ULPIA RULMENTI BUCURESTI

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General Catalogue

General Catalogue

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Foreward

This General Catalogue is a very thorough and detailed bearing catalogue. This Catalogue contains almost all the standard rolling bearings required for industrial, automotive and agricultural applications for industrial product manufacturers as well as for replacement purposes. In addition for special applications which includes non standard bearings requirements have also been included extensively according to their sizes and constructive dimensions.

The Technical section of this catalogue includes general technical data available for all types of bearings with regard to selection of bearing type, size, tolerances, frictional movement, lubrication, life rating and other technical information's essential for bearing designing and its applications.

This catalogue is useful for all designers and experts in machines, equipments, bearings mounting and dismounting, operations and maintenance. Incase these bearings do not meet user requirements and needs of rolling bearings, our qualified technicians and engineers will be at your service to help provide a suitable solution for your needs.

The Technical section is followed by bearing tables. These bearing tables are classified as per bearing construction types and listed in according to their bore diameter. Brief technical description introduces these bearing tables which are useful for bearing selection. Basic dynamic and static loads have been calculated as per ISO calculation guidelines. Axial and Radial Clearance are also up to date. All sections are arranged in an order which is usually followed by design engineers.

This catalogue is one of the advantages which we provide to our customers. In addition there are several benefits and values such as simplified bearings selection, short lead times, availability, engineering knowledge and expertise and many other values which will help in making us the supplier of choice.

We are confident that you will find this catalogue useful in the selection, use and maintainence of rolling bearings. We thank you for your support and look forward to continuously serving and updating you for all your future requirements.

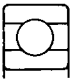
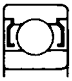
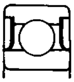
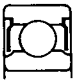
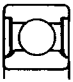
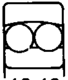
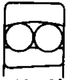
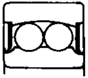
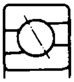
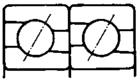
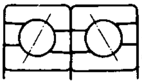
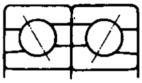
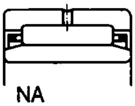
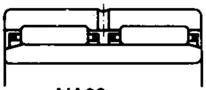
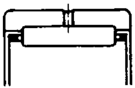
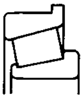
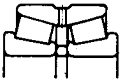
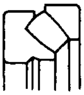
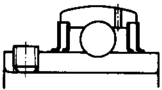
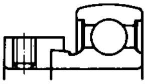
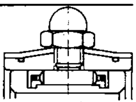
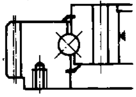
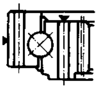
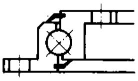
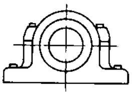
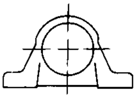
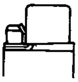
Designations (Figures)

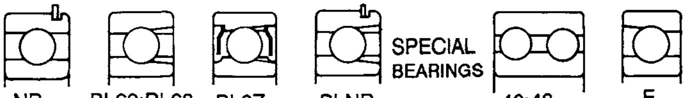
10,12,13,22,23	Self-aligning ball bearings
32,33,33D	Angular contact ball bearings, double row
34,35,36	Angular contact ball bearings, double row
42,43	Deep groove ball bearings, double row
52,53	Angular contact ball bearings, double row
60,62,63,64	Deep groove ball bearings, single row
70A,70C,72A,72C	High precision angular contact ball bearings,single row
70A,70C(D..,T..,Q..)	High precision angular contact ball bearings, paired and stack mounted
72B,73B	Angular contact ball bearings, single row
72B,73B(D..,T..,Q..)	Angular contact ball bearings, paired and stack mounted
73Q,75Q,76Q	Three point contact ball bearings, non-standardized
74,75,76,75Z,76Z,77Z	Angular contact ball bearings, non-standardized
112,113	Self-aligning ball bearings with extended inner ring
160,161	Deep groove ball bearings, single row
302,303,313,320,322,323,329	Tapered roller bearings
302R,303R,322R,323R	Tapered roller bearings, with flanged outer ring
340,342,343,345,349	Tapered roller bearings
340R,341R,342R,343R	Tapered roller bearings with flanged outer ring
350...359	Tapered roller bearings, double row
360,361,362...369	Tapered roller bearings, four row
3NN51	Support rollers
618,619,622,629	Deep groove ball bearings, single row
650(Z)...683(Z)	Deep groove ball bearings, single row, non-standardized
708,709	Angular contact ball bearings
718,719,728	Angular contact ball bearings
940...943	Drawn cup needle roller bearings
951,952,951Z	Tapered roller thrust bearings
2344,2347	Angular contact thrust ball bearings, double direction
4901...4921,4xNA49	Needle roller bearings
4904	Needle roller bearings without inner ring
4901..4923,7047..7049, 8041..8048	Bearings for cardan drives
7902,7906	Angular contact ball baerings, double row

Designations (Letters)

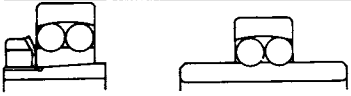
AH3,AH23,AH30,AH31, AH32,AH240,AH241	Withdrawal sleeves
ANK	Needle roller and cage thrust assemblies
AS	Thrust washers for needle roller and cage thrust assemblies
BL62,BL63	Deep groove ball bearings, single row for increased load
BM	Special sleeves
BO	Magneto type bearings
BR	Steel balls
BS,BT	Special sleeves
CaV,CNA10V,CNA16V	Drawn cup needle roller bearings
CT2,CT5,CT6	Bearing housings
E	Magneto type bearings
F40...F110	Bearing housings
H2,H3,H22,H23,H30, H31,H32	Adapter sleeves
HJ2,HJ3,HJ4,HJ10,HJ22,HJ23	Angle rings for bearings
HM,HML,HM30,HM31	Lock nuts, extraction nuts
K	Needle roller and cage asemblies
K75,K76	Angular contact ball bearings, single row (ball cages)
K811...K893	Needle roller and cage thrust assemblies
KB	Ball and cage assemblies for bicycles
KBK,KBZ	Needle roller and cage assemblies for conecting rod applications
KK	Needle roller and cage assemblies, double row
KRV	Cam followers
KM	Lock nuts
L	Magneto type bearings
LP	Pressure cylinder bearings for textile machines
LS	Raceways washers for needle roller and cage thrust assemblies
M	Magneto type bearings
MB,MBL,MS30,MS31	Locking washers and clamps
NA,NA48,NA49,NA69	Needle roller bearings
NAV,NA40V,NA49V	Needle roller bearings without cage
NAO,NA49B,NA69A	Needle roller bearings
NUTR	Support roller
OF40..OF110	Bearing housings
P16,P20	Water pump bearings
P40...P85	Pressed sheet bearing housings
PFL40...PFL100 **PFD40...PFD100** **PFT40...PFT100**	Pressed sheet bearing housings
QJ2,QJ3	Four point contact ball bearings
R340...R343	Tapered roller bearimgs without inner ring
RA	Needle rollers
RBNA,RFNA	Drawn cup needle roller bearings
RHNA,RHNAV	Drawn cup needle roller bearings
RNA,RNAO,RNA49,RNA69	Needle roller bearings, without inner ring
RNA19,RNA72,RNAO,RNAV	Needle roller bearings, without inner ring
RT	Deep groove ball bearings for textile machines
RUWL	Lower pressure cylinder bearings for spinning machines
S40...S110	Bearing housings
Ry65	Angular contact thrust ball baerings, single direction

T-75,T-76,T-78	Angular contact thrust ball bearings, single row
T-302,T-320,T-322,T-329	Tapered roller bearings, single row
T-340,T-341	Tapered roller bearings, single row
T-340...T-345	Tapered roller bearings, single row
T-350,T-351,T-359	Tapered roller bearings, double row
T-353,T354,T-355	Tapered roller bearings, double row
T-353...T-355	Tapered roller bearings, double row
T-353BJ	Rolling mills bearings
T-360...T-369	Tapered roller bearings, four row
T-360...T-364	Tapered roller bearings, four row
T-951,T-952	Tapered roller thrust bearings
UC2,UC5,UCC2	Deep groove ball bearings with extended inner ring
UD2,US2,USC2	Deep groove ball bearings with extended inner ring
UE2,UEC2	Deep groove ball bearings with extended inner ring
UWL	Lower pressure cylinder bearings for spinning machines
VE.10	Slewing bearings, single row, with external gear
VE.10	Slewing bearings, single row, with external gear
VI.10	Slewing bearings, single row, with internal gear
VU.10	Slewing bearings, single row, without gear
VU.10	Slewing bearings, single row, without gear
VIE.10	Slewing bearings, single row, with internal and external gear
VE.20	Slewing bearings, double row, with external gear
VU.20	Slewing bearings, double row, without gear

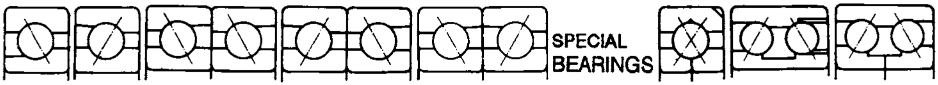
Technical Section	
Deep groove ball bearings single row double row magneto type	618 619 62 160 63 60 64   2ZR  2RSR  2Z  2RS
Self-aligning ball bearings	12 22 13 23  12;13 22;23  12K;13K 22K;23K  22-2RS 23-2RS  22K2RS 22K2RS
Angular contact ball bearings single row double row	72B 70A 73B 72C 70C 72A  B  DT  DB  DF
Needle roller bearings drawn cups needle roller and cage assemblies support rollers cam followers	48 49 40  NA  NA69  RNA
Tapered roller bearings single row double row four row	329 303 320 313 302 323 322   R SPECIAL BEARINGS  35DB
Spherical thrust roller bearings	 29
Bearings for various applications deep groove ball bearings textile machines water pump cardan drives	 UC  UE  UWL
Slewing bearings	 VE10  VI10  VU10
Bearings housings Accesories Adapter and withdrawal sleeves Rolling elements	  H2 H30 H22 H31 H3 H32 H23 



NR BL62;BL63 BL2Z BLNR SPECIAL BEARINGS 42;43 E



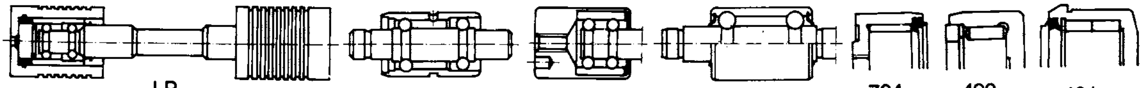
K+H 112;113



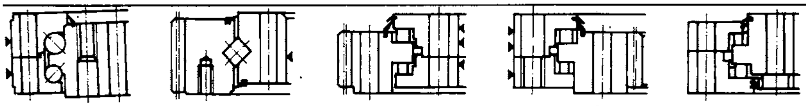
TA TB TADT TADB TADF SPECIAL BEARINGS QJ2;QJ3 32;33 33D SPECIAL BEARINGS

RNA69 RHNA RHNA...V SPECIAL BEARINGS K;KBK; KZK KK NUTR NUKR

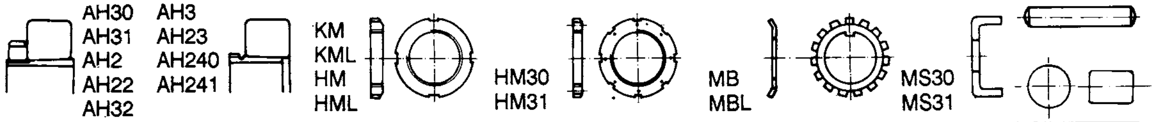
35DF 35R SPECIAL BEARINGS 36



LP RT RT P16 704 490 491



VI20 XE10 YE30 YI30 YU30



AH30 AH31 AH2 AH22 AH32 AH3 AH23 AH240 AH241 KM KML HM HML HM30 HM31 MB MBL MS30 MS31

Contents

Measuring units of the international system SI

Length

1 mm = 0,039 in
1 in = 25,4 mm

Weight

1 kg = 2,205 lb
1 lb = 0,454 kg

Force

1 kN = 1 000 N = 225 lbf
1 kgf = 9,81 N
1 lbf = 4,45 N

Moment

1 N mm = 0,102 kgf mm
1 kgf mm = 9,81 N mm
1 N m = 8,85 in lbf
1 in lbf = 0,113 N mm

Pressure per unit of area (surface)

1N/mm^2 = 1MPa = 145 psi
1 psi = 0,102 kgf/mm^2
1kgf/mm^2 = 9,81 N/mm^2

Power

1 W = 1 J/s = 1 N m/s = 0,102 kgf m/s
1 kW = 1,36 CP = 102 kgf m/s
1 kgf m/s = 9,81 N m/s = 9,81 j/s

Mechanical work

1 kgf m = 9,81 W s = 9,81 N m
1 J (Joule) = 1 N m = 1 W s = 0,102 kgf m

Kinematic viscosity

1 mm^2/s = 1 cSt (centiStokes)

1. Selection of bearing type

Each type of bearing displays characteristic features which make it suitable for a certain application. Therefore, many bearing types and constructive versions have been developed so that they can satisfy various demands for rolling bearing. Taking into account the great number of factors to be considered when selecting a bearing type, no general rule can be given.

We give further the most important criteria to be considered when selecting the bearing type.

Selection of bearing type, considering the load magnitude and direction

Radial load

Deep groove ball bearings are the most suitable types of bearings for light and moderate pure radial loads. For heavy radial load and where large-diameter shafts are used, double row cylindrical roller bearings are the adequate choice. Needle roller bearings are recommended in case of limited space and heavy loads.

Axial load

For pure axial loads, single direction thrust ball bearings are used in case of loads acting in one direction. For loads acting in both directions, double direction thrust ball bearings are used. Angular contact thrust ball bearings and single or double row angular contact ball bearings are used in case of light or moderate pure axial loads at moderate speeds.

For light axial loads at high speeds, deep groove ball bearings are suitable. Under the axial load, a contact angle different from 0° is generated in these bearings and therefore they operate as angular contact ball bearings. In order to increase axial load carrying capacity, a larger clearance should be selected (C3, C4,etc.)

For moderate axial loads at high speeds, angular contact ball bearings in tandem arrangement are used so that they can take over loads acting in both directions. Four-point contact ball bearings, QJ type, are also used.

Combined load

In order to carry combined radial and axial loads acting simultaneously, bearings with a contact angle different from 0° are used. The greater the contact angle, the greater the axial load carrying capacity.

Bearings which accommodate only one direction axial loads should always be mounted in pairs so that they can carry axial loads in both directions.

Selection of bearing type considering the alignment between shaft and housing

Angular misalignments occur generally when the shaft bends under the operating load or when bearings adjoint parts have form or position deviations.

In such cases, self-aligning ball bearings, cylindrical roller bearings or spherical roller thrust bearings should be used.

A certain bearing bent angle can compensate for errors of alignment and maximum angle values are shown for each type in the introductory texts of the table sections.

When misalignments should be compensated, radial and axial clearance are important. The larger the clearance, the greater the possibility of self-aligning.

If the misalignment exceeds the permissible values shown in the introductory texts of the bearing tables, the bearing rating life decreases. The greater the ratio F_r/C_{0r}, the shorter the rating life. If $0,1 < F_{0r}/C_{0r} < 3$, the rating life decreases with about 25%.

Selection of bearing type considering the operating temperature

Bearings are generally used up to a temperature of maximum +120°C. In case of higher temperatures, bearings with special heat treatments should be used, in accordance with specifications on page 27.

Sealed bearings, 2RS type, should be used at operating temperatures up to +80°C. If this temperature is exceeded, the efficacy of lubricants is considerably reduced.

Selection of bearing internal clearance

In most cases, while operating, bearings should have a small radial clearance that can be defined as "the possible value of displacement in radial direction of one bearing ring in relation to the other without parts deformations"

While operating, bearing internal clearance is different from the one at delivery, since the latter is reduced when mounting bearings with a certain tight fit.

Under operating conditions, internal clearance change is also caused by different temperatures between the outer and inner ring. Bearings are generally delivered with a normal radial or axial clearance according to the values shown for each rolling bearing group.

The decrease in radial clearance due to the tight fit and operating temperature is considered to be between 60-80% of the tightening value, depending on bearing series and size.

After the clearance in bearings has been decreased, a large enough operational clearance should remain, so that the lubricant film shouldn't be destroyed.

Deep groove ball bearings should have an operational clearance close to zero. There may be often a light preload, due to the point-contact between the rolling elements and raceways.

Small-sized cylindrical roller and needle roller bearings should have an operational clearance of 5-10 μm and larger-sized bearings a clearance of 10-30 μm.

Bearing producers can also manufacture - at request-bearings with radial and axial clearance smaller (C1 and C2) or larger (C3, C4 and C5) than normal, so that the most favorable operating conditions for bearings should be assured.

Cylindrical and needle roller bearings can be manufactured with interchangeable rings (no special designation) and with non interchangeable rings (suffix NA).

Bearings with non interchangeable parts have a smaller radial clearance than bearings with interchangeable parts. Changing rings from one bearing to another is not allowed.

In case of bearings with interchangeable parts, the rings may be changed and the values of radial clearance will be not altered.

Bearing types and technical characteristics

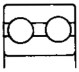
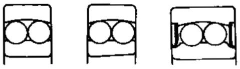
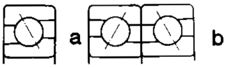
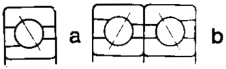
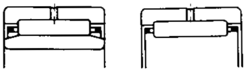
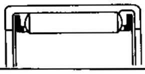
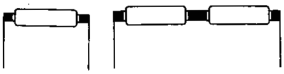
Bearing producers can manufacture bearings of various types and sizes so that they can meet the customers' requirements assuring a proper reliability for various applications.

Table 1.1 shows qualitative results of each group of bearings, considering the main technical characteristics.

Bearing type is selected depending on the technical characteristics required by a certain application.

A suggestive graphic symbol has been determined for each main technical characteristic. Thus, a proper bearing for each purpose can be easily chosen. According to the specifications in this catalogue, the proper type and size of bearing can be selected, together with all manufacturing and operating technical conditions.

Selection of bearing type

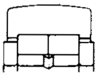
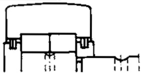
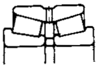
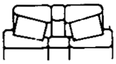
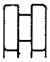
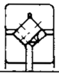
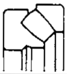
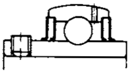
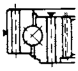
● - excellent ◕ - good ◑ - fair	◔ - poor ○ - unsuitable → - single direction ↔ - double direction	Purely radial load	Purely axial load	Combined load
Deep groove ball bearing: - single row		◕	◑ ↔	◑
- double row		◕	◑ ↔	◑
Self-aligning ball bearings		◑	◔	◔
Angular contact ball bearings		◕	◕ a ⇄ b	◕
High precision angular contact ball bearings		◕	◕ a ⇄ b	◕
Four-point contact ball bearings		◔	◔ ↔	◕
Angular contact ball bearings double row		◕	◕ ↔	◕
Needle roller bearings NA		●	○	○
Drawn cup needle roller bearings RHNA		●	○	○
Needle roller and cage assemblies K, KK		●	○	○

Performance comparison of bearing type

Table 1.1

Moment load	Tolerance class	Quiet running	High speed	High stiffness	Compensation of misalignement	Low friction	Shock resistence	Located bearing	Non - located bearing	Axial displacement possible in bearing
◔	●	●	●	◑	◔	●	◑	◕	◑	○
◑	◑	◑	◑	◑	○	◕	◑	◑	◑	○
○	◑	◕	◕	◑	●	◑	○	◑	◑	○
◑	◑	◑	◑	◕	○	◑	◕	●	○	○
◑	●	●	●	◕	○	◕	◑	●	○	○
◑	◑	◑	◕	◑	○	◑	◑	◕	◔	○
◑	◑	◑	◑	◕	○	◑	◑	◕	◕	○
○	◑	◑	◑	◑	○	◔	●	○	●	●
○	◑	◑	◑	◑	○	◔	◑	○	●	●
○	◑	◑	◑	◑	○	◔	◑	○	●	●

● - excellent
◕ - good
◑ - fair
◔ - poor
○ - unsuitable
→ - single direction
↔ - double direction

		Purely radial load	Purely axial load	Combined load
Support rollers, cam followers	 	●	◔	◔
Taper roller bearings: - single row		●	◑ →	●
- double row	 	●	◑ ↔	●
- four row		●	◑ ↔	●
Needle roller thrust bearings		○	● →	○
Crossed tapered roller bearings		●	● ↔	●
Spherical roller thrust bearings		◔	● →	◔
Deep groove ball bearings with spherical outer surface and extended inner ring		◕	◑ ↔	◑
Slewing bearings		◑	● ↔	◑

●	○	○	●	○	◔	◔	◔	○	Moment load
◑	◑	◑	◕	◑	◑	◕	◕	◑	Tolerance class
◔	◑	◔	◑	◔	◑	◑	◑	◑	Quiet running
○	◑	◑	◑	◔	◑	◑	◕	◔	High speed
●	◑	◕	●	◕	●	●	◕	◑	High stiffness
○	○	●	○	○	○	○	◔	◑	Compensation of misalignement
◑	◑	◔	◑	◔	◑	◑	◑	◔	Low friction
●	◑	◕	●	●	●	●	●	◑	Shock resistence
●	◑	◕	●	○	●	●	◕	○	Locating bearing
○	○	○	○	○	○	○	○	◑	Non - locating bearing
○	○	○	○	○	○	○	○	◑	Axial displacement possible in bearing

2. Selection of bearing dimension

The size of a bearing is selected considering the load in the used rolling bearing and also depends on the operational rating life and prescribed operating safety.

Basic load ratings

The basic dynamic load rating C_r is used to calculate bearing dimensions while rotating under load. It expresses the bearing admissible load which will give a basic rating life up to 1000 000 revolutions.

The basic dynamic load ratings of bearings have been determined in accordance with national standard and with the methods prescribed by ISO 281. The values are given in bearing tables.

Considering the basic dynamic load rating, is calculated the service time until the fatigue of the material appears, determining this way the calculated rating life.

Basic static load rating C_{or} is considered in case of low speeds, low oscillating movements or in the stationary case.

The basic static load rating is defined in accordance with ISO 76 and national standard, as the load acting upon the stationary bearing. It corresponds to a calculated contact stress in the center of the contact area between the most heavily loaded rolling element and the raceway, of:

- 4 600 MPa for self-aligning ball bearings,
- 4 200 MPa for all other ball bearings,
- 4 000 MPa for all roller bearings.

This stress produces a permanent deformation of the rolling element and raceway which is about 0,0001 of the rolling element diameter. The loads are pure radial for radial bearings and pure axial for thrust bearings.

Bearing life

The life of a rolling bearing is defined as the number of revolutions or the number of operating hours, which the bearing is capable to endure, before the first sign of fatigue occurs on one of its rings, on the raceway or the rolling elements.

If we want to consider only the fatigue on the bearing operating surfaces, the following conditions have to be observed:

1. The forces and speeds considered when calculating the bearing should correspond to the real operating conditions.
2. Proper lubrication should be assured during the entire operating period.
3. If the bearing carries a light load, its failure is generated by the wear.
4. Experience showed that the failure of many bearings was caused by other reasons than fatigue, such as: selection of an inadequate bearing type in a bearing joint, improper operation or lubrication, outer particles in bearing etc.

Basic rating life

The basic rating life of a single bearing or of a group of apparently identical bearings operating under identical conditions, is the life corresponding to a reliability of 90%.

The average life of a group of bearings is approximately five times longer than the basic rating life.

Basic rating life is marked with L_{10} (millions of revolutions) or L_{10h} (operating hours).

L_{10} can be calculated using the equation:

$$L_{10} = \left(\frac{C}{P}\right)^{p}$$, where:

L_{10} - basic rating life, millions of revolutions,
C - basic bearing load, kN,
P - equivalent dynamic bearing load, kN,
p - exponent of the life equation with the following values:
$p = 3$ - for ball bearings
$p = 10/3$ - for roller bearings

The equivalent dynamic bearing load, respectively the radial and axial load, acting simultaneously can be calculated using the following equations (applicable to ball and roller radial bearings):

$P_r = F_r$, kN, - for pure radial load
$P_r = XF_r + YF_a$, kN, - for combined load

For thrust ball bearings, the following equations can be used:

$P_a = F_a$, kN, - for pure axial load
$P_a = XF_r + YF_a$, kN, - for combined load

where:

F_r = the radial component of the load, kN
F_a = the axial component of the load, kN

In the texts preceding the bearing tables, for some groups of bearings there are given details for determining the equivalent load. Values of the coefficients X and Y can be found in tables.

For bearings operating at constant speed, the basic rating life expressed in operating hours can be calculated using the equation:

$$L_{10h} = \frac{1\,000\,000}{60\,n}(C/P)^p \text{ sau } L_{10h} = \frac{16\,666}{n}(C/P)^p$$

where:
n = rotational speed, r/min

Values of the basic rating life L_{10} (millions of revolutions) as a function of the ratio C/P can be found in the table 2.1.

Values of the basic rating life L_{10h} (operating hours) as a function of the ratio C/P and speed n can be found in table 2.2 for ball bearings and table 2.3 for roller bearings.

When determining the bearing size it is necessary to base the calculations on the rating life corresponding to the purpose of operation.

It usually depends on the machine type, service life and the requirements regarding operational safety.

Approximate values of the service life for various classes of machines and equipments for general purposes are given in table 2.4

The basic rating life L_{10h} of the bearings can be determined as a function of service life, using the life calculation chart on page 22.

Load ratio C/P for various life values L_{10} (milions of revolutions)

Table 2,1

L_{10}	C/P		L_{10}	C/P	
	Ball bearings	Roller bearings		Ball bearings	Roller bearings
0,5	0,793	0,812	**600**	8,43	6,81
0,75	0,909	0,917	**650**	8,66	6,98
1	1	1	**700**	8,88	7,14
1,5	1,14	1,13	**750**	9,09	7,29
2	1,26	1,24	**800**	9,28	7,43
3	1,44	1,39	**850**	9,47	7,56
4	1,59	1,52	**900**	9,65	7,7
5	1,71	1,62	**950**	9,83	7,82
6	1,82	1,71	**1 000**	10	7,94
8	2	1,87	**1 100**	10,3	8,17
10	2,15	2	**1 200**	10,6	8,39
12	2,29	2,11	**1 300**	10,9	8,59
14	2,41	2,21	**1 400**	11,2	8,79
16	2,52	2,3	**1 500**	11,4	8,97
18	2,62	2,38	**1 600**	11,7	9,15
20	2,71	2,46	**1 700**	11,9	9,31
25	2,92	2,63	**1 800**	12,2	9,48
30	3,11	2,77	**1 900**	12,4	9,63
35	3,27	2,91	**2 000**	12,6	9,78
40	3,42	3,02	**2 200**	13	10,1
45	3,56	3,13	**2 400**	13,4	10,3
50	3,68	3,23	**2 600**	13,8	10,6
60	3,91	3,42	**2 800**	14,1	10,8
70	4,12	3,58	**3 000**	14,4	11
80	4,31	3,72	**3 200**	14,7	11,3
90	4,48	3,86	**3 400**	15	11,5
100	4,64	3,98	**3 600**	15,3	11,7
120	4,93	4,2	**3 800**	15,6	11,9
140	5,19	4,4	**4 000**	15,9	12
160	5,43	4,58	**4 500**	16,5	12,5
180	5,65	4,75	**5 000**	17,1	12,9
200	5,85	4,9	**5 500**	17,7	13,2
220	6,04	5,04	**6 000**	18,2	13,6
240	6,21	5,18	**6 500**	18,7	13,9
260	6,38	5,3	**7 000**	19,1	14,2
280	6,54	5,42	**7 500**	19,6	14,5
300	6,69	5,54	**8 000**	20	14,8
320	6,84	5,64	**8 500**	20,4	15,1
340	6,98	5,75	**9 000**	20,8	15,4
360	7,11	5,85	**9 500**	21,2	15,6
380	7,24	5,94	**10 000**	21,5	15,8
400	7,37	6,03	**12 000**	22,9	16,7
420	7,49	6,12	**14 000**	24,1	17,5
440	7,61	6,21	**16 000**	25,2	18,2
460	7,72	6,29	**18 000**	26,2	18,9
480	7,83	6,37	**20 000**	27,1	19,5
500	7,94	6,45	**25 000**	29,2	20,9
550	8,19	6,64	**30 000**	31,1	22

Ball bearings - load ratio C/P for various basic rating lives L_{10h} (operating hours) at various speeds n (r/min)

Table 2.2

L_{10h}	C/P when n =										
	50	100	150	200	250	300	400	500	750	1 000	1 500
100	0,67	0,84	0,97	1,06	1,14	1,22	1,34	1,44	1,65	1,82	2,08
500	1,14	1,44	1,65	1,82	1,96	2,08	2,29	2,47	2,82	3,11	3,56
1 000	1,44	1,82	2,08	2,29	2,47	2,62	2,88	3,11	3,56	3,91	4,48
1 250	1,55	1,96	2,24	2,47	2,66	2,82	3,11	3,35	3,83	4,22	4,83
1 600	1,69	2,13	2,43	2,68	2,88	3,07	3,37	3,63	4,16	4,58	5,24
2 000	1,82	2,29	2,62	2,88	3,11	3,30	3,63	3,91	4,48	4,93	5,65
2 500	1,96	2,47	2,82	3,11	3,35	3,56	3,91	4,22	4,83	5,31	6,08
3 200	2,13	2,68	3,07	3,37	3,63	3,86	4,25	4,58	5,24	5,77	6,60
4 000	2,29	2,88	3,30	3,63	3,91	4,16	4,58	4,93	5,65	6,21	7,11
5 000	2,47	3,11	3,56	3,91	4,22	4,48	4,93	5,31	6,08	6,69	7,66
6 300	2,66	3,36	3,84	4,23	4,55	4,84	5,33	5,74	6,57	7,23	8,28
8 000	2,88	3,63	4,16	4,58	4,93	5,24	5,77	6,21	7,11	7,83	8,96
10 000	3,11	3,91	4,48	4,93	5,31	5,65	6,21	6,69	7,66	8,43	9,65
12 500	3,35	4,22	4,83	5,31	5,72	6,08	6,69	7,21	8,25	9,09	10,4
16 000	3,63	4,58	5,24	5,77	6,21	6,60	7,27	7,83	8,96	9,86	11,3
20 000	3,91	4,93	5,65	6,21	6,69	7,11	7,83	8,43	9,65	10,6	12,2
25 000	4,22	5,31	6,08	6,69	7,21	7,66	8,43	9,09	10,4	11,4	13,1
32 000	4,58	5,77	6,60	7,27	7,83	8,32	9,16	9,86	11,3	12,4	14,2
40 000	4,93	6,21	7,11	7,83	8,43	8,96	9,86	10,6	12,2	13,4	15,3
50 000	5,31	6,69	7,66	8,43	9,09	9,65	10,6	11,4	13,1	14,4	16,5
63 000	5,74	7,23	8,28	9,11	9,81	10,4	11,5	12,4	14,2	15,6	17,8
80 000	6,21	7,83	8,96	9,86	10,6	11,3	12,4	13,4	15,3	16,9	19,3
100 000	6,69	8,43	9,65	10,6	11,4	12,2	13,4	14,4	16,5	18,2	20,8
200 000	8,43	10,6	12,2	13,4	14,4	15,3	16,9	18,2	20,8	22,9	26,2

L_{10h}	C/P when n =										
	2 000	2 500	3 000	4 000	5 000	6 000	8 000	10 000	15 000	20 000	30 000
100	2,29	2,47	2,62	2,88	3,11	3,30	3,63	3,91	4,48	4,93	5,65
500	3,91	4,22	4,48	4,93	5,31	5,65	6,21	6,69	7,66	8,43	9,65
1 000	4,93	5,31	5,65	6,21	6,69	7,11	7,83	8,43	9,65	10,6	12,2
1 250	5,31	5,72	6,08	6,69	7,21	7,66	8,43	9,09	10,4	11,4	13,1
1 600	5,77	6,21	6,60	7,27	7,83	8,32	9,16	9,86	11,3	12,4	14,2
2 000	6,21	6,69	7,11	7,83	8,43	8,96	9,86	10,6	12,2	13,4	15,3
2 500	6,69	7,21	7,66	8,43	9,09	9,65	10,6	11,4	13,1	14,4	16,5
3 200	7,27	7,83	8,32	9,16	9,86	10,5	11,5	12,4	14,2	15,7	17,9
4 000	7,83	8,43	8,96	9,86	10,6	11,3	12,4	13,4	15,3	16,9	19,3
5 000	8,43	9,09	9,65	10,6	11,4	12,2	13,4	14,4	16,5	18,2	20,8
6 300	9,11	9,81	10,4	11,5	12,4	13,1	14,5	15,6	17,8	19,6	22,5
8 000	9,86	10,6	11,3	12,4	13,4	14,2	15,7	16,9	19,3	21,3	24,3
10 000	10,6	11,4	12,2	13,4	14,4	15,3	16,9	18,2	20,8	22,9	26,2
12 500	11,4	12,3	13,1	14,4	15,5	16,5	18,2	19,6	22,4	24,7	28,2
16 000	12,4	13,4	14,2	15,7	16,9	17,9	19,7	21,3	24,3	26,8	30,7
20 000	13,4	14,4	15,3	16,9	18,2	19,3	21,3	22,9	26,2	28,8	33,0
25 000	14,4	15,5	16,5	18,2	19,6	20,8	22,9	24,7	28,2	31,1	35,6
32 000	15,7	16,9	17,9	19,7	21,3	22,6	24,9	26,8	30,7	33,7	38,6
40 000	16,9	18,2	19,3	21,3	22,9	24,3	26,8	28,8	33,0	36,3	41,6
50 000	18,2	19,6	20,8	22,9	24,7	26,1	28,8	31,1	35,6	39,1	44,8
63 000	19,6	21,1	22,5	24,7	26,6	28,3	31,2	33,6	38,4	42,3	48,4
80 000	21,3	22,9	24,3	26,8	28,8	30,7	33,7	36,3	41,6	45,8	52,4
100 000	22,9	24,7	26,2	28,8	31,1	33,0	36,3	39,1	44,8	49,3	56,5
200 000	28,8	31,1	33,0	36,3	39,1	41,6	45,8	49,3	56,5	62,1	71,1

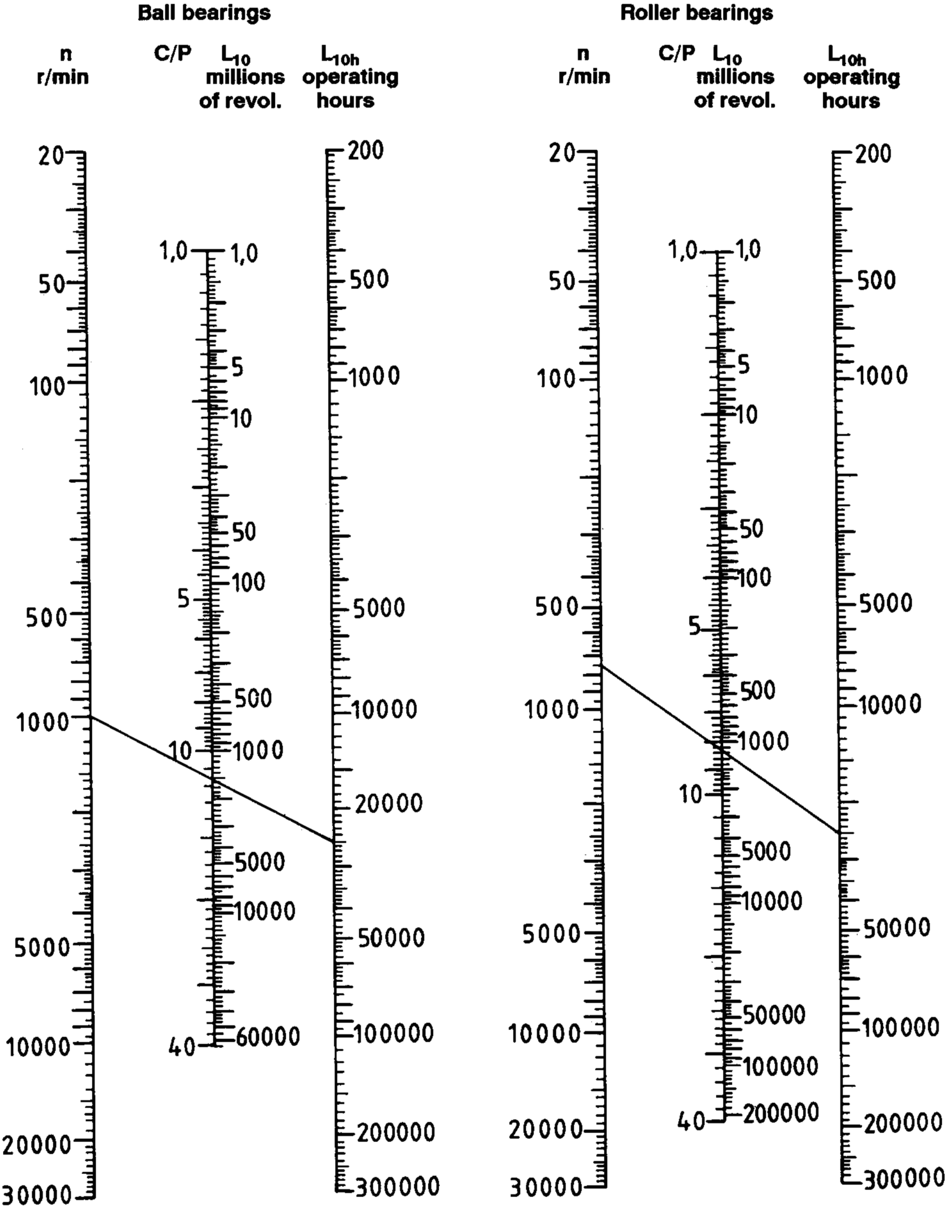
Roller bearings - load ratio C/P for various basic rating lives L_{10h} (operating hours) at various speeds n (r/min)

Table 2.3

L_{10h}	C/P when n =										
	50	100	150	200	250	300	400	500	750	1 000	1 500
100	0,70	0,86	0,97	1,06	1,13	1,19	1,30	1,39	1,57	1,71	1,83
500	1,13	1,39	1,57	1,71	1,83	1,93	2,11	2,25	2,54	2,77	3,13
1 000	1,39	1,71	1,93	2,11	2,25	2,38	2,59	2,77	3,13	3,42	3,86
1 250	1,49	1,83	2,07	2,25	2,41	2,54	2,77	2,97	3,35	3,65	4,12
1 600	1,60	1,97	2,23	2,43	2,59	2,74	2,99	3,19	3,61	3,93	4,44
2 000	1,71	2,11	2,38	2,59	2,77	2,93	3,19	3,42	3,86	4,20	4,75
2 500	1,83	2,25	2,54	2,77	2,97	3,13	3,42	3,65	4,12	4,50	5,08
3 200	1,97	2,43	2,74	2,99	3,19	3,37	3,68	3,93	4,44	4,84	5,47
4 000	2,11	2,59	2,93	3,19	3,42	3,61	3,93	4,20	4,75	5,18	5,85
5 000	2,25	2,77	3,13	3,42	3,65	3,86	4,20	4,50	5,08	5,54	6,25
6 300	2,42	2,97	3,36	3,66	3,91	4,13	4,51	4,82	5,44	5,93	6,70
8 000	2,59	3,19	3,61	3,93	4,20	4,44	4,84	5,18	5,85	6,37	7,20
10 000	2,77	3,42	3,86	4,20	4,50	4,75	5,18	5,54	6,25	6,81	7,70
12 500	2,97	3,65	4,12	4,50	4,81	5,08	5,54	5,92	6,68	7,29	8,23
16 000	3,19	3,93	4,44	4,84	5,18	5,47	5,96	6,37	7,20	7,85	8,86
20 000	3,42	4,20	4,75	5,18	5,54	5,85	6,37	6,81	7,70	8,39	9,48
25 000	3,65	4,50	5,08	5,54	5,92	6,25	6,81	7,29	8,23	8,97	10,1
32 000	3,93	4,84	5,47	5,96	6,37	6,73	7,34	7,85	8,86	9,66	10,9
40 000	4,20	5,18	5,85	6,37	6,81	7,20	7,85	8,39	9,48	10,3	11,7
50 000	4,50	5,54	6,25	6,81	7,29	7,70	8,39	8,97	10,1	11,0	12,5
63 000	4,82	5,93	6,70	7,30	7,81	8,25	8,99	9,61	10,9	11,8	13,4
80 000	5,18	6,37	7,20	7,85	8,39	8,86	9,66	10,3	11,7	12,7	14,4
100 000	5,54	6,81	7,70	8,39	8,97	9,48	10,3	11,0	12,5	13,6	15,4
200 000	6,81	8,39	9,48	10,3	11,0	11,7	12,7	13,6	15,4	16,7	18,9

L_{10h}	C/P when n =										
	2 000	2 500	3 000	4 000	5 000	6 000	8 000	10 000	15 000	20 000	30 000
100	2,11	2,25	2,38	2,59	2,77	2,93	3,19	3,42	3,86	4,20	4,75
500	3,42	3,65	3,86	4,20	4,50	4,75	5,18	5,54	6,25	6,81	7,70
1 000	4,20	4,50	4,75	5,18	5,54	5,85	6,37	6,81	7,70	8,39	9,48
1 250	4,50	4,81	5,08	5,54	5,92	6,25	6,81	7,29	8,23	8,97	10,1
1 600	4,84	5,18	5,47	5,96	6,37	6,73	7,34	7,85	8,86	9,66	10,9
2 000	5,18	5,54	5,85	6,37	6,81	7,20	7,85	8,39	9,48	10,3	11,7
2 500	5,54	5,92	6,25	6,81	7,29	7,70	8,39	8,97	10,1	11,0	12,5
3 200	5,96	6,37	6,73	7,34	7,85	8,29	9,03	9,66	10,9	11,9	13,4
4 000	6,37	6,81	7,20	7,85	8,39	8,86	9,66	10,3	11,7	12,7	14,4
5 000	6,81	7,29	7,70	8,39	8,97	9,48	10,3	11,0	12,5	13,6	15,4
6 300	7,30	7,81	8,25	8,99	9,61	10,2	11,1	11,8	13,4	14,6	16,5
8 000	7,85	8,39	8,86	9,66	10,3	10,9	11,9	12,7	14,4	15,7	17,7
10 000	8,39	8,97	9,48	10,3	11,0	11,7	12,7	13,6	15,4	16,7	18,9
12 500	8,97	9,59	10,1	11,0	11,8	12,5	13,6	14,5	16,4	17,9	20,2
16 000	9,66	10,3	10,9	11,9	12,7	13,4	14,6	15,7	17,7	19,3	21,8
20 000	10,3	11,0	11,7	12,7	13,6	14,4	15,7	16,7	18,9	20,6	23,3
25 000	11,0	11,8	12,5	13,6	14,5	15,4	16,7	17,9	20,2	22,0	24,9
32 000	11,9	12,7	13,4	14,6	15,7	16,5	18,0	19,3	21,8	23,7	26,8
40 000	12,7	13,6	14,4	15,7	16,7	17,7	19,3	20,6	23,3	25,4	28,7
50 000	13,6	14,5	15,4	16,7	17,9	18,9	20,6	22,0	24,9	27,1	30,6
63 000	14,6	15,6	16,5	17,9	19,2	20,3	22,1	23,6	26,7	29,1	32,8
80 000	15,7	16,7	17,7	19,3	20,6	21,8	23,7	25,4	28,7	31,2	35,3
100 000	16,7	17,9	18,9	20,6	22,0	23,3	25,4	27,1	30,6	33,4	37,7
200 000	20,6	22,0	23,3	25,4	27,1	28,7	31,2	33,4	37,7	41,1	46,4

Basic rating life calculation chart



Example:

1. It is required to determine the size of a deep groove ball bearing single row, considering the following conditions:

- Basic rating life L_{10h} = 25 000 operating hours
- Rotational speed n = 1 000 r/min
- Load in bearing F_r = 5 kN

The chart shows that C/P = 11,6; C = 11,6, P = 11,6 x 5 = 58 kN. In the catalogue on page, you can select the bearing 6310 type with the following characteristics: C_r = 61,8 kN; n = 7 000 r/min.

2. What is the basic rating life of the bearing NU 210E which is operating under a radial load of 7,7 kN at a rotational speed n = 750 r/min ?

In the catalogue and you will find for the bearing, NU 210E type, the following values: C_r = 63,7 kN, n = 8 000 r/min. From the chart, for a bearing operated at a rotational speed of 750 r/min and C_r/P_r = 63,7/7,7 = 8,3, a basic rating life L_{10h} = 25 000 operating hours is determined.

Recommended basic rating lives for general purpose machines

Table 2.4

Application	Recommended basic rating life L_{10h} (operating hours)
Household machines, technical apparata for medical use, instruments, agricultural machines:	300...3 000
Machines used for short periods or intermittently: electric hand tools, cranes, lifting tackles in workshops, building machines:	3 000...8 000
Machines used intermittently or for short periods with high operational reliability: lifts, small cranes:	8 000...12 000
Machines for use 8 hours/day but not always at full capacity: machines for general purposes, electric motors for industrial use, rotary crushes, gear drives for general purposes:	10 000...25 000
Machines operating 8 hours/day at full capacity: machine tools, woodworking machines, large cranes, printing equipment, ventilators, separators, centrifuges:	20 000...30 000
Machines for continuous use 24 hours/day: Rolling mill gear units, medium sized electrical machinery, compressors, pumps, textile machines, mine hoists:	40 000...50 000
Hydraulic machines, rotary furnaces, capstans, propulsion machinery for sea vessels (propellers for sea vessels):	50 000...10 0000
Machines for continuous use 24 hours/day with high reliability: large electric machinery, mine pumps and mine ventilators, power station plants, machines for cellulose industry, pumping units:	100 000...

The basic rating life of road and rail vehicle bearings, for wheel - axle bearings, is expressed as a function of the wheel diameter and covered distance (km), using the equation:

$$L_{1\sigma} = \frac{1\,000}{\pi\ D} L_{10s}, \text{ respectively: } L_{10s} = \frac{\pi\ D}{1\,000} L_{10}$$

where:

L_{10} - basic rating life, millions of revolutions
L_{10s} - service life distance, millions of kilometers
D - wheel diameter, m

Approximate values for the service life distance (kilometers covered), in case of light loaded cars and rail vehicles are given in table 2.5.

Values for basic rating life L_{10s}

Table 2.5

Type of vehicle	$L_{10s}/10^6$ km
Wheel hub bearings for road vehicles	
- light loaded cars	0,3
- trucks, buses	0,6
Axlebox bearings for rail vehicles:	
goods wagons (according to UIC)	0,8
suburban vehicles, trams	1,5
long distance passenger carriages	3
motorailers	3-4
Diesel and electric locs	3-4

In case of bearings which do not rotate but oscillate from a central position through an angle, as shown in fig.1, basic rating life can be determined as follows:

$$L_{10osc} = \frac{180}{2\gamma} L_{10}$$

where:

Complete oscilation $= 4\gamma$ from point 0 to point 4

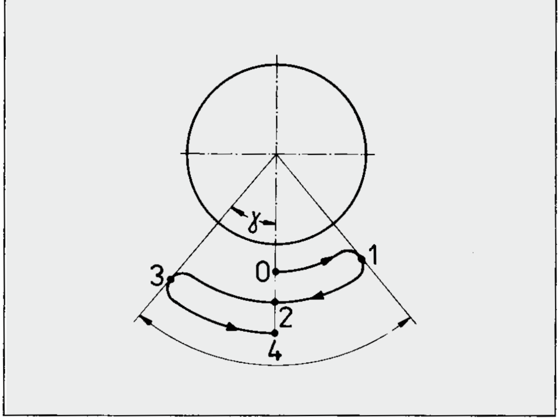


Fig. 1

L_{10osc} - basic rating life, millions of cycles
γ - oscillation amplitude (angle of maximum deviation from center position), degrees.

If the amplitude of oscillation is very small, it can be ignored for basic rating life determination.

Fluctuating dynamic load and speeds

In many cases, in operation speed and magnitude of load fluctuate. Therefore, a mean dynamic load is to be calculated.

The load acting on the bearing can vary as shown in fig. 2-a and 2-b.

In this case, the mean load can be determined using the equation:

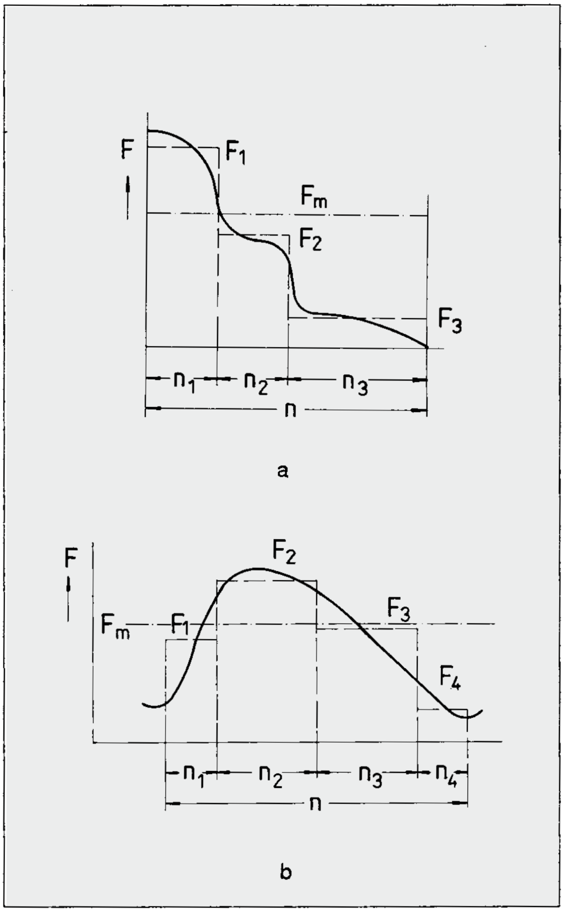


Fig. 2

$$F_m = \sqrt[p]{\frac{F_1^p\ n_1 + F_2^p n_2 + \ldots + F_n^p n_n}{n}}$$

where:

F_m - constant mean load, kN

$F_1, F_2, \ldots F_n$ - constant load during n_1, $n_2, \ldots n_n$ revolutions, kN

n - total number of revolutions ($n = n_1 + n_2 + ..$) during which loads F_1, F_2, .. act

p - exponent -3 - for ball bearings,
-10/3 - for roller bearings.

If the bearing speed is constant and the magnitude of the load is between the minimum value F_{min} and a maximum value F_{max} as shown in fig. 3 a and b, the mean load can be obtained from:

$$F_m = \frac{F_{min} + 2F_{max}}{3}, \text{kN}$$

If the external radial load consists of a load F_1 which is constant in magnitude and direction and a load F_2 which is variable in direction and constant in magnitude (F_1 and F_2 acting in the same plane) as shown in fig.4, the mean

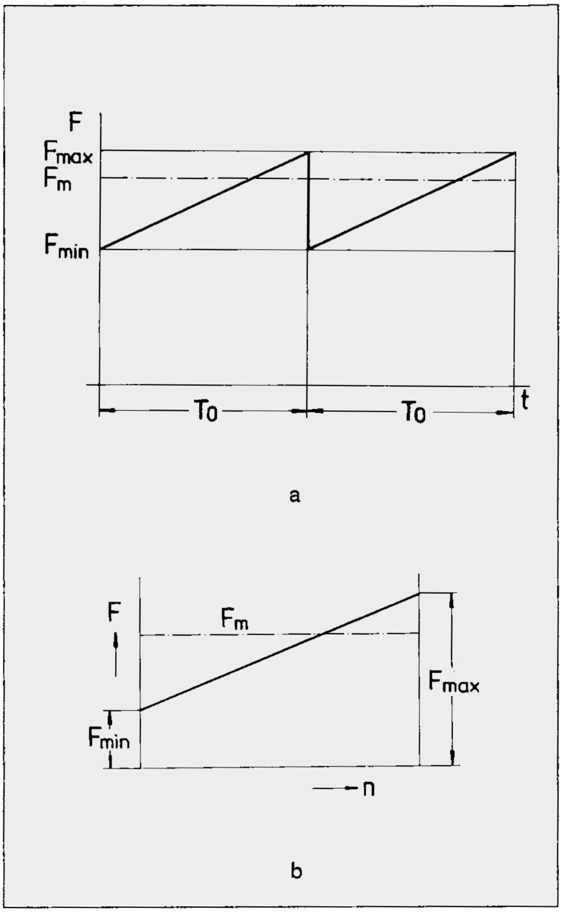


Fig. 3

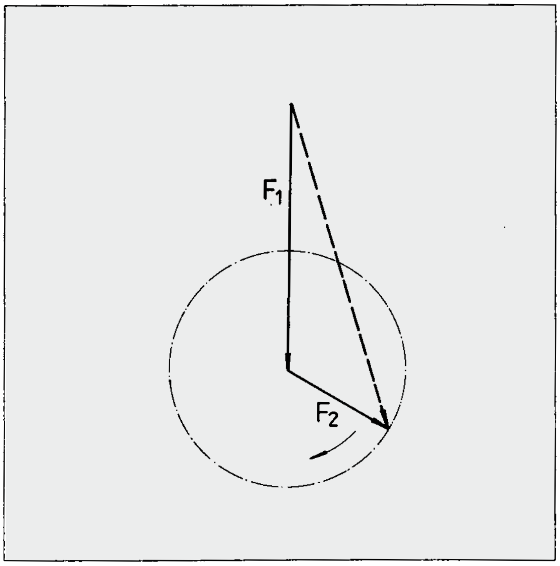


Fig. 4

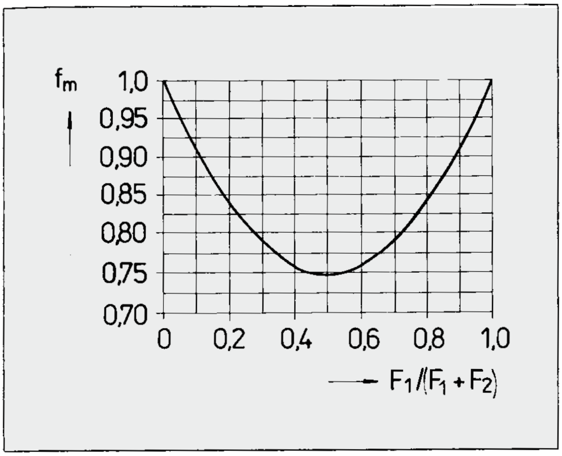


Fig. 5

load can be determined using the equation:

$F_m = f_m (F_1 + F_2)$, kN

Values for the factor f_m can be obtained from fig.5.

In case of sinusoidal movement as it is shown in fig. 6, the mean load can be obtained from:

$$F_m = \sqrt[p]{\frac{4}{3\pi}}\ F_{max}, \text{ kN},$$

$F_m \approx 0{,}75\ F_{max}$, kN, for ball bearings

$F_m \approx 0{,}77\ F_{max}$, kN, for roller bearings

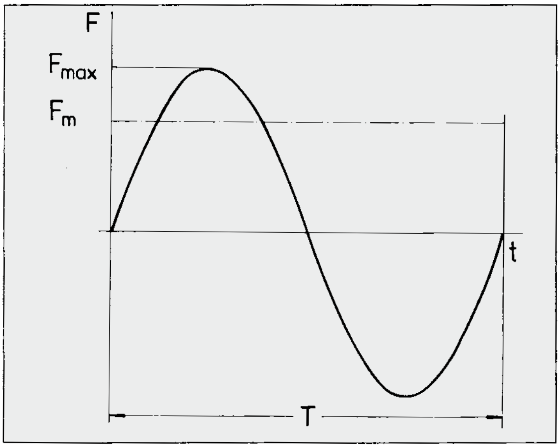


Fig. 6

In case of oscillating movements with oscillating angle γ, as shown in fig. 7, equivalent mean load can be calculated with the equation:

$$F_m = \sqrt[p]{\frac{\gamma}{90^\circ}}\ F_r, \text{ kN}$$

If the fluctuating load acts in a pure radial direction for radial bearings and in a pure axial direction for thrust bearings, the equivalent dynamic bearing load will be:

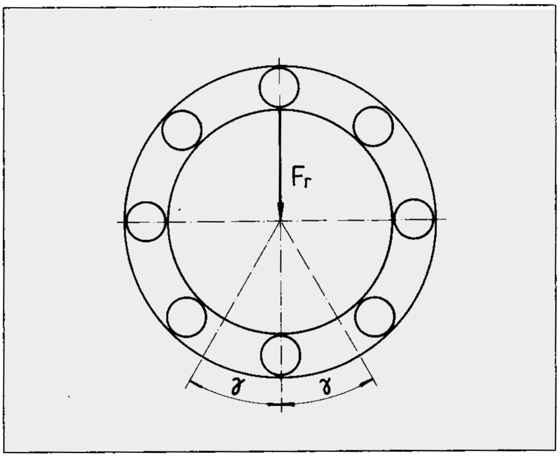


Fig. 7

$P_r = F_m$.

For combined loads, with radial load F_r and axial load F_a constant in direction and magnitude, the equivalent dynamic load can be calculated using the equation

$$P_r = X F_r + Y F_a, \text{ kN}$$

In case of combined loads, with radial and axial loads changing in time, ratio F_r/F_a being constant, the equivalent dynamic load can be calculated by:

$$P_m = X F_{r\,m} + Y F_{a\,m},$$

where:

P_m - equivalent mean dynamic load, kN,
$F_{r\,m}$ - radial mean load, kN,
$F_{a\,m}$ - axial mean load, kN,
X, Y - factors of radial and axial load.

In case the direction and magnitude of the load change in time and speeds fluctuate in time, the equivalent mean dynamic load will be calculated using the equation:

$$P_m = \sqrt[p]{\frac{P_1^p n_1 + P_2^p n_2 + \dots + P_n^p n_n}{n}}.$$

where:

P_m - equivalent mean dynamic load, kN
P_1 - equivalent dynamic load for n_1 revolutions, kN
P_2 - equivalent dynamic load for n_2 revolutions, kN
P_n - equivalent dynamic load for n_n revolutions, kN
n_1 - number of revolutions for load P_1
n_2 - number of revolutions for load P_2
n_n - number of revolutions for load P_n
n - number of revolutions ($n = n_1 + n_2 + \dots + n_n$)
p - exponent: -3 - for ball bearings,
-10/3 - for roller bearings

Basic dynamic load of a bearing group

In case of ball and roller bearings especially, a bearing group of the same type mounted close together is required, so that heavy radial loads can be carried.

In order to take over the load uniformly these bearings should be mounted in order to equal the diameter deviations to the radial clearances.

These deviations must be kept below 1/2 of the admitted tolerance class.

Basic dynamic load for a bearing group as a function of the basic load of the single bearing can be calculated using the equation:

$$C_{ri} = C_r \, i^n,$$

where:

C_{ri} - basic dynamic load of the bearing group, kN,

C_r - basic dynamic load of the single bearing, selected from the tables,

i - number of bearings of the same type, mounted close together,

n - exponent depending on the bearing type:
0,7 - for ball bearings
7/9 - for roller bearings

Values of i^n are given in table 2.6.

Values for i^n

Table 2.6

i	$i^{0,7}$	$i^{7/9}$
2	1,62	1,71
2	2,16	2,35
4	2,64	2,94

The equivalent dynamic load for each group of bearings is calculated considering the specifications in the introductory text preceding the respective group.

Adjusted rating life

Basic rating life L_{10h} is often satisfactory for bearing performances. This life means a reliability of 90% for material and a modern and usual manufacturing technology, as well as for conventional operating conditions.

For a reliability over 90% (100-n)%, ISO recommends steels elaborated in better conditions, high level manufacturing technologies and specific operating conditions. In this case, adjusted rating life can be calculated as follows:

$$L_{na} = a_1 \, a_2 \, a_3 \, L_{10} \text{ or}$$

$$L_{na} = a_1 \, a_2 \, a_3 \left(\frac{C}{P}\right)^p$$

where:

L_{na} - adjusted rating life, millions of revolutions

a_1 - life adjustment factor considering reliability

a_2 - life adjustment factor considering the material and manufacturing conditions

a_3 - life adjustment factor considering the operating conditions.

In case of life adjustment factors a_1, a_2, a_3 greater than 1, when calculating adjusted rating life, prudence and familiarity with bearing manufacturing and operating conditions, including shaft bending and housing stiffness are recommended.

Life adjustment factor a_1 for reliability

The bearing failure caused by fatigue is subjected to certain statistic laws. Therefore, this fact is recommended to be considered when calculating the bearing life.

Values of the life adjustment factor a_1 for reliabilities over than 90% are given in table 2.7.

Values for factor a_1

Table 2.7

Reliability, %	L_{na}	a_1
90	L_{10a}	1
95	L_{5a}	0,62
96	L_{4a}	0,53
97	L_{3a}	0,44
98	L_{2a}	0,33
99	L_{1a}	0,21

Life adjustment factor a_2 for material

Life adjustment factor a_2 takes into account the properties of the material, heat treatment of the steel and manufacturing technologies. For bearings, $a_2 = 1$ is recommended.

Life adjustment factor a_{23} for operating conditions

The longest life of a bearing can be reached in case of hydrodynamic lubrication, namely where there is no direct contact between rolling elements and raceway due to the lubricant film. In this field, many studies have been done by world leading bearing manufacturing companies. These studies showed that there is relationship between life adjustment factor a_2 for material and life adjustment factor a_3 for operating conditions. Preferably these factors should be unified, obtaining factor a_{23}. In this case, adjusted rating life would be:

$$L_{na} = a_1 \, a_{23} \, L_{10} \text{ or } L_{na} = a_1 \, a_{23} \, L_{10h}$$

The values of a_{23} coefficient depend on the lubricant used for bearing lubrication, namely on the ratio of the oil viscosity at +40°C, ν (initial value) to the viscosity required for adequate lubrication at the operating temperature ν_1. The values are given in table 2.8.

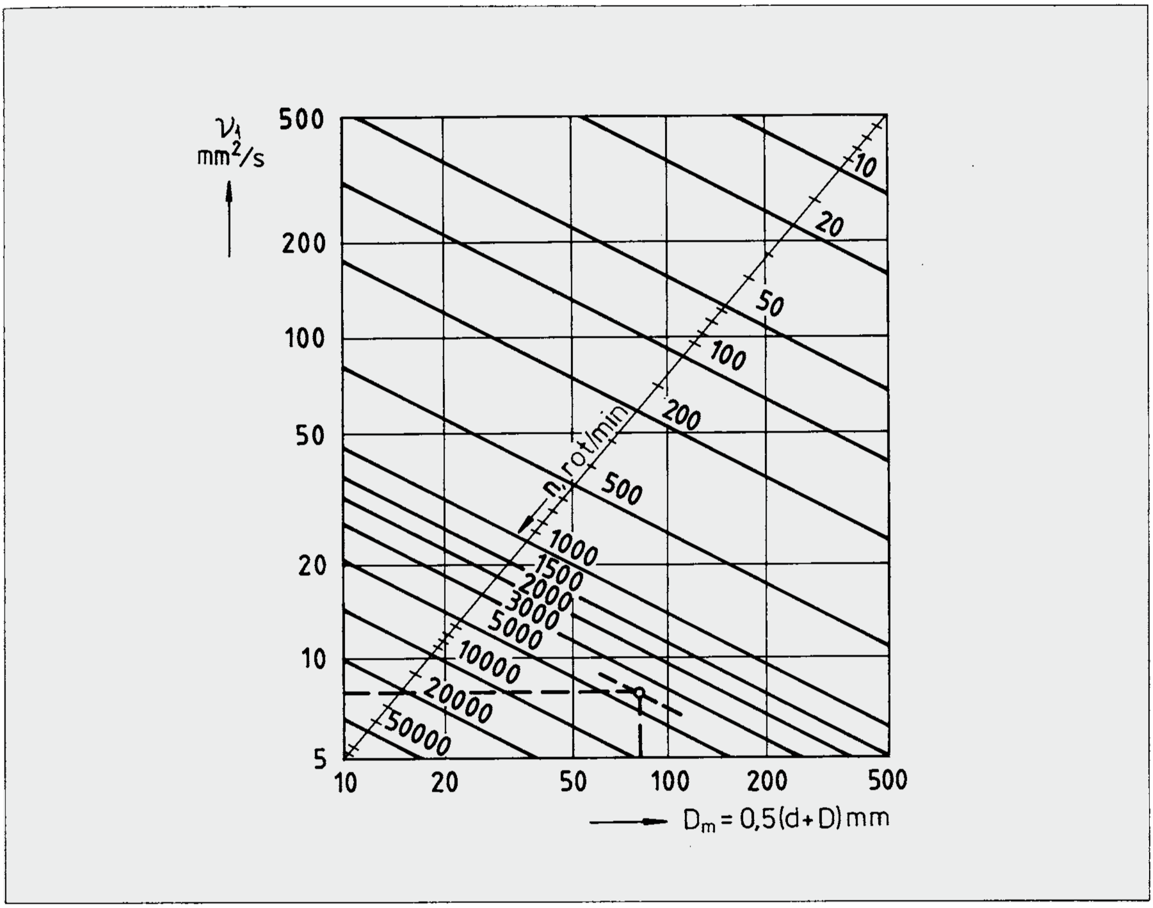


Fig. 8

Values for factor a_{23}

Table 2.8

$\frac{\nu}{\nu_1}$	0,1	0,2	0,5	1	1,5	2	3	4	5
a_{23}	0,45	0,55	0,75	1	1,3	1,6	2	2,5	2,5

The values of viscosity ν_1 as a function of the mean bearing diameter and operating speed are given in the diagram fig. 8.

Kinematic viscosity ν at the temperature of +40°C can be determined from the diagram fig. 9 in accordance with ISO, if the bearing operating temperature is known.

In case of grease lubrication, calculation should be done considering the basic oil viscosity and the value of the life adjustment factor a_{23} will be smaller than 1.

Example of oil kinematic viscosity calculation for bearing lubrication:

The bearing 6212 operates at a speed of 3500 r/min and a temperature of +70°C.

Mean diameter will be:

$0,5\ (d+D) = 0,5\ (60 + 110) = 85$ mm.

From the diagram fig.9, at a temperature of +70°C, for a viscosity $\nu_1 = 8$ mm²/s, the viscosity at +40°C is 20 mm²/s (cSt).

In this case should be selected an oil in accordance with ISO VG22 with kinematic viscosity limits: $\nu_{min} = 19,8$ mm²/s (cSt) and $\nu_{max} = 24,2$ mm²/s (Cst)

In case of bearing operating at temperatures higher than +150°C, an adjustment factor f_t for temperature should be added to the life adjustment factor a_{23}. Adjusted rating life will be:

$$L_{na} = a_1\, a_{23}\, f_t\, L_{10} \text{ or } L_{na} = a_1\, a_{23}\, f_t\, L_{10h}$$

Values for the life adjustment factor f_t for temperature are given in table 2.9.

Values for operating temperature factor f_t

Table 2.9

Operating temperature, t°C	150	200	250	300
f_t	1	0,73	0,42	0,22

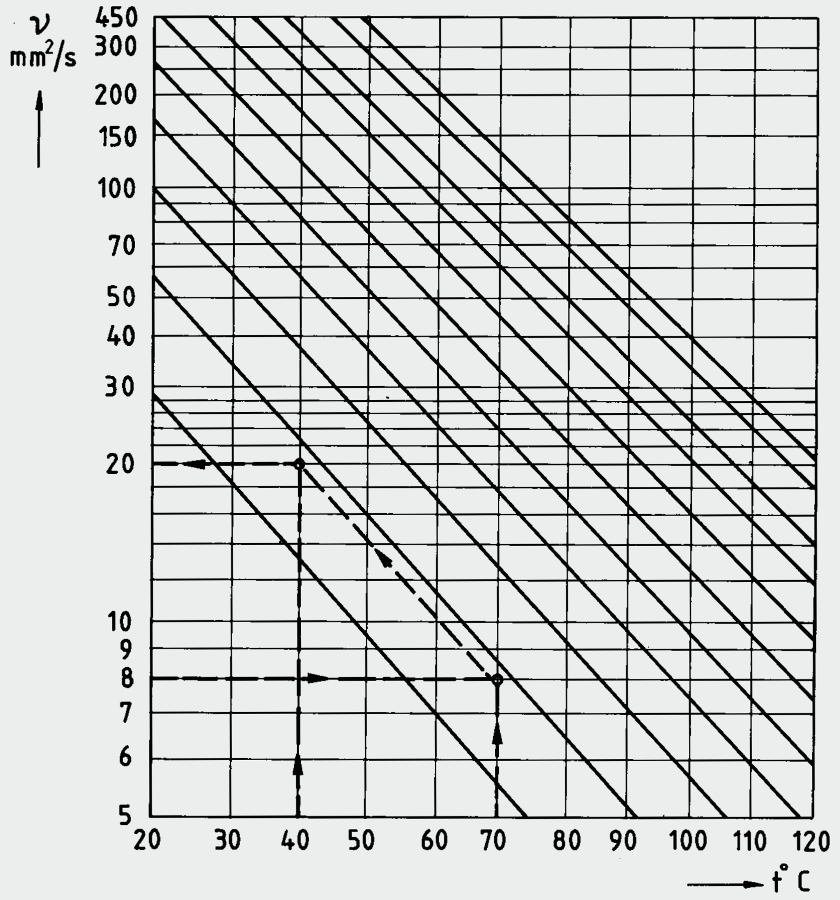


Fig. 9

Static load

When the bearing is stationary or rotates at slow movements or very low speeds (lower than 10 r/min), basic static load is not determined by the material fatigue but by permanent deformation caused at the rolling element/raceway contact.

It is also the case of rotating bearings when they have to sustain heavy shock loads which act during a fraction of their revolution.

Generally, the value of the load may increase up to the value of the basic static load C_0, without altering the bearing operating properties.

Equivalent static load

Combined static load (radial and axial load acting simultaneously on bearing) must be converted into an equivalent static bearing load. This is defined as the load (radial for radial bearings and axial for thrust bearings) which if applied, would cause the same permanent deformation in the bearing as the real load operating upon it.

Equivalent static load is obtained from the general equation:

$$P_0 = X_0 F_r + Y_0 F_a, \text{ kN},$$

where:

P_0	- equivalent static bearing load, kN,
F_r	- radial component of the heaviest static load, kN,
F_a	- axial component of the heaviest static load, kN,
X_0	- radial load factor of the bearing,
Y_0	- axial load factor of the bearing.

Data needed to calculate equivalent static load can be found in text and in bearing tables.

Requisite basic static load rating

When determining bearing size on the basis of the static load, a static safety factor s_0 is used.

The requisite basic static load is calculated using the equation:

$$C_{or} = s_0 P_{or}, \text{ kN},$$

where:

C_{Or} - basic static load rating, kN,
s_0 - static safety factor, table 2.11,
P_{Or} - equivalent static load, kN.

At high temperatures, life of the material decreases and the static load carrying capacity of bearings is reduced.

For high temperatures, basic static load is calculated using the equation:

$$C_{Or} = f_{0t}\, s_0\, P_{0r}, \text{ kN}$$

The values of factor f_{0t} depending on temperature is given in table 2.10

Values for temperature factor f_{0t}

Table 2.10

Operating temperature, t°C	150	200	250	300
f_{0t}	1	0,95	0,85	0,75

Non-rotating bearings

In case of non-rotating bearings, the values of static safety factor s_0 for certain applications are given in table 2.11. These values are also valid for bearings with oscillating movements.

Values for static safety factor s_0

Table 2.11

Application	s_0
Variable pitch propeller for aircraft	0,5
Gates for barrages, dams, sluices	1
Opening bridges	1,5
Crane hooks for:	
- large cranes without additional loads	1,5
- small cranes with additional dynamic loads	1,6

Rotating bearings

In case of fluctuating or oscillating loads and especially when heavy shock loads are acting during a fraction of revolution, it is necessary to check if the bearing has the proper static load carrying capacity.

Heavy shock loads higher than the basic static bearing load produce permanent deformations not uniformly distributed on raceway, which influence negatively upon bearing running.

Generally, heavy shock loads cannot be exactly calculated and in certain cases they produce deformations of bearing housing and consequently an unfavorable load distribution in bearing.

When a bearing rotates under maximum load, raceway becomes uniformly deformed on all its outer surface without any imprint.

For various operating conditions, maximum load acting upon the bearing is calculated with static safety factor s_0, depending on the vibrations and shock loads.

The values of static safety factor are given in table 2.12.

Values for static safety factor s_0

Table 2.12

Type of operation	Requirements regarding quiet running					
	Unimportant		Normal		High	
	Ball	Roller	Ball	Roller	Ball	Roller
	bearings		bearings		bearings	
Smooth, vibration-free	0,5	1	1	1,5	2	3
Normal	0,5	1	1	1,5	2	3,5
Heavy shock loads	>1,5	>2,5	>1,5	>3	>2	>4

For bearings with a known equivalent static load, static safety factor s_0 is necessary to be checked using the equation:

$$s_0 = \frac{C_{Or}}{P_{Or}}$$

If the value of s_0 is less than that recommended in table 2.12, then a bearing with a higher basic static load carrying capacity should be selected.

Basic static load for a group of bearings

Where more bearings of the same type are mounted close together to take over a static load, the load magnitude supported by these bearings will be calculated from:

$$C_{Ori} = C_{Or}\, i,$$

where:

C_{Ori} - basic static load of the bearing group,
C_{Or} - basic static load of the single bearing (from tables),
i - number of bearings.

3. Bearing Friction

Friction in rolling bearings is considerably lower than in sliding bearings. Power lost through friction in bearing is generally negligible, in various bearing joints and mechanisms. If a certain frictional moment is required in some applications, the coefficient of friction for the bearing should be known.

It depends on many factors such as: bearing design, speed, direction and magnitude of load, finishing quality of active surfaces, operating temperature, lubricant, bearing material etc.

The frictional moment can be calculated accurately enough using the following equation:

$M = 0{,}5\mu\ P\ d$ - for radial bearings
$M = 0{,}5\mu\ P\ D_m$ - for thrust bearings

where:
M - frictional moment, N mm,
μ - coefficient of friction, table 3.1
P - bearing load, N,
d - bearing bore diameter, mm,
D_m - thrust bearing mean diameter $0{,}5(d + D)$, mm

The values of the friction coefficient μ for various bearing types are given in table 3.1.

The frictional moment can be more accurately determined with the equation:

$$M = M_0 + M_1,$$

where:
M_0 - frictional moment which is independent of the bearing load and depends on the hydrodynamic friction
M_1 - resistance moment depending on the bearing load and the size of the elastic contact surfaces

M_0 can be calculated from:

$$M_0 = f_0(\nu_1\ n)^{2/3}\ D_m^3\ 10^{-7},\ \text{for } n > 2\,000,$$
$$M_0 = 16\ f_0\ D_m^3\ 10^{-6},\qquad \text{for } n \le 2\,000,$$

where:
M_0 - frictional moment which is independent of the bearing load, N mm
f_0 - factor which depends on the bearing type and lubricant, table 3.1,
n - rotational speed, r/min,
ν_1 - kinematic viscosity of lubricant at operating temperature, mm^2/s. In case of grease lubrication, calculation should be done considering the basic oil viscosity,
D_m - bearing mean diameter, mm.

M_1 can be calculated using the equation:

$$M_1 = f_1\ P_1\ D_m$$

where:
M_1 - load - dependent resistance moment, N mm,
f_1 - factor which depends on the bearing type and load, table 3.1,
P_1 - bearing combined load, determined using the equation in the table 3.1, N,
D_m - bearing mean diameter $= 0{,}5\ (d + D)$, mm.

The values of the friction coefficient μ for various bearing types and factors f_0 and f_1

Table 3.1

Bearing type		Friction coefficient μ	Factor f_0 Lubrication				Factors for calculating M_1	
			grease[1]	oil spot	oil bath	oil bath with vertic. shaft, oil jet	f_1	P_1 [5]
								N
Deep groove ball bearings	single row	0,0010 - 0,0020	0,75-2[2]	1	2	4	$(8\text{-}9)\times10^{-4}\,(P_{0r}/C_{0r})^{0,55}$ [2]	$3\,F_a - 0,1\,F_r$
	double row		3	2	4	8		
Self-aligning ball bearings		0,0010 - 0,0020	1,5-2[2]	0,7-1[2]	1,5-2[2]	3-4[2]	$3\times10^{-4}\,(P_{0r}/C_{0r})^{0,4}$	$1,4\,Y_2\,F_a\text{-}0,1\,F_r$
Angular contact ball bearings	single row	0,0012 - 0,0025	2	1,7	3,3	6,6	$10^{-3}\,(P_{0r}/C_{0r})^{0,33}$	$F_a - 0,1\,F_r$
	double row		4	3,4	6,5	13	$10^{-3}\,(P_{0r}/C_{0r})^{0,33}$	$1,4\,F_a - 0,1F_r$
Four-point contact bearings		0,0025 - 0,0045	6	2	6	9	$10^{-3}\,(P_{0r}/C_{0r})^{0,33}$	$1,5\,F_a + 3,6\,F_r$
Cylindrical roller bearings	with cage	0,0010 - 0,0025	0,6-1	1,5-2,8	2,2-4	2,2-4[2)3)]	$(2\text{-}4)\times10^{-4}$	F_r [6]
	without cage	0,0020 - 0,0040	5-10[4]	-	5-10	-	$5,5\times10^{-4}$	F_r [6]
Needle roller bearings	with cage	0,0020 - 0,0035	12	6	12	24	10^{-3}	F_r
	without cage	0,0035 - 0,0055	24	12	24	-	10^{-3}	F_r
Spherical roller bearings		0,0020 - 0,0025	3,5-7	1,75-3,5	3,5-7	7 -14	$(1,5\text{-}8)\times10^{-4}$	$1,35\,Y_2\,F_a,\ F_r/F_a <$ [3] Y_2 $F_r(1+0,3\,(Y_2\,F_a/F_r)^3),$ $F_r/F_a \geq Y_2$
Tapered roller bearings	single row	0,0017 - 0,0020	6	3	6	8-10[2)3)]	4×10^{-4}	$2\,Y\,F_a$
	paired	0,0030 - 0,0040	12	6	12	16-20[2)3)]	4×10^{-4}	$1,2\,Y_2\,F_a$
Thrust bearings	ball	0,0010 - 0,0025	5,5	0,8	1,5	3	$8\times10^{-4}\,(F_a/C_{0r})^{0,33}$	F_a
	roller	0,0050 - 0,0070	9	-	3,5	7	$1,5\times10^{-3}$	F_a
Needle roller thrust bearings		0,0050 - 0,0075	14	-	5	11	$1,5\times10^{-3}$	F_a
Spherical roller thrust bearings		0,0020 - 0,0030	-	-	2,5-5	5-10	$(2,3\text{-}5)\times10^{-4}$	$F_a,\ F_{rmax} < 0,55\,F_a$

1) The values apply to normal operating conditions. In case of bearing relubrication, they apply after 2...4 operating hours.

2) The low values apply to small series bearings, the high values to large series bearings.

3) The values are valid for oil jet lubrication. For oil bath lubrication and a vertical shaft, the value should be doubled.

4) The values for low speeds up to 20% of the speed values given in the catalogue. At higher speeds they should be doubled.

5) If $P_1 < F_r$, then $P_1 = F_r$

6) For bearings which are also axially loaded, specifications for f_2, on page 30, should be considered.

Symbols

P_0 = Equivalent static load,
C_0 = Basic static load
F_r = Radial component of dynamic bearing load,
F_a = Axial component of dynamic bearing load
Y, Y_2 = axial load factors

Values for factor f_2

Table 3.2

Bearing type	Lubrication	
	oil	grease
Bearings with cage		
- E design	0,002	0,003
- other bearings	0,006	0,009
Bearings without cage		
- single row	0,003	0,006
- double row	0,009	0,015

The values of factor f_2 in the table 3.2 are valid only if the value of ratio F_a/F_r doesn't exceed:

- 0,5 = for single row cylindrical roller, E design
- 0,4 = for bearings with cage and without cage, normal design
- 0,25 = for double row cylindrical roller bearings, without cage

Frictional moment for sealed bearings

In case of sealed bearings, the seal washers produce additional frictions which usually exceed those arising from the bearing.

The frictional moment M_3 for a bearing which is sealed on both sides can be calculated using the following equation:

$$M_3 = \frac{d + D}{f_3} + f_4$$

where:

M_3 - Frictional moment caused by seals, N mm,
d - Bearing bore diameter, mm
D - Bearing outside diameter, mm
f_3, f_4 - Factors, table 3.3

Values for factors f_3 and f_4

Table 3.3

Type	Factors	
	f_3	f_4
Deep groove ball bearings 2RSR, 2RS	20	10
Self-aligning ball bearings 2RS	20	15
Single row deep groove ball bearings with extended inner ring (UC, UE, US etc.)	20	20
Bearings for water pumps	20	25
Sealed cylindrical roller bearings without cage	10	50

Starting torque

The starting torque of a rolling bearing is defined as the bearing resistance moment which must be overcome so that the bearing should start rotating from the stationary condition.

Generally, the value of the starting torque is approximately twice the load dependent moment M_1.

For tapered roller bearings with a large contact angle (series 313, 322B and 323B), the starting torque can be four times higher and for spherical roller thrust bearings up to eight times higher.

4. Limiting Speed

The speed limit can be defined as the speed reached by a bearing if the following conditions are observed:

- the bearing load should correspond to a rating life L_{10h} = 150 000 operating hours
- the inner ring rotates
- the operational clearance should be properly chosen, considering the fit and the operating temperature
- the maximum operating temperature is of +70°C without other heating sources.
- proper lubrication and sealing are provided
- proper stiffness of the shaft and housing

The speed limit of bearing depends on many factors such as: bearing type, magnitude of load, tolerance class, cage design, operational clearance, lubricant, lubrication and cooling conditions etc.

In case of oil lubrication, the speed limit can be approximately determined for radial bearings as a function of the mean bearing diameter from the diagram fig. 10 and for thrust bearings as a function of the product $\sqrt{D\,H}$ (where H = mounting height of thrust bearings) from the diagram fig. 11.

The diagrams show both the speed limit for normal manufacturing and operating conditions, and maximum speed that can be reached only in special conditions:

- bearings that have a high accuracy (tolerance class P5, P4) should be used
- special design and material for the cage
- special lubrication and cooling conditions
- radial clearance larger than normal
- proper manufacturing of the adjoint parts of the bearing (shaft and housing)
- minimum pre-load $P_{min} \geq 0{,}002\ C_{0r}$, for roller bearings and $P_{min} \geq 0{,}001\ C_{0r}$ for ball bearings.

In bearing tables, the values of speed limit are given both for grease and oil lubrication.

If the bearing operating conditions and the lubricant quality are not well enough known, the effective speed is recommended not to exceed 75% of the speeds indicated in this catalogue.

In case of heavy loads when the rating life is shorter than 75 000 operating hours and bearing mean diameter is larger than 100 mm, the speed from the catalogue should be multiplied by factor f in the fig. 12:

$$n_{adm} = f\, n,\ \text{r/min}$$

For a bearing combined load, the speed from the catalogue should be multiplied by factor f_1 in the diagram - fig.13:

$$n_{adm} = f_1\, n,\ \text{r/min}$$

Special cases

Low speeds

At very low speeds it is impossible for an elasto-hydrodynamic lubricant film to be built up in the contacts between the rolling element and raceway. In such cases, lubricants with special additives should be used.

Oscillating movements

Since the rotational speed is zero at the point where the direction of rotation is reversed, an elasto-hydrodynamic lubricant film cannot be maintained in the contact areas. In such cases, lubricants with special additives should be used.

It is also necessary to analyse the inertia forces which occur and can cause damages on the raceway by temporary sliding of rolling elements at each reversal of direction.

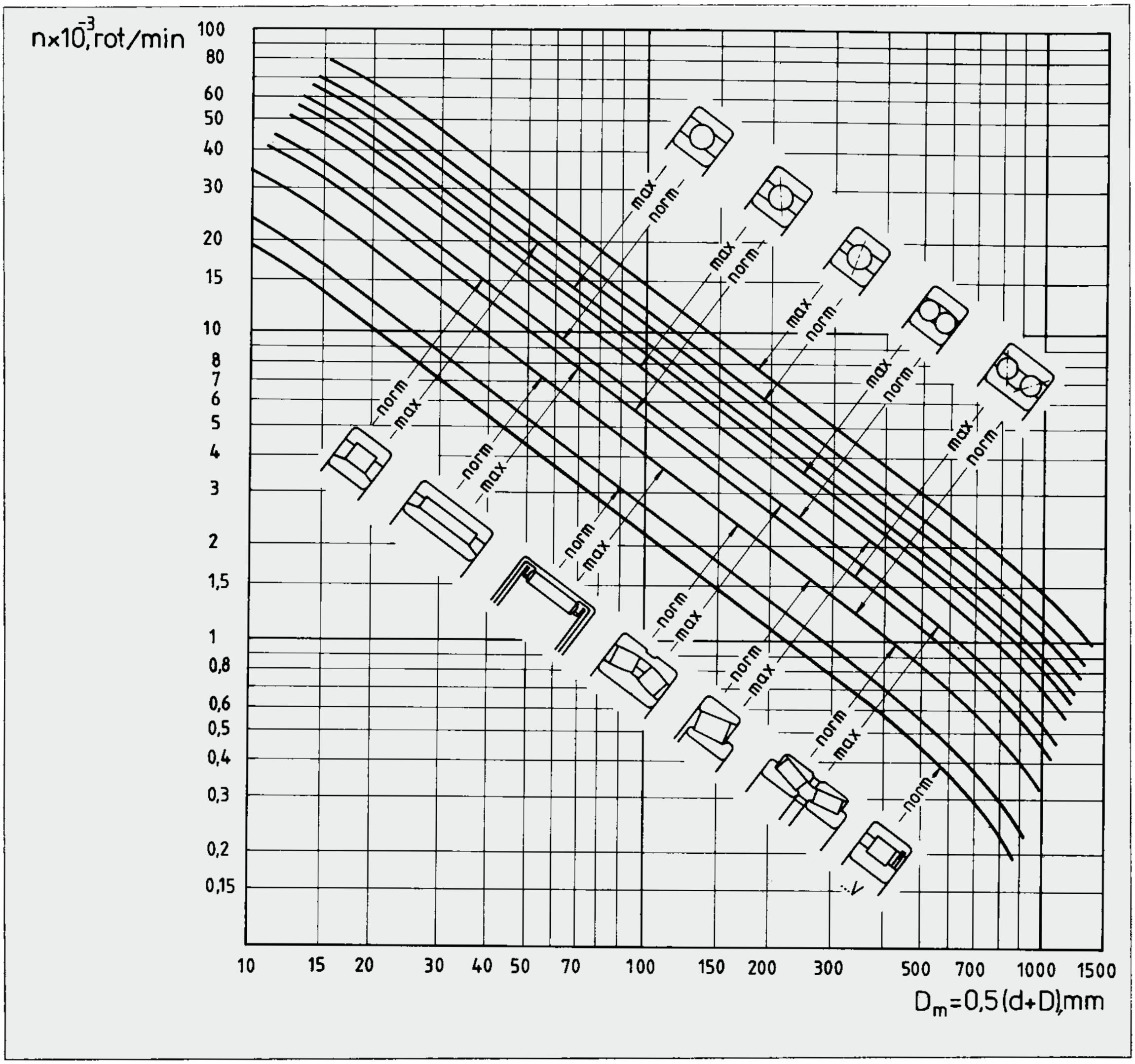


Fig. 10

Stationary conditions

If in long term stationary conditions rolling bearings vibrate, the micro-movements at the rolling element/raceway contacts produce damages on the contact surfaces.

This produces an increase in vibration level or even a shorter life.

Such damage can be avoided by insulating the bearing from external vibrations. A similar situation can also occur during bearing transport, particularly in case of large-sized bearings. Such damage can be avoided by fastening the elements.

Oil lubrication is also preferable to grease lubrication.

