
mm		μm	
over	including	min.	max.
300	340	125	239
340	420	135	261
420	530	145	285
530	670	160	320
670	850	170	350
850	1 060	195	405
1 060	1 400	220	470
1 400	1 700	240	540
1 700	2 000	260	610

Table 14 — Radial internal clearance, dimension series K

d		Group 2		Group N		Group 3	
mm		μm		μm		μm	
over	including	min.	max.	min.	max.	min.	max.
2,5	8	8	32	32	68	68	104
8	16	10	40	40	82	82	124
16	25	12	50	50	100	100	150
25	40	15	60	60	120	120	180
40	50	18	72	72	142	142	212

Table 15 — Radial internal clearance, dimension series H

d		Group 2		Group N		Group 3	
mm		μm		μm		μm	
over	including	min.	max.	min.	max.	min.	max.
90	120	18	85	85	165	165	245
120	180	18	100	100	192	192	284
180	240	18	110	110	214	214	318
240	300	18	125	125	239	239	353
300	380	–	–	135	261	–	–
380	480	–	–	145	285	–	–
480	600	–	–	160	320	–	–
600	750	–	–	170	350	–	–
750	950	–	–	195	405	–	–
950	1 000	–	–	220	470	–	–

Table 16 — Radial internal clearance, dimension series W

d		Group 2		Group N		Group 3	
mm		µm		µm		µm	
over	including	min.	max.	min.	max.	min.	max.
2,5	12	8	32	32	68	68	104
12	20	10	40	40	82	82	124
20	32	12	50	50	100	100	150
32	50	15	60	60	120	120	180
50	90	18	72	72	142	142	212
90	125	18	85	85	165	165	245
125	200	18	100	100	192	192	284
200	250	18	125	125	239	239	353
250	320	18	135	135	261	261	387

5.3.2 Radial spherical plain bearing with sliding contact surfaces: steel/bronze

Table 17 — Radial internal clearance, dimension series K

d		Group 2		Group N		Group 3	
mm		µm		µm		µm	
over	including	min.	max.	min.	max.	min.	max.
2,5	6	4	34	10	50	42	72
6	10	5	41	13	61	52	88
10	18	6	49	16	75	64	107
18	30	7	59	20	92	77	120
30	50	9	71	25	112	98	150