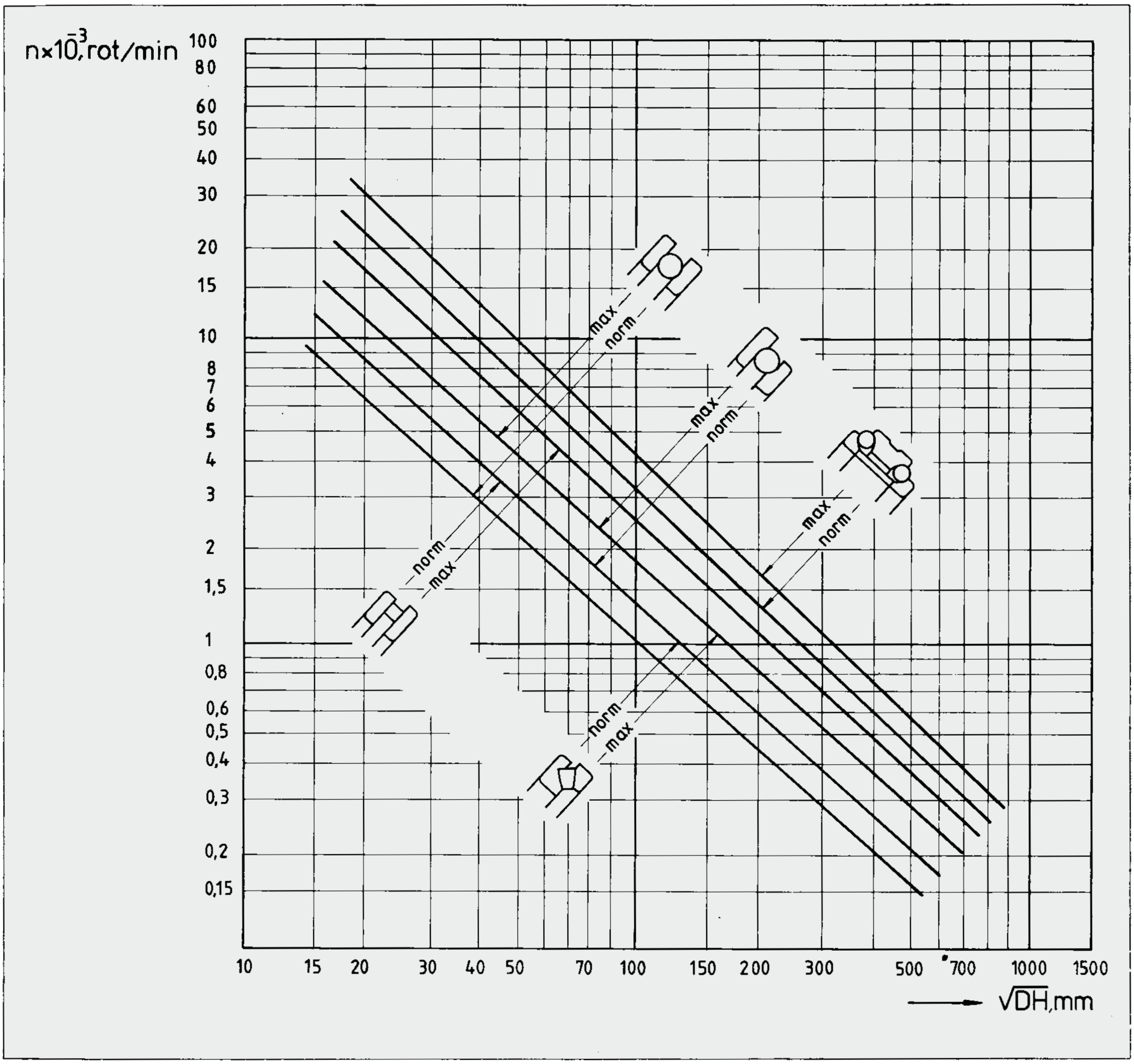

n×10⁻³,rot/min
100
80
60
50
40
30
20
15
10
8
7
6
5
4
3
2
1,5
1
0,8
0,6
0,5
0,4
0,3
0,2
0,15
10
15
20
30
40
50
70
100
150
200
300
500
700
1000
1500
√DH,mm
max
norm
max
norm
max
norm
norm
max
norm
max

Fig. 11

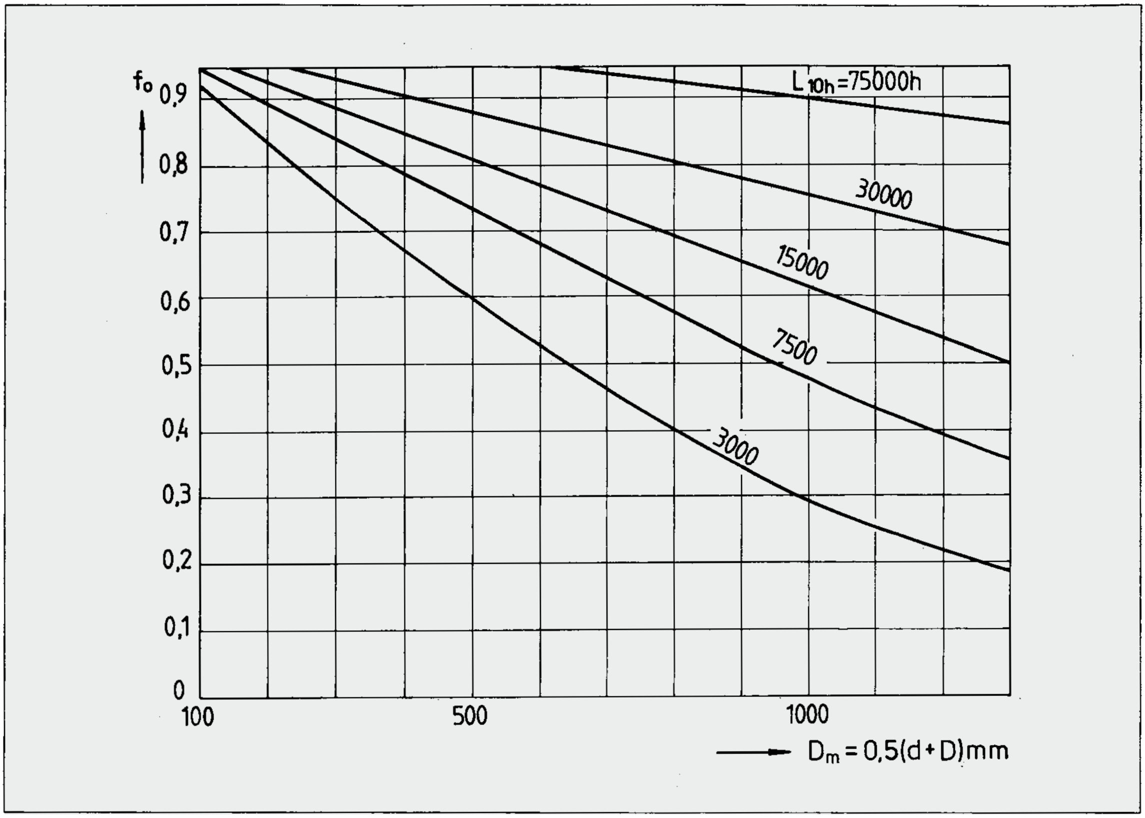

f_0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
100
500
1000
$D_m = 0,5(d+D)$mm
L_{10h}=75000h
30000
15000
7500
3000

Fig. 12

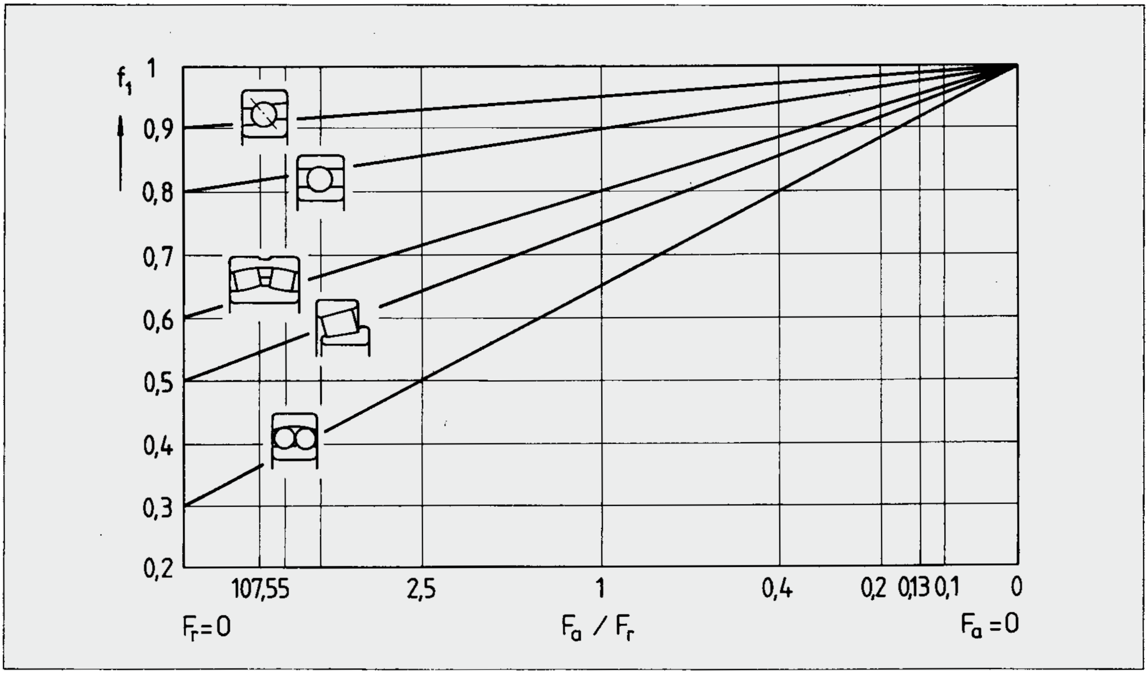

f_1
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
10
7,5
5
2,5
1
0,4
0,2
0,13
0,1
0
F_r=0
F_a / F_r
F_a =0

Fig. 13

5. Bearing tolerances

Bearing tolerances have been internationally and nationally standardized in accordance with ISO 492, 199, 582, 1132.

Bearings are generally manufactured to the tolerance class P0. At request, they can also be manufactured to the tolerance classes P6, P6X, P5, P4 and P2. These bearings are used for special applications, such as very accurate shaft guidance or very high speeds.

The values of the limit deviations for these tolerance classes are given for:

- the overall dimensions of:
  - deep groove ball bearings, angular contact ball bearings, self-aligning ball bearings, spherical roller bearings, cylindrical roller bearings, needle roller bearings, tapered roller bearings,
  - tapered roller bearings with metric(mm) and inch dimensions,
  - tapered bore bearings,
  - thrust ball bearings, angular contact thrust ball bearings, cylindrical roller thrust bearings, needle roller thrust bearings,
- mounting chamfer.

Symbols

d - nominal bore diameter or shaft washer nominal bore diameter for thrust bearings

d_1 - nominal diameter at the theoretical large end of the tapered bore

d_2 - nominal bore diameter of the shaft washer for double direction thrust bearings

d_s - deviation of single bore diameter

d_{psmax} - maximum bore diameter, in a single radial plane

d_{psmin} - minimum bore diameter, in a single radial plane

Δ_{ds} - deviation of a single bore diameter $\Delta_{ds} = d_s - d$

d_{mp} - mean bore diameter, in a single radial plane $d_{mp} = (d_{psmax} + d_{psmin})/2$

Δ_{dmp} - deviation of the mean bore diameter in a single radial plane; or deviation of the mean diameter at the theoretical small end of the tapered bore, in case of tapered bore bearings; or deviation of the mean bore diameter of the shaft washer in a single radial plane for single direction thrust bearings $\Delta_{dmp} = d_{mp} - d$

d_{1mp} - mean diameter at the large theoretical end of the tapered bore in a single plane.

Δ_{d1mp} - deviation of the mean diameter at the theoretical large end of the tapered bore $\Delta_{d1mp} = d_{1mp} - d$

Δ_{d2mp} - deviation of the mean bore diameter of the shaft washer for a double direction thrust bearing, in a single radial plane

V_{dp} - bore diameter variation in a single radial plane; or bore diameter variation of the shaft washer in a single radial plane, for single direction thrust bearings $V_{dp} = d_{psmax} - d_{psmin}$

V_{d2p} - bore diameter variation of the shaft washer for double direction thrust bearings, in a single radial plane

V_{dmp} - mean bore diameter variation (valid only for cylindrical bore) $V_{dmp} = d_{mpmax} - d_{mpmin}$

α - nominal half-angle of the tapered bore

D - nominal outside diameter or housing washer nominal diameter

D_1 - nominal outside diameter of the outer ring rib

D_s - single outside diameter

D_{psmax} - maximum outside diameter in a single radial plane

D_{psmin} - minimum outside diameter in a single radial plane

Δ_{Ds} - deviation of the single outside diameter $\Delta_{Ds} = D_s - D$

D_{mp} - mean outside diameter, in a single plane $D_{mp} = (D_{psmax} + D_{psmin})/2$

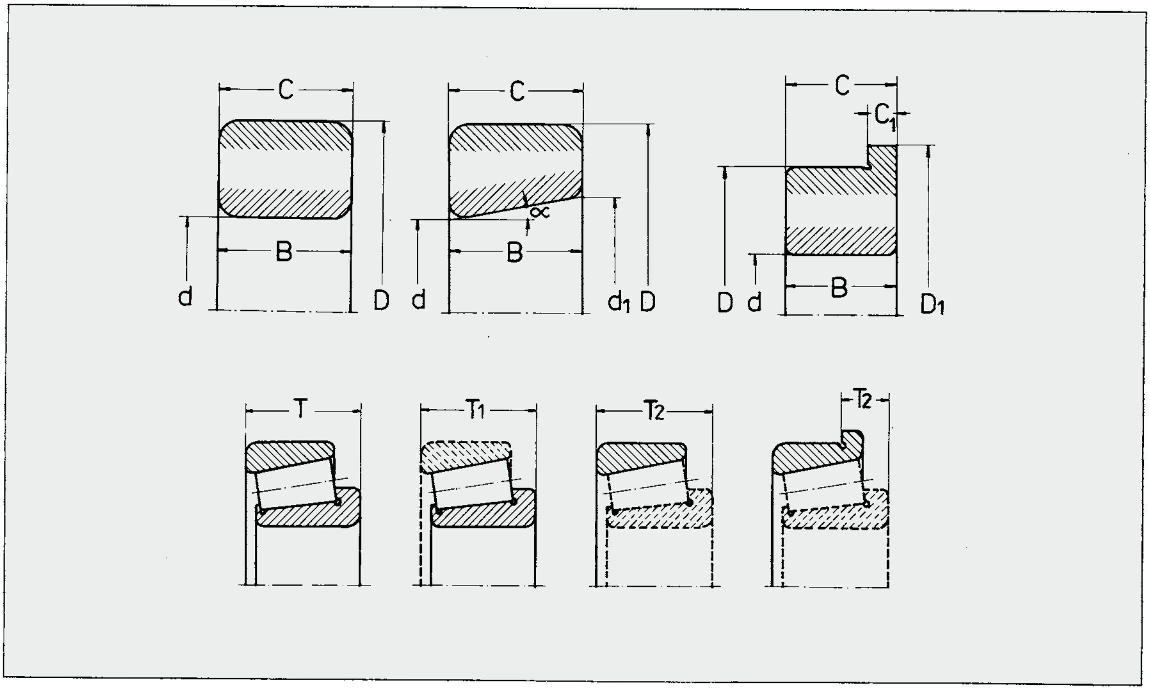
Δ_{Dmp} - deviation of the mean outside diameter in a single radial plane; or deviation of the mean diameter of housing washer in a single radial plane, for thrust bearings $\Delta_{Dmp} = D_{mp} - D$

V_{Dp} - outside diameter variation in a single radial plane; or housing washer diameter variation in a single radial plane for double direction thrust bearings $V_{Dp} = D_{psmax} - D_{psmin}$

V_{Dmp} - mean outside diameter variation

B - nominal width of the inner ring

B_s	- single width of the inner ring
Δ_{Bs}	- inner ring single width deviation $\Delta_{Bs} = B_s - B$
V_{Bs}	- inner ring single width variation
C	- nominal width of the outer ring
C_s	- single width of the outer ring
Δ_{Cs}	- deviation of outer ring single width $\Delta_{Cs} = C_s - C$
V_{Cs}	- single width variation of the outer ring $V_{Cs} = C_{smax} - C_{smin}$
T	- nominal width of tapered roller bearings
T_s	- single width of tapered roller bearings
Δ_{Ts}	- deviation of the single width of taper roller bearings $\Delta_{Ts} = T_s - T$
T_1	- nominal width of the inner ring and tapered roller assembly
T_{1s}	- single width of the inner ring and tapered roller assembly
Δ_{T1s}	- deviation of the single width of inner ring and tapered roller assembly $\Delta_{T1s} = T_{1s} - T_1$
T_2	- nominal width of the outer ring assembly
T_{2s}	- single width of the outer ring assembly
Δ_{T2s}	- deviation of the single width of outer ring assembly $\Delta_{T2s} = T_{2s} - T_2$
K_{ia}	- radial runout of assembled bearing inner ring
K_{ea}	- radial runout of assembled bearing outer ring
S_d	- side face runout with reference to bore of the inner ring
S_D	- variation in inclination of outside cylindrical surface to outer ring side face
S_{ia}	- side face runout of assembled inner ring with reference to raceway
S_{ea}	- side face runout of assembled outer ring with reference to raceway
S_i	- thickness variation measured from middle of raceway to back seating face of shaft washer
S_e	- thickness variation measured from middle of raceway to back face of housing washer
Δ_{Hs}	- deviation of mounting height of single direction thrust ball and roller bearings
Δ_{H1s}	- deviation of mounting height of thrust ball bearings with sphered housing washer
Δ_{H2s}	- deviation of mounting height of double direction thrust ball and roller bearings
Δ_{H3s}	- deviation of mounting height of double direction thrust ball bearings with sphered housing washer
Δ_{H4s}	- deviation of mounting height of spherical roller thrust bearings



Radial bearings (excepting tapered roller bearings)
Tolerance class P0

Inner ring

Deviations μm

Table 5.1

d mm		Δ_{dmp}		V_{dp}			V_{dmp}	K_{ia}	Δ_{Bs}			V_{Bs}
				Diameter series 7,8,9	0,1	2,3,4			all	nor-mal	modified 2)	
over	up to	high	low	max.	max.	max.	max.	max.	high	low	low	max.
0,6 1)	**2,5**	0	−8	10	8	6	6	10	0	−40	–	12
2,5	**10**	0	−8	10	8	6	6	10	0	−120	−250	15
10	**18**	0	−8	10	8	6	6	10	0	−120	−250	20
18	**30**	0	−10	13	10	8	8	13	0	−120	−250	20
30	**50**	0	−12	15	12	9	9	15	0	−120	−250	20
50	**80**	0	−15	19	19	11	11	20	0	−150	−380	25
80	**120**	0	−20	25	25	15	15	25	0	−200	−380	25
120	**180**	0	−25	31	31	19	19	30	0	−250	−500	30
180	**250**	0	−30	38	38	23	23	40	0	−300	−500	30
250	**315**	0	−35	44	44	26	26	50	0	−350	−500	35
315	**400**	0	−40	50	50	30	30	60	0	−400	−630	40
400	**500**	0	−45	56	56	34	34	65	0	−450	–	50
500	**630**	0	−50	63	63	38	38	70	0	−500	–	60
630	**800**	0	−75	–	–	–	–	80	0	−750	–	70
800	**1 000**	0	−100	–	–	–	–	90	0	−1 000	–	80
1 000	**1 250**	0	−125	–	–	–	–	100	0	−1 250	–	100
1 250	**1 600**	0	−160	–	–	–	–	120	0	−1 600	–	120
1 600	**2 000**	0	−200	–	–	–	–	140	0	−2 000	–	140

1) This value included.
2) It refers to isolated bearing ring for paired mounting or stack mounting.

Outer ring

Deviations μm

Table 5.2

D mm		Δ_{Dmp}		V_{Dp} 3)				V_{Dmp} 3)	K_{ea}	Δ_{Cs}		V_{Cs}
				Open bearings			Shielded bearings 2)					
				Diameter series 7,8,9	0,1	2,3,4	2,3,4					
over	up to	high	low	max.	max.	max.	max.	max.	max.	high	low	max.
2,5 1)	**6**	0	−8	10	8	6	10	6	15	Values are identical to Δ_{Bs} and V_{Bs} for the inner ring of the same bearing.		
6	**18**	0	−8	10	8	6	10	6	15			
18	**30**	0	−9	12	9	7	12	7	15			
30	**50**	0	−11	14	11	8	16	8	20			
50	**80**	0	−13	16	13	10	20	10	25			
80	**120**	0	−15	19	19	11	26	11	35			
120	**150**	0	−18	23	23	14	30	14	40			
150	**180**	0	−25	31	31	19	38	19	45			
180	**250**	0	−30	38	38	23	–	23	50			
250	**315**	0	−35	44	44	26	–	26	60			
315	**400**	0	−40	50	50	30	–	30	70			
400	**500**	0	−45	56	56	34	–	34	80			
500	**630**	0	−50	63	63	38	–	38	100			
630	**800**	0	−75	94	94	55	–	55	120			
800	**1 000**	0	−100	125	125	75	–	75	140			
1 000	**1 250**	0	−125	–	–	–	–	–	160			
1 250	**1 600**	0	−160	–	–	–	–	–	190			
1 600	**2 000**	0	−200	–	–	–	–	–	220			
2 000	**2 500**	0	−250	–	–	–	–	–	250			

1) This value included.
2) For bearings of diameter series 7,8,9,0 and 1 values are not indicated.
3) Values are valid before mounting the snap ring or shields or after their dismounting.

Tolerance class P6

Inner ring

Deviations µm

Table 5.3

d mm		Δ_{dmp}		V_{dp}			V_{dmp}	K_{ia}	Δ_{Bs}			V_{Bs}
				Diameter series 7,8,9	0,1	2,3,4			all	normal	modified[2]	
over	up to	high	low	max.	max.	max.	max.	max.	high	low	max.	max.
0,6[1]	**2,5**	0	−7	9	7	5	5	5	0	−40	–	12
2,5	**10**	0	−7	9	7	5	5	6	0	−120	−250	15
10	**18**	0	−7	9	7	5	5	7	0	−120	−250	20
18	**30**	0	−8	10	8	6	6	8	0	−120	−250	20
30	**50**	0	−10	13	10	8	8	10	0	−120	−250	20
50	**80**	0	−12	15	15	9	9	10	0	−150	−380	25
80	**120**	0	−15	19	19	11	11	13	0	−200	−380	25
120	**180**	0	−18	23	23	14	14	18	0	−250	−500	30
180	**250**	0	−22	28	28	17	17	20	0	−300	−500	30
250	**315**	0	−25	31	31	19	19	25	0	−350	−500	35
315	**400**	0	−30	38	38	23	23	30	0	−400	−630	40
400	**500**	0	−35	44	44	26	26	35	0	−450	–	45
500	**630**	0	−40	50	50	30	30	40	0	−500	–	50

1) This value included.
2) It refers to isolated bearing ring for paired mounting or stack mounting.

Outer ring

Deviations µm

Table 5.4

D mm		Δ_{Dmp}		V_{Dp}[3]				V_{Dmp}[2][3]	K_{ea}	Δ_{Cs}		V_{Cs}
				Open bearings		Shielded bearings						
				Diameter series 7,8,9	0,1	2,3,4	0,1,2, 3,4					
over	up to	high	low	max.	max.	max.	max.	max.	max.	high	low	max.
2,5[1]	**6**	0	−7	9	7	5	9	5	8	Values are identical to Δ_{Bs} and V_{Bs} for the inner ring		
6	**18**	0	−7	9	7	5	9	5	8			
18	**30**	0	−8	10	8	6	10	6	9			
30	**50**	0	−9	11	9	7	13	7	10			
50	**80**	0	−11	14	11	8	16	8	13			
80	**120**	0	−13	16	16	10	20	10	18			
120	**150**	0	−15	19	19	11	25	11	20			
150	**180**	0	−18	23	23	14	30	14	23			
180	**250**	0	−20	25	25	15	–	15	25			
250	**315**	0	−25	31	31	19	–	19	30			
315	**400**	0	−28	35	35	21	–	21	35			
400	**500**	0	−33	41	41	25	–	25	40			
500	**630**	0	−38	48	48	29	–	29	50			
630	**800**	0	−45	56	56	34	–	34	60			
800	**1 000**	0	−60	75	75	45	–	45	75			

1) This value included.
2) For bearings of diameter series 7,8 and 9 values are not indicated.
3) Values are valid before mounting the snap ring or shields or after their dismounting.

Tolerance class P5

Inner ring

Deviations μm

Table 5.5

d mm		Δ_{dmp}		V_{dp}		V_{dmp}	K_{ia}	S_d	S_{ia}[2]	Δ_{Bs}			V_{Bs}
				Diameter series 7,8,9	0,1, 2,3,4					all	norm.	modi- fied[3]	
over	up to	sup	low	max.	max.	max.	max.	max.	max.	high	low	low	max.
0,6[1]	2,5	0	−5	5	4	3	4	7	7	0	−40	−250	5
2,5	10	0	−5	5	4	3	4	7	7	0	−40	−250	5
10	18	0	−5	5	4	3	4	7	7	0	−80	−250	5
18	30	0	−6	6	5	3	4	8	8	0	−120	−250	5
30	50	0	−8	8	6	4	5	8	8	0	−120	−250	5
50	80	0	−9	9	7	5	5	8	8	0	−150	−250	6
80	120	0	−10	10	8	5	6	9	9	0	−200	−380	7
120	180	0	−13	13	10	7	8	10	10	0	−250	−380	8
180	250	0	−15	15	12	8	10	11	13	0	−300	−500	10
250	315	0	−18	18	14	9	13	13	15	0	−350	−500	13
315	400	0	−25	25	18	12	15	15	20	0	−400	−630	15

1) This value included.
2) Applies only to ball bearings.
3) It refers to single bearing ring for paired mounting or stack mounting.

Outer ring

Deviations μm

Table 5.6

D mm		Δ_{Dmp}		V_{Dp}[2]		V_{Dmp}	K_{ea}	S_D	S_{ea}[3]	Δ_{Cs}		V_{Cs}
				Diameter series 7,8,9	0,1,2, 3,4							
over	up to	high	low	max.	max.	max.	max.	max.	max.	high	low	max.
2,5[1]	6	0	−5	5	4	3	5	8	8	Identical to Δ_{Bs} for the inner ring		5
6	18	0	−5	5	4	3	5	8	8			5
18	30	0	−6	6	5	3	6	8	8			5
30	50	0	−7	7	5	4	7	8	8			5
50	80	0	−9	9	7	5	8	8	10			6
80	120	0	−10	10	8	5	10	9	11			8
120	150	0	−11	11	8	6	11	10	13			8
150	180	0	−13	13	10	7	13	10	14			8
180	250	0	−15	15	11	8	15	11	15			10
250	315	0	−18	18	14	9	18	13	18			11
315	400	0	−20	20	15	10	20	13	20			13
400	500	0	−23	23	17	12	23	15	23			15
500	630	0	−28	28	21	14	25	18	25			18
630	800	0	−35	35	26	18	30	20	30			20

1) This value included.
2) Do not apply to shielded bearings.
3) Apply to ball bearings.

Tolerance class P4

Inner ring

Deviations μm

Table 5.7

d mm		Δ_{dmp},Δ_{ds} 2)		V_{dp} Diameter series 7,8,9	V_{dp} Diameter series 0,1,2,3,4	V_{dmp}	K_{ia}	S_d	S_{ia} 3)	Δ_{Bs} all	Δ_{Bs} normal	Δ_{Bs} modified 4)	V_{Bs}
over	up to	high	low	max.	max.	max.	max.	max.	max.	high	low	low	max.
0,6 1)	2,5	0	−4	4	3	2	2,5	3	3	0	−40	−250	2,5
2,5	10	0	−4	4	3	2	2,5	3	3	0	−40	−250	2,5
10	18	0	−4	4	3	2	2,5	3	3	0	−80	−250	2,5
18	30	0	−5	5	4	2,5	3	4	4	0	−120	−250	2,5
30	50	0	−6	6	5	3	4	4	4	0	−120	−250	3
50	80	0	−7	7	5	3,5	4	5	5	0	−150	−250	4
80	120	0	−8	8	6	4	5	5	5	0	−200	−380	4
120	180	0	−10	10	8	5	6	6	7	0	−250	−380	5
180	250	0	−12	12	9	6	8	7	8	0	−300	−500	6

1) This value included.
2) Apply only to bearings of diameter series 0,1,2,3,4.
3) Apply only to ball bearings.
4) It refers to single bearing ring for paired mounting or stack mounting.

Outer ring

Deviations μm

Table 5.8

D mm		Δ_{Dmp},Δ_{Ds} 2)		V_{Dp} 3) Diameter series 7,8,9	V_{Dp} 3) Diameter series 0,1,2,3,4	V_{Dmp}	K_{ea}	S_D	S_{ea} 4)	Δ_{Cs}		V_{Cs}
over	up to	high	low	max.	max.	max.	max.	max.	max.	high	low	max.
2,5 1)	6	0	−4	4	3	2	3	4	5	Identical to Δ_{Bs} fot the inner ring		2,5
6	18	0	−4	4	3	2	3	4	5			2,5
18	30	0	−5	5	4	2,5	4	4	5			2,5
30	50	0	−6	6	5	3	5	4	5			2,5
50	80	0	−7	7	5	3,5	5	4	5			3
80	120	0	−8	8	6	4	6	5	6			4
120	150	0	−9	9	7	5	7	5	7			5
150	180	0	−10	10	8	5	8	5	8			5
180	250	0	−11	11	8	6	10	7	10			7
250	315	0	−13	13	10	7	11	8	10			7
315	400	0	−15	15	11	8	13	10	13			8

1) This value included.
2) Apply to bearings of diameter series 0,1,2,3 and 4.
3) Do not apply to sealed and shielded bearings.
4) Apply only to ball bearings.

Tolerance class P2

Inner ring

Deviations µm

Table 5.9

d mm		Δ_{dmp},Δ_{ds}		V_{dp}	V_{dmp}	K_{ia}	S_d	S_{ia} 2)	Δ_{Bs}		V_{Bs}
over	up to	high	low	max.	max.	max.	max.	max.	high	low	max.
0,61)	**2,5**	0	−2,5	2,5	1,5	1,5	1,5	1,5	0	−40	1,5
2,5	**10**	0	−2,5	2,5	1,5	1,5	1,5	1,5	0	−40	1,5
10	**18**	0	−2,5	2,5	1,5	1,5	1,5	1,5	0	−80	1,5
18	**30**	0	−2,5	2,5	1,5	2,5	1,5	2,5	0	−120	1,5
30	**50**	0	−2,5	2,5	1,5	2,5	1,5	2,5	0	−120	1,5
50	**80**	0	−4	4	2	2,5	1,5	2,5	0	−150	1,5
80	**120**	0	−5	5	2,5	2,5	2,5	2,5	0	−200	2,5
120	**150**	0	−7	7	3,5	2,5	2,5	2,5	0	−250	2,5
150	**180**	0	−7	7	3,5	5	4	5	0	−300	4
180	**250**	0	−8	8	4	5	5	5	0	−350	5

1) This value included.
2) Apply only to ball bearings.

Outer ring

Deviations µm

Table 5.10

D mm		Δ_{Dmp}-Δ_{Ds}		V_{Dp}	V_{Dmp}	K_{ea}	S_D 2)3)	S_{ea} 2)	Δ_{Cs}		V_{Cs}
over	up to	high	low	max.	max.	max.	max.	max.	high	low	max.
2,51)	6	0	−2,5	2,5	1,5	1,5	1,5	1,5	Identical to Δ_{Bs}		1,5
6	**18**	0	−2,5	2,5	1,5	1,5	1,5	1,5	for the inner-		1,5
18	**30**	0	−4	4	2	2,5	1,5	2,5	ring		1,5
30	**50**	0	−4	4	2	2,5	1,5	2,5			1,5
50	**80**	0	−4	4	2	4	1,5	4			1,5
80	**120**	0	−5	5	2,5	5	2,5	5			2,5
120	**150**	0	−5	5	2,5	5	2,5	5			2,5
150	**180**	0	−7	7	3,5	5	2,5	5			2,5
180	**250**	0	−8	8	4	7	4	7			4
250	**315**	0	−8	8	4	7	5	7			5
315	**400**	0	−10	10	5	8	7	8			7

1) This value included.
2) Do not apply to bearings with rib on the inner ring.
3) Apply only to ball bearings.

Tolerance class SP

Inner ring

Deviations μm

Tabelul 5.11

d mm		Cylindrical bore			Tapered bore										
		Δ_{dmp}VΔ_{ds}		V_{dp}	Δ_{ds}		V_{dp}	$\Delta_{d1mp}-\Delta_{dmp}$		Δ_{Bs}		V_{Bs}	K_{ia}	S_d	S_{ia}
over	up to	low	high	max.	low	high	max.	low	high	low	high	max.	max.	max.	max.
-	**18**	–5	0	3	–	–	–	–	–	–100	0	5	3	8	8
18	**30**	–6	0	3	0	+10	3	0	+4	–100	0	5	3	8	8
30	**50**	–8	0	4	0	+12	4	0	+4	–120	0	5	4	8	8
50	**80**	–9	0	5	0	+15	5	0	+5	–150	0	6	4	8	8
80	**120**	–10	0	5	0	+20	5	0	+6	–200	0	7	5	9	9
120	**180**	–13	0	7	0	+25	7	0	+8	–250	0	8	6	10	10
180	**250**	–15	0	8	0	+30	8	0	+10	–300	0	10	8	11	13
250	**315**	–18	0	9	0	+35	9	0	+12	–350	0	13	10	13	15
315	**400**	–23	0	12	0	+40	12	0	+13	–400	0	15	12	15	20
400	**500**	–28	0	14	0	+45	14	0	+15	–450	0	25	12	18	23
500	**630**	–35	0	18	0	+50	18	0	+17	–500	–	30	15	20	25

Outer ring

Deviations μm

Table 5.12

D mm		Δ_{Dmp},Δ_{Ds}		V_{Dp}	K_{ea}	S_D	S_{ea}	Δ_{Cs}	V_{Cs}
over	up to	low	high	max.	max.	max.	max.		
30	**50**	−7	0	4	5	8	8	Identical to Δ_{Bs} and V_{Bs} for the inner ring	
50	**80**	−9	0	5	5	8	10		
80	**120**	−10	0	5	6	9	11		
120	**150**	−11	0	6	7	10	13		
150	**180**	−13	0	7	8	10	14		
180	**250**	−15	0	8	10	11	15		
250	**315**	−18	0	9	11	13	18		
315	**400**	−20	0	10	13	13	20		
400	**500**	−23	0	12	15	15	23		
500	**600**	−28	0	14	17	18	25		
630	**800**	−35	0	18	20	20	30		

Tolerance class UP

Inner ring

Deviations μm

Table 5.13

d mm		Cylindrical bore			Tapered bore											
		Δ_{dmp},Δ_{ds}		V_{dp}	Δ_{ds}		V_{dp}	Δ_{d1mp}–Δ_{dmp}		Δ_{Bs}		V_{Bs}	K_{ia}	S_d	S_{ia}
over	up to	low	high	max.	low	high	max.	low	high	low	high	max.	max.	max.	max.
–	18	−4	0	2	–	–	–	–	–	−25	0	1,5	1,5	2	3
18	30	−5	0	3	0	+6	3	0	+2	−25	0	1,5	1,5	3	3
30	50	−6	0	3	0	+8	3	0	+3	−30	0	2	2	3	3
50	80	−7	0	4	0	+9	4	0	+3	−40	0	3	2	4	3
80	120	−8	0	4	0	+10	4	0	+4	−50	0	3	3	4	4
120	180	−10	0	5	0	+13	5	0	+5	−60	0	4	3	5	6
180	250	−12	0	6	0	+15	6	0	+7	−75	0	5	4	6	7
250	315	−18	0	9	0	+18	9	0	+8	−90	0	6	5	6	8
315	400	−23	0	12	0	+23	12	0	+9	−100	0	8	6	8	9
400	500	−28	0	14	0	+28	14	0	+10	−150	0	10	7	9	1
500	630	−35	0	18	0	+35	18	0	+11	−200	0	12	8	12	1

Outer ring

Deviations μm

Tabelul 5.14

D mm		Δ_{Dmp},Δ_{DS}		V_{Dp}	K_{ea}	S_D	S_{ea}	Δ_{Cs}	V_{Cs}
over	up to	low	high	max.	max.	max.	max.		
30	50	−5	0	3	3	2	4	Identical to Δ_{Bs} and V_{Bs} for the innr ring	
50	80	−6	0	3	3	2	4		
80	120	−7	0	4	3	3	5		
120	150	−8	0	4	4	3	6		
150	180	−9	0	5	4	3	7		
180	250	−10	0	5	5	4	9		
250	315	−12	0	6	6	4	9		
315	400	−14	0	7	7	5	12		
400	500	−23	0	12	8	–	12		
500	630	−28	0	14	10	–	14		
630	800	−35	0	18	12	–	17		

5.2. Tapered roller bearings

Tolerance class P0 and P6X

Inner ring

Deviations µm

Table 5.15

d mm		Δ_{dmp}		V_{dp}	V_{dmp}	K_{ia}
over	up to	high	low	max.	max.	max.
10 1)	18	0	–12	12	9	15
18	**30**	0	–12	12	9	18
30	**50**	0	–12	12	9	20
50	**80**	0	–15	15	11	25
80	**120**	0	–20	20	15	30
120	**180**	0	–25	25	19	35
180	**250**	0	–30	30	23	50
250	**315**	0	–35	35	26	60
315	**400**	0	–40	40	30	70

1) This value included.

Outer ring

Deviations µm

Table 5.16

D mm		Δ_{Dmp}		V_{Dp}	V_{Dmp}	K_{ea}
over	up to	high	low	max.	max.	max.
18 1)	**30**	0	–12	12	9	18
30	**50**	0	–14	14	11	20
50	**80**	0	–16	16	12	25
80	**120**	0	–18	18	14	35
120	**150**	0	–20	20	15	40
150	**180**	0	–25	25	19	45
180	**250**	0	–30	30	23	50
250	**315**	0	–35	35	26	60
315	**400**	0	–40	40	30	70
400	**500**	0	–45	45	34	80
500	**630**	0	–50	50	38	100

1) This value included.

Note: Limit deviations of the diameter D_1 of the outer ring rib for bearings with ribs are in accordance with tolerance class h9.

Tolerance class P0

Inner and outer ring

Deviations µm

Table 5.17

d mm		Δ_{Bs}, Δ_{Cs}		Δ_{Ts}		Δ_{T1s}		Δ_{T2s}	
over	up to	high	low	high	low	high	low	high	low
10 1)	18	0	–120	+200	0	+100	0	+100	0
18	**30**	0	–120	+200	0	+100	0	+100	0
30	**50**	0	–120	+200	0	+100	0	+100	0
50	**80**	0	–150	+200	0	+100	0	+100	0
80	**120**	0	–200	+200	–200	+100	–100	+100	–100
120	**180**	0	–250	+350	–250	+150	–150	+200	–100
180	**250**	0	–300	+350	–250	+150	–150	+200	–100
250	**315**	0	–350	+350	–250	+150	–150	+200	–100
315	**400**	0	–400	+400	–400	+200	–200	+200	–200

1) This value included.

Tolerance class P6X

Inner and outer ring

Diameter limit deviations and radial runout of the inner and outer ring for this tolerance class are the same as those of tolerance class P0.

Deviations µm

Table 5.18

d mm		Δ_{Bs}		Δ_{Cs}		Δ_{Ts}		Δ_{T1s}		Δ_{T2s}	
over	up to	high	low	high	low	high	low	high	low	high	low
10 1)	18	0	–50	0	–100	+100	0	+50	0	+50	0
18	**30**	0	–50	0	–100	+100	0	+50	0	+50	0
30	**50**	0	–50	0	–100	+100	0	+50	0	+50	0
50	**80**	0	–50	0	–100	+100	0	+50	0	+50	0
80	**120**	0	–50	0	–100	+100	0	+50	0	+50	0
120	**180**	0	–50	0	–100	+150	0	+50	0	+100	0
180	**250**	0	–50	0	–100	+150	0	+50	0	+100	0
250	**315**	0	–50	0	–100	+200	0	+100	0	+100	0
315	**400**	0	–50	0	–100	+200	0	+100	0	+100	0

1) This value included.

Tolerance class P5

Inner ring

Deviations µm

Table 5.19

d mm		Δ_{dmp}		V_{dp}	V_{dmp}	K_{ia}	S_d	Δ_{Bs}		Δ_{Ts}	
over	up to	high	low	max.	max.	max.	max.	high	low	high	low
10 1)	**18**	0	−7	5	5	5	7	0	−200	+200	−200
18	**30**	0	−8	6	5	5	8	0	−200	+200	−200
30	**50**	0	−10	8	5	6	8	0	−240	+200	−200
50	**80**	0	−12	9	6	7	8	0	−300	+200	−200
80	**120**	0	−15	11	8	8	9	0	−400	+200	−200
120	**180**	0	−18	14	9	11	10	0	−500	+350	−250
180	**250**	0	−22	17	11	13	11	0	−600	+350	−250

1) This value included.

Outer ring

Deviations µm

Table 5.20

D mm		Δ_{Dmp}		V_{Dp}	V_{Dmp}	K_{ea}	S_D	Δ_{Cs}	
over	up to	high	low	max.	max.	max.	max.	high	low
18 1)	**30**	0	−8	6	5	6	8		
30	**50**	0	−9	7	5	7	8	Identical to Δ_{Bs} for the inner ring	
50	**80**	0	−11	8	6	8	8		
80	**120**	0	−13	10	7	10	9		
120	**150**	0	−15	11	8	11	10		
150	**180**	0	−18	14	9	13	10		
180	**250**	0	−20	15	10	15	11		
250	**315**	0	−25	19	13	18	13		
315	**400**	0	−28	22	14	20	13		

1) This value included.

Note Limit deviations of diameter D_1 of the outer ring for bearings with ribs are in accordance with tolerance class h9.

Tolerance class P4

Inner ring

Deviations µm

Table 5.21

d mm		Δ_{dmp},Δ_{ds}		V_{dp}	V_{dmp}	K_{ia}	S_d	S_{ia}	Δ_{Bs}		Δ_{Ts}	
over	up to	high	low	max.	max.	max.	max.	max.	high	low	high	low
10$^{1)}$	**18**	0	–5	4	4	3	3	3	0	–200	+200	–200
18	**30**	0	–6	5	4	3	4	4	0	–200	+200	–200
30	**50**	0	–8	6	5	4	4	4	0	–240	+200	–200
50	**80**	0	–9	7	5	4	5	4	0	–300	+200	–200
80	**120**	0	–10	8	5	5	5	5	0	–400	+200	–200
120	**180**	0	–13	10	7	6	6	7	0	–500	+350	–250
180	**250**	0	–15	11	8	8	7	8	0	–600	+350	–250

1) This value included.

Outer ring

Deviations µm

Table 5.22

D mm		Δ_{Dmp},Δ_{Ds}		V_{Dp}	V_{Dmp}	K_{ea}	S_D	S_{ea}	Δ_{Cs}	
over	up to	high	low	max.	max.	max.	max.	max.	high	low
18	**30**	0	–6	5	4	4	4	5	Identical to Δ_{Bs} for the inner ring	
30	**50**	0	–7	5	5	5	4	5		
50	**80**	0	–9	7	5	5	4	5		
80	**120**	0	–10	8	5	6	5	6		
120	**150**	0	–11	8	6	7	5	7		
150	**180**	0	–13	10	7	8	5	8		
180	**250**	0	–15	11	8	10	7	10		
250	**315**	0	–18	14	9	11	8	10		
315	**400**	0	–20	15	10	13	10	13		

1) This value included.

Note Limit deviations of diameter D_1 of the outer ring for bearings with ribs are in accordance with tolerance class h9.

Tapered roller bearings, inch-metric sizes (AFBMA)

Inner ring–Δ_{dmp}

Deviations µm

Table 5.23

d mm		Tolerance classes									
		4		2		3		0		00	
over	up to	high	low	high	low	high	low	high	low	high	low
–	**76,2**	+13	0	+13	0	+13	0	+13	0	+8	0
76,2	**266,7**	+25	0	+25	0	+13	0	+13	0	+8	0
266,7	**304,8**	+25	0	+25	0	+13	0	+13	0	–	–
304,8	**609,6**	+51	0	+51	0	+25	0	–	–	–	–
609,6	**914,4**	+76	0	–	–	+38	0	–	–	–	–
914,4	**1 219,2**	+102	0	–	–	+51	0	–	–	–	–
1 219,2	–	+127	0	–	–	+76	0	–	–	–	–

Outer ring–Δ_{Dmp}

Deviations µm

Table 5.24

D mm		Tolerance classes									
		4		2		3		0		00	
over	up to	high	low	high	low	high	low	high	low	high	low
–	**266,7**	+25	0	+25	0	+13	0	+13	0	+8	0
266,7	**304,8**	+25	0	+25	0	+13	0	+13	0	–	–
304,8	**609,6**	+51	0	+51	0	+25	0	–	–	–	–
609,6	**914,4**	+76	0	+76	0	+38	0	–	–	–	–
914,4	**1 219,2**	+102	0	–	–	+51	0	–	–	–	–
1 219,2	–	+127	0	–	–	+76	0	–	–	–	–

Assembled bearing –K_{ia}, K_{ea}

Deviations µm

Table 5.25

D mm		Tolerance classes				
		4	2	3	0	00
over	up to	max.	max.	max.	max.	max.
–	**266,7**	51	38	8	4	2
266,7	**304,8**	51	38	8	4	–
304,8	**609,6**	51	38	18	–	–
609,6	**914,4**	76	51	51	–	–
914,4	–	76	–	76	–	–

Assembled bearing $-\Delta_{Ts}$

Deviations µm

Table 5.26

d mm		D mm		Tolerance classes 4		2		3		0		00	
over	up to	over	up to	high	low	high	low	high	low	high	low	high	low
–	101,6	–	–	+203	–	+203	0	+203	−203	+203	−203	+203	−203
101,6	**266,7**	–	–	+356	−254	+203	0	+203	−203	+203	−203	+203	−203
266,7	**304,8**	–	–	+356	−254	+203	0	+203	−203	+203	−203	–	–
304,8	**609,6**	–	**508,0**	+381	−381	+381	−381	+203	−203	–	–	–	–
304,8	**609,6**	**508,0**	–	+381	−381	+381	−381	+381	−381	–	–	–	–
609,6	–	–	–	+381	−381	–	–	+381	−381	–	–	–	–

Inner roller ring - standard outer ring assembly $-\Delta_{T1s}$

Deviations µm

Table 5.27

d mm		D mm		Tolerance classes 4		2		3		0		00	
over	up to	over	up to	high	low	high	low	high	low	high	low	high	low
–	**101,6**	–	–	+102	0	+102	0	+102	−102	+102	−102	+102	−102
101,6	**304,8**	–	–	+152	−152	+102	0	+102	−102	+102	−102	+102	−102
304,8	**609,6**	–	**508,0**	+178	−178	+178	−178	+102	−102	–	–	–	–
304,8	**609,6**	**508,0**	–	–	+178	−178	+178	−178	+178	−178	–	–	–
609,6	–	–	–	+178	−178	–	–	+178	−178	–	–	–	–

Outer ring with gauge inner ring assembly $-\Delta_{T2s}$

Abateri în µm

Tabelul 5.28

d mm		D mm		Tolerance classes 4		2		3		0		00	
over	up to	over	up to	high	low	high	low	high	low	high	low	high	low
–	**101,6**	–	–	+102	0	+102	0	+102	−102	+102	−102	+102	−102
101,6	**304,8**	–	–	+203	−102	+102	0	+102	−102	+102	−102	+102	−102
304,8	**609,6**	–	**508,0**	+203	−203	+203	−203	+102	−102	–	–	–	–
304,8	**609,6**	**508,0**	–	+203	−203	+203	−203	+203	−203	–	–	–	–
609,6	–	–	–	+203	−203	–	–	+203	−203	–	–	–	–

Tapered bore bearings
Taper 1:12

Deviations μm

Table 5.29

d mm		Normal tolerance class,P6 Δ_{dmp}		V_{dp} 1)	$\Delta_{d1mp}-\Delta_{dmp}$		Tolerance class P5 Δ_{dmp}		V_{dp} 1)	$\Delta_{d1mp}-\Delta_{dmp}$	
over	up to	high	low	max.	high	low	high	low	max.	high	low
18	**30**	+21	0	13	+21	0	+13	0	13	+13	0
30	**50**	+25	0	15	+25	0	+16	0	15	+16	0
50	**80**	+30	0	19	+30	0	+19	0	19	+19	0
80	**120**	+35	0	25	+35	0	+22	0	22	+22	0
120	**180**	+40	0	31	+40	0	+25	0	25	+25	0
180	**250**	+46	0	38	+46	0	+29	0	29	+29	0
250	**315**	+52	0	44	+52	0	+32	0	32	+32	0
315	**400**	+57	0	50	+57	0	+36	0	36	+36	0
400	**500**	+63	0	56	+63	0	+40	0	–	+40	0
500	**630**	+70	0	–	+70	0	+44	0	–	+44	0
630	**800**	+80	0	–	+80	0	+50	0	–	+50	0
800	**1 000**	+90	0	–	+90	0	+56	0	–	+56	0
1 000	**1 250**	+105	0	–	+105	0	+66	0	–	+66	0
1 250	**1 600**	+125	0	–	+125	0	+78	0	–	+78	0
1 600	**2 000**	+150	0	–	+150	0	+92	0	–	+92	0

1) Applies in all single radial planes of the bore.

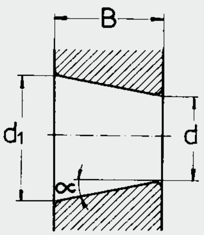
Taper 1:30

Deviations μm

Table 5.30

d mm		Normal tolerance class Δ_{dmp}		V_{dp} 1)	$\Delta_{d1mp}-\Delta_{dmp}$	
over	up to	high	low	max.	high	low
80	**120**	+20	0	25	+40	0
120	**180**	+25	0	31	+50	0
180	**250**	+30	0	38	+55	0
250	**315**	+35	0	44	+60	0
315	**400**	+40	0	50	+65	0
400	**500**	+45	0	56	+75	0
500	**630**	+50	0	63	+85	0
630	**800**	+75	0	–	+100	0
800	**1 000**	+100	0	–	+100	0
1 000	**1 250**	+125	0	–	+115	0
1 250	**1 600**	+160	0	–	+125	0
1 600	**2 000**	+200	0	–	+150	0

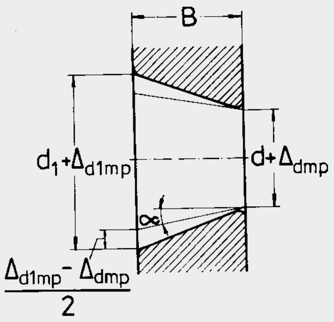
1) Applies in all singular planes.



Tapered bore
Half angle of taper, ∝

∝ = 2°23'9,4" (taper 1:12)

∝ = 0°57'17,4" (taper 1:30)



Nominal diameter, d_1 at the theoretical large end of bore

$d_1 = d + \frac{1}{12}B$ (taper 1:12)

$d_1 = d + \frac{1}{30}B$ (taper 1:30)

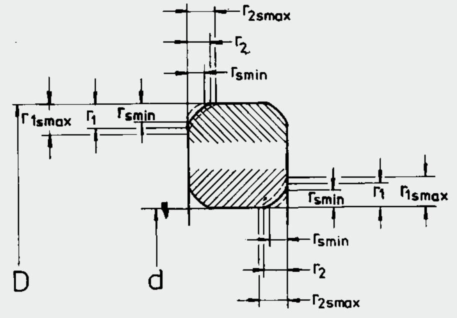
Mounting chamfer dimension tolerances

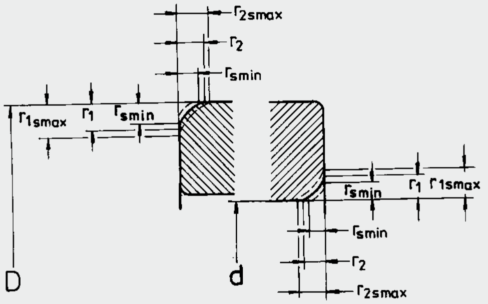
Symbols:
r_1,r_3 – chamfer dimension in radial direction,
r_2,r_4 – chamfer dimension in axial direction,
$r_{s\,min}$ – general symbol for minimum limit of r_1, r_2, r_3, r_4,
$r_{1s\,max}$, $r_{3s\,max}$ – maximum dimension in radial direction,
$r_{2s\,max}$, $r_{4s\,max}$ – maximum dimension in axial direction.

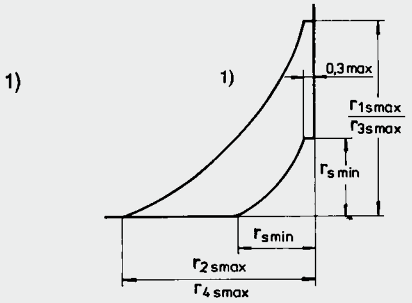
Mounting chamfer dimension limits for radial and thrust bearings

Values in mm **Table 5.37**

			Radial bearings		**Thrust bearings**
$r_{s\,min}$	**d**		**r_{1s},r_{3s}**	**r_{2s},r_{4s}**	**r_{1s},r_{2s}**
	over	up to	max.	max.	max.
0,1	–	–	0,2	0,4	0,2
0,15	–	–	0,3	0,6	0,3
0,2	–	–	0,5	0,8	0,5
0,3	–	40	0,6	1	0,8
	40	–	0,8	1	0,8
0,6	–	40	1	2	1,5
	40	–	1,3	2	1,5
1	–	50	1,5	3	2,2
	50	–	1,9	3	2,2
1,1	–	120	2	3,5	2,7
	120	–	2,5	4	2,7
1,5	–	120	2,3	4	3,5
	120	–	3	5	3,5
2	–	80	3	4,5	4
	220	–	3,8	6	4
	80	220	3,5	5	4
2,1	–	100	3,8	6	4,5
	–	280	4	6,5	4,5
	280	–	4,5	7	4,5
2,5	100	280	4,5	6	–
	280	–	5	7	–
3	–	280	5	8	5,5
	280	–	5,5	8	5,5
4	–	–	6,5	9	6,5
5	–	–	8	10	8
6	–	–	10	13	10
7,5	–	–	12,5	17	12,5
9,5	–	–	15	19	15
12	–	–	18	24	18
15	–	–	21	30	21
19	–	–	25	38	25







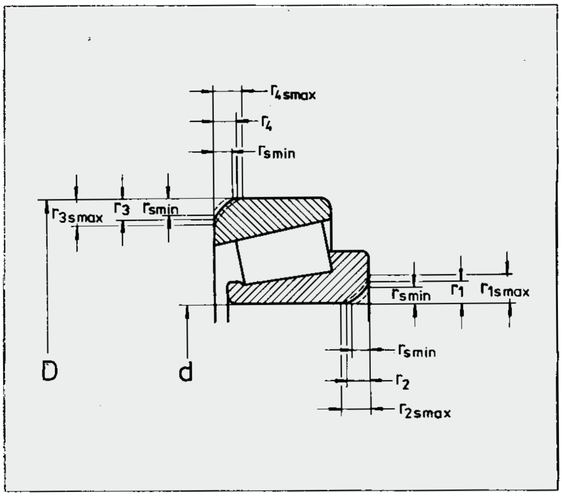
1) Only for d < 30 mm

Mounting chamfer dimension limits for tapered roller bearings

Values in mm

Table 5.38

r_s min.	d,D		r_{1s},r_{3s}	r_{2s},r_{4s}
	high	low	max.	max.
0,3	–	40	0,7	1,4
	40	–	0,9	1,6
0,6	–	40	1,1	1,7
	40	–	1,3	2
1	–	50	1,6	2,5
	50	–	1,9	3
1,5	–	120	2,3	3
	120	250	2,8	3,5
	250	–	3,5	4
2	–	120	2,8	4
	120	250	3,5	4,5
	250	–	4	5
	250	–	4,5	6
2,5	–	120	3,5	5
	120	250	4	5,5
3	–	120	4	5,5
	120	250	4,5	6,5
	250	400	5	7
	400	–	5,5	7,5
4	–	120	5	7
	120	250	5,5	7,5
	250	400	6	8
	400	–	6,5	8,5
5	–	180	6,5	8
	180	–	7,5	9
6	–	180	7,5	10
	180	–	9	11



Mounting chamfer dimension limits for tapered roller bearings (inch-metric sizes)

Values in mm

Table 5.39

Minimum values	**Inner ring Nominal bore diameter**		**Maximum values**		**Outer ring Nominal outer diameter**		**Maximum values**	
r_s min	**d**		**r_{1s}** max.	**r_{2s}** max.	**D**		**r_{3s}** max.	**r_{4s}** max.
	over	up to			over	up to		
See **bearing tables**	–	50,8	$r_{s\,min}+0{,}4$	$r_{s\,min}+0{,}9$	–	101,6	$r_{s\,min}+0{,}6$	$r_{s\,min}+1{,}1$
	50,8	101,6	$r_{s\,min}+0{,}5$	$r_{s\,min}+1{,}3$	101,6	168,3	$r_{s\,min}+0{,}6$	$r_{s\,min}+1{,}2$
	101,6	254	$r_{s\,min}+0{,}6$	$r_{s\,min}+1{,}8$	168,3	266,7	$r_{s\,min}+0{,}8$	$r_{s\,min}+1{,}4$
					266,7	355,6	$r_{s\,min}+1{,}7$	$r_{s\,min}+1{,}7$
1	254	–	1,9	3	355,6	–	1,9	3
1,5	254	–	3,5	4	355,6	–	3,5	4
2,5	254	–	4,5	6	355,6	–	4,5	6
3	254	–	5,5	7,5	355,6	–	5,5	7,5
3,3	254	–	6,5	9	355,6	–	6,5	9
3,5	254	–	6,5	9	355,6	–	6,5	9
6,4	254	–	12,5	17	355,6	–	12,5	17
8,5	254	–	15	19	355,6	–	15	19
9,7	254	–	15	19	355,6	–	15	19
19	254	–	25	38	355,6	–	25	38

6. Bearing materials

Due to various operating conditions and intricate aspects of deterioration phenomena, direct connections between mechanical characteristics and materials used for bearing manufacturing have been ascertained. Experimental studies proved that the following characteristics have to be considered, when appreciating the quality of bearing steels: rating life and contact fatigue loading, hardness at environment temperature and high temperatures, coefficient of expansion, tenacity, corrosion resistance and metallurgical conversion characteristics.

In case of normal applications and operating conditions, only the first two characteristics are of importance, the other being of importance only in case of bearings used for special applications.

Material behavior when being loaded at fatigue contact is difficult to be estimated due to the complexity of the factors involved while hardness can be estimated by classic methods.

These led to the selection of some steels, which are able to satisfy the main demands of normal and special operating conditions. The steels that meet the requirements for rings and rolling elements manufacturing are the following:

Chrome-alloy bearing steels

Steels with high carbon content (1%) and with chrome 1,5% have been chosen for bearing rings and rolling elements. Table 6.1 shows the chemical content of bearing steels used in Romania and also in Germany, U.S.A., Japan.

Case-hardening steels

Although case-hardening steels are not usually selected for bearing manufacturing, for certain applications they can be successfully used.

These steels are generally recommended for large-sized bearings and where bearings are operated under shock loads and vibrations.

Bearings manufactured of case-hardening steels are less liable to casual failure due to the ductile and soft core of these steels.

Table 6.2 shows the chemical content of the case-hardening bearing steels used in Romania and also in Germany, U.S.A., Japan.

Chemical content of bearing steels

Table 6.1

Country	Symbol	C	Si	Mn	P	S	Cr	Ni	Mo
		%							
Romania	**Rul 1V**	0,95–1,10	0,17–0,37	0,20–0,45	≤0,027	≤0,020	1,30–1,65	≤0,30	≤0,08
	Rul 2V	0,95–1,10	0,40–0,65	0,90–1,20	≤0,027	≤0,020	1,30–1,65	≤0,30	≤0,08
	Rul 3V	0,95–1,10	0,20–0,35	1,05–1,35	≤0,027	≤0,020	1,10–1,50	≤0,30	0,45–0,60
Germany	**105Cr4**	1,00–1,10	0,15–0,35	0,25–0,40	≤0,030	≤0,025	0,90–1,15	–	–
	100Cr6	0,90–1,05	0,15–0,35	0,25–0,40	≤0,025	≤0,025	1,40–1,65	–	–
	100CrMn6	0,90–1,05	0,50–0,70	1,00–1,20	≤0,025	≤0,020	1,40–1,65	–	–
USA	**E51100**	0,98–1,10	0,20–0,35	0,25–0,45	≤0,025	≤0,025	0,90–1,15	≤0,25	≤0,08
	E52100	0,98–1,10	0,20–0,35	0,25–0,45	≤0,025	≤0,025	1,30–1,60	≤0,25	≤0,08
	485Gr.4	0,98–1,10	0,20–0,35	1,05–1,35	≤0,025	≤0,025	1,90–1,40	≤0,25	0,45–0,65
Japan	**SUJ 2**	0,95–1,10	0,15–0,35	≤0,50	≤0,025	≤0,025	1,30–1,60	≤0,25	≤0,08
	SUJ 3	0,95–1,10	0,40–0,70	0,90–1,15	≤0,025	≤0,025	0,90–1,20	≤0,25	≤0,08

Chemical content of the case-hardening bearing steels

Table 6.2

Country	Symbol	C	Si	Mn	P	S	Cr	Ni	Mo
		%							
Romania	**20MoCrNi06V**	0,17–0,23	0,20–0,30	0,60–0,90	≤0,025	≤0,025	0,35–0,60	0,35–0,75	0,20–0,30
	13CrNi35V	0,09–0,13	0,17–0,37	0,30–0,60	≤0,025	≤0,025	1,25–1,65	3,25–3,75	–
	21MoMnCr12	0,18–0,24	0,17–0,37	0,80–1,20	≤0,025	≤0,025	1,00–1,40	–	0,20–0,30
	15Cr08Mo	0,12–0,18	0,17–0,37	0,40–0,70	≤0,025	≤0,025	0,70–1,00	–	0,08–0,15
Germany	**16MnCr5**	0,14–0,19	0,15–0,35	1,00–1,30	≤0,035	≤0,035	–	0,80–1,00	–
	20MnCr5	0,17–0,22	0,15–0,35	1,10–1,40	≤0,035	≤0,035	–	1,00–1,30	–
	15CrNi6	0,12–0,17	0,15–0,35	0,40–0,60	≤0,035	≤0,035	1,40–1,70	1,40–1,70	–
	18CrNi8	0,15–0,20	0,15–0,35	0,40–0,60	≤0,035	≤0,035	1,80–2,10	1,80–2,10	–
USA	**5120H**	0,17–0,23	0,15–0,30	0,60–1,00	≤0,025	≤0,025	–	0,60–1,00	–
	4118H	0,17–0,23	0,15–0,30	0,60–1,00	≤0,025	≤0,025	–	0,30–0,70	0,08–0,15
	8620H	0,17–0,23	0,15–0,30	0,60–0,95	≤0,025	≤0,025	0,35–0,75	0,35–0,65	0,15–0,25
	4320H	0,17–0,23	0,15–0,30	0,40–0,70	≤0,025	≤0,025	1,55–2,00	0,35–0,65	0,20–0,30
Japan	**SCr420H**	0,17–0,23	0,15–0,35	0,55–0,90	≤0,030	≤0,030	–	0,85–1,25	–
	SCM415H	0,12–0,18	0,15–0,35	0,55–0,90	≤0,030	≤0,030	–	0,85–1,25	0,15–0,35
	SCM420H	0,17–0,23	0,15–0,35	0,55–0,90	≤0,030	≤0,030	–	0,85–1,25	0,15–0,35
	SNCM220H	0,17–0,23	0,15–0,35	0,60–0,95	≤0,030	≤0,030	0,35–0,65	0,35–0,65	0,15–0,30
	SNCM420H	0,17–0,23	0,15–0,35	0,40–0,70	≤0,030	≤0,030	1,55–2,00	0,35–0,65	0,15–0,30

Heat treatment steels

For large sized-bearings of special design, with internal or external gearing, alloyed heat treatment steels are used.

Table 6.3 shows the chemical content of heat treatment bearing steels.

Bearing cages

Bearing cages are of great importance for bearing design.

The main purpose of the cage is to prevent immediate contact between two neighboring rolling elements and to guide them on raceways. Where bearings are of separable design, the cage also serves to retain the rolling elements when one bearing ring is removed during mounting and dismounting.

Considering the cage manufacturing technologies, they can be classified as follows:

- Pressed cages of steel sheet, low carbon content, for extra- deep drawing.
- Polyamide cages are used for some small and medium-sized bearings due to the following properties:
  - low density
  - high elasticity
  - low wear at sliding movement
  - low inertia moment

Heat-stabilized glass fibre reinforced polyamide 6.6 is the mostly used material. Maximum operating temperature for these cages must be of +120°C.

- Textolite cages, for high accuracy bearings, high speed operating.
- Machined cage of carbon steel, nodular cast iron and brass. These materials are generally used for cages of large-sized bearings.

Chemical content of the heat treatment bearing steels

Table 6.3

Country	Symbol	C	Si	Mn	P	S	Cr	Ni	Mo
		%							
Romania	**41MoCr11**	0,38–0,45	0,15–0,35	0,40–0,80	≤0,025	≤0,025	0,90–1,30	–	0,15–0,30
Germany	**42CrMo4**	0,42	0,25	0,65	≤0,035	≤0,035	1,05	–	0,20
USA	**4140** **(4142)**	0,38–0,43	0,20–0,35	0,75–1,00	≤0,035	≤0,035	0,80–1,10	–	0,15–0,25
Japan	**SCM4(H)**	0,37–0,44	0,15–0,35	0,55–0,90	≤0,030	≤0,030	0,85–1,25	–	0,15–0,35

7. Bearing applications

Locating bearings and non-locating bearings

Radial and axial loads in bearing units can be transmitted by locating and non-locating bearings.

A locating bearing is generally used for medium- and large-sized shafts that can reach high temperatures during operation. It has to support radially the shaft assembly and to locate it axially in both directions.

A non-locating bearing supports the shaft assembly only radially It also allows axial displacement in relation to the housing to take place so that additional axial loading is avoided.

Axial displacement can take place either in the housing bore seating or in the bearing itself.

In case the shaft is supported by more than two bearings, only one of them will be a locating bearing and it will be the one with the lightest radial load.

In case of small-sized shafts, two non-locating bearings with limited displacement can be used. Each of them can accommodate axial loads in a single direction, having thus mutual location.

Fig. 7.1 shows a few of the most representative applications of locating and non-locating bearings, as follows:

a) The locating bearing is a single row deep groove ball bearing and the non-locating one is a cylindrical roller bearing with both rings tightly fitted on the shaft and into the housing, respectively.

b) Both bearings are supported by spherical roller bearings. The locating bearing is tightly fitted both on the shaft and into the housing. The non-locating bearing has the outer ring mounted with clearance into the housing and thus allows axial displacement in both directions.

c) The locating bearing consists of two tapered roller bearings, pair mounted and the non-locating bearing consists of one cylindrical roller bearing, NU type, tightly fitted into the housing bore.

d) The locating bearing consists of a cylindrical roller bearing, NUP type and the non-locating bearing consists of a cylindrical roller bearing, NU type.

e) The locating bearing consists of a cylindrical roller bearing, NU type which takes over radial loads and of a four-point contact ball bearing (unloaded on the outside). The non-locating bearing consists of a cylindrical roller bearing, NU type.

f) The locating bearing consists of a needle roller bearing, NA type which takes over radial loads and of a single row deep groove ball bearing (unloaded on the outside) which takes over axial loads in both directions. The non-locating bearing consists of a needle roller bearing, NA type.

g) The shafts bearings can also be X-type arrangement of two tapered roller bearings which can be considered mutual located bearing.

Recommendation for bearing fit selection

Three main criteria have to be considered when selecting the bearing fit:

1. Firm location and uniform support of rings
2. Ease of mounting and dismounting
3. Axial displacement of non-locating bearing

The most common location is assured by a tight fit.

A high tightening is recommended for roller bearings and large- sized bearings in comparison to ball bearings of the same size.

In case of a tight fit, the inner ring is supported by the entire shaft contact surface, thus bearing is used at full load carrying capacity. When selecting the fit, one has to consider the difference of temperature which may occur between ring and shaft or between ring and housing.

The tolerance classes given in tables 7.1 and 7.3 are available for bearing fits which do not exceed +120 °C during operation.

As a general rule, the selection of the tolerance class "H" is recommended for bearings of separable design and tolerance class "J" for bearings of non-separable design.

When selecting a fit, the load of the rotating ring has to be considered, namely:

- If the inner ring rotates and the load is stationary, the outer ring should be mounted with clearance fit.
- If the inner ring rotates and the load is a rotating one, the outer ring should be mounted with tight fit.
- If the inner ring rotates and the direction of load is not determinated, both rings should be mounted with tight fit.

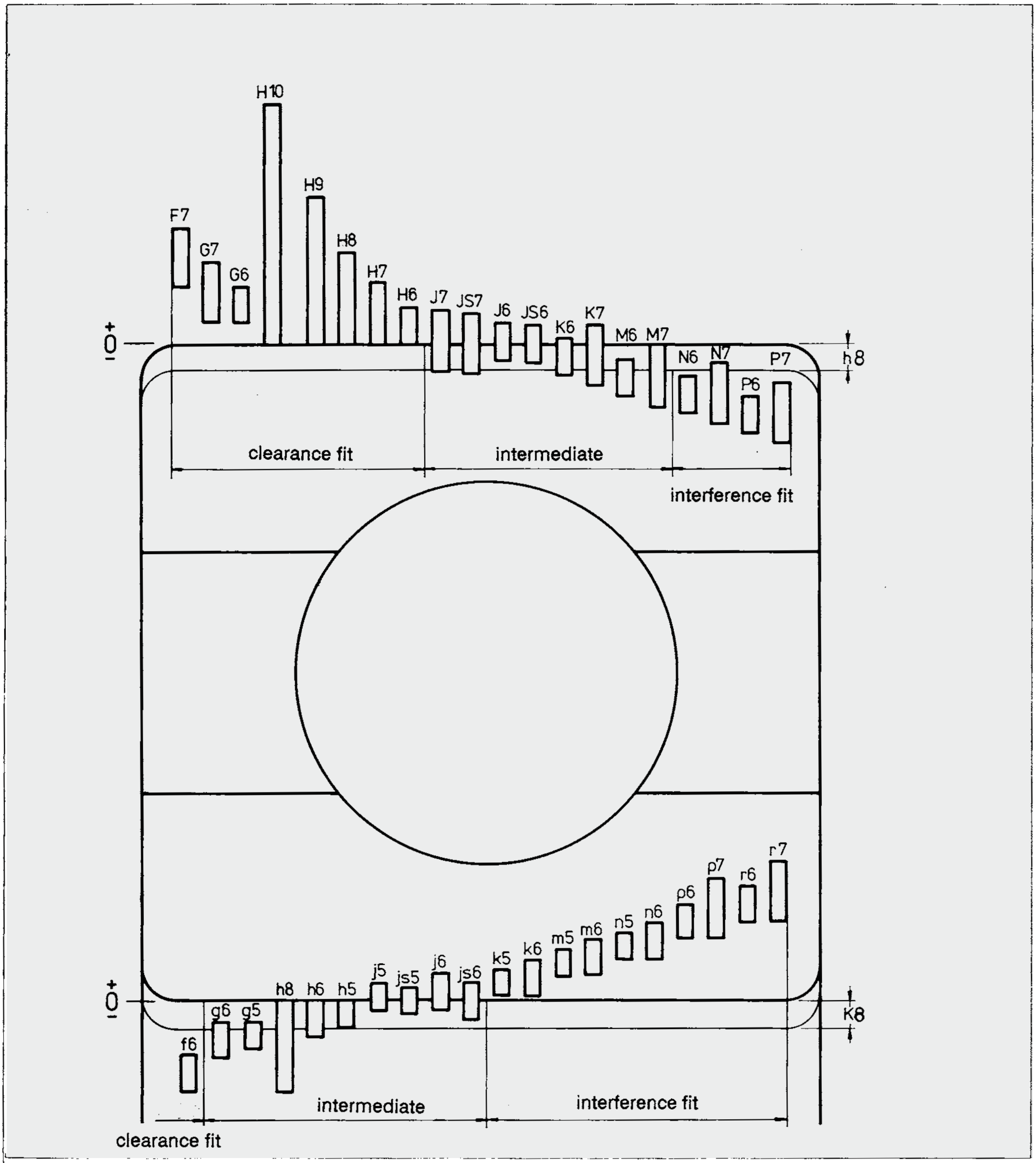

H10
H9
F7
H8
G7
G6
H7
H6
J7
JS7
J6
JS6
K6
K7
M6
M7
N6
N7
P7
P6
+
0
-
h8
clearance fit
intermediate
interference fit
r7
p7
r6
p6
n6
n5
m5
m6
k6
k5
j6
js6
j5
js5
h8
h6
h5
g6
g5
f6
+
0
-
K8
intermediate
interference fit
clearance fit

Fig.7.2

Bearings application

Tolerance classes for shafts

Table 7.1

Operating conditions	Examples	Shaft diameter (mm)		
		Ball bearings	**Needle and tapered roller bearings**	**Tolerance class symbol**
Radial bearings with cylindrical bore **Stationary inner ring load**				
Easy axial displacement of inner ring on shaft desirable	Wheels on non-rotating shafts (free wheels)	All diameters		g6(f6)
Axial displacement of inner ring on shaft not necessary	Tension pullyes, sheaves			h6
Rotating inner ring load				
Light and variable loads (P < 0,06C)	Conveyers lightly loaded mechanisms, bearings	18...100	≤40	j6
		> 100...140	> 40...100	k6
Normal and heavy loads (P > 0,06C)	General mechanical engineering, electric motors, turbines, pups, gearboxes, woodworking machines	≤18	–	j5
		> 18...100	≤40	k5(k6)
		> 100...140	> 40...100	m5(m6)
		> 140...200	> 100...140	m6
		> 200...280	> 140...200	n6
		–	> 200...400	p6
		–	–	r6
		–	–	r7
Heavy loads and shock loads, ardous working conditions (P > 0,12C)	Heavy duty railway vehicles axle bearings, traction motors, rolling mills	–	> 50...140	n6
		–	> 140...200	p6
		–	> 200	r6
High running accuracy, light loads (P < 0,06C)	Machine tools	≤18	–	h5
		> 18...100	≤40	j5
		> 100...200	> 40...140	k5
		–	> 140...200	m5
Axial loads				
	All kind of bearing application	≤250	≤250	j6
		> 250	> 250	js6

Bearings application

Shaft fits

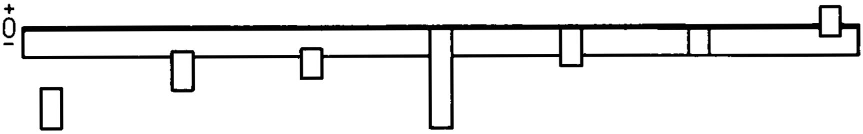


Table 7.2

Shaft Diameter d nominal		Bearing Bore diameter tolerance Δdmp		Deviations of shaft diameter, resultant fits Tolerances a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance														
over	up to	low	high		f6		g6		g5		h8		h6		h5		j5	
mm		µm																
1	3	−8	0	a)	−6	−12	−2	−8	−2	−6	0	−14	0	−6	0	−4	+2	−2
				b)	+2	−12	+6	−8	+6	−6	+8	−14	+8	−6	+8	−4	+10	−2
				c)	0	−10	+4	−6	+5	−5	+6	−12	+6	−4	+7	−3	+9	−1
3	6	−8	0		−10	−18	−4	−12	−4	−9	0	−18	0	−8	0	−5	+3	−2
					−2	−18	+4	−12	+4	−9	+8	−18	+8	−8	+8	−5	+11	−2
					−4	−16	+2	−10	+3	−8	+5	−15	+6	−6	+7	−4	+10	−1
6	10	−8	0		−13	−22	−5	−14	−5	−11	0	−22	0	−9	0	−6	+4	−2
					−5	−22	+3	−14	+3	−11	+8	−22	+8	−9	+8	−6	+12	−2
					−7	−20	+1	−12	+1	−9	+5	−19	+6	−7	+6	−4	+10	0
10	18	−8	0		−16	−27	−6	−17	−6	−14	0	−27	0	−11	0	−8	+5	−3
					−8	−27	+2	−17	+2	−14	+8	−27	+8	−11	+8	−8	+13	−3
					−10	−25	0	−15	0	−12	+5	−24	+6	−9	+6	−6	+11	−1
18	30	−10	0		−20	−33	−7	−20	−7	−16	0	−33	0	−13	0	−9	+5	−4
					−10	−33	+3	−20	+3	−16	+10	−33	+10	−13	+10	−9	+15	−4
					−13	−30	0	−17	+1	−14	+6	−29	+7	−10	+8	−7	+13	−2
30	50	−12	0		−25	−41	−9	−25	−9	−20	0	−39	0	−16	0	−11	+6	−5
					−13	−41	+3	−25	+3	−20	+12	−39	+12	−16	+12	−11	+18	−5
					−17	−37	−1	−21	0	−17	+7	−34	+8	−12	+9	−8	+15	−2
50	80	−15	0		−30	−49	−10	−29	−10	−23	0	−46	0	−19	0	−13	+6	−7
					−15	−49	+5	−29	+5	−23	+15	−46	+15	−19	+15	−13	+21	−7
					−19	−45	+1	−25	+1	−19	+9	−40	+11	−15	+11	−9	+17	−3
80	120	−20	0		−36	−58	−12	−34	−12	−27	0	−54	0	−22	0	−15	+6	−9
					−16	−58	+8	−34	+8	−27	+20	−54	+20	−22	+20	−15	+26	−9
					−22	−52	+2	−28	+3	−22	+12	−46	+14	−16	+15	−10	+21	−4
120	180	−25	0		−43	−68	−14	−39	−14	−32	0	−63	0	−25	0	−18	+7	−11
					−18	−68	+11	−39	+11	−32	+25	−63	+25	−25	+25	−18	+32	−11
					−25	−61	+4	−32	+5	−26	+15	−53	+18	−18	+19	−12	+26	−5
180	250	−30	0		−50	−79	−15	−44	−15	−35	0	−72	0	−29	0	−20	+7	−13
					−20	−79	+15	−44	+15	−35	+30	−72	+30	−29	+30	−20	+37	−13
					−28	−71	+7	−36	+9	−29	+18	−60	+22	−21	+24	−14	+31	−7
250	315	−35	0		−56	−88	−17	−49	−17	−40	0	−81	0	−32	0	−23	+7	−16
					−21	−88	+18	−49	+18	−40	+35	−81	+35	−32	+35	−23	+42	−16
					−30	−79	+9	−40	+10	−32	+22	−68	+26	−23	+27	−15	+34	−8
315	400	−40	0		−62	−98	−18	−54	−18	−43	0	−89	0	−36	0	−25	+7	−18
					−22	−98	+22	−54	+22	−43	+40	−89	+40	−36	+40	−25	+47	−18
					−33	−87	+11	−43	+14	−35	+25	−74	+29	−25	+32	−17	+39	−10
400	500	−45	0		−68	−108	−20	−60	−20	−47	0	−97	0	−40	0	−27	+7	−20
					−23	−108	+25	−60	+25	−47	+45	−97	+45	−40	+45	−27	+52	−20
					−35	−96	+13	−48	+16	−38	+28	−80	+33	−28	+36	−18	+43	−11

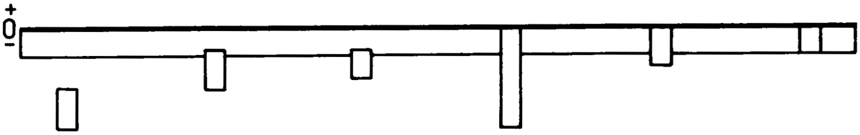


Table 7.2 (continued)

Shaft Diameter d nominal		Bearing Bore diameter tolerance Δdmp		Deviations of shaft diameter, resultant fits Tolerances a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance	f6		g6		g5		h8		h6		h5	
over	up to	low	high													
mm		µm														
500	**630**	**−50**	**0**	a)	−76	−120	−22	−66	−22	−50	0	−110	0	−44	0	−28
				b)	−26	−120	+28	−66	+28	−50	+50	−110	+50	−44	+50	−28
				c)	−39	−107	+15	−53	+18	−40	+31	−91	+37	−31	+40	−18
630	**800**	**−75**	**0**		−80	−130	−24	−74	−24	−56	0	−125	0	−50	0	−32
					−5	−130	+51	−74	+51	−56	+75	−125	+75	−50	+75	−32
					−22	−113	+34	−57	+39	−44	+48	−98	+58	−33	+63	−20
800	**1 000**	**−100**	**0**		−86	−142	−26	−82	−26	−62	0	−140	0	−56	0	−36
					+14	−142	+74	−82	+74	−62	+100	−140	+100	−56	+100	−36
					−6	−122	+54	−62	+60	−48	+67	−107	+80	−36	+86	−22
1 000	**1 250**	**−125**	**0**		−98	−164	−28	−94	−28	−70	0	−165	0	−66	0	−42
					+27	−164	+97	−94	+97	−70	+125	−165	+125	−66	+125	−42
					+3	−140	+73	−70	+80	−53	+84	−124	+101	−42	+108	−25
1 250	**1 600**	**−160**	**0**		−110	−188	−30	−108	−30	−80	0	−195	0	−78	0	−50
					+50	−188	+130	−108	+130	−80	+160	−195	+160	−78	+160	−50
					+20	−158	+100	−78	+109	−59	+109	−144	+130	−48	+139	−29
1 600	**2 000**	**−200**	**0**		−120	−212	−32	−124	−32	−92	0	−230	0	−92	0	−60
					+80	−212	+168	−124	+168	−92	+200	−230	+200	−92	+200	−60
					+45	−177	+133	−89	+143	−67	+138	−168	+165	−57	+175	−35

Bearings application

Shaft fits

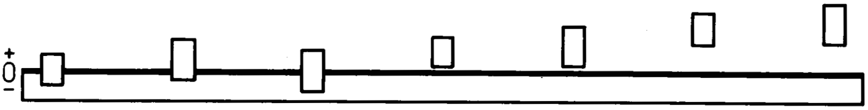


Table 7.2 (continued)

Shaft Diameter d nominal		Bearing Bore diameter tolerance Δdmp		Deviations of shaft diameter, resultant fits Tolerances	js5		j6		js6		k5		k6		m5		m6	
over	up to	low	high	a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance														
mm		µm																
1	**3**	**−8**	**0**	a)	+2	−2	+4	−2	+3	−3	+4	0	+6	0	+6	+2	+8	+2
				b)	+10	−2	+12	−2	+11	−3	+12	0	+14	0	+14	+2	+16	+2
				c)	+9	−1	+10	0	+9	−1	+11	+1	+12	+2	+13	+3	+14	+4
3	**6**	**−8**	**0**		+2,5	−2,5	+6	−2	+4	−4	+6	+1	+9	+1	+9	+4	+12	+4
					+10,5	−2,5	+14	−2	+12	−4	+14	+1	+17	+1	+17	+4	+20	+4
					+9	−1	+12	0	+10	−2	+13	+2	+15	+3	+16	+5	+18	+6
6	**10**	**−8**	**0**		+3	−3	+7	−2	+4,5	−4,5	+7	+1	+10	+1	+12	+6	+15	+6
					+11	−3	+15	−2	+12,5	−4,5	+15	+1	+18	+1	+20	+6	+23	+6
					+9	−1	+13	0	+11	−3	+13	+3	+16	+3	+18	+8	+21	+8
10	**18**	**−8**	**0**		+4	−4	+8	−3	+5,5	−5,5	+9	+1	+12	+1	+15	+7	+18	+7
					+12	−4	+16	−3	+13,5	−5,5	+17	+1	+20	+1	+23	+7	+26	+7
					+10	−2	+14	−1	+11	−3	+15	+3	+18	+3	+21	+9	+24	+9
18	**30**	**−10**	**0**		+4,5	−4,5	+9	−4	+6,5	−6,5	+11	+2	+15	+2	+17	+8	+21	+8
					+14,5	−4,5	+19	−4	+16,5	−6,5	+21	+2	+25	+2	+27	+8	+31	+8
					+12	−2	+16	−1	+14	−4	+19	+4	+22	+5	+25	+10	+28	+11
30	**50**	**−12**	**0**		+5,5	−5,5	+11	−5	+8	−8	+13	+2	+18	+2	+20	+9	+25	+9
					+17,5	−5,5	+23	−5	+20	−8	+25	+2	+30	+2	+32	+9	+37	+9
					+15	−3	+19	−1	+16	−4	+22	+5	+26	+6	+29	+12	+33	+13
50	**80**	**−15**	**0**		+6,5	−6,5	+12	−7	+9,5	−9,5	+15	+2	+21	+2	+24	+11	+30	+11
					+21,5	−6,5	+27	−7	+24,5	−9,5	+30	+2	+36	+2	+39	+11	+45	+11
					+18	−3	+23	−3	+20	−5	+26	+6	+32	+6	+35	+15	+41	+15
80	**120**	**−20**	**0**		+7,5	−7,5	+13	−9	+11	−11	+18	+3	+25	+3	+28	+13	+35	+13
					+27,5	−7,5	+33	−9	+31	−11	+38	+3	+45	+3	+48	+13	+55	+13
					+23	−3	+27	−3	+25	−5	+33	+8	+39	+9	+43	+18	+49	+19
120	**180**	**−25**	**0**		+9	−9	+14	−11	+12,5	−12,5	+21	+3	+28	+3	+33	+15	+40	+15
					+34	−9	+39	−11	+37,5	−12,5	+46	+3	+53	+3	+58	+15	+65	+15
					+28	−3	+32	−4	+31	−6	+40	+9	+46	+10	+52	+21	+58	+22
180	**250**	**−30**	**0**		+10	−10	+16	−13	+14,5	−14,5	+24	+4	+33	+4	+37	+17	+46	+17
					+40	−10	+46	−13	+44,5	−14,5	+54	+4	+63	+4	+67	+17	+76	+17
					+34	−4	+38	−5	+36	−6	+48	+10	+55	+12	+61	+23	+68	+25
250	**315**	**−35**	**0**		+11,5	−11,5	+16	−16	+16	−16	+27	+4	+36	+4	+43	+20	+52	+20
					+46,5	−11,5	+51	−16	+51	−16	+62	+4	+71	+4	+78	+20	+87	+20
					+39	−4	+42	−7	+42	−7	+54	+12	+62	+13	+70	+28	+78	+29
315	**400**	**−40**	**0**		+12,5	−12,5	+18	−18	+18	−18	+29	+4	+40	+4	+46	+21	+57	+21
					+52,5	−12,5	+58	−18	+58	−18	+69	+4	+80	+4	+86	+21	+97	+21
					+44	−4	+47	−7	+47	−7	+61	+12	+69	+15	+78	+29	+86	+32
400	**500**	**−45**	**0**		+13,5	−13,5	+20	−20	+20	−20	+32	+5	+45	+5	+50	+23	+63	+23
					+58,5	−13,5	+65	−20	+65	−20	+77	+5	+90	+5	+95	+23	+108	+23
					+49	−4	+53	−8	+53	−8	+68	+14	+78	+17	+86	+32	+96	+35

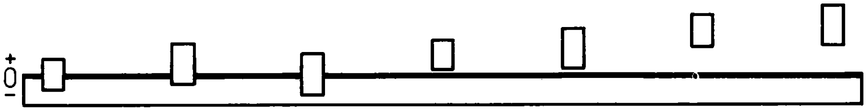
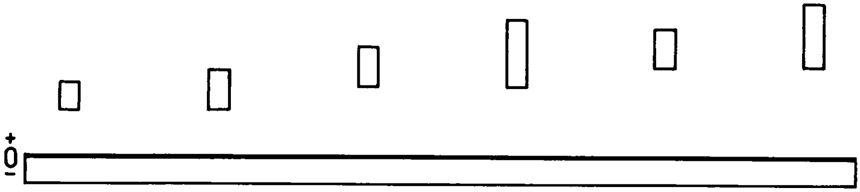


Table 7.2 (continued)

Shaft Diameter d nominal		Bearing Bore diameter tolerance Δdmp		Deviations of shaft diameter, resultant fits Tolerances														
					js5		j6		js6		k5		k6		m5		m6	
over	up to	low	high	a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance														
mm		µm																
500	630	−50	0	a)	+14	−14	+22	−22	+22	−22	+29	0	+44	0	+55	+26	+70	+26
				b)	+64	−14	+72	−22	+72	−22	+78	0	+94	0	+104	+26	+120	+26
				c)	+54	−4	+59	−9	+59	−9	+68	+10	+81	+13	+94	+36	+107	+39
630	800	−75	0		+16	−16	+25	−25	+25	−25	+32	0	+50	0	+62	+30	+80	+30
					+91	−16	+100	−25	+100	−25	+107	0	+125	0	+137	+30	+155	+30
					+79	−4	+83	−8	+83	−8	+95	+12	+108	+17	+125	+42	+138	+47
800	1 000	−100	0		+18	−18	+28	−28	+28	+28	+36	0	+56	0	+70	+34	+90	+34
					+118	−18	+128	−28	+128	−28	+136	0	+156	0	+170	+34	+190	+34
					+104	−4	+108	−8	+108	−8	+122	+14	+136	+20	+156	+48	+170	+54
1 000	1 250	−125	0		+21	−21	+33	−33	+33	−33	+42	0	+66	0	+82	+40	+106	+40
					+146	−21	+158	−33	+158	−33	+167	0	+191	0	+207	+40	+231	+40
					+129	−4	+134	−9	+134	−9	+150	+17	+167	+24	+190	+57	+207	+64
1 250	1 600	−160	0		+25	−25	+39	−39	+39	−39	+50	0	+78	0	+98	+48	+126	+48
					+185	−25	+199	−39	+199	−39	+210	0	+238	0	+258	+48	+286	+48
					+164	−4	+169	−9	+169	−9	+189	+21	+208	+30	+237	+69	+256	+78
1 600	2 000	−200	0		+30	−30	+46	−46	+46	−46	+60	0	+92	0	+118	+58	+150	+58
					+230	−30	+246	−46	+246	−46	+260	0	+292	0	+318	+58	+350	+58
					+205	−5	+211	−11	+211	−11	+235	+25	+257	+35	+293	+83	+315	+93

Bearings application

Shaft fits



Tabelul 7.2 (continued)

Shaft Diameter d nominal		Bearing Bore diameter tolerance Δ_{dmp}		Deviations of shaft diameter, resultant fits Tolerances a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance												
over	up to	low	high		n5		n6		p6		p7		r6		r7	
mm		µm														
1	3	−8	0	a)	+8	+4	+10	+4	+12	+6	+16	+6	+16	+10	+20	+10
				b)	+16	+4	+18	+4	+20	+6	+24	+6	+24	+10	+28	+10
				c)	+15	+5	+16	+6	+18	+8	+22	+8	+22	+12	+26	+12
3	6	−8	0		+13	+8	+16	+8	+20	+12	+24	+12	+23	+15	+27	+15
					+21	+8	+24	+8	+28	+12	+32	+12	+31	+15	+35	+15
					+20	+9	+22	+10	+26	+14	+30	+14	+29	+17	+33	+17
6	10	−8	0		+16	+10	+19	+10	+24	+15	+30	+15	+28	+19	+34	+19
					+24	+10	+27	+10	+32	+15	+38	+15	+36	+19	+42	+19
					+22	+12	+25	+12	+30	+17	+35	+18	+34	+21	+39	+22
10	18	−8	0		+20	+12	+23	+12	+29	+18	+36	+18	+34	+23	+41	+23
					+28	+12	+31	+12	+37	+18	+44	+18	+42	+23	+49	+23
					+26	+14	+29	+14	+35	+20	+41	+21	+40	+25	+46	+26
18	30	−10	0		+24	+15	+28	+15	+35	+22	+43	+22	+41	+28	+49	+28
					+34	+15	+38	+15	+45	+22	+53	+22	+51	+28	+59	+28
					+32	+17	+35	+18	+42	+25	+50	+25	+48	+31	+56	+31
30	50	−12	0		+28	+17	+33	+17	+42	+26	+51	+26	+50	+34	+59	+34
					+40	+17	+45	+17	+54	+26	+63	+26	+62	+34	+71	+34
					+37	+20	+41	+21	+50	+30	+59	+30	+58	+38	+67	+38
50	65	−15	0		+33	+20	+39	+20	+51	+32	+62	+32	+60	+41	+71	+41
					+48	+20	+54	+20	+66	+32	+77	+32	+75	+41	+86	+41
					+44	+24	+50	+24	+62	+36	+72	+37	+71	+45	+81	+46
65	80	−15	0		+33	+20	+39	+20	+51	+32	+62	+32	+62	+43	+73	+43
					+48	+20	+54	+20	+66	+32	+77	+32	+77	+43	+88	+43
					+44	+24	+50	+24	+62	+36	+72	+37	+73	+47	+83	+48
80	100	−20	0		+38	+23	+45	+23	+59	+37	+72	+37	+73	+51	+86	+51
					+58	+23	+65	+23	+79	+37	+92	+37	+93	+51	+106	+51
					+53	+28	+59	+29	+73	+43	+85	+44	+87	+57	+99	+58
100	120	−20	0		+38	+23	+45	+23	+59	+37	+72	+37	+76	+54	+89	+54
					+58	+23	+65	+23	+79	+37	+92	+37	+96	+54	+109	+54
					+53	+28	+59	+29	+73	+43	+85	+44	+90	+60	+102	+61
120	140	−25	0		+45	+27	+52	+27	+68	+43	+83	+43	+88	+63	+103	+63
					+70	+27	+77	+27	+93	+43	+108	+43	+113	+63	+128	+63
					+64	+33	+70	+34	+86	+50	+100	+51	+106	+70	+120	+71
140	160	−25	0		+45	+27	+52	+27	+68	+43	+83	+43	+90	+65	+105	+65
					+70	+27	+77	+27	+93	+43	+108	+43	+115	+65	+130	+65
					+64	+33	+70	+34	+86	+50	+100	+51	+108	+72	+122	+73
160	180	−25	0		+45	+27	+52	+27	+68	+43	+83	+43	+93	+68	+108	+68
					+70	+27	+77	+27	+93	+43	+108	+43	+118	+68	+133	+68
					+64	+33	+70	+34	+86	+50	+100	+51	+111	+75	+125	+76

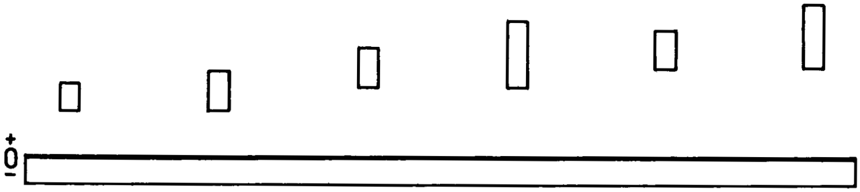


Table 7.2 (continued)

Shaft Diameter d nominal		**Bearing Bore diameter tolerance Δdmp**		**Deviations of shaft diameter, resultant fits Tolerances** a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance												
over	**up to**	**low**	**high**		**n5**		**n6**		**p6**		**p7**		**r6**		**r7**	
mm		µm														
180	**200**	**−30**	**0**	a)	+51	+31	+60	+31	+79	+50	+96	+50	+106	+77	+123	+77
				b)	+81	+31	+90	+31	+109	+50	+126	+50	+136	+77	+153	+77
				c)	+75	+37	+82	+39	+101	+58	+116	+60	+128	+85	+143	+87
200	**225**	**−30**	**0**		+51	+31	+60	+31	+79	+50	+96	+50	+109	+80	+126	+80
					+81	+31	+90	+31	+109	+50	+126	+50	+139	+80	+156	+80
					+75	+37	+82	+39	+101	+58	+116	+60	+131	+88	+146	+90
225	**250**	**−30**	**0**		+51	+31	+60	+31	+79	+50	+96	+50	+113	+84	+130	+84
					+81	+31	+90	+31	+109	+50	+126	+50	+143	+84	+160	+84
					+75	+37	+82	+39	+101	+58	+116	+60	+135	+92	+150	+94
250	**280**	**−35**	**0**		+57	+34	+66	+34	+88	+56	+108	+56	+126	+94	+146	+94
					+92	+34	+101	+34	+123	+56	+143	+56	+161	+94	+181	+94
					+84	+42	+92	+43	+114	+65	+131	+68	+152	+103	+169	+106
280	**315**	**−35**	**0**		+57	+34	+66	+34	+88	+56	+108	+56	+130	+98	+150	+98
					+92	+34	+101	+34	+123	+56	+143	+56	+165	+98	+185	+98
					+84	+42	+92	+43	+114	+65	+131	+68	+156	+107	+173	+110
315	**355**	**−40**	**0**		+62	+37	+73	+37	+98	+62	+119	+62	+144	+108	+165	+108
					+102	+37	+113	+37	+138	+62	+159	+62	+184	+108	+205	+108
					+94	+45	+102	+48	+127	+73	+146	+75	+173	+119	+192	+121
355	**400**	**−40**	**0**		+62	+37	+73	+37	+98	+62	+119	+62	+150	+114	+171	+114
					+102	+37	+113	+37	+138	+62	+159	+62	+190	+114	+211	+114
					+94	+45	+102	+48	+127	+73	+146	+75	+179	+125	+198	+127
400	**450**	**−45**	**0**		+67	+40	+80	+40	+108	+68	+131	+68	+166	+126	+189	+126
					+112	+40	+125	+40	+153	+68	+176	+68	+211	+126	+234	+126
					+103	+49	+113	+52	+141	+80	+161	+83	+199	+138	+219	+141
450	**500**	**−45**	**0**		+67	+40	+80	+40	+108	+68	+131	+68	+172	+132	+195	+132
					+112	+40	+125	+40	+153	+68	+176	+68	+217	+132	+240	+132
					+103	+49	+113	+52	+141	+80	+161	+83	+205	+144	+225	+147
500	**560**	**−50**	**0**		+73	+44	+88	+44	+122	+78	+148	+78	+194	+150	+220	+150
					+122	+44	+138	+44	+172	+78	+198	+78	+244	+150	+270	+150
					+112	+54	+125	+57	+159	+91	+182	+94	+231	+163	+254	+166
560	**630**	**−50**	**0**		+73	+44	+88	+44	+122	+78	+148	+78	+199	+155	+225	+155
					+122	+44	+138	+44	+172	+78	+198	+78	+249	+155	+275	+155
					+112	+54	+125	+57	+159	+91	+182	+94	+236	+168	+259	+171
630	**710**	**−75**	**0**		+82	+50	+100	+50	+138	+88	+168	+88	+225	+175	+255	+175
					+157	+50	+175	+50	+213	+88	+243	+88	+300	+175	+330	+175
					+145	+62	+158	+67	+196	+105	+221	+110	+283	+192	+308	+197
710	**800**	**−75**	**0**		+82	+50	+100	+50	+138	+88	+168	+88	+235	+185	+265	+185
					+157	+50	+175	+50	+213	+88	+243	+88	+310	+185	+340	+185
					+145	+62	+158	+67	+196	+105	+221	+110	+293	+202	+318	+207

Bearings application

Shaft fits

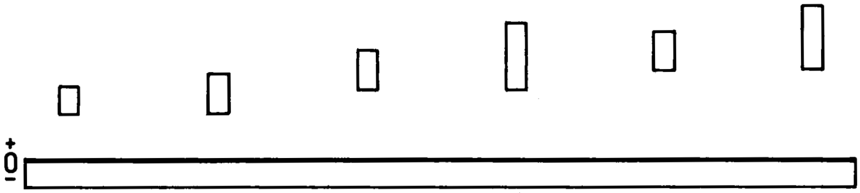
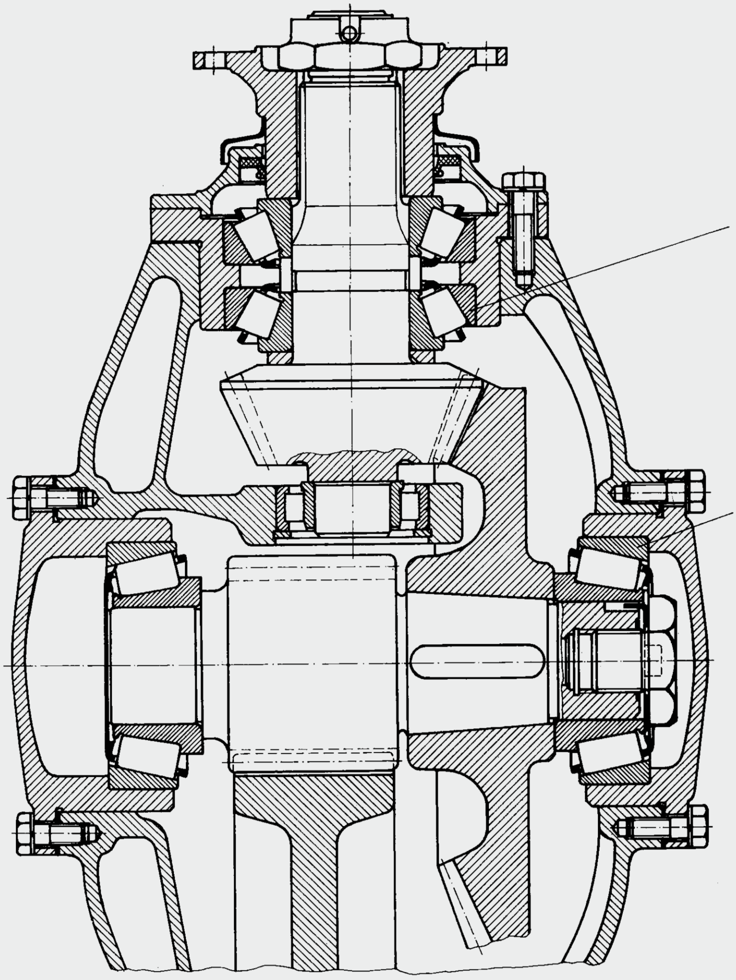


Table 7.2 (continued)

Shaft Diameter d nominal		Bearing Bore diameter tolerance Δ_{dmp}		Deviations of shaft diameter, resultant fits Tolerances a) Deviations (shaft diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance												
over	up to	low	high		n5		n6		p6		p7		r6		r7	
mm		µm														
800	900	−100	0	a)	+92	+56	+112	+56	+156	+100	+190	+100	+266	+210	+300	+210
				b)	+192	+56	+212	+56	+256	+100	+290	+100	+366	+210	+400	+210
				c)	+178	+70	+192	+76	+236	+120	+263	+127	+346	+230	+373	+237
900	1 000	−100	0		+92	+56	+112	+56	+156	+100	+190	+100	+276	+220	+310	+220
					+192	+56	+212	+56	+256	+100	+290	+100	+376	+220	+410	+220
					+178	+70	+192	+76	+236	+120	+263	+127	+356	+240	+383	+247
1 000	1 120	−125	0		+108	+66	+132	+66	+186	+120	+225	+120	+326	+250	+355	+250
					+233	+66	+257	+66	+311	+120	+350	+120	+441	+250	+480	+250
					+216	+83	+233	+90	+287	+144	+317	+153	+417	+274	+447	+283
1 120	1 250	−125	0		+108	+66	+132	+66	+186	+120	+225	+120	+326	+260	+365	+260
					+233	+66	+257	+66	+311	+120	+350	+120	+451	+260	+490	+260
					+216	+83	+233	+90	+287	+144	+317	+153	+427	+284	+457	+293
1 250	1 400	−160	0		+128	+78	+156	+78	+218	+140	+265	+140	+378	+300	+425	+300
					+288	+78	+316	+78	+378	+140	+425	+140	+538	+300	+585	+300
					+267	+99	+286	+108	+348	+170	+385	+180	+508	+330	+545	+340
1 400	1 600	−160	0		+128	+78	+156	+78	+218	+140	+265	+140	+408	+330	+455	+330
					+288	+78	+316	+78	+378	+140	+425	+140	+568	+330	+615	+330
					+267	+99	+286	+108	+348	+170	+385	+180	+538	+360	+575	+370
1 600	1 800	−200	0		+152	+92	+184	+92	+262	+170	+320	+170	+462	+370	+520	+370
					+352	+92	+384	+92	+462	+170	+520	+170	+662	+370	+720	+370
					+327	+117	+349	+127	+427	+205	+470	+220	+627	+405	+670	+420
1 800	2 000	−200	0		+152	+92	+184	+92	+262	+170	+320	+170	+492	+400	+550	+400
					+352	+92	+384	+92	+462	+170	+520	+170	+692	+400	+750	+400
					+327	+117	+349	+127	+427	+205	+470	+220	+657	+435	+700	+450

Bearings application

Examples



Bearings application

Tolerance classes for housing bores

Radial bearings

Solid housing

Table 7.3

Operating conditions	Examples	Tolerance class symbol	Outer ring displacement
Rotating outer ring load			
Heavy loads on bearings in thin-walled housings, heavy shock lads (P > 0,12C)	Roller bearing wheel hubs, connecting rod bearing	P7	Outer ring cannot be displaced
Normal and heavy loads (P > 0,06C)	Ball bearing wheel hubs, connecting rod bearings, crane traveling wheels	N7	
Light and variable loads (P≤0,06C)	Conveyer rollers, rope sheaves, belt tension pulleys	M7	
Direction of load indeterminate			
Heavy shock loads	Traction motors	M7	Outer ring cannot be displaced
Normal and heavy loads (P > 0,06 C). Outer ring displacement is not necessary	Electric motors, pumps crankshaft main bearings	K7	

Split or solid housings

Table 7.3 (continued)

Operating conditions	Examples	Tolerance class symbol	Outer ring displacement
Direction of load indeterminate			
Light and normal loads. Desirable outer ring displacement (P≤0,12C)	Medium-sized electric motors, pumps, crankshaft main bearings	J7	The outer ring can be displaced
Stationary outer ring load			
Loads of all kinds	Genaral mechanical engineering, railway axleboxes	H7	The outer ring can be easily displaced
Light and normal loads with simple conditions (P≤0,12C)		H8	
Heat conduction through shaft	Drying cylinders, large electrical machines with spherical roller bearings	G7	

Split housings

Table 7.3 (continued)

Operating conditions	**Examples**		**Tolerance class symbol**	**Outer ring displacement**
High accuracy rotation, quiet running				
High shiftness at variable loads	Main shafts for machine-tools with roller bearings	D≤125 D>125	M6 N6	The outer ring cannot be displaced
Light loads, indeterminate load direction	Shaft operating surface for grinding machines with ball bearings, free bearing for high speed superchargers		K6	The outer ring cannot be displaced
Desirable outer ring displacement	Shaft operating surface for grinding machines with ball bearings, free bearing for high speed superchargers		J6	The outer ring can be displaced
Quiet running	Small-sized electrical machines		H6	The outer ring can be easily displaced

Bearings application

Housing fits

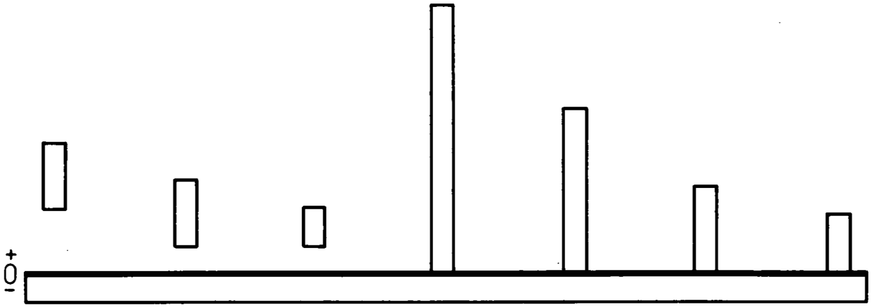


Table 7.4

Housing Diameter D nominal		Bearing Outside diameter tolerance ΔDmp		Deviations of housing bore diameter, resultant fits Tolerances a) Deviations (housing bore diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance														
					F7		G7		G6		H10		H9		H8		H7	
over	up to	low	high															
mm		µm																
6	**10**	**0**	**−8**	a) b) c)	+13 −13 −16	+28 −36 −33	+5 −5 −8	+20 −28 −25	+5 −5 −7	+14 −22 −20	0 0 −3	+58 −66 −63	0 0 −3	+36 −44 −41	0 0 −3	+22 −30 −27	0 0 −3	+15 −23 −20
10	**18**	**0**	**−8**		+16 −16 −19	+34 −42 −39	+6 −6 −9	+24 −32 −29	+6 −6 −8	+17 −25 −23	0 0 −3	+70 −78 −75	0 0 −3	+43 −51 −48	0 0 −3	+27 −35 −32	0 0 3	+18 −26 −23
18	**30**	**0**	**−9**		+20 −20 −23	+41 −50 −47	+7 −7 −10	+28 −37 −34	+7 −7 −10	+20 −29 −26	0 0 −4	+84 −93 −89	0 0 −4	+52 −61 −57	0 0 −3	+33 −42 −39	0 0 −3	+21 −30 −27
30	**50**	**0**	**−11**		+25 −25 −29	+50 −61 −57	−9 −9 −13	+34 −45 −41	+9 −9 −12	+25 −36 −33	0 0 −5	+100 −111 −106	0 0 −5	+62 −73 −68	0 0 −4	+39 −50 −46	0 0 −4	+25 −36 −32
50	**80**	**0**	**−13**		+30 −30 −35	+60 −73 −68	+10 −10 −15	+40 −53 −48	+10 −10 −14	+29 −42 −38	0 0 −6	+120 −133 −127	0 0 −5	+74 −87 −82	0 0 −5	+46 −59 −54	0 0 −5	+30 −43 −38
80	**120**	**0**	**−15**		+36 −36 −41	+71 −86 −81	+12 −12 −17	+47 −62 −57	+12 −12 −17	+34 −49 −44	0 0 −7	+140 −155 −148	0 0 −6	+87 −102 −96	0 0 −6	+54 −69 −63	0 0 −5	+35 −50 −45
120	**150**	**0**	**−18**		+43 −43 −50	+83 −101 −94	+14 −14 −21	+54 −72 −65	+14 −14 −20	+39 −57 −51	0 0 −8	+160 −178 −170	0 0 −8	+100 −118 −110	0 0 −7	+63 −81 −74	0 0 −7	+40 −58 −51
150	**180**	**0**	**−25**		+43 −43 −51	+83 −108 −100	+14 −14 −22	+54 −79 −71	+14 −14 −21	+39 −64 −57	0 0 −11	+160 −185 −174	0 0 −10	+100 −125 −115	0 0 −10	+63 −88 −78	0 0 −8	+40 −65 −57
180	**250**	**0**	**−30**		+50 −50 −60	+96 −126 −116	+15 −15 −25	+61 −91 −81	+15 −15 −23	+44 −74 −66	0 0 −13	+185 −215 −202	0 0 −13	+115 −145 −132	0 0 −12	+72 −102 −90	0 0 −10	+46 −76 −66
250	**315**	**0**	**−35**		+56 −56 −68	+108 −143 −131	−17 −17 −29	+69 −104 −92	+17 −17 −26	+49 −84 −75	0 0 −16	+210 −245 −229	0 0 −15	+130 −165 −150	0 0 −13	+81 −116 −103	0 0 −12	+52 −87 −75
315	**400**	**0**	**−40**		+62 −62 −75	+119 −159 −146	+18 −18 −31	+75 −115 −102	+18 −18 −29	+54 −94 −83	0 0 −18	+230 −270 −252	0 0 −17	+140 −180 −163	0 0 −15	+89 −129 −114	0 0 −13	+57 −97 −84
400	**500**	**0**	**−45**		+68 −68 −83	+131 −176 −161	+20 −20 −35	+83 −128 −113	+20 −20 −32	+60 −105 −93	0 0 −20	+250 −295 −275	0 0 −19	+155 −200 −181	0 0 −17	+97 −142 −125	0 0 −15	+63 −108 −93
500	**630**	**0**	**−50**		+76 −76 −92	+146 −196 −180	+22 −22 −38	+92 −142 −126	+22 −22 −35	+66 −116 −103	0 0 −22	+280 −330 −308	0 0 −21	+175 −225 −204	0 0 −19	+110 −160 −141	0 0 −16	+70 −120 −104

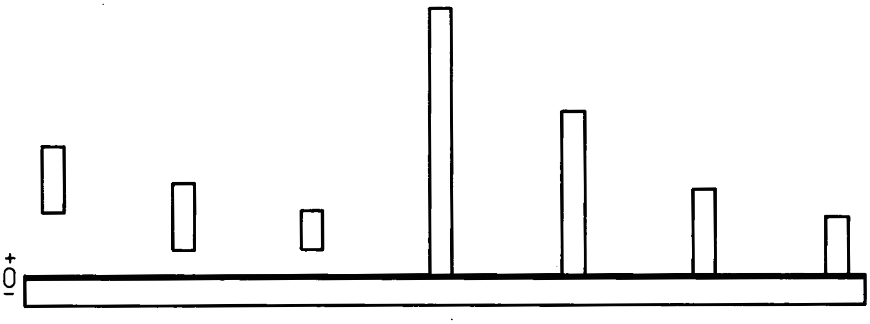


Table 7.4 (continued)

Housing Diameter D nominal		Bearing Outside diameter tolerance ΔDmp		Deviations of housing bore diameter, resultant fits Tolerances a) Deviations (housing bore diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance														
over	up to	low	high		F7		G7		G6		H10		H9		H8		H7	
mm		µm																
630	800	0	−75	a)	+80	+160	+24	+104	+24	+74	0	+320	0	+200	0	+125	0	+80
				b)	−80	−235	−24	−179	−24	−149	0	−395	0	−275	0	−200	0	−155
				c)	−102	−213	−46	−157	−41	−132	−33	−362	−30	−245	−27	−173	−22	−133
800	1 000	0	−100		+86	+176	+26	+116	+26	+82	0	+360	0	+230	0	+140	0	+90
					−86	−276	−26	−216	−26	−182	0	−460	0	−330	0	−240	0	−190
					−113	−249	−53	−189	−46	−162	−43	−417	−39	−291	−33	−207	−27	−163
1 000	1 250	0	−125		+98	+203	+28	+133	+28	+94	0	+420	0	+260	0	+165	0	+105
					−98	−328	−28	−258	−28	−219	0	−545	0	−385	0	−290	0	−230
					−131	−295	−61	−225	−52	−195	−53	−492	−48	−337	−41	−249	−33	−197
1 250	1 600	0	−160		+110	+235	+30	+155	+30	+108	0	+500	0	+310	0	+195	0	+125
					−110	−395	−30	−315	−30	−268	0	−660	0	−470	0	−355	0	−285
					−150	−355	−70	−275	−60	−238	−67	−593	−60	−410	−51	−304	−40	−245
1 600	2 000	0	−200		+120	+270	+32	+182	+32	+124	0	+600	0	+370	0	+230	0	+150
					−120	−470	−32	−382	−32	−324	0	−800	0	−570	0	−430	0	−350
					−170	−420	−82	−332	−67	−289	−83	−717	−74	−496	−62	−368	−50	−300
2 000	2 500	0	−250		+130	+305	+34	+209	+34	+144	0	+700	0	+440	0	+280	0	+175
					−130	−555	−34	−459	−34	−394	0	−950	0	−690	0	−530	0	−425
					−189	−496	−93	−400	−77	−351	−103	−847	−91	−599	−77	−453	−59	−366

Bearings application
Housing fits

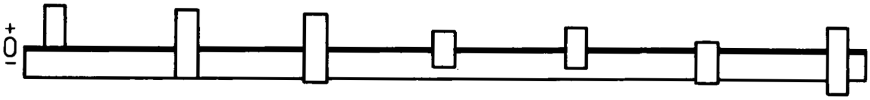


Table 7.4 (continued)

Housing Diameter D nominal		Bearing Outside diameter tolerance ΔDmp		Deviations of housing bore diameter, resultant fits Tolerances a) Deviations (housing bore diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance													
over	up to	low	high	H6		J7		JS7		J6		JS6		K6		K7	
mm		µm															
6	10	0	−8	a) 0	+9	−7	+8	−7,5	+7,5	−4	+5	−4,5	+4,5	−7	+2	−10	+5
				b) 0	−17	+7	−16	+7,5	−15,5	+4	−13	+4,5	−12,5	+7	−10	+10	−13
				c) −2	−15	+4	−13	+5	−13	+2	−11	+3	−11	+5	−8	+7	−10
10	18	0	−8	0	+11	−8	+10	−9	+9	−5	+6	−5,5	+5,5	−9	+2	−12	+6
				0	−19	+8	−18	+9	−17	+5	−14	+5,5	−13,5	+9	−10	+12	−14
				−2	−17	+5	−15	+6	−14	+3	−12	+3	−11	+7	−8	+9	−11
18	30	0	−9	0	+13	−9	+12	−10,5	+10,5	−5	+8	−6,5	+6,5	−11	+2	−15	+6
				0	−22	+9	−21	+10,5	−19,5	+5	−17	+6,5	−15,5	+11	−11	+15	−15
				−3	−19	+6	−18	+7	−16	+2	−14	+4	−13	+8	−8	+12	−12
30	50	0	−11	0	+16	−11	+14	−12,5	+12,5	−6	+10	−8	+8	−13	+3	−18	+7
				0	−27	+11	−25	+12,5	−23,5	+6	−21	+8	−19	+13	−14	+18	−18
				−3	−24	+7	−21	+9	−20	+3	−18	+5	−16	+10	−11	+14	−14
50	80	0	−13	0	+19	−12	+18	−15	+15	−6	+13	−9,5	+9,5	−15	+4	−21	+9
				0	−32	+12	−31	+15	−28	+6	−26	+9,5	−22,5	+15	−17	+21	−22
				−4	−28	+7	−26	+10	−23	+2	−22	+6	−19	+11	−13	+16	−17
80	120	0	−15	0	+22	−13	+22	−17,5	+17,5	−6	+16	−11	+11	−18	+4	−25	+10
				0	−37	+13	−37	+17,5	−32,5	+6	−31	+11	−26	+18	−19	+25	−25
				−5	−32	+8	−32	+12	−27	+1	−26	+6	−21	+13	−14	+20	−20
120	150	0	−18	0	+25	−14	+26	−20	+20	−7	+18	−12,5	+12,5	−21	+4	−28	+12
				0	−43	+14	−44	+20	−38	+7	−36	+12,5	−30,5	+21	−22	+28	−30
				−6	−37	+7	−37	+13	−31	+1	−30	+7	−25	+15	−16	+21	−23
150	180	0	−25	0	+25	−14	+26	−20	+20	−7	+18	−12,5	+12,5	−21	+4	−28	+12
				0	−50	+14	−51	+20	−45	+7	−43	+12,5	−37,5	+21	−29	+28	−37
				−7	−43	+6	−43	+12	−37	0	−36	+6	−31	+14	−22	+20	−29
180	250	0	−30	0	+29	−16	+30	−23	+23	−7	+22	−14,5	+14,5	−24	+5	−33	+13
				0	−59	+16	−60	+23	−53	+7	−52	+14,5	−44,5	+24	−35	+33	−43
				−8	−51	+6	−50	+13	−43	−1	−44	+6	−36	+16	−27	+23	−33
250	315	0	−35	0	+32	−16	+36	−26	+26	−7	+25	−16	+16	−27	+5	−36	+16
				0	−67	+16	−71	+26	−61	+7	−60	+16	+51	+27	−40	+36	−51
				−9	−58	+4	−59	+14	−49	−2	−51	+7	−42	+18	−31	+24	−39
315	400	0	−40	0	+36	−18	+39	−28,5	+28,5	−7	+29	−18	+18	−29	+7	−40	+17
				0	−76	+18	−79	+28,5	−68,5	+7	−69	+18	−58	+29	−47	+40	−57
				−11	−65	+5	−66	+15	−55	−4	−58	+7	−47	+18	−36	+27	−44
400	500	0	−45	0	+40	−20	+43	−31,5	+31,5	−7	+33	−20	+20	−32	+8	−45	+18
				0	−85	+20	−88	+31,5	−76,5	+7	−78	+20	−65	+32	−53	+45	−63
				−12	−73	+5	−73	+17	−62	−5	−66	+8	−53	+20	−41	+30	−48
500	630	0	−50	0	+44	–	–	−35	+35	–	–	−22	+22	−44	0	−70	0
				0	−94	–	–	+35	−85	–	–	+22	−72	+44	−50	+70	−50
				−13	−81	–	–	+19	−69	–	–	+9	−59	+31	−37	+54	−34

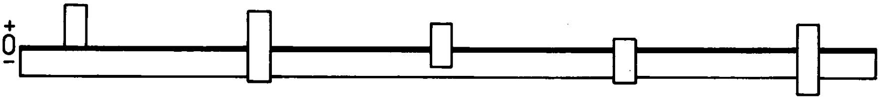


Table 7.4 (continued)

Housing Diameter D nominal		**Bearing Outside diameter tolerance ΔDmp**		**Deviations of housing bore diameter, resultant fits Tolerances**										
					H6		**JS7**		**JS6**		**K6**		**K7**	
				a) Deviations (housing bore diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance										
over	**up to**	**low**	**high**											
mm		µm												
630	**800**	**0**	**−75**	a)	0	+50	−40	+40	−25	+25	−50	0	−80	0
				b)	0	−125	+40	−115	+25	−100	+50	−75	+80	−75
				c)	−17	−108	+18	−93	+8	−83	+33	−58	+58	−53
800	**1 000**	**0**	**−100**		0	+56	−45	+45	−28	+28	−56	0	−90	0
					0	−156	+45	−145	+28	−128	+56	−100	+90	−100
					−20	−136	+18	−118	+8	−108	+36	−80	+63	−73
1 000	**1 250**	**0**	**−125**		0	+66	−52	+52	−33	+33	−66	0	−105	0
					0	−191	+52	−177	+33	−158	+66	−125	+105	−125
					−24	−167	+20	−145	+9	−134	+42	−101	+72	−92
1 250	**1 600**	**0**	**−160**		0	+78	−62	+62	−39	+39	−78	0	−125	0
					0	−238	+62	−222	+39	−199	+78	−160	+125	−160
					−30	−208	+22	−182	+9	−169	+48	−130	+85	−120
1 600	**2 000**	**0**	**−200**		0	+92	−75	+75	−46	+46	−92	0	−150	0
					0	−292	+75	−275	+46	−246	+92	−200	+150	−200
					−35	−257	+25	−225	+11	−211	+57	−165	+100	−150
2 000	**2 500**	**0**	**−250**		0	+110	−87	+87	−55	+55	−110	0	−175	0
					0	−360	+87	−337	+55	−305	+110	−250	+175	−250
					−43	−317	+28	−278	+12	−262	+67	−207	+116	−191

Bearings application

Housing fits

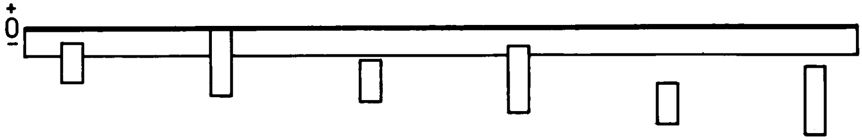


Table 7.4 (continued)

Housing Diameter D nominal		Bearing Outside diameter tolerance ΔDmp		Deviations of housing bore diameter, resultant fits Tolerances												
					M6		M7		N6		N7		P6		P7	
				a) Deviations (housing bore diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance												
over	up to	low	high													
mm		µm														
6	**10**	**0**	**−8**	a)	−12	−3	−15	0	−16	−7	−19	−4	−21	−12	−24	−9
				b)	+12	−5	+15	−8	+16	−1	+19	−4	+21	+4	+24	+1
				c)	+10	−3	+12	−5	+14	+1	+16	−1	+19	+6	+21	+4
10	**18**	**0**	**−8**		−15	−4	−18	0	−20	−9	−23	−5	−26	−15	−29	−11
					+15	−4	+18	−8	+20	+1	+23	−3	+26	+7	+29	+3
					+13	−2	+15	−5	+18	+3	+20	0	+24	+9	+26	+6
18	**30**	**0**	**−9**		−17	−4	−21	0	−24	−11	−28	−7	−31	−18	−35	−14
					+17	−5	+21	−9	+24	+2	+28	−2	+31	+9	+35	+5
					+14	−2	+18	−6	+21	+5	+25	+1	+28	+12	+32	+8
30	**50**	**0**	**−11**		−20	−4	−25	0	−28	−12	−33	−8	−37	−21	−42	−17
					+20	−7	+25	−11	+28	+1	+33	−3	+37	+10	+42	+6
					+17	−4	+21	−7	+25	+4	+29	+1	+34	+13	+38	+10
50	**80**	**0**	**−13**		−24	−5	−30	0	−33	−14	−39	−9	−45	−26	−51	−21
					+24	−8	+30	−13	+33	+1	+39	−4	+45	+13	+51	+8
					+20	−4	+25	−8	+29	+5	+34	+1	+41	+17	+46	+13
80	**120**	**0**	**−15**		−28	−6	−35	0	−38	−16	−45	−10	−52	−30	−59	−24
					+28	−9	+35	−15	+38	+1	+45	−5	+52	+15	+59	+9
					+23	−4	+30	−10	+33	+6	+40	0	+47	+20	+54	+14
120	**150**	**0**	**−18**		−33	−8	−40	0	−45	−20	−52	−12	−61	−36	−68	−28
					+33	−10	+40	−18	+45	+2	+52	−6	+61	+18	+68	+10
					+27	−4	+33	−11	+39	+8	+45	+1	+55	+24	+61	+17
150	**180**	**0**	**−25**		−33	−8	−40	0	−45	−20	−52	−12	−61	−36	−68	−28
					+33	−17	+40	−25	+45	−5	+52	−13	+61	+11	+68	+3
					+26	−10	+32	−17	+38	+2	+44	−5	+54	+18	+60	+11
180	**250**	**0**	**−30**		−37	−8	−46	0	−51	−22	−60	−14	−70	−41	−79	−33
					+37	−22	+46	−30	+51	−8	+60	−16	70	+11	+79	+3
					+29	−14	+36	−20	+43	0	+50	−6	+62	+19	+69	+13
250	**315**	**0**	**−35**		−41	−9	−52	0	−57	−25	−66	−14	−79	−47	−88	−36
					+41	−26	+52	−35	+57	−10	+66	−21	+79	+12	+88	+1
					+32	−17	+40	−23	+48	−1	+54	−9	+70	+21	+76	+13
315	**400**	**0**	**−40**		−46	−10	−57	0	−62	−26	−73	−16	−87	−51	−98	−41
					+46	−30	+57	−40	+62	−14	+73	−24	+87	+11	+98	+1
					+35	−19	+44	−27	+51	−3	+60	−11	+76	+22	+85	+14
400	**500**	**0**	**−45**		−50	−10	−63	0	−67	−27	−80	−17	−95	−55	−108	−45
					+50	−35	+63	−45	+67	−18	+80	−28	+95	+10	+108	0
					+38	−23	+48	−30	+55	−6	+65	−13	+83	+22	+93	+15
500	**630**	**0**	**−50**		−70	−26	−96	−26	−88	−44	−114	−44	−122	−78	−148	−78
					+70	−24	+96	−24	+88	−6	+114	−6	+122	+28	+148	+28
					+57	−11	+80	−8	+75	+7	+98	+10	+109	+41	+132	+44

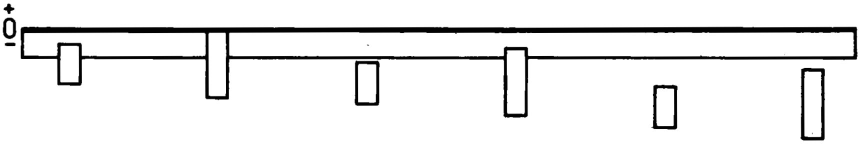


Table 7.4 (continued)

Housing Diameter D nominal		**Bearing Outside diameter tolerance ΔDmp**		**Deviations of housing bore diameter, resultant fits Tolerances**												
					M6		**M7**		**N6**		**N7**		**P6**		**P7**	
over	**up to**	**low**	**high**	a) Deviations (housing bore diameter) b) Tightening/Theoretical clearance c) Tightening/Probable clearance												
mm		µm														
630	**800**	**0**	**−75**	a)	−80	−30	−110	−30	−100	−50	−130	−50	−138	−88	−168	−88
				b)	+80	−45	+110	−45	+100	−25	+130	−25	+138	+13	+168	+13
				c)	+63	−28	+88	−23	+83	−8	+108	−3	+121	+30	+146	+35
800	**1 000**	**0**	**−100**		−90	−34	−124	−34	−112	−56	−146	−56	−156	−100	−190	−100
					+90	−66	+124	−66	+112	−44	+146	−44	+156	0	+190	0
					+70	−46	+97	−39	+92	−24	+119	−17	+136	+20	+163	+27
1 000	**1 250**	**0**	**−125**		−106	−40	−145	−40	−132	−66	−171	−66	−186	−120	−225	−120
					+106	−85	+145	−85	+132	−59	+171	−59	+186	−5	+225	−5
					+82	−61	+112	−52	+108	−35	+138	−26	+162	+19	+192	+28
1 250	**1 600**	**0**	**−160**		−126	−48	−173	−48	−156	−78	−203	−78	−218	−140	−265	−140
					+126	−112	+173	−112	+156	−82	+203	−82	+218	−20	+265	−20
					+96	−82	+133	−72	+126	−52	+163	−42	+188	+10	+225	+20
1 600	**2 000**	**0**	**−200**		−150	−58	−208	−58	−184	−92	−242	−92	−262	−170	−320	−170
					+150	−142	+208	−142	+184	−108	+242	−108	+262	−30	+320	−30
					+115	−107	+158	−92	+149	−73	+192	−58	+227	+5	+270	+20
2 000	**2 500**	**0**	**−250**		−178	−68	−243	−68	−220	−110	−285	−110	−305	−195	−370	−195
					+178	−182	+243	−182	+220	−140	+285	−140	+305	−55	+370	−55
					+135	−139	+184	−123	+177	−97	+226	−81	+262	−12	+311	+4

Deviations of form and position

Permissible deviations of form and position for shaft and housing where bearings are to be mounted are given in fig. 7.3 and table 7.5.

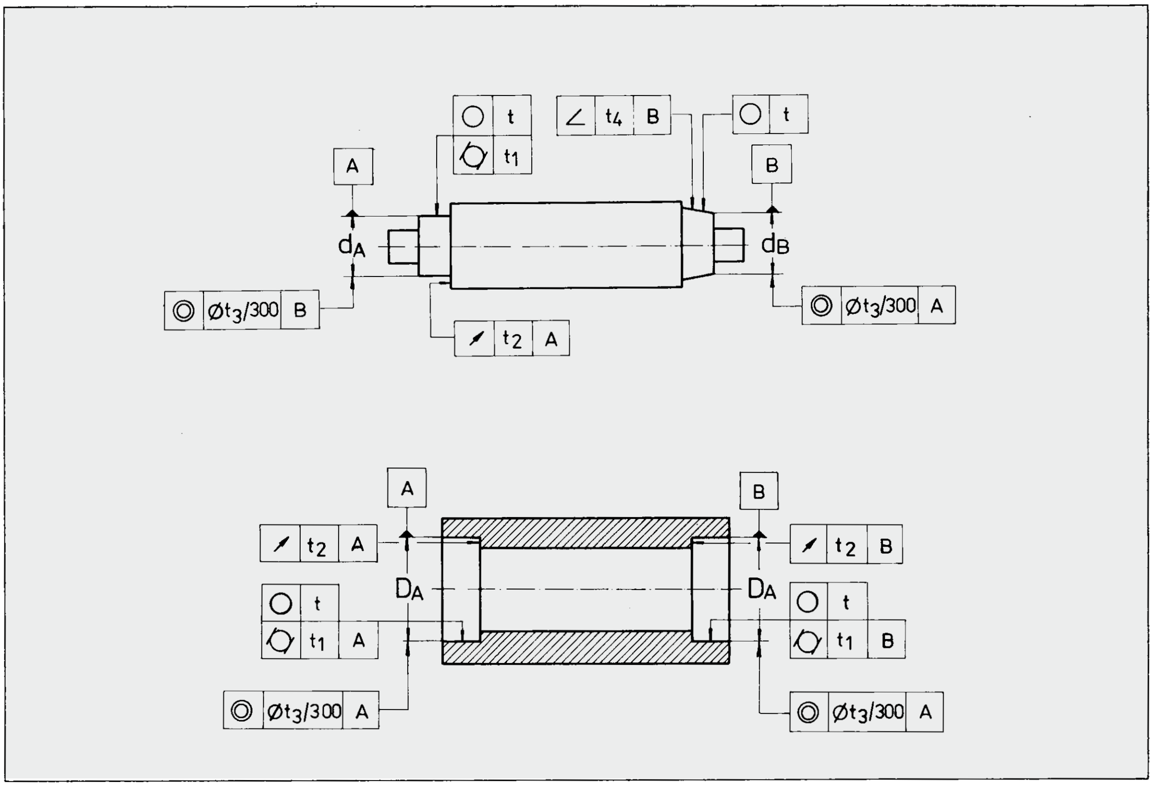


Fig.7.3.

Permissible deviations depending on the tolerance class

Table 7.5

Tolerance name	**Fit**	**Symbol of deviation**		**Permissible deviations depending on the tolerance class**				
				P0 P6X	**P6**	**P5**	**P4(SP)**	**P2(UP)**
Tolerance of dimension	shaft	–	–	IT6(IT5)	IT5	IT4	IT4	IT3
	housing			IT7(IT6)	IT6	IT5	IT4	IT4
Tolerance of roundness and cylindricity	shaft	○ ⌭	t,t_1	$\frac{\text{IT4}}{2}\left(\frac{\text{IT3}}{2}\right)$	$\frac{\text{IT3}}{2}\left(\frac{\text{IT2}}{2}\right)$	$\frac{\text{IT2}}{2}$	$\frac{\text{IT1}}{2}$	$\frac{\text{IT0}}{2}$
	housing		t,t_1	$\frac{\text{IT5}}{2}\left(\frac{\text{IT4}}{2}\right)$	$\frac{\text{IT4}}{2}\left(\frac{\text{IT2}}{2}\right)$	$\frac{\text{IT3}}{2}$	$\frac{\text{IT2}}{2}$	$\frac{\text{IT1}}{2}$
Tolerance of face runout	shaft	↗	t_2	IT4(IT3)	IT3(IT2)	IT2	IT1	IT0
	housing			IT5(IT4)	IT4(IT3)	IT3	IT2	IT1
Tolerance of concentricity	shaft	◎	t_3	IT5	IT4	IT4	IT3	IT3
	housing			IT6	IT5	IT5	IT4	IT3
Tolerance of angularity	shaft	∠	t_4	$\frac{\text{IT7}}{2}$	$\frac{\text{IT6}}{2}$	$\frac{\text{IT4}}{2}$	$\frac{\text{IT3}}{2}$	$\frac{\text{IT2}}{2}$

In case of bearings on which adapter or withdrawal sleeves are to be mounted, the shaft tolerances for deviations of form and position should be to IT 5/2 tolerance class for shafts with diameter tolerance h9 and IT7/2 for shaft tolerance h10.

Surface roughness of bearing seating is given in table 7.6.

Shaft and housing mounting surfaces roughness

Table 7.6

Bearing tolerance class	Shaft			Housing		
	Diameter d, mm			Diameter D, mm		
	≤80	>80..500	>500	≤80	>80..500	>500
	Roughness Ra, µm					
P0, P6X and P6	0,8 (N6)	1,6 (N7)	3,2 (N8)	0,8 (N6)	1,6 (N7)	3,2 (N8)
P5, SP and P4	0,4 (N5)	0,8 (N6)	1,6 (N7)	0,8 (N6)	1,6 (N7)	1,6 (N7)
P2 and UP	0,2 (N4)	0,4 (N5)	0,8 (N6)	0,4 (N5)	0,8 (N6)	0,8 (N6)

If bearings are mounted with adapter or withdrawal sleeves, shaft surface roughness should be of max. $R_a = 1{,}6\,\mu m$.

The values of fundamental tolerances - ISO (tolerance classes IT0...IT12) are given in table 7.7.

Tolerance ISO (IT)

Nominal dimension, mm

Table 7.7

over	1	3	6	10	18	30	50	80	120	180	250	315	400	500	630	800	1 000	1 250	1 600	2 000	2 500
up to	3	6	10	18	30	50	80	120	180	250	315	400	500	630	800	1 000	1 250	1 600	2 000	2 500	3 150
Tolerances in micrometers (0,001 mm)																					
IT0	0,5	0,6	0,6	0,8	1	1	1,2	1,5	2	3	4	5	6								
IT1	0,8	1	1	1,2	1,5	1,5	2	2,5	3,5	4,5	6	7	8								
IT2	1,2	1,5	1,5	2	2,5	2,5	3	4	5	7	8	9	10								
IT3	2	2,5	2,5	3	4	4	5	6	8	10	12	13	15								
IT4	3	4	4	5	6	7	8	10	12	14	16	18	20								
IT5	4	5	6	8	9	11	13	15	18	20	23	25	27	29	32	36	42	50	60	70	86
IT6	6	8	9	11	13	16	19	22	25	29	32	36	40	44	50	56	66	78	92	110	135
IT7	10	12	15	18	21	25	30	35	40	46	52	57	63	70	80	90	105	125	150	175	210
IT8	14	18	22	27	33	39	46	54	63	72	81	89	97	110	125	140	165	195	230	280	330
IT9	25	30	36	43	52	62	74	87	100	115	130	140	155	175	200	230	260	310	370	440	540
IT10	40	48	58	70	84	100	120	140	160	185	210	230	250	280	320	360	420	500	600	700	860
IT11	60	75	90	110	130	160	190	220	250	290	320	360	400	440	500	560	660	780	920	1 100	1 350
IT12	100	120	150	180	210	250	300	350	400	460	520	570	630	700	800	900	1 050	1 250	1 500	1 750	2 100

Bearing axial location

Axial location of bearings is necessary for a proper guiding of bearing in an assembly under operation.

An tight fit is inadequate for the axial location of bearing. In case of locating bearings, axial location for both rings is generally needed. Some important solutions of bearing axial location, on shaft or into the housing are shown in Fig.7.4.

In case of bearings with light axial loads, bearings can be located using a lock nut and a lock washer (a), an end plate fastened by a screw at the shaft end (b) and, for bearings carrying light axial loads, by lock rings mounted in shaft and housing grooves (c).

Bearings with NR design, with groove and snap ring on the outer ring can be easily located by the lock ring (d). Tapered roller bearings can be located by supporting the inner ring on the shaft shoulder and the outer ring with a threaded ring and a safety plate fastened by a screw (e).

Tapered bore bearings can be mounted and axially located by adapter or withdrawal sleeves (f, g, h).

The axial load carrying capacity of the bearings mounted with adapter or withdrawal sleeves is governed by the friction between shaft and sleeve (g).

To locate radial bearings, where axial adjustment of the shaft is required, setting washers (i) or spacer rings (j) are used between the outer rings, the width of the spacer ring being experimentally determined, during mounting.

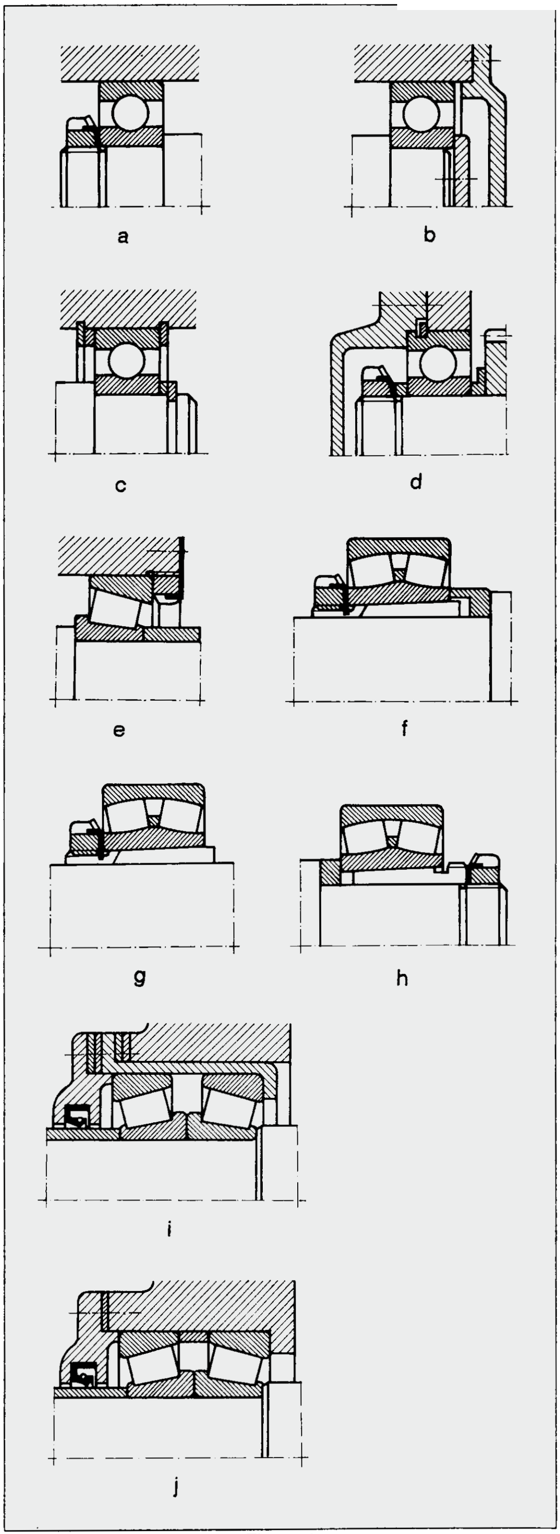


Fig. 7.4

Bearing sealing

Seals are used in most of bearing arrangements and they must ensure the conditions of a proper operation.

For such a purpose, they have to prevent solid contaminants (dust, hard particles, water, aggressive substances etc.) from penetrating into the bearing and at the same time to retain the lubricant in the bearing.

Seals for rolling bearings can be classified considering some important criteria such as: design, operation, type of lubricant etc.

Considering their design and operation, seals can be: stationary seals between the stationary bearing elements (housing and cover), rotary seals, between the rotating bearing elements and they also can be rubbing seals or non-rubbing seals, which are used in special applications (surroundings conditions and loading stress).

Rotary non-rubbing seals are often used due to their simple design. They are particularly used at high speeds or temperatures, both for grease and oil, and have practically no friction and do not wear.

In case of bearing grease lubrication, bearing operating temperature must be lower with 20°C than the dropping point of the grease (melting temperature).

The main constructive types of rotary non-rubbing seals have narrow gaps, labyrinths and their combinations are shown in fig. 7.5 a-c.

Gap seals represent the simplest constructive solution for a rotary non-rubbing seal which have to retain grease in the bearing housing. The efficacy of sealing depends on the gap length (L) and the clearance between shaft and housing. It can be improved by providing one or more circular grooves on the shaft or in the housing, which are to be filled with grease (b). In case of oil lubrication, the grooves on the shaft must be helical (c) and their direction must be the same with the direction of the shaft rotary movement.

Experiments proved that most favorable clearance is obtained between the limits of the fit A11/h10, geometrical deviations should be IT6 and gap surface roughness $R_a = 12{,}6\,\mu m$.

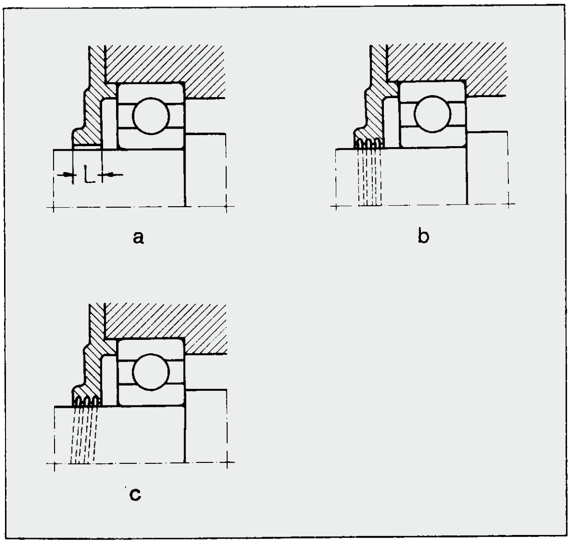


Fig. 7.5

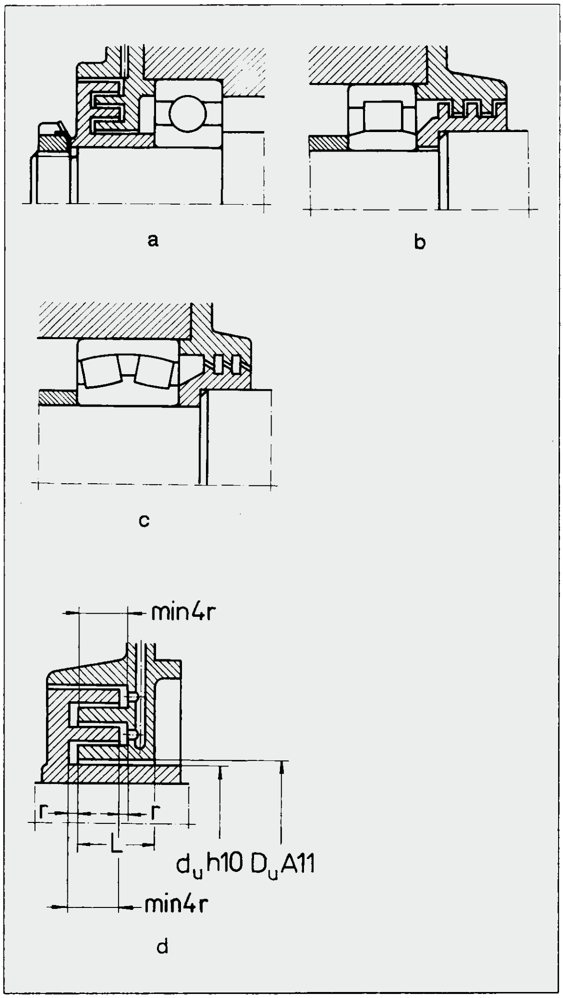


Fig. 7.6

Labyrinth seals are used at high peripheral speeds, in impure surroundings. They are shown in fig. 7.6 a-d.

The labyrinths are spaces where periodically water-insoluble grease (e.g. Lithium or Calcium base grease) is to be supplied.

The tongues of the labyrinth seals can be radially (a), axially (b) arranged or they can have inclined passages.

Details of an axial labyrinth design are given in fig. 7.6 d and values of axial clearance r and length L are given in table 7.8.

Values for dimensions r and L

Table 7.8

d **over**	 **up to**	**Axial clearance** **r**	**Length** **L**
mm			
–	50	1,5	13,5...27
50	120	2	18...36
120	180	2,5	22,5...45

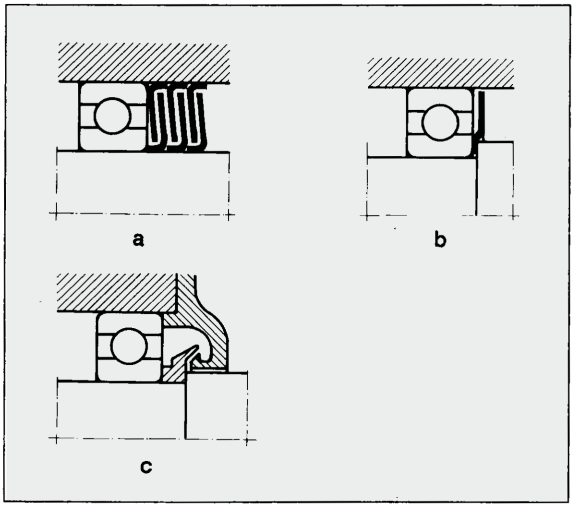


Fig. 7.7

Sealing efficacy increases where both radial and axial labyrinths are used and the number of gaps is increased.

Other types of seals are shown in fig. 7.7 a-c.

in case of rotary rubbing seals there is a direct contact between a seal elastic element and the rotating element. They are shown in fig. 7.8.

When selecting the proper rotary rubbing seal, the following factors have to be considered: material and its elasticity (felt, rubber, plastics, leather, graphite, asbestos etc.); resistance at various temperatures, maximum peripheral speed on sealing surface; sealing direction etc. These systems have sealing properties higher than those corresponding to non-rubbing seals. In case of grease lubrication at peripheral speeds higher than 4 m/s and temperatures over +100°C, felt ring seals (a) are frequently used because of their simple design and cheapness.

Before mounting, felt rings are impregnated during an hour with a mixture of mineral oil (66%) and paraffin (34%), at a temperature of +70...+80°C so that sealing properties are improved as the friction is reduced.

At higher temperatures and peripheral speeds over 12 m/s, surface roughness is $R_a = 1,6\ \mu m$ and the space between the ends of the seal should be filled with grease. Two felt rings can be used for sealing.

Rubbing seals with a spring incorporated are preferably to be used in case of oil lubricated bearings which are operated under peripheral speeds of 5-10 m/s, temperatures between -40°C and +20°C. Their efficacy depends on the material and operating surroundings.

In most cases, rubbing seals with a spring incorporated are made of synthetic rubber and have a metallic hardening fixture.

Inclined sealing surfaces are recommended to be ground at $R_a = 0,8\mu m$ and hardened at 45 HRC, when operating at peripheral speeds over 8 m/s. Lubricant outflow can be stopped by mounting the rubbing seal with incorporated spring with the edge inwards (c) or outwards (d) if sealing has to prevent dust or other impurities from penetrating into the bearing.

Double sealing with these rubbing seals can also be used.

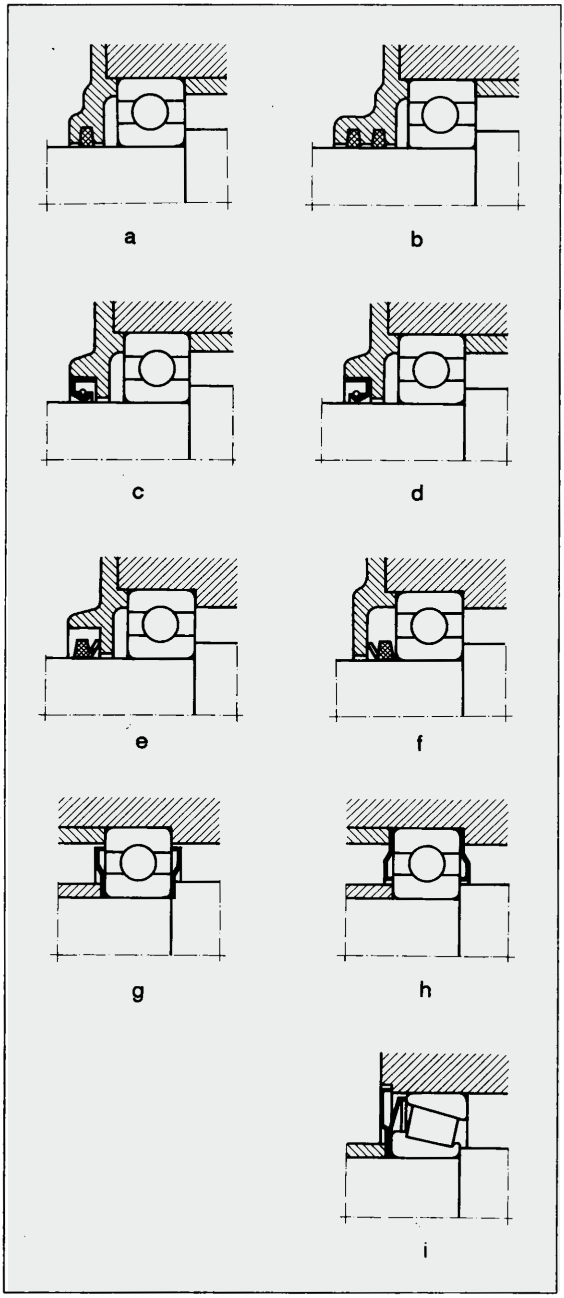


Fig. 7.8

V-ring seal is used to prevent dust or contaminants from penetrating into the bearing with best results both in case of grease or oil lubrication. The elastic rubber lip of the V-ring seal is notched on the plane sealing surface, drawing the fluids in centrifugal motion. V-ring seals are used at temperatures of −40°C...+100°C, roughness of sealing surface being $R_a = 1,5 - 3\mu m$. Generally, at peripheral speeds up to 15 m/s, the V-ring seal operates as a rubbing seal

(seal lip reaches sealing surface), and at peripheral speeds over 15 m/s the seal lip will lift from the sealing surface, operating as a centrifugal sealing.

V-ring seals can also be used in case of angular misalignments of the shaft (2°...3°), as they are made of high quality, elastic rubber, easy to be mounted.

The efficacy of sealing depends on the fact that the ring body acts as a flinger for dirt and fluids. Therefore, with grease lubrication the seal is generally arranged outside the housing and with oil lubrication it is placed inside the housing.

Pressed sheet washers provide simple, inexpensive and space-saving sealing especially for grease lubricated deep groove ball bearings. The washers are clamped against either the outer ring or the inner ring and exert a resilient pressure axially against the rubbing ring. For tapered roller bearings, two elastic washers are usually used, the space between them being filled with grease.

In case of usual applications, the types of seals mentioned above or their combinations shown in fig. 7.9 are used, some of them becoming standard seals for rolling bearings (e.g. labyrinths, felt rings, V-rings etc.). Thus, better sealing can be obtained if felt ring (a) or V-ring (b) rubbing seals are combined with radial or axial labyrinth non-rubbing seals.

Special seals are used in case of unusual surroundings and loading conditions (e.g. rolling mills, helm of ocean-vessels, main shaft of grinding machines etc.)

Sealed bearings of the type 2RS (2RSR) (a) or shielded bearings of the type 2Z (2ZR) (b) shown in fig. 7.10 a.b. provide simple and inexpensive sealing, with upper operating results. These rolling bearings are delivered ready greased , provision for relubrication and maintenance are not needed. They are used in case of bearings with small free space where other seals cannot be used.

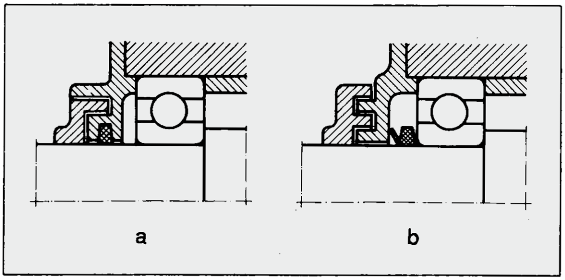


Fig. 7.9

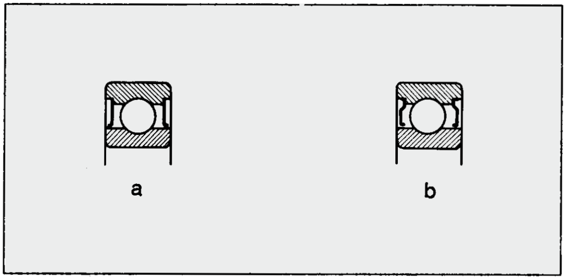


Fig. 7.10

8. Bearing lubrication

Safe operating and long rating life of bearings depend on the lubricant type and quality and on the lubrication method. Bearing lubrication is used for certain purposes, such as:

- to reduce friction between rolling elements and raceway, rolling elements and cage, cage and guiding ribs of rings during operation;
- to ensure anticorrosive protection of bearings;
- to reduce noise in bearing within certain limits;
- to distribute heat uniformly in contact areas and to remove it outside through lubricant circulation.

Lubricants for bearing lubrication should satisfy the following conditions:

- they should have physical and chemical stability;
- foreign mechanical substances (abrasive, metallic substances etc.) are not admitted in lubricant;
- they should have a minimal coefficient of friction;
- to be non-corrosive;
- good unctuosity (lubricating capacity).

There are two categories of lubricants used for bearing lubrication:

- fluid lubricants (oils);
- plastic lubricants (greases).

Table 8.1 shows comparison between fluid and plastic lubricants.

Although fluid lubricants have better characteristics than plastic lubricants, they cannot be used in all cases because of sealing difficulties.

Comparative values for lubricants

Table 8.1

Characteristics	**Lubricant** **Fluid**	**Plastic**
speed	any value	low and medium
friction	low (reduced)	high
unctuosity	excellent	good
service life	long	short
cooling effect	high	low
replacement	easy	difficult

Selection of lubricants

When selecting lubricants, much care is needed and all operating conditions and lubricant properties should be considered.

No lubrication system can be considered universal.

The most important criteria when selecting a lubricant have to be as follows:

- size of bearing
- speed
- load
- bearing operating temperature

These characteristics act upon lubricant viscosity as follows:

- the higher the bearing size, value of load and temperature, the higher the viscosity
- bearing speed acts by product D_m n, as shown in table 8.2.

Corelation between D_m n and lubricant type

Table 8.2

Dm n over	up to	**Lubricant type**
–	150×10^3	Mineral oil and grease with medium or high viscosity
150×10^3	300×10^3	Mineral oil with medium viscosity and grease
300×10^3	500×10^3	Mineral oil with low viscosity and grease
500×10^3	$1\,200\times10^3$	Mineral oil with low viscosity and lubricating equipment

Grease lubrication

Grease can be used to lubricate rolling bearings only when product D_m n $\leq 500\times10^3$ and it offers the following

advantages:
- it is more easily retained in the bearing;
- it assures anti-corrosive protection to bearing as it is water-resistant;
- low expenses for sealing.

The grease quantity to be supplied shouldn't be excessive, otherwise rotation is braked, friction increases and also operating temperature without extending the bearing rating life.

The quantity of grease that is to be inserted in bearing seating should be as follows, considering the free space inside the housing:
- 1/2...3/4 of the free space in the housing, in case of normal speeds;
- 1/3 of the free space in the housing, in case of high speeds and speed limit;
- the whole housing space should be free, in case of low speeds and product $D_m\, n < 10 \times 10^3$.

The quantity of grease can be calculated as a function of bearing bore diameter using the equation:

$$G = K\, d^{2,5}\ ,\ g.$$

where:

K = 1/900 - for ball bearings
K = 1/350 - for roller bearings
d = bore diameter, mm

Relubrication intervals in most cases can be experimentally determined and depend on:
- bearing type
- bearing size
- operating temperature
- grease properties

Grease service life and relubricating interval can be calculated from:

$$T_{ur} = k_0 \left(\frac{14 \times 10^6}{n\, d} - 4d \right) f_1\, f_2,$$

where:

T_{ur} = service life or relubricating interval, in operating hours
k_0 = coefficient depending on the bearing type, table 8.3
n = speed, r/min
d = bore diameter, mm
f_1 = temperature factor, table 8.4
f_2 = factor depending on the operating conditions, table 8.5

Values for coefficient k_0

Table 8.3

Bearing type	Value of k_0	
	Relubrication interval	Grease service life
Angular contact ball bearings Tapered roller bearings Thrust ball bearings	1	2
Cylindrical roller bearings Needle roller bearings	5	15
Deep groove ball bearings	10	20...40

Low values are valid for deep groove ball bearings with shields, 2Z type, or with seals, 2RS type, series 60, 62 and 63.

Values for factor f_1

Table 8.4

Temperature	70°C	85°C	100°C
Factor f_1	1	0,5	0,25

Values for factor f_2

Table 8.5

Operating conditions	Light	Moderate	Hard	Very hard
Factorul f_2	1	0,7...0,9	0,4..0,7	0,1....0,4

Bearing relubrication interval can be also determined using the chart - fig. 8.1, as a function of bearing type, bore diameter and speed.

Example:

A bearing 6208-2RSR is operated under reduced load (it is not considered for calculation), at a speed $n = 1500$ r/min, at a temperature of +60deg C, light operating conditions. What is the grease service life and relubrication interval?

Grease service life will be:

$$T_u = k_0 \left(\frac{14 \times 10^6}{n\, d} - 4d \right) f_1\, f_2 = 32\,893 \text{ hours,}$$

k_0 = 25 from table 8.3
d = 40 mm
f_1 = 1, from table 8.4
f_2 = 1, from table 8.5

Relubrication interval:

$$T_r = k_0 \left(\frac{14 \times 10^6}{n\, d} - 4d \right) f_1\, f_2 = 13\,157 \text{ hours,}$$

k_0 = 10, from table 8.3
f_1, f_2 = 1, from tables 8.4, 8.5.

From the diagram fig. 8.1, the value of the relubrication interval will be of 13 500 operating hours.

The grease quantity to be supplied can be determined using the equation:

$$G = K\, D\, B,\ \ g,$$

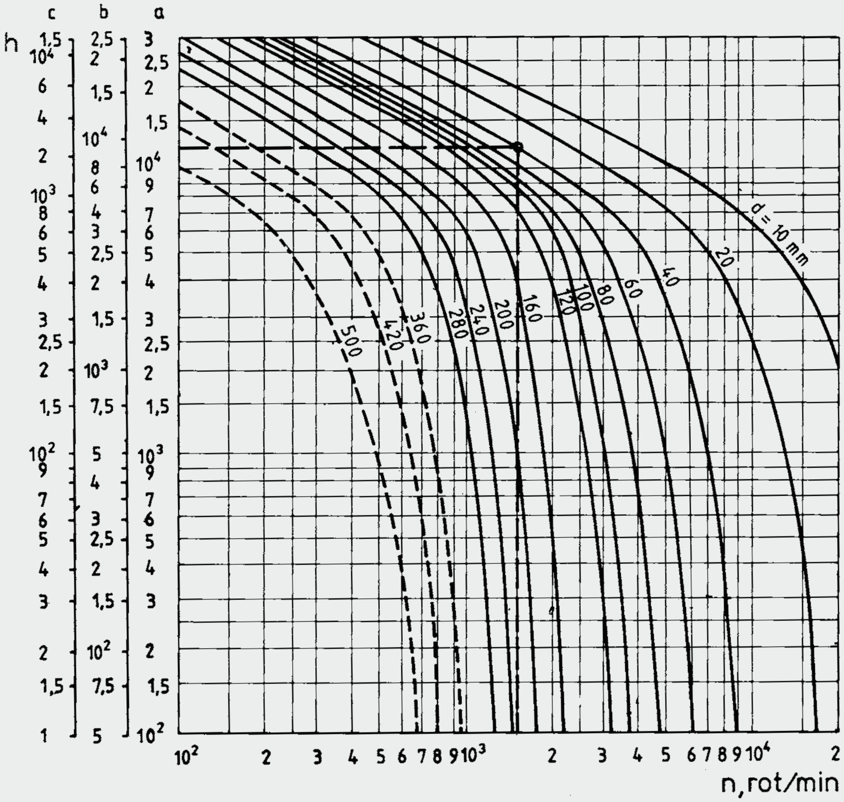
where:

G = grease quantity, g
K = coefficient depending on the relubrication interval, table 8.6
D = bearing outside diameter, mm
B = total bearing width for radial bearings, mm and total bearing height for thrust bearings, mm

Values for coefficient K

Table 8.6

Relubrication interval	K
weekly	0,0015...0,0020
monthly	0,0020...0,0030
yearly	0,0030...0,0045
after 2...3 years	0,0045...0,0055



Scale a; deep groove ball bearings
Scale b; cylindrical and needle roller bearings
Scale c; spherical roller bearings, taper roller bearings, thrust ball bearings, roller thrust bearings and needle roller bearings, cylindrical and needle roller bearings without cage, crossed roller bearings, spherical roller thrust bearings.

Fig. 8.1

The chart in fig. 8.1 applies to operating temperatures which do not exceed +70°C. For operating temperatures over +70°C, see table 8.4.

Grease service life can be defined as the period of time when it preserves physical and mechanical characteristics in time and oxidizing due to temperature and vaporization of base oil doesn't occur.

A more accurate calculation of grease service life, considering grease quality and bearing operating conditions (load, size, speed, temperature etc.) can be done using the equation:

$$L = 10^{a-(m_1+m_2+m_3)}$$

where:
L = service life, operating hours
a = exponent depending on the grease quality (a = 5,8...6,1)
$m_1...m_3$ = exponents which take into account the following factors:
$m_1 = 4{,}4\times10^{-6} D_m\, n,$
$m_2 = 2{,}5(\, P/C - 0{,}05\,),$
$m_3 = (0{,}021 - 1{,}80\times10^{-6} D_m\, n)T,$
D_m = bearing mean diameter, mm,
n = bearing speeds, r/min,
P = equivalent radial load, kN,
C = basic dynamic load, kN,
t = bearing operating temperature, °C

When calculating the values of t, $D_m\, n$ and P/C, the following have to be considered:
- when bearing operating temperature is lower than +50°C, then t = +50°C
- when speed factor $D_m\, n < 125\,000$, then $D_m\, n = 125\,000$
- when ratio $P/C < 0{,}05$, then $P/C = 0{,}05$

Grease service life, as a function of operating temperature can be approximately determined using the diagram fig. 8.2.

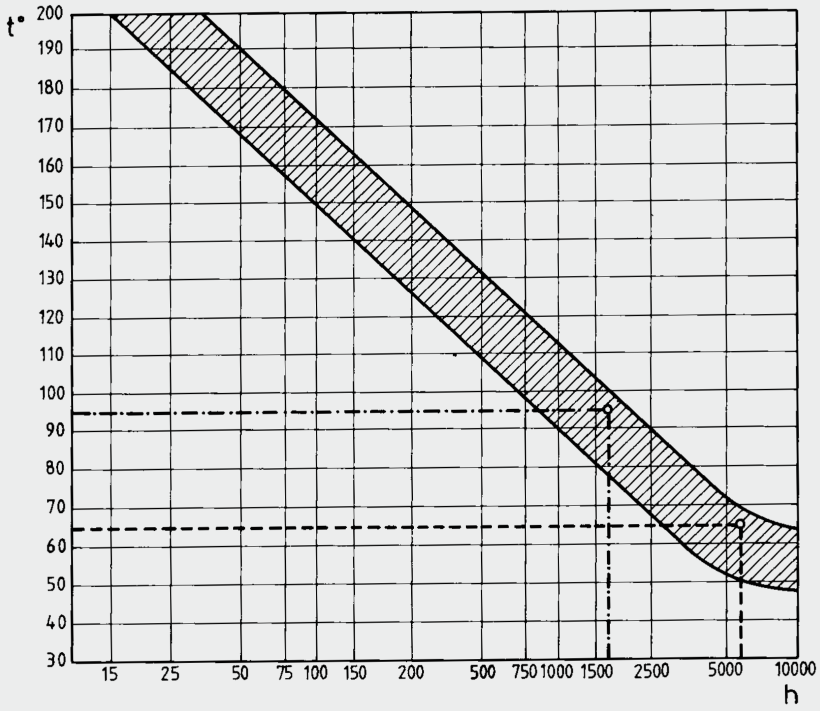


Fig.8.2

Example 1

A bearing 6210 operates under a load $P_r = 5$ kN, speed $n = 3000$ r/min at an operating temperature $T = 50°C$. What is the service life of the grease used for bearing lubrication?

$C_r = 35{,}1$ kN, tables on page 132, bearing 6210

$$L = 10^{a-(m_1+m_2+m_3)} = 10^{6{,}1-2.273} = 10^{3{,}827} = 6\,214 \text{ hours}$$

$a = 6{,}1$, for Mobil grease,

$D_m n = 65 \times 3\,000 = 195 \times 10^3$
$P_r/C_r = 5/35{,}1 = 0{,}143$
$m_1 = 4{,}4 \times 10^{-6} D_m n = 0{,}858$
$m_2 = 2{,}5\ (P_r/C_r - 0{,}05) = 0{,}23$
$m_3 = (0{,}021 - 1{,}80 \times^{-8} D_m n)65 = 1{,}119$
$m_1 + m_2 + m_3 = 2{,}273$

Example 2

For the same bearing and operating conditions as in Example 1, it is required to find the service life of the same grease at a temperature of $T = 95°C$.

$m_3 = 1{,}66$
$m_1 + m_2 + m_3 = 2{,}794$

$$L = 10^{6{,}1-2{,}794} = 10^{3{,}306} = 1\,774 \text{ operating hours}$$

From the diagram fig. 8.2, we can find approximately the same value, respectively 6 000 operating hours at +65°C and 1 700 operating hours at +95°C.

Table 8.7 shows technical characteristics of usual grease, which are recommended for lubrication of sealed and shielded bearings, 2RS and 2Z types and also for rolling bearings in various assemblies and machines.

Technical characteristics for usual greases for bearing lubrication

Table 8.7

Grease main components Base oil	 Thickener	**Dropping point °C**	**Temperature range (continuous running)**	**Application**	**Grease type, producer**
Mineral oil	Lithium soap	170°C-190°C	–30°C... + 130°C	Ball, roller and needle roller bearings: - small and medium sized, - moderate speeds, - temperatures up to 70°C	- Mobilux 2-3, Mobil Austria, - Castrol Spherol SRB2, Castrol Germany - Shell Alvania R 2-3, Shell England - Aguila Nr30, Brugarolas Spain - UM 185 Li 2-3, Lubrifin Braşov
Mineral oil + additive for excessive pressure (EP)	Lithium soap	185°C-190°C	–30°C... + 150°C	Ball and roller bearings, - moderate speeds, - heavy loads, shock loads, - continuous running temperature + 130°C, - initial lubrication and relubrication at periods of 6-9 months	- Mobilux EP 2-3, Mobil Austria - Shell Alvania EP 2-3, Shell England - Beacon EP 2, Esso Germany
Synthetic oil (diesteric)	Lithium soap	180°C-230°C	–30°C... + 130°C	Bearings for electrical motors, generators, electronic equipment, - small sizes, - light loads, - high speeds $D_m \times n \leq 1000 \times 10^3$	- Beacon 325, Esso Germany
Synthetic oil (diesteric)	Lithium soap	190°C-230°C	–50°C... + 120°C	Bearings for electrical motors, generators, electronic equipment, - small sizes, - light loads, - high speeds $D_m \times n \leq 1000 \times 10^3$	- Izoflex LDS 18 Special A, Kluber Lubrication Germany
Mineral oil	Complex calcium soap	100°C-180°C	–30°C... + 130°C	Bearings for general applications, - heavy loads, moderate speeds, - continuous running temperature 100°C	- Beacon 2-3, Esso Germany - Beacon EP1, Esso Germany - UM 170 Li Ca 2-3, Lubrifin Braşov
Synthetic oil	Without soap, synthetic thickener	indeterminate	–30°C... + 250°C	Bearings for general applications, - large sizes, - low speeds $D_m \times n < 200 \times 10^3$, - high temperature	- Barlerta 1S, Kluber Lubrication Germany
Synthetic oil + additive for excessive pressure (EP)	without soap, synthetic thickener	265°C	–54°C... + 177°C	Spherical roller thrust bearings, roller thrust bearings etc., bearings operating with high friction, - moderate and high speeds, - low and high temperatures	- Mobilgrease 28, Mobil Austria
Synthetic oil	without soap, inorganic thickener	260°C	–50°C... + 177°C	Bearing for general applications, - light loads, - high speeds, - low and high temperatures	- Armingras BT-2, Burgarolas Spain
			–30°C... + 140°C	Cylindrical roller bearings, - moderate and high speeds $D_m \times n \leq 300 \times 10^3$	- Statburgas NUB12, Kluber Lubrication Germany
			0°C... + 260°C	Roller bearings operating at high temperatures	- Mobiltemp 1-2, Mobil Austria

Oil lubrication

Oil lubrication can be used in any operating condition, but this kind of lubrication is compulsory when the value of the product Dmxn from table 8.2, namely $D_m\, n < 500 \times 10^3$ is exceeded for grease and when high temperatures occur in bearing. Then, oil has to lubricate and to remove heat from bearing.

Oils used for bearing lubrication can be:

- mineral oils, used up to a temperature of + 150°C
- synthetic oils, used up to a temperature of + 220°C

For a proper lubrication of bearings, low quantities of lubricants to reach the rolling elements are needed.

The lubricating systems must provide oil quantity necessary to prevent oil draining from bearing and heat removal in case of high speeds.

Most usual oil lubricating systems depending on factor $D_m\, n$ are given in table 8.8.

Oil lubricating systems

Table 8.8

Lubricating system	Operating conditions	Factor Dm n	Oil viscosity at 40°C (m^2/s)	Example in fig.
Oil bath	Bath is filled up to the lowest rolling element for horizontal shaft and 70-80% of bath width for vertical shaft	$< 250 \times 10^3$	$(17.....300) \times 10^{-6}$	8.3 a), b)
Oil bath with external circulation	Central tank, oil circulates under a pressure of 1,5 MPa. High speeds.	$< 600 \times 10^3$	$(45...175) \times 10^{-6}$	8.4
Oil injection	Oil is injected into the operating area under a pretssure of 0.1..0.5 MPa, with flow capacity of 0.5..10 l/min depending on temperature. Heavy loads and high speeds.	$< 900 \times 10^3$	$(13,5..80) \times 10^{-6}$	8.5
Oil spot	Oil in air current under a pressure of (0.05..0.5)MPa, flow capacity of (0,5..4) m^3/hour, 0.5..4)m/hour for small and medium-sized bearings, heavy loads and high speeds.	$< 1200 \times 10^3$	$(10...45) \times 10^{-6}$	8.6

Approximate values of oil kinematic viscosity at +40°C depending on the operating temperature are given in table 8.9.

Corelation between viscosity and temperature

Table 8.9

Temperature t°C		**Viscosity at 40°C, cSt**
over	up to	
-	**50**	12...60
50	**80**	37...75,5
80	**120**	> 75,5
120	**150**	227

Diagram fig. 8.7 shows kinematic viscosity classes at 40°C in accordance with ISO, its variation depending on the operating temperature (t °C) in relation to speed and bearing mean diameter (D_m).

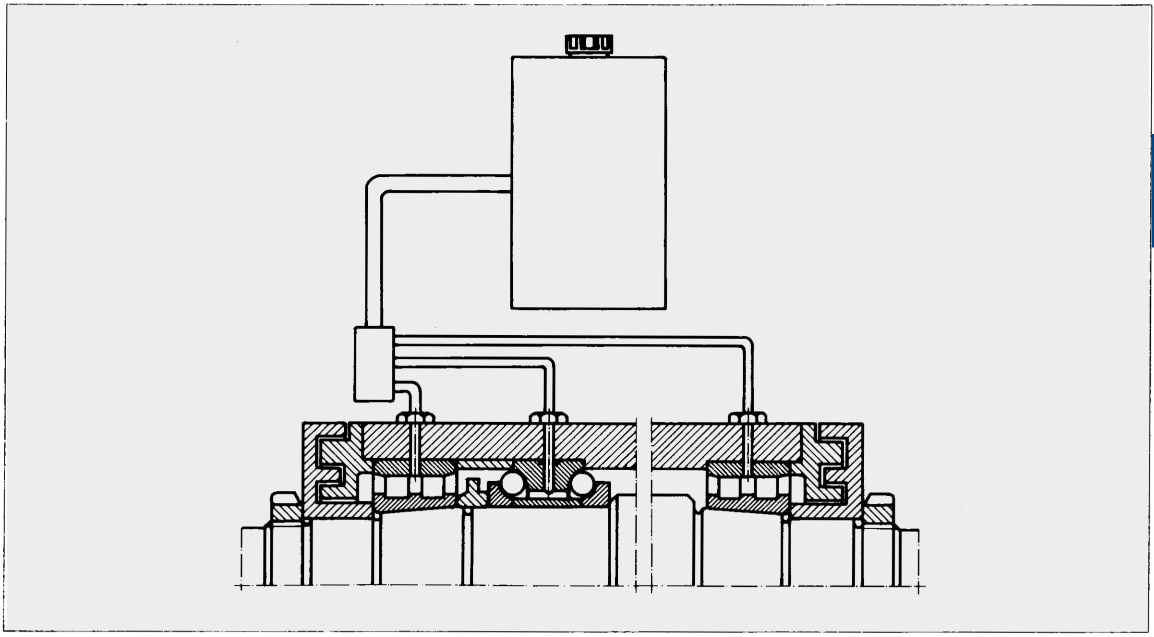


Fig. 8.6

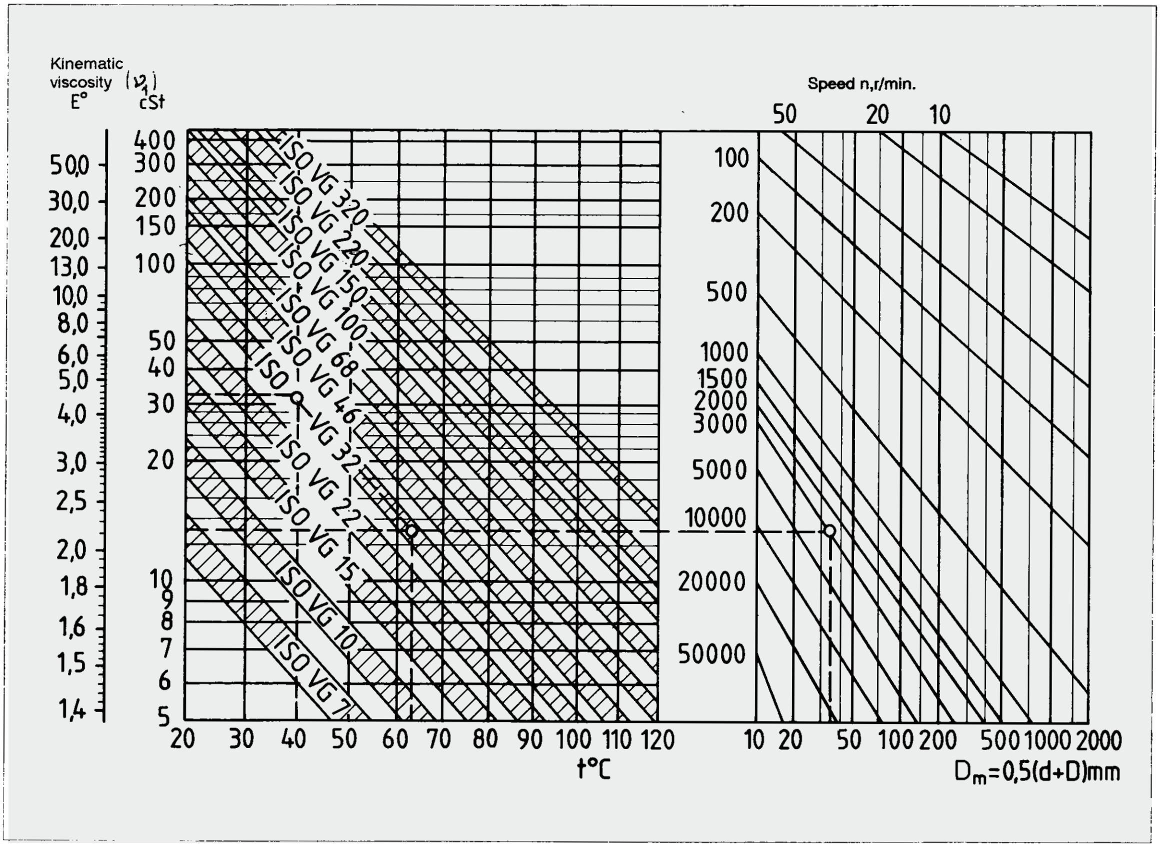

Kinematic viscosity
E°
(ν1)
cSt
50,0
30,0
20,0
13,0
10,0
8,0
6,0
5,0
4,0
3,0
2,5
2,0
1,8
1,6
1,5
1,4
400
300
200
150
100
50
40
30
20
10
9
8
7
6
5
ISO VG 320
ISO VG 220
ISO VG 150
ISO VG 100
ISO VG 68
ISO VG 46
ISO VG 32
ISO VG 22
ISO VG 15
ISO VG 10
ISO VG 7
20
30
40
50
60
70
80
90
100
110
120
t°C
Speed n,r/min.
50
20
10
100
200
500
1000
1500
2000
3000
5000
10000
20000
50000
10
20
50
100
200
500
1000
2000
Dm=0,5(d+D)mm

Fig. 8.7

Example

A bearing 6204 is to operate under a speed $n = 2\,000$ r/min at a temperature $t = +65°C$. $D_m = 0,5\,(d + D) = 35,5$ mm.

The viscosity of the oil for bearing lubrication is required.

From the diagram, for $D_m = 35,5$ mm, we can find viscosity at +65°C, $\nu_1 = 13$ cSt and viscosity at +40°C, $\nu = 32$ cSt.

Table 8.10 shows oils which are recommended by ISO for bearing lubrication. Values of kinematic viscosity at +40°C, mm^2/s are also given.

Recommended oils by ISO standards

Table 8.10

Class ISO	Kinematic viscosity at +40°C, mm^2/s (cSt)		
	mean	low	high
ISO VG 2	2,2	1,98	2,42
ISO VG 3	3,2	2,88	3,52
ISO VG 5	4,6	4,14	5,06
ISO VG 7	6,8	6,12	7,48
ISO VG 10	10	9	11
ISO VG 15	15	13,5	16,5
ISO VG 22	22	19,8	24,2
ISO VG 32	32	28,8	35,2
ISO VG 46	46	41,4	50,6
ISO VG 68	68	61,2	74,8
ISO VG 100	100	90	110
ISO VG 150	150	135	165
ISO VG 220	220	198	242
ISO VG 320	320	288	352
ISO VG 460	460	414	506
ISO VG 680	680	612	748
ISO VG 1 000	1 000	900	1 100
ISO VG 1 500	1 500	1 350	1 650

9. Bearing designation

The purpose of designation is that of identification of bearings, so that bearings with the same designation to be interchangeable both dimensionally and operationally no matter who the producers may be. Designations of rolling bearings are in accordance with those used by world-known bearing companies: SKF, FAG, INA, KOYO etc. and they are standardized by national standard

The complete designation of a bearing consists of a basic design and may include one or more supplementary designations (prefixes and suffixes), as shown in chart fig.9.1.

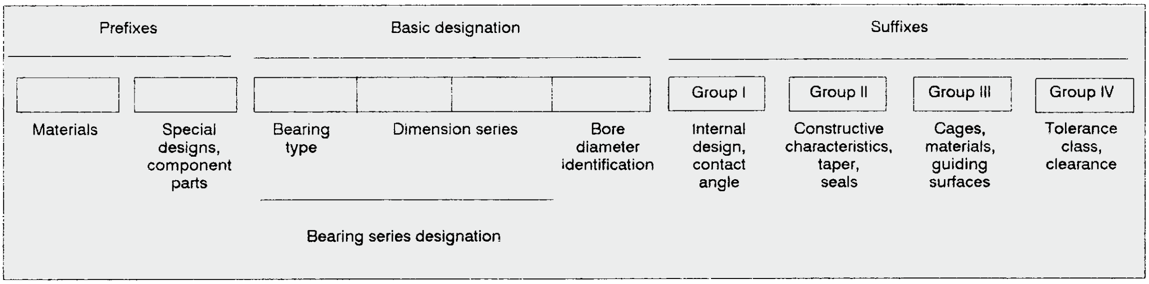


Fig. 9.1

The basic designation consists of an identification of the type of bearing (figure or letter), the series designation, in accordance with ISO and the bore diameter identification.

The designations of the bearing type and dimension series for main standardized and unstandardized bearing types are given in table 9.1.

Bore diameter identification consists of one, two or more figures as follows:

- bore diameter from 1 to 9 mm	- one figure, representing the bore diameter (e.g. 623, 608);
- bore diameter from 10 to 495 mm	- two figures, as follows:00 for 10 mm, 01 for 12 mm, 02 for 15 mm, 03 for 17 mm, 04 and up to 99 for bore diameter from 20 to 495 mm. (bore diameter = bore diameter identification x 5, e.g. 6230, d = 150 mm);
- bore diameter of 500 mm and over 500 mm	- is stated directly separated by a slash, the same applies to the values which are not perfect multiples of 5, or if they include a decimal point (e.g. 610/560, 62/32, 62/1,5).

Dismountable single row deep groove ball bearings of magneto-type (E, BO, L, M), non-standardized needle roller bearings, needle roller and cage assemblies , support rollers, cam followers and other types of special bearings listed in this catalogue make an exception from this rule. In this cases, the values of bore diameter are stated (e.g. E15, L20, NA304520, K121515, NATR22).

Prefixes

Prefixes are letter-identifications which indicate the material, other than steel for bearings or component parts of bearing. The prefix for material is separated by a horizontal line from the rest of designation.

Prefixes for materials

H - heat-resisting steel (e.g. H - NUP 210)
M - copper alloy (e.g. M - 6008)
S - plastics, glass, ceramics etc. (e.g. S - 6204)
T - case - hardening steel (e.g. T - 35352)
X - stainless steel (e.g. X - 6202)

Prefixes for special designs or parts of bearings

BL - single row deep groove ball bearings with maximum number of balls (e.g. BL6208)
K - cage with rolling elements of dismountable bearing (e.g. KNU205)
L - free ring of dismountable bearing (e.g. LNU205) (interchangeable ring, e.g. L30205)
R - dismountable bearing without free ring) (e.g. RNU205; RN205)
E - shaft washer of thrust ball bearing (e.g. E51210)
W - housing washer of thrust ball bearing (e.g. W51216)
WS - shaft washer of roller thrust bearing (e.g. WS81108)
GS - housing washer of roller thrust bearing (e.g. GS 81112)
LS - axial washer, thickness greater than 1 mm (e.g. LS 2035)
AS - axial washer, thickness less than 1 mm or less (e.g. AS 2035)

Suffixes

Suffixes are used to identify various constructive modifications of the bearing in comparison to normal design. They are classified in four different groups, as follows:

Group I - Modifications of internal design, design with increased basic load (e.g. A, C, E etc.), contact angle (e.g. A, B, C) and others.

Group II - Modifications of external design, tapered bore, groove on outer ring etc. (e.g. 30205A, 1210K, 6210NR, 6310-2RS)

Group III - Modifications of cage design, material, guiding surfaces etc. (e.g. 6205TN, NU310MA).

Group IV - Modifications of normal design regarding tolerance classes, bearing radial or axial clearance, stability of dimensions at high temperatures, bearing matching etc. (e.g. 6206P5, 6310P53, NU210SO, 7010CDB).

These suffixes for bearing designation are listed considering the groups they belong to, at the beginning of each bearing group.

10. Examples of bearing calculation

Example no. 1

Operating conditions

- Oscilating movement with angular amplitude $\gamma = 15°$,
- Steady radial load: 5 kN.

Problem to be solved

A deep groove ball bearing, single row, with the smallest width is to be selected so that a rating life of 10 000 cycles should be economically satisfied.

Answer

On page 23, the following equation can be found:

$$L_{10osc} = \frac{180°}{2\gamma} L_{10}$$

Using this equation, bearing rating life for complete rotary movement can be determined:

$$L_{10} = \frac{2\gamma}{180} L_{10osc},$$

$$C_r = P_r \sqrt[3]{L_{10}} = P_r \sqrt[3]{\frac{2\gamma}{180} L_{osc}} = 5 \sqrt[3]{\frac{2\cdot 15}{180} 10\cdot 10^3} = 59{,}3 \text{ kN}$$

Bearing 6310 can be found on page 133 with: $C_r = 61{,}8$ kN şi $d = 50$ mm, $D = 110$ mm, $B = 27$ mm.

Example no. 2

Operating conditions

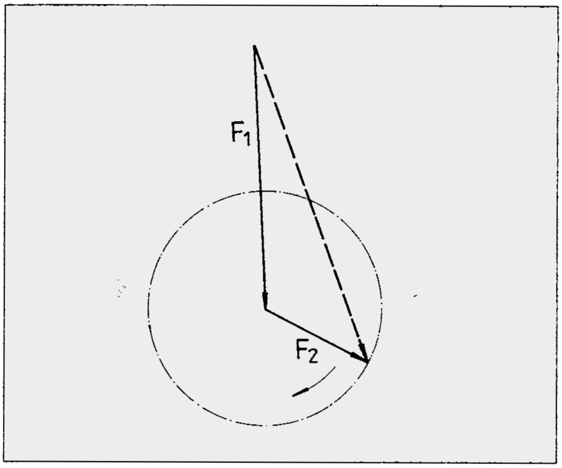
- Rotary movement under a radial load with a component steady in magnitude and direction $F_1 = 25$ kN and a component with variable direction and steady magnitude $F_2 = 10$ kN. Components F_1 and F_2 are acting in the same plane (see the figure below).
- Component F_2 rotates $n = 3\,000$ r/min.
- Oil lubrication.

Problem to be solved

A single row cylindrical roller bearing NU type , with outside diameter less than 220 mm, and a rating life $L_{10h} = 20\,000$ operating hours should be selected.

Answer

We calculate



$$k = \frac{F_1}{F_1 + F_2} = \frac{25}{25+10} = 0{,}7$$

From fig. 5, page 25, for $k = 0{,}7$ corresponds $f_m = 0{,}79$

Then, mean load is to be calculated:

$$F_m = f_m(F_1 + F_2) = 0{,}79\cdot 35 = 27{,}65 \text{ kN}$$

We further use the equation:

$$L_{10h} = \frac{16\,666}{n}(C/P)^p,\ p = 10/3 \text{ for roller bearings.}$$

$$C = P \sqrt[10/3]{\frac{n L_{10h}}{16\,666}} = 27{,}65 \sqrt[10/3]{\frac{3\,000\cdot 20\,000}{16\,666}} = 322{,}54 \text{ kN}$$

From the bearing table, page 246, we find out that the bearings NU420 or NU2224MA are proper.

Example no. 3

Operating conditions

A deep groove ball bearing, single row, 6312, mounted in the gearbox of a vehicle is to operate under the following conditions:

Operating conditions	1	2	3
The fraction of operating time in conditions i and q_i	0,2	0,3	0,5
Speed, n (min^{-1})	400	800	1000
Radial load, F_{ri} (kN)	14,32	7,613	3,57
Axial load, F_{ai} (kN)	4,76	2,36	1,18

Problem to be solved

Which will be the rating life of this bearing (L_{10h}, operating hours)?

Answer

In the bearing table, for the bearing 6312, $C_r = 81{,}8$ kN and $C_{0r} = 51{,}9$ kN can be found.

$0{,}5(d+D) = 0{,}5(60+130) = 95$ mm

From fig.3, $f_0 = 13{,}14$ can be determined.

For the operating conditions 1:

$\frac{f_0 F_{a1}}{C_{0r}} = \frac{13{,}14 \cdot 4{,}726}{51{,}9} = 1{,}20$ and corresponds to $e = 0{,}28$,

$\frac{F_{a1}}{F_{r1}} = \frac{4{,}726}{14{,}320} = 0{,}33 > e.$

By insert, for $e = 0{,}28$ and normal radial clearance, from table 4,

$X_1 = 0{,}56$, $Y_1 = 1{,}56$,
$X_2 = 0{,}56$, $Y_2 = 1{,}81$,
$X_3 = 0{,}56$, $Y_3 = 2{,}10$,

The equivalent radial force in case i can be calculated using the equation:

$P_i = X_i F_{ri} + Y_i F_{ai}$,

$P_1 = 0{,}56 \cdot 14{,}320 + 1{,}56 \cdot 4{,}726 = 15{,}39$ kN,
$P_2 = 0{,}56 \cdot 7{,}613 + 1{,}81 \cdot 2{,}360 = 8{,}53$ kN,
$P_3 = 0{,}56 \cdot 3{,}57 + 2{,}1 \cdot 1{,}18 = 4{,}48$ kN.

Number of bearing revolutions under steady load F_i will be:

$$N_i = n_i q_i L_{10h}; \quad n_m = \sum_{i=1}^{n} n_i q_i$$

The bearing total number of revolutions can be calculated from:

$$N = \sum_{i=1}^{n} N_i = L_{10h} \sum_{i=1}^{n} n_i q_i$$

To calculate the equivalent mean dynamic load, the following equation on page 25 can be used

$$P_m = \sqrt[3]{\frac{P_1^3 n_1 + P_2^3 n_2 + P_3^3 n_3}{n_1 + n_2 + n_3}} =$$

$$= \sqrt[3]{\frac{P_1^3 n_1 q_1 L_{10h} + P_2^3 n_2 q_2 L_{10h} + P_3^3 n_3 q_3 L_{10h}}{n_1 q_1 L_{10h} + n_2 q_2 L_{10h} + n_3 q_3 L_{10h}}} =$$

$$= \sqrt[3]{\frac{P_1^3 n_1 q_1 + P_2^3 n_2 q_2 + P_3^3 n_3 q_3}{n_1 q_1 + n_2 q_2 + n_3 q_3}} =$$

$$= \sqrt[3]{\frac{15{,}39^3 \cdot 400 \cdot 0{,}2 + 8{,}53 \cdot 800 \cdot 0{,}3 + 4{,}48^3 \cdot 1000 \cdot 0{,}5}{400 \cdot 0{,}2 + 800 \cdot 0{,}3 + 1000 \cdot 0{,}5}} = 8{,}39 \text{ kN}$$

The rating life L_{10h} is to be calculated using the equation on page 19

$$L_{10h} = \frac{1\,000\,000}{60\,n} \left(\frac{C}{P}\right)^3$$

$L_{10h} = 20\,437$ operating hours

Example no. 4

Operating conditions

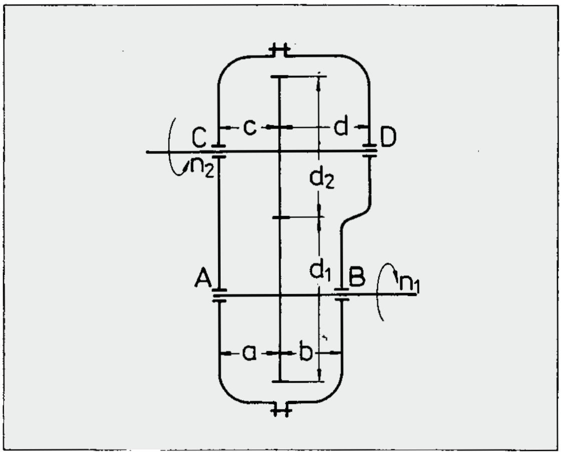
For the reverser shown in the adjoining figure, the following data are known:

Input power:	N = 97 kW,
Input shaft speed:	$n_1 = 1\,000$ r/min,
An axial load is intermittently acting on the input shaft for a period of 5% of the operating period:	$F_a = 4$ kN,
Operating period:	$L_{10h} = 10\,000$ operating hours,
Constructive details:	$a = b = c = 38$ mm, $d = 52$ mm, $d_1 = 172$ mm, $d_2 = 148$ mm.

Lubrication in oil bath.

Problem to be solved

The type and dimensions of the bearing suitable for the bearing joints (A, B, C, D) of the reverser should be determined.



Answer

Output shaft speed:

$$n_2 = \frac{n_1 d_1}{d_2} = \frac{1\,000 \cdot 172}{148} = 1\,162 \text{ r/min}$$

Input moment can be calculated from:

$$M = \frac{9{,}74\,N}{n_1} = \frac{9{,}74 \cdot 97}{1\,000} = 0{,}94 \text{ kN m}$$

Tangential force on the wheels 1 and 2:

$$T = \frac{M}{0{,}5\ d_1} = \frac{0{,}94}{0{,}5 \cdot 172 \cdot 10^{-3}} = 10{,}93\ \text{kN}$$

Rejecting force between wheels 1 and 2:

$$R = T\ \text{tg}\alpha = 10{,}93 \cdot \text{tg}\ 20° = 3{,}97\ \text{kN}$$

Loading force of the shafts 1, 2:

$$F = \sqrt{T^2 + R^2} = \sqrt{10{,}93^2 + 3{,}97^2} = 11{,}63\ \text{kN}.$$

Loading forces in bearing joints:

$$F_{rA} = F_{rB} = \frac{F}{2} = \frac{11{,}63}{2} = 5{,}82\ \text{kN},$$

$$F_{rC} = \frac{F\ d}{c+d} = \frac{11{,}63 \cdot 52}{38+52} = 6{,}72\ \text{kN},$$

$$F_{rD} = \frac{F\ c}{c+d} = \frac{11{,}63 \cdot 38}{38+52} = 4{,}91\ \text{kN}.$$

Cylindrical roller bearings in all bearing joints:

$$P = F_r$$

Minimum radial dynamic loads which are necessary for the bearings in the joints A, B, C, D can be calculated using the equation on page 19:

$$C_{rA} = C_{rB} = 5{,}82 \sqrt[10/3]{\frac{60 \cdot 10\,000 \cdot 1\,000}{10^6}} = 39{,}66\ \text{kN},$$

$$C_{rC} = 6{,}72 \sqrt[10/3]{\frac{60 \cdot 10\,000 \cdot 1\,162}{10^6}} = 47{,}91\ \text{kN},$$

$$C_{rD} = 4{,}91 \sqrt[10/3]{\frac{60 \cdot 10\,000 \cdot 1\,162}{10^6}} = 35\ \text{kN}.$$

For the joints A, B and C a bearing NJ207E with $C_r = 49{,}9$ kN, $C_{0r} = 49{,}7$ kN can be used.

For joint D, a bearing NJ206E with $C_r = 39{,}7$ kN, $C_{0r} = 37{,}9$ kN can be used.

Maximum axial loads admitted by the bearings NJ207E and NJ206E respectively, can be calculated from:

$$F_{ap} = \frac{K_1\ C_{0r}\ 10^4}{n(d+D)} + K_2\ F_r$$

We select from table 5, pag. 228, $K_1 = 1{,}5$ şi $K_2 = 0{,}15$.

$$F_{apC} = \frac{1{,}5 \cdot 49{,}7 \cdot 10^4}{1\ 162(35+72)} - 0{,}15 \cdot 6{,}72 = 4{,}98\ \text{kN},$$

$$F_{apD} = \frac{1{,}5 \cdot 37{,}9 \cdot 10^4}{1\ 162(35+72)} - 0{,}15 \cdot 4{,}91 = 3{,}83\ \text{kN}.$$

One can notice that $F_{apD} < F_a$. The problem can be correctly solved by using the same bearing NJ207E also in joint D.

Example no. 5

Operating conditions

Loads in bearings: $F_{rA} = 2\ 100$ N,
$F_{rB} = 3\ 200$ N,
$F_a = 400$ N.

Angular deformation: $\varphi_A = \varphi_B = 2°$

Shaft diameters: $d_A = d_B = 70$ mm

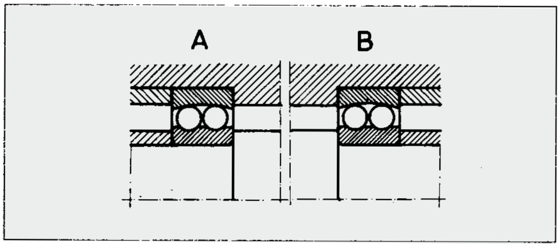
Housing maximum diameters: $D_{A\max} = D_{B\max} = 140$ mm

Shaft speed: $n = 1\ 400$ r/min

Requisite rating life: $L_{10h} = 20\ 000$ h

Problem to be solved

Selecting and checking the bearings, in the figure below:



Answer

Due to the great angular deformations in bearing units, self-aligning ball bearings, small width series 1214, are to be selected, characteristics in the catalogue:

$d = 70$ mm,
$D = 125$ mm < 140,
$B = 24$ mm,
$C_r = 34\ 600$ N,
$e = 0{,}18$,
$Y_1 = 3{,}5$,
$Y_2 = 5{,}4$.

Equivalent load for each bearing is to be calculated:

For bearing unit A: $F_{aA} = F_a$,

$$\frac{F_{aA}}{F_{rA}} = \frac{460}{2\ 100} = 0{,}19 > e.$$

$$P_A = 0{,}65\ F_{rA} + Y_2\ F_{aA} = 0{,}65 \cdot 2\ 100 + 5{,}6 \cdot 400 = 3\ 525\ \text{N}.$$

For bearing unit B: $P_{aB} = 0$,

$$P_B = F_{rB} = 3\ 200\ \text{N}.$$

Since $P_A > P_B$, the bearing in the bearing unit A should be checked. Rating life, operating hours, can be calculated using the equation:

$$L_{10h} = \frac{1\ 000\ 000}{60\ n}\left(\frac{C_r}{P_A}\right)^3 = \frac{1\ 000\ 000}{60 \cdot 1\ 400}\left(\frac{34\ 600}{3\ 525}\right)^3 = 11\ 258\ \text{hours} < L_{10h}$$

Other bearings should be selected, wide series 2214, with the characteristics in the catalogue.

$d = 70$ mm,
$D = 125$ mm < 140 mm,
$B = 31$ mm,
$C_r = 44\ 200$ N,
$e = 0{,}27$,
$Y_1 = 2{,}3$,
$Y_2 = 3{,}6$.

Equivalent load is to be calculated:

for bearing unit A: $\frac{F_{aA}}{F_{rA}} = 0{,}19 < e$,

$$P_A = F_{rA} + Y_1\ F_{aA} = 2\ 100 + 2{,}3 \cdot 400 = 3\ 020\ \text{N}.$$

for bearing unit B: $F_{aB} = 0$,
$P_B = F_{rB} = 3\ 200$ N.

In this case, $P_B > P_A$, then the bearing in bearing unit B should be checked:

$$L_{10h} = \frac{1\ 000\ 000}{60 \cdot 1\ 400}\left(\frac{44\ 200}{3\ 200}\right)^3 = 31\ 371\ \text{operating hours} > \text{requisite}\ L_{10h}$$

Example no. 6

Operating conditions

Loads in bearing units: $F_r = 1\ 000$ N,
$F_a = 1\ 800$ N.

Shaft diameter: $d = 30$ mm

Shaft speed: $n = 2\ 500$ r/min

Requisite rating life: $L_h = 15\ 000$ operating hours.

Problem to be solved

Checking the angular ball bearing, double row, 3306.

Answer

The bearing 3306 is to be checked, characteristics in the catalogue:

$d = 30$ mm, $C_r = 38\ 000$ N,
$D = 72$ mm, $C_{0r} = 24\ 500$ N,
$B = 30{,}2$ mm,
$\alpha = 32°$.

$$\frac{F_a}{F_r} = \frac{1\ 800}{1\ 000} = 1{,}8 > 0{,}86,$$

$$P_r = 0{,}62\ F_r + 1{,}17\ F_a = 0{,}62 \cdot 1\ 000 + 1{,}17 \cdot 1\ 800 = 2\ 726\ \text{N},$$

$$L_{10h} = \frac{1 \cdot 10^6}{60\ n}\left(\frac{C_r}{P_r}\right)^3 = \frac{1 \cdot 10^6}{60 \cdot 2\ 500}\left(\frac{38\ 000}{2\ 726}\right)^3 = 18\ 058\ \text{hours} > 15\ 000\ \text{hours.}$$

Example no. 7

Operating conditions

Loads in bearing units: $F_r = 7\ 900$ N,
$F_a = 7\ 100$ N.

Shaft diameter: $d = 60$ mm

Shaft speed: $n = 4\ 500$ r/min

Requisite rating life: $L_{10h} = 6\ 000$ operating hours

Problem to be solved

Checking the arrangement: four-point contact bearing and cylindrical roller bearing

Answer

The bearing QJ212, characteristics in the catalogue, is to be checked under a pure axial load:

$d = 60$ mm, $C_r = 92\ 300$ N,
$D = 110$ mm, $C_{0r} = 71\ 000$ N,
$B = 22$ mm.

$F_r = 0,$

$P_a = 1{,}07\ F_a = 1{,}07 \cdot 7\ 100 = 7\ 597$ N,

$$L_{10h} = \frac{1 \cdot 10^6}{60 \cdot 4\ 500}\left(\frac{92\ 300}{7\ 597}\right)^3 = 6\ 642\ \text{hours} > 6\ 000\ \text{hours.}$$

The bearing NU212E, characteristics in the catalogue, is to be checked under a pure radial load:

$d = 60$ mm, $C_r = 93\ 400$ N,
$D = 110$ mm, $C_{0r} = 101\ 000$ N,
$B = 22$ mm.

$P_r = F_r = 7\ 900$ N,

$$L_{10h} = \frac{1 \cdot 10^6}{60 \cdot 4\ 500}\left(\frac{93\ 400}{7\ 900}\right)^3 = 6\ 120\ \text{hours} > 6\ 000\ \text{hours.}$$

Example no. 8

Determining the size of a needle cage and the thickness of the case-hardened layer for the adjoint parts for the operating conditions specified below:

Fraction of operating time	Speed r/min	Radial load F_r (N)
$m_1 = 0{,}2$	$n_1 = 300$	$F_{r1} = 16\ 500$
$m_2 = 0{,}025$	$n_2 = 540$	$F_{r2} = 12\ 000$
$m_3 = 0{,}015$	$n_3 = 720$	$F_{r3} = 9\ 000$
$m_4 = 0{,}76$	$n_4 = 1\ 200$	$F_{r4} = 6\ 000$

Shaft diameter: $d_{a\ min} = 57$ mm
Material: case-hardening steel 13CrNi35X
Hardness: 60-62 HRC

Problem to be solved

The needle cage is to be selected so that the bearing rating life should be $L_{10h} = 8\ 000$ hours.

Answer

We calculate the equivalent radial load (see page 24):

$$F_{re} = \sqrt[10/3]{\frac{m_1 n_1 F_{r1}^{10/3} + m_2 n_2 F_{r2}^{10/3} + m_3 n_3 F_{r3}^{10/3} + m_4 n_4 F_{r4}^{10/3}}{m_1 n_1 + m_2 n_2 + m_3 n_3 + m_4 n_4}} =$$

$$= \sqrt[10/3]{\frac{0{,}2 \cdot 300 \cdot 16\ 500^{10/3} + 0{,}025 \cdot 540 \cdot 12\ 000^{10/3} + 0{,}015 \cdot 720 \cdot 9\ 000^{10/3} + 0{,}76 \cdot 1\ 200 \cdot 6\ 000^{10/3}}{0{,}2 \cdot 300 + 0{,}025 \cdot 540 + 0{,}015 \cdot 720 + 0{,}76 \cdot 1\ 200}} = 8\ 214\ \text{N}$$

Equivalent medium speed:

$$n_e = m_1 n_1 + m_2 n_2 + m_3 n_3 + m_4 n_4 = 0{,}2 \cdot 300 + 0{,}025 \cdot 540 + 0{,}015 \cdot 720 + 0{,}76 \cdot 1\ 200 = 996\ \text{r/min},$$

$$L_{10} = \frac{60 \cdot L_h \cdot n_e}{10^6} = \frac{60 \cdot 8\ 000\ 996}{10^6} = 478\ \text{mil. revolutions}$$

Requisite dynamic load carrying capacity:

$$C_r = F_{re} \sqrt[10/3]{L_{10}} = 8\ 214 \sqrt[10/3]{478} = 52\ 286\ \text{N}$$

From the bearings tables, a double row needle cage KK 576343 is to be selected:

$F_w = 57$ mm,
$E_w = 63$ mm,
$C_r = 55{,}55$ kN.

Rolling element diameter is: $D_W = \frac{E_W - F_W}{2} = 3$ mm

In accordance with the specifications on page 288, the minimum thickness of the case-hardened layer (t_{min}) can be determined from the equation:

$t_{min} = (0{,}07..0{,}12)D_W = 0{,}3 \dots 0{,}36$ mm.

Example no. 9

Operating conditions

A drawn cup needle roller bearing, RHNA 253226, rotates at a speed $n = 4\,000$ r/min on a shaft with surface hardness 50 HRC. Bearing rating life must be $L_{10h} = 5\,000$ operating hours.

Problem to be solved

What radial dynamic load can this bearing carry?

Answer

Basic radial dynamic load $C_r = 24{,}5$ kN found in the table, page 301, should be multiplied by 0,6, so that the shaft hardness of 50 HRC, table 1, could be considered.

$C_r = 24{,}5 \cdot 0{,}6 = 14{,}7$ kN

On page 21, for 4 000 r/min and 5 000 hours it corresponds C/P = 8,39.

Admissible dynamic load will be:

$$P_r = \frac{C_r}{8{,}39} = \frac{14{,}7}{8{,}39} = 1{,}75 \text{ kN.}$$

Example no. 10

Operating conditions

Loads on bearings: $F_{rA} = F_{rB} = F_r = 300$ N,
$K_a = 200$ N.

Shaft diameter: d = 20 mm

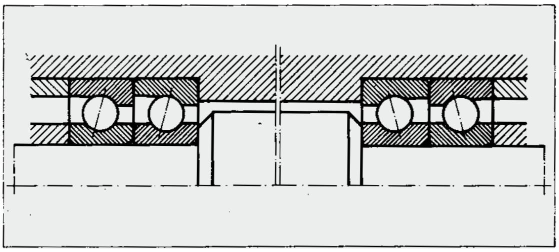
Shaft speed: n = 30 000 r/min

Lubrication: oil spot

Temperature: t = 180°C

Problem to be solved

From constructive considerations, the bearing 7204CTAP4 is to be selected. A set of 2 bearings in tandem arrangement, 7204CTAP4DT, should be mounted as in the figure below.



The basic load rating is to be calculated and the speed limit is to be checked, considering that the axial load K_a, may be oriented toward any of the two bearings.

Answer

The characteristics of the bearing pair 7204 CTAP4DT are:

d = 20 mm, $C_{0r} = 18\,000$ N,
D = 47 mm, $C_r = 25\,300$ N,
B = 14 mm, n = 43 000 r/min (oil).

The axial loads in bearings:

$F_{aA} = F_{aB} = 1{,}14\,F_r + K_a = 1{,}14 \cdot 300 + 200 = 542$ N.

The factors for the axial load are to be selected from table 6, depending on the equation:

$$\frac{f_0\, i\, F_a}{C_{0r}} = \frac{13{,}3 \cdot 2 \cdot 542}{18\,000} = 0{,}80$$

We find: e = 0,44, Y = 1,28

The equivalent load is to be calculatedz:

$$\frac{F_a}{F_r} = \frac{542}{300} = 1{,}81 > e,$$

$P_r = 0{,}44 \cdot 300 + 1{,}28 \cdot 542 = 826$ N.

Requisite rating life is:

$$L_{10h} = \frac{1 \cdot 10^6}{60 \cdot 30\,000}\left(\frac{25\,300}{826}\right)^3 = 15\,964 \text{ hours}$$

Adjusted rating life:

$L_{nah} = f_t\, L_{10h} = 0{,}89 \cdot 15\,964 = 14\,208$ hours (f_t, from table 2.9, page 27).

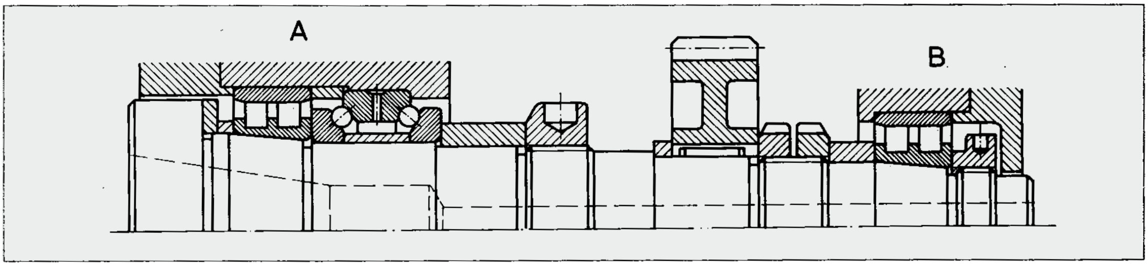
Permissible speed limit:

$n_{adm} = f_1\, n = 0{,}94 \cdot 43\,000 = 40\,400$ r/min > 30 000
(f_1, according to the figure 13, page 36)

Example no. 11

Operating conditions

The bearing of an universal milling machine (see figure below) consist of a cylindrical roller bearing, double row, NN3020KMP41 type. For axial location, the thrust ball bearing, double row, 234420SP is used.



The loads in the bearing F_a = 4 000 N,
F_r = 12 000 N.

Medium speed: n_{med} = 3 000 r/min.

Problem to be solved

Determining the rating life for the bearings in the locating ring.

Answer

Radial load F_r and P_r, respectively, are taken over by the cylindrical roller bearing. In accordance with the table

C_r = 152 000 N

The rating life of this bearing is:

$$L = \left(\frac{C_r}{P_r}\right)^{10/3} = \left(\frac{152\,000}{12\,000}\right)^{10/3} = 4\,737{,}5 \text{ mil. revolutions,}$$

and the requisite rating life:

$$L_{10h} = \frac{10^6\,L_{10}}{60\,n_{med}} = \frac{10^6 \cdot 4\,737{,}5}{60 \cdot 3\,000} = 26\,320 \text{ hours,}$$

this value correspond to table 2.4, page 21.

The axial load F_a and P_a, respectively, are taken over by the thrust ball bearing. In accordance to table

C_a = 62 000 N

The bearing rating life is:

$$L = \left(\frac{C_a}{P_a}\right)^{3} = \left(\frac{62\,000}{4\,000}\right)^{3} = 3\,724 \text{ mil. revolutions,}$$

and the requisite rating life, in operating hours, is:

$$L_{10h} = \frac{10^6\,L_{10}}{60\,n} = \frac{10^6 \cdot 3\,724}{60 \cdot 3\,000} = 20\,690 \text{ hours,}$$

this value correspond to table 2.4, page 23.
The same results can be obtained using the table 2.2, page 20 and table 2.3, page 21, respectively:

for the bearing NN3020KMP41:
C_r/P_r = 12,66, n = 3 000 r/min,
L_{10h} = 26 244 hours.

for the bearing 234420SP:
C_a/P_a = 15,5, n = 3 000 r/min.
L_{10h} = 20 833 hours.

Example no. 12

Operating conditions

Loads in bearing units: F_{rA} = 6 500 N,
F_{rB} = 7 200 N,
K_a = 2 500 N,

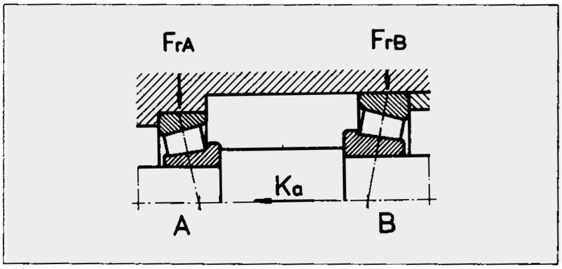
Shaft diameters d_A = 25 mm,
d_B = 30 mm.

Shaft speed: n = 550 r/min

Requisite rating life: L_{10h} = 2 000 hours

Problem to be solved

Selecting the tapered roller bearings for the arrangement in the adjoining figure:



Answer

For constructive reasons, the following bearings are to be selected:
- 30305A for the bearing unit A, with: C_{rA} = 43 000 N,
e_A = 0,3,
Y_A = 2.

- 32006XA for the bearing unit A, with: C_{rB} = 34 000 N,
e_B = 0,43,
Y_B = 1,4.

We calculate:

$$\frac{F_{rA}}{Y_A} = \frac{6\,500}{2} = 3\,250,$$

$$\frac{F_{rB}}{Y_B} = \frac{7\,200}{1{,}4} = 5\,143,$$

Since

$\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ şi $K_a \geq 0$, it is the case 2a in table 4,

The total axial loads in the two bearing units can be calculated with the equation:

$$F_{aA} = F_{aB} + K_a = 2\,250 + 2\,500 = 4\,750 \text{ N,}$$

$$F_{aB} = \frac{0{,}5\,F_{rB}}{Y_B} = \frac{0{,}5 \cdot 7\,200}{1{,}4} = 2\,571 \text{ N.}$$

Equivalent dynamic load on bearing unit should be calculated:

$$\frac{F_{aA}}{F_{rA}} = \frac{4\,750}{6\,500} = 0{,}73 > e_A, \text{ bearing unit A:}$$

$$P_{rA} = 0{,}4\,F_{rA} + Y_A\,F_{aA} = 0{,}4 \cdot 6\,500 + 2 \cdot 4\,750 = 12\,100 \text{ N}$$

$$\frac{F_{aB}}{F_{rB}} = \frac{2\,250}{7\,200} = 0{,}31 < e_B, \text{ bearing unit B:}$$

$$P_{rB} = F_{rB} = 7\,200 \text{ N.}$$

The rating life of the two bearings can be determined considering the requisite rating life:

$$L_{10} = \frac{60\,n\,L_{10h}}{10^6} = \frac{60 \cdot 550 \cdot 2\,000}{10^6} = 66 \text{ mil. revolutions}$$

The requisite dynamic load should be determined:

$$C_{rA\,nec} = P_A \sqrt[10/3]{L_{10}} = 12\,100 \sqrt[10/3]{66} = 42\,525 \text{ N} < C_{rA},$$

$$C_{rB\,nec} = P_B \sqrt[10/3]{L_{10}} = 7\,200 \sqrt[10/3]{66} = 25\,304 \text{ N} < C_{rB}.$$

The selected bearings correspond to the operating conditions.

Example no. 13

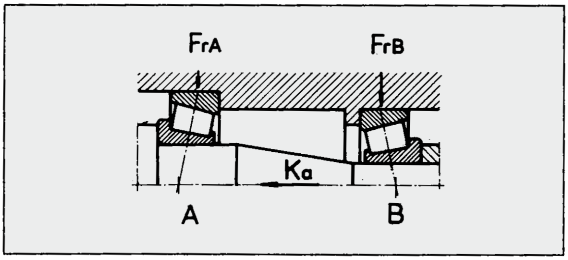
Operating conditions

Bearing unit A: bearing 30210A,
Bearing unit B: bearing 32208A.

Loads in bearing units: F_{rA} = 15 000 N,
F_{rB} = 11 000 N,
K_a = 3 000 N.
Shaft speed: n = 1 200 r/min.

Problem to be solved

To determine the minimum rating life for the arrangement in the figure below.



Answer

The characteristics of the used bearings

- 30210A: $C_r = 69\,700$ N, $e = 0{,}43$, $Y_A = 1{,}4$.
- 32208A: $C_r = 66\,200$ N, $e = 0{,}37$, $Y_B = 1{,}6$.

We calculate:

$$\frac{F_{rA}}{Y_A} = \frac{15\,000}{1{,}4} = 10\,714,$$

$$\frac{F_{rB}}{Y_B} = \frac{11\,000}{1{,}6} = 6\,875.$$

Since:

$$\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B} \text{ şi}$$

$$K_a > 0{,}5\left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right) = 0{,}5\left(\frac{15\,000}{1{,}4} - \frac{11\,000}{1{,}6}\right) = 1\,919 \text{ N}$$

it is the case 2b in table 4,

Total axial loads in the two bearing units can be determinated by the equations:

$$F_{aA} = F_{aB} + K_a = 3\,475{,}5 + 3\,000 = 6\,437 \text{ N},$$

$$F_{aB} = \frac{0{,}5\,F_{rB}}{Y_B} = \frac{0{,}5 \cdot 11\,000}{1{,}6} = 3\,437 \text{ N}.$$

Equivalent dynamic load on bearing unit should be calculated:

$$\frac{F_{aA}}{F_{rA}} = \frac{6\,437}{15\,000} = 0{,}429 < e, \text{ thus for the bearing unit A:}$$

$$P_A = F_{rA} = 15\,000 \text{ N}.$$

$$\frac{F_{aB}}{F_{rB}} = \frac{3\,437}{11\,000} = 0{,}31 < e, \text{ thus for the bearing unit B:}$$

$$P_B = F_{rB} = 11\,000 \text{ N}$$

The rating lives are to be calculated:

$$L_{10A} = \left(\frac{C_r}{P_A}\right)^{10/3} = \left(\frac{69\,700}{15\,000}\right)^{10/3} = 167{,}42 \text{ mil. revolutions},$$

$$L_{10B} = \left(\frac{C_r}{P_B}\right)^{10/3} = \left(\frac{66\,200}{11\,000}\right)^{10/3} = 396{,}47 \text{ mil. revolutions}.$$

thus the requisite rating lives are::

$$L_{10hA} = \frac{10^6\,L_{10A}}{60\,n} = \frac{10^6 \cdot 167{,}42}{60 \cdot 1\,200} = 2\,325{,}3 \text{ hours},$$

$$L_{10hB} = \frac{10^6\,L_{10B}}{60\,n} = \frac{10^6 \cdot 396{,}47}{60 \cdot 1\,200} = 5\,506{,}5 \text{ hours}.$$

Then the minimum rating life of the arrangement is L = 2 325,3 hours.

Example no. 14

Operating conditions:

The bearing units for the drive pinion and the drive gear of a motor car are shown in fig. 1 and 2, respectively.

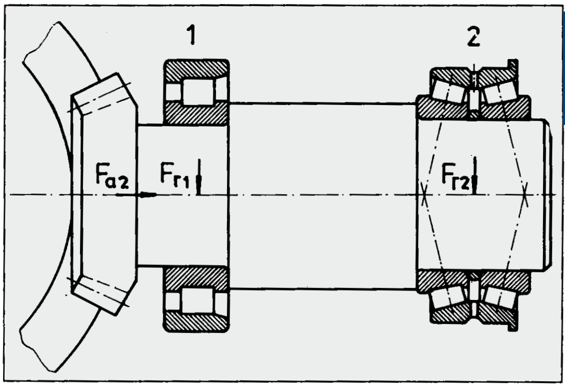


Fig. 1

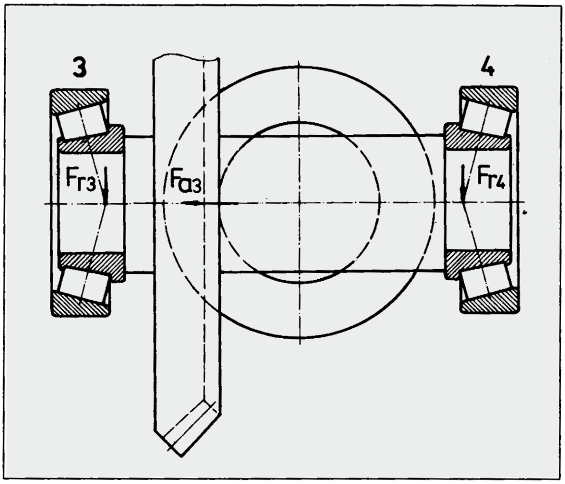


Fig. 2

The following data are known:

- the motor car has 4 velocity steps:

Step	Step operating time	Gear ratio	Median speed (r/min) drive pinion	drive gear
1	0,01	3,615	830	220
2	0,14	2,263	1 300	350
3	0,25	1,480	2 000	530
4	0,60	1,032	3 000	800

- gear ratio for the bevel gearing: 3,777:1

The loads on the bearings will be:

Step	1	2	3	4
F_{r1} (N)	39 120	24 480	16 000	11 170
F_{r2} (N)	16 110	10 080	6 590	4 600
$F_{a2} = F_{a3}$ (N)	23 710	14 830	9 700	6 770
F_{r3} (N)	23 010	14 400	9 420	6 570
F_{r4} (N)	29 740	18 610	12 170	8 490

The bearing bores should meet the condition: $d_1 \geq 30$ mm, $d_2 \geq 25$ mm, $d_3 \geq 35$ mm, $d_4 \geq 35$ mm

Problem to be solved

To determine the dimensions of the bearings that should be selected so that a bearing rating life could be obtained as follows:

Bearing	1	2	3	4
Rating life (number of revolutions)	$35 \cdot 10^6$	$35 \cdot 10^6$	$9{,}2 \cdot 10^6$	$9{,}2 \cdot 10^6$

Answer

For bearing 1:

Median dynamic load can be determined using the equation on page 25

$$P_m = \sqrt[10/3]{\frac{0{,}01 \cdot 830 \cdot 39\,120^{10/3} + 0{,}14 \cdot 1\,300 \cdot 24\,480^{10/3} + 0{,}25 \cdot 2\,000 \cdot 16\,000^{10/3} + 0{,}60 \cdot 3\,000 \cdot 11\,170^{10/3}}{0{,}01 \cdot 830 + 0{,}14 \cdot 1\,300 + 0{,}25 \cdot 2\,000 + 0{,}60 \cdot 3\,000}} =$$

$$= \sqrt[10/3]{\frac{2{,}02076 \cdot 10^{17}}{2\,490{,}3}} = 14\,886 \text{ N} \approx 15 \text{ kN}.$$

For bearing 2: Medium dynamic load can be determined using the equation on page 25

$$\frac{F_a}{F_r} = 1{,}47 > e = 0{,}83,$$

$$P_2 = 0{,}67\, F_r + Y_2\, F_a.$$

Step	1	2	3	4
P_2 (N)	3 521	2 203	1 813	1 120

$$P_m = \sqrt[10/3]{\frac{0{,}01 \cdot 830 \cdot 35\,210^{10/3} + 0{,}14 \cdot 1\,300 \cdot 22\,030^{10/3} + 0{,}25 \cdot 2\,000 \cdot 18\,130^{10/3} + 0{,}60 \cdot 3\,000 \cdot 11\,200^{10/3}}{0{,}01 \cdot 830 + 0{,}14 \cdot 1\,300 + 0{,}25 \cdot 2\,000 + 0{,}60 \cdot 3\,000}} =$$

$$= \sqrt[10/3]{\frac{2{,}0128 \cdot 10^{17}}{2\,490{,}3}} = 14\,868 \text{ N} \approx 15 \text{ kN}.$$

For bearing 3: Median dynamic load can be determined using the equation on page 25

$$\frac{F_a}{F_r} = 1{,}03 > e = 0{,}37,$$

$$P_3 = 0{,}4\, F_r + Y_3\, F_a.$$

Step	1	2	3	4
P_3 (N)	4 714	2 949	1 929	1 346

$$P_m = \sqrt[10/3]{\frac{0{,}01 \cdot 220 \cdot 47\,140^{10/3} + 0{,}14 \cdot 350 \cdot 29\,490^{10/3} + 0{,}25 \cdot 530 \cdot 19\,290^{10/3} + 0{,}60 \cdot 800 \cdot 13\,460^{10/3}}{0{,}01 \cdot 220 + 0{,}14 \cdot 350 + 0{,}25 \cdot 530 + 0{,}60 \cdot 800}} = \sqrt[10/3]{\frac{1{,}005 \cdot 10^{17}}{663{,}7}} = 17\,949 \text{ N} \approx$$

$$\approx 18 \text{ kN}.$$

For bearing 4: $P_4 = F_{r4}$,

$$P_m = \sqrt[10/3]{\frac{0{,}01 \cdot 220 \cdot 29\,740^{10/3} + 0{,}14 \cdot 350 \cdot 18\,610^{10/3} + 0{,}25 \cdot 530 \cdot 12\,170^{10/3} + 0{,}60 \cdot 800 \cdot 8\,490^{10/3}}{0{,}01 \cdot 220 + 0{,}14 \cdot 350 + 0{,}25 \cdot 530 + 0{,}60 \cdot 800}} = \sqrt[10/3]{\frac{2{,}1648 \cdot 10^{17}}{683{,}5}} = 11\,325$$

$$\approx 11{,}5 \text{ kN}.$$

In order to obtain the requisite rating lives, it is necessary to satisfy the conditions in table 2.1, page 19:

Bearing	1	2	3	4
C_r/P_r	2,91	2,91	2	2
C_r requisite (kN)	44	44	36	23

After consulting the bearing tables, a choice could be:

Bearing	1	2	3	4
Type	NF 5306HV	35305 R	30207 A	30207 A
C_r (kN)	55,1	73	50,5	50,5

Note: The bearings 3 and 4 were chosen on constructive reasons.

Example no. 15

Operating conditions

Loads in bearing units: $F_a = 30\,000$ N,
$F_r = 60\,000$ N.

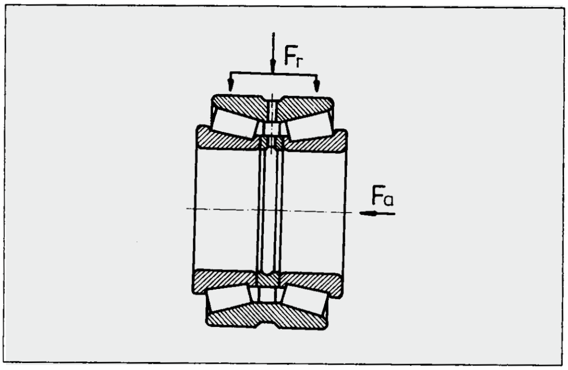
Shaft diameter: $d_{min} = 160$ mm

Shaft speed: n = 200 r/min.

Requisite rating life: Lh = 20 000 hours

Problem to be solved

Selecting a double row tapered roller bearing.



Answer

For constructive reasons, the bearing 35032, in the catalogue, with:

d = 160 mm,
D = 240 mm,
T = 115 mm,

$C_r = 662\,000$ N,
e = 0,37,
$Y_1 = 1,8$,
$Y_2 = 2,7$.

Since:

$$\frac{F_a}{F_r} = \frac{30\,000}{60\,000} = 0,5 > e,$$

equivalent dynamic radial load will be calculated with the equation:

$$P_r = 0,67\,F_r + Y_2\,F_a = 0,67\cdot60\,000 + 2,7\cdot30\,000 = 121\,200 \text{ N}$$

The rating life of the bearing can be determined considering the requisite rating life:

$$L_{10} = \frac{60\,n\,L_{10h}}{10^6} = \frac{60\cdot200\cdot20\,000}{10^6} = 240 \text{ mil. revolutions}$$

Requisite dynamic load carrying capacity should be determined:

$$C_{r\,nec} = P_r\sqrt[10/3]{L_{10}} = 121\,200\sqrt[10/3]{240} = 627\,431 \text{ N} < C_r.$$

The selected bearings correspond to the operating conditions.

Example no. 16

Operating conditions:

Loads in bearing units: $F_a = 10\,000$ N,
$F_r = 30\,000$ N.

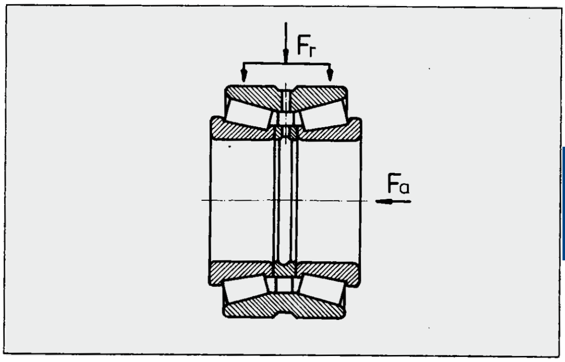
Shaft speed: n = 600 r/min

Bearing operating temperature: t = 200°C

A bearing 35220 has been mounted.

Problem to be solved

To determine the rating life of this tapered roller bearing, double row.



Answer

For bearing 35220, in catalogue,

d = 100mm,
D = 180 mm,
T = 80 mm,

$C_r = 265\,000$ N,
e = 0,42,
$Y_1 = 1,6$,
$Y_2 = 2,4$.

Since:

$$\frac{F_a}{F_r} = \frac{10\,000}{30\,000} = 0,33 < e,$$

equivalent dynamic radial load will be calculated using the equation:

$$P_r = F_r + Y_1\,F_a = 30\,000 + 1,6\cdot10\,000 = 46\,000 \text{ N}$$

Bearing rating life should be calculated:

$$L_{10} = \left(\frac{C_r}{P_r}\right)^{10/3} = \left(\frac{265\,000}{46\,000}\right)^{10/3} = 342,74 \text{ mil. revolutions,}$$

Requisite rating life is calculated using the equation:

$$L_{10h} = f_t\frac{10^6\,L_{10}}{60\,n} = 0,73\,\frac{10^6\cdot342,74}{60\cdot600} = 6\,950 \text{ hours.}$$

Since the bearing operates at a temperature of 200°C, the rating life is to be adjusted by the temperature factor:

$f_t = 0,73$ (see table 2.9, page 27)

Example no. 17

Operating conditions

Loads in bearing units: $F_r = 450$ kN,
$F_a = 250$ kN.

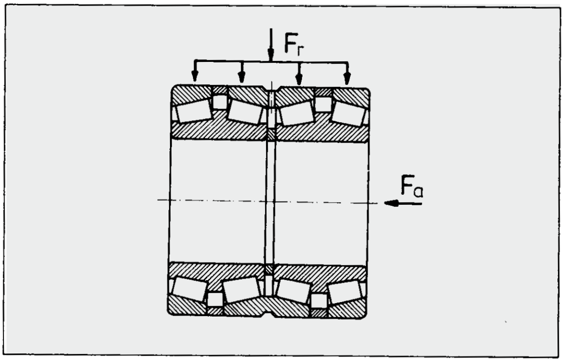
Shaft diameter: $d_{min} = 240$ mm

Shaft speed: n = 60 r/min

Requisite rating life: $L_{10p} = 10\,000$ hours

Problem to be solved:

Selecting the four-row tapered roller bearing.



Answer

For constructive reasons, the bearing type T-36248 is selected. It has the following characteristics, as shown in the catalogue

$d = 240$ mm, $C_r = 2\,735$ kN,
$D = 410$ mm, $e = 0{,}46$,
$T = 270$ mm, $Y_1 = 1{,}5$,
$Y_2 = 2{,}2$.

Since:

$$\frac{F_a}{F_r} = \frac{250}{450} = 0{,}55 > e,$$

equivalent dynamic radial load can be determined using the equation:

$$P_r = 0{,}67\ F_r + Y_2\ F_a = 0{,}67 \cdot 450 + 2{,}2 \cdot 250 = 851{,}5\ \text{kN}$$

The rating life of the bearing can be determined considering the requisite rating life:

$$L_{10} = \frac{60\ n\ L_{10h}}{10^6} = \frac{60 \cdot 60 \cdot 10\,000}{10^6} = 36\ \text{mil. revolutions.}$$

Requisite dynamic load carrying capacity should be determined:

$$C_{r\ nec} = P_r \sqrt[10/3]{L_{10}} = 851{,}5 \sqrt[10/3]{36} = 2\,495\ \text{kN} < C.$$

One can notice that the bearing has been properly selected for the operating conditions,

Example no. 18

Operating conditions

Loads in bearing units: $F_r = 123\,000$ N,
$F_{a1} = 175\,000$ N,
$F_{a2} = 19\,000$ N.

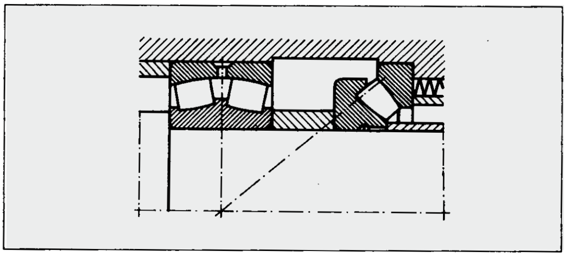
Shaft diameter: $d_{min} = 200$ mm

Shaft speed: $n = 500$ r/min

Requisite rating life: $L_{10h} = 40\,000$ hours

Problem to be solved

For constructive reasons, the bearing 23140CAW33 (spherical roller bearing) and 29340 EM (spherical roller thrust bearing), mounted as in the figure below are to be related.



It is necessary to verify the arrangement, considering that the heavier axial load is caried by the spherical roller thrust bearing 29340EM and the lighter load (in the opposite direction) by the spherical roller bearing 23140CAW33.

Answer

The bearing 23140CAW33 characteristics in the catalogue, is to be verified under the combined load:

$d = 200$ mm, $C_r = 137\,000$ N,
$D = 340$ mm, $e = 0{,}35$,
$B = 112$ mm, $Y1 = 1{,}9$,
$Y2 = 2{,}9$.

$$\frac{F_{a2}}{F_r} = \frac{19\,000}{123\,000} = 0{,}154 < e,$$

$$P_r = F_r + Y_1\ F_{a2} = 123\,000 + 1{,}9 \cdot 19\,000 = 159\,100\ \text{N},$$

$$L_{10h} = \frac{1 \cdot 10^6}{60 \cdot 500}\left(\frac{1\,370\,000}{159\,100}\right)^{10/3} = 43\,623\ \text{hours} > 40\,000\ \text{hours.}$$

The bearing 29340EM characteristics in the catalogue, is to be verified under the pure axial load:

$d = 200$ mm, $C_a = 1\,500\,000$ N,
$D = 340$ mm, $F_r = 0$,
$H = 85$, $P_a = F_{a1} = 175\,000$ N.

$$L_{10h} = \frac{1 \cdot 10^6}{60 \cdot 500}\left(\frac{1\,500\,000}{175\,000}\right)^{10/3} = 42\,959\ \text{hours} > 40\,000\ \text{hours.}$$

A similar result is obtained for the rating life of the two bearings, using the data in the table 2.3, page 21, respectively:

For the bearing 23140CAW33: $C_r/P_r = 8{,}61$,
$n = 500$ r/min,
$L_{10h} = 43\,800$ hours.

For the bearing 29340EM: $C_a/P_a = 8{,}57$,
$n = 500$ r/min,
$L_{10h} = 43\,103$ hours.

Example no. 19

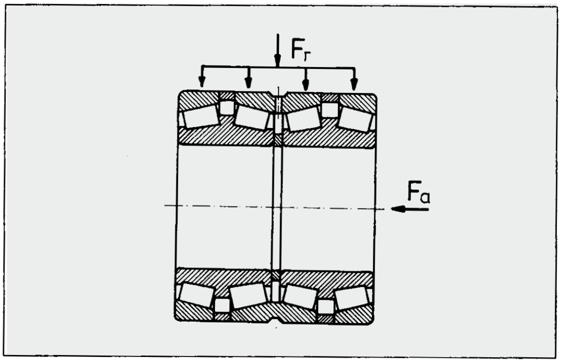
Operating conditions

Loads in bearing units: $F_a = 20$ kN,
$= 70$ kN.

Shaft speed: $n = 200$ r/min.

Problem to be solved

To determine the minimum rating life for the four row tapered bearing T-36428P6W28 type.



Answer

The bearing T-36428P6W28 has the following characteristics, see page 422 in the catalogue:

$d = 139{,}7$ mm, $C_r = 767$ kN,
$D = 200{,}025$ mm, $e = 0{,}34$,
$T = 160{,}338$ mm, $Y_1 = 2{,}0$,
$Y_2 = 3{,}0$.

Since:

$$\frac{F_a}{F_r} = \frac{20}{70} = 0{,}285 < e,$$

equivalent dynamic radial load can be calculated using the equation:

$$L_{10} = \left(\frac{C_r}{P_r}\right)^{10/3} = \left(\frac{767}{110}\right)^{10/3} = 647{,}6 \text{ mil. revolutions,}$$

The minimum rating life will be:

$$L_{10h} = \frac{10^6 L}{60\, n} = \frac{10^6 \cdot 647{,}6}{60 \cdot 200} = 54\,000 \text{ hours.}$$

Example no. 20

Operating conditions

The load in the crane clamp-hookF_a = 1 200 000 N

Shaft diameter: d = 260 mm

Bearing speed: n = 0.

Problem to be solved

To select a thrust ball bearingz.

Answer

Under static load, the selection of the bearing depends on the basic static load. From table 2.11, page 29, it is to be selected:

$s_0 = 1{,}5$

Since the bearing is only axially loaded, the equivalent load is:

$P_a = F_a = 1\,200\,000$ N

Requisite basic static load is:

$C_{0a\ nec} = s_0\, P_a = 1{,}5 \cdot 1\,200\,000 = 1\,800\,000$ N

Example no. 21

Operating conditions

Static axial load: $F_a = 60\,000$ N, frequent shock loads

Shaft diameter: d = 40 mm

Bearing speed: n = 0

Problem to be solved

A cylindrical roller thrust bearing, single direction, is to be selected.

Answer

Under a static load, the selection of bearing depends on the basic static load.

From table 2.11, page 29, it is to be selected:

$s_0 = 1{,}6$

Since the bearing is axially loaded, the equivalent load is:

$P_a = F_a = 60\,000$ N

Requisite basic static load is:

$C_{0a\ nec} = s_0\, P_a = 1{,}6 \cdot 60\,000 = 96\,000$ N

The bearing 81108, characteristics in the catalogue, is to be selected:

d = 40 mm,
D = 60 mm,
H = 13 mm,
C_{0a} = 137 kN.

$C_{0anec} = 96\,000 \text{ N} < C_{0a} = 137\,000$ N

11. Bearing mounting

Proper operation of rolling bearings is also determined by a proper selection of the solution of mounting and dismounting, considering the type and size of bearing, fit, adequate tools for these operations, performance etc.

As being precision components, rolling bearings should be handled carefully when storing or mounting. Thus, the following conditions should be observed:

- storing in their original package, on special shelves, in dry room, temperature of +18°C...+20°C, maximum moisture degree of 60%
- handling bearings while storing and mounting should be carefully done so that original package to be protected and not to be deteriorated.
- bearings should be unpacked only when they are to be mounted.

They shouldn't be washed if original package hasn't been destroyed.

- as the adjoint parts of bearings are accurate, without burrs, chips or hits, special care should be taken

Mounting of bearings with cylindrical bore

Bearings with cylindrical bore which are to have tight fit on shaft or in housing respectively, will be mounted by mechanical, thermic or hydraulic means.

The pressing force should be transmitted only by the ring which is pressed on the shaft or into the housing bore. Transmission by rolling bearings should be avoided as they can get deformed and premature damage can occur.

Special sleeves with one or two ribs, fig.11.1, a and b are used when mounting small and medium-sized bearings, which are to be mounted with transition fit. In case of self-aligning ball bearings or spherical roller thrust bearings, a plate is mounted for a proper location of the outer ring, as shown in fig. 11.2.

Mechanical or hydraulic presses are used as shown in fig. 11.3, in case of serial production so that force can be continuously and gradually applied.

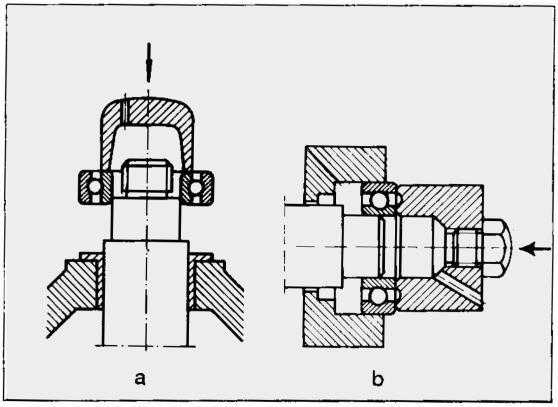


Fig. 11.1

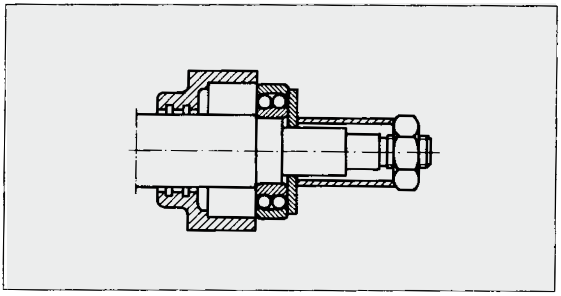


Fig. 11.2

For the mounting of bearings with clearance fit into the housing or on the shaft, the ring with transition or tight fit should be mounted first, after which the shaft-bearing assembly will be mounted into the housing as shown in fig.11.4, a and b.

In case of dismountable bearings, rings can be mounted separately - fig. 11.5, even if an tight fit is required for both rings.

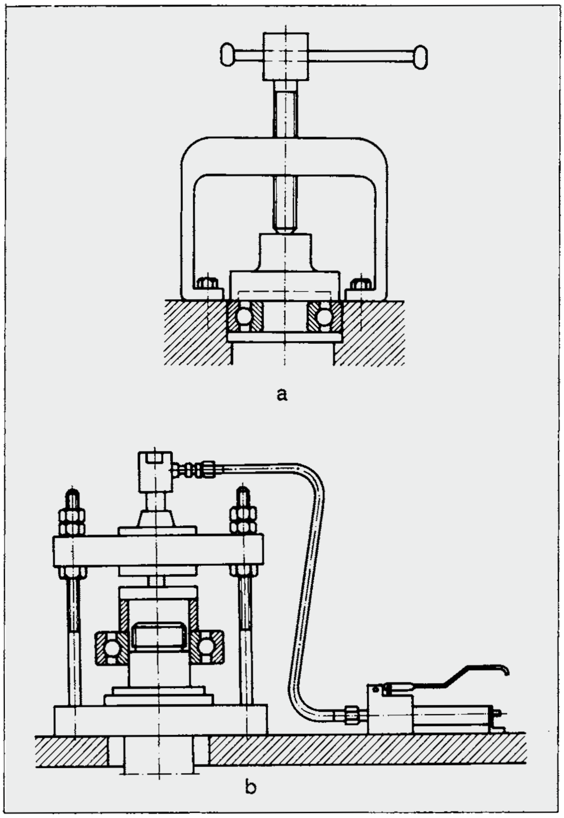


Fig. 11.3

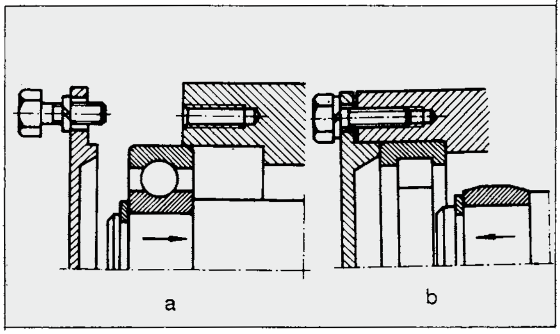


Fig. 11.4

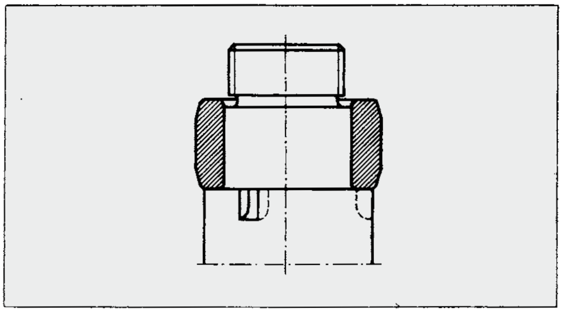


Fig. 11.5

The mounting of medium (d > 50 mm) and large-sized bearings with tight fit, requires much greater pressing forces. That's why in this case heating of bearings up to +80°C...+110°C should be used instead of pressing, excepting shielded bearings, 2Z (2ZR) type and sealed bearings, 2RS (2RSR) type.

For the bearings heating, oil bath, electric range, heating device with thermic ring or induction heating device etc. can be used as shown in fig.11.6, a-d.

The device with thermic ring - fig.11.6 c consists of a split aluminium ring with three grips and cuts which make it be elastic.

Thermic ring bore diameter is equal to inner ring raceway diameter of dismountable bearings.

The ring outside diameter can be calculated using the equation:

$$D_{ex} = \sqrt{4\,d_1^2 - 3d^2}\text{, mm,}$$

where:

D_{ex} = outside diameter of the thermic ring,
d_1 = diameter of the inner ring raceway, mm
d = bearing bore diameter, mm

The weight of the thermic ring is approximately equal to the weight of the bearing inner ring.

In case of large-sized cylindrical roller bearings, heating is done with induction devices. These devices consist of a coil inductor, thermal relays for temperature adjustment and timers. 380 V voltage and 50 - 60 Hz frequency inductors are used for bearings with bore diameter up to 200 mm. For larger-sized bearings, 20... 40 V voltage and 50 - 60 Hz inductors are used.

This device is schematically shown in fig. 11.6.d.

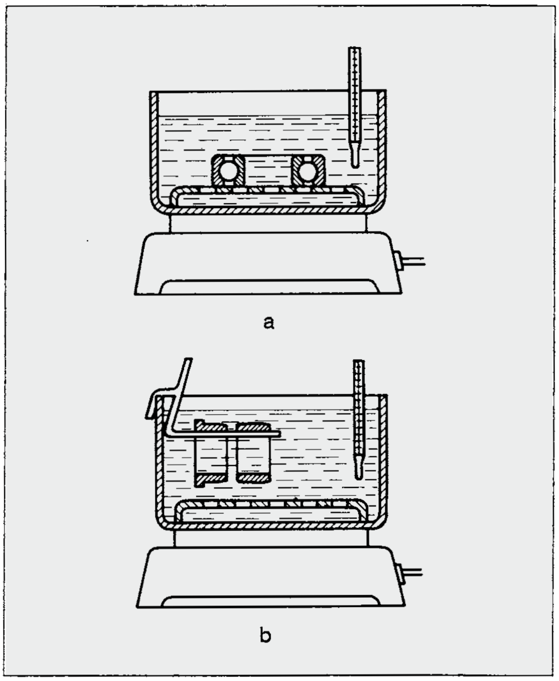


Fig. 11.6

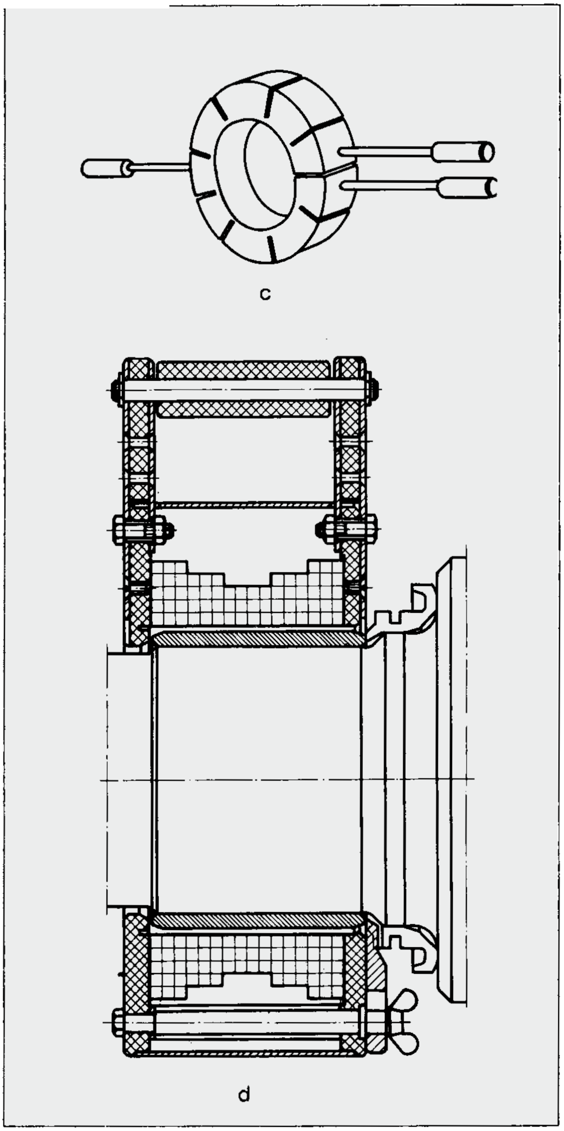


Fig. 11.6 (continued)

Mounting of bearings with tapered bore

Tapered bore bearings can be mounted directly on the shaft, on adapter sleeve or withdrawal sleeve. These bearings should always be mounted only with an tight fit. The tight fit can be done by an axial displacement of the bearing inner ring which is mounted directly on the tapered spindle of the shaft or by an axial displacement of the adapter or withdrawal sleeve.

The values of reduction in radial clearance are given in tables 11.1 and 11.2, as function of axial displacement on shaft of self-aligning ball bearings and spherical roller thrust bearings. After mounting the initial radial clearance is to be considered.

After mounting, radial clearance of radial and self-aligning ball bearings are in accordance with table 11.1.

The values of tightening are estimated by the values of the radial clearance reduction or of axial displacement. Axial displacement of the mounted bearing is measured by means of a limit gauge, as shown in fig. 11.7, a and b. The thickness of the limit gauge can be calculated from:

$m = S - a$

where:
m = thickness of the limit gauge, mm
S = distance initially measured, mm
a = axial displacement, from table 11.1, mm

Example A bearing 22252, d = 260 mm, taper 1:12, distance s = 10 mm, distance "a" from table 11.1 = 1,90 mm, m = 10 - 1,9 = 8,10 mm

Small-sized bearings with tapered bore which are to be mounted directly on the shaft or with adapter or withdrawal sleeves can be axially displaced by means of a nut as shown in fig. 11.8, a, or by means of a special sleeve as in fig. 11.8 b,c.

Medium-sized bearings can be axially displaced by means of a special nut as shown in fig. 11.9 and some screws. Then, the nut is to be dismounted and replaced with a nut for axial fastening.

Values for self-aligning ball bearings radial clearance, after mounting

Values in mm

Table 11.1

Bore diameter d		Reduction of radial clearance		Axial displacement "a", taper 1:12				Minimum radial clearance after mounting, in case of clearance group	
				on tapered shaft		on tapered sleeve			
over	up to	low	high	low	high	low	high	normal	C3
-	20	0,003	0,010	0,22	0,23	0,24	0,25	0,01	0,02
20	30	0,005	0,010	0,22	0,23	0,23	0,24	0,01	0,02
30	40	0,009	0,015	0,30	0,30	0,32	0,32	0,01	0,02
40	50	0,010	0,016	0,31	0,34	0,35	0,37	0,015	0,025
50	65	0,012	0,018	0,39	0,41	0,40	0,42	0,015	0,03
65	80	0,015	0,025	0,43	0,47	0,45	0,50	0,02	0,04
80	100	0,022	0,030	0,54	0,60	0,56	0,62	0,02	0,04
100	120	0,025	0,035	0,58	0,70	0,60	0,75	0,025	0,055

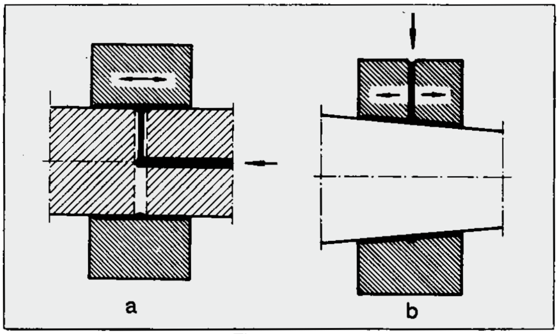


Fig. 11.11

To reduce the bearing displacing force in case of large -sized bearings, pressurized oil is to be introduced between the tapered surfaces of the shaft spindle, bearing and adapter or withdrawal sleeves, as shown in fig. 11.11a and b, by means of an oil pump - fig.11.10 or oil injector - fig. 11.12. One or more grooves should be provided as shown in fig. 11.13, a and b so that oil can be distributed between the mounting surfaces.

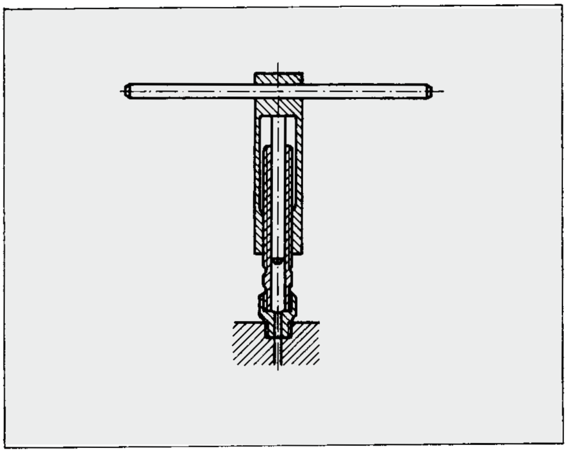


Fig. 11.12

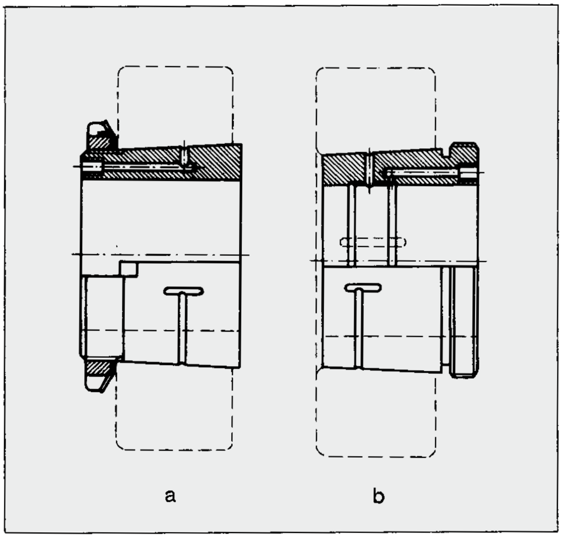


Fig. 11.13

Bearing dismounting

When bearings with tapered bore are to be dismounted from the shaft or housing, the succession of operations is inversely done than in case of mounting.

Thus, the assembly mounted with clearance fit or small tightening is to be dismounted first and then the parts mounted with greater tightening, as shown in fig. 11.14 and fig. 11.15.

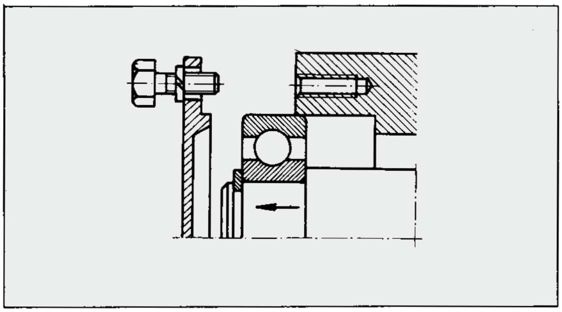


Fig. 11.14

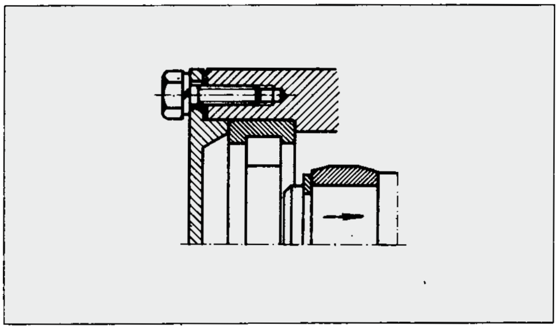


Fig. 11.15

To use mechanical or hydraulic instruments when dismounting bearings, a special design of the shaft and housing is required, as shown in fig. 11.16, a-b: withdrawal grooves (a), threaded bores (b), grooves for oil distribution, fig.11.13.

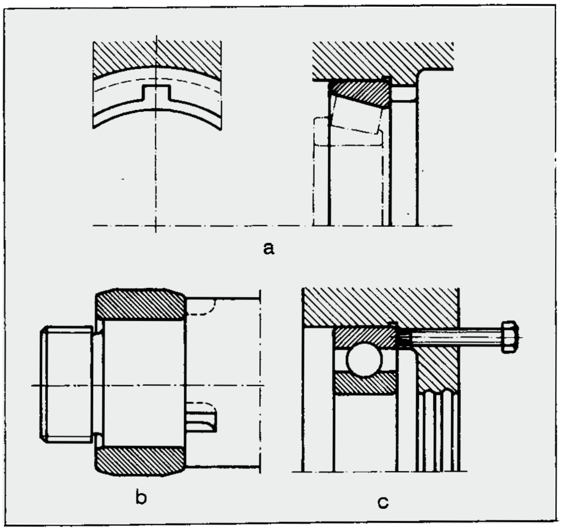


Fig. 11.16

Medium and small-sized bearings which are mounted with an tight fit are dismounted from the shaft by means of a soft steel or copper mandrel or by means of mechanical or hydraulic presses - fig.11.17, a-c.

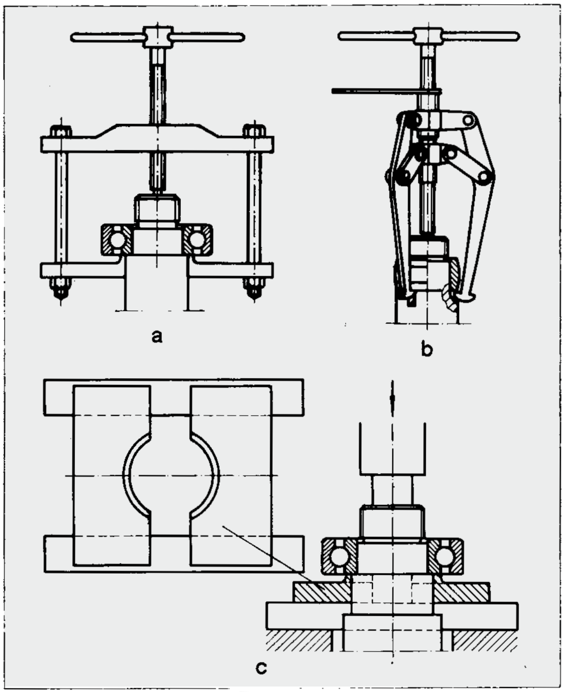


Fig. 11.17

To reduce the frictional force when dismounting large-sized bearings which were mounted on shaft with tight fit, pressurized oil should be introduced, as in case of mounting - fig.11.11.

To dismount bearings with tapered bore which were mounted directly on the shaft or bearings which were mounted with withdrawal or adapter sleeves, the nut axially fastened should be first stripped. Then, dismounting is to be done by light hammering on the inner ring by means of a soft steel or copper mandrel, as shown in fig. 11.18, a and b.

In case of bearings mounted with withdrawal sleeves, a nut is to be screwed up on the threaded part provided for this purpose, as shown in fig. 11.19, a and b.

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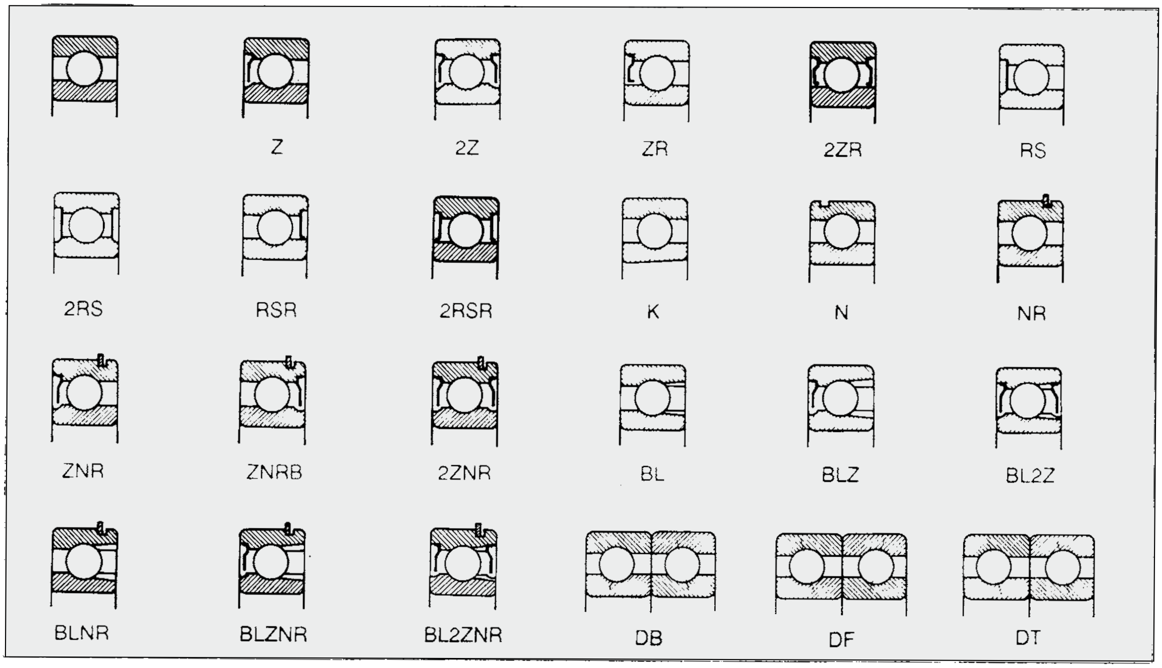
Deep groove ball bearings

Single row deep groove ball bearings are manufactured by us in a varied range, both of standard design and various constructive versions.

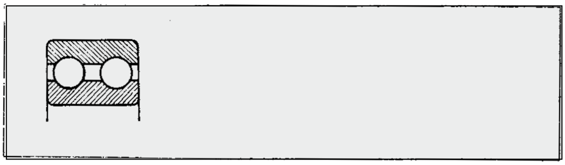
Single row deep groove ball bearings can take double direction radial and axial loads and also allow good operation at high speeds.

For this reason, they can be widely used. Therefore, single row deep groove ball bearings are manufactured in many constructive versions as shown below.

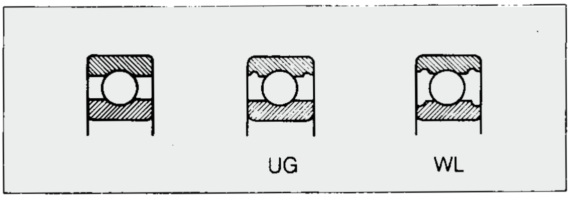
- single row



- double row



Beside single row deep groove ball bearings of basic design, bearings with UG design, with grooves on the outer ring and WL design, with grooves on both rings are also used for the purpose of mounting seals or shields on bearings, 2ZR, 2RSR or 2RS type, as shown in the bellow figure.



Suffixes

A	- bearing with extended outer ring
B	- bearing with extended inner ring
C2	- radial clearance smaller than normal
C3	- radial clearance larger than normal
FA	- machined cage of steel or cast iron guided in the outer ring
F2	- constructive modifications
K	- bearing with tapered bore
M	- machined cage of brass guided on the rolling elements
MA	- machined cage of brass guided in the outer ring
MB	- machined cage of brass guided on the inner ring
N	- circular groove for snap ring on the outer ring
NR	- circular groove on the outer ring and snap ring
P0	- normal tolerance class (it is not marked)
P6	- tolerance class more accurate than normal
P63	- tolerance class P6 and radial clearance C3
P5	- tolerance class more accurate than P6
P4	- tolerance class more accurate than P5
R	- rib on the outer ring
RS	- bearing with seal on one side, with friction on the inner ring recess
RSA	- bearing with special seal
2RS	- bearing with 2 seals, friction on the inner ring recess
RSR	- bearing with seal on one side, friction on the rib of the inner ring
2RSR	- bearing with 2 seals, friction on the rib of the inner ring
S0	- bearing which can operate up to a temperature of +150°C
S1	- bearing which can operate up to a temperature of +200°C
SP	- snap ring, diameter series 0, 2, 3, 4
SR	- snap ring, dimension series 18 and 19
T30	- bearing which can operate up to a temperature of +300°C, radial clearance 0,20...0,25 mm; phosphate-treated surfaces
TN	- polyamide cage
V	- bearing without cage
Z	- bearing with shield and recess on the inner ring
Z	- sealed bearing
2Z	- bearing with 2 shields and recess on the inner ring
ZNRB	- bearing with shield and snap ring on the same side
ZR	- bearing with shield, without recess on the inner ring
2ZR	- bearing with 2 shields, without recess on the inner ring

Sealed and shielded deep groove ball bearings

We manufactures two versions of sealed and shielded bearings, namely:

- bearings RS and Z type, with recess on the inner ring for sealing or shielding.
- bearings RSR and ZR type, when shielding and sealing respectively are done directly on the outside surface of the inner ring.

In case of bearings with non-rubbing shields, there is a small interstice between the shield and the rib of the inner ring; in case of bearings with seals, the gasoline and oil resistant elastic rubber lip rubs on the groove on the inner ring side or directly on the outside surface.

Bearings sealed and shielded on both sides manufactured in series are delivered filled with lithium base grease and are used at temperatures between -30°C and +110°C, in accordance with the specifications in chapter 8. Bearings can also be greased with special greases, relubrication not being necessary. Washing or heating are not allowed before bearing mounting in the assembly.

Bearings with shields have been designed first of all for cases when the inner ring rotates.

When the outer ring rotates, the lubricant can flow out of the bearing at a certain speed. In such cases, we recommend you to consult our experts.

Deep groove ball bearings with snap ring groove

Single row deep groove ball bearings, with snap ring groove on the outer ring can be located in the housing with snap rings.

Because of their simple and space saving mounting, these bearings simplify the assembly design. The groove for the snap ring and the snap rings are in accordance with ISO 464, national standard STAS 6246 and tables 7 and 8 respectively.

Misalignments

Single row deep groove ball bearings have limited abilities to compensate for bearing errors of alignment. The permissible misalignment between the outer ring and the inner ring, which will not produce inadmissible high additional loads in the bearing, depends on the bearing size, operational radial clearance, inner bearing design and also on the magnitude of loads and moments acting upon the bearing.

Because of the complex relationship of these influence factors, definite and universally valid values of permissible misalignment cannot be determined .

Considering the above mentioned factors, under normal operation conditions the permissible misalignments are between 2 and 10 minutes of arc, depending on the bearing series and load.

For bearings with filling slots for balls, the values of permissible misalignment are between 2 and 5 minutes of arc.

It should be considered that misalignments of bearing rings in operation produce a considerably higher noise .

Single row deep groove ball bearings with filling slots

Single row deep groove ball bearings are also manufactured in a version with filling slot. These bearings have the prefix BL in the bearing basic designation.

These bearings can support heavier loads than those of the basic design since they have more balls. At the same time, the filling slot causes a decrease of axial load carrying capacity.

Paired single row deep groove ball bearings

If the basic load of a single bearing is inadequate or the shaft has to be axially located in both directions with a certain clearance, paired deep groove ball bearings are recommended to be used.

These bearings can be delivered matched in pairs in three versions, as follows: DT (tandem arrangement), DB (back-to-back arrangement) or DF (face-to-face arrangement). They can be delivered with axial clearance or preloaded. The values of clearance or preload are given in table 2.

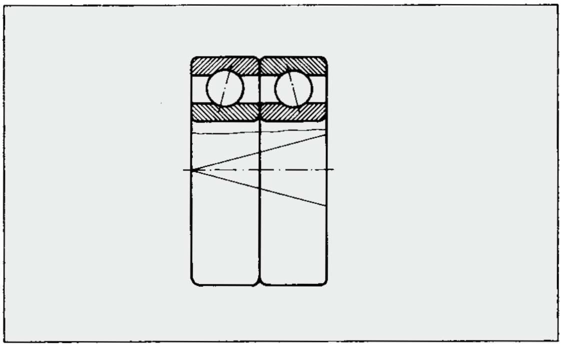
The producer marks "V" on the bearing outside surface as shown in the next figure, so that paired bearings to be correctly mounted.

The speed limit of these bearings can be calculated multiplying the speed of the basic bearing by 0,8.

Paired bearings are packed and delivered in the same box.

Dimensions

The overall dimensions of single row deep groove ball bearings are in accordance with the stipulations of ISO 15 and national standard 3041 respectively.



Tolerances

Single row deep groove ball bearings are generally manufactured to the normal tolerance class P0.

At request, they can also be manufactured to the tolerance classes P6, P5 or P4.

The values of tolerances are given in chapter 5 on page 37.

Radial and axial clearance

Single row deep groove ball bearings are generally manufactured with normal radial clearance. At request, they can also be manufactured with radial clearance different from the normal one, according to ISO 5753 and national standard 7115. The values of radial clearance are given in table 1.

Paired bearings can be manufactured with axial clearance (suffix A) or preloaded (suffix L). Values for axial clearance and preload are given in table 2.

Axial clearance of single row deep groove ball bearing is generally not standardized. It can be defined as the axial displacement of a ring in relation to the located one, under an alternative axial load.

The axial clearance depends on the value of the radial clearance, ball size and raceway radius. It can be calculated using the equation:

$$J_a = \sqrt{A D_w J_r - J_r^2}$$

where:
J_a = axial clearance, mm
A = bearing total curvature (raceways curvature, $f_e + f_i - 1$),
where $f_{e(i)} = R_{e(i)}/D_w$
D_w = ball diameter, mm
J_r = radial clearance, mm
$R_{e(i)}$ = raceway curvature

If a certain axial clearance is prescribed, this has to be measured and marked on the bearing by "A", followed by clearance actual value.

Radial clearance of single and double row deep groove ball bearings

Table 1

Bore diameter d		Clearance group symbol for bearings with cylindrical bore									
		C2		Normal		C3		C4		C5	
		Clearance group symbol for bearings with tapered bore									
		–		C2		Normal		C3		C4	
over	up to	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
mm		µm									
2,5	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	25	85	75	140	125	195	175	265
225	250	2	40	30	95	85	160	145	225	205	300
250	280	2	45	35	105	90	170	155	245	225	340
280	315	2	55	40	115	100	190	175	270	245	370
315	355	3	60	45	125	110	210	195	300	275	410
355	400	3	70	55	145	130	240	225	340	315	460
400	450	3	80	60	170	150	270	250	380	350	510
450	500	3	90	70	190	170	300	280	420	390	570
500	560	10	100	80	210	190	333	310	470	440	630
560	630	10	110	90	230	210	360	340	520	490	690
630	710	20	130	110	260	240	400	380	570	540	780
710	800	20	140	120	290	270	450	430	630	600	840
800	900	20	160	140	320	300	500	480	700	670	940
900	1 000	20	170	150	350	330	550	530	770	740	1 040
1 000	1 120	20	180	160	380	360	600	580	850	820	1 150
1 120	1 250	20	190	170	410	390	650	630	920	890	1 260
1 250	1 400	30	220	200	450	430	710	680	1100	980	1 380

Axial clearance and mounting preload of paired bearings series 60, 62, 63

Table 2

Bore diameter d		Axial clearance (suffix A)		Preload (suffix L)		
				Bearing series		
over	up to	min.	max.	60	62	63
mm		µm		N		
–	10	15	35	30	30	–
10	18	20	40	50	50	100
18	30	25	45	100	100	100
30	50	35	55	100	100	200
50	80	40	70	200	200	350
80	120	50	80	300	400	600
120	180	60	100	500	700	900
180	250	70	110	800	1000	1200

Contact angle

Single row deep groove ball bearings can take over pure radial loads and also combined loads. In this case, the balls roll on the raceway under a contact angle α which depends on the bearing radial clearance, raceway radius and ball diameter.

The contact angle can be calculated from:

$$\alpha = \text{arc cos}\left(1 - \frac{J_r}{2A\,D_w}\right)$$

where:

J_r = radial clearance, mm

A = total bearing curvature (raceways curvature $f_e + f_i - 1$), where $f_{e(i)} = R_{e(i)}/D_w$

D_w = ball diameter, mm

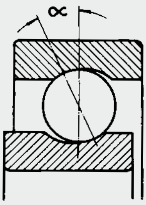
$R_{e(i)}$ = raceway radius, mm

Contact angle α of ready-made bearings can be determined accurately enough with the following equation, if the number of revolutions n_c of the cage and the number of revolutions n_i of the inner ring, under a light axial load are considered:

$$n_c = 0{,}5n_i\left(1 - \frac{D_w}{D_m}\cos\alpha\right),$$

$$\alpha = \text{arc cos}\left[\frac{D_m}{D_w}\left(1 - \frac{n_c}{0{,}5n_i}\right)\right].$$

where:
D_m = bearing mean diameter, mm
D_w = ball diameter, mm



Cages

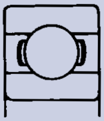
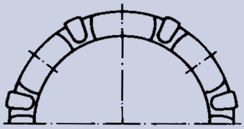
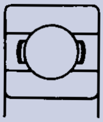
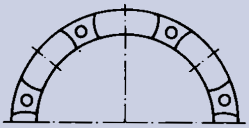
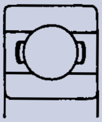
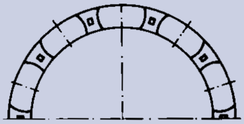
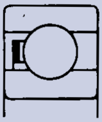
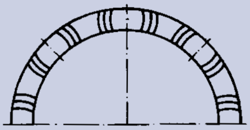
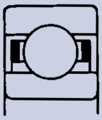
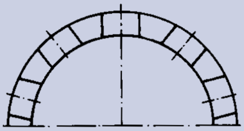
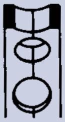
Single row deep groove ball bearings are generally fitted with cages of pressed steel sheet.

Cages of glass fibre reinforced polyamide 6.6 are also suitable if the operating temperature doesn't exceed +120°C. They have reduced weight, low coefficient of friction and are noiseless in operation. Large-sized bearings are fitted with machined brass cages.

Cage design and some technical data are given in table 3.

Cage design and technical data

Table 3

Cage	**Design**		**Application**	**Max. value** $D_m\,n$	
	bearing	cage		oil	grease
Pressed sheet cage with fins		 	- General application - Bearings with d < 10 mm - Low frictional moment - Low inertia - Moderate speeds.	550×10^3	450×10^3
Pressed cage of riveted sheet		 	- General application - Bearings with d > 10 mm - Low frictional moment - Low inertia - Moderate speeds.	1000×10^3	550×10^3
Pressed cage of sheet with spacer		 	- General application - Bearing series BL 62, BL 63	700×10^3	550×10^3
Polyamide cage		 	- General application - Low frictional moment - High speeds	$1\,400\times10^3$	$1\,100\times10^3$
Brass machined cage		 	- General application - Bearings: 61836-618/1400, 61936-619/950, 16036-16072, 6030-60/630, 6230-6248, 6320-6330.	$1\,000\times10^3$	800×10^3

Bearing minimum radial load

A minimum load must be applied on a deep groove ball bearing so that they can operate correctly, especially in case of operating under heavy loads.

The forces of inertia which occur in bearing as well as the friction in lubricant influence negatively the operating conditions and can cause detrimental sliding movements between balls and raceways.

Minimum radial load depends on the bearing size, speed and lubricant viscosity at operating temperature. It can be roughly calculated from the equation:

$F_{r\,min} = 0{,}01C_r$, (C_r = basic dynamic radial load).

Equivalent dynamic radial load

Deep groove ball bearings can take also radial and axial combined loads.

For single row deep groove ball bearings, single or paired in tandem arrangement DT, equivalent dynamic radial load can be calculated using the equation:

$P_r = F_r$, kN, when $F_a/F_r \leq e$
$P_r = X F_r + Y F_a$, kN, when $F_a/F_r > e$

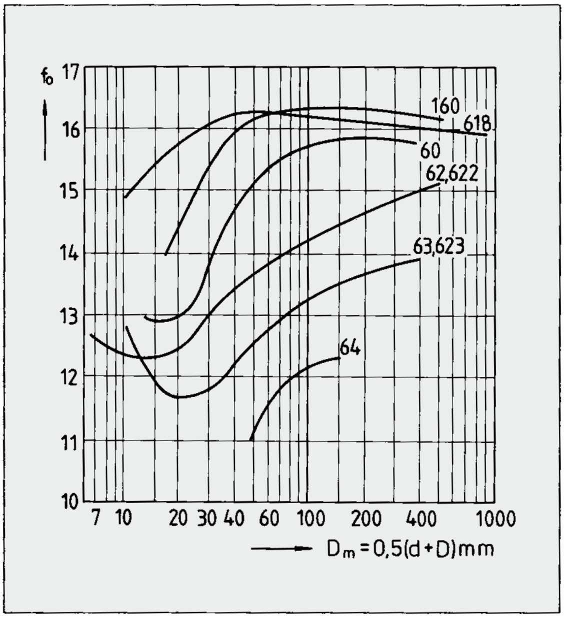
In case of single row deep groove ball bearings with filling slot, it can be calculated from:

$P_r = F_r + F_a$, kN,
in following conditions: $F_a/F_r < 0{,}6$ and $P < 0{,}5\,C_0$

Bearings with filling slot are not recommended in case of axial loads F_a heavier than $0{,}6\,F_r$. In this case, deep groove ball bearings without filling slots are recommended to be used.

The greater the axial load, the greater the contact angle of these bearings.

Factors e, X and Y depend on the ratio f_0F_a/C_{0r}. Factor f_0 can be determined using the diagram in the bellow figure, as a function of dimension series and mean diameter (d + D)/2. F_a is the axial load and C_{0r} is the static basic load of the bearing.



The values of factors e, X, Y which depend on the bearing clearance can be determined from table 4, corresponding to the values of the ratio f_0F_a/C_{0r}. The values in table 4 apply to bearings mounted with normal fit, i.e. shafts manufactured to tolerance class j5 or k5 and housing in J6, respectively.

Calculation factors e, X and Y for deep groove ball bearings, single mounted or matched in tandem.

Table 4

	Normal radial clearance			Radial clearance C3			Radial clearance C4		
f_0F_a/C_{0r}	e	X	Y	e	X	Y	e	X	Y
0,2	0,19	0,56	2,25	0,32	0,46	1,77	0,38	0,44	1,44
0,4	0,22	0,56	1,95	0,34	0,46	1,63	0,42	0,44	1,36
0,8	0,26	0,56	1,68	0,38	0,46	1,44	0,45	0,44	1,25
1,6	0,31	0,56	1,40	0,43	0,46	1,27	0,48	0,44	1,16
3	0,37	0,56	1,20	0,48	0,46	1,14	0,52	0,44	1,08
6	0,44	0,56	1,02	0,54	0,46	1	0,56	0,44	1

For bearings matched in DB or DT arrangement, equivalent dynamic radial load can be calculated using the equation:

$P_r = F_r + Y_1 F_a$, kN, when $F_a / F_r \leq e$,
$P_r = 0{,}75 F_r + Y_2 F_a$, kN, when $F_a / F_r > e$.

The values of factors e, Y_1 and Y_2, as functions of ratio F_a/C_{0r} are given in table 5.

Calculation factors e, Y_1, Y_2 for DB and DF arrangements

Table 5

F_a/C_{0r}	e	Y_1	Y_2
0,03	0,32	2	2,8
0,10	0,4	1,55	2,2
0,25	0,47	3	1,65

Equivalent static radial load

For single row deep groove ball bearings, single or matched in tandem (DT), equivalent static radial load can be calculated using the equations:

$P_0 = F_r$, kN, when $F_a/F_r \leq 0{,}8$
$P_0 = 0{,}6\ F_r + 0{,}5\ F_a$, kN, when $F_a/F_r > 0{,}8$

For single row deep groove ball bearings with filling slot, it can be calculated using the equation:

$P_0 = F_r + 0{,}5\ F_a$, kN, on the condition that $F_a/F_r < 0{,}6$

For bearings matched in DB or DF arrangement, it can be calculated from:

$P_0 = F_r + 1{,}7\ F_a$, kN

Axial load

If single row deep groove ball bearings are purely axial loaded, the axial load should not exceed 0,5 C_{0r}. In case of small-sized bearings and bearings of light series (diameter series 8, 9, 0 and 1), the axial load should not exceed 0,25 C_{0r}.

Heavy axial loads cause a significant decrease of bearing rating life. In such cases, we recommend you to consult our experts.

Abutment dimensions

For a proper location of bearing rings on the shaft shoulder and housing shoulder, respectively, maximum shaft (housing) connection radius $r_{u\ max}$ should be less than minimum bearing mounting chamfer $r_{s\ min}$.

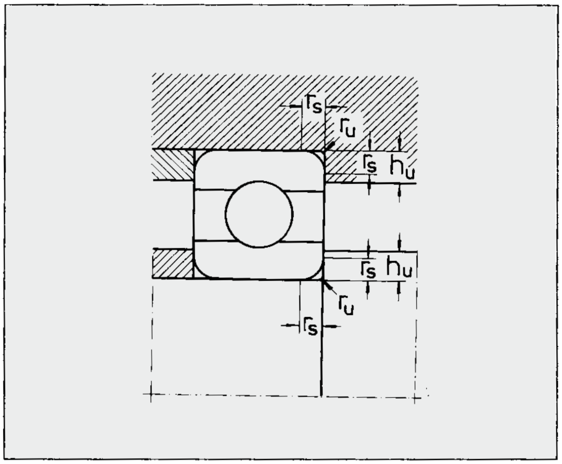
The shoulder should have the proper height corresponding to maximum bearing mounting chamfer.

The values of the connection radius (r_u) and support shoulder height (h_u) as functions of mounting chamfers are given in table 6 and are in accordance with national standard.

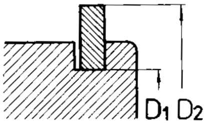
Abutment dimensions

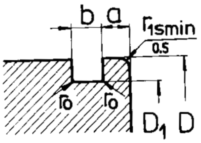
Table 6

r_s min.	r_u max.	h_u min. Bearing series 618,619, 160	161,60, 62,63	64
mm				
0,15	0,15	0,4	0,7	–
0,2	0,20	0,7	0,9	–
0,3	0,30	1	1,2	–
0,6	0,60	1,6	2,1	–
1	1	2,3	2,8	–
1,1	1	3	3,5	4,5
1,5	1,5	3,5	4,5	5,5
2	2	4,4	5,5	6,5
2,1	2,1	5,1	6	7
3	2,5	6,2	7	8
4	3	7,3	8,5	10
5	4	9	10	12
6	5	11,5	13	15
7,5	6	14	–	–



Snap ring groove dimensions and tolerance

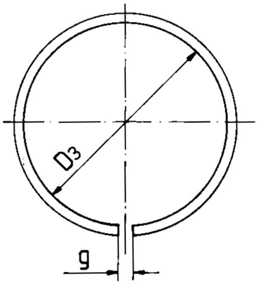


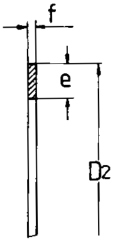


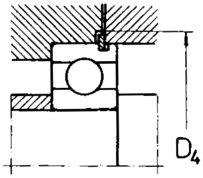
Snap ring groove

Outer diameter D	D1		a Dimensions series 18		19		b		ro	
	nom.	toler.	nom.	toler.	nom.	toler.	nom.	toler.	nom.	toler.
mm										
22	20,8	−0,3	–	–	1,05	−0,15	0,8	+0,25	0,2	−0,1
24	22,8	−0,3	–	–	1,05	−0,15	0,8	+0,25	0,2	−0,1
28	26,7	−0,3	–	–	1,3	−0,15	0,95	+0,25	0,25	−0,12
30	28,7	−0,3	–	–	1,3	−0,15	0,95	+0,25	0,25	−0,12
32	30,7	−0,3	1,3	−0,15	–	–	0,95	+0,25	0,25	−0,12
34	32,7	−0,3	1,3	−0,15	–	–	0,95	+0,25	0,25	−0,12
37	35,7	−0,3	1,3	−0,15	1,7	−0,15	0,95	+0,25	0,25	−0,12
39	37,7	−0,3	–	–	1,7	−0,15	0,95	+0,25	0,25	−0,12
40	38,7	−0,3	1,3	−0,15	–	–	0,95	+0,25	0,25	−0,12
42	40,7	−0,3	1,3	−0,15	1,7	−0,15	0,95	+0,25	0,25	−0,12
44	42,7	−0,3	1,3	−0,15	–	–	0,95	+0,25	0,25	−0,12
45	43,7	−0,3	–	–	1,7	−0,15	0,95	+0,25	0,25	−0,12
47	45,7	−0,3	1,3	−0,15	1,7	−0,15	0,95	+0,25	0,25	−0,12
52	50,7	−0,3	1,3	−0,15	1,7	−0,15	0,95	+0,25	0,25	−0,12
55	53,7	−0,3	–	–	1,7	−0,15	0,95	+0,25	0,25	−0,12
58	56,7	−0,3	1,3	−0,15	–	–	0,95	+0,25	0,25	−0,12
62	60,7	−0,4	–	–	1,7	−0,15	0,95	+0,25	0,25	−0,12
65	63,7	−0,4	1,3	−0,15	–	–	0,95	+0,25	0,25	−0,12
68	66,7	−0,4	–	–	1,7	−0,15	0,95	+0,25	0,25	−0,12
72	70,7	−0,4	1,7	−0,15	1,7	−0,15	0,95	+0,25	0,25	−0,12
78	76,2	−0,4	1,7	−0,15	–	–	1,3	+0,3	0,4	−0,2
80	77,9	−0,4	–	–	2,1	−0,2	1,3	+0,3	0,4	−0,2
85	82,9	−0,4	1,7	−0,15	2,1	−0,2	1,3	+0,3	0,4	−0,2
90	87,9	−0,4	1,7	−0,15	2,1	−0,2	1,3	+0,3	0,4	−0,2
95	92,9	−0,4	1,7	−0,15	–	–	1,3	+0,3	0,4	−0,2
100	97,9	−0,4	1,7	−0,15	2,5	−0,2	1,3	+0,3	0,4	−0,2
105	102,6	−0,5	–	–	2,5	−0,2	1,3	+0,3	0,4	−0,2
110	107,6	−0,5	2,1	−0,2	2,5	−0,2	1,3	+0,3	0,4	−0,2
115	112,6	−0,5	2,1	−0,2	–	–	1,3	+0,3	0,4	−0,2
120	117,6	−0,5	2,1	−0,2	3,3	−0,2	1,3	+0,3	0,4	−0,2
125	122,6	−0,5	2,1	−0,2	3,3	−0,2	1,3	+0,3	0,4	−0,2
130	127,6	−0,5	2,1	−0,2	3,3	−0,2	1,3	+0,3	0,4	−0,2
140	137,6	−0,5	2,5	−0,2	3,3	−0,2	1,9	+0,3	0,6	−0,2
145	142,6	−0,5	–	–	3,3	−0,2	1,9	+0,3	0,6	−0,3
150	147,6	−0,5	2,5	−0,2	3,3	−0,2	1,9	+0,3	0,6	−0,3
165	161,8	−0,5	3,3	−0,2	3,7	−0,2	1,9	+0,3	0,6	−0,3
175	171,8	−0,5	3,3	−0,2	–	–	1,9	+0,3	0,6	−0,3
180	176,8	−0,5	–	–	3,7	−0,2	1,9	+0,3	0,6	−0,3
190	186,8	−0,5	3,3	−0,2	3,7	−0,2	1,9	+0,3	0,6	−0,3
200	196,8	−0,5	3,3	−0,2	–	–	1,9	+0,3	0,6	−0,3

The outer ring chamfer on the side of snap ring groove should allow a housing connection radius of:
0,3 mm for dimension series 18, up to D = 78 mm included and for dimension series 19, up to D = 47 mm included;
0,5 mm for dimension series 18, for D > 78 mm and for dimension series 19, for D > 47 mm





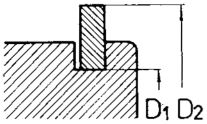


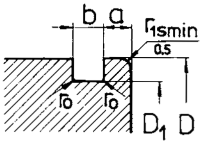
Snap ring **Table 7**

Outer diameter D	D2 1)	D3 2)		D4	e	f	g	r	Weight	Snap ring designation
	max.	nom.	toler.	min.	nom.	nom.	nom.	min.		
mm									g	–
22	24,8	20,5	−0,3	25	2	0,7	2	0,2	0,812	SR22
24	26,8	22,5	−0,3	28	2	0,7	2	0,2	0,886	SR24
28	30,8	26,4	−0,3	32	2,05	0,85	3	0,2	1,269	SR28
30	32,8	28,3	−0,3	34	2,05	0,85	3	0,2	1,39	SR30
32	34,8	30,3	−0,3	36	2,05	0,85	3	0,2	1,483	SR32
34	36,8	32,3	−0,3	38	2,05	0,85	3	0,2	1,577	SR34
37	39,8	35,3	−0,3	41	2,05	0,85	3	0,2	1,718	SR37
39	41,8	37,3	−0,3	43	2,05	0,85	3	0,2	1,811	SR39
40	42,8	38,3	−0,3	44	2,05	0,85	3	0,2	1,858	SR40
42	44,8	40,3	−0,4	46	2,05	0,85	3	0,2	1,952	SR42
44	46,8	42,3	−0,4	48	2,05	0,85	4	0,2	2,032	SR44
45	47,8	43,3	−0,4	49	2,05	0,85	4	0,2	2,079	SR45
47	49,8	45,3	−0,4	51	2,05	0,85	4	0,2	2,173	SR47
52	54,8	50,3	−0,4	56	2,05	0,85	4	0,2	2,407	SR52
55	57,8	53,3	−0,4	59	2,05	0,85	4	0,2	2,547	SR55
58	60,8	56,3	−0,6	62	2,05	0,85	4	0,2	2,688	SR58
62	64,8	60,2	−0,6	66	2,05	0,85	4	0,2	2,938	SR62
65	67,8	63,2	−0,6	69	2,05	0,85	4	0,2	3,081	SR65
68	70,8	66,2	−0,6	72	2,05	0,85	5	0,2	3,212	SR68
72	74,8	70,2	−0,6	76	2,05	0,85	5	0,2	3,403	SR72
78	82,7	75,7	−0,6	84	3,25	1,12	5	0,4	7,462	SR78
80	84,4	77,4	−0,6	86	3,25	1,12	5	0,4	7,625	SR80
85	89,4	82,4	−0,6	91	3,25	1,12	5	0,4	8,105	SR85
90	94,4	87,4	−0,6	96	3,25	1,12	5	0,4	8,585	SR90
95	99,4	92,4	−0,6	101	3,25	1,12	5	0,4	9,065	SR95
100	104,4	97,4	−0,6	106	3,25	1,12	5	0,4	9,545	SR100
105	110,7	101,9	−0,8	112	4,04	1,12	5	0,4	12,653	SR105
110	115,7	106,9	−0,8	117	4,04	1,12	5	0,4	13,257	SR110
115	120,7	111,9	−0,8	122	4,04	1,12	5	0,4	13,861	SR115
120	125,7	116,9	−0,8	127	4,04	1,12	7	0,4	14,393	SR120
125	130,7	121,8	−0,8	132	4,04	1,12	7	0,4	15,164	SR125
130	135,7	126,8	−0,8	137	4,04	1,12	7	0,4	15,774	SR130
140	145,7	136,8	−1	147	4,04	1,7	7	0,4	25,796	SR140
145	150,7	141,8	−1	152	4,04	1,7	7	0,6	26,722	SR145
150	155,7	146,8	−1,2	157	4,04	1,7	7	0,6	27,648	SR150
165	171,5	161	−1,2	173	4,85	1,7	7	0,6	35,89	SR165
175	181,5	171	−1,2	183	4,85	1,7	10	0,6	37,883	SR175
180	186,5	176	−1,2	187	4,85	1,7	10	0,6	38,976	SR180
190	196,5	186	−1,4	198	4,85	1,7	10	0,6	41,162	SR190
200	206,5	196	−1,4	208	4,85	1,7	10	0,6	43,348	SR200

1) D2 dimension refer to snap ring
2) D3 represent dimension before mounting

Snap ring groove dimensions and tolerance

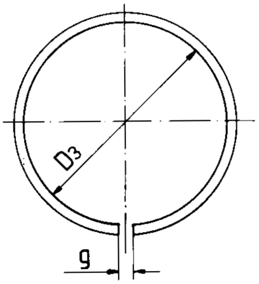


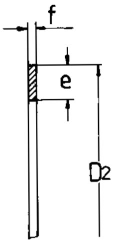


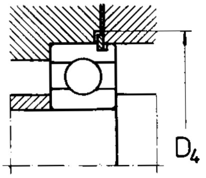
Snap ring groove

Outer diameter D	D1		a Dimensions series 18		19		b		r0	
	nom.	toler.	nom.	toler.	nom.	toler.	nom.	toler.	nom.	toler.
mm										
30	28,17	−0,25			2,06	−0,15	1,35	+0,3	0,4	−0,2
32	30,15	−0,25	2,06	−0,15	2,06	−0,15	1,35	+0,3	0,4	−0,2
35	33,17	−0,25	2,06	−0,15	2,06	−0,15	1,35	+0,3	0,4	−0,2
40	38,10	−0,25			2,06	−0,15	1,35	+0,3	0,4	−0,2
42	39,75	−0,25	2,06	−0,15	2,06	−0,15	1,35	+0,3	0,4	−0,2
47	44,60	−0,25	2,06	−0,15	2,46	−0,15	1,35	+0,3	0,4	−0,2
52	49,73	−0,25	2,06	−0,15	2,46	−0,15	1,35	+0,3	0,4	−0,2
55	52,60	−0,25	2,08	−0,2			1,35	+0,3	0,4	−0,2
62	59,61	−0,5	2,08	−0,2	3,28	−0,2	1,90	+0,3	0,6	−0,3
68	64,82	−0,5	2,49	−0,2	3,28	−0,2	1,90	+0,3	0,6	−0,3
72	68,81	−0,5			3,28	−0,2	1,90	+0,3	0,6	−0,3
75	71,83	−0,5	2,49	−0,2	3,28	−0,2	1,90	+0,3	0,6	−0,3
80	76,81	−0,5	2,49	−0,2	3,28	−0,2	1,90	+0,3	0,6	−0,3
85	81,81	−0,5			3,28	−0,2	1,90	+0,3	0,6	−0,3
90	86,79	−0,5	2,87	−0,2	3,28	−0,2	2,70	+0,3	0,6	−0,3
95	91,82	−0,5			2,87	−0,2	2,70	+0,3	0,6	−0,3
100	96,80	−0,5	2,87	−0,2	3,28	−0,2	2,70	+0,3	0,6	−0,3
110	106,81	−0,5	2,87	−0,2	3,28	−0,2	2,70	+0,3	0,6	−0,3
115	111,81	−0,5	2,87	−0,2			2,70	+0,3	0,6	−0,3
120	115,21	−0,5			4,06	−0,2	3,10	+0,3	0,6	−0,3
125	120,22	−0,5	2,87	−0,2	4,06	−0,2	3,10	+0,3	0,6	−0,3
130	125,22	−0,5	2,87	−0,2	4,06	−0,2	3,10	+0,3	0,6	−0,3
140	135,23	−0,5	3,71	−0,25	4,90	−0,25	3,10	+0,3	0,6	−0,3
145	140,23	−0,5	3,71	−0,25			3,10	+0,3	0,6	−0,3
150	145,24	−0,5	3,71	−0,25	4,90	−0,25	3,10	+0,3	0,6	−0,3
160	155,22	−0,5	3,71	−0,25	4,90	−0,25	3,10	+0,3	0,6	−0,3
170	163,65	−0,5	3,71	−0,25	5,69	−0,25	3,50	+0,3	0,6	−0,3
180	173,66	−0,5	3,71	−0,25	5,69	−0,25	3,50	+0,3	0,6	−0,3
200	193,65	−0,5	5,69	−0,25	5,69	−0,25	3,50	+0,3	0,6	−0,3

The outer ring chamfer on the side of snap ring groove should allow a housing connection radius of:
0,3 mm for dimension series 0, up to D = 35 mm
0,5 mm for dimension series 0, for D > 35 mm and for all diameters, for dimensions series 2, 3 and 4







Snap ring **Table 8**

Outer diameter D mm	D_2 1) max.	D_3 2) nom.	toler.	D_4 min.	e nom.	f nom.	g nom.	r min.	Weight g	Snap ring designation –
30	34,7	27,9	−0,4	36	3,25	1,12	3	0,4	2,78	**SP30**
32	36,7	29,9	−0,4	38	3,25	1,12	3	0,4	2,98	**SP32**
35	39,7	32,9	−0,4	41	3,25	1,12	3	0,4	3,22	**SP35**
40	44,6	37,8	−0,4	46	3,25	1,12	3	0,4	3,60	**SP40**
42	46,3	39,5	−0,5	47	3,25	1,12	3	0,4	3,75	**SP42**
47	52,7	44,3	−0,5	54	4,04	1,12	4	0,4	5,30	**SP47**
52	57,9	49,4	−0,5	59	4,04	1,12	4	0,4	5,92	**SP52**
55	60,7	52,3	−0,5	62	4,04	1,12	4	0,4	6,17	**SP55**
62	67,7	59,0	−0,6	69	4,04	1,70	4	0,6	10,5	**SP62**
68	74,6	64,2	−0,6	76	4,85	1,70	5	0,6	12,6	**SP68**
72	78,6	68,2	−0,6	80	4,85	1,70	5	0,6	14,7	**SP72**
75	81,6	71,2	−0,6	83	4,85	1,70	5	0,6	15,3	**SP75**
80	86,6	76,2	−0,6	88	4,85	1,70	5	0,6	16,3	**SP80**
85	91,6	81,2	−0,6	93	4,85	1,70	5	0,6	17,5	**SP85**
90	96,5	86,2	−0,6	98	4,85	2,46	5	0,6	26,6	**SP90**
95	101,6	91,2	−0,6	103	4,85	2,46	5	0,6	28,2	**SP95**
100	106,5	96,2	−0,8	108	4,85	2,46	5	0,6	29,2	**SP100**
110	116,6	106,2	−0,8	118	4,85	2,46	5	0,6	32,8	**SP110**
115	121,6	111,2	−0,8	123	4,85	2,46	5	0,6	34,4	**SP115**
120	129,7	114,6	−0,8	131	7,21	2,82	7	0,6	60,6	**SP120**
125	134,7	119,6	−0,8	136	7,21	2,82	7	0,6	63,0	**SP125**
130	139,7	124,6	−0,8	141	7,21	2,82	7	0,6	65,6	**SP130**
140	149,7	134,6	−1,2	151	7,21	2,82	7	0,6	70,6	**SP140**
145	154,7	139,6	−1,2	156	7,21	2,82	7	0,6	73,0	**SP145**
150	159,7	144,5	−1,2	161	7,21	2,82	7	0,6	77,2	**SP150**
160	169,7	154,5	−1,2	172	7,21	2,82	7	0,6	81,0	**SP160**
170	182,9	162,9	−1,2	185	9,60	3,10	10	0,6	122	**SP170**
180	192,9	172,8	−1,2	195	9,60	3,10	10	0,6	128	**SP180**
200	212,9	192,8	−1,4	215	9,60	3,10	10	0,6	148	**SP200**

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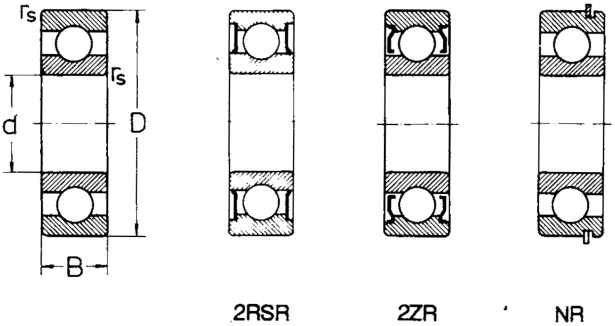
1) D_2 dimension refer to snap ring
2) D_3 represent dimension before mounting

Single-row deep groove ball bearings

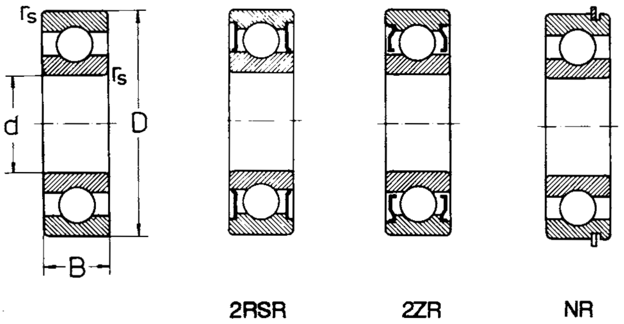


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
3	10	4	0,1	0,64	0,23	40 000	48 000	623		0,002
	10	4	0,1	0,64	0,23	40 000		623–2ZR		0,002
4	13	5	0,2	1,3	0,49	38 000	45 000	624		0,003
	13	5	0,2	1,3	0,49	38 000		624–2ZR		0,003
	16	5	0,3	1,2	0,5	34 000	40 000	634		0,005
	16	5	0,3	1,2	0,5	34 000		634–2ZR		0,005
5	11	3	0,1	0,64	0,26	55 000	65 000	618/5		0,001
	16	5	0,3	1,9	0,69	34 000	40 000	625		0,005
	16	5	0,3	1,9	0,69	34 000		625–2ZR		0,005
	16	5	0,3	1,9	0,69	22 000		625–2RSR		0,005
	19	6	0,3	1,7	0,72	32 000	38 000	635		0,009
	19	6	0,3	1,7	0,72	32 000		635–2ZR		0,009
6	13	3,5	0,1	1	0,44	50 000	59 000	618/6		0,002
	15	5	0,2	1,45	0,6	47 000	56 000	619/6		0,004
	19	6	0,3	2,2	0,89	32 000	38 000	626		0,008
	19	6	0,3	2,2	0,89	32 000		626–2ZR		0,008
	19	6	0,3	2,2	0,89	22 000		626–2RSR		0,008
7	14	3,5	0,1	0,96	0,4	47 000	56 000	618/7		0,002
	17	5	0,3	2,1	0,8	44 000	51 000	619/7Y		0,005
	19	6	0,3	2,25	0,89	32 000	38 000	607		0,008
	19	6	0,3	2,25	0,89	32 000		607–2ZR		0,008
	19	6	0,3	2,25	0,89	22 000		607–2RSR		0,008
	22	7	0,3	3,3	1,35	30 000	36 000	627		0,012
	22	7	0,3	3,3	1,35	30 000		627–2ZR		0,012
	22	7	0,3	3,3	1,35	20 000		627–2RSR		0,012
8	16	4	0,2	1,35	0,57	44 000	51 000	618/8		0,003
	19	6	0,3	1,6	0,74	40 000	47 000	619/8		0,007
	22	7	0,3	3,3	1,35	30 000	36 000	608		0,015
	22	7	0,3	3,3	1,35	30 000		608–2ZR		0,015
	22	7	0,3	3,3	1,35	20 000		608–2RSR		0,015
9	17	4	0,2	1,45	0,64	40 000	47 000	618/9		0,003
	20	6	0,3	2,65	1,1	37 000	43 000	619/9		0,007
	24	7	0,3	3,35	1,4	30 000	36 000	609		0,018
	24	7	0,3	3,35	1,4	30 000		609–2ZR		0,018
	24	7	0,3	3,35	1,4	20 000		609–2RSR		0,018
	26	8	0,3	4,55	1,95	28 000	34 000	629		0,020
	26	8	0,3	4,55	1,95	26 000		629–2ZR		0,020
	26	8	0,3	4,55	1,95	18 000		629–2RSR		0,020
10	19	5	0,3	1,7	0,83	37 000	43 000	61800		0,005
	22	6	0,3	1,95	0,75	34 000	41 000	61900TN		0,010
	26	8	0,3	4,55	1,95	28 000	34 000	6000TN		0,020
	26	8	0,3	4,55	1,95	28 000		6000–2ZR		0,020

Single-row deep groove ball bearings

Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
10	26	8	0,3	4,55	1,95	17 000		6000-2RSR		0,020
	28	8	0,3	4,55	1,95	28 000	34 000	16100		0,023
	30	9	0,6	5,1	2,4	32 000	38 000	6200TN		0,032
	30	9	0,6	5,1	2,4	26 000		6200-2ZR		0,032
	30	9	0,6	5,1	2,4	17 000		6200-2RSR		0,032
	35	11	0,6	8,1	3,45	20 000	26 000	6300		0,057
	35	11	0,6	8,1	3,45	20 000		6300-2ZR		0,057
	35	11	0,6	8,1	3,45	14 000		6300-2RSR		0,057
12	21	5	0,3	1,8	0,95	33 000	39 000	61801		0,006
	21	5	0,3	1,45	0,67	33 000	39 000	61801NR	SR21	0,006
	24	6	0,3	2,9	1,45	31 000	36 000	61901		0,011
	24	6	0,3	2,9	1,45	31 000	36 000	61901NR	SR24	0,011
	28	8	0,3	5,1	2,4	26 000	32 000	6001		0,022
	28	8	0,3	5,1	2,4	26 000	32 000	6001TN		0,022
	28	8	0,3	5,1	2,4	26 000		6001-2ZR		0,022
	28	8	0,3	5,1	2,4	17 000		6001-2RSR		0,022
	30	8	0,3	5,1	2,4	26 000	32 000	16101		0,026
	32	10	0,6	6,8	3,05	22 000	28 000	6201		0,037
	32	10	0,6	6,8	3,05	22 000	28 000	6201TN		0,037
	32	10	0,6	6,8	3,05	22 000		6201-2ZR		0,037
	32	10	0,6	6,8	3,05	15 000		6201-2RSR		0,037
	32	14	0,6	6,8	3,05	22 000		62201-2RSR		0,049
	37	12	1	9,65	4,15	19 000	24 000	6301		0,065
	37	12	1	9,65	4,15	19 000		6301-2ZR		0,065
	37	12	1	9,65	4,15	12 000		6301-2RSR		0,065
15	24	5	0,3	2	1,25	28 000	33 000	61802		0,007
	24	5	0,3	2	1,25	28 000	33 000	61802NR	SR24	0,007
	28	7	0,3	4	2,05	26 000	30 000	61902		0,017
	28	7	0,3	4	2,05	26 000	30 000	61902NR	SR28	0,017
	30	8	0,3	4	2,05	22 000	28 000	16002		0,037
	32	9	0,3	5,6	2,85	22 000	28 000	6002		0,031
	32	9	0,3	5,6	2,85	22 000		6002-2ZR		0,031
	32	9	0,3	5,6	2,85	14 000		6002-2RSR		0,031
	35	11	0,6	7,65	3,75	19 000	24 000	6202		0,046
	35	11	0,6	7,65	3,75	19 000		6202-2ZR		0,046
	35	11	0,6	7,65	3,75	19 000	24 000	6202TN		0,046
	35	11	0,6	7,65	3,75	13 000		6202-2RSR		0,046
	35	14	0,6	7,65	3,75	19 000		62202-2RSR		0,053
	42	13	1	11,4	5,45	17 000	20 000	6302		0,092
	42	13	1	11,4	5,45	17 000		6302-2ZR		0,092
	42	13	1	11,4	5,45	11 000		6302-2RSR		0,092
	42	17	1	11,4	5,45	17 000		62302-2RSR		0,099

Single-row deep groove ball bearings

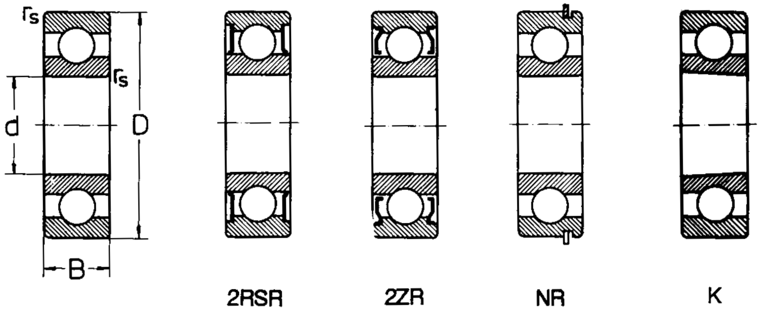


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
17	26	5	0,3	2,2	1,4	26 000	32 000	**61803**		0,009
	30	7	0,3	4,35	2,3	26 000	32 000	**61903**		0,018
	35	8	0,3	6	3,25	20 000	26 000	**16003**		0,040
	35	10	0,3	6	3,25	20 000	26 000	**6003**		0,042
	35	10	0,3	6	3,25	20 000		**6003−2ZR**		0,042
	35	10	0,3	6	3,25	12 000		**6003−2RSR**		0,042
	40	12	0,6	9,55	4,8	17 000	20 000	**6203**		0,070
	40	12	0,6	9,55	4,8	17 000	20 000	**6203TN**		0,070
	40	12	0,6	9,55	4,8	17 000		**6203−2ZR**		0,070
	40	12	0,6	9,55	4,8	11 000		**6203−2RSR**		0,070
	40	12	0,6	9,55	4,8	17 000	20 000	**6203NR**	**SP40**	0,070
	40	16	1	9,55	4,8	17 000	20 000	**62203−2RSR**		0,082
	47	14	1	13,4	6,55	16 000	19 000	**6303**		0,120
	47	14	1	13,4	6,55	16 000		**6303−2ZR**		0,120
	47	14	1	13,4	6,55	11 000		**6303−2RSR**		0,120
	47	19	1	13,4	6,55	16 000		**62303−2RSR**		0,145
	62	17	1,1	22,5	11	12 000	15 000	**6403**		0,285
	62	17	1,1	22,5	11	12 000	15 000	**6403NR**	**SP62**	0,285
20	32	7	0,3	3,45	2,25	20 000	26 000	**61804**		0,020
	32	7	0,3	3,45	2,25	21 000	25 000	**61804NR**	**SR32**	0,020
	37	9	0,3	6,55	3,65	19 000	23 000	**61904**		0,036
	37	9	0,3	6,55	3,65	19 000	23 000	**61904NR**	**SR37**	0,036
	42	8	0,3	7,95	4,5	17 000	20 000	**16004**		0,050
	42	12	0,6	9,4	5,05	17 000	20 000	**6004**		0,070
	42	12	0,6	9,4	5,05	17 000		**6004−2ZR**		0,070
	42	12	0,6	9,4	5,05	11 000		**6004−2RSR**		0,070
	47	14	1	12,8	6,65	15 000	18 000	**6204**		0,118
	47	14	1	12,8	6,65	15 000	18 000	**6204TN**		0,118
	47	14	1	12,8	6,65	15 000		**6204−2ZR**		0,118
	47	14	1	12,8	6,65	10 000		**6204−2RSR**		0,118
	47	14	1	12,8	6,65	15 000	18 000	**6204NR**	**SP47**	0,118
	47	18	1	12,8	6,65	15 000		**62204−2RSR**		0,131
	52	15	1,1	15,9	7,9	13 000	16 000	**6304**		0,158
	52	15	1,1	15,9	7,9	13 000	16 000	**6304TN**		0,158
	52	15	1,1	15,9	7,9	13 000	16 000	**6304MAP5**		0,158
	52	15	1,1	15,9	7,9	13 000		**6304−2ZR**		0,158
	52	15	1,1	15,9	7,9	8 000		**6304−2RSR**		0,158
	52	15	1,1	15,9	7,9	13 000	16 000	**6304NR**	**SP52**	0,158
	52	21	1,1	15,9	7,9	13 000		**62304−2RSR**		0,197
	72	19	1,1	31	15,2	10 000	13 000	**6404**		0,420
22	50	14	1	12,9	6,8	15 000	17 000	**62/22**		0,118
	50	14	1	12,9	6,8	15 000		**62/22-2ZR**		0,118
	50	14	1	12,9	6,8	15 000		**62/22−2RSR**		0,118

Single-row deep groove ball bearings

Dimensions				**Basic radial load**		**Speed limit**		**Designation**		**Weight**
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
22	56	16	1,1	18,5	9,5	13 000	15 000	**63/22**		0,201
	56	16	1,1	18,5	9,5	13 000		**63/22–2ZR**		0,201
	56	16	1,1	18,5	9,5	13 000		**63/22–2RSR**		0,201
25	37	7	0,3	4,35	2,6	18 000	25 000	**61805**		0,022
	42	9	0,3	6,65	4,1	16 000	19 000	**61905**		0,041
	47	8	0,3	8,4	5,1	15 000	18 000	**16005**		0,058
	47	12	0,6	10,1	5,85	15 000	18 000	**6005TN**		0,086
	47	12	0,6	10,1	5,85	15 000		**6005–2ZR**		0,086
	47	12	0,6	10,1	5,85	9 500		**6005–2RSR**		0,086
	52	15	1	14	7,85	12 000	15 000	**6205**		0,142
	52	15	1	14	7,85	12 000		**6205–2ZR**		0,142
	52	15	1	14	7,85	8 000		**6205–2RSR**		0,142
	52	15	1	14	7,85	12 000	15 000	**6205NR**	**SP52**	0,142
	52	18	1	14	7,85	12 000		**62205–2RSR**		0,148
	62	17	1,1	20,6	11,3	11 000	14 000	**6305**		0,250
	62	17	1,1	20,6	11,3	11 000	14 000	**6305MAP5**		0,250
	62	17	1,1	20,6	11,3	11 000		**6305–2ZR**		0,250
	62	17	1,1	20,6	11,3	7 500		**6305–2RSR**		0,250
	62	17	1,1	20,6	11,3	11 000	14 000	**6305NR**	**SP62**	0,250
	62	24	1,1	20,6	11,3	11 000		**62305–2RSR**		0,317
	80	21	1,5	37	18,8	9 000	11 000	**6405**		0,575
	80	21	1,5	37	18,8	9 000	11 000	**6405NR**	**SP80**	0,575
28	58	16	1	10,7	6,65	14 000	16 000	**62/28**		0,173
	58	16	1	10,7	6,65	14 000		**62/28–2ZR**		0,173
	58	16	1	10,7	6,65	14 000		**62/28–2RSR**		0,173
	68	18	1,1	19,5	11,5	10 000	12 000	**63/28**		0,328
	68	18	1,1	19,5	11,5	10 000		**63/28–2ZR**		0,328
	68	18	1,1	19,5	11,5	10 000		**63/28–2RSR**		0,328
30	42	7	0,3	4,4	2,9	15 000	18 000	**61806**		0,027
	42	7	0,3	4,4	2,9	15 000	18 000	**61806NR**	**SR42**	0,027
	47	9	0,3	7,8	4,7	14 000	17 000	**61906**		0,045
	47	9	0,3	7,8	4,7	14 000	17 000	**61906NR**	**SR47**	0,045
	55	9	3	11,2	7,35	12 000	15 000	**16006**		0,087
	55	13	1	13,2	8,25	12 000	15 000	**6006TN**		0,129
	55	13	1	13,2	8,25	12 000		**6006–2ZR**		0,129
	55	13	1	13,2	8,25	7 000		**6006–2RSR**		0,129
	55	13	1	13,2	8,25	12 000	15 000	**6006NR**	**SP55**	0,129
	62	16	1	19,5	11,3	10 000	13 000	**6206**		0,210
	62	16	1	19,5	11,3	10 000		**6206–2ZR**		0,210
	62	16	1	19,5	11,3	7 500		**6206–2RSR**		0,210
	62	16	1	19,5	11,3	10 000	10 000	**6206NR**	**SP62**	0,210
	62	20	1	19,5	11,3	10 000		**62206–2RSR**		0,236
	72	19	1,1	29,9	15,8	9 000	11 000	**6306**		0,371

Single-row deep groove ball bearings

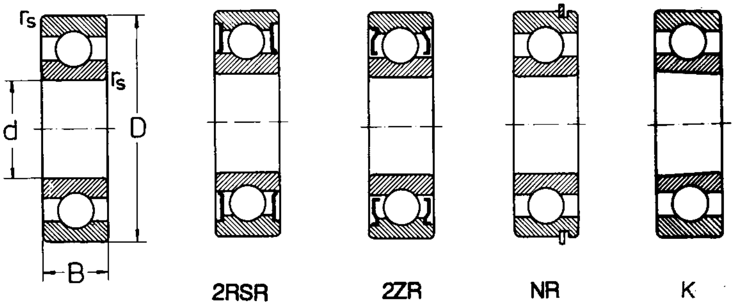


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg –
30	72	19	1,1	29,9	15,8	9 000	11 000	**6306MAP5**		0,371
	72	19	1,1	29,9	15,8	9 000		**6306–2ZR**		0,371
	72	19	1,1	29,9	15,8	6 000		**6306-2RSR**		0,371
	72	19	1,1	29,9	15,8	9 000	11 000	**6306NR**	**SP72**	0,371
	72	27	1,1	26,6	14,9	9 000		**62306–2RSR**		0,473
	90	23	1,5	47,3	24,5	8 500	10 000	**6406**		0,785
	90	23	1,5	47,3	24,5	8 500	10 000	**6406NR**	**SP90**	0,785
32	65	17	1	23	13	10 000	12 000	**62/32**		0,228
	65	17	1	23	13	10 000		**62/32–2ZR**		0,228
	65	17	1	23	13	10 000		**62/32–2RSR**		0,228
	75	20	1,1	30	16	9 000	11 000	**63/32**		0,437
	75	20	1,1	30	16	9 000		**63/32–2ZR**		0,437
	75	20	1,1	30	16	9 000		**63/32–2RSR**		0,437
35	47	7	0,3	4	3,25	13 000	16 000	**61807**		0,031
	55	10	0,6	9,5	6,2	12 000	14 000	**61907**		0,073
	62	9	0,3	12,2	8,85	10 000	13 000	**16007**		0,111
	62	14	1	15,9	10,3	10 000	13 000	**6007**		0,164
	62	14	1	15,9	10,3	10 000		**6007–2ZR**		0,164
	62	14	1	15,9	10,3	7 000		**6007–2RSR**		0,164
	62	14	1	15,9	10,3	10 000	13 000	**6007NR**	**SP62**	0,164
	72	17	1,1	25,7	15,4	9 000	11 000	**6207K**		0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207TN**		0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207MAP6**		0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207P6**		0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207P5**		0,315
	72	17	1,1	25,7	15,4	9 000		**6207–2ZR**		0,315
	72	17	1,1	25,7	15,4	6 000		**6207–2RSR**		0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207NR**	**SP72**	0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207NRP6**	**SP72**	0,315
	72	17	1,1	25,7	15,4	9 000	11 000	**6207MA**		0,315
	72	23	1,1	25,7	15,4	9 000		**62207–2RSR**		0,375
	80	21	1,5	33,5	18,3	8 500	10 000	**6307**		0,450
	80	21	1,5	33,5	18,3	8 500	10 000	**6307K**		0,450
	80	21	1,5	33,5	18,3	8 500	10 000	**6307P6**		0,450
	80	21	1,5	33,5	18,3	8 500	10 000	**6307P5**		0,450
	80	21	1,5	33,5	18,3	8 500		**6307–2ZR**		0,450
	80	21	1,5	33,5	18,3	8 500		**6307-2ZRP5**		0,450
	80	21	1,5	33,5	18,3	5 600		**6307–2RSR**		0,450
	80	21	1,5	33,5	18,3	5 600		**6307–2RSRP6**		0,450
	80	21	1,5	33,5	18,3	5 600		**6307–2RSRP5**		0,450
	80	21	1,5	33,5	18,3	8 500	10 000	**6307NR**	**SP80**	0,450
	80	31	1,5	33,5	18,3	8 500		**62307–2RSR**		0,658
	100	25	1,5	55,5	29,4	7 000	8 500	**6407**		0,954

Single-row deep groove ball bearings

Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
35	100	25	1,5	55,5	29,4	7 000	8 500	6407NR	SP100	0,954
40	52	7	0,3	4,5	4,05	11 000	14 000	61808P5		0,034
	52	7	0,3	4,5	4,05	12 000	14 000	61808NR	SR52	0,034
	62	12	0,6	14,5	10,2	11 000	13 000	61908		0,110
	62	12	0,6	14,5	10,2	11 000	13 000	61908NR	SR62	0,110
	68	9	0,3	13,3	9,8	9 500	12 000	16008		0,130
	68	15	1	16,8	11,6	9 500	12 000	6008		0,210
	68	15	1	16,8	11,6	9 500		6008–2ZR		0,210
	68	15	1	16,8	11,6	6 000		6008–2RSR		0,210
	68	15	1	16,8	11,6	9 500	12 000	6008NR	SP68	0,210
	80	18	1,1	32	17,8	8 500	10 000	6208		0,402
	80	18	1,1	32	17,8	8 500	10 000	6208K		0,402
	80	18	1,1	32	17,8	8 500	10 000	6208P6		0,402
	80	18	1,1	32	17,8	8 500	10 000	6208P5		0,402
	80	18	1,1	32	17,8	8 500		6208–2ZR		0,402
	80	18	1,1	32	17,8	8 500		6208–2ZRP5		0,402
	80	18	1,1	32	17,8	5 600		6208–2RSR		0,402
	80	18	1,1	32	17,8	5 600		6208–2RSRP5		0,402
	80	18	1,1	32	17,8	8 500	10 000	6208NR	SP80	0,402
	80	18	1,1	32	17,8	8 500	10 000	6208MB		0,402
	80	18	1,1	32	17,8	8 500	10 000	6208NMA		0,402
	80	23	1,1	32	19,8	8 500		62208–2RSR		0,460
	90	23	1,5	40,7	24	7 500	9 000	6308		0,635
	90	23	1,5	40,7	24	7 500	9 000	6308K		0,635
	90	23	1,5	40,7	24	7 500	9 000	6308TN		0,635
	90	23	1,5	40,7	24	7 500	9 000	6308P6		0,635
	90	23	1,5	40,7	24	7 500	9 000	6308P5		0,635
	90	23	1,5	40,7	24	7 500		6308–2ZR		0,635
	90	23	1,5	40,7	24	7 500		6308–2ZRP5		0,635
	90	23	1,5	40,7	24	5 000		6308–2RSR		0,635
	90	23	1,5	40,7	24	7 500	9 000	6308NMA		0,635
	90	23	1,5	40,7	24	7 500	9 000	6308NR	SP90	0,635
	90	33	1,5	40,7	24	7 500		62308–2RSR		0,874
	110	27	2	64	35	6 700	7 500	6408		1,23
	110	27	2	64	35	6 700	8 000	6408NR	SP110	1,23
45	58	7	0,3	6,4	5,6	9 500	12 000	61809		0,043
	68	12	0,6	14	9,8	9 700	11 000	61909		0,120
	75	10	0,6	15,5	12,3	9 000	11 000	16009		0,170
	75	16	1	21	15	9 000	11 000	6009		0,261
	75	16	1	21	15	9 000	11 000	6009P5		0,261
	75	16	1	21	15	9 000	11 000	6009P4		0,261
	75	16	1	21	15	9 000		6009–2ZR		0,261
	75	16	1	21	15	9 000		6009–2ZRP4		0,261

Single-row deep groove ball bearings

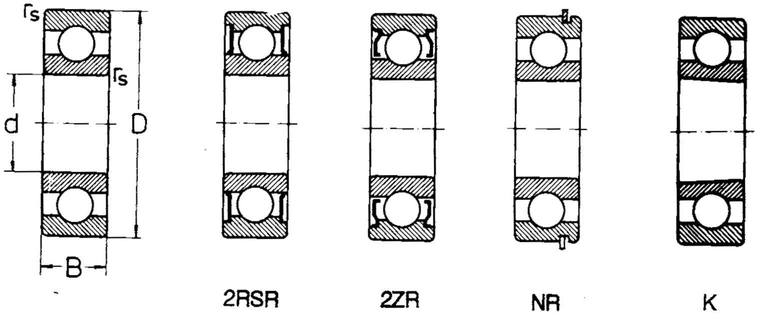


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
45	75	16	1	21	15	5 600		**6009–2RSR**		0,261
	75	16	1	21	15	9 000	11 000	**6009NR**	**SP75**	0,261
	85	19	1,1	32,7	20,2	7 500	9 000	**6209**		0,414
	85	19	1,1	32,7	20,2	7 500	9 000	**6209K**		0,414
	85	19	1,1	32,7	20,2	7 500	9 000	**6209P6**		0,414
	85	19	1,1	32,7	20,2	7 500	9 000	**6209P5**		0,414
	85	19	1,1	32,7	20,2	8 000		**6209–2ZR**		0,414
	85	19	1,1	32,7	20,2	8 000		**6209–2ZRP5**		0,414
	85	19	1,1	32,7	20,2	5 300		**6209–2RSR**		0,414
	85	19	1,1	32,7	20,2	5 300		**6209–2RSRP6**		0,414
	85	19	1,1	32,7	20,2	5 300		**6209–2RSRP5**		0,414
	85	19	1,1	32,7	20,2	8 000	9 500	**6209NR**	**SP85**	0,414
	85	23	1,1	32,7	20,2	8 000		**62209–2RSR**		0,481
	100	25	1,5	52,8	31,7	6 700	8 000	**6309**		0,838
	100	25	1,5	52,8	31,7	6 700	8 000	**6309K**		0,838
	100	25	1,5	52,8	31,7	6 700	8 000	**6309MB**		0,838
	100	25	1,5	52,8	31,7	6 700	8 000	**6309MAP6**		0,838
	100	25	1,5	52,8	31,7	6 700	8 000	**6309P6**		0,838
	100	25	1,5	52,8	31,7	6 700	8 000	**6309P5**		0,838
	100	25	1,5	52,8	31,7	6 700		**6309–2ZR**		0,838
	100	25	1,5	52,8	31,7	6 700		**6309–2ZRP5**		0,838
	100	25	1,5	52,8	31,7	4 500		**6309–2RSR**		0,838
	100	25	1,5	52,8	31,7	4 500		**6309–2RSRP6**		0,838
	100	25	1,5	52,8	31,7	4 500		**6309–2RSRP5**		0,838
	100	25	1,5	52,8	31,7	6 700	8 000	**6309NR**	**SP100**	0,838
	100	36	1,5	52,8	31,7	6 700		**62309–2RSR**		1,18
	120	29	2	76,8	44,9	5 600	6 700	**6409**		1,54
	120	29	2	76,8	44,9	5 600	6 700	**6409NR**	**SP120**	1,54
50	65	7	0,3	6,8	6,3	9 500	12 000	**61810**		0,057
	65	7	0,3	6,8	6,3	9 700	11 000	**61810NR**	**SR65**	0,057
	72	12	0,6	14,5	10,4	9 000	11 000	**61910**		0,130
	72	12	0,6	14,5	10,4	9 000	11 000	**61910NR**	**SR72**	0,130
	80	10	0,6	16,3	13,1	8 500	10 000	**16010**		0,188
	80	16	1	21,8	16,5	8 500	10 000	**6010K**		0,260
	80	16	1	21,8	16,5	8 500		**6010–2ZR**		0,260
	80	16	1	21,8	16,5	5 300		**6010–2RSR**		0,260
	90	20	1,1	35,1	23,1	7 000	8 500	**6210**		0,460
	90	20	1,1	35,1	23,1	7 000	8 500	**6210K**		0,460
	90	20	1,1	35,1	23,1	7 000	8 500	**6210M**		0,460
	90	20	1,1	35,1	23,1	7 000	8 500	**6210MAP6**		0,460
	90	20	1,1	35,1	23,1	7 000	8 500	**6210P6**		0,460
	90	20	1,1	35,1	23,1	7 000	8 500	**6210P5**		0,460
	90	20	1,1	35,1	23,1	7 000		**6210–2ZR**		0,460

Single-row deep groove ball bearings

Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
50	90	20	1,1	35,1	23,1	7 000		6210–2ZRP5		0,460
	90	20	1,1	35,1	23,1	4 500		6210–2RSR		0,460
	90	20	1,1	35,1	23,1	4 500		6210–2RSRP6		0,460
	90	20	1,1	35,1	23,1	4 500		6210–2RSRP5		0,460
	90	20	1,1	35,1	23,1	7 000	8 500	6210NR	SP90	0,460
	90	23	1,1	35,1	23,1	7 000		62210–2RSR		0,514
	110	27	2	61,8	37,9	6 000	7 000	6310		1,06
	110	27	2	61,8	37,9	6 000	7 000	6310K		1,06
	110	27	2	61,8	37,9	6 000	7 000	6310MAP6		1,06
	110	27	2	61,8	37,9	6 000		6310–2ZR		1,06
	110	27	2	61,8	37,9	4 000		6310–2RSR		1,06
	110	27	2	61,8	37,9	6 000	7 000	6310NR	SP110	1,06
	110	40	2	61,8	37,9	6 000		62310–2RSR		1,65
	130	31	2,1	87,1	52	5 000	6 000	6410		1,89
	130	31	2,1	87,1	52	5 000	6 000	6410NR	SP130	1,89
55	72	9	0,3	9	8,5	8 500	10 000	61811		0,083
	90	11	0,6	19,3	16,3	7 500	9 000	16011		0,26
	90	18	1,1	28,3	21,2	7 500	9 000	6011MB		0,39
	90	18	1,1	28,3	21,2	7 500		6011–2ZR		0,39
	90	18	1,1	28,3	21,2	4 500		6011–2RSR		0,39
	90	18	1,1	28,3	21,2	7 500	9 000	6011NR	SP90	0,39
	100	21	1,5	43,4	29,3	6 300	7 500	6211		0,611
	100	21	1,5	43,4	29,3	6 300	7 500	6211K		0,611
	100	21	1,5	43,4	29,3	6 300	7 500	6211MA		0,611
	100	21	1,5	43,4	29,3	6 300		6211–2ZR		0,611
	100	21	1,5	43,4	29,3	4 000		6211–2RSR		0,611
	100	21	1,5	43,4	29,3	6 300	7 500	6211NR	SP100	0,611
	120	29	2	71,5	44,6	5 300	6 300	6311		1,38
	120	29	2	71,5	44,6	5 300	6 300	6311K		1,38
	120	29	2	71,5	44,6	5 300	6 300	6311MA		1,38
	120	29	2	71,5	44,6	5 300		6311–2ZR		1,38
	120	29	2	71,5	44,6	3 600		6311–2RSR		1,38
	120	29	2	71,5	44,6	5 300	6 300	6311NR	SP120	1,38
	140	33	2,1	100	62	4 800	5 600	6411		2,30
	140	33	2,1	100	62	4 800	5 600	6411NR	SP140	2,30
60	78	10	0,3	8,7	6,7	8 000	9 500	61812		0,120
	95	11	0,6	20	17,6	7 000	8 500	16012		0,280
	95	18	1,1	29,4	23,2	6 700	8 000	6012		0,420
	95	18	1,1	29,4	23,2	6 700		6012–2ZR		0,420
	95	18	1,1	29,4	23,2	4 300		6012–2RSR		0,420
	95	18	1,1	29,4	23,2	7 000	8 500	6012NR	SP95	0,420
	110	22	1,5	52,4	36	6 000	7 000	6212		0,780
	110	22	1,5	52,4	36	6 000	7 000	6212K		0,780
	110	22	1,5	52,4	36	6 000	7 000	6212MA		0,780

Single-row deep groove ball bearings

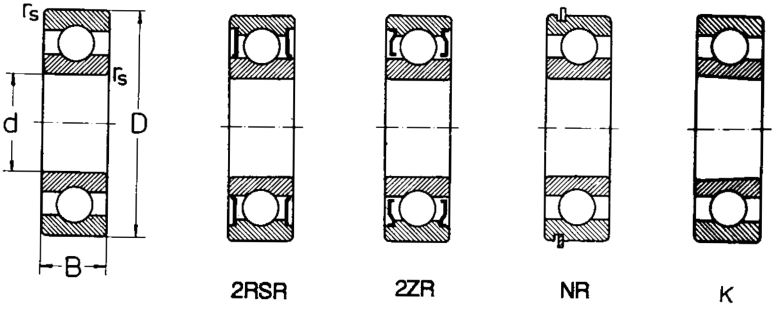


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
60	110	22	1,5	52,4	36	6 000		6212-2ZR		0,780
	110	22	1,5	52,4	36	4 000		6212-2RSR		0,780
	110	22	1,5	52,4	36	6 000	7 000	6212NR	SP110	0,780
	130	31	2,1	81,8	51,9	5 000	6 000	6312		1,72
	130	31	2,1	81,8	51,9	5 000	6 000	6312K		1,72
	130	31	2,1	81,8	51,9	5 000		6312-2ZR		1,72
	130	31	2,1	81,8	51,9	3 400		6312-2RSR		1,72
	130	31	2,1	81,8	51,9	5 000	6 000	6312NR	SP130	1,72
	150	35	2,1	110	70,8	4 300	5 000	6412		2,76
	150	35	2,1	110	70,8	4 300	5 000	6412NR	SP150	2,76
62	110	22	1,5	47,5	28	6 000	7 000	62/62		0,600
65	85	10	0,6	12,2	12	7 000	8 500	61813		0,130
	100	11	0,6	22,9	19,6	6 300	7 500	16013		0,300
	100	18	1,1	30,5	25,2	6 300	7 500	6013K		0,440
	100	18	1,1	30,5	25,2	6 300		6013-2ZR		0,440
	100	18	1,1	30,5	25,2	4 000		6013-2RSR		0,440
	100	18	1,1	30,5	25,2	6 300	7 500	6013NR	SP100	0,440
	120	23	1,5	57,2	40	5 300	6 300	6213		0,995
	120	23	1,5	57,2	40	5 300	6 300	6213M		0,995
	120	23	1,5	57,2	40	5 300	6 300	6213MA		0,995
	120	23	1,5	57,2	40	5 300		6213-2ZR		0,995
	120	23	1,5	57,2	40	3 600		6213-2RSR		0,995
	120	23	1,5	57,2	40	5 300	6 300	6213NR	SP120	0,995
	140	33	2,1	92,7	59,7	4 800	5 600	6313		2,10
	140	33	2,1	92,7	59,7	4 800	5 600	6313MA		2,10
	140	33	2,1	92,7	59,7	4 800	5 600	6313MB		2,10
	140	33	2,1	92,7	59,7	4 800		6313-2ZR		2,10
	140	33	2,1	92,7	59,7	3 000		6313-2RSR		2,10
	140	33	2,1	92,7	59,7	4 800	5 600	6313NR	SP140	2,10
	160	37	2,1	118	79	4 000	4 800	6413		3,300
	160	37	2,1	118	79	4 000	4 800	6413NR	SP160	3,300
70	90	10	0,6	12,5	10	6 700	8 000	61814		0,160
	110	13	0,6	27,9	25	6 000	7 000	16014		0,433
	110	20	1,1	38,1	30,9	6 000	7 000	6014		0,600
	110	20	1,1	38,1	30,9	6 000	7 000	6014MAP5		0,600
	110	20	1,1	38,1	30,9	6 000		6014-2ZR		0,600
	110	20	1,1	38,1	30,9	3 600		6014-2RSR		0,600
	110	20	1,1	38,1	30,9	6 000	7 000	6014NR	SP110	0,600
	125	24	1,5	62,2	44,1	5 000	6 000	6214		1,07
	125	24	1,5	62,2	44,1	5 000	6 000	6214MA		1,07
	125	24	1,5	62,2	44	5 000		6214-2ZR		1,07
	125	24	1,5	62,2	44	3 400		6214-2RSR		1,07
	125	24	1,5	62,2	44	5 000	6 000	6214NR	SP125	1,07

Single-row deep groove ball bearings

Dimensions d	D	B	r_s min.	**Basic radial load** dyn. C_r	stat. C_{0r}	**Speed limit** grease	oil	**Designation** bearing	snap ring	**Weight**
mm				kN		min^{-1}		–		kg
70	150	35	2,1	104	68,1	4 500	5 300	**6314**		2,50
	150	35	2,1	104	68,1	4 500	5 300	**6314K**		2,50
	150	35	2,1	104	68,1	4 500	5 300	**6314MAP6**		2,50
	150	35	2,1	104	68,1	4 500		**6314-2ZR**		2,50
	150	35	2,1	104	68,1	2 800		**6314-2RSR**		2,50
	150	35	2,1	104	68,1	4 500	5 300	**6314NR**	**SP150**	2,50
	180	42	3	144	104	3 800	4 500	**6414**		4,85
75	95	10	0,6	12,8	12,1	6 300	7 500	**61815P5**		0,160
	95	10	0,6	12,8	12,1	4 000		**61815-2RSR**		0,160
	115	13	0,6	28,5	26,8	5 600	6 700	**16015**		0,460
	115	20	1,1	39,7	33,5	5 600	6 700	**6015M**		0,640
	115	20	1,1	39,7	33,5	5 600	6 700	**6015MAP5**		0,640
	115	20	1,1	39,7	33,5	5 600		**6015-2ZR**		0,640
	115	20	1,1	39,7	33,5	3 400		**6015-2RSR**		0,640
	115	20	1,1	39,7	33,5	5 600	6 700	**6015NR**	**SP115**	0,640
	130	25	1,5	67,4	49,3	4 800	5 600	**6215**		1,18
	130	25	1,5	67,4	49,3	4 800	5 600	**6215K**		1,18
	130	25	1,5	67,4	49,3	4 800		**6215-2ZR**		1,18
	130	25	1,5	67,4	49,3	3 200		**6215-2RSR**		1,18
	130	25	1,5	67,4	49,3	4 800	5 600	**6215NR**	**SP130**	1,18
	160	37	2,1	113	77	4 000	4 800	**6315**		3,03
	160	37	2,1	113	77	4 000	4 800	**6315MP6**		3,03
	160	37	2,1	113	77	4 000		**6315-2ZR**		3,03
	160	37	2,1	113	77	2 800		**6315-2RSR**		3,03
	160	37	2,1	113	77	4 000	5 000	**6315NR**	**SP160**	3,03
	190	45	3	154	115	3 600	4 300	**6415**		6,50
80	100	10	0,6	12,9	13,7	6 000	7 000	**61816**		0,160
	110	16	1	25,1	20,5	5 600	6 700	**61916**		0,380
	125	14	0,6	31,9	29,7	5 300	6 300	**16016**		0,600
	125	22	1,1	47,6	39,8	5 300	6 300	**6016MA**		0,850
	125	22	1,1	47,6	39,8	5 300		**6016-2ZR**		0,850
	125	22	1,1	47,6	39,8	3 600		**6016-2RSR**		0,850
	125	22	1,1	47,6	39,8	5 300	6 300	**6016NR**	**SP125**	0,850
	140	26	2	72,7	53	4 500	5 300	**6216**		1,40
	140	26	2	72,7	53	4 500	5 300	**6216K**		1,40
	140	26	2	72,7	53	4 500	5 300	**6216MA**		1,40
	140	26	2	72,7	53	4 500		**6216-2ZR**		1,40
	140	26	2	72,7	53	3 000		**6216-2RSR**		1,40
	140	26	2	72,7	53	4 500	5 300	**6216NR**	**SP140**	1,40
	170	39	2,1	123	86,5	3 800	4 500	**6316K**		3,60
	170	39	2,1	123	86,5	3 800	4 500	**6316M**		3,60
	170	39	2,1	123	86,5	3 800		**6316-2ZR**		3,60
	170	39	2,1	123	86,5	3 800	4 500	**6316NR**	**SP170**	3,60

Single-row deep groove ball bearings

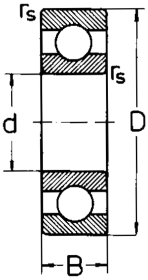


Dimensions				Basic radial load		Speed limit		Designation bearing	snap ring	Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil			
mm				kN		min^{-1}		–		kg
80	200	48	3	164	125	3 400	4 000	**6416**		7,50
85	110	13	1	19,3	20	5 300	6 300	**61817**		0,290
	130	14	1	33,8	33,5	5 000	6 000	**16017**		0,630
	130	22	1,1	49,5	43,1	5 000	6 000	**6017**		0,890
	130	22	1,1	49,5	43,1	5 000		**6017−2ZR**		0,890
	130	22	1,1	49,5	43,1	3 400		**6017−2RSR**		0,890
	130	22	1,1	49,5	43,1	5 000	6 000	**6017NR**	**SP130**	0,890
	150	28	2	84	61,9	4 300	5 000	**6217**		1,80
	150	28	2	84	61,9	4 300	5 000	**6217K**		1,80
	150	28	2	84	61,9	4 300	5 000	**6217MP6**		1,80
	150	28	2	84	61,9	4 300		**6217−2ZR**		1,80
	150	28	2	84	61,9	2 800		**6217−2RSR**		1,80
	150	28	2	84	61,9	4 300	5 000	**6217NR**	**SP150**	1,80
	180	41	3	133	96,6	3 600	4 300	**6317**		4,20
	180	41	3	133	96,6	3 600	4 300	**6317K**		4,20
	180	41	3	133	96,6	3 600	4 300	**6317MA**		4,20
	180	41	3	133	96,6	3 600	4 300	**6317MB**		4,20
	180	41	3	133	96,6	3 600		**6317−2ZR**		4,20
	180	41	3	133	96,6	3 600	4 300	**6317NR**	**SP180**	4,20
	210	52	4	173	136	3 200	3 800	**6417**		9,00
90	115	13	1	19,6	20,4	5 300	6 300	**61818**		0,300
	140	16	1	41,9	40,4	4 500	5 300	**16018**		0,850
	140	24	1,5	58,2	49,7	4 500	5 300	**6018MA**		1,16
	140	24	1,5	58,2	49,7	4 500	5 300	**6018MP6**		1,16
	140	24	1,5	58,2	49,7	4 500		**6018−2ZR**		1,16
	140	24	1,5	58,2	49,7	3 000		**6018−2RSR**		1,16
	140	24	1,5	58,2	49,7	4 500	5 600	**6018NR**	**SP140**	1,16
	160	30	2	96	71,5	3 800	4 500	**6218**		2,16
	160	30	2	96	71,5	3 800	4 500	**6218K**		2,16
	160	30	2	96	71,5	3 800	4 500	**6218MA**		2,16
	160	30	2	96	71,5	3 800	4 500	**6218MP6**		2,16
	160	30	2	96	71,5	3 800		**6218−2ZR**		2,16
	160	30	2	96	71,5	3 800	4 500	**6218NR**	**SP160**	2,16
	190	43	3	143	107	3 400	4 000	**6318**		4,90
	190	43	3	143	107	3 400	4 000	**6318K**		4,90
	190	43	3	143	107	3 400	4 000	**6318M**		4,90
	190	43	3	143	107	3 400		**6318−2ZR**		4,90
	190	43	3	143	107	3 400	4 000	**6318NR**	**SP190**	4,90
	225	54	4	190	160	3 000	3 600	**6418**		11,5
95	145	16	1	42,3	41,5	4 300	5 000	**16019**		0,890
	145	24	1,5	60,5	53,6	4 300	5 000	**6019**		1,20
	145	24	1,5	60,5	53,6	4 300		**6019−2ZR**		1,20
	145	24	1,5	60,5	53,6	2 800		**6019−2RSR**		1,20

Single-row deep groove ball bearings

Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
95	145	24	1,5	60,5	53,6	4 300	5 000	**6019NR**	**SP145**	1,20
	170	32	2,1	109	81,9	3 600	4 300	**6219MBP6**		2,60
	170	32	2,1	109	81,9	3 600	4 300	**6219NR**	**SP170**	2,60
	200	45	3	153	118	3 200	3 800	**6319**		5,60
	200	45	3	153	118	3 200	3 800	**6319MAP6**		5,60
100	125	13	1	19,6	21,2	4 800	5 600	**61820MAP5**		0,320
	150	16	1	45	44	4 300	5 000	**16020**		0,910
	150	24	1,5	60,5	54	4 300	5 000	**6020MAP6**		1,25
	150	24	1,5	60,5	54	4 300		**6020−2ZR**		1,25
	150	24	1,5	60,5	54	2 800		**6020−2RSR**		1,25
	150	24	1,5	60,5	54	4 300	5 000	**6020NR**	**SP150**	1,25
	180	34	2,1	124	93	3 400	4 000	**6220**		3,10
	180	34	2,1	124	93	3 400	4 000	**6220MA**		3,15
	180	34	2,1	124	93	3 400	4 000	**6220MP6**		3,15
	180	34	2,1	124	93	3 400	4 000	**6220NR**	**SP180**	3,15
	215	47	3	173	140	3 000		**6320−2ZR**		7,00
	215	47	3	173	140	3 000	3 600	**6320MAP6**		7,00
105	130	13	1	20,8	19,6	4 500	5 300	**61821MAP5**		0,350
	160	18	1	52	51	4 000	4 800	**16021**		1,20
	160	26	2	72,3	65,8	3 800	4 500	**6021M**		1,60
	190	36	2,1	133	104	3 200	3 800	**6221**		3,70
	190	36	2,1	133	104	3 200	3 800	**6221MA**		3,70
	225	49	3	184	153	2 800	3 400	**6321MA**		8,00
110	140	16	1	28,1	29	4 300	5 000	**61822**		0,600
	170	19	1	57,5	56,7	3 800	4 500	**16022**		1,46
	170	28	2	82	73	3 600	4 300	**6022**		1,95
	200	38	2,1	143	118	3 000	3 600	**6222**		4,35
	200	38	2,1	143	118	3 000	3 600	**6222M**		4,35
	200	38	2,1	143	118	3 000	3 600	**6222NR**	**SP200**	4,35
	240	50	3	203	178	2 600	3 200	**6322**		9,58
	240	50	3	203	178	2 600	3 200	**6322MA**		9,58
120	150	16	1	29,1	32,5	3 800	4 500	**61824**		0,650
	180	19	1	63,2	63,3	3 400	4 000	**16024**		1,70
	180	28	2	85	79,3	3 400	4 000	**6024MP6**		2,09
	215	40	2,1	155	131	2 800	3 400	**6224**		5,15
	215	40	2,1	155	131	2 800	3 400	**6224MB**		5,15
	215	40	2,1	155	131	2 800	3 400	**6224MAP6**		5,15
	215	40	2,1	155	131	2 800		**6224−2ZR**		5,15
	215	40	2,1	155	131	2 800	3 400	**6224NR**	**SP215**	5,15
	260	55	3	212	190	2 400	3 000	**6324MA**		13,6
130	165	18	1,1	38	43	3 600	4 300	**61826MAP5**		0,930
	200	22	1,1	79	81	3 200	3 800	**16026**		2,50

Single-row deep groove ball bearings

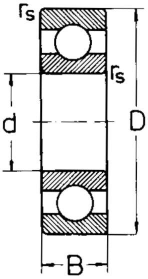


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
130	200	33	2	106	101	3 000	3 600	**6026**		3,25
	230	40	3	167	146	2 600	3 200	**6226**		6,00
	230	40	3	167	146	2 600	3 200	**6226M**		6,00
	280	58	4	229	214	2 200	2 800	**6326MA**		17,0
140	175	18	1,1	39	46	3 400	4 000	**61828MAP5**		1,00
	210	22	1,1	80,5	86	2 800	3 400	**16028**		2,70
	210	33	2	110	109	2 800	3 400	**6028MP6**		3,35
	250	42	3	176	164	2 400	3 000	**6228**		7,50
	250	42	3	176	164	2 400	3 000	**6228MA**		7,50
	300	62	4	253	246	2 000	2 600	**6328MA**		21,0
150	190	20	1,1	48,8	61	3 000	3 600	**61830**		1,40
	225	24	1,1	92,3	98	2 600	3 200	**16030**		3,40
	225	35	2,1	125	126	2 600	3 200	**6030MA**		4,75
	270	45	3	176	170	2 000	2 600	**6230MA**		9,60
	320	65	4	275	284	1 900	2 400	**6330MA**		25,0
160	200	20	1,1	52	62	2 800	3 400	**61832**		1,49
	240	25	1,5	99,4	107	2 400	3 000	**16032**		3,60
	240	38	2,1	140	143	2 400	3 000	**6032MA**		5,85
	290	48	3	185	186	1 900	2 400	**6232MA**		15,0
170	215	22	1,1	61,8	73,5	2 600	3 200	**61834P6**		2,00
	260	28	1,5	118	127	2 200	2 800	**16034**		5,70
	260	42	2,1	168	172	2 200	2 800	**6034MA**		7,80
	310	52	4	212	224	1 900	2 400	**6234MA**		17,5
180	225	22	1,1	62,3	78,5	2 400	3 000	**61836P5**		2,00
	250	33	2	128	137	2 200	2 800	**61936MA**		4,90
	280	31	2	140	146	2 000	2 600	**16036MA**		7,00
	280	46	2,1	186	194	2 000	2 600	**6036**		10,5
	320	52	4	227	242	1 800	2 200	**6236**		18,5
190	240	24	1,5	74,1	92	2 200	2 800	**61838**		2,60
	290	31	2	148	162	2 000	2 600	**16038**		7,90
	290	46	2,1	194	210	2 000	2 600	**6038MA**		11,0
	290	46	2,1	194	210	2 000	2 600	**6038MB**		11,0
	290	46	2,1	194	210	2 000	2 600	**6038MBP6**		11,0
	290	46	2,1	194	210	2 000	2 600	**6038MBP5**		11,0
	340	55	4	255	278	1 700	2 000	**6238MA**		23,0
	340	55	4	255	278	1 700	2 000	**6238MB**		23,0
200	250	24	1,5	78	93	2 200	2 800	**61840MB**		2,70
	280	38	2,1	151	160	2 200	2 800	**61940MB**		7,25
	310	34	2	168	187	1 900	2 400	**16040MBP6**		9,00
	310	34	2	168	187	1 900	2 400	**16040MBP5**		9,00
	310	51	2,1	208	226	1 900	2 400	**6040MA**		13,5
	310	51	2,1	208	226	1 900	2 400	**6040MB**		13,5

Single-row deep groove ball bearings

Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B*	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
200	310	51	2,1	208	226	1 900	2 400	**6040MBP52**		13,5
	360	58	4	280	314	1 700	2 000	**6240M**		28,0
	360	58	4	280	314	1 700	2 000	**6240MB**		27,0
220	270	24	1,5	80,6	101	1 900	2 400	**61844MB**		3,00
	300	38	2,1	152	178	1 900	2 400	**61944MB**		7,80
	300	38	2,1	152	178	1 900	2 400	**61944MAP5**		7,90
	340	37	2,1	191	226	1 800	2 200	**16044MB**		12,0
	340	56	3	247	291	1 800	2 200	**6044MA**		19,0
	340	56	3	247	291	1 800	2 200	**6044MB**		18,5
	400	65	4	311	376	1 500	1 800	**6244MB**		37,0
	400	65	4	311	376	1 500	1 800	**6244MBP6**		37,0
240	300	28	2	104	128	1 800	2 200	**61848MB**		4,50
	320	38	2,1	159	180	1 800	2 200	**61948MB**		8,45
	360	37	2,1	181	215	1 700	2 000	**16048MAC4S1**		14,5
	360	37	2,1	181	215	1 700	2 000	**16048MB**		14,0
	360	56	3	247	295	1 700	2 000	**6048MB**		19,5
	360	56	3	247	295	1 700	2 000	**6048MAP6**		20,0
	360	56	3	247	295	1 700	2 000	**6048MBP6**		19,5
	360	56	3	247	295	1 700	2 000	**6048MP64SO**		20,0
	440	72	4	360	470	1 300	1 600	**6248MB**		51,0
260	320	28	2	106	138	1 700	2 000	**61852MB**		4,80
	360	46	2,1	213	263	1 600	1 900	**61952MB**		14,5
	400	44	3	235	298	1 500	1 800	**16052MB**		21,5
	400	65	4	294	373	1 500	1 800	**6052MB**		28,5
	400	65	4	294	373	1 500	1 800	**6052MAP6**		29,5
	400	65	4	294	373	1 500	1 800	**6052MBP6**		28,5
	480	80	5	335	594	1 100	1 400	**6252MB**		65,5
280	350	33	2	134	177	1 600	1 900	**61856MB**		7,40
	350	33	2	134	177	1 600	1 900	**61856MBP6**		7,40
	350	33	2	134	177	1 600	1 900	**61856MBP5**		7,40
	380	46	2,1	218	282	1 500	1 800	**61956MB**		15,0
	420	44	3	252	360	1 400	1 700	**16056MB**		23,0
	420	65	4	325	422	1 400	1 700	**6056MB**		31,0
	500	80	5	429	604	1 100	1 400	**6256MB**		71,0
300	380	38	2,1	164	213	1 400	1 700	**61860MB**		10,5
	380	38	2,1	164	213	1 400	1 700	**61860MBP6**		10,5
	380	38	2,1	164	213	1 400	1 700	**61860MBP5**		10,5
	420	56	3	257	340	1 300	1 600	**61960MB**		24,0
	420	72	3	323	437	1 200	1 500	**62960MAP6**		32,0
	460	50	4	285	403	1 200	1 500	**16060MB**		32,0
	460	74	4	357	492	1 200	1 500	**6060M**		43,5
	460	74	4	357	492	1 200	1 500	**6060MA**		44,0

Single-row deep groove ball bearings

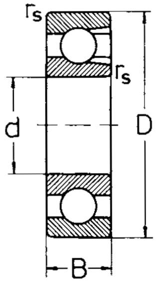


Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		$\min^{-1}$		–		kg
300	460	74	4	357	492	1 200	1 500	6060MB		43,0
	460	74	4	357	492	1 200	1 500	6060MBP6		43,0
320	400	38	2,1	170	220	1 300	1 600	61864MB		11,0
	440	56	3	275	388	1 200	1 500	61964MB		25,5
	480	50	4	293	430	1 100	1 400	16064MB		34,0
	480	74	4	363	512	1 100	1 400	6064M		46,5
	480	74	4	363	512	1 100	1 400	6064MB		46,0
	480	74	4	363	512	1 100	1 400	6064MBP6		46,0
340	420	38	2,1	178	240	1 200	1 500	61868MB		11,5
	460	56	3	272	390	1 100	1 400	61968MB		26,5
	520	57	4	345	515	1 000	1 300	16068MB		45,0
	520	82	5	437	663	1 000	1 300	6068MB		62,0
360	440	38	2,1	192	268	1 100	1 400	61872MB		12,0
	480	56	3	280	413	1 100	1 400	61972MB		28,0
	540	57	4	346	530	1 000	1 300	16072MB		49,0
	540	82	5	421	648	1 000	1 300	6072MB		65,0
	540	82	5	421	648	1 000	1 300	6072MBP6		65,0
	540	82	5	421	648	1 000	1 300	6072MBP5		65,0
380	480	46	2,1	244	395	1 000	1 300	61876MB		20,0
	520	65	4	365	584	1 000	1 300	61976MB		39,0
	560	82	5	438	700	950	1 200	6076MB		67,5
400	500	46	2,1	261	396	1 000	1 300	61880MB		20,5
	500	46	2,1	261	396	1 000	1 300	61880MBP6		20,5
	540	65	4	362	585	950	1 200	61980MB		41,5
	600	90	5	493	809	900	1 100	6080MA		87,5
	600	90	5	493	809	900	1 100	6080MB		91,0
420	520	46	2,1	259	388	950	1 200	61884MB		21,5
	560	65	4	359	587	900	1 100	61984MB		43,0
	620	90	5	530	896	900	1 100	6084MB		91,5
440	540	46	2,1	256	403	900	1 100	61888MB		22,5
	650	94	6	530	939	850	1 000	6088MAP6		105
460	580	56	3	275	600	900	1 100	61892MB		35,0
	620	74	4	425	740	850	1 000	61992MB		62,5
	680	100	6	563	995	800	950	6092MB		120
480	600	56	3	310	515	850	1 000	61896MB		36,5
	650	78	5	458	814	800	950	61996MB		74,0
	700	100	6	538	1 088	750	900	6096MB		125
500	620	56	3	333	580	800	950	618/500MA		37,5
	720	100	6	627	1 171	750	900	60/500MB		135

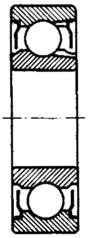
Single-row deep groove ball bearings

Dimensions				Basic radial load		Speed limit		Designation		Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil	bearing	snap ring	
mm				kN		min^{-1}		–		kg
530	650	56	3	320	552	750	900	**618/530MB**		39,5
	710	82	5	512	970	700	850	**619/530MB**		90,5
	780	112	6	678	1 298	670	800	**60/530MB**		185
560	680	56	3	324	575	700	850	**618/560MB**		42,0
	750	85	5	525	1 021	670	800	**619/560MB**		103
	750	85	5	525	1 021	670	800	**619/560MAP6**		105
	820	115	6	726	1 414	630	750	**60/560MB**		210
600	730	60	3	367	687	670	800	**618/600MB**		52,0
	800	90	5	584	1 195	700	750	**619/600MBP6**		125
	870	118	6	826	1 753	670	700	**60/600MBP6**		236
630	780	69	4	433	848	630	750	**618/630MB**		73,0
	850	100	6	630	1 320	600	700	**619/630MB**		156
	920	128	7,5	856	1 812	560	670	**60/630MB**		285
670	820	69	4	438	878	560	670	**618/670MB**		77,5
	900	103	6	675	1 454	530	630	**619/670MB**		185
710	870	74	4	482	997	530	630	**618/710MB**		93,5
	950	106	6	690	1 526	500	600	**619/710MB**		220
750	920	78	5	501	1 066	500	600	**618/750MB**		110
	1 000	112	6	764	1 754	450	530	**619/750MB**		255
800	980	82	5	572	1 298	450	530	**618/800MB**		142
900	1 090	85	5	611	1 449	380	450	**618/900MB**		160
950	1 250	132	7,5	910	2 378	360	430	**619/950FB**		464
1 000	1 220	100	5	749	1 909	340	400	**618/1000MB**		245
1 120	1 360	106	6	880	2 456	300	360	**618/1120M**		331
1 320	1 600	122	6	953	2 834	260	320	**618/1320MB**		500
1 400	1 700	132	7,5	1 278	3 999	200	260	**618/1400FA**		567

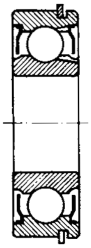
Single-row deep groove ball bearings with filling slots



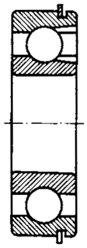
BL



BL 2Z



BL 2ZNR



BL NR

Dimensions				Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		–	kg
35	72	17	1,1	31,2	25	9 000	11 000	**BL6207**	0,343
	72	17	1,1	31,2	25	9 000		**BL6207-2Z**	0,343
	72	17	1,1	31,2	25	9 000		**BL6207-2ZNR**	0,343
	72	17	1,1	31,2	25	9 000	11 000	**BL6207NR**	0,353
	80	21	1,5	35,9	26,2	8 500	10 000	**BL6307**	0,395
	80	21	1,5	35,9	26,2	8 500		**BL6307-2Z**	0,395
	80	21	1,5	35,9	26,2	8 500		**BL6307-2ZNR**	0,395
	80	21	1,5	35,9	26,2	8 500	10 000	**BL6307NR**	0,405
40	80	18	1,1	35,3	28,7	8 500	10 000	**BL6208**	0,433
	80	18	1,1	35,3	28,7	8 500		**BL6208-2Z**	0,433
	80	18	1,1	35,3	28,7	8 500		**BL6208-2ZNR**	0,433
	80	18	1,1	35,3	28,7	8 500	10 000	**BL6208NR**	0,443
	90	23	1,5	42,6	32,9	7 500	9 000	**BL6308**	0,644
	90	23	1,5	42,6	32,9	7 500		**BL6308-2Z**	0,644
	90	23	1,5	42,6	32,9	7 500		**BL6308-2ZNR**	0,644
	90	23	1,5	42,6	32,9	7 500	9 000	**BL6308NR**	0,662
45	85	19	1,1	37,2	31,8	8 000	9 500	**BL6209**	0,443
	85	19	1,1	37,2	31,8	8 000		**BL6209-2Z**	0,443
	85	19	1,1	37,2	31,8	8 000		**BL6209-2ZNR**	0,443
	85	19	1,1	37,2	31,8	8 000	9 500	**BL6209NR**	0,463
	100	25	1,5	55,2	43,5	6 700	8 000	**BL6309**	0,904
	100	25	1,5	55,2	43,5	6 700		**BL6309-2Z**	0,904
	100	25	1,5	55,2	43,5	6 700		**BL6309-2ZNR**	0,904
	100	25	1,5	55,2	43,5	6 700	8 000	**BL6309NR**	0,998
50	90	20	1,1	38,9	34,8	7 000	8 500	**BL6210**	0,490
	90	20	1,1	38,9	34,8	7 000		**BL6210-2Z**	0,490
	90	20	1,1	38,9	34,8	7 000		**BL6210-2ZNR**	0,490
	90	20	1,1	38,9	34,8	7 000	8 500	**BL6210NR**	0,510
	110	27	2	64,7	52	6 000	7 000	**BL6310**	1,21
	110	27	2	64,7	52	6 000		**BL6310-2Z**	1,21
	110	27	2	64,7	52	6 000		**BL6310-2ZNR**	1,21
	110	27	2	64,7	52	6 000	7 000	**BL6310NR**	1,21
55	100	21	1,5	48,1	43,8	6 300	7 500	**BL6211**	0,680
	100	21	1,5	48,1	43,8	6 300		**BL6211-2Z**	0,680
	100	21	1,5	48,1	43,8	6 300		**BL6211-2ZNR**	0,680
	100	21	1,5	48,1	43,8	6 300	7 500	**BL6211NR**	0,700
	120	29	2	79,6	65,2	5 300	6 300	**BL6311**	1,54
	120	29	2	79,6	65,2	5 300		**BL6311-2Z**	1,54
	120	29	2	79,6	65,2	5 300		**BL6311-2ZNR**	1,54
	120	29	2	79,6	65,2	5 300	6 300	**BL6311NR**	1,58
60	110	22	1,5	52,4	49,2	6 000	7 000	**BL6212**	0,884
	110	22	1,5	52,4	49,2	6 000		**BL6212-2Z**	0,884
	110	22	1,5	52,4	49,2	6 000		**BL6212-2ZNR**	0,884
	110	22	1,5	52,4	49,2	6 000	7 000	**BL6212NR**	0,904
	130	31	2,1	90,1	71,5	5 000	6 000	**BL6312**	1,92

Single-row deep groove ball bearings with filling slots

Dimensions				Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		–	kg
60	130	31	2,1	90,1	71,5	5 000		BL6312-2Z	1,92
	130	31	2,1	90,1	71,5	5 000		BL6312-2ZNR	1,92
	130	31	2,1	90,1	71,5	5 000	6 000	BL6312NR	1,96
65	120	23	1,5	63,4	60	5 300	6 300	BL6213	1,21
	120	23	1,5	63,4	60	5 300		BL6213-2Z	1,21
	120	23	1,5	63,4	60	5 300		BL6213-2ZNR	1,21
	120	23	1,5	63,4	60	5 300	6 300	BL6213NR	1,25
	140	33	2,1	105	82	4 800	5 600	BL6313	2,41
	140	33	2,1	105	82	4 800		BL6313-2Z	2,41
	140	33	2,1	105	82	4 800		BL6313-2ZNR	2,41
	140	33	2,1	105	82	4 800	5 600	BL6313NR	2,46
70	125	24	1,5	68,4	66,8	5 000	6 000	BL6214	1,23
	125	24	1,5	68,4	66,8	6 000		BL6214-2Z	1,23
	125	24	1,5	68,4	66,8	6 000		BL6214-2ZNR	1,23
	125	24	1,5	68,4	66,8	5 000	6 000	BL6214NR	1,27
	150	35	2,1	119	96,2	4 500	5 300	BL6314	2,89
	150	35	2,1	119	96,2	4 500		BL6314-2Z	2,89
	150	35	2,1	119	96,2	4 500	5 300	BL6314NR	2,94
75	130	25	1,5	71,9	71,7	4 800	5 600	BL6215	1,33
	130	25	1,5	71,9	71,7	4 800		BL6215-2Z	1,33
	130	25	1,5	71,9	71,7	4 800	5 600	BL6215NR	1,38
	160	37	2,1	131	115	4 300	5 000	BL6315	3,50
	160	37	2,1	131	115	4 300		BL6315-2Z	3,50
80	140	26	2	86,9	84,7	4 500	5 300	BL6216	1,63
	140	26	2	86,9	84,7	4 500		BL6216-2Z	1,63
	140	26	2	86,9	84,7	4 500	5 300	BL6216NR	1,70
	170	39	2,1	141	133	3 800	4 500	BL6316	4,15
	170	39	2,1	141	133	3 800		BL6316-2Z	4,15
85	150	28	2	102	95	4 300	5 000	BL6217	2,02
	150	28	2	102	95	4 300		BL6217-2Z	2,02
	150	28	2	102	95	4 300	5 000	BL6217NR	2,06
	180	41	3	145	138	3 600	4 300	BL6317	4,87
	180	41	3	145	138	3 600		BL6317-2Z	4,87
90	160	30	2	118	112	3 800	4 500	BL6218	2,49
	160	30	2	118	112	3 800		BL6218-2Z	2,49
	160	30	2	118	112	3 800	4 500	BL6218NR	2,54
	190	43	3	158	161	3 400	4 000	BL6318	5,62
	190	43	3	158	161	3 400		BL6318-2Z	5,62
100	180	34	2,1	153	140	3 400	4 000	BL6220	3,67
	180	34	2,1	153	140	3 400		BL6220-2Z	3,67
	180	34	2,1	153	140	3 400	4 000	BL6220NR	3,75
	215	47	3	191	214	3 000	3 600	BL6320	7,99
	215	47	3	191	214	3 000		BL6320-2Z	7,99

Non-standard Single-row deep groove ball bearings

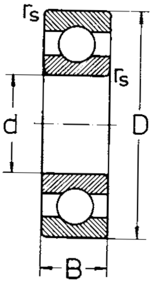


Fig.1

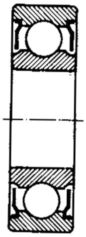


Fig.2

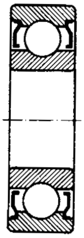


Fig.3

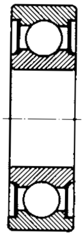


Fig.4

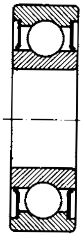


Fig. 5

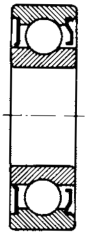


Fig. 6

Dimensions				Fig.	Basic radial load		Speed limit grease	Weight	Designation
d	D	B	r_s min.		dyn. C_r	stat. C_{0r}			
mm				–	kN		min^{-1}	kg	–
6,35	19	6	0,3	3	2,2	0,89	34 000	0,009	**62/6A2ZR**
	22	7	0,3	3	3,2	1,35	30 000	0,013	**63/6A2ZR**
7,93	22	7	0,3	5	3,3	1,35	18 000	0,012	**60/8A2RSR**
9,525	22,225	5,558	0,4	1	3,35	1,4	28 000	0,008	**650/9**
	22,225	7,142	0,4	4	3,35	1,4	17 000	0,012	**651/9-2RS**
	22,225	7,142	0,4	2	3,35	1,4	28 000	0,012	**651/9-2Z**
	23,017	7,937	0,4	3	3,35	1,4	26 000	0,013	**658/9-2ZR**
	28,575	9,525	0,6	1	5,1	2,4	22 000	0,030	**655/9**
	28,575	9,525	0,6	5	5,1	2,4	14 000	0,030	**655/9-2RSR**
	28,575	9,525	0,6	3	5,1	2,4	22 000	0,030	**655/9-2ZR**
	28,575	9,525	0,6	1	5,1	2,4	22 000	0,032	**655/9TN**
11,112	23,017	7,937	0,4	2	2,7	1,3	26 000	0,017	**65100-2ZR**
	28,575	9,525	0,6	1	5,1	2,4	22 000	0,030	**65000**
12	28	12	0,3	5	5,1	2,4	13 000	0,033	**66101-2RSR**
	28	12	0,3	3	5,1	2,4	22 000	0,033	**66101-2ZR**
12,7	28,575	6,35	0,4	1	5,1	2,4	22 000	0,019	**65101**
	28,575	6,35	0,4	5	5,1	2,4	12 000	0,017	**65101-2RSR**
	28,575	7,937	0,4	5	5,1	2,4	12 000	0,021	**65201-2RSR**
	28,575	7,937	0,4	3	5,1	2,4	22 000	0,021	**65201-2ZR**
	28,575	9,525	0,6	1	5,1	2,4	22 000	0,024	**65301**
	28,575	9,525	0,6	5	5,1	2,4	12 000	0,025	**65301-2RSR**
	28,575	9,525	0,6	5	5,1	2,4	13 000	0,023	**65301-2RSU**
	28,575	9,525	0,6	3	5,1	2,4	22 000	0,026	**65301-2Z**
	28,575	9,525	0,7	1	5,1	2,4	22 000	0,029	**65301TN**
	34,925	11,112	0,7	1	6	3,25	18 000	0,053	**65401**
	34,925	11,112	0,7	5	6	3,25	11 000	0,052	**65401-2RSR**
	34,925	11,112	0,7	3	6	3,25	18 000	0,052	**65401-2ZR**
	34,925	11,112	0,7	7	6	3,25	11 000	0,049	**65401-2RSRN**
	34,925	11,112	0,7	9	6	3,25	18 000	0,057	**65401NR**
	34,925	11,112	0,7	1	6	3,25	18 000	0 053	**65401TN**
15	35	9	0,6	3	6	2,4	19 000	0,040	**65202ZR**
	40	11	0,6	2	7,65	3,75	16 000	0,045	**65902-2Z**
	40	11	0,6	2	7,65	3,75	16 000	0,045	**65902Z**
	42	11	0,6	1	7,65	3,75	15 000	0,080	**66402**
15,863	42,16	20	0,6	1	11,2	5,4	15 000	0,132	**65402**
15,875	34,925	7,142	0,8	1	6	3,25	20 000	0,032	**65002**
	34,925	8,732	0,8	5	6	3,25	12 000	0,039	**65702-2RSR**
	34,925	8,732	0,8	3	6	3,25	17 000	0,039	**65702-2ZR**
	34,925	8,732	0,8	6	6	3,25	12 000	0,039	**65702ZRRSR**
	34,925	11	0,6	1	7,65	3,75	19 000	0,041	**65302**

Non-standard Single-row deep groove ball bearings

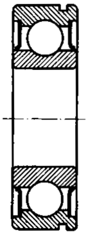


Fig. 7

Dimensions				Fig.	Basic radial load		Speed limit	Weight	Designation
d	D	B	r_s min.		dyn. C_r	stat. C_{0r}	grease		
mm				–	kN		min^{-1}	kg	–
15,875	34,925	11	0,6	4	7,65	3,75	12 000	0,044	65302-2RS
	34,925	11	0,6	5	7,65	3,75	12 000	0,043	65302-2RSR
	34,925	11	0,6	7	7,65	3,75	12 000	0,042	65302-2RSNR
	34,925	11	0,6	7	7,65	3,75	12 000	0,042	65302-2RSRN
	34,925	11,112	0,7	1	6	3,25	17 000	0,049	66702
	35	11	0,6	3	7,65	3,75	12 000	0,042	65802RSR
	39,687	11,112	0,6	5	7,65	3,75	16 000	0,045	66802-2ZR
	40	12	0,6	5	9,55	4,8	10 000	0,067	65602RSR
17	30	10	0,5	1	3,25	2	19 000	0,033	65903
	40	12	0,5	7	9,55	4,8	9 500	0,063	65703-2RSR2N
	40	14	0,6	5	9,6	4,6	11 000	0,079	65303RSR
	40	17,462	0,6	5	9,55	4,8	11 000	0,097	65103-2RSR
	47	15,5	1	5	13,5	6,6	11 000	0,130	65403RSR
18,5	35	10	0,3	6	6	3,25	10 000	0,040	60/18RSRZRF2
19	47	14	1	3	12,7	5,7	14 000	0,156	62/19ZR
	52	15	1	5	14	7,85	7 500	0,142	63/19-2RSR
	52	15	1	3	14	7,85	12 000	0,156	63/19-2ZR
19,05	40	12	0,6	5	9,5	4,15	11 000	0,067	65304-2RSR
	40	12	0,6	3	9,5	4,15	16 000	0,067	65304-2ZR
	41,275	7,937	0,8	1	9,4	5,05	16 000	0,050	65704
	41,275	11,113	0,8	5	9,4	5,05	11 000	0,070	65804-2RSR
	41,275	11,113	0,8	3	9,4	5,05	17 000	0,070	65804-2ZR
	41,275	12,7	0,6	1	9,4	5,05	16 000	0,068	65504
	41,275	12,7	0,6	5	9,4	5,05	9 000	0,075	65504-2RSR
	47,625	14,287	1	3	12,8	6,65	13 000	0,114	66804-2ZR
	50,8	14,287	0,8	1	10,1	5,8	12 000	0,144	66704
19,063	42,225	15,49	1	5	12,7	5,7	11 000	0,108	65404-2RSR 1)
	45,225	15,49	1	1	12,7	5,7	16 000	0,108	65404
	45,225	15,49	1	5	12,8	6,65	11 000	0,108	65404RSR 1)
	45,225	15,49	1	5	12,8	6,65	11 000	0,109	65404-2RSRA 1)
	45,225	15,49	1	4	12,8	6,65	11 000	0,109	65404-2RSA 1)
20	42	9	0,6	1	9,4	5	15 000	0,052	66004
22,217	52	15	1	2	16,2	8,1	12 000	0,142	65904Z
22,225	47,625	9,525	0,8	1	10,1	5,85	15 000	0,070	65104
	47,625	12,7	0,8	5	10,1	5,85	7 500	0,100	65204-2RSR
	47,625	12,7	0,8	3	10,1	5,85	15 000	0,095	65204-2ZR
	50,8	14,287	1,1	5	15,9	7,9	8 000	0,124	66904-2RSR
	50,8	14,287	1,1	3	15,9	7,9	12 000	0,124	66904-2ZR
25	42	9	0,3	1	8,95	5,15	13 000	0,047	61905P6

1) Special seal

Non-standard Single-row deep groove ball bearings

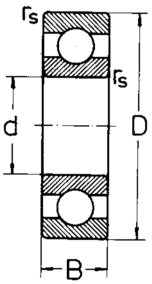


Fig. 1

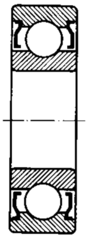


Fig. 2

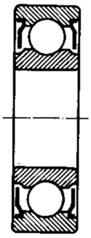


Fig. 3

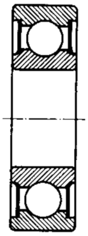


Fig. 4

Fig. 5

Dimensions				Fig.	Basic radial load		Speed limit	Weight	Designation
d	D	B	r_s min.		dyn. C_r	stat. C_{0r}	grease		
mm				–	kN		min^{-1}	kg	–
25	42	9	0,3	1	8,95	5,15	13 000	0,046	61905TNP6
	52	12	1	1	14	7,85	12 000	0,104	65105
	52	12	1	1	14	7,85	12 000	0,112	65105TN
	62	11,303	1	1	20,6	11,3	12 000	0,201	65305
	62	12	0,6	1	20,5	11,1	12 000	0,177	68305
	62	21	1	5	17,9	9,8	8 000	0,300	65405RSR
	62	25,4	1	5	20,6	11,8	8 000	0,344	65505-2RSR
	68	19	1	1	19,5	11,3	9 500	0,214	66305
25,4	50,8	12,7	0,8	5	10,1	5,85	9 500	0,120	66705-2RSR
	50,8	12,7	0,8	3	10,1	5,85	12 000	0,126	66705-2ZR
	50,8	14,287	0,8	9	10,1	5,85	12 000	0,126	66605NR
	50,8	14,287	0,8	1	10,1	5,85	12 000	0,130	66605
	50,8	14,287	0,8	4	10,1	5,85	7 000	0,130	66605RS
	50,8	14,287	0,8	4	10,1	5,85	7 000	0,142	66605-2RS
	50,8	14,287	0,8	5	10,1	5,85	7 000	0,122	66605-2RSR
	50,8	14,287	0,8	2	10,1	5,85	9 500	0,142	66605-2Z
	50,8	14,287	0,8	3	10,1	5,85	9 500	0,142	66605-2ZR
	50,8	14,287	0,8	7	10,1	5,85	7 000	0,138	66605-2RSN
	50,8	14,287	0,8	7	10,1	5,85	7 000	0,142	66605-2RSRN
	50,8	14,287	0,8	1	10,1	5,85	12 000	0,142	66605TN
	62	16	1	3	19,5	11,3	10 000	0,188	65605ZRC4
28,575	52	15	1	5	10,7	6,65	6 700	0,135	62/28A2RSR
28,58	71,425	20,638	2,3	1	26,6	15	9 000	0,385	65006
30	62	23,813	1	5	19,5	11,3	5 500	0,300	63206-2RSR
	72	17	1	1	28,1	14,6	9 000	0,368	65806
32	72	17	1	1	25,7	15,3	9 000	0,327	6207/32
38	80	18	1,5	2	32,6	19,8	8 500	0,392	6208Z/38
40	52	8	0,3	10	4,5	4	10 000	0,040	65508-2ZNR
	85	19	1	1	33,8	18,2	8 500	0,449	65008
	90	20	1,5	9	40,7	24	8 500	0,659	65108NR
45	100	21	1,5	8	52,8	31,7	6 000	0,714	65109N
110	175	31	2	2	93,5	78,2	3 400	2,42	65022Z
133,35	184,15	25,4	2,3	11	49	52,6	2 800	2,05	65027SK
165,1	184,15	12,7	0,6	1	20	40	700	0,371	65033V
	184,1	12,7	0,6×45°	5	12,2	19	700	0,396	65033-2RSR
	279,4	39,687	4	4	170	170	700	9,08	66033MBP6F2
172,3	228,5	35	0,3	2	66,7	79	2 200	3,36	65034-2Z

Non-standard Single-row deep groove ball bearings

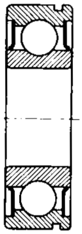


Fig. 7

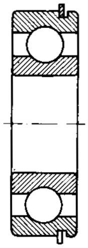


Fig. 8

Fig. 9

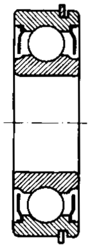


Fig. 10

Fig. 11

Dimensions				Fig.	Basic radial load		Speed limit	Weight	Designation
d	D	B	r_s min.		dyn. C_r	stat. C_{0r}	grease		
mm				–	kN		min^{-1}	kg	–
180	259,6	33	2	1	140	147	2 000	5,78	**65036MC3**
190	269,5	33	2	1	151	156	2 000	5,75	**65038MC3**
200	289,5	38	2,1	1	163	179	1 900	8,70	**65040MBC3**
230	329,5	40	2,1	1	185	218	1 900	12,0	**65046MC3**
260	369,5	46	2,1	1	229	289	1 500	16,5	**65052MAC3**
280	389,5	46	2,1	1	216	285	1 300	19,0	**65056MAC3**
390	475	40	2,1	1	200	290	750	11,5	**65078TNP6**
440	525	40	2,1	1	209	320	630	14,0	**65088TNP6**
490	575	40	3	1	217	350	560	15,5	**65098TNP6**
540	625	40	3	1	225	379	500	17,5	**650/540TNP6**
590	675	40	3	1	233	409	480	18,5	**650/590TNP6**
760	1080	150	7,5	1	1 028	2 426	480	406	**650/760MBC3**

Non-standard Single-row deep groove ball bearings

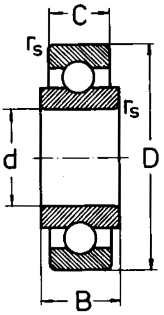


Fig. 12

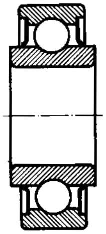


Fig. 13

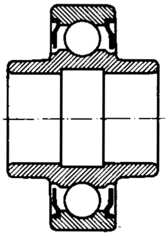


Fig. 14

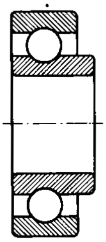


Fig. 15

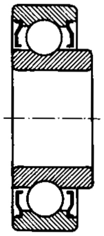


Fig. 16

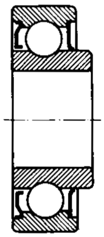


Fig. 17

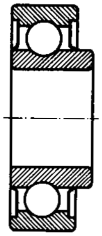


Fig. 18

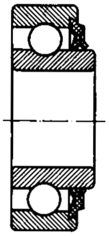


Fig. 19

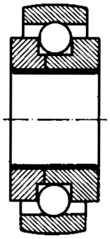


Fig. 20

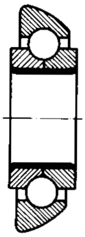


Fig. 21

Dimensions					Fig.	Basic radial load		Speed limit grease	Weight	Designation
d	D	B	C	r_s min.		dyn. C_r	stat. C_{0r}			
mm					–	kN		min^{-1}	kg	–
6	20	9,4	8,2		20				0,020	**658/6B**
6,35	34,925	8,25	6,35		21				0,035	**659/6B**
	37,338	13,46	9,5		22				0,067	**660/6B**
8	20,5	12	6,3	0,3	23				0,012	**655/8B**
	22	12	7	0,3	23				0,015	**651/8B**
11	32	15,4	10	0,6	13	6,8	3,1	8 000	0,045	**65001B2RSR**
12,75	40	33,324	11,999	0,6	14	9,55	4,8	8 000	0,102	**65501B2Z**
15	35	14,4	11	0,6	13	7,65	3,75	8 000	0,049	**65102B2RSR**
16,256	39,98	18,288	11,989	0,6	13	9,55	4,8	7 500	0,096	**65003B2RSR**
	39,98	18,288	11,989	0,6	13	9,55	4,8	7 500	0,085	**65003B2RSRTN**
17	40	16,6	11,988	0,6	13	9,55	4,8	7 500	0,080	**65603B2RSR**
20	47	15	12	0,6	16	10,1	5,8	6 300	0,108	**66404BZR**
	47	18	14	1	16	12,7	5,75	6 300	0,125	**6204B2ZR**
	47	18	14	1	16	12,7	5,75	6 300	0,125	**6204BZR**
25	52	15,875	15	1	17	14	7,85	5 000	0,143	**66405BZRRSR**
	47	15	12	0,6	16	10	5,1	6 000	0,089	**6005BZR**
	62	21	17	1	17	20,6	11,3	5 000	0,268	**65205BZRRSR**
	62	21	17	1	19	20,6	11,3	5 000	0,268	**65405BRSR**
25,438	50,8	18,034	15	1,1	13	14	7,85	5 600	0,140	**66505B2ZANR**
28,588	55	25,5	12,98	0,6	18	13,2	8,25	5 300	0,127	**65106B2RSRTN**
30	55	19	13	1	18	12,7	6,95	5 000	0,146	**6006B2RSR**
	55	19	13	1	17	12,7	6,95	5 000	0,146	**6006BZRRSR**
	62	24	16	1	13	15,2	10,3	5 000	0,234	**65606B2RSR**
	67	17,5	15,5	1	13	19,5	11,3	5 000	0,270	**66306B**
	75	30	23	1,5	13	29,9	15,8	4000	0,527	**66606B2RSZ**
	80	37	18	1,1	13	29,1	17,9	4000	0,662	**66506B2RSR**
	80	37	30	1,1	26	29,1	17,9	4000	0,795	**66506B2ZRA**
32,893	57,15	15,113	9,525	0,6	15	11,2	7,45	6000	0,110	**65207B**

Non-standard Single-row deep groove ball bearings

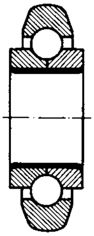


Fig. 22

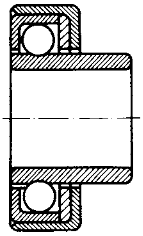


Fig. 23

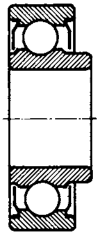


Fig. 24

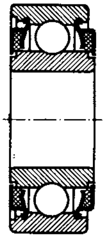


Fig. 25

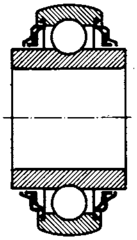


Fig. 26

Dimensions					Fig.	Basic radial load		Speed limit	Weight	Designation
d	D	B	C	r_s min.		dyn. C_r	stat. C_{0r}	grease	•	
mm					–	kN		min^{-1}	kg	–
35	62	22	14	1	18	15,9	8,5	4 500	0,195	**6007B2RSRA**
	72	25	17	1,1	19	25,5	13,7	4 000	0,307	**6207BRSA**
	72	25	17	1	13	28,9	17,1	4 000	0,340	**65107B2RSR**
	72	25	17	2	13	22,9	17,1	4 000	0,361	**65107B2RSRTN**
	72	33,376	19	2	26	25,7	15,3	4 000	0,415	**65007B2ZA**
37	62	21,7	14	1	17	19,5	11,4	4 000	0,232	**65807BRSRZRT**
40	80	27	24	1,1	25	32,6	19,8	3 600	0,488	**65208B2RSA**
	80	27	21	1,1	14	32,6	19,8	3 600	0,448	**65608B2Z**
41,29	73,46	19,62	16	2	15	22,5	13,8	4 000	0,299	**65308BC3**
45	85	27	21	1,1	12	32,7	20,2	4 000	0,482	**65409B**
	85	27	21	1,1	13	32,7	20,2	4 000	0,482	**65409B2RSR**
	100	31,5	25	1,5	15	52,8	31,7	4 000	0,903	**65009B**
55	100	55,6	25	1,5	26	43,4	29,2	3 600	0,104	**65111B2ZA**
60	110	29,5	22	1,5	15	52,5	36	3 600	0,875	**65012B**
95,27	128,62	19,3	16	2	15	31,3	29,8	3 000	0,622	**65019B**
111,125	147,638	31,75	28,575	1	16	39,1	40,5	1 700	1,21	**65922B2ZR**
172,3	228,6	65	35	0,3	24	66,7	79	1 100	4,36	**65034B2Z**

Non-standard Single-row deep groove ball bearings

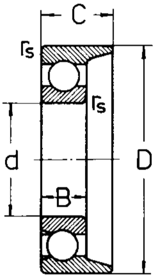


Fig. 27

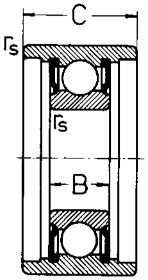


Fig. 28

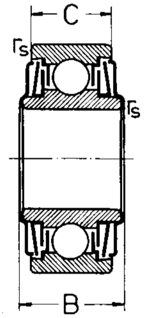


Fig. 29

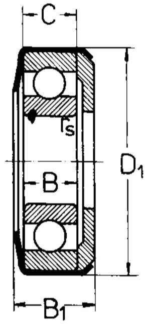


Fig. 30

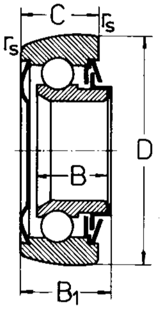


Fig. 31

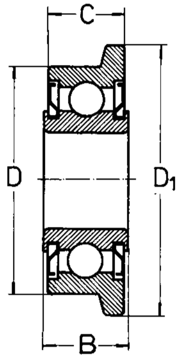


Fig. 32

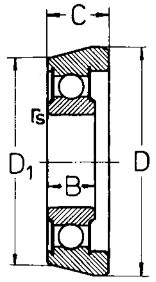


Fig. 33

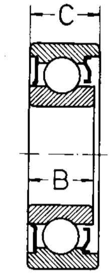
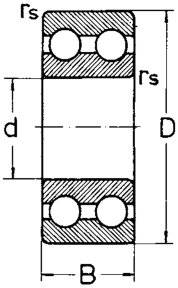


Fig. 34

Dimensions							Fig.	Basic radial load		Speed limit grease	Weight	Designation
d	D	D_1	B	C	B_1	r_s min.		dyn. C_r	stat. C_{0r}			
mm							–	kN		min^{-1}	kg	–
7	22		9,8	10,3		0,3	34	3,3	1,35	18 000	0,080	**650/7AZRRSR**
8	24		9,8	10,3		0,3	34	3,35	1,4	17 000	0,090	**650/8AZRRSR**
9	47	50	14	14		1	32	13,4	6,55	15 000	0,128	**657/9RZR**
12,7	26,67	29	7,93	7,93		1	32	4,5	3,5	12 000	0,020	**66001R2RS**
17	40		13,66	14,3		0,6	34	9,55	4,8	10 000	0,079	**65203AZRRSR**
20	60		21	24	26	1,1	31	15,9	7,9	10 000	0,308	**65004AZC3S1**
	60		31,6	24		1	29	15,9	7,9	10 000	0,451	**67004B2ZAC3S1**
25	80	100	36	35		0,7	32	37,2	18,8	7 500	1,15	**65005R2Z**
25,4	82,6		29,4	25,4		1	31	25,7	15,4	7 500	0,610	**66205Z**
30	57		13	24		1	28	13,2	8,25	6 000	0,150	**65306A2RSTN**
	80		15	30	30		31	44	27,4	3 500	0,541	**65506VC5S4**
	80		28	30	33,5		31	29,9	15,8	7 000	0,635	**65506ZC3**
	80		37	30		1	29	29,9	15,8	7 000	0,635	**65206-2ZRAS1**
40	68	70	9	9	18	0,3	30	13,3	9,8	9 500	0,795	**658Z08**
50	80	82	10	10	20	0,6	30	16,3	13,1	6 000	0,346	**654Z10**
	89	80	16	22		1	33	21,8	16,5	4 000	0,400	**65210A2RS**
50,8	95,25		15,875	25,4		1	27	21,8	16,5	5 000	0,734	**65310A**
55	90	92	18	18	25,6	1	30	28,3	21,2	6 000	0,624	**650Z11C3**
63,5	100	102	15,6	15,6	22,1	1	30	30,5	25,2	4 500	0,605	**650Z13P63**

Double-row deep groove ball bearings

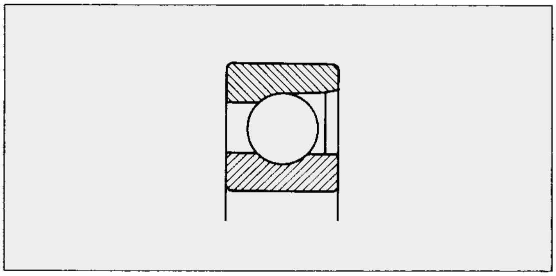


Dimensions				Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		–	kg
10	30	14	0,6	7,7	5,9	18 000	24 000	**4200**	0,057
12	32	14	0,6	7,75	6,15	16 000	20 000	**4201**	0,062
15	35	14	0,6	9,75	9	14 000	18 000	**4202**	0,071
	42	17	1	13,1	11,7	13 000	17 000	**4302**	0,123
17	40	16	0,6	11,7	10,4	13 000	17 000	**4203**	0,106
	47	19	1	16,5	15	11 000	15 000	**4303**	0,171
20	47	18	1	16,4	16	10 000	14 000	**4204**	0,165
	52	21	1,1	19,5	17	9 500	13 000	**4304**	0,227
25	52	18	1	16,3	16,9	9 000	12 000	**4205**	0,189
	62	24	1,1	26,3	25,7	8 000	10 000	**4305**	0,365
30	62	20	1	22	24,7	7 500	9 500	**4206**	0,298
	72	27	1,1	35,5	35,9	6 700	8 500	**4306**	0,542
35	72	23	1,1	26,4	30,7	6 700	8 500	**4207**	0,460
	80	31	1,5	40,6	41,8	6 300	8 000	**4307**	0,752
40	80	23	1,1	33,7	42,4	6 000	7 500	**4208**	0,558
	90	33	1,5	46	48,8	5 600	7 000	**4308**	1,01
45	85	23	1,1	31,9	43,9	5 600	7 000	**4209**	0,605
	100	36	1,5	57,6	62,4	4 800	6 000	**4309**	1,35
50	90	23	1,1	31,4	44,6	5 000	6 300	**4210**	0,651
	110	40	2	70,4	77,7	4 300	5 300	**4310**	1,80
55	100	25	1,5	37,2	54,1	4 500	5 600	**4211**	0,882
	120	43	2	84,2	94,4	4 000	5 000	**4311**	2,29
60	110	28	1,5	47,9	67,6	4 000	5 000	**4212**	1,20
	130	46	2,1	99,2	113	3 600	4 500	**4312**	2,87
65	120	31	1,5	54,7	78,5	3 800	4 800	**4213**	1,59
	140	48	2,1	107	124	3 400	4 300	**4313**	3,46
70	125	31	1,5	62,1	89,8	3 600	4 500	**4214**	1,68
	150	51	2,1	115	136	3 000	3 800	**4314**	4,21
75	130	31	1,5	61,6	90,7	3 400	4 300	**4215**	1,77
	160	55	2,1	132	158	2 800	3 600	**4315**	5,15

Magneto ball bearings

The inner ring of dismountable single row deep groove ball bearings (magneto-type) is similar to that of normal bearings and the outer ring has one rib which makes bearing to be dismountable. The raceway on the outer ring has a cylindrical surface.

The inner and outer ring are mounted separately in the operating assembly.



Cages for these bearings are pressed sheet cages or glass fibre reinforced polyamide 6.6 cages.

Dismountable deep groove ball bearings, single row, are generally manufactured to the normal tolerance class and the tolerance of the outside diameter for the whole bearing range is 0/+ 0,010 mm. Radial clearance is also normal.

If two bearings of this type are to be mounted on a shaft, a small axial clearance should compensate for possible shaft length variations.

Equivalent dynamic load

Equivalent dynamic load can be calculated using the equations:

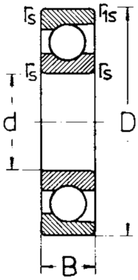
$P_r = F_r$, kN, when $F_a / F_r \leq 0{,}2$,
$P_r = 0{,}5\ F_r + 2{,}5\ F_a$, kN, when $F_a / F_r > 0{,}2$.

Equivalent static load

$P_{0r} = F_r$, kN, when $F_a / F_r \leq 0{,}8$,
$P_{0r} = 0{,}6\ F_r + 0{,}5\ F_a$, kN, when $F_a / F_r > 0{,}8$.

Abutment dimensions of these bearings correspond to those of deep groove ball bearings, single row, of series 62, page 121.

Magneto ball bearings



Dimensions					Basic radial load		Speed limit		Designation	Weight
d	D 1)	B	r_s min.	r_{1s} min	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		–	kg
3	16	5	0,15	0,10	1,55	0,26	34 000	40 000	**E3**	0,005
4	16	5	0,15	0,10	1,55	0,26	34 000	40 000	**E4**	0,005
5	16	5	0,15	0,10	1,55	0,26	34 000	40 000	**E5**	0,005
6	21	7	0,30	0,15	2,80	0,45	30 000	36 000	**E6**	0,011
7	22	7	0,30	0,15	3,10	0,55	28 000	34 000	**E7**	0,012
8	24	7	0,30	0,15	3,20	0,60	28 000	34 000	**E8**	0,014
9	28	8	0,30	0,15	4,25	0,83	26 000	32 000	**E9**	0,022
10	28	8	0,30	0,15	4,25	0,83	26 000	32 000	**E10**	0,021
11	32	7	0,30	0,15	3,50	0,80	22 000	28 000	**E11**	0,027
12	32	7	0,30	0,15	3,50	0,80	22 000	28 000	**E12**	0,027
13	30	7	0,30	0,15	3,50	0,80	22 000	26 000	**E13**	0,021
14	35	8	0,30	0,15	4,50	1,10	19 000	24 000	**E14**	0,034
15	35	8	0,30	0,15	4,50	1,10	19 000	24 000	**E15**	0,033
	40	10	0,60	0,30	7,35	1,70	18 000	22 000	**BO15**	0,055
17	40	10	0,60	0,30	5,70	1,45	17 000	20 000	**L17**	0,053
	44	11	0,60	0,30	8,80	2,10	15 000	18 000	**BO17**	0,073
19	40	9	0,60	0,15	3,45	1,00	17 000	20 000	**E19**	0,048
20	47	12	1,00	0,60	8,80	2,24	14 000	17 000	**E20**	0,087
	47	14	1,00	0,60	8,80	2,24	14 000	17 000	**L20**	0,100
	52	15	1,00	0,60	12,20	3,00	13 000	16 000	**M20**	0,138
25	52	15	1,00	0,60	8,65	2,40	12 000	15 000	**L25**	0,122
	62	17	1,10	0,60	16,00	4,00	11 000	14 000	**M25**	0,217

1) Deviation of D diameter Δ_{Dmp} is 0/+10 μm for all bearings.

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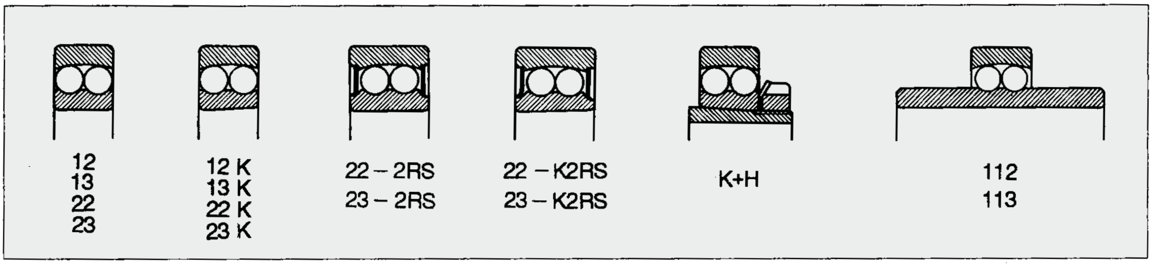
Self-aligning ball bearings

Self-aligning ball bearings have a common sphered raceway in the outer ring. This feature allows angular misalignment of the shaft relative to the housing. Therefore self-aligning ball bearings are particularly used in case of bearings where misalignment can occur from errors in mounting or from shaft bending.

Double row self-aligning ball bearings are manufactured both with cylindrical bore and tapered bore (taper 1:12). Self-aligning bearings with tapered bore can be delivered, at request, with adapter sleeves.



Suffixes

C2 - radial clearance smaller than normal
C3 - radial clearance larger than normal
H - adapter sleeve
K - tapered bore bearings
M - machined brass cage, ball guided
MB - machined brass cage, guided on the inner ring
P6 - tolerance class more accurate than normal
P63 - tolerance class P6 with radial clearance C3
2RS - bearing with two seals
TN - polyamide cage

Sealed self-aligning ball bearings

Self-aligning ball bearings are also available in a sealed version with seals at both sides. The seals are made of gasoline, oil and wear-resistant synthetic rubber. Sealed bearings are delivered filled with a certain grease quantity. Sealed bearing operating temperatures are between -30°C and +80°C. Grease service life is much reduced if bearing operates at a temperature higher than +80°C (see Chapter 8).

Sealed bearings are greased for the entire operating period, relubrication not being necessary. Sealed bearings washing or heating before mounting in assembly is not allowed.

Self-aligning ball bearings with extended inner ring

Self-aligning ball bearings with extended inner ring of series 112 and 113 are used in applications where high accuracy is not necessary and generally, they can be mounted directly on rolled shafts. The bore manufactured to tolerance class J7 allows fast mounting and dismounting. The inner ring has a groove for bearing axial location which can be done by means of a screw or pin.

Dimensions

Overall dimensions of self-aligning ball bearings are in accordance with ISO 15

Dimensions of adapter sleeves are in accordance with ISO 113/1

Tolerances and radial clearance

Bearings of serial production are manufactured to normal tolerance class and with normal radial clearance. Tapered bore bearings of serial production are also manufactured with radial clearance C3.

Self-aligning ball bearings with extended inner ring are manufactured with radial clearance C2 and normal clearance.

At request, these bearings can also be manufactured to other tolerance classes and with smaller or larger radial clearance.

The bore of self-aligning ball bearings with extended inner ring is manufactured to tolerance class J7.

Bearing tolerances are given on page 37 and the values of radial clearance are given in tables 2 and 3.

Misalignment

Self-aligning ball bearings allow within certain limits an angular misalignment of the outer ring in relation to the inner ring, without detrimental effects in bearing unit.

Approximate values for permissible misalignment, under normal operating conditions are given in table 1.

Permissible misalignment

Table 1

Bearing series	**Permissible misalignment**
	degrees
108,126,127,129,135	3
12,112	2,5
13,113	3
22	2,5
22-2 RS	1,5
23	3
23-2 RS	1,5

Radial clearance of self-aligning ball bearings
With cylindrical bore

Table 2

Bore diameter d		**Designation of clearance group**									
		C2		**Normal**		**C3**		**C4**		**C5**	
		Bearing radial clearance									
over	up to	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
mm		µm									
2,5	**6**	1	8	5	15	10	20	15	25	21	33
6	**10**	2	9	6	17	12	25	19	33	27	42
10	**14**	2	10	6	19	13	26	21	35	30	48
14	**18**	3	12	8	21	15	28	23	37	32	50
18	**24**	4	14	10	23	17	30	25	39	34	52
24	**30**	5	16	11	24	19	35	29	46	40	58
30	**40**	6	18	13	29	23	40	34	53	46	66
40	**50**	6	19	14	31	25	44	37	57	50	71
50	**65**	7	21	16	36	30	50	45	69	62	88
65	**80**	8	24	18	40	35	60	54	83	76	108
80	**100**	9	27	22	48	42	70	64	96	89	124
100	**120**	10	31	25	56	50	83	75	114	105	145
120	**140**	10	38	30	68	60	100	90	135	125	175
140	**160**	15	44	35	80	70	120	110	161	150	210

With tapered bore

Table 3

Bore diameter d		**Designation of clearance group**									
		C2		**Normal**		**C3**		**C4**		**C5**	
		Bearing radial clearance									
over	up to	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
mm	µm										
18	**24**	7	17	13	26	20	33	28	42	37	55
24	**30**	9	20	15	28	23	39	33	50	44	62
30	**40**	12	24	19	35	29	46	40	59	52	72
40	**50**	14	27	22	39	33	52	45	65	58	79
50	**65**	18	32	27	47	41	61	56	80	73	99
65	**80**	23	39	35	57	50	75	69	98	91	123
80	**100**	29	47	42	68	62	90	84	116	109	144
100	**120**	35	56	50	81	75	108	100	139	130	170
120	**140**	40	68	60	98	90	130	120	165	155	205
140	**160**	45	74	65	110	100	150	140	191	180	240

Equivalent dynamic radial load

$P_r = F_r + Y_1 F_a$, kN, when $F_a/F_r \le e$,
$P_r = 0{,}65 F_r + Y_2 F_a$, kN when $F_a/F_r > e$

The values of factors e, Y_1 and Y_2 which depend on bearings are given in bearing tables.

Equivalent static radial load

$P_{0r} = F_r + Y_0 F_a$, kN

The values of the factor Y_0 which depends on bearing are given in bearing tables.

Axial load on bearings with adapter sleeves

If self-aligning ball bearings are mounted with adapter sleeves on smooth shafts, without side location, their axial carrying capacity depends on the friction between the sleeve bore and shaft.

Permissible axial load can be precisely enough determined using the equation:

$F_{a\,max} = 3\,B\,d$,
where:
$F_{a\,max}$ - maximum permissible axial load, N
B - bearing width, mm
d - bearing bore diameter, mm

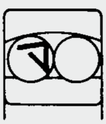
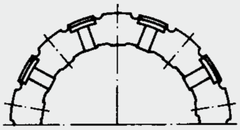
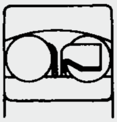
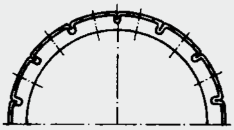
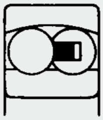
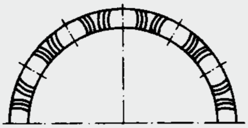
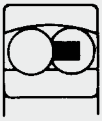
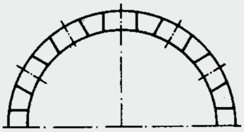
Cages

Self-aligning ball bearings are generally fitted with pressed cages of sheet. At special request, when bearings operate under fluctuating loads, at high speeds and where large sizes are required, machined brass cages are recommended to be used. Glass fibre reinforced polyamide 6.6 cages are also suitable if the operating temperatures do not exceed +120°C. They have low weight, a low coefficient of friction and are noiseless while running.

Cage design and technical data are given in table 4.

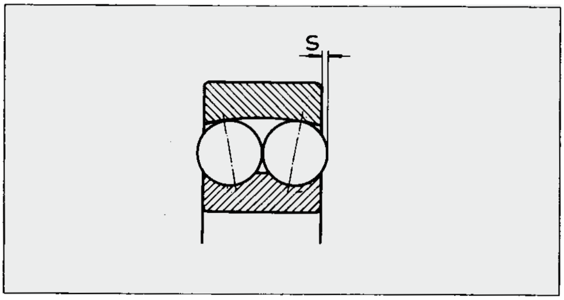
Cage design and technical data

Table 4

Cage	**Design**		**Application**	**Max. value** $D_m n$	
	bearing	cage		oil	grease
Pressed sheet cage		 	- General application - Moderate speeds - Sealed bearings series 12, 13, 22, 23	600×10³	450×10³
Pressed sheet cage		 	- General application - Moderate speeds - Bearings series 22, 23	600×10³	450×10³
Polyamide cage TN		 	- High speeds - Bearings series 12, 13, 22, 23	1000×10³	800×10³
Machined brass cage M		 	- High speeds - Bearings: 1220-1222, 1317-1322, 2217-2222, 2317-2320.	900×10³	700×10³

Special characteristics

In case of some dimensions of self-aligning ball bearings series 12 and 13, the balls protrude somewhat from the bearing, as shown in the adjacent design and table. This should be considered both by designer and user.



Values of dimension S

Table 5

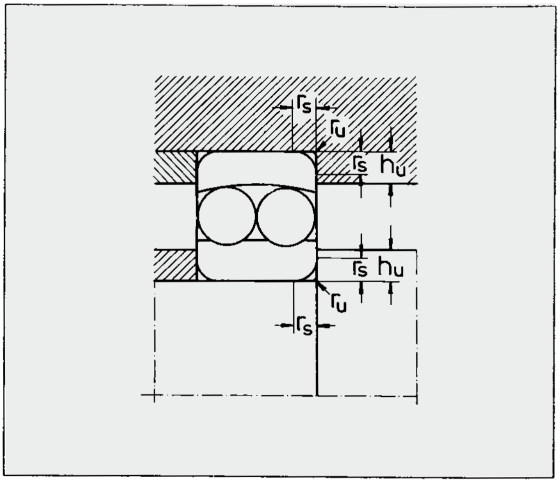
Bearing	S
	mm
1224	1,3
1226	0,7
1318	1,0
1319	1,5
1320	2,5
1321	2,6
1322	2,6

Abutment dimensions

For a proper location of bearing rings on the shaft shoulder and housing shoulder respectively, maximum connection radius $r_{u\,max.}$ of shaft (housing) should be less than minimum mounting chamfer $r_{s\,min}$ of bearing.

Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

In case of self-aligning ball bearings with tapered bore which are mounted directly on a tapered shaft or with an adapter sleeve, proper tightening and minimum radial clearance of 10 - 20 μm should be assured for normal clearance and of 20 - 55 μm for clearance C3 , depending on bearing size and series . The values of the connection radius and support shoulder height are given in table 6 and mounting dimensions for bearings mounted with adapter sleeves are given in table 7.

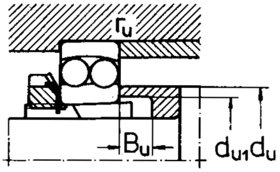


Abutment dimensions

Table 6

r_s min.	**r_u max.**	**h_{umin} min.** Bearing series 12, 13, 112, 22, 23, 113
mm		
0,3	0,2	1,2
0,6	0,6	2,1
1	1	2,8
1,1	1	3,5
1,5	1,5	4,5
2	2	5,5
2,1	2,1	6
2,5	2,5	7
3	2,5	7

Self-aligning ball bearings with adapter sleeves



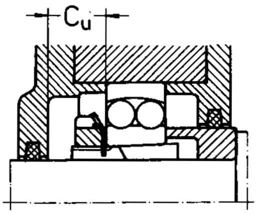
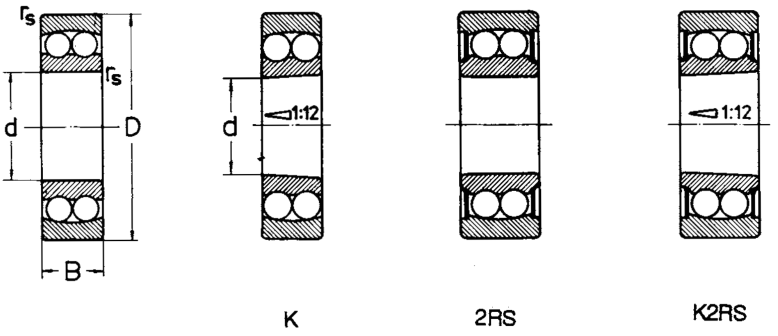


Table 7

Bore symbol	Shaft diameter	Bearing series												
		12K			22K			13K			23K			All series
		d_{u1} min.	d_u max.	B_u min.	d_{u1} min.	d_u max.	B_u min.	d_{u1} min.	d_u max.	B_u min.	d_{u1} min.	d_u max.	B_u min.	C_u min
	mm													
04	**17**	23	27	5	23	27	5	23	30	8	24	28	5	
05	**20**	28	32	6	28	32	5	28	35	6	30	34	5	15
06	**25**	33	38	6	33	38	5	33	42	6	35	40	5	15
07	**30**	38	45	5	39	44	5	39	49	7	40	45	5	17
08	**35**	43	52	5	44	50	5	44	55	5	45	51	5	17
09	**40**	48	57	5	50	56	7	50	61	5	50	57	5	17
10	**45**	53	62	5	55	61	9	50	61	5	56	63	5	19
11	**50**	60	69	6	60	68	10	60	74	6	61	69	6	19
12	**55**	64	75	6	65	73	9	65	83	6	66	74	6	20
13	**60**	70	83	6	70	79	8	70	89	6	72	82	6	21
14	**60**	75	86	6	75	85	11	75	94	6	77	88	6	21
15	**65**	80	92	6	80	90	12	80	100	6	82	94	6	23
16	**70**	85	99	6	85	96	12	85	107	6	88	100	6	25
17	**75**	90	105	7	91	102	12	91	114	7	94	106	7	27
18	**80**	95	110	7	96	108	10	96	120	7	100	112	7	28
19	**85**	100	117	7	102	114	9	102	126	7	105	117	7	29
20	**90**	106	124	7	108	120	8	108	132	7	110	125	7	30

Self-aligning ball bearings

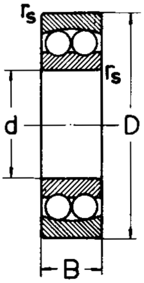


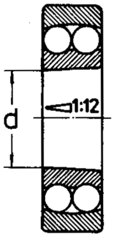
Dimensions				Basic radial load.Factors						Speed limit		Designation	Weight
d	D	B	r_s min.	dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil		
mm				kN	–			kN	–	min^{-1}		–	kg
5	19	6	0,3	2,55	0,33	1,9	3	0,48	2	30 000	36 000	**135**	0,010
6	19	6	0,3	2,5	0,33	1,9	3	0,48	2	30 000	36 000	**126**	0,010
7	22	7	0,3	2,65	0,33	1,9	3	0,56	2	30 000	36 000	**127**	0,010
8	22	7	0,3	2,65	0,33	1,9	3	0,56	2	30 000	36 000	**108**	0,010
9	26	8	0,6	3,8	0,33	1,9	3	0,8	2	26 000	32 000	**129**	0,020
10	30	9	0,6	5,5	0,33	1,9	3	1,2	2	24 000	30 000	**1200**	0,030
	30	14	0,6	7,2	0,54	1,2	1,8	1,6	1,2	22 000	28 000	**2200**	0,040
	35	11	0,6	7,2	0,34	1,9	2,9	1,6	1,9	20 000	26 000	**1300**	0,620
12	32	10	0,6	5,6	0,37	1,7	2,6	1,25	1,8	22 000	28 000	**1201**	0,040
	32	14	0,6	7,6	0,53	1,2	1,8	1,75	1,2	20 000	26 000	**2201**	0,050
	37	12	1	9,4	0,35	1,8	2,8	2,15	1,9	18 000	22 000	**1301**	0,060
	37	17	1	9,4	0,54	1,2	1,8	2,3	1,2	17 000	20 000	**2301**	0,090
15	35	11	0,6	7,5	0,36	1,8	2,7	1,75	1,9	19 000	24 000	**1202**	0,040
	35	14	0,6	7,7	0,5	1,3	2	1,85	1,3	18 000	22 000	**2202**	0,060
	42	13	1	9,55	0,35	1,8	2,8	2,3	1,9	17 000	20 000	**1302**	0,090
	42	17	1	12,1	0,5	1,3	2	2,9	1,3	15 000	18 000	**2302**	0,110
17	40	12	0,6	7,9	0,32	1,9	3	2,05	2	18 000	22 000	**1203**	0,070
	40	16	0,6	9,8	0,5	1,3	2	2,4	1,3	17 000	20 000	**2203**	0,080
	47	14	1	12,5	0,34	1,8	2,9	3,15	2	14 000	17 000	**1303**	0,130
	47	19	1	14,5	0,49	1,3	2	3,6	1,3	13 000	16 000	**2303**	0,160
20	47	14	1	9,9	0,28	2,2	3,5	2,65	2,4	15 000	18 000	**1204**	0,120
	47	14	1	9,9	0,28	2,2	3,5	2,65	2,4	15 000	18 000	**1204K**	0,120
	47	18	1	12,6	0,28	2,2	3,5	3,3	2,4	14 000	17 000	**2204**	0,140
	47	18	1	12,6	0,28	2,2	3,5	3,3	2,4	14 000	17 000	**2204K**	0,140
	52	15	1,1	12,4	0,3	2,1	3,3	3,35	2,2	12 000	15 000	**1304**	0,160
	52	15	1,1	12,4	0,3	2,1	3,3	3,35	2,2	12 000	15 000	**1304K**	0,160
	52	21	1,1	18,2	0,52	1,2	1,9	4,7	1,3	11 000	14 000	**2304**	0,210
	52	21	1,1	18,2	0,52	1,2	1,9	4,7	1,3	11 000	14 000	**2304K**	0,210
25	52	15	1	12,2	0,29	2,2	3,4	3,3	2,3	13 000	16 000	**1205**	0,140
	52	15	1	12,2	0,29	2,2	3,4	3,3	2,3	13 000	16 000	**1205K**	0,140
	52	15	1	12,2	0,29	2,2	3,4	3,3	2,3	13 000	16 000	**1205M**	0,140
	52	18	1	12,5	0,43	1,5	2,3	3,45	1,6	11 000	14 000	**2205**	0,160
	52	18	1	12,5	0,43	1,5	2,3	3,45	1,6	11 000	14 000	**2205K**	0,160
	52	18	1	12,2	0,29	2,2	3,4	3,3	2,3	7 000		**2205–2RS**	0,160
	52	18	1	12,2	0,29	2,2	3,4	3,3	2,3	7 000		**2205K2RS**	0,160
	62	17	1,1	17,8	0,28	2,2	3,5	4,9	2,4	9 500	12 000	**1305**	0,260
	62	17	1,1	17,8	0,28	2,2	3,5	4,9	2,4	9 500	12 000	**1305K**	0,260
	62	24	1,1	24,5	0,44	1,4	2,2	6,55	1,5	9 500	12 000	**2305**	0,340
	62	24	1,1	24,5	0,44	1,4	2,2	6,55	1,5	9 500	12 000	**2305K**	0,340

Self-aligning ball bearings

Dimensions				Basic radial load.Factors						Speed limit		Designation	Weight
				dyn.				stat.					
d	D	B	r_s min.	C_r	e	Y_1	Y_2	C_{0r}	Y_0	grease	oil		
mm				kN	–			kN	–	$\min^{-1}$		–	kg
25	62	24	1,1	17,8	0,28	2,2	3,5	4,9	2,4	6 300		**2305-2RS**	0,330
30	62	16	1	15,7	0,25	2,5	3,9	4,7	2,7	10 000	13 000	**1206**	0,220
	62	16	1	15,7	0,25	2,5	3,9	4,7	2,7	10 000	13 000	**1206K**	0,220
	62	20	1	15,3	0,4	1,6	2,5	4,6	1,7	9 500	12 000	**2206**	0,260
	62	20	1	15,3	0,4	1,6	2,5	4,6	1,7	9 500	12 000	**2206K**	0,260
	62	20	1	15,3	0,4	1,6	2,5	4,6	1,7	9 500	12 000	**2206M**	0,260
	62	20	1	15,7	0,25	2,5	3,9	4,7	2,7	5 300		**2206–2RS**	0,260
	62	20	1	15,7	0,25	2,5	3,9	4,7	2,7	5 300		**2206K2RS**	0,260
	72	19	1,1	21,4	0,24	2,6	4,1	6,35	2,8	9 000	11 000	**1306**	0,380
	72	19	1,1	21,4	0,24	2,6	4,1	6,35	2,8	9 000	11 000	**1306K**	0,380
	72	27	1,1	31,4	0,4	1,6	2,5	8,7	1,7	8 500	10 000	**2306**	0,500
	72	27	1,1	31,4	0,4	1,6	2,5	8,7	1,7	8 500	10 000	**2306K**	0,500
	72	27	1,1	21,4	0,24	2,6	4,1	6,35	2,8	5 600		**2306–2RS**	0,500
35	72	17	1,1	15,8	0,23	2,8	4,2	5,15	2,9	9 000	11 000	**1207**	0,320
	72	17	1,1	15,8	0,23	2,8	4,2	5,15	2,9	9 000	11 000	**1207K**	0,320
	72	17	1,1	15,8	0,23	2,8	4,2	5,15	2,9	9 000	11 000	**1207M**	0,320
	72	23	1,1	21,7	0,37	1,7	2,6	6,7	1,8	8 500	10 000	**2207**	0,400
	72	23	1,1	21,7	0,37	1,7	2,6	6,7	1,8	8 500	10 000	**2207K**	0,400
	72	23	1,1	15,8	0,23	2,8	4,2	5,15	2,9	5 600		**2207–2RS**	0,400
	72	23	1,1	15,8	0,23	2,8	4,2	5,15	2,9	5 600		**2207K2RS**	0,400
	80	21	1,5	25,1	0,25	2,5	3,9	7,95	2,7	7 500	9 000	**1307**	0,510
	80	21	1,5	25,1	0,25	2,5	3,9	7,95	2,7	7 500	9 000	**1307K**	0,510
	80	31	1,5	39,7	0,43	1,5	2,3	12,9	1,6	7 000	8 500	**2307**	0,670
	80	31	1,5	39,7	0,43	1,5	2,3	12,9	1,6	7 000	8 500	**2307K**	0,670
	80	31	1,5	25,1	0,25	2,5	3,9	7,95	2,7	4 500		**2307–2RS**	0,670
40	80	18	1,1	19,2	0,22	2,9	4,5	6,5	3	8 500	10 000	**1208**	0,410
	80	18	1,1	19,2	0,22	2,9	4,5	6,5	3	8 500	10 000	**1208K**	0,410
	80	23	1,1	22,4	0,33	1,9	3	7,4	2	7 500	9 000	**2208**	0,500
	80	23	1,1	22,4	0,33	1,9	3	7,4	2	7 500	9 000	**2208K**	0,500
	80	23	1,1	22,4	0,33	1,9	3	7,4	2	7 500	9 000	**2208M**	0,500
	80	23	1,1	19,2	0,22	2,9	4,5	6,5	3	4 800		**2208–2RS**	0,500
	80	23	1,1	19,2	0,22	2,9	4,5	6,5	3	4 800		**2208K2RS**	0,500
	90	23	1,5	29,5	0,24	2,6	4,1	9,75	2,8	6 700	8 000	**1308**	0,710
	90	23	1,5	29,5	0,24	2,6	4,1	9,75	2,8	6 700	8 000	**1308K**	0,710
	90	33	1,5	44,9	0,39	1,6	2,5	15,1	1,7	6 300	7 500	**2308**	0,920
	90	33	1,5	44,9	0,39	1,6	2,5	15,1	1,7	6 300	7 500	**2308K**	0,920
	90	33	1,5	44,9	0,39	1,6	2,5	15,1	1,7	6 300	7 500	**2308M**	0,920
	90	33	1,5	29,5	0,24	2,6	4,1	9,75	2,8	4 000		**2308–2RS**	0,920
45	85	19	1,1	21,8	0,21	3	4,7	7,4	3,2	7 500	9 000	**1209**	0,460
	85	19	1,1	21,8	0,21	3	4,7	7,4	3,2	7 500	9 000	**1209K**	0,460
	85	23	1,1	23,3	0,31	2	3,1	8,15	2,1	7 000	8 500	**2209**	0,540
	85	23	1,1	23,3	0,31	2	3,1	8,15	2,1	7 000	8 500	**2209K**	0,540

Self-aligning ball bearings





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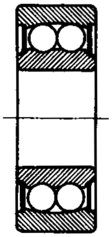
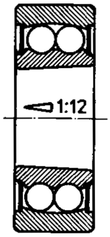


2RS



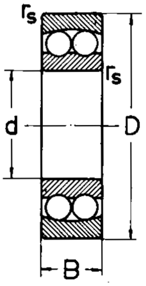
K2RS

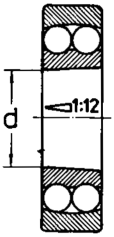
Dimensions				Basic radial load.Factors						Speed limit		Designation	Weight
d	D	B	r_s min.	dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil		
mm				kN	–			kN	–	min^{-1}		–	kg
45	85	23	1,1	21,8	0,21	3	4,7	7,4	3,2	4 500		2209–2RS	0,540
	85	23	1,1	21,8	0,21	3	4,7	7,4	3,2	4 500		2209K2RS	0,540
	100	25	1,5	37,7	0,24	2,6	4,1	12,9	2,8	6 300	7 500	1309	0,950
	100	25	1,5	37,7	0,24	2,6	4,1	12,9	2,8	6 300	7 500	1309K	0,950
	100	36	1,5	54,1	0,31	2	3,1	16,5	2,1	5 600	6 700	2309	1,23
	100	36	1,5	54,1	0,31	2	3,1	16,5	2,1	5 600	6 700	2309K	1,23
	100	36	1,5	37,7	0,24	2,6	4,1	12,9	2,8	3 600		2309–2RS	1,23
50	90	20	1,1	22,9	0,21	3	4,7	8,1	3,2	7 000	8 500	1210	0,520
	90	20	1,1	22,9	0,21	3	4,7	8,16	3,2	7 000	8 500	1210K	0,520
	90	23	1,1	23,3	0,29	2,2	3,4	8,5	2,3	6 300	7 500	2210	0,590
	90	23	1,1	23,3	0,29	2,2	3,4	8,5	2,3	6 300	7 500	2210K	0,590
	90	23	1,1	22,9	0,21	3	4,6	8,1	3,2	4 000		2210–2RS	0,590
	90	23	1,1	22,9	0,21	3	4,6	8,1	3,2	4 000		2210K2RS	0,590
	110	27	2	43,4	0,24	2,6	4,1	14,2	2,8	5 600	6 700	1310	1,21
	110	27	2	43,4	0,24	2,6	4,1	14,2	2,8	5 600	6 700	1310K	1,21
	110	40	2	64,4	0,42	1,5	2,3	20	1,6	5 300	6 300	2310	1,23
	110	40	2	64,4	0,42	1,5	2,3	20	1,6	5 300	6 300	2310K	1,23
	110	40	2	43,4	0,24	2,6	4,1	14,2	2,8	3 400		2310–2RS	1,64
55	100	21	1,5	26,6	0,2	3,2	4,9	10,1	3,3	6 300	7 500	1211	0,700
	100	21	1,5	26,6	0,2	3,2	4,1	10,1	3,3	6 300	7 500	1211K	0,700
	100	25	1,5	26,5	0,27	2,3	3,6	9,9	2,5	6 000	7 000	2211	0,810
	100	25	1,5	26,5	0,27	2,3	3,6	9,9	2,5	6 000	7 000	2211K	0,810
	120	29	2	51,3	0,23	2,3	4,2	18,1	2,9	5 000	6 000	1311	1,58
	120	29	2	51,3	0,23	2,8	4,2	18,1	2,9	5 000	6 000	1311K	1,58
	120	43	2	75,3	0,41	1,5	2,4	23,8	1,6	4 800	5 600	2311	2,10
	120	43	2	75,3	0,41	1,5	2,4	23,8	1,6	4 800	5 600	2311K	2,10
60	110	22	1,5	30,2	0,19	3,4	5,2	11,6	3,5	5 600	6 700	1212	0,900
	110	22	1,5	30,2	0,19	3,4	5,2	11,6	3,5	5 600	6 700	1212K	0,900
	110	28	1,5	33,8	0,28	2,2	3,5	12,6	2,4	5 300	6 300	2212	1,10
	110	28	1,5	33,8	0,28	2,2	3,5	12,6	2,4	5 300	6 300	2212K	1,10
	130	31	2,1	57,1	0,23	2,8	4,2	20,8	2,9	4 500	5 300	1312	1,96
	130	31	2,1	57,1	0,23	2,8	4,2	20,8	2,9	4 500	5 300	1312K	1,96
	130	46	2,1	87,1	0,41	1,5	2,4	28	1,6	4 300	5 000	2312	2,60
	130	46	2,1	87,1	0,41	1,5	2,4	28	1,6	4 300	5 000	2312K	2,60
65	120	23	1,5	31	0,17	3,7	5,7	12,4	3,9	5 300	6 300	1213	1,15
	120	23	1,5	31	0,17	3,7	5,7	12,4	3,9	5 300	6 300	1213K	1,15
	120	31	1,5	43,6	0,28	2,2	3,5	16,4	2,4	5 000	6 000	2213	1,45
	120	31	1,5	43,6	0,28	2,2	3,5	16,4	2,4	5 000	6 000	2213K	1,45
	140	33	2,1	62	0,23	2,8	4,2	22,9	2,8	4 300	5 000	1313	2,45
	140	33	2,1	62	0,23	2,8	4,2	22,9	2,8	4 300	5 000	1313K	2,45
	140	48	2,1	95,6	0,38	1,7	2,6	32,5	1,7	4 000	4 800	2313	3,25
	140	48	2,1	95,6	0,38	1,7	2,6	32,5	1,7	4 000	4 800	2313K	3,25

Self-aligning ball bearings

Dimensions				Basic radial load.Factors						Speed limit		Designation	Weight
				dyn.				stat.					
d	D	B	r_s min.	C_r	e	Y_1	Y_2	C_{0r}	Y_0	grease	oil		
mm				kN	–			kN	–	min^{-1}		–	kg
70	125	24	1,5	34,6	0,18	3,5	5,4	13,7	3,7	5 000	6 000	1214	1,25
	125	24	1,5	34,6	0,18	3,5	5,4	13,7	3,7	5 000	6 000	1214K	1,25
	125	31	1,5	44,2	0,27	2,3	3,6	17,1	2,5	4 800	5 600	2214	1,50
	125	31	1,5	44,2	0,27	2,3	3,6	17,1	2,5	4 800	5 600	2214K	1,50
	150	35	2,1	74,1	0,22	2,9	4,5	27,7	3	4 000	4 800	1314	3,00
	150	35	2,1	74,1	0,22	2,9	4,5	27,7	3	4 000	4 800	1314K	3,00
	150	51	2,1	111	0,35	1,8	2,8	31,7	1,9	3 600	4 300	2314	3,90
	150	51	2,1	111	0,35	1,8	2,8	31,7	1,9	3 600	4 300	2314K	3,90
75	130	25	1,5	38,9	0,18	3,5	5,4	15,6	3,7	4 800	5 600	1215	1,35
	130	25	1,5	38,9	0,18	3,5	5,4	15,6	3,7	4 800	5 600	1215K	1,35
	130	31	1,5	44	0,25	2,5	3,9	17,8	2,7	4 500	5 300	2215	1,60
	130	31	1,5	44	0,25	2,5	3,9	17,8	2,7	4 500	5 300	2215K	1,60
	160	37	2,1	79,2	0,22	2,9	4,5	30	3	3 600	4 300	1315	3,55
	160	37	2,1	79,2	0,22	2,9	4,5	30	3	3 600	4 300	1315K	3,55
	160	55	2,1	123	0,38	1,7	2,6	42,8	1,7	3 400	4 000	2315	4,70
	160	55	2,1	123	0,38	1,7	2,6	42,8	1,7	3 400	4 000	2315K	4,70
	160	55	2,1	123	0,38	1,7	2,6	42,8	1,7	3 400	4 000	2315KM	4,70
80	140	26	2	39,8	0,16	3,9	6,1	17	4,1	4 300	5 000	1216	1,65
	140	26	2	39,8	0,16	3,9	6,1	17	4,1	4 300	5 000	1216K	1,65
	140	33	2	48,8	0,26	2,4	3,7	19,9	2,5	4 000	4 800	2216	2,00
	140	33	2	48,8	0,26	2,4	3,7	19,9	2,5	4 000	4 800	2216K	2,00
	170	39	2,1	88,4	0,22	2,9	4,5	33	3	3 400	4 000	1316	4,20
	170	39	2,1	88,4	0,22	2,9	4,5	33	3	3 400	4 000	1316K	4,20
	170	58	2,1	136	0,34	1,9	2,9	48,5	2	3 200	3 800	2316	6,10
	170	58	2,1	136	0,34	1,9	2,9	48,5	2	3 200	3 800	2316K	6,10
	170	58	2,1	136	0,34	1,9	2,9	48,5	2	3 200	3 800	2316M	6,10
85	150	28	2	48,2	0,17	3,7	5,7	20,8	3,9	4 000	4 800	1217	2,05
	150	28	2	48,2	0,17	3,7	5,7	20,8	3,9	4 000	4 800	1217K	2,05
	150	36	2	58,5	0,25	2,5	3,9	23,8	2,7	3 800	4 800	2217	2,50
	150	36	2	58,5	0,25	2,5	3,9	23,8	2,7	3 800	4 500	2217K	2,50
	180	41	3	97,5	0,22	2,9	4,5	37,9	3	3 200	4 800	1317	5,00
	180	41	3	97,5	0,22	2,9	4,5	37,9	3	3 200	3 800	1317K	5,00
	180	60	3	140	0,37	1,7	2,6	51,5	1,8	3 000	3 600	2317	7,05
	180	60	3	140	0,37	1,7	2,6	51,5	1,8	3 000	3 600	2317K	7,05
90	160	30	2	57	0,17	3,7	5,7	23,1	3,9	3 800	4 500	1218	2,50
	160	30	2	57	0,17	3,7	5,7	23,1	3,9	3 800	4 500	1218K	2,50
	160	40	2	70,2	0,27	2,3	3,6	27,2	2,5	3 600	4 300	2218	3,40
	160	40	2	70,2	0,27	2,3	3,6	27,2	2,5	3 600	4 300	2218K	3,40
	190	43	3	117	0,22	2,9	4,5	44,5	3	3 000	3 600	1318	5,80
	190	43	3	117	0,22	2,9	4,5	44,5	3	3 000	3 600	1318K	5,80
	190	64	3	153	0,38	1,7	2,6	57,7	1,7	2 800	3 400	2318	8,45
	190	64	3	153	0,38	1,7	2,6	57,7	1,7	2 800	3 400	2318K	8,45

Self-aligning ball bearings





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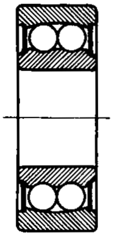
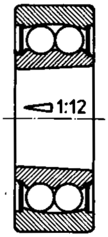


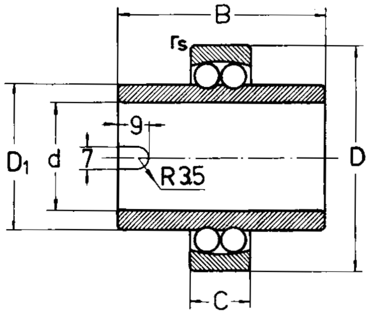
2RS



K2RS

Dimensions				Basic radial load.Factors						Speed limit		Designation	Weight
d	D	B	r_s min.	dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil		
mm				kN	–			kN	–	min^{-1}		–	kg
95	170	32	2,1	63,7	0,17	3,7	5,7	24,3	3,9	3 400	4 000	**1219**	3,10
	170	32	2,1	63,7	0,17	3,7	5,7	24,3	3,9	3 400	4 000	**1219K**	3,10
	200	45	3	133	0,23	2,8	4,2	50,8	2,9	2 800	3 400	**1319**	6,70
	200	45	3	133	0,23	2,8	4,2	50,8	2,9	2 800	3 400	**1319K**	6,70
100	180	34	2,1	68,9	0,17	3,7	5,7	29,7	3,9	3 200	3 800	**1220**	3,70
	180	34	2,1	68,9	0,17	3,7	5,7	29,7	3,9	3 200	3 800	**1220K**	3,70
	180	46	2,1	97,5	0,24	2,6	4,1	34	2,8	3 200	3 800	**2220**	5,00
	180	46	2,1	97,5	0,24	2,6	4,1	34	2,8	3 200	3 800	**2220K**	5,00
	215	47	3	143	0,24	2,6	4,1	57,3	2,8	2 600	3 200	**1320**	8,30
	215	47	3	143	0,24	2,6	4,1	57,3	2,8	2 600	3 200	**1320K**	8,30
	215	73	3	193	0,34	1,9	2,9	73,4	2	2 400	3 000	**2320**	12,2
	215	73	3	193	0,34	1,9	2,9	73,4	2	2 400	3 000	**2320K**	12,5
110	200	38	2,1	88	0,17	3,7	5,7	35,2	3,9	2 800	3 400	**1222**	5,15
	200	38	2,1	88	0,17	3,7	5,7	35,2	3,9	2 800	3 400	**1222K**	5,15
	200	53	2,1	124	0,26	2,4	3,7	48,9	2,5	2 800	3 400	**2222**	7,10
	200	53	2,1	124	0,26	2,4	3,7	48,9	2,5	2 800	3 400	**2222K**	7,10
	240	50	3	163	0,22	2,9	4,5	67,5	3	2 400	3 000	**1322**	12,0
	240	50	3	163	0,22	2,9	4,5	67,5	3	2 400	3 000	**1322K**	12,0

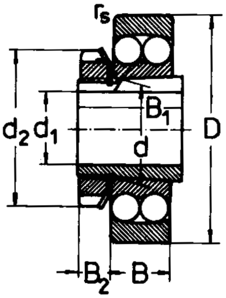
Self-aligning ball bearings with extended inner ring



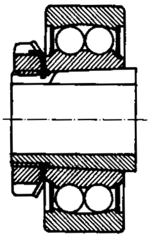
Dimensions						Basic radial load. Factors						Speed limit		Designation	Weight
$d^{1)}$	D	C	B	D_1	r_s min.	dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil		
mm						kN	–			kN	–	min^{-1}		–	kg
20	47	14	40	29,2	1	9,9	0,28	2,2	3,5	2,65	2,4	7 100	9 000	**11204**	0,180
	52	15	44	31,5	1,1	12,4	0,3	2,1	3,3	3,35	2,2	8 000	6 300	**11304**	0,270
25	52	15	44	33,3	1	12,2	0,29	2,2	3,4	3,3	2,3	6 300	8 000	**11205**	0,220
	62	17	48	38	1,1	17,8	0,28	2,2	3,5	4,9	2,4	5 000	6 300	**11305**	0,410
30	62	16	48	40,1	1	15,7	0,25	2,5	3,9	4,7	2,7	5 000	6 300	**11206**	0,350
	72	19	52	45	1,1	21,4	0,24	2,6	4,1	6,35	2,8	4 000	5 000	**11306**	0,610
35	72	17	52	47,7	1,1	15,8	0,23	2,8	4,2	5,15	2,9	4 000	5 000	**11207**	0,540
	80	21	56	51,7	1,5	25,1	0,25	2,5	3,9	7,95	2,7	3 600	4 500	**11307**	0,810
40	80	18	56	54	1,1	19,2	0,22	2,9	4,5	6,5	3	3 600	4 500	**11208**	0,720
	90	23	58	57,7	1,5	29,5	0,24	2,6	4,1	9,75	2,8	3 200	4 000	**11308**	1,08
45	85	19	58	57,7	1,1	21,8	0,21	3	4,7	7,4	3,2	3 600	4 500	**11209**	0,770
	100	25	60	63,9	1,5	37,7	0,24	2,6	4,1	12,8	2,8	2 800	3 600	**11309**	1,38
50	90	20	58	62,7	1,1	22,9	0,21	3	4,7	8,1	3,2	3 200	4 000	**11210**	0,850
	110	27	62	70,3	2	43,4	0,24	2,6	4,1	14,1	2,8	2 500	3 200	**11310**	1,72
55	100	21	60	69,5	1,5	26,6	0,2	3,2	4,9	10,0	3,3	2 800	3 600	**11211**	1,13
60	110	22	62	78	1,5	30,2	0,19	3,4	5,2	11,6	3,5	2 500	3200	**11212**	1,50

1) Tolerance J7

Adapter assemblies for Self-aligning ball bearings



K+H

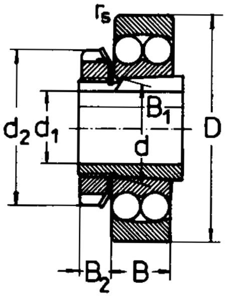


K2RS +H

Dimensions								Designation		Weight
d_1	d	D	B	r_s min.	d_2	B_1	B_2	bearing	adapter sleeve	
mm								–		kg
17	20	47	14	1	32	24	7	1204K	H204	0,167
	20	47	18	1	32	28	7	2204K	H304	0,201
	20	52	15	1,1	32	28	7	1304K	H304	0,221
	20	52	21	1,1	32	31	7	2304K	H2304	0,281
20	25	52	15	1	38	26	8	1205K	H205	0,219
	25	52	18	1	38	29	8	2205K	H305	0,233
	25	52	18	1	38	29	8	2205K2RS	H305	0,236
	25	62	17	1,1	38	29	8	1305K	H305	0,227
	25	62	24	1,1	38	35	8	2305K	H2305	0,414
25	30	62	16	1	45	27	8	1206K	H206	0,33
	30	62	20	1	45	31	8	2206K	H306	0,363
	30	62	20	1	45	31	8	2206K2RS	H306	0,363
	30	72	19	1,1	45	31	8	1306K	H306	0,49
	30	72	27	1,1	45	38	8	2306K	H2306	0,615
30	35	72	17	1,1	52	29	9	1207K	H207	0,422
	35	72	23	1,1	52	35	9	2207K	H307	0,538
	35	72	23	1,1	52	35	9	2207K2RS	H307	0,538
	35	80	21	1,5	52	35	9	1307K	H307	0,644
	35	80	31	1,5	52	43	9	2307K	H2307	0,822
35	40	80	18	1,1	58	31	10	1208K	H208	0,585
	40	80	23	1,1	58	36	10	2208K	H308	0,683
	40	80	23	1,1	58	36	10	2208K2RS	H308	0,683
	40	90	23	1,5	58	36	10	1308K	H308	0,893
	40	90	33	1,5	58	46	10	2308K	H2308	1,13
40	45	85	19	1,1	65	33	11	1209K	H209	0,686
	45	85	23	1,1	65	39	11	2209K	H309	0,781
	45	85	23	1,1	65	39	11	2209K2RS	H309	0,781
	45	100	25	1,5	65	39	11	1309K	H309	1,19
	45	100	36	1,5	65	50	11	2309K	H2309	1,48
45	50	90	20	1,1	70	35	12	1210K	H210	0,789
	50	90	23	1,1	70	42	12	2210K	H310	0,88
	50	90	23	1,1	70	42	12	2210K2RS	H310	0,88
	50	110	27	2	70	42	12	1310K	H310	1,49
	50	110	40	2	70	55	12	2310K	H2310	1,96
50	55	100	21	1,5	75	37	12	1211K	H211	1
	55	100	25	1,5	75	45	12	2211K	H311	1,2
	55	120	29	2	75	45	12	1311K	H311	1,91
	55	120	43	2	75	59	12	2311K	H2311	2,47
55	60	110	22	1,5	80	38	13	1212K	H212	1,03
	60	110	28	1,5	80	47	13	2212K	H312	1,55
	60	130	31	2,1	80	47	13	1312K	H312	2,32
	60	130	46	2,1	80	62	13	2312K	H2312	3,01
60	65	120	23	1,5	85	40	14	1213K	H213	1,53

Basic radial load. Factors						Speed limit	
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil
kN	–			kN	–	min^{-1}	
9,9	0,28	2,2	3,5	2,65	2,4	15 000	18 000
12,6	0,28	2,2	3,5	3,3	2,4	14 000	17 000
12,4	0,3	2,1	3,3	3,35	2,2	12 000	15 000
18,2	0,52	1,2	1,9	4,7	1,3	11 000	14 000
12,2	0,29	2,2	3,4	3,3	2,3	13 000	16 000
12,5	0,43	1,5	2,3	3,45	1,6	11 000	14 000
12,2	0,29	2,2	3,4	3,3	2,3	7 000	
17,8	0,28	2,2	3,5	4,9	2,4	9 500	12 000
24,5	0,44	1,4	2,2	6,55	1,5	9 500	12 000
15,7	0,25	2,5	3,9	4,7	2,7	10 000	13 000
15,3	0,4	1,6	2,5	4,6	1,7	9 500	12 000
15,7	0,25	2,5	3,9	4,7	2,7	5 300	
21,4	0,24	2,6	4,1	6,35	2,8	9 000	11 000
31,4	0,4	1,6	2,5	8,7	1,7	8 500	10 000
15,8	0,23	2,8	4,2	5,15	2,9	9 000	11 000
21,7	0,37	1,7	2,6	6,7	1,8	8 500	10 000
15,8	0,23	2,8	4,2	5,15	2,9	5 600	
25,1	0,25	2,5	3,9	7,95	2,7	7 500	9 000
39,7	0,43	1,5	2,3	12,9	1,6	7 000	8 500
19,2	0,22	2,9	4,5	6,5	3	8 500	10 000
22,4	0,33	1,9	3	7,4	2	7 500	9 000
19,2	0,22	2,9	4,5	6,5	3	4 800	
29,5	0,24	2,6	4,1	9,75	2,8	6 700	8 000
44,9	0,39	1,6	2,5	15,1	1,7	6 300	7 500
21,8	0,21	3	4,7	7,4	3,2	7 500	9 000
23,3	0,31	2	3,1	8,15	2,1	7 000	8 500
21,8	0,21	3	4,7	7,4	3,2	4 500	
37,7	0,24	2,6	4,1	12,9	2,8	6 300	7 500
54,1	0,31	2	3,1	16,5	2,1	5 600	6 700
22,9	0,21	3	4,7	8,16	3,2	7 000	8 500
23,3	0,29	2,2	3,4	8,5	2,3	6 300	7 500
22,9	0,21	3	4,6	8,1	3,2	4 000	
43,4	0,24	2,6	4,1	14,2	2,8	5 600	6 700
64,4	0,42	1,5	2,3	20	1,6	5 300	6 300
26,6	0,2	3,2	4,1	10,1	3,3	6 300	7 500
26,5	0,27	2,3	3,6	9,9	2,5	6 000	7 000
51,3	0,23	2,8	4,2	18,1	2,9	5 000	6 000
75,3	0,41	1,5	2,4	23,8	1,6	4 800	5 600
30,2	0,19	3,4	5,2	11,6	3,5	5 600	6 700
33,8	0,28	2,2	3,5	12,6	2,4	5 300	6 300
57,1	0,23	2,8	4,2	20,8	2,9	4 500	5 300
87,1	0,41	1,5	2,4	28	1,6	4 300	5 000
31	0,17	3,7	5,7	12,4	3,9	5 300	6 300

Adapter assemblies for Self-aligning ball bearings



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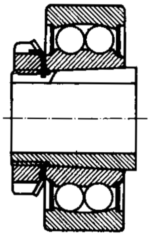

K2RS +H

Dimensions								Designation		Weight
d_1	d	D	B	r_s min.	d_2	B_1	B_2	bearing	adapter sleeve	
mm								–		kg
60	65	120	31	1,5	85	50	14	2213K	H313	2,00
	65	140	33	2,1	85	50	14	1313K	H313	2,87
	65	140	48	2,1	85	65	14	2313K	H2313	3,71
65	75	130	25	1,5	98	43	15	1215K	H215	2,05
	75	130	31	1,5	98	55	15	2215K	H315	2,52
	75	160	37	2,1	98	55	15	1315K	H315	4,34
65	75	160	55	2,1	98	73	15	2315K	H2315	5,66
70	80	140	26	2	105	46	17	1216K	H216	2,52
	80	140	33	2	105	59	17	2216K	H316	3,18
	80	170	39	2,1	105	59	17	1316K	H316	5,33
	80	170	58	2,1	105	78	17	2316K	H2316	7,24
75	85	150	28	2	110	50	18	1217K	H217	3,06
	85	150	36	2	110	63	18	2217K	H317	3,85
	85	180	41	3	110	63	18	1317K	H317	6,27
	85	180	60	3	110	82	18	2317K	H2317	8,34
80	90	160	30	2	120	52	18	1218K	H218	3,67
	90	160	40	2	120	65	18	2218K	H318	4,74
	90	190	43	3	120	65	18	1318K	H318	7,36
	90	190	64	3	120	86	18	2318K	H2318	9,94
85	95	170	32	2,1	125	55	19	1219K	H219	4,42
	95	200	45	3	125	68	19	1319K	H319	8,30
90	100	180	34	2,1	130	58	20	1220K	H220	5,13
	100	180	46	2,1	130	71	20	2220K	H320	6,63
	100	215	47	3	130	71	20	1320K	H320	9,96
	100	215	73	3	130	97	20	2320K	H2320	14,3
100	110	200	38	2,1	145	63	21	1222K	H222	7,00
	110	200	53	2,1	145	77	21	2222K	H322	9,15
	110	240	50	3	145	77	21	1322K	H322	13,9

Basic radial load. Factors						Speed limit	
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil
kN	–			kN	–	min^{-1}	
43,6	0,28	2,2	3,5	16,4	2,4	5 000	6 000
62	0,23	2,8	4,2	22,9	2,8	4 300	5 000
95,6	0,38	1,7	2,6	32,5	1,7	4 000	4 800
38,9	0,18	3,5	5,4	15,6	3,7	4 800	5 600
44	0,25	2,5	3,9	17,8	2,7	4 500	5 300
79,2	0,22	2,9	4,5	30	3	3 600	4 300
123	0,38	1,7	2,6	42,8	1,7	4 300	4 000
39,8	0,16	3,9	6,1	17	4,1	4 300	5 000
48,8	0,26	2,4	3,7	19,9	2,5	4 000	4 800
88,4	0,22	2,9	4,5	33	3	3 400	4 000
136	0,34	1,9	2,9	48,5	2	3 200	3 800
48,8	0,17	3,7	5,7	20,8	3,9	4 000	4 800
58,5	0,25	2,5	3,9	23,8	2,7	3 800	4 500
97,5	0,22	2,9	4,5	37,9	3	3 200	3 800
140	0,37	1,7	2,6	51,5	1,8	3 000	3 600
57	0,17	3,7	5,7	23,1	3,9	3 800	4 500
70,2	0,27	2,3	3,6	27,2	2,5	3 600	4 300
117	0,22	2,9	4,5	44,5	3	3 000	3 600
153	0,38	1,7	2,6	57,7	1,7	2 800	3 400
63,7	0,17	3,7	5,7	24,3	3,9	3 400	4 000
133	0,23	2,8	4,2	50,8	2,9	2 800	3 400
68,9	0,17	3,7	5,7	29,7	3,9	3 200	3 800
97,5	0,24	2,6	4,1	34	2,8	2 200	3 800
143	0,24	2,6	4,1	57,3	2,8	2 600	3 200
193	0,34	1,9	2,9	73,4	2	2 400	3 000
88	0,17	3,7	5,7	35,2	3,9	2 800	3 400
124	0,26	2,4	3,7	48,9	2,5	2 800	3 400
163	0,22	2,9	4,5	67,5	3	2 400	3 000

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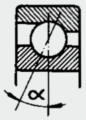
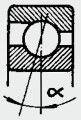
Angular contact ball bearings

Single row angular contact ball bearings are manufactured in various constructive versions, with various contact angles, depending on the application. Bearings series 72B and 73B for general applications have a contact angle α = 40°. Bearings series 718, 719, 70 and 72 generally used for tool-holders, have phenol resins (textolite) cages or machined brass cages. Those with bore diameters up to d = 100 mm are manufactured to tolerance classes P5, P4 and P2 and have a contact angle of 15° (C) and 25° (A) respectively.

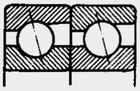
Series 72B, 73B
Contact angle α = 40°



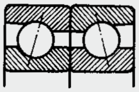
Series 70A, 72A
Contact angle α = 25°



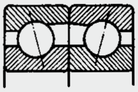
Series 70C, 72C
Contact angle α = 15°



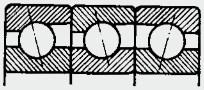
DT arrangement
(Tandem)



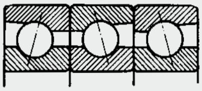
DB arrangement
(Back-to-back)



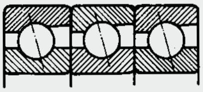
DF arrangement
(Face-to-face)



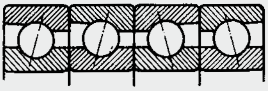
TFT arrangement



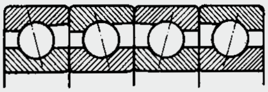
TBT arrangement



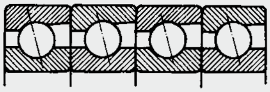
TT arrangement



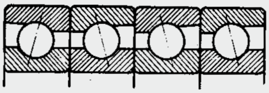
QBC arrangement



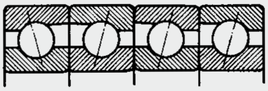
QFC arrangement



QT arrangement



QBT arrangement



QFT arrangement

Suffixes

A	- bearing with extended outer ring
A	- bearing with contact angle $\alpha = 25°$
A1	- bearing with contact angle $\alpha = 30°$
A2	- bearing with contact angle $\alpha = 36°$
A10..	- bearing with specified radial and axial clearance
B	- bearing with extended outer ring
B	- bearing with contact angle $\alpha = 40°$
BB	- bearing with $\alpha = 40°$ and extended inner ring
C	- bearing with contact angle $\alpha = 15°$
CA	- bearing with radial clearance smaller than normal
CB	- bearing with normal radial clearance
CC	- radial bearing with axial clearance larger than normal
D	- two bearings set
D	- bearing with two-pieces inner ring
DB	- two bearings set in back-to-back arrangement, (O)
DF	- two bearings set in face-to-face arrangement, (X)
DT	- two bearings set in tandem arrangement
E	- bearing with contact angle $\alpha = 20°$
F	- special prescriptions
F2	- modified construction
FA	- bearing with machined cage of steel or cast iron, guided in the outer ring
FB	- bearing with machined cage of steel or cast iron guided on the inner ring
GA	- light preload, bearings series 72B, 73B
GB	- moderate preload, bearings series 72B, 73B
GC	- heavy preload, bearings series 72B, 73B
L	- light preload, bearings series 70C, 70A, 72A
M	- moderate preload, bearings series 70C, 70A, 72A
M	- machined brass cage, ball guided
MA	- machined brass cage, guided in the outer ring
MB	- machined brass cage, guided on the inner ring
O	- bearing set without axial clearance
P0	- normal tolerance class
P6	- tolerance class more accurate than normal
P5	- tolerance class more accurate than P6
P4	- tolerance class more accurate than P5
P2	- tolerance class more accurate than P4
Q	- four bearings set
QBC	- tandem pairs in O arrangement
QBT	- tandem pairs plus O arrangement
QFC	- tandem pairs in X arrangement
QFT	- tandem pairs plus X arrangement
QT	- tandem pairs
S	- heavy preload, bearings series 70C, 70A, 72A
S0	- bearings operating up to a temperature of +150°C
S1	- bearings operating up to a temperature of +200°C
T	- three bearings set
T	- bearing set total width (T168, T200)
TBT	- three bearings set in O arrangement, plus T
TFT	- three bearings set in X arrangement, plus T
TT	- three bearings set in tandem arrangement
TN	- polyamide cage
V	-full complement bearing
W8	- lubricating grooves on one side of the outer ring
U	- bearings of universal design, with deviations of d and D, from table 1 on page 175 and K_i, K_e in P2 class
UA	- bearings with small axial clearance at DB and DF arrangements
UL	- bearings with light preload at DB and DF arrangements
UO	- bearings without small axial clearance at DB and DF arrangements
UP	- tolerance class with deviations of d and D in P4 class and of K_i and K_e in P2 class.

Single row angular contact ball bearings can take only one direction axial loads. When being radially loaded, in bearing occurs an axially acting load which has to be compensated.

For this reason, a bearing or paired bearings are mounted on each shaft end.

Single row angular contact ball bearings with B suffix have a contact angle $\alpha = 40°$ and are suitable in case of heavy loads.

These bearings are not dismountable and their use at relatively high speeds is allowed.

Pair mounting of bearings as shown in figures on page 173 is used when the load carrying capacity of a single bearing is inadequate (tandem arrangement), respectively when axial loads have to be taken in both directions (DB or DF arrangements).

In case of DT tandem arrangement , the contact lines are in parallel. Radial and axial loads are uniformly distributed on both bearings. The bearing pair can take axial loads in only one direction. Therefore, a third bearing should take axial loads in the opposite direction.

In case of DB arrangement, the contact lines diverge towards the bearing axis and form letter "O". Axial loads are taken in both directions, but only by one single bearing for each direction.

DB arrangement is considered to be a relatively stiff arrangement and can also take tilting moments.

The contact lines of DF arrangement converge towards the bearing axis and form letter "X". Axial loads are taken in the same way as in case of DB arrangement, but the arrangement is not so stiff and it is less suitable for taking tilting moments.

Universal design

Single row angular contact ball bearings of universal design are suitable for DB, DF and DT arrangements.

Bearings of universal design are manufactured to more accurate tolerance classes and can be matched if the mounting conditions UA, UO and UL are observed.

The values of clearance or preload are obtained when the shaft is manufactured to tolerance class j5 and the housing bore to tolerance class J6.

Dimensions

Main dimensions of bearings given in tables are in accordance with ISO/R15 and national standard 7416, respectively.

Misalignment

In case of single row angular contact ball bearings the conditions regarding the permissible error of alignment of the outer ring relative to the inner ring are as complex as for single row deep groove ball bearings.

When the bearings are paired in DB arrangement, angular misalignments of the outer ring in relation to the inner ring can only be accommodated between the balls and raceways by force, leading to a reduction in bearing life.

Contact angle

In case of single row angular contact ball bearings, the efforts between rings and rolling elements (contact points of rolling elements/ outer or inner ring) are transmitted at an angle α (< 90°) to a plane perpendicular to the bearing axis.

The value of this angle depends on the magnitude of the raceway radius, rolling element diameter and radial clearance in bearing, when the curvature centres of the raceways in the outer or on the inner ring are in the same plane.

The contact angle α can be calculated and verified in accordance with the specifications

Tolerances

Single row angular contact ball bearings of series 72B and 73B, with a contact angle α = 40° (B) are generally manufactured to the normal tolerance class.

At request, they also can be manufactured to normal tolerance classes P6 and P5.

Single row angular contact ball bearings of high accuracy, series 70C, 72C, 70A and 72A, with a contact angle α = 15° (C) and α = 25° are manufactured to tolerance classes SP, P4, UP and P2.

The deviations of bore diameter, outside diameter and width of high accuracy single row angular contact ball bearings of universal design (UL) are given in table 1.

In case of single row angular contact ball bearings manufactured and delivered in sets of 2, 3 or 4 bearings, outside and bore diameter should be chosen considering the mean tolerance values, which are given on the package.

Deviations of main dimensions of high accuracy single row angular contact bearings

Deviations in μm

Bore **d** (mm)		**Δ_{dmp}, Δ_{Dmp}** P4		UP		P2		**Δ_{BS}**	
over	up to	low	high	low	high	low	high	low	high
–	**18**	−3	−1	−3	−1	−2	0	−250	0
18	**30**	−3,5	−1,5	−3	−1	−2	0	−250	0
30	**50**	−4	−1,5	−3	−1	−2	0	−250	0
50	**80**	−5	−2	−3,5	−1,5	−3	−1	−250	0
80	**120**	−5,5	−2			−3,5	−1,5	−380	0

Axial clearance - preload

Axial clearance or preload can be obtained only when single row angular contact ball bearing is mounted in the assembly and depends on the location of the second bearing which assures the shaft axial guiding.

Single row angular contact ball bearings series 72B and 73B, paired mounted in DB and DF arrangements are manufactured with normal axial clearance CB, smaller than normal, CA, larger than normal, CC, or with light preload, GA, moderate preload GB, or heavy preload, GC, according to the values given in table 2.

High accuracy single row angular contact ball bearings

Axial clearance or preload of single row angular contact ball bearings series 72B and 73B, pair mounted in DB or DF arrangements

Table 2

Bore **d**		**Axial clearance** **CA**		**CB**		**CC**		**Preload** **GA**			**GB**				**GC**			
over	up to	min.	max.	min.	max.	min.	max.	min.	max.	min.	min.	max.	min.	max.	min.	ma.x	min.	max.
mm		μm								N	μm		N		μm		N	
–	**10**	4	12	14	22	22	30	–	–	–	–	–	–	–	–	–	–	–
10	**18**	5	13	15	23	24	32	+4	−4	80	−2	−10	30	330	−8	−16	230	260
18	**30**	7	15	18	26	32	40	+4	−4	120	−2	−10	40	480	−8	−16	340	970
30	**50**	9	17	22	30	40	48	+4	−4	160	−2	−10	60	630	−8	−16	450	1280
50	**80**	11	23	26	38	48	60	+6	−6	380	−3	−15	140	1500	−12	−24	1080	3050
80	**120**	14	26	32	44	55	67	+6	−6	410	−3	−15	150	1600	−12	−24	1150	3250
120	**180**	17	29	35	47	62	74	+6	−6	540	−3	−15	200	2150	−12	−24	1500	4300
180	**250**	21	37	45	61	74	90	+8	−8	940	−4	−20	330	3700	−16	−32	2650	7500
250	**315**	26	42	52	68	90	106	+8	−8	1080	−4	−20	380	4250	−16	−32	3000	8600

series 70C, 70A and 72A, with a contact angle α = 15°(C) and α = 25° (A), which are generally used for grinding stone holders, paired mounted in DB and DF arrangement, are manufactured with an initial preload. It can be: light (L), moderate (M), heavy (S). The values of these preloads are given in table 3.

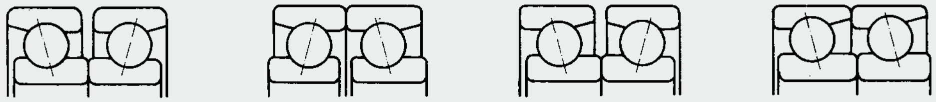
Values of axial preload of bearings of series 70C, 70A and 72A, in DB and DF arrangements

Table 3

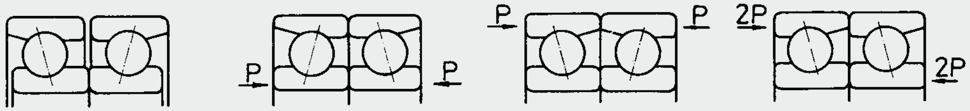
Bore		Axial preload Series 70C			Series 72C			Series 70A			Series 72A		
d	Symbol	L	M	S	L	M	S	L	M	S	L	M	S
mm	–	N											
10	00	15	30	60	20	40	80	25	50	100	35	70	140
12	01	15	30	60	20	40	80	25	50	100	35	70	140
15	02	20	40	80	20	60	120	30	60	120	45	90	180
17	03	25	50	100	35	70	140	40	80	160	60	120	240
20	04	35	70	140	45	90	180	50	100	200	70	140	280
25	05	35	70	140	50	100	200	60	120	240	80	160	320
30	06	50	100	200	90	180	360	90	180	360	150	300	600
35	07	60	120	240	120	240	480	90	180	360	190	380	760
40	08	60	120	240	150	300	600	100	200	400	240	480	960
45	09	110	220	440	160	320	640	170	340	680	260	520	1040
50	10	110	220	440	170	340	680	180	360	720	260	520	1040
55	11	150	300	600	210	420	840	230	460	920	330	660	1320
60	12	150	300	600	250	500	1000	240	480	960	400	800	1600
65	13	160	320	640	290	580	1160	240	480	960	450	900	1800
70	14	200	400	800	300	600	1200	300	600	1200	480	960	1920
75	15	200	400	800	310	620	1240	310	620	1240	500	1000	2000
80	16	240	480	960	370	740	1480	390	780	1560	580	1160	2320
85	17	250	500	1000	370	740	1480	400	800	1600	600	1200	2400
90	18	300	600	1200	480	960	1920	460	920	1840	750	1500	3000
95	19	310	620	1240	520	1040	2080	480	960	1920	850	1700	3400
100	20	310	620	1240	590	1180	2360	500	1000	2000	950	1900	3800
105	21	360	720	1440	650	1300	2600	560	1120	2240	1000	2000	4000
110	22	420	840	1680	670	1340	2680	650	1300	2600	1050	2100	4200
120	24	430	860	1720	750	1500	3000	690	1380	2760	1200	2400	4800
130	26	560	1120	2240	800	1600	3200	900	1800	3600	1250	2500	5000
140	28	570	1140	2280	–	–	–	900	1800	3600	–	–	–
150	30	650	1300	2600	–	–	–	1000	2000	4000	–	–	–
160	32	730	1460	2920	–	–	–	1150	2300	4600	–	–	–
170	34	800	1600	3200	–	–	–	1250	2500	5000	–	–	–
180	36	900	1800	3600	–	–	–	1450	2900	5800	–	–	–
190	38	950	1900	3800	–	–	–	1450	2900	5800	–	–	–

Designs of single row angular contact ball bearings with clearance or initial preload are given in the figures below.

Before mounting (preload)



After mounting (preload)



Cages

Single row angular contact ball bearings series 72B and 73B are generally fitted with pressed sheet cages.

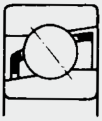
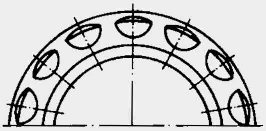
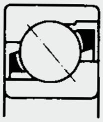
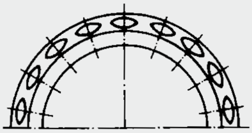
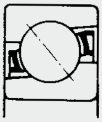
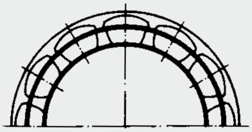
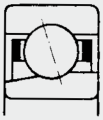
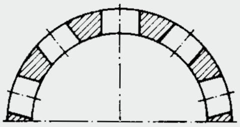
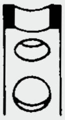
High precision single row angular contact ball bearings series 70C, 72C, 70A and 72A are fitted with textolite cages (textile fibre reinforced phenol resins).

At special request (high speeds, large sizes), bearings series 70C, 72C, 70A and 72A are fitted with machined brass cages. Cages of glass fibre reinforced polyamide 6.6 are also used with good results if operating temperature doesn't exceed +120°C.

Cages design and some technical data are given in table 4

Cages design and some technical data

Table 4

Cage	**Design** bearing	cage	**Application**	**Max. value** $D_m n$ oil	grease
Pressed sheet cage		 	- General application - Moderate speeds - Bearings series 72B, 73B	600×10^3	450×10^3
Machined brass cage M,MA,MB		 	- General application - High speeds - Bearings: 7231B-7238B 7310B-7338B	1100×10^3	800×10^3
Polyamide cage TN		 	- General application - Low friction moment - High speeds	1100×10^3	900×10^3
Textolite cage T,TA,TB		 	- High accuracy bearings series: 70C, 72C, 70A, 72A - High speeds Low vibration level	1200×10^3	900×10^3

Equivalent dynamic radial load

For single row angular contact ball bearings series 72B and 73B, single and in tandem arrangement the following equations are used:

$P_r = F_r$, kN, when $F_a/F_r \leq 1{,}14$,
$P_r = 0{,}35\, F_r + 0{,}57\, F_a$, kN, when $F_a/F_r > 1{,}14$

For bearings in DB or DF arrangement

$P_r = F_r + 0{,}65\, F_a$, kN, when $F_a/F_r \leq 1{,}14$
$P_r = 0{,}57\, F_r + 0{,}93\, F_a$, kN, when $F_a/F_r > 1{,}14$

In case of paired bearings, F_r and F_a are the loads acting upon the bearings pair.

As the load is transmitted from one raceway to the other under a certain angle to the bearing axis, the actual load will cause an axial load. This has to be considered when calculating the equivalent dynamic load, in case of two single bearings or tandem arrangements. The equations needed for calculation are given in table 5, for various arrangements and loading versions.

These equations are available for bearings mounted without clearance and without preload (clearance equal to zero).

For single row angular contact ball bearings series 70C and 72C with a contact angle $\alpha = 15°$ (C), single or in DT arrangement, the following equations are available:

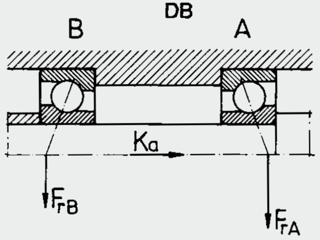
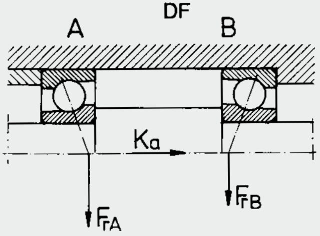
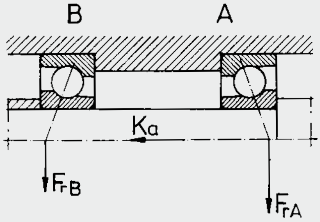
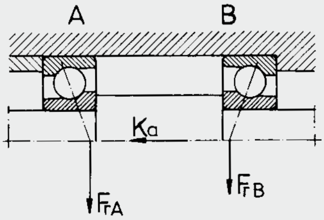
$P_r = F_r$, kN, for $F_a/F_r \leq e$
$P_r = 0{,}44F_r + YF_a$, kN, for $F_a/F_r > e$

The values of factor Y depend on the values of the ratio f_0 i F_a/C_{0r} and are given in table 6. Factor f_0 can be found in diagram as a function of dimensions series and bearing mean diameter. "i" represents the number of bearings or bearing pairs in a bearing joint.

For bearings in DB and DF arrangements, the following equations are available:

Determination of axial loads

Table 5

	Loading version	Axial load
Back-to-back arrangement DB 	1a) $F_{rA} \geq F_{rB}$ $K_a \geq 0$	$F_{aA} = 1,14\ F_{rA}$ $F_{aB} = F_{aA} + K_a$
Face-to-face arrangement DF	1b) $F_{rA} < F_{rB}$ $K_a \geq 1,14\ (F_{rB} - F_{rA})$	$F_{aA} = 1,14\ F_{rA}$ $F_{aB} = F_{aA} + K_a$
	1c) $F_{rA} < F_{rB}$ $K_a < 1,14\ (F_{rB} - F_{rA})$	$F_{aA} = F_{aB} - K_a$ $F_{aB} = 1,14\ F_{rB}$
Back-to-back arrangement DB 	2a) $F_{rA} \leq F_{rB}$ $K_a \geq 0$	$F_{aA} = F_{aB} + K_a$ $F_{aB} = 1,14\ F_{rB}$
Face-to-face arrangement DF	2b) $F_{rA} > F_{rB}$ $K_a \geq 1,14\ (F_{rA} - F_{rB})$	$F_{aA} = F_{aB} + K_a$ $F_{aB} = 1,14\ F_{rB}$
	2c) $F_{rA} > F_{rB}$ $K_a < 1,14\ (F_{rA} - F_{rB})$	$F_{aA} = 1,14\ F_{rA}$ $F_{aB} = F_{aA} - K_a$

$P_r = F_r + Y_1F_a$, kN, for $F_a/F_r \leq e$
$P_r = 0,72\ F_r + Y_2\ Fa$, kN, for $F_a/F_r > e$

The values of factors Y_1 and Y_2 depend on the ratio f_0iF_a/C_{0r} and are given in table 6 (f_0 from diagram below).

For single row angular contact ball bearings series 70A and 72A, with a contact angle $\alpha = 25°$, single or in DT arrangement, the following equations are available:

$P_r = F_r$, kN, for $F_a/F_r \leq 0,68$
$P_r = 0,41F_r + 0,87\ F_a$, kN, for $F_a/F_r > 0,68$

For bearings in DB and DF arrangement, the following equations are available:

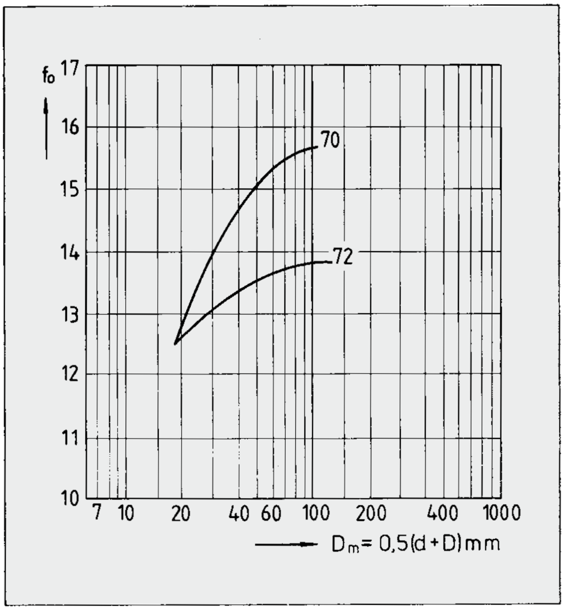
$P_r = F_r + Y_1\ F_a$, kN, for $F_a/F_r \leq e$
$P_r = 0,72\ F_r + Y_2\ F_a$, kN, for $F_a/F_r > e$

Values of factors e, Y, Y_1 and Y_2

Table 6

$\frac{f_0 \text{ i } F_a}{C_{0r}}$	e	Single and DT Y	Arrangement DB or DF Y1	Y2
0,2	0,38	1,46	1,64	2,37
0,4	0,41	1,36	1,52	2,21
0,8	0,44	1,28	1,44	2,11
1,6	0,48	1,16	1,31	1,90
3	0,52	1,08	1,21	1,78
6	0,56	1	1,12	1,66

Values for Y_1 and Y_2 are given in table 6.



Equivalent static load

For single row angular contact ball bearings series 72B and 73B with a contact angle $\alpha = 40°$, single and in DT arrangement, the following equation is available:

$P_{0r} = 0,6\ F_r + 0,26\ F_a$, kN
If $P_{0r} < F_r$, then we consider $P_0 = F_r$

For bearings in DB and DT arrangement, the following equation is available:

$P_{0r} = F_r + 0,52\ F_a$, kN

For single row angular contact ball bearings series 70C and 72C, with a contact angle $\alpha = 15°$, single and in DT arrangement, the following equation is available:

$P_{0r} = 0,5\ F_r + 0,46\ F_a$, kN

For bearings in DB and DE arrangement, the following equation is available:

$P_{0r} = 0,5\ F_r + 0,92\ F_a$, kN

For single row angular contact ball bearings series 70A and 72A with a contact angle $\alpha = 25°$, single and in DT arrangement, the following equation is available:

$P_{0r} = 0,5\ F_r + 0,38\ F_a$, kN

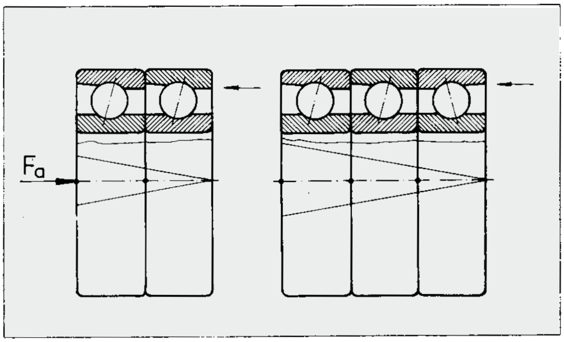
For bearings in DB and DE arrangement, the following equation is available:

$P_{0r} = F_r + 0,76\ F_a$, kN

Two "V" scratches are marked on the outside surface where the runout is maximum, i.e. where the outer ring thickness is maximum, so that the bearings of a set can be mounted in the manufacturing order. The place of maximum runout is marked on the chamfer between the inner ring bore and side face. Thus, the possible fit ovalnesses on the shaft can be compensated.

Every set is delivered as an unit, separately packed. In each unit, bearings are singly packed.

If distance rings are necessary to be mounted between bearings, they have not to be adjusted when being mounted. There is only one condition to be observed: the inner distance ring width should be equal to that of the outer ring, the side faces being parallel to each other. This can be easily done if both distance rings are simultaneously ground on a grinding and lapping machine. If bearings are mounted with distance rings, the mounting is also done observing the "V" marked as mentioned above. The cone vertex should be on the ring side opposite to that one on which the load acts (see next figure).



Basic dynamic load of paired bearings

Basic dynamic load given in bearing tables is valid for each single bearing. Basic dynamic load of a paired bearings set can be determined according to the specifications on page 26.

Basic static load of paired bearings

Basic static load of paired bearings can be similarly determined, multiplying the values of C_{0r} in the tables by

2, 3 and 4 respectively.

Bearing speed limit

Single row angular contact ball bearings are used at high speeds.

High precision bearings allow operation at higher speeds than those in the catalogue, depending on the oil lubrication system (oil bath, dropping lubrication, oil spot, with oil cooling).

The values of speeds for bearings series 72B and 73B, normal tolerance class, without preload are given in this catalogue.

In case of preloaded bearings, for single mounted bearing and bearings in DB, DF or DT arrangements, speeds should be multiplied by the coefficients in table 7.

For bearings series 70C, 72C, 70A and 72A, speeds are given for the tolerance class P4 and light preload.

In case of bearings with other values of preloads or arrangements of 3 or 4 bearing sets, the speeds of the bearing of basic design should be multiplied by the values of the coefficients in table 7.

Speed limit reduction factor

Table 7

Arrangement	**Bearing preload** UA,UO	L	M	S
Single	1,0	1,0	0,90	0,80
Tandem, DT	0,90	0,90	0,80	0,65
Back-to-back, DB	0,80	0,80	0,70	0,55
Face-to-face, DF	0,80	0,75	0,60	0,40
Three bearings set	0,75	0,70	0,55	0,35
Four bearings set	0,70	0,65	0,45	0,25

Abutment dimensions

For a proper location of bearing rings on the shaft and housing shoulder respectively, shaft (housing) maximum connection radius $r_{u\ max}$ should be less than bearing minimum mounting chamfer $r_{1min.}, r_{2min.}$

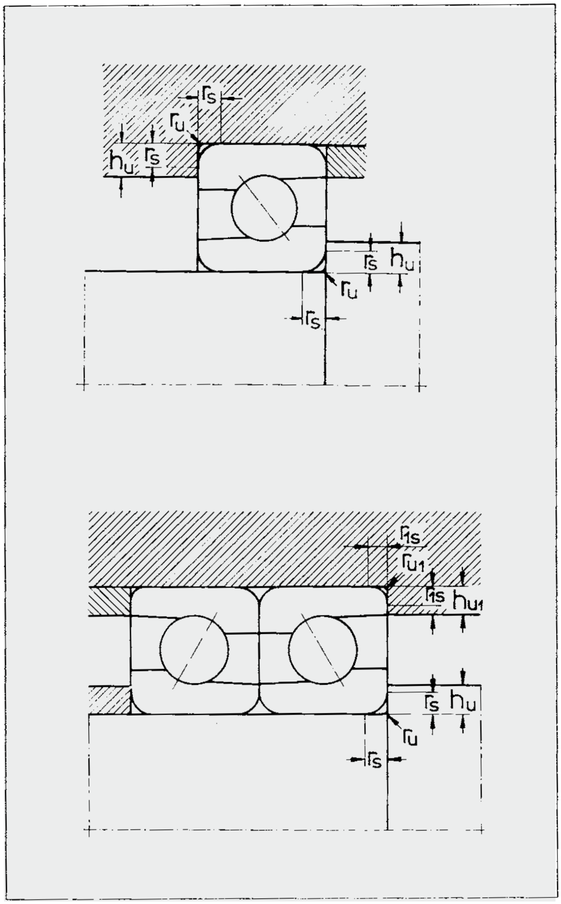
Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

The values of the connection radii and support shoulder height are given in table 8.

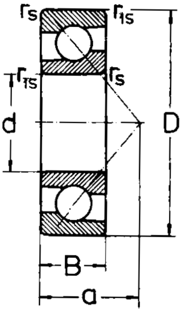
Abutment dimensions

Table 8

r_s, r_{1s} min.	**r_u , r_{u1} max.**	**h_u, h_{u1} min.**	
		Bearing series	
		718, 728 719, 729 70	72 73
mm			
0,3	0,3	1	1,2
0,6	0,6	1,6	2,1
1	1	2,3	2,6
1,1	1	3	3,5
1,5	1,5	3,5	4,5
2	2	4,4	5,5
2,1	2,1	5,1	6
3	2,5	6,2	7
4	3	7,3	8,5

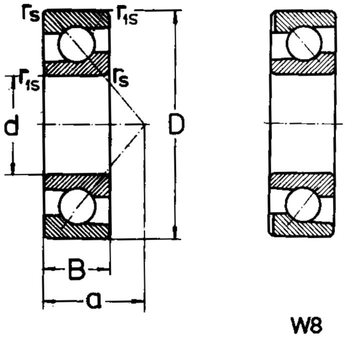


Single-row angular contact ball bearings



Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
10	30	9	0,6	0,3	13	4,95	2,5	19 000	28 000	**7200B**	0,031
12	32	10	0,6	0,3	14	7,4	3,75	17 000	24 000	**7201B**	0,045
15	35	11	0,6	0,3	16	7,45	3,9	16 000	22 000	**7202B**	0,048
	35	11	0,6	0,3	16	7,45	3,9	16 000	22 000	**7202BP6**	0,048
	35	11	0,6	0,3	16	7,45	3,9	16 000	22 000	**7202BP5**	0,048
	42	13	1	0,6	19	12,9	6,5	14 000	19 000	**7302B**	0,090
17	40	12	0,6	0,6	18	11	6,1	14 000	19 000	**7203B**	0,070
	40	12	0,6	0,6	18	11	6,1	14 000	19 000	**7203BP6**	0,070
	40	12	0,6	0,6	18	11	6,1	14 000	19 000	**7203BP5**	0,070
	47	14	1	0,6	21	14,8	8,1	12 000	17 000	**7303B**	0,120
20	47	14	1	0,6	21	14,1	8,4	11 000	16 000	**7204B**	0,110
	47	14	1	0,6	21	14,1	8,4	11 000	16 000	**7204BP6**	0,110
	47	14	1	0,6	21	14,1	8,4	11 000	16 000	**7204BP5**	0,110
	52	15	1,1	0,6	23	17,3	9,7	10 000	15 000	**7304B**	0,150
	52	15	1,1	0,6	23	17,3	9,7	10 000	15 000	**7304BP6**	0,150
25	52	15	1	0,6	24	15,5	10,1	9 500	14 000	**7205B**	0,130
	52	15	1	0,6	24	15,5	10,1	9 500	14 000	**7205BP6**	0,130
	52	15	1	0,6	24	15,5	10,1	9 500	14 000	**7205BP5**	0,130
	62	17	1,1	0,6	27	24,4	14,6	8 500	12 000	**7305B**	0,250
	62	17	1,1	0,6	27	24,4	14,6	8 500	12 000	**7305BP6**	0,250
	62	17	1,1	0,6	27	24,4	14,6	8 500	12 000	**7305AMA**	0,250
30	62	16	1	0,6	27	20,5	13,6	8 500	12 000	**7206B**	0,210
	62	16	1	0,6	27	20,5	13,6	8 500	12 000	**7206BP6**	0,210
	62	16	1	0,6	27	20,5	13,6	8 500	12 000	**7206BP5**	0,210
	62	16	1	0,6	27	20,5	13,6	8 500	12 000	**7206ATAP2**	0,210
	72	19	1,1	0,6	31	29,3	19	7 500	10 000	**7306B**	0,370
	72	19	1,1	0,6	31	29,3	19	7 500	10 000	**7306BP6**	0,370
	72	19	1,1	0,6	31	29,3	19	7 500	10 000	**7306BP5**	0,370
	72	19	1,1	0,6	31	29,3	19	7 500	10 000	**7306AMA**	0,370
35	72	17	1,1	0,6	31	28,5	19,8	7 500	10 000	**7207B**	0,300
	72	17	1,1	0,6	31	28,5	19,8	7 500	10 000	**7207BP5**	0,300
	80	21	1,5	1	35	36,7	24,3	7 000	9 500	**7307B**	0,510
	80	21	1,5	1	35	36,7	24,3	7 000	9 500	**7307BP5**	0,510
40	80	18	1,1	0,6	34	32,1	23	6 700	9 000	**7208B**	0,390
	80	18	1,1	0,6	34	32,1	23	6 700	9 000	**7208BP6**	0,390
	80	18	1,1	0,6	34	32,1	23	6 700	9 000	**7208BP5**	0,390
	90	23	1,5	1	39	44,8	30,3	6 300	8 500	**7308B**	0,670
	90	23	1,5	1	39	44,8	30,3	6 300	8 500	**7308BP6**	0,670
	90	23	1,5	1	39	44,8	30,3	6 300	8 500	**7308BP5**	0,670
45	85	19	1,1	0,6	37	36,1	26,2	6 300	8 500	**7209B**	0,440

Single-row angular contact ball bearings

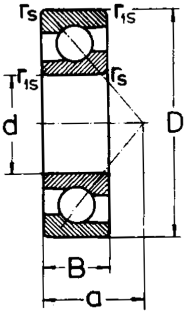


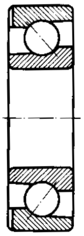
Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
45	85	19	1,1	0,6	37	36,1	26,2	6 300	8 500	7209BP5	0,440
	100	25	1,5	1	43	58,3	40,1	5 600	7 500	7309B	0,900
	100	25	1,5	1	43	58,3	40,1	5 600	7 500	7309BP6	0,900
	100	25	1,5	1	43	58,3	40,1	5 600	7 500	7309BP5	0,900
50	90	20	1,1	0,6	39	37,4	28,6	5 600	7 500	7210B	0,490
	90	20	1,1	0,6	39	37,4	28,6	5 600	7 500	7210BP6	0,490
	90	20	1,1	0,6	39	37,4	28,6	5 600	7 500	7210BP5	0,490
	110	27	2	1	47	68,2	47,9	5 000	6 700	7310B	1,15
	110	27	2	1	47	68,2	47,9	5 000	6 700	7310BP6	1,15
	110	27	2	1	47	68,2	47,9	5 000	6 700	7310BP5	1,15
55	100	21	1,5	1	43	46,2	36,2	5 300	7 000	7211B	0,650
	120	29	2	1	52	78,8	56,4	4 500	6 000	7311B	1,45
60	110	22	1,5	1	47	56,3	44,7	4 800	6 300	7212B	0,840
	110	22	1,5	1	47	56,3	44,7	4 800	6 300	7212BP5	0,840
	130	31	2,1	1,1	56	90	65,5	4 300	5 600	7312B	1,85
	130	31	2,1	1,1	56	90	65,5	4 300	5 600	7312BP5	1,85
65	120	23	1,5	1	50	63,6	52,5	4 300	5 600	7213B	1,05
	120	23	1,5	1	50	63,6	52,5	4 300	5 600	7213BP6	1,05
	120	23	1,5	1	50	63,6	52,5	4 300	5 600	7213BP5	1,05
	140	33	2,1	1,1	60	101	75,3	4 000	5 300	7313B	2,25
70	125	24	1,5	1	53	69,1	57,8	4 300	5 600	7214B	1,15
	125	24	1,5	1	53	69,1	57,8	4 300	5 600	7214B	1,15
	150	35	2,1	1,1	64	114	86	3 800	5 000	7314B	2,75
	150	35	2,1	1,1	64	114	86	3 800	5 000	7314BP6	2,75
	150	35	2,1	1,1	64	114	86	3 800	5 000	7314BP5	2,75
	150	35	2,1	1,1	64	114	86	3 800	5 000	7314BTN	2,75
75	130	25	1,5	1	56	74,8	63,2	4 000	5 300	7215B	1,30
	130	25	1,5	1	56	74,8	63,2	4 000	5 300	7215BP6	1,30
	130	25	1,5	1	56	74,8	63,2	4 000	5 300	7215BP5	1,30
	160	37	2,1	1,1	68	125	97,5	3 400	4 500	7315B	3,30
	160	37	2,1	1,1	68	125	97,3	3 400	4 500	7315BMAP6	3,30
	160	37	2,1	1,1	68	125	97,5	3 400	4 500	7315AMA	3,30
80	140	26	2	1	59	80,5	69,3	3 800	5 000	7216B	1,55
	170	39	2,1	1,1	72	135	109	3 200	4 300	7316B	3,90
	170	39	2,1	1,1	72	135	109	3 200	4 300	7316BP6	3,90
	170	39	2,1	1,1	72	135	109	3 200	4 300	7316BMAP6	3,90
85	150	28	2	1	64	93,1	81,1	3 400	4 500	7217B	1,95
	180	41	3	1,1	76	145	122	3 000	4 000	7317B	4,60
85	180	41	3	1,1	76	145	122	3 000	4 000	7317BP6	4,60
	180	41	3	1,1	76	145	122	3 000	4 000	7317BMP6	4,60

Single-row angular contact ball bearings

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
90	160	30	2	1	67	107	93,8	3 200	4 300	**7218B**	2,40
	160	30	2	1	67	107	93,8	3 200	4 300	**7218BMB**	2,40
	190	43	3	1,1	80	156	135	2 800	3 800	**7318B**	5,40
95	170	32	2,1	1,1	71	116	101	3 000	4 000	**7219B**	2,90
	200	45	3	1,1	84	168	150	2 600	3 600	**7319B**	6,25
100	180	34	2,1	1,1	76	129	116	2 800	3 800	**7220B**	3,45
	180	34	2,1	1,1	76	129	116	2 800	3 800	**7220BP6**	3,45
	180	34	2,1	1,1	76	129	116	2 800	3 800	**7220BMA**	3,45
	180	34	2,1	1,1	76	129	116	2 800	3 800	**7220BMAP6**	3,45
	180	34	2,1	1,1	76	129	116	2 800	3 800	**7220BMAP4**	3,45
	180	34	2,1	1,1	76	129	116	2 800	3 800	**7220BMB**	3,45
	215	47	3	1,1	90	190	178	2 400	3 400	**7320B**	7,75
	215	47	3	1,1	90	190	178	2 400	3 400	**7320BP6**	7,75
	215	47	3	1,1	90	190	178	2 400	3 400	**7320BM**	7,75
110	200	38	2,1	1,1	84	153	145	2 400	3 400	**7222B**	4,80
	200	38	2,1	1,1	84	153	145	2 400	3 400	**7222BMB**	4,80
	240	50	3	1,1	99	248	229	2 000	3 000	**7322B**	10,5
	240	50	3	1,1	99	248	229	2 000	3 000	**7322BP5**	10,5
	240	50	3	1,1	99	248	229	2 000	3 000	**7322BM**	10,5
140	250	42	3	1,1	103	191	210	1 700	2 400	**7228B**	8,80
	300	62	4	1,5	123	290	334	1 700	2 400	**7328B**	21,6
	300	62	4	1,5	123	290	334	1 700	2 400	**7328BMBP5**	21,6
150	190	24	1,1	0,6	35	60,5	79,2	2 200	3 000	**72830CMA**	3,36
	270	45	3	1,1	111	195	222	2 000	2800	**7230BM**	11,6
	320	65	4	1,5	131	317	380	1 600	2 000	**7330BM**	26,5
	320	65	4	1,5	131	317	380	1 600	2 000	**7330BMP5**	26,5
160	220	28	2	1	58	110	134	2 200	3 000	**71932AMAP5**	3,26
180	250	33	2	2	33	131	162	2 000	2 800	**71936AM**	5,36
200	250	30	1,5	0,6	45	102	141	3 000	5 600	**72840CMAP4**	3,43
	310	51	2,1	1,5	118	224	296	1 800	2 600	**7040A2MAP6**	14,5
	420	80	5	2	170	387	538	1 600	2 000	**7340BMAW8**	62,2
220	300	38	2,1	1,1	128	160	210	2 000	2 800	**71944BFS1F2**	7,25
240	320	38	2,1	1,1	154	159	217	2 000	2 800	**71948BMP6**	8,10
	360	56	3	3	137	255	355	1 600	2 200	**7048BMAP5**	20,0
260	360	46	3,5	3,5	171	215	308	1 600	2 000	**71952BMP6**	13,8
	400	65	4	4	118	316	475	1 300	1 800	**7052BA1MAP6W8**	29,7
280	380	46	2,1	2,1	180	221	327	1 300	1 800	**71956BMP6**	14,8
320	400	48	2,1	2,1	72	233	350	1 200	1 600	**72864CMBP5**	12,1

Single-row angular contact ball bearings

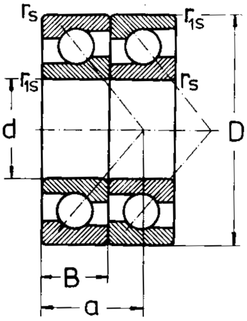




W8

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
360	480	56	3	3	149	308	511	1 000	1 400	**71972A1MBP5**	25,0
460	680	100	6	6	215	701	1 440	700	1 000	**7092A1M**	119
560	750	85	5	4	130	753	1 738	630	900	**719/560CMAP6**	106,7
600	730	60	3	3	222	511	1 140	630	900	**718/600A1MB**	52,2
	800	90	5	2	138,8	750	1 797	600	850	**719/600CMAP6**	128
670	820	69	4	4	134	620	1 466	560	800	**718/670CMAP6**	77,9
	820	69	4	4	134	620	1 466	560	800	**718/670CMBP6**	77,3
800	980	82	5	5	298	590	1 473	480	670	**718/800A1FBP5**	152
850	1 120	118	6	6	343,3	880	2 423	430	600	**719/850A1FBP5**	363
1 060	1 280	100	6	6	322,8	906	2 805	360	500	**718/1060AFB**	338

Angular contact ball bearings (Matched Pair)



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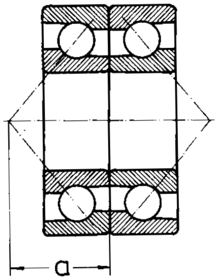

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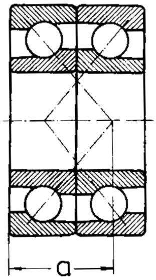

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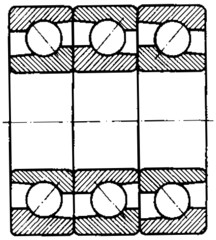
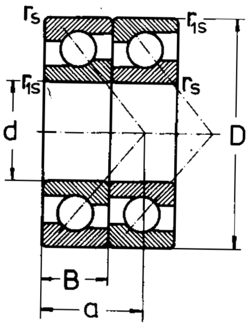


TFT

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
15	35	11	0,6	0,3	16	12	7,8	14 000	20 000	7202BDT	0,096
	35	11	0,6	0,3	16	12	7,8	13 000	18 000	7202BDB	0,096
	35	11	0,6	0,3	16	12	7,8	14 000	20 000	7202BP6DT	0,096
	35	11	0,6	0,3	16	12	7,8	13 000	18 000	7202BP5DB	0,096
17	40	12	0,6	0,6	18	17,8	12,2	13 000	17 000	7203BDT	0,140
	40	12	0,6	0,6	18	17,8	12,2	11 000	15 000	7203BDB	0,140
	40	12	0,6	0,6	18	17,8	12,2	11 000	15 000	7203BDF	0,140
	40	12	0,6	0,6	18	17,8	12,2	11 000	15 000	7203BP6DB	0,140
	40	12	0,6	0,6	18	17,8	12,2	11 000	15 000	7203BP5DB	0,140
	47	14	1	0,6	21	24	16,2	11 000	15 000	7303BDT	0,240
20	47	14	1	0,6	21	22,8	16,8	10 000	14 000	7204BDT	0,220
	47	14	1	0,6	21	22,8	16,8	10 000	14 000	7204BDB	0,220
	47	14	1	0,6	21	22,8	16,8	9 000	13 000	7204BDF	0,220
	47	14	1	0,6	21	22,8	16,8	9 000	13 000	7204BP6DB	0,220
	47	14	1	0,6	21	22,8	16,8	9 000	13 000	7204BP5DB	0,220
	52	15	1,1	0,6	23	28	19,4	9 000	14 000	7304BDT	0,300
	52	15	1,1	0,6	23	28	19,4	8 000	12 000	7304BDB	0,300
	52	15	1,1	0,6	23	28	19,4	8 000	12 000	7304BDF	0,300
25	52	15	1	0,6	24	25,1	20,2	9 000	13 000	7205BDT	0,260
	52	15	1	0,6	24	25,1	20,2	7 500	11 000	7205BDB	0,260
	52	15	1	0,6	24	25,1	20,2	7 500	11 000	7205BDF	0,260
	52	15	1	0,6	24	25,1	20,2	7 500	11 000	7205BP6DB	0,260
	52	15	1	0,6	24	25,1	20,2	9 000	13 000	7205BP5DT	0,260
	52	15	1	0,6	24	25,1	20,2	7 500	11 000	7205BP5DB	0,260
	52	15	1	0,6	24	33,5	30,3	7 000	10 000	7205BP5TFT	0,390
	62	17	1,1	0,6	27	39,5	29,2	7 500	11 000	7305BDT	0,500
	62	17	1,1	0,6	27	39,5	29,2	6 700	9 500	7305BDB	0,500
	62	17	1,1	0,6	27	39,5	29,2	6 700	9 500	7305BDF	0,500
	62	17	1,1	0,6	27	39,5	29,2	6 700	9 500	7305AMADF	0,500
30	62	16	1	0,6	27	33,2	27,2	7 500	11 000	7206BDT	0,420
	62	16	1	0,6	27	33,2	27,2	6 700	9 500	7206BDB	0,420
	62	16	1	0,6	27	33,2	27,2	6 700	9 500	7206BDF	0,420
	62	16	1	0,6	27	33,2	27,2	6 700	9 500	7206BP6DB	0,420
	62	16	1	0,6	27	33,2	27,2	6 700	9 500	7206BP5DB	0,420
	62	16	1	0,6	27	33,2	27,2	6 700	9 500	7206BP5DF	0,420
	62	16	1	0,6	27	44,3	40,8	6 000	8 500	7206BP5TFT	0,630
	62	16	1	0,6	27	33,2	27,2	7 500	11 000	7206ATAP2DT	0,420
	72	19	1,1	0,6	31	47,5	38	6 700	9 000	7306BDT	0,740
	72	19	1,1	0,6	31	47,5	38	6 000	8 000	7306BDB	0,740
	72	19	1,1	0,6	31	47,5	38	6 000	8 000	7306BDF	0,740
	72	19	1,1	0,6	31	63,3	57	5 300	7 000	7306BTFT	1,11
	72	19	1,1	0,6	31	77,4	76	5 300	7 000	7306BQFC	1,48

Angular contact ball bearings (Matched Pair)



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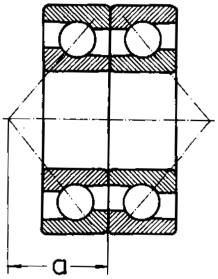

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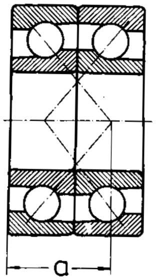

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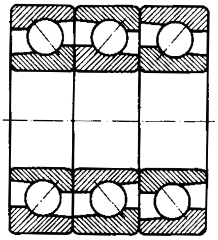
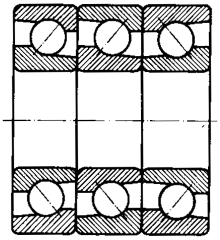


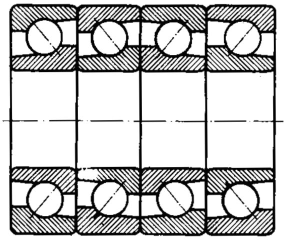
TFT

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
30	72	19	1,1	0,6	31	47,5	38	6 700	9 000	**7306BP5DT**	0,740
	72	19	1,1	0,6	31	47,5	38	6 700	9 000	**7306AMADT**	0,740
	72	19	1,1	0,6	31	47,5	38	6 000	8 000	**7306AMADF**	0,740
35	72	17	1,1	0,6	31	46,2	39,6	6 700	9 000	**7207BDT**	0,600
	72	17	1,1	0,6	31	46,2	39,6	6 000	8 000	**7207BDB**	0,600
	72	17	1,1	0,6	31	46,2	39,6	6 000	8 000	**7207BDF**	0,600
	72	17	1,1	0,6	31	46,2	39,6	6 700	9 000	**7207BP5DT**	0,600
	72	17	1,1	0,6	31	46,2	39,6	6 000	8 000	**7207BP5DB**	0,600
	72	17	1,1	0,6	31	61,6	59,4	5 300	7 000	**7207BP5TBT**	0,900
	72	17	1,1	0,6	31	75,2	79,2	5 300	7 000	**7207BP5QFC**	1,20
	80	21	1,5	1	35	59,5	48,6	6 300	8 500	**7307BDT**	1,02
	80	21	1,5	1	35	59,5	48,6	5 600	7 500	**7307BDB**	1,02
	80	21	1,5	1	35	59,5	48,6	5 600	7 500	**7307BDF**	1,02
	80	21	1,5	1	35	59,5	48,6	5 600	7 500	**7307BP6DB**	1,02
40	80	18	1,1	0,6	34	52	46	6 000	8 000	**7208BDT**	0,780
	80	18	1,1	0,6	34	52	46	6 030	8 100	**7208BDB**	0,780
	80	18	1,1	0,6	34	52	46	5 300	7 000	**7208BDF**	0,780
	80	18	1,1	0,6	34	52	46	6 000	8 000	**7208BP5DT**	0,780
	80	18	1,1	0,6	34	52	46	5 300	7 000	**7208BP5DB**	0,780
	90	23	1,5	1	39	72,6	60,6	5 600	7 500	**7308BDT**	1,34
	90	23	1,5	1	39	72,6	60,6	5 000	6 700	**7308BDB**	1,34
	90	23	1,5	1	39	72,6	60,6	5 000	6 700	**7308BDF**	1,34
	90	23	1,5	1	39	96,8	91,8	4 500	6 000	**7308BTFT**	0,670
	90	23	1,5	1	39	118	121	4 500	6 000	**7308BQFC**	2,68
	90	23	1,5	1	39	72,6	60,6	5 000	6 700	**7308BP6DF**	1,34
	90	23	1,5	1	39	72,6	60,6	5 000	6 700	**7308BP5DB**	1,34
	90	23	1,5	1	39	96,8	91,8	4 500	6 000	**7308BP5TFT**	2,01
	90	23	1,5	1	39	118	121	4 500	6 000	**7308BP5QFC**	2,68
45	85	19	1,1	0,6	37	58,5	52,4	5 600	7 500	**7209BDT**	0,880
	85	19	1,1	0,6	37	58,5	52,4	5 000	6 700	**7209BDB**	0,880
	85	19	1,1	0,6	37	58,5	52,4	5 000	6 700	**7209BDF**	0,880
	85	19	1,1	0,6	37	58,5	52,4	5 000	6 700	**7209BP5DB**	0,880
	100	25	1,5	1	43	94,4	80,2	5 000	6700	**7309BDT**	1,80
	100	25	1,5	1	43	94,4	80,2	4 500	6 000	**7309BDB**	1,80
	100	25	1,5	1	43	94,4	80,2	4 480	6 000	**7309BDF**	1,80
	100	25	1,5	1	43	94,4	80,2	4 500	6 000	**7309BP6DB**	1,80
	100	25	1,5	1	43	94,4	80,2	4 500	6 000	**7309BP6DF**	1,80
50	90	20	1,1	0,6	39	60,6	57,2	5 000	6 700	**7210BDT**	0,980
	90	20	1,1	0,6	39	60,6	57,2	4 500	6 000	**7210BDF**	0,980
	90	20	1,1	0,6	39	60,6	57,2	5 000	6 700	**7210BP5DT**	0,980
	90	20	1,1	0,6	39	60,6	57,2	4 500	6 000	**7210BP5DB**	0,980
	110	27	2	1	47	111	95,8	4 500	6 000	**7310BDT**	2,30

Angular contact ball bearings (Matched Pair)



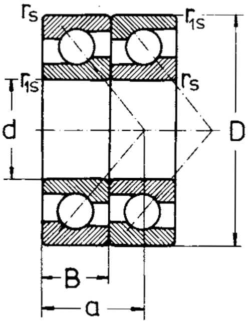
TBT



QFC

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
50	110	27	2	1	47	111	95,8	4 000	5 300	7310BDB	2,30
	110	27	2	1	47	111	95,8	4 000	5 300	7310BDF	2,30
	110	27	2	1	47	205	144	3 600	4 800	7310BP5TFT	3,45
	110	27	2	1	47	273	192	3 600	4 800	7310BP5QFC	4,60
55	100	21	1,5	1	43	74,8	72,4	4 800	6 300	7211BDT	1,30
	100	21	1,5	1	43	74,8	72,4	4 300	5 600	7211BDB	1,30
	100	21	1,5	1	43	74,8	72,4	4 300	5 600	7211BDF	1,30
	120	29	2	1	51	128	113	4 000	5 300	7311BDT	2,90
	120	29	2	1	51	128	113	3 600	4 800	7311BDB	2,90
	120	29	2	1	52	128	113	3 600	4 800	7311BDF	2,90
60	110	22	1,5	1	47	91,2	89,4	4 300	5 600	7212BDT	1,68
	110	22	1,5	1	47	91,2	89,4	3 800	5 000	7212BDB	1,68
	110	22	1,5	1	47	91,2	89,4	3 800	5 000	7212BDF	1,68
	110	22	1,5	1	47	91,2	89,4	3 800	5 000	7212BP5DB	1,68
	130	31	2,1	1,1	55	146	131	3800	5 000	7312BDT	3,70
	130	31	2,1	1,1	55	146	131	3 400	4 500	7312BDB	3,70
	130	31	2,1	1,1	55	146	131	3 400	4 500	7312BDF	3,70
	130	31	2,1	1,1	55	146	131	3 400	4 500	7312BP5DB	3,70
65	120	23	1,5	1	50	103	105	3 800	5 000	7213BDT	2,10
	120	23	1,5	1,1	50	103	105	3 800	5 000	7213BDB	2,10
	120	23	1,5	1,1	50	103	105	3 800	5 000	7213BDF	2,10
	120	23	1,5	1	50	103	105	3 400	4 500	7213BP6DB	2,10
	120	23	1,5	1	50	103	105	3 400	4 500	7213BP6DF	2,10
	140	33	2,1	1,1	60	164	151	3 600	4 800	7313BDT	4,50
	140	33	2,1	1,1	60	164	151	3 200	4 300	7313BDB	4,50
	140	33	2,1	1,1	60	164	151	3 200	4 300	7313BDF	4,50
70	125	24	1,5	1	53	112	116	3 800	5 000	7214BDT	2,30
	125	24	1,5	1	53	112	116	3 400	4 500	7214BDB	2,30
	125	24	1,5	1	53	112	116	3 400	4 500	7214BDF	2,30
	150	35	2,1	1,1	64	185	172	3 400	4 500	7314BDT	5,50
	150	35	2,1	1,1	64	185	172	3 000	4 000	7314BDB	5,50
	150	35	2,1	1,1	64	185	172	3 000	4 000	7314BDF	5,50
	150	35	2,1	1,1	64	185	172	3 400	4 500	7314BP6DT	5,50
	150	35	2,1	1,1	64	185	172	3 400	4 500	7314BP5DT	5,50
	150	35	2,1	1,1	64	185	172	3 000	4 000	7314BP5DB	5,50
75	130	25	1,5	1	56	121	126	3 600	4 300	7215BDT	2,60
	130	25	1,5	1	56	121	126	3 200	4 300	7215BDB	2,60
	130	25	1,5	1	56	121	126	3 200	4 300	7215BDF	2,60
	130	25	1,5	1	56	121	126	3 200	4 300	7215BP6DB	2,60
	130	25	1,5	1	56	121	126	3 200	4 300	7215BMAP6DB	2,60
	160	37	2,1	1,1	68	203	195	3 200	4 000	7315BDT	6,60
	160	37	2,1	1,1	68	203	195	2 800	3 600	7315BDB	6,60

Angular contact ball bearings (Matched Pair)



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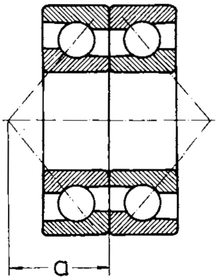

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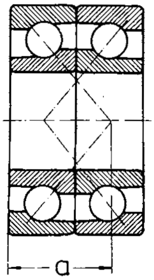

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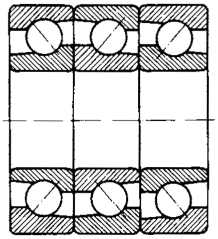
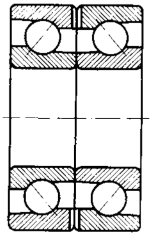


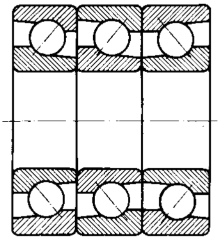
TFT

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
75	160	37	2,1	1,1	68	203	195	2 800	3 600	7315BDF	6,60
	160	37	2,1	1,1	68	203	195	2 800	3 600	7315AMADF	6,60
80	110	16	1	1	21	55,1	69,2	4 000	5 300	71916CTAP4DT	0,736
	140	26	2	1	59	130	139	3 200	4 300	7216BDT	3,10
	140	26	2	1	59	130	139	2 800	3 800	7216BDB	3,10
	140	26	2	1	59	130	139	2 800	3 800	7216BDF	3,10
	170	39	2,1	1,1	72	219	218	2 800	3 800	7316BDT	7,80
	170	39	2,1	1,1	72	219	218	2 600	3 400	7316BDB	7,80
	170	39	2,1	1,1	72	219	218	2 600	3 400	7316BDF	7,80
	170	39	2,1	1,1	72	292	327	2 200	3 000	7316BTBT	11,7
	170	39	2,1	1,1	72	219	218	2 800	3 800	7316BP6DT	7,80
	170	39	2,1	1,1	72	292	327	2 200	3 000	7316BMAP6TBT	11,7
85	150	28	2	1	64	151	162	3 000	4 000	7217BDT	3,90
	150	28	2	1	64	151	162	2 800	3 600	7217BDB	3,90
	150	28	2	1	64	151	162	2 800	3 600	7217BDF	3,90
	180	41	3	1,1	76	235	244	2 800	3 600	7317BDT	9,20
	180	41	3	1,1	76	235	244	2 400	3 200	7317BDB	9,20
	180	41	3	1,1	76	235	244	2 400	3 200	7317BDF	9,20
90	160	30	2	1	67	173	188	2 800	3 800	7218BDT	4,80
	160	30	2	1	67	173	188	2 600	3 400	7218BDB	4,80
	160	30	2	1	67	173	188	2 600	3 400	7218BDF	4,80
	190	43	3	1,1	80	253	270	2 600	3 400	7318BDT	10,8
	190	43	3	1,1	80	253	270	2 200	3 000	7318BDB	10,8
	190	43	3	1,1	80	253	270	2 200	3 000	7318BDF	10,8
	190	43	3	1,1	80	337	405	2 000	2 600	7318BTBT	16,2
95	170	32	2,1	1,1	72	188	202	2 800	3 600	7219BDT	5,80
	170	32	2,1	1,1	72	188	202	2 400	3 200	7219BDB	5,80
	170	32	2,1	1,1	72	188	202	2 400	3 200	7219BDF	5,80
	200	45	3	1,1	84	272	300	2 400	3 200	7319BDT	12,5
	200	45	3	1,1	84	272	300	2 000	2 800	7319BDB	12,5
	200	45	3	1,1	84	272	300	2 000	2 800	7319BDF	12,5
100	180	34	2,1	1,1	76	208	232	2 600	3 400	7220BDT	6,90
	180	34	2,1	1,1	76	208	232	2 200	3 000	7220BDB	6,90
	180	34	2,1	1,1	76	208	232	2 200	3 000	7220BDF	6,90
	180	34	2,1	1,1	76	208	232	2 200	3 000	7220BMADB	6,90
	180	34	2,1	1,1	76	208	232	2 200	3 000	7220BMAP6DB	6,90
	180	34	2,1	1,1	76	208	232	2 600	2 800	7220BMAP4DT	6,90
	215	47	3	1,1	90	308	356	2 200	3 000	7320BDT	15,5
	215	47	3	1,1	90	308	356	1 900	2 800	7320BDB	15,5
	215	47	3	1,1	90	308	356	1 900	2 800	7320BDF	15,5
	215	47	3	1,1	90	308	356	2 200	3 000	7320BP6DT	15,5

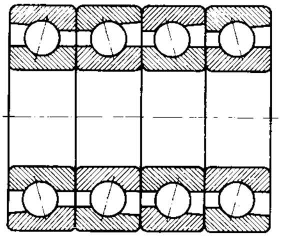
Angular contact ball bearings (Matched Pair)



DB W8



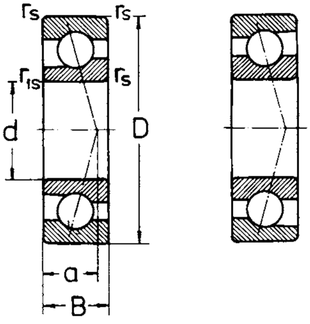
TBT



QBT

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
100	215	47	3	1,1	90	308	356	2 200	3 000	7320BMDT	15,5
110	200	38	2,1	1,1	84	248	290	2 200	3 000	7222BDT	9,60
	200	38	2,1	1,1	84	248	290	1 900	2 800	7222BDB	9,60
	240	50	3	1,1	99	365	458	1 800	2 800	7322BDT	21,0
	240	50	3	1,1	99	365	458	1 600	2 400	7322BDB	21,0
	240	50	3	1,1	99	536	687	1 400	2 200	7322BTBT	31,5
	240	50	3	1,1	99	365	458	1 800	2 800	7322BP5DT	21,0
	240	50	3	1,1	99	365	458	1 600	2 400	7322BMDF	21,0
140	250	42	3	1,1	103	172	189	1 400	1 900	7228BDT	17,6
	300	62	4	1,5	123	470	668	1 400	2 200	7328BDT	43,2
	300	62	4	1,5	123	470	668	1 200	1 900	7328BDB	43,2
	300	62	4	1,5	123	470	668	1 400	2 200	7328BMBP5DT	43,2
150	270	45	3	1,1	111	156	444	2 400	3 800	7230BDB	23,2
	270	45	3	1,1	111	156	444	2 400	3 800	7230BMDB	23,2
	320	65	4	1,5	131	254	760	1 400	1 800	7330BMDF	53,0
	320	65	4	1,5	131	254	760	1 400	1 800	7330BMP5DT	53,0
160	220	28	2	1	58	176	268	1 600	2 400	71932AMAP5DB	6,52
180	250	33	2	2	33	210	324	1 500	2 200	71936AMDB	10,8
200	250	30	1,5	0,6	45	165	282	1 400	2 000	72840CMAP4DB	6,86
200	250	30	1,5	0,6	45	220	423	1 300	1 800	72840CMAP4TBT	10,2
	310	51	1,1	1,5	118	361	592	1 300	1 800	7040A2MAP6DB	29,0
	420	80	5	2	170	1 023	1 076	1 200	2 000	7340BMAQBT	249
220	300	38	2,1	1,1	128	260	420	1 600	2 200	71944BFS1F2DB	14,5
240	360	56	3	1,5	137	410	700	1 300	1 800	7048BMAP6W8DB	40,0
	360	56	3	3	137	410	700	1 300	1 800	7048BMAP5DF	40,0
260	360	46	3,5	3,5	171	344	616	1 100	1 600	71952BMP6DB	27,96
	400	65	4	1,5	118	514	946	2 000	3 200	7052A2MAP6W8DB	59,5
280	380	46	2,1	2,1	180	358	654	880	1 200	71956BMP6DB	29,7
320	400	48	2,1	2,1	72	377	701	880	1 280	72864CMBP5DB	24,0
460	680	100	6	6	215	1 135	2 880	560	800	7092A1MDB	238
560	750	85	5	4	130	1 216	3 476	500	750	719/560CMAP6DB	213
600	730	60	3	3	222	825	2 280	500	750	718/600A1MBDB	104
	800	90	5	2	139	1 216	3 594	560	680	719/600CMAP6DB	257
670	820	69	4	4	134	1 000	2 932	560	670	718/670CMAP6DB	155

High precision single-row angular contact ball bearings



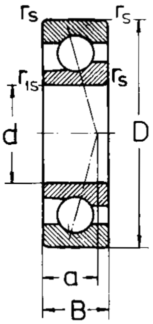
TA TB

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
10	26	8	0,3	0,1	6	5,3	2,45	56 000	90 000	**7000CTAP4**	0,020
	26	8	0,3	0,1	6	5,3	2,45	56 000	90 000	**7000CTAP2**	0,020
	30	9	0,6	0,3	7	5,8	2,95	50 000	80 000	**7200CTAP4**	0,029
	30	9	0,6	0,3	7	9,4	2,95	50 000	80 000	**7200CTAP2**	0,029
12	28	8	0,3	0,1	7	5,4	2,6	50 000	80 000	**7001CTAP4**	0,023
	28	8	0,3	0,1	7	5,4	2,6	50 000	80 000	**7001CTAP2**	0,023
	32	10	0,6	0,3	10	7,5	3,4	45 000	70 000	**7201ATAP4**	0,030
	32	10	0,6	0,3	10	7,5	3,4	45 000	70 000	**7201ATAP2**	0,030
15	32	9	0,3	0,1	8	6,3	3,4	43 000	67 000	**7002CTAP4**	0,030
	32	9	0,3	0,1	8	6,3	3,4	43 000	67 000	**7002CTAP2**	0,030
	35	11	0,6	0,3	9	8,9	4,5	40 000	63 000	**7202CTAP4**	0,042
	35	11	0,6	0,3	9	8,9	4,5	40 000	63 000	**7202CTAP2**	0,042
	35	11	0,6	0,3	12	8,7	4,4	36 000	56 000	**7202ATAP4**	0,042
	35	11	0,6	0,3	12	8,7	4,4	36 000	56 000	**7202ATAP2**	0,042
17	35	10	0,3	0,1	9	7,2	4,2	38 000	60 000	**7003CTAP4**	0,039
	35	10	0,3	0,1	9	7,2	4,2	38 000	60 000	**7003CTAP2**	0,039
	40	12	0,6	0,3	10	10,9	5,8	36 000	56 000	**7203CTAP4**	0,060
	40	12	0,6	0,3	10	10,9	5,8	36 000	56 000	**7203CTAP2**	0,060
	40	12	0,6	0,3	13	9	5,1	30 000	48 000	**7203ATAP4**	0,060
	40	12	0,6	0,3	13	9	5,1	30 000	48 000	**7203ATAP2**	0,060
20	42	12	0,6	0,3	10	10,5	6,1	32 000	50 000	**7004CTAP4**	0,070
	42	12	0,6	0,3	10	10,5	6,1	32 000	50 000	**7004CTAP2**	0,070
	42	12	0,6	0,3	10	10,5	6,1	32 000	50 000	**7004CTBP4**	0,070
	42	12	0,6	0,3	10	10,5	6,1	32 000	50 000	**7004CTBP2**	0,070
	42	12	0,6	0,3	13	10	5,8	28 000	45 000	**7004ATAP4**	0,070
	42	12	0,6	0,3	13	10	5,8	28 000	45 000	**7004ATAP2**	0,070
	47	14	1	0,6	12	15,6	9	30 000	48 000	**7204CTAP4**	0,100
	47	14	1	0,6	12	15,6	9	30 000	48 000	**7204CTAP2**	0,100
	47	14	1	0,6	12	15,6	9	30 000	48 000	**7204CTBP4**	0,100
	47	14	1	0,6	12	15,6	9	30 000	48 000	**7204CTBP2**	0,100
	47	14	1	0,6	15	14,9	8,6	26 000	43 000	**7204ATAP4**	0,100
	47	14	1	0,6	15	14,9	8,6	26 000	43 000	**7204ATAP2**	0,100
25	47	12	0,6	0,3	11	11,7	7,4	28 000	45 000	**7005CTAP4**	0,080
	47	12	0,6	0,3	11	11,7	7,4	28 000	45 000	**7005CTAP2**	0,080
	47	12	0,6	0,3	11	11,7	7,4	28 000	45 000	**7005CTBP4**	0,080
	47	12	0,6	0,3	11	11,7	7,4	28 000	45 000	**7005CTBP2**	0,080
	47	12	0,6	0,3	15	10,4	6,95	24 000	40 000	**7005ATAP4**	0,080
	47	12	0,6	0,3	15	10,4	6,95	24 000	40 000	**7005ATAP2**	0,080
	52	15	1	0,6	13	16,6	10,3	26 000	43 000	**7205CTAP4**	0,120
	52	15	1	0,6	13	16,6	10,3	26 000	43 000	**7205CTAP2**	0,120
	52	15	1	0,6	13	16,6	10,3	26 000	43 000	**7205CTBP4**	0,120
	52	15	1	0,6	13	16,6	10,3	26 000	43 000	**7205CTBP2**	0,120

High precision single-row angular contact ball bearings

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
25	52	15	1	0,6	17	13,7	8,8	22 000	38 000	**7205ATAP4**	0,120
	52	15	1	0,6	17	13,7	8,8	22 000	38 000	**7205ATAP2**	0,120
30	55	13	1	0,3	12	15,1	10,3	24 000	40 000	**7006CTAP4**	0,120
	55	13	1	0,3	12	15,1	10,3	24 000	40 000	**7006CTAP2**	0,120
	55	13	1	0,3	12	15,1	10,3	24 000	40 000	**7006CTBP4**	0,120
	55	13	1	0,3	12	15,1	10,3	24 000	40 000	**7006CTBP2**	0,120
	55	13	1	0,3	17	13,4	9,5	20 000	36 000	**7006ATAP4**	0,120
	55	13	1	0,3	17	13,4	9,5	20 000	36 000	**7006ATAP2**	0,120
	62	16	1	0,6	14	23	14,8	22 000	38 000	**7206CTAP4**	0,190
	62	16	1	0,6	14	23	14,8	22 000	38 000	**7206CTAP2**	0,190
	62	16	1	0,6	14	23	14,8	22 000	38 000	**7206CTBP4**	0,190
	62	16	1	0,6	14	23	14,8	22 000	38 000	**7206CTBP2**	0,190
	62	16	1	0,6	19	22	14,1	19 000	34 000	**7206ATAP4**	0,190
	62	16	1	0,6	19	22	14,1	19 000	34 000	**7206ATAP2**	0,190
35	62	14	1	0,3	14	19,2	13,7	20 000	36 000	**7007CTAP4**	0,160
	62	14	1	0,3	14	19,2	13,7	20 000	36 000	**7007CTAP2**	0,160
	62	14	1	0,3	14	19,2	13,7	20 000	36 000	**7007CTBP4**	0,160
	62	14	1	0,3	14	19,2	13,7	20 000	36 000	**7007CTBP2**	0,160
	62	14	1	0,3	19	18,2	13,1	18 000	32 000	**7007ATAP4**	0,160
	62	14	1	0,3	19	18,2	13,1	18 000	32 000	**7007ATAP2**	0,160
	62	14	1	0,3	19	18,2	13,1	18 000	32 000	**7007ATBP4**	0,160
	72	17	1,1	0,6	16	30,4	20,2	19 000	34 000	**7207CTAP4**	0,270
	72	17	1,1	0,6	16	30,4	20,2	19 000	34 000	**7207CTAP2**	0,270
	72	17	1,1	0,6	16	30,4	20,2	19 000	34 000	**7207CTBP4**	0,270
	72	17	1,1	0,6	16	30,4	20,2	19 000	34 000	**7207CTBP2**	0,270
	72	17	1,1	0,6	21	24,5	17	16 000	28 000	**7207ATAP4**	0,270
	72	17	1,1	0,6	21	24,5	17	16 000	28 000	**7207ATAP2**	6,270
40	68	15	1	0,3	15	20,6	15,9	19 000	34 000	**7008CTAP4**	0,190
	68	15	1	0,3	15	20,6	15,9	19 000	34 000	**7008CTAP2**	0,190
	68	15	1	0,3	20	19,5	15	16 000	28 000	**7008ATAP4**	0,190
	68	15	1	0,3	20	19,5	15	16 000	28 000	**7008ATAP2**	0,190
	68	15	1	0,3	20	19,5	15	16 000	28 000	**7008ATBP4**	0,190
	80	18	1,1	0,6	17	36,3	25,2	17 000	30 000	**7208CTAP4**	0,350
	80	18	1,1	0,6	17	36,3	25,2	17 000	30 000	**7208CTAP2**	0,350
	80	18	1,1	0,6	17	36,3	25,2	17 000	30 000	**7208CTBP4**	0,350
	80	18	1,1	0,6	17	36,3	25,2	17 000	30 000	**7208CTBP2**	0,350
	80	18	1,1	0,6	23	35,2	24,4	15 000	26 000	7208ATAP4	0,350
	80	18	1,1	0,6	23	35,2	24,4	15 000	26 000	**7208ATAP2**	0,350
	80	18	1,1	0,6	23	35,2	24,4	15 000	26 000	**7208ATBP4**	0,350
45	75	16	1	0,3	16	24,4	19,3	16 000	28 000	**7009CTAP4**	0,250
	75	16	1	0,3	16	24,4	19,3	15 000	28 000	**7009CTAP2**	0,250
	75	16	1	0,3	22	22	17,3	15 000	26 000	**7009ATAP4**	0,250

High precision single-row angular contact ball bearings



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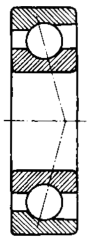


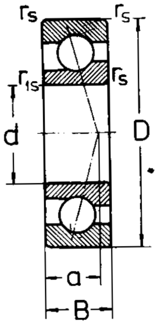
TB

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
45	75	16	1	0,3	22	22	17,3	15 000	26 000	7009ATAP2	0,250
	85	19	1,1	0,6	18	40	29	15 000	26 000	7209CTAP4	0,400
	85	19	1,1	0,6	18	40	29	15 000	26 000	7209CTAP2	0,400
	85	19	1,1	0,6	25	36,8	27,5	13 000	22 000	7209ATAP4	0,400
	85	19	1,1	0,6	25	36,8	27,5	13 000	22 000	7209ATAP2	0,400
	85	19	1,1	0,6	25	36,8	27,5	13 000	22 000	7209ATBP4	0,400
	85	19	1,1	0,6	25	36,8	27,5	13 000	22 000	7209ATBP2	0,400
50	80	16	1	0,3	17	25,1	20,7	15 000	26 000	7010CTAP4	0,260
	80	16	1	0,3	17	25,1	20,7	15 000	26 000	7010CTAP2	0,260
	80	16	1	0,3	23	23,2	20	13 000	22 000	7010ATAP4	0,260
	80	16	1	0,3	23	23,2	20	13 000	22 000	7010ATAP2	0,260
	90	20	1,1	0,6	20	42,8	31,7	14 000	24 000	7210CTAP4	0,450
	90	20	1,1	0,6	20	42,8	31,7	14 000	24 000	7210CTAP2	0,450
	90	20	1,1	0,6	27	42	31	12 000	20 000	7210ATAP4	0,450
	90	20	1,1	0,6	27	42	31	12 000	20 000	7210ATAP2	0,450
	90	20	1,1	0,6	27	42	31	12 000	20 000	7210ATBP4	0,450
	90	20	1,1	0,6	27	42	31	12 000	20 000	7210ATBP2	0,450
55	90	18	1,1	0,6	19	34,1	28,6	13 000	22 000	7011CTAP4	0,390
	90	18	1,1	0,6	19	34,1	28,6	13 000	22 000	7011CTAP2	0,390
	90	18	1,1	0,6	19	34,1	28,6	13 000	22 000	7011CTBP4	0,390
	90	18	1,1	0,6	26	32,3	27,1	12 000	20 000	7011ATAP4	0,390
	90	18	1,1	0,6	26	32,3	27,1	12 000	20 000	7011ATAP2	0,390
	100	21	1,5	1	21	53	40	12 000	20 000	7211CTAP4	0,600
	100	21	1,5	1	21	53	40	12 000	20 000	7211CTAP2	0,600
	100	21	1,5	1	29	50,6	38,3	11 000	19 000	7211ATAP4	0,600
	100	21	1,5	1	29	50,6	38,3	11 000	19 000	7211ATAP2	0,600
	100	21	1,5	1	29	50,6	38,3	11 000	19 000	7211ATBP4	0,600
	100	21	1,5	1	29	50,6	38,3	11 000	19 000	7211ATBP2	0,600
60	95	18	1,1	0,6	20	35	30,5	12 000	20 000	7012CTAP4	0,420
	95	18	1,1	0,6	20	35	30,5	12 000	20 000	7012CTAP2	0,420
	95	18	1,1	0,6	20	35	30,5	12 000	20 000	7012CTBP2	0,420
	95	18	1,1	0,6	27	33,2	29,1	11 000	19 000	7012ATAP4	0,420
	95	18	1,1	0,6	27	33,2	29,1	11 000	19 000	7012ATAP2	0,420
	110	22	1,5	1	23	64,2	49	11 000	19 000	7212CTAP4	0,770
	110	22	1,5	1	23	64	49	11 000	19 000	7212CTAP2	0,770
	110	22	1,5	1	31	61	47,5	9 500	17 000	7212ATAP4	0,770
	110	22	1,5	1	31	61	47,5	9 500	17 000	7212ATAP2	0,770
	110	22	1,5	1	31	61	47,5	9 500	17 000	7212ATBP4	0,770
	110	22	1,5	1	31	61	47,5	9 500	17 000	7212ATBP2	0,770
65	100	18	1,1	0,6	20	36	32,5	12 000	20 000	7013CTAP4	0,460
	100	18	1,1	0,6	20	36	32,5	12 000	20 000	7013CTAP2	0,460
	100	18	1,1	0,6	28	34	31	10 000	18 000	7013AMBP4	0,460

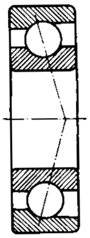
High precision single-row angular contact ball bearings

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
65	100	18	1,1	0,6	28	34	31	10 000	18 000	**7013ATAP4**	0,460
	100	18	1,1	0,6	28	34	31	10 000	18 000	**7013ATAP2**	0,460
	100	18	1,1	0,6	28	34	31	10 000	18 000	**7013ATBP4**	0,460
	120	23	1,5	1	24	72	57	10 000	18 000	**7213CTAP4**	0,970
	120	23	1,5	1	24	72	57	10 000	18 000	**7213CTAP2**	0,970
	120	23	1,5	1	33	69,5	54	9 000	16 000	**7213ATAP4**	0,970
	120	23	1,5	1	33	69,5	54	9 000	16 000	**7213ATAP2**	0,970
	120	23	1,5	1	33	69,5	54	9 000	16 000	**7213ATBP4**	0,970
	120	23	1,5	1	33	69,5	54	9 000	16 000	**7213ATBP2**	0,970
70	110	20	1,1	0,6	22	45,3	40,8	10 000	18 000	**7014CTAP4**	0,640
	110	20	1,1	0,6	22	45,3	40,8	10 000	18 000	**7014CTAP2**	0,640
	110	20	1,1	0,6	22	45,3	40,8	10 000	18 000	**7014CTBP4**	0,640
	110	20	1,1	0,6	31	43	34	9 000	16 000	**7014ATAP4**	0,640
	110	20	1,1	0,6	31	43	34	9 000	16 000	**7014ATAP2**	0,640
	125	24	1,5	1	25	76	60,2	9 500	17 000	**7214CTAP4**	1,05
	125	24	1,5	1	25	76	60,2	9 500	17 000	**7214CTAP2**	1,05
	125	24	1,5	1	35	78	57	8 500	15 000	**7214ATAP4**	1,05
	125	24	1,5	1	35	78	57	8 500	15 000	**7214ATAP2**	1,05
	125	24	1,5	1	35	78	57	8 500	15 000	**7214ATBP4**	1,05
	125	24	1,5	1	35	78	57	8 500	15 000	**7214ATBP2**	1,05
75	115	20	1,1	0,6	23	46,5	43,5	10 000	18 000	**7015CTAP4**	0,680
	115	20	1,1	0,6	23	46,5	43,5	10 000	18 000	**7015CTAP2**	0,680
	115	20	1,1	0,6	32	44	41,2	8 500	15 000	**7015ATAP4**	0,680
	115	20	1,1	0,6	32	44	41,2	8 500	15 000	**7015ATAP2**	0,680
	115	20	1,1	0,6	32	44	41,2	8 500	15 000	**7015ATBP2**	0,680
	130	25	1,5	1	26	80	65,5	9 000	16 000	**7215CTAP4**	1,15
	130	25	1,5	1	26	80	65,5	9 000	16 000	**7215CTAP2**	1,15
	130	25	1,5	1	37	73	60,5	8 000	14 000	**7215ATAP4**	1,15
	130	25	1,5	1	37	73	60,5	8 000	14 000	**7215ATAP2**	1,15
	130	25	1,5	1	37	73	60,5	8 000	14 000	**7215ATBP4**	1,15
	130	25	1,5	1	37	73	60,5	8 000	14 000	**7215ATBP2**	1,15
80	125	22	1,1	0,6	25	58,6	55	9 000	16 000	**7016CTAP4**	0,890
	125	22	1,1	0,6	25	58,7	55,2	9 000	16 000	**7016CTAP2**	0,890
	125	22	1,1	0,6	35	56	63	8 000	14 000	**7016AMAP4**	0,890
	125	22	1,1	0,6	35	56,2	63	8 000	14 000	**7016ATAP4**	0,890
	125	22	1,1	0,6	35	56	63	8 000	14 000	**7016ATAP2**	0,890
	140	26	2	1	28	92,6	78	7 500	13 000	**7216CTAP4**	1,40
	140	26	2	1	28	93,2	78	8 000	14 000	**7216CTAP2**	1,40
	140	26	2	1	39	86	73,5	7 000	12 000	**7216ATAP4**	1,40
	140	26	2	1	39	86	73,5	7 000	12 000	**7216ATAP2**	1,40
	140	26	2	1	39	86	73,5	7 000	12 000	**7216ATBP4**	1,40
	140	26	2	1	39	86	73,5	7 000	12 000	**7216ATBP2**	1,40

High precision single-row angular contact ball bearings



TA



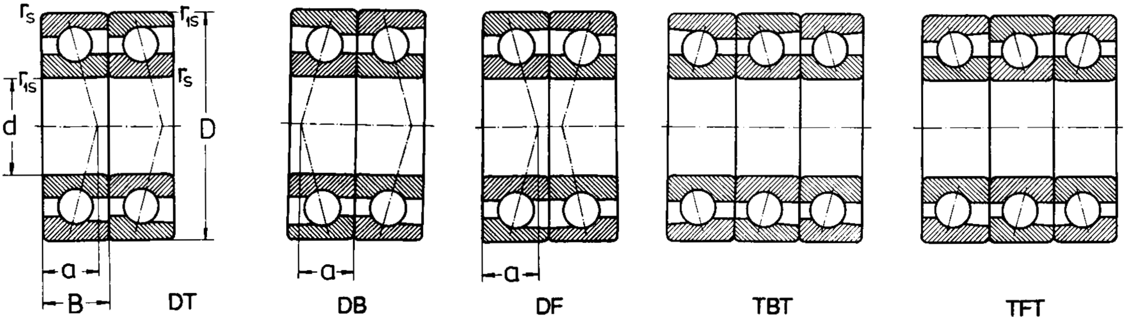
TB

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
85	130	22	1,1	0,6	26	60,2	58,6	8 500	15 000	**7017CTAP4**	0,930
	130	22	1,1	0,6	26	60,2	58,6	8 500	15 000	**7017CTAP2**	0,930
	130	22	1,1	0,6	36	57	56	7 500	13 000	**7017ATAP4**	0,930
	130	22	1,1	0,6	36	57	56	7 500	13 000	**7017ATAP2**	0,930
	150	28	2	1	30	104	90	7 500	13 000	**7217CTAP4**	1,75
	150	28	2	1	30	104	90	7 500	13 000	**7217CTAP2**	1,75
	150	28	2	1	42	98	76,5	6 700	11 000	**7217ATAP4**	1,75
	150	28	2	1	42	98	76,5	6 700	11 000	**7217ATAP2**	1,75
	150	28	2	1	42	98	76,5	6 700	11 000	**7217ATBP4**	1,75
	150	28	2	1	42	98	76,5	6 700	11 000	**7217ATBP2**	1,75
90	140	24	1,5	0,6	28	71,6	69	7 000	12 000	**7018CTAP4**	1,20
	140	24	1,5	0,6	28	71,7	69,1	7 500	13 000	**7018CTAP2**	1,20
	140	24	1,5	0,6	28	71,7	69,1	7 500	13 000	**7018CTBP4**	1,20
	140	24	1,5	0,6	39	68	65,5	6 700	11 000	**7018ATAP4**	1,20
	140	24	1,5	0,6	39	68	65,5	6 700	11 000	**7018ATAP2**	1,20
	160	30	2	1	32	123	105	7 000	12 000	**7218CTAP4**	2,15
	160	30	2	1	32	123	105	7 000	12 000	**7218CTAP2**	2,15
	160	30	2	1	44	117	100	6 000	9 500	**7218AMAP4**	2,15
	160	30	2	1	44	117	100	6 000	9 500	**7218ATAP4**	2,15
	160	30	2	1	44	117	100	6 000	9 500	**7218ATAP2**	2,15
	160	30	2	1	44	117	100	6 000	9 500	**7218ATBP4**	2,15
	160	30	2	1	44	189	100	6 000	9 500	**7218ATBP2**	2,15
95	145	24	1,5	0,6	28	73,4	73,4	8 000	14 000	**7019CTAP4**	1,25
	145	24	1,5	0,6	28	73,4	73,4	8 000	14 000	**7019CTAP2**	1,25
	145	24	1,5	0,6	40	68	66	6 300	10 000	**7019ATAP4**	1,25
	145	24	1,5	0,6	40	68	66	6 300	10 000	**7019ATAP2**	1,25
	170	32	2,1	1,1	34	130	115	6 300	10 000	**7219CTAP4**	2,65
	170	32	2,1	1,1	34	130	115	6 300	10 000	**7219CTAP2**	2,65
	170	32	2,1	1,1	47	126	110	5 600	9 000	**7219ATAP4**	2,65
	170	32	2,1	1,1	47	126	110	5 600	9 000	**7219ATAP2**	2,65
	170	32	2,1	1,1	47	126	110	5 600	9 000	**7219ATBP4**	2,65
	170	32	2,1	1,1	47	126	110	5 600	9 000	**7219ATBP2**	2,65
100	150	24	1,5	0,6	29	75,3	77,2	7 000	12 000	**7020CTAP4**	1,30
	150	24	1,5	0,6	29	75,3	77,2	7 000	12 000	**7020CTAP2**	1,30
	150	24	1,5	0,6	41	71,1	73	6 000	9 500	**7020AMBP4**	1,30
	150	24	1,5	0,6	41	71	73	6 000	9 500	**7020ATAP2**	1,30
	150	24	1,5	0,6	41	71	73	6 000	9 500	**7020ATAP4**	1,30
	180	34	2,1	1,1	36	148,	127	6 000	9 500	**7220CTAP4**	3,20
	180	34	2,1	1,1	36	150	127	6 000	9 500	**7220CTAP2**	3,15
	180	34	2,1	1,1	50	142	121	5300	8 500	**7220AMAP4**	3,15
	180	34	2,1	1,1	50	142	121	5 300	8 500	**7220ATAP4**	3,15
	180	34	2,1	1,1	50	142	121	5 300	8 500	**7220ATAP2**	3,15
	180	34	2,1	1,1	50	142	121	5 300	8 500	**7220ATBP4**	3,15

High precision single-row angular contact ball bearings

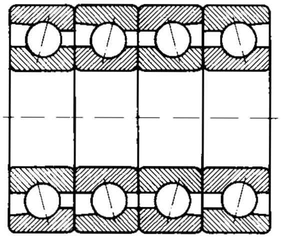
Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
100	180	34	2,1	1,1	50	142	121	5 300	8 000	**7220ATBP2**	3,15
105	160	26	2	1	31	87	89	5 600	8 500	**7021CTAP4**	1,66
110	170	28	2	1	47	104	104	5 300	8 000	**7022ATAP4**	3,20
120	180	28	2	2	34	109	111	5 000	7 500	**7024CTBP4**	2,08
	180	28	2	2	49	104	105	5 000	7 500	**7024AMAP4**	2,29
	180	28	2	2	49	104	105	5 000	7 500	**7024ATAP4**	2,29
130	200	33	2	1	39	145	99	6 300	8 500	**7026CMAP4**	3,19
	200	33	2	1	39	145	149	5 600	7 500	**7026CTAP4**	3,19
150	225	35	2,1	1,1	61	159	173	4 500	6 000	**7030CMAP4**	4,32
	225	35	2,1	1,1	61	159	173	4 500	6 000	**7030CTAP4**	4,32
	225	35	2,1	1,1	61	159	173	5 000	6 700	**7030AMAP4**	4,32

High precision single-row angular contact ball bearings (Matched pair)



Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
10	26	8	0,3	0,1	6	8,6	4,9	48 000	80 000	7000CTAP4DT	0,040
	26	8	0,3	0,1	6	8,6	4,9	43 000	70 000	7000CTAP4DB	0,040
	26	8	0,3	0,1	6	8,6	4,9	43 000	70 000	7000CTAP4DF	0,040
	30	9	0,6	0,3	7	9,4	5,9	43 000	70 000	7200CTAP4DT	0,058
	30	9	0,6	0,3	7	9,4	5,9	38 000	63 000	7200CTAP4DB	0,058
	30	9	0,6	0,3	7	9,4	5,9	38 000	63 000	7200CTAP4DF	0,058
12	28	8	0,3	0,1	7	8,75	5,2	43 000	70 000	7001CTAP4DT	0,046
	28	8	0,3	0,1	7	8,75	5,2	38 000	63 000	7001CTAP4DB	0,046
	28	8	0,3	0,1	7	8,75	5,2	38 000	63 000	7001CTAP4DF	0,046
	32	10	0,6	0,3	10	12,2	6,8	38 000	63 000	7201ATAP4DT	0,060
	32	10	0,6	0,3	10	12,2	6,8	34 000	56 000	7201ATAP4DB	0,060
	32	10	0,6	0,3	10	12,2	6,8	34 000	56 000	7201ATAP4DF	0,060
15	32	9	0,3	0,1	8	10,2	6,8	36 000	60 000	7002CTAP4DT	0,060
	32	9	0,3	0,1	8	10,2	6,8	32 000	53 000	7002CTAP4DB	0,060
	32	9	0,3	0,1	8	10,2	6,8	32 000	53 000	7002CTAP4DF	0,060
	32	9	0,3	0,1	8	16,6	13,6	28 000	48 000	7002CTAP4QBC	0,120
	32	9	0,3	0,1	8	10,2	6,8	36 000	60 000	7002CTAP2DT	0,060
	32	9	0,3	0,1	8	10,2	6,8	36 000	60 000	7002CTBP4DT	0,060
	35	11	0,6	0,3	9	14,4	9	34 000	56 000	7202CTAP4DT	0,084
	35	11	0,6	0,3	9	14,4	9	30 000	50 000	7202CTAP4DB	0,084
	35	11	0,6	0,3	9	14,4	9	30 000	50 000	7202CTAP4DF	0,084
	35	11	0,6	0,3	12	14,1	8,8	30 000	50 000	7202ATAP4DT	0,048
	35	11	0,6	0,3	12	14,1	8,8	28 000	45 000	7202ATAP4DB	0,048
	35	11	0,6	0,3	12	14,1	8,8	28 000	45 000	7202ATAP4DF	0,048
	35	11	0,6	0,3	12	14,1	8,8	28 000	45 000	7202ATAP2DB	0,084
17	35	10	0,3	0,1	9	11,7	8,4	32 000	53 000	7003CTAP4DT	0,078
	35	10	0,3	0,1	9	11,7	8,4	28 000	48 000	7003CTAP4DB	0,078
	35	10	0,3	0,1	9	11,7	8,4	28 000	48 000	7003CTAP4DF	0,078
	35	10	0,3	0,1	9	15,6	16,8	28 000	45 000	7003CTAP4TBT	0,117
	35	10	0,3	0,1	9	11,7	8,4	28 000	48 000	7003CTAP2DB	0,078
	40	12	0,6	0,3	10	17,7	11,6	30 000	50 000	7203CTAP4DT	0,120
	40	12	0,6	0,3	10	17,7	11,6	28 000	45 000	7203CTAP4DB	0,120
	40	12	0,6	0,3	10	17,7	11,6	28 000	45 000	7203CTAP4DF	0,120
	40	12	0,6	0,3	13	14,6	10,2	26 000	43 000	7203ATAP4DT	0,120
	40	12	0,6	0,3	13	14,6	10,2	22 000	38 000	7203ATAP4DB	0,120
	40	12	0,6	0,3	13	14,6	10,2	22 000	38 000	7203ATAP4DF	0,120
20	42	12	0,6	0,3	10	17	12,2	28 000	45 000	7004CTAP4DT	0,140
	42	12	0,6	0,3	10	17	12,2	24 000	40 000	7004CTAP4DB	0,140
	42	12	0,6	0,3	10	17	12,2	24 000	40 000	7004CTAP4DF	0,140
	42	12	0,6	0,3	10	27,7	24,4	22 000	36 000	7004CTAP4QBC	0,280
	42	12	0,6	0,3	10	17	12,2	24 000	40 000	7004CTAP2DB	0,140

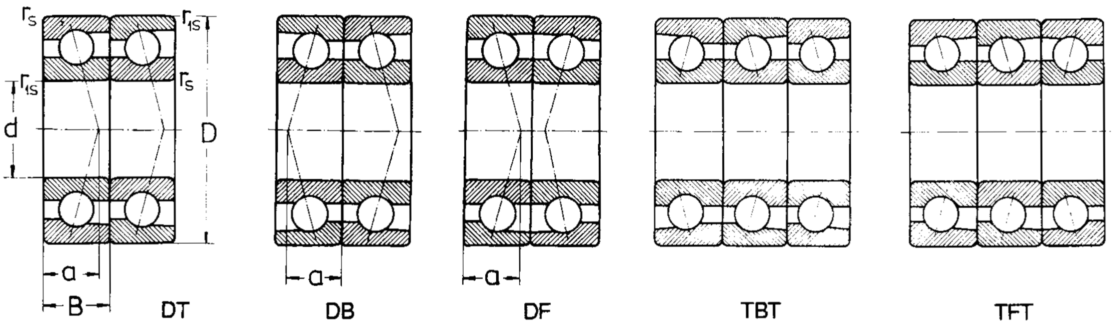
High precision single-row angular contact ball bearings (Matched pair)



QBC

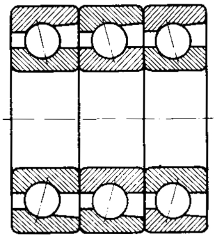
Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
20	42	12	0,6	0,3	10	17	12,2	24 000	40 000	7004CTBP4DB	0,140
	42	12	0,6	0,3	10	17	12,2	28 000	45 000	7004CTBP2DT	0,140
	42	12	0,6	0,3	13	16,2	11,6	24 000	40 000	7004ATAP4DT	0,140
	42	12	0,6	0,3	13	16,2	11,6	22 000	36 000	7004ATAP4DB	0,140
	42	12	0,6	0,3	13	16,2	11,6	22 000	36 000	7004ATAP4DF	0,140
	47	14	1	0,6	12	25,3	18	26 000	43 000	7204CTAP4DT	0,200
	47	14	1	0,6	12	25,3	18	22 000	38 000	7204CTAP4DB	0,200
	47	14	1	0,6	12	25,3	18	22 000	38 000	7204CTAP4DF	0,200
	47	14	1	0,6	12	25,3	18	26 000	43 000	7204CTBP4DT	0,200
	47	14	1	0,6	12	25,3	18	22 000	38 000	7204CTBP4DB	0,200
	47	14	1	0,6	12	25,3	18	22 000	38 000	7204CTBP4DF	0,200
	47	14	1	0,6	12	25,3	18	22 000	38 000	7204CTBP2DF	0,200
	47	14	1	0,6	15	24,2	17,2	22 000	38 000	7204ATAP4DT	0,200
	47	14	1	0,6	15	24,2	17,2	20 000	34 000	7204ATAP4DB	0,200
	47	14	1	0,6	15	24,2	17,2	20 000	34 000	7204ATAP4DF	0,200
25	47	12	0,6	0,3	11	17	14,8	24 000	40 000	7005CTAP4DT	0,160
	47	12	0,6	0,3	11	19	14,8	22 000	36 000	7005CTAP4DB	0,160
	47	12	0,6	0,3	11	19	14,8	22 000	36 000	7005CTAP4DF	0,160
	47	12	0,6	0,3	11	19	14,8	24 000	40 000	7005CTAP2DT	0,160
	47	12	0,6	0,3	11	19	14,8	22 000	36 000	7005CTAP2DB	0,160
	47	12	0,6	0,3	11	25,3	22,2	20 000	34 000	7005CTAP2TBT	0,240
	47	12	0,6	0,3	11	19	14,8	24 000	40 000	7005CTBP2DT	0,160
	47	12	0,6	0,3	11	19	14,8	22 000	36 000	7005CTBP2DB	0,160
	47	12	0,6	0,3	15	16,9	13,9	22 000	36 000	7005ATAP4DT	0,160
	47	12	0,6	0,3	15	16,9	13,9	19 000	32 000	7005ATAP4DB	0,160
	47	12	0,6	0,3	15	16,9	13,9	19 000	32 000	7005ATAP4DF	0,160
	52	15	1	0,6	13	26,9	20,6	22 000	38 000	7205CTAP4DT	0,240
	52	15	1	0,6	13	26,9	20,6	20 000	34 000	7205CTAP4DB	0,240
	52	15	1	0,6	13	26,9	20,6	20 000	34 000	7205CTAP4DF	0,240
	52	15	1	0,6	13	43,8	41,2	18 000	30 000	7205CTAP4QBC	0,120
	52	15	1	0,6	13	26,9	20,6	22 000	38 000	7205CTAP2DT	0,240
	52	15	1	0,6	13	26,9	20,6	20 000	34 000	7205CTAP2DB	0,240
	52	15	1	0,6	13	26,9	20,6	22 000	38 000	7205CTBP4DT	0,240
	52	15	1	0,6	13	26,9	20,6	20 000	34 000	7205CTBP4DB	0,240
	52	15	1	0,6	13	26,9	20,6	20 000	34 000	7205CTBP4DF	0,240
	52	15	1	0,6	13	43,8	41,2	18 000	30 000	7205CTBP4QBC	0,480
	52	15	1	0,6	17	22,2	17,6	20 000	34 000	7205ATAP4DT	0,240
	52	15	1	0,6	17	22,2	17,6	18 000	30 000	7205ATAP4DB	0,240
	52	15	1	0,6	17	22,2	17,6	18 000	30 000	7205ATAP4DF	0,240
	52	15	1	0,6	17	29,6	26,4	17 000	28 000	7205ATAP4TFT	0,360
30	55	13	1	0,3	12	24,5	20,6	22 000	36 000	7006CTAP4DT	0,240
	55	13	1	0,3	12	24,5	20,6	19 000	32 000	7006CTAP4DB	0,240
	55	13	1	0,3	12	24,5	20,6	19 000	32 000	7006CTAP4DF	0,240
	55	13	1	0,3	12	32,6	30,9	18 000	30 000	7006CTAP4TBT	0,360

High precision single-row angular contact ball bearings (Matched pair)



Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
30	55	13	1	0,3	12	24,5	20,6	19 000	32 000	7006CTAP2DB	0,240
	55	13	1	0,3	12	24,5	20,6	22 000	36 000	7006CTBP2DT	0,240
	55	13	1	0,3	17	21,7	19	19 000	32 000	7006ATAP4DT	0,240
	55	13	1	0,3	17	21,7	19	17 000	28 000	7006ATAP4DB	0,240
	55	13	1	0,3	17	21,7	19	17 000	28 000	7006ATAP4DF	0,240
	62	16	1	0,6	14	37,3	29,6	20 000	34 000	7206CTAP4DT	0,380
	62	16	1	0,6	14	37,3	29,6	18 000	30 000	7206CTAP4DB	0,380
	62	16	1	0,6	14	37,3	29,6	18 000	30 000	7206CTAP4DF	0,380
	62	16	1	0,6	14	49,7	44,4	17 000	28 000	7206CTAP4TT	0,570
	62	16	1	0,6	14	49,7	44,4	17 000	28 000	7206CTAP4TBT	0,570
	62	16	1	0,6	14	60,7	59,2	16 000	26 000	7206CTAP4QFC	0,760
	62	16	1	0,6	14	37,3	29,6	20 000	34 000	7206CTAP2DT	0,380
	62	16	1	0,6	14	37,3	29,6	18 000	30 000	7206CTAP2DB	0,380
	62	16	1	0,6	14	37,3	29,6	20 000	34 000	7206CTBP4DT	0,380
	62	16	1	0,6	14	37,3	29,6	18 000	30 000	7206CTBP4DB	0,380
	62	16	1	0,6	14	37,3	29,6	18 000	30 000	7206CTBP4DF	0,380
	62	16	1	0,6	14	49,7	44,4	17 000	28 000	7206CTBP4TT	0,570
	62	16	1	0,6	14	60,7	59,2	16 000	26 000	7206CTBP4QFC	0,760
	62	16	1	0,6	19	35,7	28,2	18 000	30 000	7206ATAP4DT	0,380
	62	16	1	0,6	19	35,7	28,2	17 000	28 000	7206ATAP4DB	0,380
	62	16	1	0,6	19	35,7	28,2	17 000	28 000	7206ATAP4DF	0,380
35	62	14	1	0,3	14	31,1	27,4	19 000	32 000	7007CTAP4DT	0,320
	62	14	1	0,3	14	31,1	27,4	17 000	28 000	7007CTAP4DB	0,320
	62	14	1	0,3	14	31,1	27,4	17 000	28 000	7007CTAP4DF	0,320
	62	14	1	0,3	14	31,1	27,4	17 000	28 000	7007CTAP2DB	0,320
	62	14	1	0,3	14	31,1	27,4	17 000	28 000	7007CTBP4DB	0,320
	62	14	1	0,3	14	31,1	27,4	19 000	32 000	7007CTBP2DT	0,320
	62	14	1	0,3	19	29,5	26,2	17 000	28 000	7007ATAP4DT	0,320
	62	14	1	0,3	19	29,5	26,2	16 000	26 000	7007ATAP4DB	0,320
	62	14	1	0,3	19	29,5	26,2	16 000	26 000	7007ATAP4DF	0,320
	72	17	1,1	0,6	16	49,3	40,4	18 000	30 000	7207CTAP4DT	0,540
	72	17	1,1	0,6	16	49,3	40,4	17 000	28 000	7207CTAP4DB	0,540
	72	17	1,1	0,6	16	49,3	40,4	17 000	28 000	7207CTAP4DF	0,540
	72	17	1,1	0,6	16	65,7	60,6	16 000	26 000	7207CTAP4TFT	0,810
	72	17	1,1	0,6	16	80,3	80,8	14 000	24 000	7207CTAP4QFC	1,08
	72	17	1,1	0,6	16	49,3	40,4	18 000	30 000	7207CTBP4DT	0,540
	72	17	1,1	0,6	16	49,3	40,4	17 000	28 000	7207CTBP4DB	0,540
	72	17	1,1	0,6	16	49,3	40,4	17 000	28 000	7207CTBP4DF	0,540
	72	17	1,1	0,6	21	39,7	34	16 000	26 000	7207ATAP4DT	0,540
	72	17	1,1	0,6	21	39,7	34	13 000	22 000	7207ATAP4DB	0,540
	72	17	1,1	0,6	21	39,7	34	13 000	22 000	7207ATAP4DF	0,540
40	68	15	1	0,3	15	33,4	31,8	18 000	30 000	7008CTAP4DT	0,380
	68	15	1	0,3	15	33,4	31,8	17 000	28 000	7008CTAP4DB	0,380

High precision single-row angular contact ball bearings (Matched pair)



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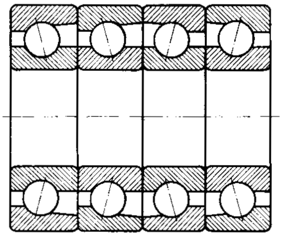

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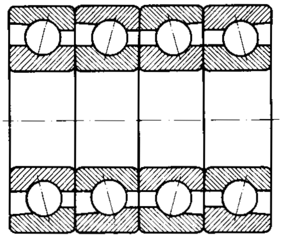
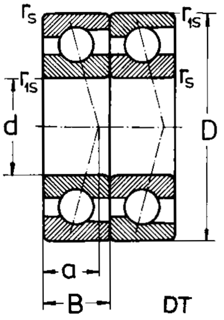
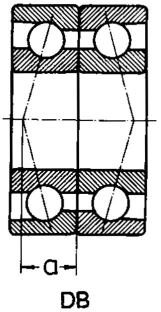


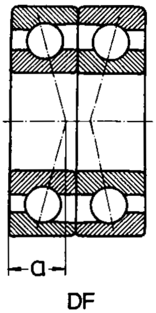
QBC

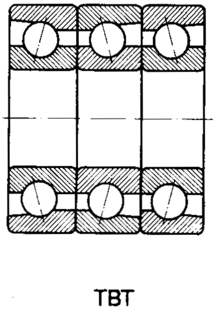
Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
40	68	15	1	0,3	15	33,4	31,8	17 000	28 000	**7008CTAP4DF**	0,380
	68	15	1	0,3	15	33,4	31,8	18 000	30 000	**7008CTAP2DT**	0,380
	68	15	1	0,3	15	33,4	31,8	17 000	28 000	**7008CTAP2DB**	0,380
	68	15	1	0,3	15	33,4	31,8	18 000	30 000	**7008CTBP4DT**	0,380
	68	15	1	0,3	15	33,4	31,8	17 000	28 000	**7008CTBP4DB**	0,380
	68	15	1	0,3	20	31,6	30	16 000	26 000	**7008ATAP4DT**	0,380
	68	15	1	0,3	20	31,6	30	13 000	22 000	**7008ATAP4DB**	0,380
	68	15	1	0,3	20	31,6	30	13 000	22 000	**7008ATAP4DF**	0,380
	68	15	1	0,3	20	31,6	30	13 000	22 000	**7008ATBP4DB**	0,380
	68	15	1	0,3	15	44,5	47,7	13 000	22 000	**7008ATBP4TBT**	0,570
	80	18	1,1	0,6	17	58,8	50,4	17 000	28 000	**7208CTAP4DT**	0,700
	80	18	1,1	0,6	17	58,8	50,4	14 000	24 000	**7208CTAP4DB**	0,700
	80	18	1,1	0,6	17	58,8	50,4	14 000	24 000	**7208CTAP4DF**	0,700
	80	18	1,1	0,6	17	58,8	50,4	17 000	28 000	**7208CTBP4DT**	0,700
	80	18	1,1	0,6	17	58,8	50,4	14 000	24 000	**7208CTBP4DB**	0,700
	80	18	1,1	0,6	17	58,8	50,4	14 000	24 000	**7208CTBP4DF**	0,700
	80	18	1,1	0,6	17	78,4	75,6	13 000	22 000	**7208CTBP4TT**	1,05
	80	18	1,1	0,6	17	95,8	101	13 000	22 000	**7208CTBP4QT**	1,40
	80	18	1,1	0,6	17	95,8	101	13 000	22 000	**7208CTBP4QFC**	1,40
	80	18	1,1	0,6	23	57	48,8	14 000	24 000	**7208ATAP4DT**	0,700
	80	18	1,1	0,6	23	57	48,8	12 000	20 000	**7208ATAP4DB**	0,700
	80	18	1,1	0,6	23	57	48,8	12 000	20 000	**7208ATAP4DF**	0,700
	80	18	1,1	0,6	23	57	48,8	14 000	24 000	**7208ATBP4DT**	0,700
	80	18	1,1	0,6	23	57	48,8	12 000	20 000	**7208ATBP4DB**	0,700
	80	18	1,1	0,6	17	95,8	101	11 000	18 000	**7208ATBP4QT**	1,40
45	75	16	1	0,3	16	39,5	38,6	16 000	26 000	**7009CTAP4DT**	0,500
	75	16	1	0,3	16	39,5	38,6	13 000	22 000	**7009CTAP4DB**	0,500
	75	16	1	0,3	16	39,5	38,6	13 000	22 000	**7009CTAP4DF**	0,500
	75	16	1	0,3	16	52,7	57,9	13 000	22 000	**7009CTAP4TBT**	0,750
	75	16	1	0,3	16	64,5	77,2	12 000	20 000	**7009CTAP4QBC**	1,00
	75	16	1	0,3	16	39,5	38,6	16 000	26 000	**7009CTAP2DT**	0,500
	75	16	1	0,3	16	39,5	38,6	13 000	22 000	**7009CTAP2DB**	0,500
	75	16	1	0,3	22	35,7	34,6	14 000	24 000	**7009ATAP4DT**	0,500
	75	16	1	0,3	22	35,7	34,6	12 000	20 000	**7009ATAP4DB**	0,500
	75	16	1	0,3	22	35,7	34,6	12 000	20 000	**7009ATAP4DF**	0,500
	85	19	1,1	0,6	18	64,8	58	14 000	24 000	**7209CTAP4DT**	0,800
	85	19	1,1	0,6	18	64,8	58	12 000	20 000	**7209CTAP4DB**	0,800
	85	19	1,1	0,6	18	64,8	58	12 000	20 000	**7209CTAP4DF**	0,800
	85	19	1,1	0,6	18	64,8	58	14 000	24 000	**7209CTAP2DT**	0,800
	85	19	1,1	0,6	25	59,6	55	12 000	20 000	**7209ATAP4DT**	0,800
	85	19	1,1	0,6	25	59,6	55	11 000	18 000	**7209ATAP4DB**	0,800
	85	19	1,1	0,6	25	59,6	55	11 000	18 000	**7209ATAP4DF**	0,800
	85	19	1,1	0,6	18	64,8	58	11 000	18 000	**7209CTAP2DB**	0,800
	85	19	1,1	0,6	25	59,6	55	12 000	20 000	**7209ATBP4DT**	0,800

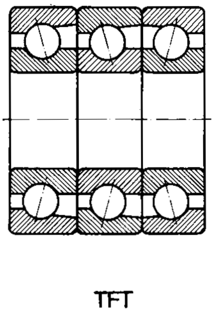
High precision single-row angular contact ball bearings (Matched pair)





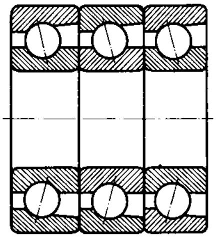






Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
45	85	19	1,1	0,6	25	59,6	55	11 000	18 000	7209ATBP4DB	0,800
	85	19	1,1	0,6	25	59,6	55	11 000	18 000	7209ATBP4DF	0,800
50	80	16	1	0,3	17	40,7	41,4	14 000	24 000	7010CTAP4DT	0,520
	80	16	1	0,3	17	40,7	41,4	12 000	20 000	7010CTAP4DB	0,520
	80	16	1	0,3	17	40,7	41,4	12 000	20 000	7010CTAP4DF	0,520
	80	16	1	0,3	17	66,3	82,8	11 000	18 000	7010CTAP4QBC	1,04
	80	16	1	0,3	17	40,7	41,4	14 000	24 000	7010CTAP2DT	0,520
	80	16	1	0,3	17	40,7	41,4	12 000	20 000	7010CTAP2DB	0,520
	80	16	1	0,3	23	37,6	40	12 000	20 000	7010ATAP4DT	0,520
	80	16	1	0,3	23	37,6	40	11 000	18 000	7010ATAP4DB	0,520
	80	16	1	0,3	23	37,6	40	11 000	18 000	7010ATAP4DF	0,520
	90	20	1,1	0,6	20	69,4	63,4	13 000	22 000	7210CTAP4DT	0,900
	90	20	1,1	0,6	20	69,4	63,4	11 000	19 000	7210CTAP4DB	0,900
	90	20	1,1	0,6	20	69,4	63,4	11 000	19 000	7210CTAP4DF	0,900
	90	20	1,1	0,6	27	68	62	11 000	18 000	7210ATAP4DT	0,900
	90	20	1,1	0,6	27	68	62	9 500	16 000	7210ATAP4DB	0,900
	90	20	1,1	0,6	27	68	62	9 500	16 000	7210ATAP4DF	0,900
	90	20	1,1	0,6	27	68	62	11 000	18 000	7210ATBP4DT	0,900
	90	20	1,1	0,6	27	68	62	9 500	16 000	7210ATBP4DB	0,900
	90	20	1,1	0,6	27	68	62	9 500	16 000	7210ATBP4DF	0,900
	90	20	1,1	0,6	27	68	62	11 000	18 000	7210ATBP2DT	0,900
55	90	18	1,1	0,6	19	55,3	57,2	12 000	20 000	7011CTAP4DT	0,780
	90	18	1,1	0,6	19	55,3	57,2	11 000	18 000	7011CTAP4DB	0,780
	90	18	1,1	0,6	19	55,3	57,2	11 000	18 000	7011CTAP4DF	0,780
	90	18	1,1	0,6	19	73,7	85,2	10 000	17 000	7011CTAP4TT	1,17
	90	18	1,1	0,6	19	73,7	85,2	10 000	17 000	7011CTAP4TBT	1,17
	90	18	1,1	0,6	26	52,3	54,2	11 000	18 000	7011ATAP4DT	0,780
	90	18	1,1	0,6	26	52,3	54,2	9 500	16 000	7011ATAP4DB	0,780
	90	18	1,1	0,6	26	52,3	54,2	9 500	16 000	7011ATAP4DF	0,780
	100	21	1,5	1	21	85,9	80	11 000	18 000	7211CTAP4DT	1,20
	100	21	1,5	1	21	85,9	80	9 500	16 000	7211CTAP4DB	1,20
	100	21	1,5	1	21	85,9	80	9 500	16 000	7211CTAP4DF	1,20
	100	21	1,5	1	29	82	76,6	10 000	17 000	7211ATAP4DT	1,20
	100	21	1,5	1	29	82	76,6	9 000	15 000	7211ATAP4DB	1,20
	100	21	1,5	1	29	82	76,6	9 000	15 000	7211ATAP4DF	1,20
	100	21	1,5	1	29	82	76,6	9 000	15 000	7211ATAP2DB	1,20
	100	21	1,5	1	29	82	76,6	10 000	17 000	7211ATBP4DT	1,20
	100	21	1,5	1	29	82	76,6	9 000	15 000	7211ATBP4DB	1,20
	100	21	1,5	1	29	82	76,6	9 000	15 000	7211ATBP4DF	1,20
60	95	18	1,1	0,6	20	56,7	61	11 000	18 000	7012CTAP4DT	0,840
	95	18	1,1	0,6	20	56,7	61	9 500	16 000	7012CTAP4DB	0,840
	95	18	1,1	0,6	20	56,7	61	9 500	16 000	7012CTAP4DF	0,840
	95	18	1,1	0,6	20	75,6	91,5	9 000	15 000	7012CTAP4TBT	1,26

High precision single-row angular contact ball bearings (Matched pair)



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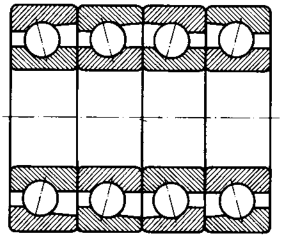

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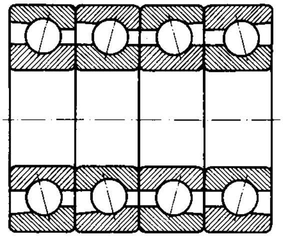
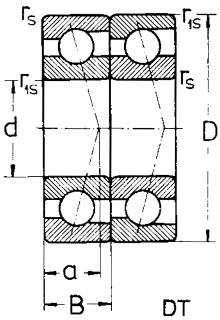


QBC

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
60	95	18	1,1	0,6	20	92,4	122	8 500	14 000	7012CTAP4QBC	1,68
	95	18	1,1	0,6	20	56,7	61	9 500	16 000	7012CTBP2DB	0,840
	95	18	1,1	0,6	27	53,8	58,2	10 000	17 000	7012ATAP4DT	0,840
	95	18	1,1	0,6	27	53,8	58,2	9 000	15 000	7012ATAP4DB	0,840
	95	18	1,1	0,6	27	53,8	58,2	9 000	15 000	7012ATAP4DF	0,840
	95	18	1,1	0,6	27	53,8	58,2	9 000	15 000	7012ATAP2DF	0,840
	110	22	1,5	1	23	104	98	10 000	17 000	7212CTAP4DT	1,54
	110	22	1,5	1	23	104	98	9 000	15 000	7212CTAP4DB	1,54
	110	22	1,5	1	23	104	98	9 000	15 000	7212CTAP4DF	1,54
	110	22	1,5	1	23	138	147	8 500	14 000	7212CTAP4TBT	2,31
	110	22	1,5	1	23	104	98	9 000	15 000	7212CTAP2DB	1,54
	110	22	1,5	1	31	98,8	95	9 000	15 000	7212ATAP4DT	1,54
	110	22	1,5	1	31	98,8	95	8 500	14 000	7212ATAP4DB	1,54
	110	22	1,5	1	31	98,8	95	8 500	14 000	7212ATAP4DF	1,54
	110	22	1,5	1	31	98,8	95	9 000	15 000	7212ATBP4DT	1,54
	110	22	1,5	1	31	98,8	95	8 500	14 000	7212ATBP4DB	1,54
	110	22	1,5	1	31	98,8	95	8 500	14 000	7212ATBP4DF	1,54
65	100	18	1,1	0,6	20	58,3	65	11 000	18 000	7013CTAP4DT	0,920
	100	18	1,1	0,6	20	58,3	65	9 500	16 000	7013CTAP4DB	0,920
	100	18	1,1	0,6	20	58,3	65	9 500	16 000	7013CTAP4DF	0,920
	100	18	1,1	0,6	20	77,8	97,5	9 000	15 000	7013CTAP4TBT	1,38
	100	18	1,1	0,6	20	95	130	8 500	14 000	7013CTAP4QBC	1,84
	100	18	1,1	0,6	20	77,8	97,5	9 000	15 000	7013CTAP2TBT	1,38
	100	18	1,1	0,6	28	55	62	9 500	16 000	7013AMBP4DT	0,920
	100	18	1,1	0,6	28	55	62	8 500	14 000	7013ATAP4DB	0,920
	100	18	1,1	0,6	28	55	62	8 500	14 000	7013ATAP4DF	0,920
	120	23	1,5	1	24	117	114	9 500	20 000	7213CTAP4DT	1,94
	120	23	1,5	1	24	117	114	8 500	14 000	7213CTAP4DB	1,94
	120	23	1,5	1	24	117	114	8 500	14 000	7213CTAP4DF	1,94
	120	23	1,5	1	24	117	114	9 500	16 000	7213CTAP2DT	1,94
	120	23	1,5	1	33	113	108	8 500	14 000	7213ATAP4DT	1,94
	120	23	1,5	1	33	113	108	8 000	13 000	7213ATAP4DB	1,94
	120	23	1,5	1	33	113	108	8 000	13 000	7213ATAP4DF	1,94
	120	23	1,5	1	33	113	108	8 500	14 000	7213ATBP4DT	1,94
	120	23	1,5	1	33	113	108	8 000	13 000	7213ATBP4DB	1,94
	120	23	1,5	1	33	113	108	8 000	13 000	7213ATBP4DF	1,94
70	110	20	1,1	0,6	22	73,4	81,6	9 500	16 000	7014CTAP4DT	1,28
	110	20	1,1	0,6	22	73,4	81,6	8 500	14 000	7014CTAP4DB	1,28
	110	20	1,1	0,6	22	73,4	81,6	8 500	14 000	7014CTAP4DF	1,28
	110	20	1,1	0,6	31	93	102	8 500	14 000	7014CTAP4TBT	1,92
	110	20	1,1	0,6	31	69,7	68	8 500	14 000	7014AMBP4DT	1,28
	110	20	1,1	0,6	31	114	136	6 700	11 000	7014AMBP4QBC	2,56
	110	20	1,1	0,6	31	69,7	68	8 500	14 000	7014ATAP4DT	1,28

High precision single-row angular contact ball bearings (Matched pair)



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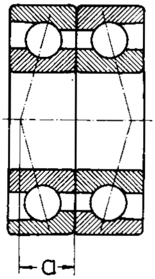

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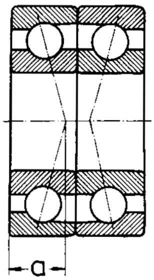

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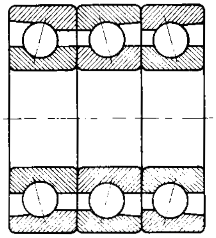
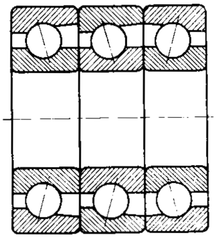
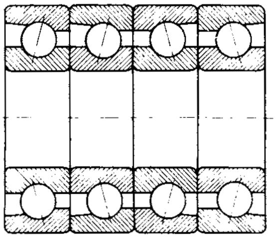

TBT

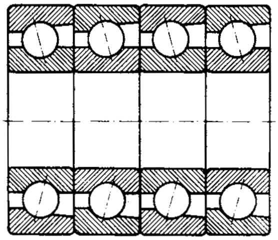

TFT

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
70	110	20	1,1	0,6	31	69,7	68	8 000	12 000	**7014ATAP4DB**	1,28
	110	20	1,1	0,6	31	69,7	68	8 000	13 000	**7014ATAP4DF**	1,28
	110	20	1,1	0,6	31	93	102	7 000	13 000	**7014ATAP2TBT**	1,92
	125	24	1,5	1	25	123	120	9 000	15 000	**7214CTAP4DT**	2,10
	125	24	1,5	1	25	123	120	8 500	14 000	**7214CTAP4DB**	2,10
	125	24	1,5	1	25	123	120	8 500	14 000	**7214CTAP4DF**	2,10
	125	24	1,5	1	25	123	120	8 500	14 000	**7214CTAP2DB**	2,10
	125	24	1,5	1	35	126	114	8 500	14 000	**7214ATAP4DT**	2,10
	125	24	1,5	1	35	126	114	7 000	12 000	**7214ATAP4DB**	2,10
	125	24	1,5	1	35	126	114	7 000	12 000	**7214ATAP4DF**	2,10
	125	24	1,5	1	35	126	114	8 500	14 000	**7214ATBP4DT**	2,10
	125	24	1,5	1	35	126	114	7 000	12 000	**7214ATBP4DB**	2,10
	125	24	1,5	1	35	126	114	7 000	12 000	**7214ATBP4DF**	2,10
75	115	20	1,1	0,6	23	75,4	87	9 500	16 000	**7015CTAP4DT**	1,36
	115	20	1,1	0,6	23	75,4	87	8 500	14 000	**7015CTAP4DB**	1,36
	115	20	1,1	0,6	23	75,4	87	8 500	14 000	**7015CTAP4DF**	1,36
	115	20	1,1	0,6	32	71,3	82,4	7 000	12 000	**7015AMAP4DB**	1,36
	115	20	1,1	0,6	23	100	131	6 700	11 000	**7015AMAP4TBT**	2,04
	115	20	1,1	0,6	32	116	165	6 700	11 000	**7015AMAP4QBC**	2,72
	115	20	1,1	0,6	32	71,3	82,4	8 500	14 000	**7015ATAP4DT**	1,36
	115	20	1,1	0,6	32	71,3	82,4	7 000	11 000	**7015ATAP4DB**	1,36
	115	20	1,1	0,6	32	71,3	82,4	7 000	11 000	**7015ATAP4DF**	1,36
	115	20	1,1	0,6	32	71,3	82,4	7 000	12 000	**7015ATBP2DB**	1,36
	130	25	1,5	1	26	130	131	8 500	14 000	**7215CTAP4DT**	2,30
	130	25	1,5	1	26	130	131	8 000	13 000	**7215CTAP4DB**	2,30
	130	25	1,5	1	26	130	131	8 000	13 000	**7215CTAP4DF**	2,30
	130	25	1,5	1	37	118	121	8 000	13 000	**7215ATAP4DT**	2,30
	130	25	1,5	1	37	118	121	6 700	11 000	**7215ATAP4DB**	2,30
	130	25	1,5	1	37	118	121	6 700	11 000	**7215ATAP4DF**	2,30
	130	25	1,5	1	37	118	121	8 000	13 000	**7215ATBP4DT**	2,30
	130	25	1,5	1	37	118	121	6 700	11 000	**7215ATBP4DB**	2,30
	130	25	1,5	1	37	118	121	6 700	11 000	**7215ATBP4DF**	2,30
80	125	22	1,1	0,6	25	95	110	8 500	14 000	**7016CTAP4DT**	1,78
	125	22	1,1	0,6	25	95	110	8 000	13 000	**7016CTAP4DB**	1,78
	125	22	1,1	0,6	25	95	110	8 000	13 000	**7016CTAP4DF**	1,78
	125	22	1,1	0,6	35	91	126	8 000	13 000	**7016AMAP4DT**	1,78
	125	22	1,1	0,6	35	91	126	6 700	11 000	**7016AMAP4DB**	1,78
	125	22	1,1	0,6	25	155	221	6 000	10 000	**7016AMAP4QBC**	3,56
	125	22	1,1	0,6	35	91	126	8 000	13 000	**7016ATAP4DT**	1,78
	125	22	1,1	0,6	35	91	126	6 700	11 000	**7016ATAP4DB**	1,78
	125	22	1,1	0,6	35	91	126	6 700	11 000	**7016ATAP4DF**	1,78
	140	26	2	1	28	151	156	7 000	12 000	**7216CTAP4DT**	2,80
	140	26	2	1	28	151	156	6 000	10 000	**7216CTAP4DB**	2,80

High precision single-row angular contact ball bearings (Matched pair)



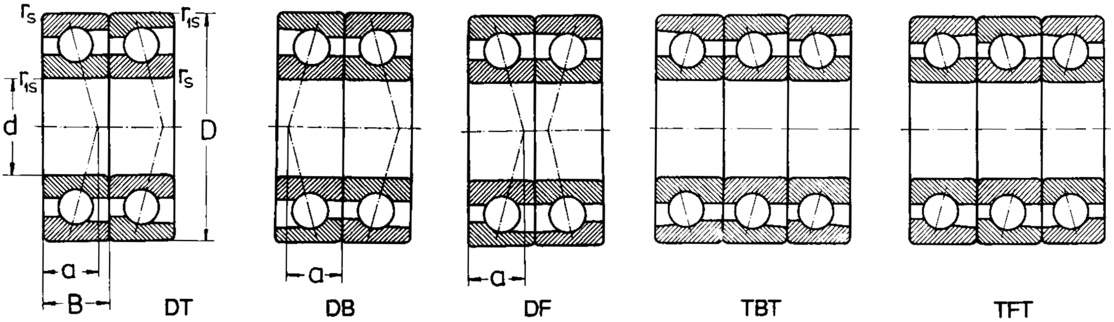
QBC



QT

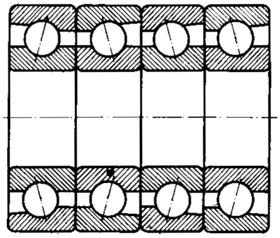
Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
80	140	26	2	1	28	151	156	6 000	10 000	7216CTAP4DF	2,80
	140	26	2	1	28	201	234	6 000	10 000	7216CTAP4TBT	4,20
	140	26	2	1	28	151	156	7 000	12 000	7216CTAP2DT	2,80
	140	26	2	1	28	151	156	6 000	10 000	7216CTAP2DB	2,80
	140	26	2	1	28	151	156	6 000	10 000	7216CTAP2DF	2,80
	140	26	2	1	28	246	312	5 300	9 000	7216CTAP2QBC	5,60
	140	26	2	1	39	139	147	6 700	11 000	7216ATAP4DT	2,80
	140	26	2	1	39	139	147	5 600	9 500	7216ATAP4DB	2,80
	140	26	2	1	39	139	147	5 600	9 500	7216ATAP4DF	2,80
	140	26	2	1	39	139	147	6 700	11 000	7216ATBP4DT	2,80
	140	26	2	1	39	139	147	5 600	9 500	7216ATBP4DB	2,80
	140	26	2	1	39	139	147	5 600	9 500	7216ATBP4DF	2,80
85	130	22	1,1	0,6	26	97,5	117	8 500	14 000	7017CTAP4DT	1,86
	130	22	1,1	0,6	26	97,5	117	7 000	12 000	7017CTAP4DB	1,86
	130	22	1,1	0,6	26	97,5	117	7 000	12 000	7017CTAP4DF	1,86
	130	22	1,1	0,6	36	92	112	7 000	12 000	7017ATAP4DT	1,86
	130	22	1,1	0,6	36	92	112	6 000	10 000	7017ATAP4DB	1,86
	130	22	1,1	0,6	36	92	112	6 000	10 000	7017ATAP4DF	1,86
	150	28	2	1	30	168	180	7 000	12 000	7217CTAP4DT	3,50
	150	28	2	1	30	168	180	6 000	10 000	7217CTAP4DB	3,50
	150	28	2	1	30	168	180	6 000	10 000	7217CTAP4DF	3,50
	150	28	2	1	42	159	153	6 000	10 000	7217ATAP4DT	3,50
	150	28	2	1	42	159	153	5 300	9 000	7217ATAP4DB	3,50
	150	28	2	1	42	159	153	5 300	9 000	7217ATAP4DF	3,50
	150	28	2	1	42	159	153	6 000	10 000	7217ATBP4DT	3,50
	150	28	2	1	42	159	153	5 300	9 000	7217ATBP4DB	3,50
	150	28	2	1	42	159	153	5 300	9 000	7217ATBP4DF	3,50
90	140	24	1,5	0,6	28	116	138	7 000	12 000	7018CMBP4DT	2,40
	140	24	1,5	0,6	28	116	138	7 000	12 000	7018CTAP4DT	2,40
	140	24	1,5	0,6	28	116	138	6 000	10 000	7018CTAP4DB	2,40
	140	24	1,5	0,6	28	116	138	6 000	10 000	7018CTAP4DF	2,40
	140	24	1,5	0,6	28	155	207	5 300	10 000	7018CTAP2TBT	3,60
	140	24	1,5	0,6	39	110	131	6 000	10 000	7018AMBP4DT	2,40
	140	24	1,5	0,6	39	147	262	5 000	8 500	7018AMBP4TBT	3,60
	140	24	1,5	0,6	39	180	262	4 500	7 500	7018AMBP4QT	4,80
	140	24	1,5	0,6	39	110	131	6 000	10 000	7018ATAP4DT	2,40
	140	24	1,5	0,6	39	110	131	5 300	9 000	7018ATAP4DB	2,40
	140	24	1,5	0,6	39	110	131	5 300	9 000	7018ATAP4DF	2,40
	160	30	2	1	32	199	210	6 700	11 000	7218CTAP4DT	4,30
	160	30	2	1	32	199	210	5 600	9 500	7218CTAP4DB	4,30
	160	30	2	1	32	199	210	5 600	9 500	7218CTAP4DF	4,30
	160	30	2	1	44	189	200	5 000	8 500	7218AMAP4DT	4,30
	160	30	2	1	44	189	200	4 500	7 500	7218AMAP4DB	4,30

High precision single-row angular contact ball bearings (Matched pair)

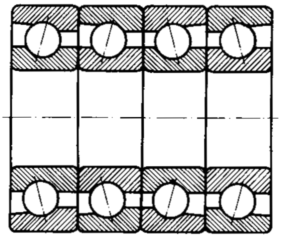


Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
90	160	30	2	1	44	189	200	4 500	7 500	**7218AMAP4DF**	4,30
	160	30	2	1	44	189	200	5 000	8 500	**7218ATAP4DT**	4,30
	160	30	2	1	44	189	200	4 500	7 500	**7218ATAP4DB**	4,30
	160	30	2	1	44	189	200	4 500	7 500	**7218ATAP4DF**	4,30
	160	30	2	1	44	189	200	5 000	8 500	**7218ATBP4DT**	4,30
	160	30	2	1	44	189	200	4 500	7 500	**7218ATBP4DB**	4,30
	160	30	2	1	44	189	200	4 500	7 500	**7218ATBP4DF**	4,30
95	145	24	1,5	0,6	28	119	147	8 000	13 000	**7019CTAP4DT**	2,50
	145	24	1,5	0,6	28	119	147	6 700	11 000	**7019CTAP4DB**	2,50
	145	24	1,5	0,6	28	119	147	6 700	11 000	**7019CTAP4DF**	2,50
	145	24	1,5	0,6	40	110	132	5 300	9 000	**7019ATAP4DT**	2,50
	145	24	1,5	0,6	40	110	132	4 800	8 000	**7019ATAP4DB**	2,50
	145	24	1,5	0,6	40	110	132	4 800	8 000	**7019ATAP4DF**	2,50
	170	32	2,1	1,1	34	211	230	5 300	9 000	**7219CTAP4DT**	5,30
	170	32	2,1	1,1	34	211	230	4 800	8 000	**7219CTAP4DB**	5,30
	170	32	2,1	1,1	34	211	230	4 800	8 000	**7219CTAP4DF**	5,30
	170	32	2,1	1,1	34	211	230	4 800	8 000	**7219CTAP2DB**	5,30
	170	32	2,1	1,1	47	204	220	4 800	8 000	**7219ATAP4DT**	5,30
	170	32	2,1	1,1	47	204	220	4 300	7 000	**7219ATAP4DB**	5,30
	170	32	2,1	1,1	47	204	220	4 300	7 000	**7219ATAP4DF**	5,30
	170	32	2,1	1,1	47	126	220	4 800	8 000	**7219ATBP4DT**	5,30
	170	32	2,1	1,1	47	126	220	4 300	7 000	**7219ATBP4DB**	5,30
	170	32	2,1	1,1	47	126	220	4 300	7 000	**7219ATBP4DF**	5,30
100	150	24	1,5	0,6	29	122	154	6 700	11 000	**7020CTAP4DT**	2,60
	150	24	1,5	0,6	29	122	154	5 600	9 500	**7020CTAP4DB**	2,60
	150	24	1,5	0,6	29	122	154	5 600	9 500	**7020CTAP4DF**	2,60
	150	24	1,5	0,6	41	115	146	5 000	8 500	**7020AMBP4DT**	2,60
	150	24	1,5	0,6	29	163	231	4 300	7 000	**7020AMBP4TBT**	3,90
	150	24	1,5	0,6	41	188	292	4 000	6 700	**7020AMBP4QBT**	5,20
	150	24	1,5	0,6	41	115	146	4 500	7 500	**7020AMBP2DB**	2,60
	150	24	1,5	0,6	41	115	146	5 000	8 500	**7020ATAP4DT**	2,60
	150	24	1,5	0,6	41	115	146	4 500	7 500	**7020ATAP4DB**	2,60
	150	24	1,5	0,6	41	115	146	4 500	7 500	**7020ATAP4DF**	2,60
	180	34	2,1	1,1	36	243	254	5 000	8 500	**7220CTAP4DT**	6,30
	180	34	2,1	1,1	36	243	254	4 500	7 500	**7220CTAP4DB**	6,30
	180	34	2,1	1,1	36	243	254	4 500	7 500	**7220CTAP4DF**	6,30
	180	34	2,1	1,1	36	398	508	4 000	6 700	**7220CTAP4QBC**	12,6
	180	34	2,1	1,1	50	230	243	4 500	7 500	**7220AMAP4DT**	6,30
	180	34	2,1	1,1	50	230	243	4 000	6 700	**7220AMAP4DB**	6,30
	180	34	2,1	1,1	50	230	243	4 500	7 500	**7220ATAP4DT**	6,30
	180	34	2,1	1,1	50	230	243	4 000	6 700	**7220ATAP4DB**	6,30
	180	34	2,1	1,1	50	230	243	4 000	6 700	**7220ATAP4DF**	6,30
	180	34	2,1	1,1	50	230	243	4 500	7 500	**7220ATBP4DT**	6,30

High precision single-row angular contact ball bearings (Matched pair)



QBT



QBC

Dimensions						Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	r_{1s} min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm						kN		min^{-1}		–	kg
100	180 180	34 34	2,1 2,1	1,1 1,1	50 50	230 230	243 243	4 000 4 000	6 700 6 700	7220ATBP4DB 7220ATBP4DF	6,30 6,30
105	160	26	2	1	31	143	178	4 500	7 500	7021CTAP4DB	3,32
110	170	28	2	1	47	169	208	3 800	6 300	7022ATAP4DB	6,40
120	180	28	2	2	49	169	210	3 600	6 000	7024AMAP4DB	2,29
130	200 200	33 33	2 2	1 1	39 39	313 235	298 298	3 800 4 000	6 300 6 700	7026CMAP4TBT 7026CTAP4DB	9,57 6,38
150	225	35	2,1	1,1	61	258	346	2 800	4 500	7030AMAP4DB	8,64

Non-standard single-row angular contact ball bearings

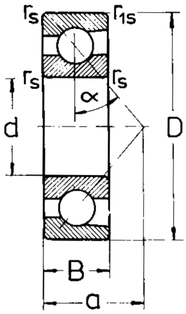


Fig.1

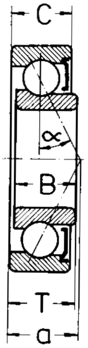


Fig.2

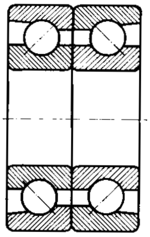


Fig.3

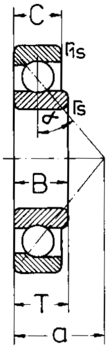


Fig.4

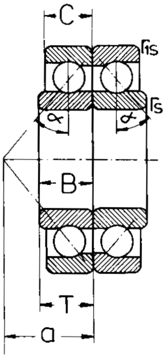


Fig.5

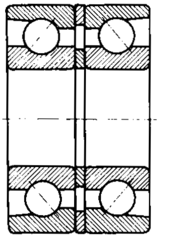


Fig.6

Dimensions									Fig.	Basic radial load		Speed limit		Designation	Weight
d	D	B	C	T	a	α	r_s min.	r_{1s} min.		dyn. C_r	stat. C_{0r}	grease	oil		
mm						degrees	mm			—	kN		min^{-1}		–
35	55	7	7		8,7	16	0,3	0,3	1	7,95	6,73	9 000	13 000	**70907CMB**	0,066
58	100	20,5	20,5	21	30,2	25	1,5	0,6	2	44,7	26,4	5 300	7 000	**7512AZ**	0,595
70	180	42	24		73,8	40	3	3	1	148	118	3 200	4 800	**7414BMB**	5,46
	180	42	42		73,8	40	3	3	3	237	236	2 500	3 800	**7414BMBDB**	10,9
	180	42	42	89	73,8	40	3	3	6	148	118	3 200	4 800	**7414BMP5DBT**	48,0
110	175	30	30		28,2	26	1	0,6	1	105	83,4	2 400	3 400	**7522AM**	2,60
150	210	28	25	28	86	40	2	4	4	154	160	2 000	3 000	**7530BBM**	2,95
	210	28	25	28	88,1	40	2	4	5	246	320	1 600	2 400	**7530BMDB**	5,91
160	400	88	88		161	40	5	5	1	493	502	1 300	1 800	**7432BMBP6W8**	60,2
165	280	40	39	40	113	40	3	3	4	175	205	1 800	2 600	**7533BBMB**	11,0
190	255	33	29	33	110	40	1,5	1	4	110	142	1 800	2 600	**7538BBM**	4,47
	255	33	29	33	110	40	1,5	1	5	176	284	1 500	2 000	**7538BBMDB**	8,94
260	360	48	31		112	25	2,1	1,1	2	248	361	1 300	1 900	**7552A1BM**	12,4
335	450	56	56		193	40	3	1	1	278	450	1 000	1 500	**7567BFS1**	25,0
	450	56	56		193	40	3	1	3	451	900	800	1 200	**7567BFS1DB**	50,0
380	520	65	65		222	40	4	1	1	347	610	850	1 200	**7576BFS1**	42,4
	520	65	65		222	40	4	1	1	562	1 220	800	1 000	**7576BFS1DB**	84,8
410	560	70	70		238	40	4	1	1	421	788	850	1 200	**7582BFS1**	48,0
	560	70	70		238	40	4	1	3	683	1 576	670	950	**7582BFS1DB**	96,0
465	635	76	76		269	40	4	4	1	464	924	700	1 000	**7593BFS1**	67,7
	635	76	76		269	40	4	4	3	753	1 848	670	950	**7593BFS1DB**	135
560	680	42	42		200	30	2,1	1,1	1	265	523	670	950	**75/560A1FP5**	30,8
570	700	42	42		169	25	3	3	1	335	693	670	950	**75/570AFS1**	35,6
750	920	54	54		268	30	4	4	1	458	1 110	500	700	**708/750A1MB**	79,5
	920	54	54		268	30	4	4	3	740	2 220	400	600	**708/750A1MBDB**	159

Non-standard single-row angular contact ball bearings

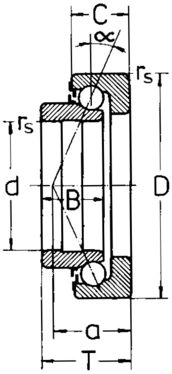


Fig.7

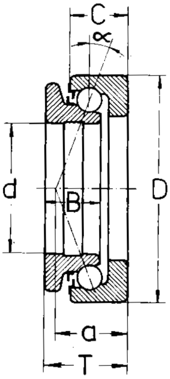


Fig.8

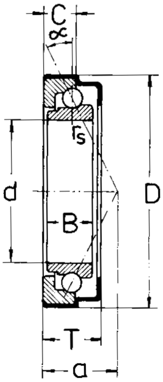


Fig.9

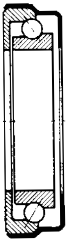


Fig.10

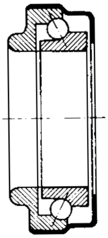


Fig.11

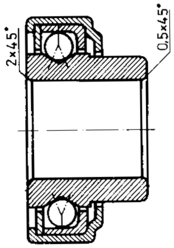


Fig.12

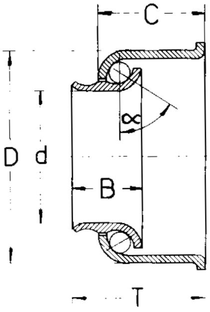


Fig.13

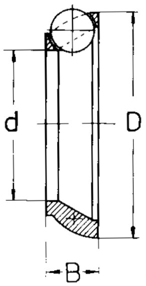
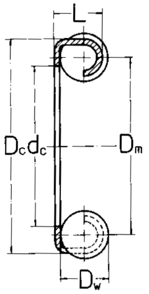


Fig.14

Dimensions									Fig.	Basic radial load		Speed limit		Designation	Weight
d	D	B	C	T	a	α	r_s min.	r_{1s} min.		dyn. C_r	stat. C_{0r}	grease	oil		
mm						degrees		mm		—	kN		min^{-1}	-	–
13	53,6	24	14,4	24			2	0,5	12			3 000	4 000	**75Z01**	0,260
24	37	12,5	10,5	14		60			13	5,1	3,9	3 800	5 000	**7505V**	0,030
26,1	42,1	12,4	23	26		60			13	7	5	3 000	4 000	**7605V**	0,060
30,1	50	14,5	31,5	35		60			13	16,9	8	3 000	4 000	**7506V**	0,105
32	48	9							14	11,1	5,9	3 000	4 000	**K7604TN**	0,016
37,5	55,8	12,6							14	22,3	11,9	3 000	4 000	**K7507TN**	0,051
55	90	18,4	12,4	23		26	1		9	20,1	12,8	3 800	5 000	**76Z11A**	0,397
	90,5	16,5	14,5	25	71	26	1,1		10	20,1	12,8	3 800	5 000	**75Z11A**	0,472
	90,5	16,5	21,5	32	33	26	1,1		11	20,5	18,5	3 800	5 000	**77Z11A**	0,550
64	102	24,5	29,5	37	33	20			8	30,3	17	3 800	5 000	**T-7513AZTN**	0,817
	102	24,5	26,5	37	33	20			8	30,3	17	3 800	5 000	**T-7613AZTN**	0,900
	102	32,5	29,5	45	33	20			7	33,5	26,6	3 800	5 000	**T-7813AZTN**	0,817

Non-standard ball and cage assemblies for bycicles



Dimensions D	d	L	D_m	D_w	balls	Designation	Weight
mm				inch	no.	–	kg
18	13,5	4,2	15	5/32	7	**KB180**	0,003
19,4	15,2	4,8	15,2	3/16	6	**KB194**	0,004
25,5	19,5	6,5	19,5	1/4	7	**KB255**	0,010
34,5	29,5	6,5	29,1	1/4	9	**KB345**	0,013
36,7	27	4	33,2	5/32	11	**KB367**	0,006
39,2	29	3,7	36	5/32	16	**KB392**	0,007
40,4	30,2	6,2	34,5	1/4	11	**KB404**	0,014

Angular contact ball bearings

Equivalent designations

Designation	Fig.	Equivalent	Producer
7505V	13		
7605V	13	791105	
7506V	13	791207	
K7604TN	14		
70907CMB	1	7006907	GPZ
K7507TN	14	790307TN	
76Z11A 75Z11A 77Z11A	9 10 11	306775	SKF
7512AZ	2	2889	RIV
T-7513AZTN T-7613AZTN T-7813AZTN	8 8 7	790713 790813	
7414DMB 7414BMBDB	1 3	7414 2x7414	KOYO KOYO
7522AM	1	926722	GPZ
7530BBM 7530BMDB	5 4	466895A 2x466895AN	SKF SKF

Designation	Fig.	Equivalent
7432BMBP6W8	1	
7533BBMB	4	
7538BBM 7538BBMDB	4 5	466880 2x466880
7552A1F2BM	2	
7567BFS1 7567BFS1DB	1 3	466952 2x466952
7576BFS1 7576BFS1DB	1 3	466953 2x466953
7582BFS1 7582BFS1DB	1 3	468431 2x468431
7593BFS1 7593BFS1DB	1 3	307352 2x307352
75/560AF2FP5	1	560752
75/570AFS1	1	307140
708/750A1F2MB 708/750A1F2MBDB	1 3	560425 2x560425

Four-point contact ball bearings

Four-point contact ball bearings are angular contact ball bearings which have a contact angle $\alpha = 35°$. The profile of the outer and inner ring raceways consists of two arcs of circle which form an ogive, so that these bearings can accommodate significant axial loads in both directions.

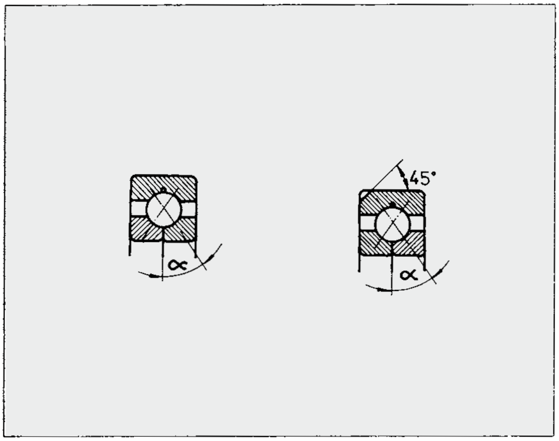
These bearings are also manufactured with three points contact . In this case, one of the raceways is normal (a single circle arc).

They need less axial space than double row angular contact ball bearings.

Four-point contact ball bearings have a two-part inner ring, allowing a large number of balls to be incorporated, thus providing a high load carrying capacity. The bearings are dismountable so that the assembly "outer ring - cage - balls" can be separately mounted from the inner semi-rings.

Four-point contact ball bearings are used to take axial loads and in many cases as thrust bearings radially unloaded in the housing. To prevent rotation of the outer ring in the housing, all bearings with an outside diameter over 160 mm are provided with two locating slots. The dimensions of these locating slots are given in table 1.

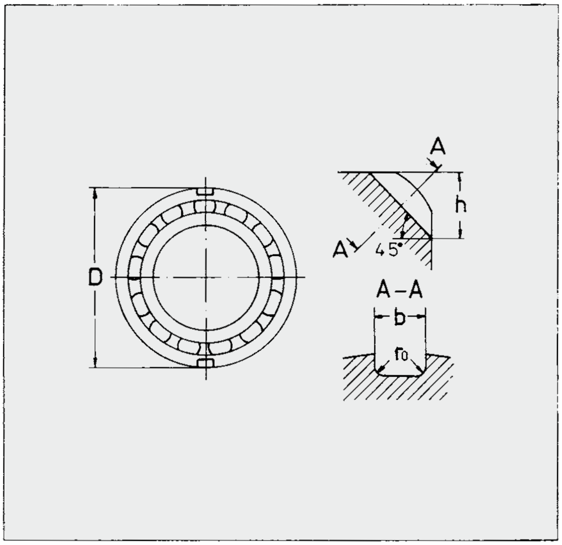
Suffix N2 is added at the designation of the bearings with two locating slots.



Locating slots in the outer ring for four-point contact ball bearings

Table 1

Diameter		**Dimensions**					
D		series QJ2			series QJ3		
over	up to	b	h	r	b	h	r
mm							
	170	6,6	8,1	1	8,5	10,1	2
170	**210**	8,5	10,1	2	10,5	11,7	2
210	**270**	10,5	11,7	2	10,5	11,7	2
270	**400**	10,5	12,7	2	10,5	12,7	2



Dimensions

Main dimensions of the four-point contact ball bearings given in tables are in accordance with ISO/R15

Misalignment

Four-point contact ball bearings have only limited ability to accommodate errors in alignment between outer and inner rings. The relationships between the factors governing the permissible values are as complex as for single row deep groove ball bearings.

Tolerances

Four-point contact ball bearings are generally manufactured only to the normal tolerance class.

Bearings tolerances are given on page 37.

Axial clearance

Four-point contact ball bearings are generally manufactured with normal axial clearance. They can also be manufactured with smaller or larger clearances.

The values of axial clearance are given in table 2.

Cages

Four-point contact ball bearings are generally fitted with machined brass cages.

Cage design and some technical data are given in table 3.

Equivalent dynamic radial load

In case of four-point contact ball bearings (series QJ2 and QJ3) with contact angle $\alpha = 35°$, the following equations are available:

$$P_r = F_r + 0{,}66\,F_a,\ \text{kN}, \quad \text{for } F_a/F_r \le 0{,}95$$
$$P_r = 0{,}6\,F_r + 1{,}07\,F_a,\ \text{kN}, \text{ for } F_a/F_r < 0{,}95$$

Satisfactory performance of the balls rolling on the ring raceways of four-point contact ball bearings is only obtained when balls are in contact with the raceways at two points, depending on the load direction, i.e. when the axial load is:

$$F_a > 1{,}27\,F_r.$$

In case the four-point contact ball bearings are used as thrust bearings in combination with other radial bearings and they are mounted with radial clearance in the housing, radial load will be:

$$P_r = 1{,}07\,F_a,\ \text{kN}$$

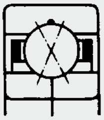
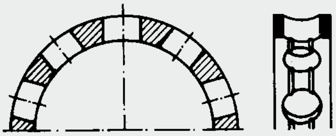
Axial clearance of QJ bearings

Table 2

Diameter d over	 up to	Axial clearance Clearance group symbol C2 min.	 max.	 Normal min.	 max.	 C3 min..	 max..	 C4 min.	 max.
mm		µm							
10	**18**	15	55	45	85	75	125	115	165
18	**40**	26	66	56	106	96	146	136	186
40	**60**	36	86	76	126	116	166	156	206
60	**80**	46	96	86	136	126	176	166	226
80	**100**	56	106	96	156	136	196	186	246
100	**140**	66	126	116	176	156	216	206	266
140	**180**	76	156	136	196	176	246	226	296

Cage design and some technical data

Table 3

Cage	**Design** bearing	 cage	**Application**	**Max. value** $D_m\,n$ oil	 grease
Machined brass cage MPA			- General application - Bearings series QJ2, QJ3	550×10^3	450×10^3

Equivalent static radial load

In case of four-point contact ball bearings with a contact angle $\alpha = 35°$.

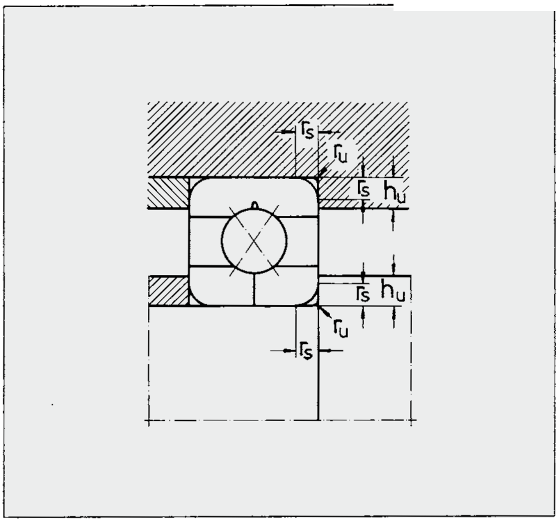
$P_{0r} = F_r + 0{,}58\, F_a$, kN

Abutment dimensions

For a proper location of bearing rings on the shaft and housing shoulder respectively, shaft (housing) maximum radius $r_{u\,max}$ should be less than bearing minimum mounting chamfer $r_{s\,min}$.

Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

The maximum values of the fillet radius r_u must be smaller or equal to the minimum corner $r_{s\,min}$ of the bearing (see table 4).

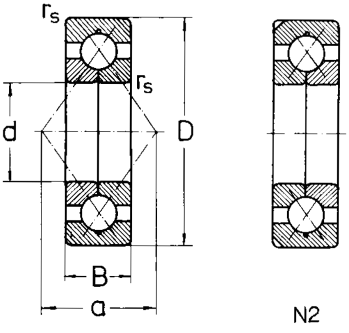


Abutment dimensions

Tabelul 4

r_s min. mm	r_u max.	h_u min. Bearing series QJ2, QJ3
1	1	2,8
1,1	1,1	3,5
1,5	1,5	4,5
2	2	5,5
2,1	2,1	6
3	2,5	7
4	3	8,5

Four-point contact ball bearings



Dimensions					Basic radial load		Speed limit		Desig-nation	Weight
d	D	B	r_s min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		–	kg
17	47	14	1	22	23,4	16,2	11 000	16 000	• QJ303	0,140
20	52	15	1	25	29,6	20,3	10 000	15 000	QJ304	0,176
30	62	16	1	32	40	29,2	9 000	13 000	QJ206	0,240
	72	19	1,1	36	49,4	40	8 000	11 000	QJ306	0,420
35	72	17	1	37	44	38,4	7 500	10 000	QJ207	0,350
	80	21	1,5	40	59	46,5	7 000	9 500	QJ307	0,570
40	80	18	1,1	42	53	43	6 700	9 000	QJ208	0,450
	90	23	1,5	46	72	58,2	6 300	8 500	QJ308	0,780
45	85	19	1,1	46	58,5	50,5	6 300	8 500	QJ209	0,520
	100	25	1,5	51	93,6	80	5 600	7 500	QJ309	1,04
50	90	20	1,1	49	61,8	54,2	5 600	7 500	QJ210	0,590
	110	27	2	56	111	95	5 000	6 700	QJ310	1,37
55	100	21	1,5	54	76,5	74	5 300	7 000	QJ211	0,770
	120	29	2	61	127	111	4 500	6 000	QJ311	1,74
60	110	22	1,5	60	92	85,2	4 800	6 300	QJ212	0,990
	130	31	2,1	67	145	126	4 300	5 600	QJ312	2,14
65	120	23	1,5	65	103	99,2	4 300	5 600	QJ213	1,20
	140	33	2,1	72	164	145	4 000	5 300	QJ313	2,71
70	125	24	1,5	68	113	114	4 300	5 600	QJ214	1,30
	150	35	2,1	77	184	165	3 600	4 800	QJ314	3,16
75	130	25	1,5	72	116	117	4 000	5 300	QJ215	1,45
	160	37	2,1	82	199	192	3 400	4 500	QJ315N2	3,88
80	140	26	2	77	140	139	3 600	4 800	QJ216	1,85
	170	39	2,1	88	230	229	3 200	4 300	QJ316N2	4,59
85	150	28	2	83	148	159	3 400	4 500	QJ217	2,25
	180	41	3	93	234	240	3 000	4 000	QJ317N2	5,47
90	160	30	2	88	174	180	3 200	4 300	QJ218N2	2,75
	190	43	3	98	267	283	2 800	3 800	QJ318N2	6,43
95	170	32	2,1	93	200	200	3 000	4 000	QJ219N2	3,35
	200	45	3	103	285	313	2 600	3 600	QJ319N2	7,45
100	180	34	2,1	98	225	228	2 800	3 800	QJ220N2	4,05
	215	47	3	110	306	341	2 400	3 400	QJ320N2	9,30
110	200	38	2,1	109	256	294	2 400	3 400	QJ222N2	5,60
	240	50	3	123	363	434	2 000	3 000	QJ322N2	12,5

Four-point contact ball bearings

Dimensions					Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		–	kg
120	215	40	2,1	117	283	340	2 200	3 200	**QJ224N2**	6,95
	260	55	3	133	379	532	1 900	2 800	**QJ324N2**	16,0
130	230	40	3	126	294	369	1 900	2 800	**QJ226N2**	7,75
	280	58	4	144	425	594	1 800	2 600	**QJ326N2**	19,5
140	250	42	3	137	328	436	1 800	2 600	**QJ228N2**	9,85
	300	62	4	154	470	646	1 700	2 400	**QJ328N2**	24,0
150	270	45	3	147	337	469	1 700	2 400	**QJ230N2**	12,5
	320	65	4	246	493	743	1 600	2 200	**QJ330N2**	29,0
200	360	58	4	196	507	850	1 300	1 800	**QJ240N2**	28,5

Three-point contact ball bearings

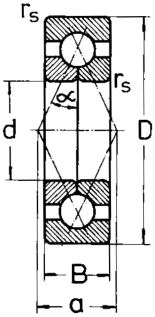


Fig.1

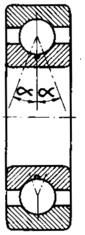


Fig.2

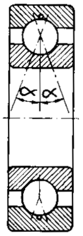


Fig.3

Dimensions						Fig.	Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	a	α		dyn. C_r	stat. C_{0r}	grease	oil		
mm					degrees	–	kN		min^{-1}		–	kg
60	130	31	2,1	34,6	20	1	85	60	4 300	5 600	**7312QD**	2,00
70	125	24	1,5	35,5	19	2	57,5	41	4 300	5 600	**7514Q**	1,06
	125	24	1,5	28	16	3	57,5	41	4 300	5 600	**7614Q**	1,06

Equivalent designations

Designation	Fig.	Equivalent designation
7312QD	1	305816
7514Q	2	
7614Q	3	9214S

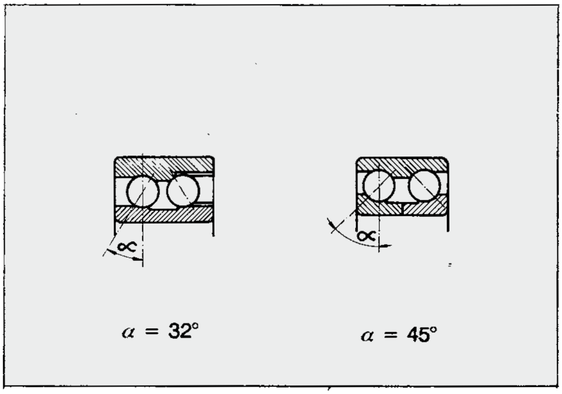
Angular contact ball bearings

Double row angular contact ball bearings are functionally similar to two single row angular contact ball bearings in DB arrangement and they have to take axial loads acting in both directions and tilting moments.

Double row angular contact ball bearings are narrower than a pair of single row angular contact ball bearings.

Double row angular contact ball bearings can be manufactured in two versions:

- with non-separable inner ring, series 32 and 33, with a contact angle $\alpha = 32°$;
- with separable inner ring, series 33D, with a contact angle $\alpha = 45°$.



$\alpha = 32°$ $\alpha = 45°$

Double row angular contact ball bearings, series 32 and 33 have filling slots on one side. If these bearings have to take axial loads mainly in one direction, they are to be mounted so that axial loads acting upon the shaft should be directed to the filling slots.

Double row angular contact ball bearings series 33D are suitable to accommodate heavy axial loads in both directions.

Dimensions

Main bearing dimensions given in tables are in accordance with ISO/R15

Misalignment

Angular misalignment of the outer ring relative to the inner ring is accommodated by force between the balls and raceway. This leads to a shortening of bearing life.

Tolerances

Double row angular contact ball bearings are generally manufactured to the normal tolerance class.

Bearing tolerances are given on page 37.

Axial clearance

Double row angular contact ball bearings series 32 and 33, with a contact angle $\alpha = 32°$ are generally manufactured with normal axial clearance. They can also be manufactured with smaller or larger axial clearances.

Double row angular contact ball bearings series 33D, with a contact angle $\alpha = 45°$ are generally mounted on the shaft with greater tightening than those of series 33. For this reason, the axial clearance is larger.

The values of axial clearance of the double row angular contact ball bearings are given in table 1.

Axial clearance of the double row angular contact ball bearings

Table 1

Outer diameter d over	 up to	Series 32 and 33 C2 min.	 max.	 Normal min.	 max.	 C3 min.	 max.	Series 33D Normal min.	 max.	 C3 min.	 max.
mm		µm									
–	10	1	11	5	21	12	28	11	28	20	37
10	18	1	12	6	23	13	31	13	31	23	41
18	24	2	14	7	25	16	34	14	32	24	42
24	30	2	15	8	27	18	37	16	35	27	46
30	40	2	16	9	29	21	40	18	38	30	50
40	50	2	18	11	33	23	44	22	44	36	58
50	65	3	22	13	36	26	48	25	48	40	63
65	80	3	24	15	40	30	54	29	54	48	71
80	100	3	26	18	46	35	63	35	63	55	83
100	110	4	30	22	53	42	73	42	73	65	96

Radial clearance = 0,6 axial clearance

Cages

Double row angular contact ball bearings series 32, 33 are fitted with machined brass cages.

Glass fibre reinforced polyamide 6.6 cages are also used with good results.

Large-sized bearings are fitted with machined brass cages.

Cage design and some technical data are given in table 2.

Equivalent dynamic radial load

For double row angular contact ball bearings series 32 and 33 with a contact angle $\alpha = 32°$, the following equations are available:

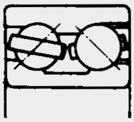
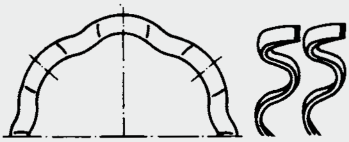
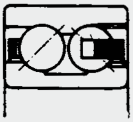
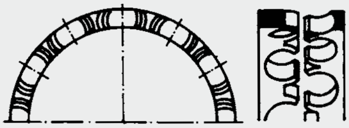
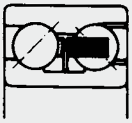
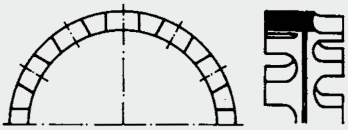
$P_r = F_r + 0{,}73\ F_a$, kN, for $F_a/F_r \leq 0{,}86$
$P_r = 0{,}62\ F_r + 1{,}17\ F_a$, kN, for $F_a/F_r > 0{,}86$

For double row angular contact ball bearings series 33D with a contact angle $\alpha = 45°$, the following equations are used:

$P_r = F_r + 0{,}47\ F_a$, kN, for $F_a/F_r \leq 1{,}33$,
$P_r = 0{,}54\ F_r + 0{,}81\ F_a$, kN, for $F_a/F_r > 1{,}33$

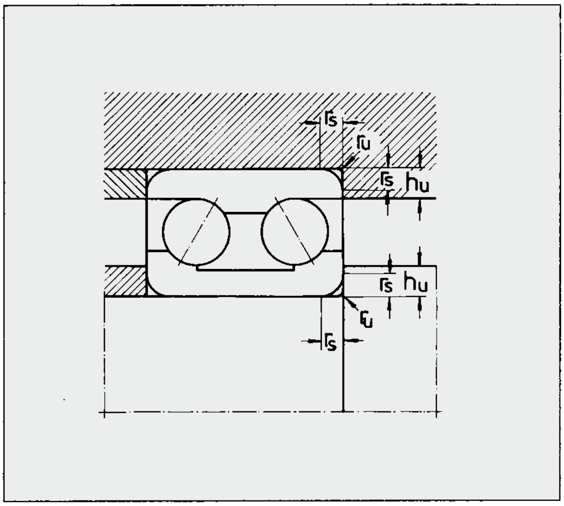
Cage design and some technical data

Table 2

Cage	**Design** Bearing	 Cage	**Application**	**Max. value** Dm n oil	 grease
Pressed sheet cage			- General application - Bearing series 32, 33	450×10^3	350×10^3
Polyamide cage TN			- General application - Bearing series 32, 33	1000×10^3	800×10^3
Machined brass cage M			- General application - Bearings dimensions 3319-3322, 3305D-3318D	800×10^3	600×10^3

For double row angular contact ball bearings with a contact angle $\alpha = 40°$, the following equations are used:

$P_r = F_r + 0{,}55\ F_a$, kN, for $F_a/F_r \le 1{,}14$,
$P_r = 0{,}57\ F_r + 0{,}93\ F_a$, kN, for $F_a/F_r > 1{,}14$.



Equivalent static radial load

For double row angular contact ball bearings series 32 and 33 with a contact angle $\alpha = 32°$:

$P_{0r} = F_r + 0{,}63\ F_a$, kN

For double row angular contact ball bearings series 33D with a contact angle $\alpha = 45°$:

$P_{0r} = F_r + 0{,}46\ F_a$, kN

For double row angular contact ball bearings with a contact angle $\alpha = 40°$:

$P_{0r} = F_r + 0{,}52\ F_a$, kN

Abutment dimensions

For a proper location of bearing rings on the shaft and housing shoulder respectively, shaft (housing) maximum radius $r_{u\ max}$ should be less than bearing minimum mounting chamfer $r_{s\ min}$

Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

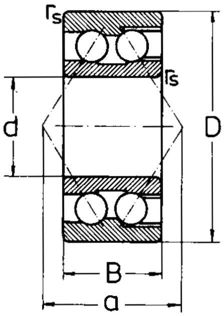
The values of the connection radii and support shoulder height are given in table 3.

Abutment dimensions

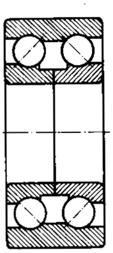
Table 3

r_s min. mm	**r_u max.**	**h_u min.** Bearing series 32; 33; 33D
0,6	0,6	2,1
1	1	2,8
1,1	1,1	3,5
1,5	1,5	4,5
2	2	5,5
2,1	2,1	6
3	2,5	7

Double-row angular contact ball bearings



32 ; 33



33D

Dimensions					Basic radial load		Speed limit		Designation	Weight
d	D	B	rs min.	a	dyn. Cr	stat. C0r	grease	oil		
mm					kN		min^{-1}		–	kg
10	30	14,3	0,6	19	7,8	3,9	16 000	22 000	3200	0,050
12	32	15,9	0,6	22	10,6	5,1	15 000	20 000	3201	0,060
15	35	15,9	0,6	23	11,8	6,1	13 000	18 000	3202	0,070
	42	19	1	27	16,3	8,7	10 000	15 000	3302	0,130
17	40	17,5	0,6	27	14,6	7,8	10 000	15 000	3203	0,100
	47	22,2	1	31	20,8	10,6	9 500	14 000	3303	0,190
20	47	20,6	1	31	19,6	10,8	9 000	13 000	3204	0,170
	52	22,2	1,1	34	23,2	12,9	8 500	12 000	3304	0,230
	52	22,2	1,1	46	24	11	8 500	12 000	3304D	0,230
25	52	20,6	1	35	21,2	12,7	8 000	11 000	3205	0,190
	62	25,4	1,1	40	29,2	17,3	7 500	10 000	3305	0,370
	62	25,4	1,1	57	30	19	7 500	10 000	3305D	0,380
30	62	23,8	1	41	28,1	18,3	7 000	9 500	3206	0,310
	72	30,2	1,1	47	38	24,5	6 300	8 500	3306	0,580
	72	30,2	1,1	67	41,5	30	6 300	8 500	3306D	0,600
35	72	27	1,1	47	39	25	6 000	8 000	3207	0,480
	80	34,9	1,5	54	51	30	5 600	7 500	3307	0,780
	80	34,9	1,5	76	58	38	5 600	7 500	3307D	0,780
40	80	30,2	1,1	52	48	31,5	5 600	7 500	3208	0,650
	90	36,5	1,5	58	62	39	5 000	6 700	3308	1,05
	90	36,5	1,5	84	70	45	5 000	6 700	3308D	1,15
45	85	30,2	1,1	56	49	32,5	5 000	6 700	3209	0,700
	100	39,7	1,5	64	71	57	4 500	6 000	3309	1,41
	100	39,7	1,5	93	78	51	4 500	6 000	3309D	1,61
50	90	30,2	1,1	59	51	36	4 800	6 300	3210	0,740
	110	44,4	2	73	85	75	4 000	5 300	3310	1,90
	110	44,4	2	102	90	72	4 000	5 300	3310D	2,05
55	100	33,3	1,5	64	54	55	4 300	5 600	3211	1,05
	120	49,2	2	80	98	88	3 600	4 800	3311	2,48
	120	49,2	2	114	104	81,5	3600	4800	3311D	2,68
60	110	36,5	1,5	71	69,5	72	3 800	5 000	3212	1,36
	130	54	2,1	86	114	112	3 400	4 500	3312	3,17
	130	54	2,1	123	116	104	3 400	4 500	3312D	3,42
65	120	38,1	1,5	76	73,5	83	3 600	4 800	3213	1,76
	140	58,7	2,1	94	129	130	3 200	4 300	3313	4,01
	140	58,7	2,1	132	135	117	3 200	4 300	3313D	4,31
70	125	39,7	1,5	81	81,5	91,5	3 200	4 300	3214	1,93
	150	63,5	2,1	101	143	146	2 800	3 800	3314	5,04

Double-row angular contact ball bearings

Dimensions					Basic radial load		Speed limit		Desig-nation	Weight
d	D	B	r_s min.	a	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		–	kg
70	150	63,5	2,1	142	159	130	2 800	3 800	3314D	5,40
75	130	41,3	1,5	84	85	98	3 200	4 300	3215	2,08
	160	68,3	2,1	107	163	166	2 600	3 600	3315	6,16
	160	68,3	2,1	140	179	150	2 600	3 600	3315D	6,66
80	140	44,4	2	91	95	110	2 800	3 800	3216	2,64
	170	68,3	2,1	112	176	186	2 400	3 400	3316	6,93
	170	68,3	2,1	149	192	170	2 400	3 400	3316D	7,53
85	150	49,2	2	97	112	132	2 600	3 600	3217	3,39
	180	73	3	119	190	200	2 200	3 200	3317	8,30
	180	73	3	155	208	193	2 200	3 200	3317D	9,00
90	160	52,4	2	104	125	146	2 400	3 400	3218	4,14
	190	73	3	125	216	240	2 000	3 000	3318	9,23
	190	73	3	166	228	216	2 000	3 000	3318D	10,0
95	170	55,6	2,1	111	140	163	2 200	3 200	3219	5,00
	200	77,8	3	133	220	245	1 900	2 800	3319	11,4
100	180	60,3	2,1	118	160	196	2 000	3 000	3220	6,10
	215	82,6	3	139	240	280	1 800	2 600	3320	14,2
110	200	69,8	2,1	132	190	228	1 900	2 800	3222	8,79
	240	92,1	3	153	280	400	1 800	2 600	3322	19,0

Non-standard double-row angular contact ball bearings

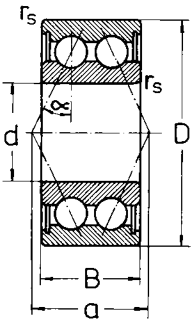


Fig.1

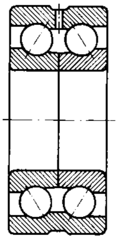


Fig.2

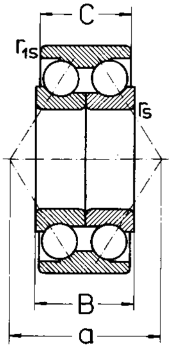


Fig.3

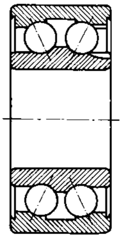


Fig.4

Dimensions							Fig.	Basic radial load		Speed limit		Designation	Weight
d	D	B	C	r_s min.	α	a		dyn. C_r	stat. C_{0r}	grease	oil		
mm					degree	mm	—	kN		min^{-1}		—	kg
20	47	20,6		1	32	30	1	15,8	7,9	9 500	14 000	**5204**	0,157
35	72	29	22	2	32	48	3	54,6	35,5	6 000	8 000	**3407D**	0,310
	74	30		3	32	48	2	57,3	46,1	6 000	8 000	**3507DTN**	0,585
36	76	29	27	2,3	31	45	3	54	44,5	5 600	7 500	**3607DTN**	0,575
45	100	39,7		2,3	26	17	4	85,9	75,8	5 600	7 500	**5309**	1,75
120	190	66		2	36	146	2	157	207	1 900	2 800	**3424DMP6**	7,11
	190	66		2	32	130	2	175	226	1 900	2 800	**3524DMP6**	6,17
180	259,5	66		2,1	32	171	2	208	318	1 300	1 900	**3436DM**	10,9
190	269,5	33	66	2,1	32	180	2	273	396	1 200	1 800	**3438DMW1**	9,66
200	289,5	76		2,1	32	192	2	307	468	1 100	1 600	**3440DMW33**	15,5
230	329,5	80		2,1	32	214	2	354	592	1 000	1 400	**3446DMW33**	21,0
250	340	76	70	2,1	40	286	3	317	539	600	900	**3450DFS1**	19,0
260	369,5	46		2,1	32	246	2	395	705	850	1 300	**3452DMW33**	28,0
280	389,5	92		2,1	32	258	2	416	776	800	1 200	**3456DMW33**	32,5

Non-standard double-row angular contact ball bearings

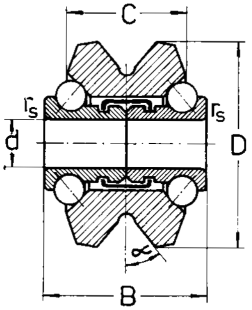


Fig.1

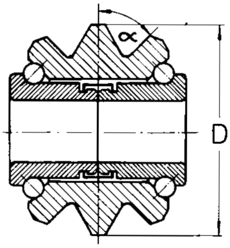


Fig.2

Dimensions						Fig.	Basic radial load		Designation	Weight
d	D	B	C	r_s min.	a		dyn. C_r	stat. C_{0r}		
mm							kN		—	kg
12	42,945	31	21,5	0,6	33,7	1	12	8,5	**790601**	0,182
15	54,5	45	33	0,6	49,1	2	13,3	10,8	**790202**	0,428

Angular contact ball bearings, double row

Equivalent designations

Designation	Fig.	Equivalent
5204	1	5204 5204
3407D	3	790107
3507DTN	2	
3607DTN	3	440190D
5309	4	5309
3424DMP6	2	
3524DMP6	2	305256D
3436DM	2	305262D
3438DMW1	2	305338D
3440DMW33	2	305263D 509590A
3446DMW33	2	305264D 506732A
3450DFS1	3	305611D
3452DMW33	2	305270D 508731
3456DMW33	2	305269D

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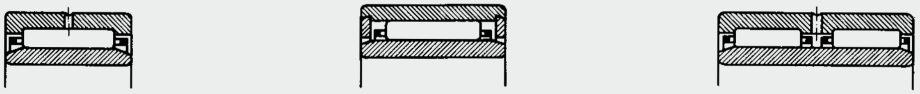
Needle roller bearings

Needle roller bearings can be considered a version of cylindrical roller bearings. As these small-sized bearings can take over heavy dynamic loads, they provide high stiffness in bearing units.

Needle roller bearings are manufactured in the following constructive versions:

Needle roller bearings with inner ring

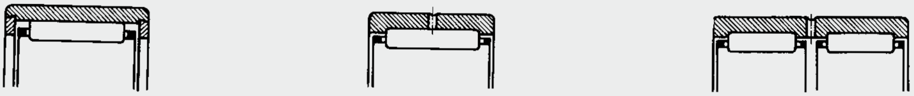


NA,d < 9mm

NA

NA69

Needle roller bearings without inner ring (full complement)



RNA,·F_w < 12mm

RNA

RNA69
F_w = 35mm

Suffixes

A	- dimensions rounded to whole numbers
B	- extended inner ring
C2	- radial clearance smaller than normal
C3	- radial clearance larger than normal
C4	- radial clearance larger than C3
F2	- constructive modifications
L	- light alloy machined cage
NA	- radial clearance, non-interchangeable bearing elements
NR	- groove on the inner ring and snap ring
P6	- tolerance class more accurate than normal
P5	- tolerance class more accurate than P6
P52	- tolerance class P5, radial clearance C2
S0	- bearing which can be used up to a temperature of +150°C
TN	- polyamide cage
V	- bearing without cage (full complement)
W2	- needle roller bearing with lubrication holes and grooves in the outer ring

In case of limited space needle roller bearings without inner rings (RNA type) can be used instead of needle roller bearings with inner rings. The shaft must be hardened and ground.

The shaft raceway must have a hardness of 58...65 HRC and a minimum roughness R_a = 0,2 μm for normal bearings. In case of less pretentious bearings, R_a = 0,3 μm is allowed.

RUL 1V - national standard is the most frequently used material for shafts on which needle roller bearings without inner rings are to be mounted. As for case-hardening steels, 13CrNi35X, 21MoCr12, 15Cr08Mo, 20MoCrNi06 types, minimum thickness of the case-hardened layer can be determined as a function of the rolling

Values of factors f_H and f_{0H}

Table 1

HRC	60	58	55	50	45	40	35	30
f_H	1,0	0,95	0,80	0,60	0,40	0,30	0,25	0,18
f_{0H}	1,0	1,0	0,95	0,80	0,70	0,55	0,40	0,30

element diameter, using the equation:

$t_{min} = (0{,}07...0{,}12)\ D_{w}$, mm

where:

D_w = rolling element diameter, mm

Greater values are valid in case of materials with core low strength and heavy loads.

In case of heat treatment steels (e.g. 41MoCr11) which have been surface hardened and tempered, layer thickness can be calculated using the equation:

$t_{min} = (0{,}1...0{,}15)D_{w}$, mm

where:

D_w = rolling element diameter, mm

Layer thickness after grinding must be of minimum 0,3 mm.

If the hardness of the surface layer is less than 58 HRC, bearing cannot accommodate the initial basic dynamic load C_r and basic static load C_{0r}, respectively. In this case, basic dynamic load will be decreased by factor f_H and basic static load by factor f_{0H}, according to the equations:

$C_{r\ ef} = f_H\ C_r$, kN

$C_{0r\ ef} = f_{0H}\ C_{0r}$, kN

Factors f_H and f_{0H} are given in table 1.

Dimensions

The dimensions of needle roller bearings are standardized only for dimension series NA48, NA49, NA69, in accordance with ISO 1206

Tolerances

Needle roller bearings with one-piece rings are generally manufactured to the normal tolerance class (P0). At request, they can be manufactured to other tolerance classes (P6 and P5).

The values of tolerances are given in chapter 5 on page 37.

Radial clearance

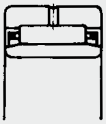
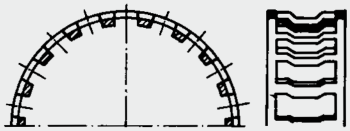
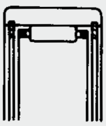
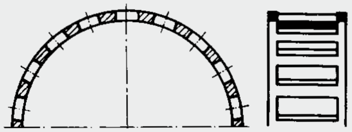
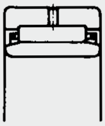
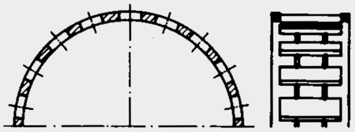
Needle roller bearings with one-piece rings are generally manufactured with normal radial clearances and the values of clearance are the same with those of the cylindrical roller bearings, according to ISO 5753

At request, these bearings are manufactured with other clearances (C2, C3 or C4).

If needle roller bearings are to be matched in pairs, radial clearance should be the same for both bearings so that loads should be uniformly distributed.

Cage design and some technical data

Table 2

Cage	Design		Application	Max. value $D_m n$	
	bearing	cage		oil	grease
Pressed sheet cage			- General application - Moderate speeds	450×10^3	230×10^3
Polyamide cage TN			- General application - Moderate and high speeds - Bearings with $d \leq 80$ mm	850×10^3	500×10^3
Machined steel cage			- General application - Moderate speeds	450×10^3	250×10^3

Cages

Needle roller bearings with one-piece rings are generally fitted with pressed sheet cages. At special request, when bearings are to be operated at high speeds and/or under heavy loads, machined steel cages are recommended to be used. Glass fibre reinforced polyamide 6.6 cages are also successfully used up to an operating temperature of +120°C.

Cage design and some technical data are given in table 2.

Fits

Needle roller bearings are generally mounted with interference fits so that rings should not get deformed due to their low section. In case of large-sized bearings, heavy loads and shock loads, bearings are more tightly mounted. When determining the fit, the difference of temperature between the inner ring and the outer ring, respectively, should be considered. The manufacturing tolerance of the shaft should be in the tolerance class 6 (IT6) and of the housing in the tolerance class 7 (IT7). In case of bearings manufactured to more accurate tolerance classes, the manufacturing tolerance of the shaft should be in the tolerance class 5 (IT5) and of the housing in the tolerance class 6 (IT6). These classes are also compulsory for the raceway on shaft. Deviations of form and position should be in accordance with the stipulations

The shaft tolerances are given in table 3. They depend on the radial clearance necessary for needle roller bearings without inner rings which are mounted into the housing, the housing bore being manufactured to the tolerance class K6.

Shaft tolerances for direct bearing unit

Table 3

Shaft diameter d (mm)	**Radial clearance** Smaller than normal	Normal	Larger than normal
≤ 80	k5	h5	g6
> 80	k5	h5	f6

Bearing minimum radial load

Needle roller bearings must be subjected to a given minimum load especially when being operated at high speeds, so that a proper operation of these bearings can be guaranteed.

The inertia forces which occur in bearing and the friction in the lubricant have a detrimental influence on the rolling conditions in bearing and may cause damaging sliding movements between needle rollers and raceways.

Minimum radial load can be approximately calculated using the equation:

$$F_{r\,min} = 0{,}02\ C_r$$

where:

$F_{r\,min}$ = minimum radial load, kN

C_r = basic dynamic load, kN

Dynamic and static equivalent load

Needle roller bearings can accommodate only radial loads which can be calculated using the equations:

$P_r = F_r$, kN

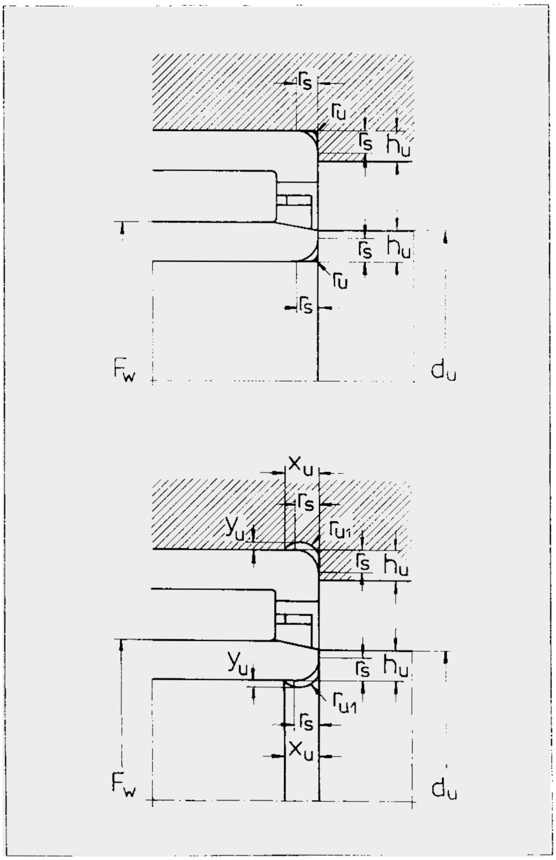
$P_{0r} = F_{0r}$, kN

Abutment dimensions

For a proper location of bearing rings on the shaft and housing shoulder respectively, shaft (housing) maximum radius $r_{u\,max}$ should be less than bearing minimum mounting chamfer $r_{s\,min}$.

Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

The values of the connection radius (r_u) and support shoulder height (h_u), depending on the mounting chamfer, are given in table 4 and are in accordance with national standard



The diameter d_u should not exceed the values given in table 5, so that the shaft can be mounted and remounted. The dimension F_w is given in bearing tables.

Abutment dimensions

Table 4

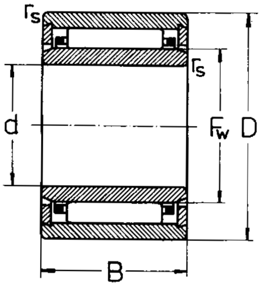
r_s min.	r_u max.	Y_u	r_{u1}	X_u	h_u min.
mm					
0,15	0,15				0,6
0,3	0,3				1
0,6	0,6				2
1	1	0,2	1,3	2	2,5
1,1	1	0,3	2	3	3,25
1,5	1,5	0,4	2	3,2	4
2	2	0,5	2,5	4	5
2,1	2,1	0,5	3	4,7	5,5
3	2,5	0,5	3,5	5,3	6
4	3	0,6	4	5,5	7

Shoulder diameter

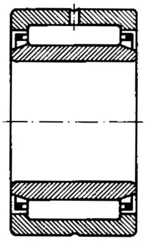
Table 5

F_w over	up to	d_u max.
mm		
—	**20**	$F_w-0,3$
20	**55**	$F_w-0,5$
55	**100**	$F_w-0,7$
100	**250**	F_w-1
255	**—**	$F_w-1,5$

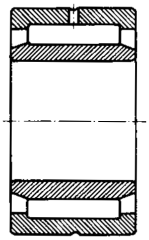
Needle roller bearings



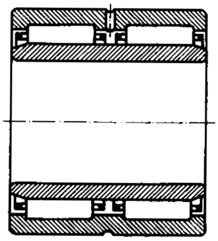
NA,d ⩽ 9mm



NA



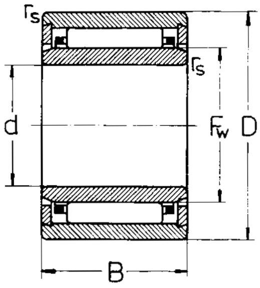
NA V



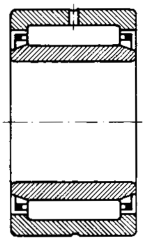
NA69

Dimensions					Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	F_w	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		—	kg
5	15	12	0,3	8	3,7	3,95	19 000	32 000	**NA051512**	0,013
	15	16	0,3	8	4,95	5,65	19 000	32 000	**NA051516**	0,016
6	16	12	0,3	9	4,3	4,8	18 000	30 000	**NA061612**	0,014
	16	16	0,3	9	5,6	6,9	18 000	30 000	**NA061616**	0,018
7	17	12	0,3	10	4,5	5,35	17 000	28 000	**NA071712**	0,015
	17	16	0,3	10	5,8	6,5	17 000	28 000	**NA071716**	0,020
9	19	12	0,3	12	4,65	5,8	16 000	26 000	**NA091912**	0,018
	19	16	0,3	12	6,15	8,1	16 000	26 000	**NA091916**	0,023
10	22	13	0,3	14	8,25	9,1	15 000	24 000	**NA4900**	0,024
	22	16	0,3	14	9,8	11,3	15 000	24 000	**NA102216**	0,031
	22	20	0,3	14	11,8	15,4	15 000	24 000	**NA102220**	0,038
12	24	13	0,3	16	9,1	10,6	15 000	24 000	**NA4901**	0,027
	24	22	0,3	16	14,8	20,2	15 000	24 000	**NA6901**	0,048
15	28	13	0,3	20	10,4	13,2	13 000	20 000	**NA4902**	0,035
	28	23	0,3	20	16,8	24,5	13 000	20 000	**NA6902**	0,065
17	30	13	0,3	22	10,7	13,9	11 000	18 000	**NA4903**	0,039
	30	23	0,3	22	18,2	27,8	11 000	18 000	**NA6903**	0,074
20	37	17	0,3	25	20,6	24,4	9 500	16 000	**NA4904**	0,077
	37	30	0,3	25	33	47,6	9 500	16 000	**NA6904**	0,143
25	42	17	0,3	30	22,2	28,3	8 000	13 000	**NA4905**	0,096
	42	17	0,3	30	30	42,8	3 000	6 000	**NA4905V**	0,100
	42	30	0,3	30	40,1	60,1	8 000	13 000	**NA6905**	0,170
30	45	20	0,3	35	24,2	38,5	7 000	11 000	**NA304520**	0,117
	47	17	0,3	35	23,7	32,1	7 000	11 000	**NA4906**	0,107
	47	30	0,3	35	43,1	69,3	7 000	11 000	**NA6906**	0,202
35	55	20	0,6	42	29,8	45,5	6 300	9 500	**NA4907**	0,174
	55	36	0,6	42	52,7	95	6 300	9 500	**NA6907**	0,330
40	55	30	0,3	45	40,2	86,9	6 000	9 000	**NA405530**	0,221
	62	22	0,6	48	38,7	60,9	5 600	8 500	**NA4908**	0,239
	62	22	0,6	48	55	97,1	2 000	4 000	**NA4908V**	0,266
	62	40	0,6	48	63,8	116	5 600	8 500	**NA6908**	0,450
	65	22	1	50	40,7	66,9	5 600	8 500	**NA406522**	0,290
45	62	25	0,6	50	36,3	76	5 300	8 000	**NA456225**	0,235
	62	35	0,6	50	49,4	114	5 300	8 000	**NA456235**	0,330
	68	22	0,6	52	46,4	73,9	5 000	7 500	**NA4909**	0,285
	68	40	0,6	52	64,5	123	5 000	7 500	**NA6909**	0,515
50	68	25	0,6	55	38,5	82,2	5 000	7 500	**NA506825TN**	0,268
	72	22	0,6	58	45	73,5	4 800	7 000	**NA4910**	0,280

Needle roller bearings



NA,d ≤ 9mm



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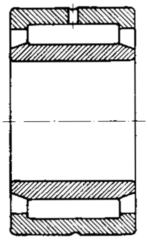
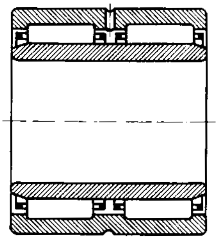


NA V



NA69

Dimensions					Basic radial load		Speed limit		Designation	Weight
d	D	B	r_s min.	F_w	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		—	kg
50	72	40	0,6	58	67,3	136	4 800	7 000	**NA6910**	0,545
55	72	25	0,6	60	40,2	87	4 500	6 700	**NA557225TN**	0,283
	72	35	0,6	60	55,7	130	4 500	6 700	**NA557235**	0,380
	80	25	1	63	59,3	101	4 500	6 700	**NA4911**	0,423
55	80	25	1	63	80,3	151	1 500	3 000	**NA4911V**	0,448
	80	45	1	63	83,8	173	4 500	6 700	**NA6911**	0,795
60	85	25	1	68	62	109	4 000	6 000	**NA4912**	0,454
	85	25	1	68	83,4	163	1 400	2 800	**NA4912V**	0,480
	85	45	1	68	89,1	175	4 000	6 000	**NA6912**	0,836
65	90	25	1	72	58,3	110	3 800	5 600	**NA4913**	0,472
	90	45	1	72	91,3	193	3 800	5 600	**NA6913**	0,881
70	95	25	1	80	53,4	115	3 400	5 000	**NA709525**	0,538
	100	30	1	80	76,5	148	3 400	5 000	**NA4914TN**	0,725
	100	30	1	80	103	231	1 200	2 700	**NA4914V**	0,774
	100	54	1	80	125	254	3 400	5 000	**NA6914**	1,39
75	105	30	1	85	80,6	158	3 200	4 800	**NA4915**	0,796
	105	54	1	85	127	270	3 200	4 800	**NA6915**	1,51
80	110	30	1	90	84,9	169	3 000	4 500	**NA4916**	0,870
	110	54	1	90	144	316	3 000	4 500	**NA6916**	1,48
85	115	26	1	95	74,3	137	2 800	4300	**NA85/26**	0,830
	120	35	1,1	100	98,8	222	2 600	4 000	**NA4917**	1,28
	120	63	1,1	100	143	378	2 600	4 000	**NA6917**	2,33
	130	45	1,1	104	121	408	900	1 800	**NA4617V**	2,57
90	125	35	1,1	105	110	222	2 400	3 800	**NA4918**	1,34
	125	63	1,1	105	144	400	2 400	3 800	**NA6918**	2,47
95	130	35	1,1	110	105	244	2 200	3 600	**NA4919**	1,39
	130	63	1,1	110	149	411	2 200	3 600	**NA6919**	2,63
100	130	30	1,1	110	99,6	210	2 200	3 600	**NA100/30**	1,00
	140	40	1,1	115	124	267	2 200	3 600	**NA4920**	1,93
110	140	30	1	120	102	222	2 000	3 400	**NA4822**	1,15
	150	40	1,1	125	127	283	2 000	3 400	**NA4922**	2,09
120	150	30	1	130	86,8	228	1 800	3 000	**NA4824**	1,23
	165	45	1,1	135	170	385	1 800	3 000	**NA4924**	2,95
130	165	35	1,1	145	122	316	1 700	2 800	**NA4826**	1,90
	180	50	1,5	150	188	421	1 700	2 800	**NA4926**	3,98
140	175	35	1,1	155	128	323	1 600	2 600	**NA4828**	1,99
	180	32	1,5	155	116	258	1 600	2 600	**NA140/32**	2,05
	190	50	1,5	160	190	484	1 600	2 600	**NA4928**	4,32
150	190	40	1,1	165	150	386	1 500	2 400	**NA4830**	2,85

Non-standard needle roller bearings

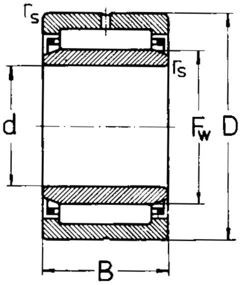


Fig.1

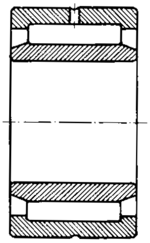


Fig.2

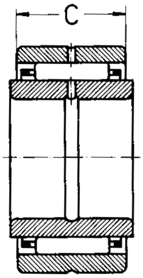


Fig.3

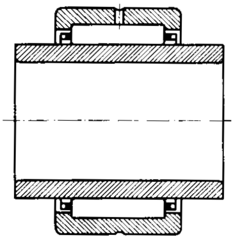


Fig.4

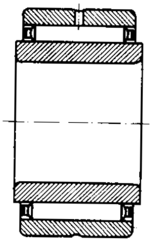


Fig.5

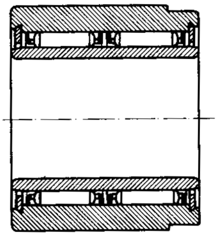


Fig.6

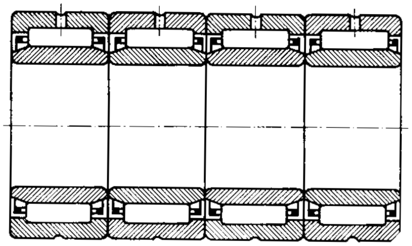
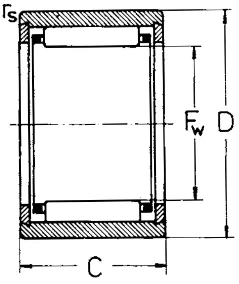


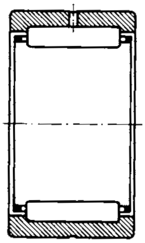
Fig.7

Dimensions						Basic radial load		Speed limit		Designation	Fig.	Weight
d	D	B	C	r_s min.	F_w	dyn. C_r	stat. C_{0r}	grease	oil			
mm						kN		min^{-1}		—		kg
10	33	24,5	24,5	1	12,3	27,3	43,3	15 000	24 000	**492100V**	4	0,145
28,575	47,625	26,654	25,4	1	34,925	36,1	55,2	7 000	11 000	**NA294825ABW2**	3	0,191
31,75	53,975	32	31,75	1,5	39,687	49,3	85,8	6 300	9 500	**NA325432ABW2**	3	0,318
35	55	36	36	1	41,51	46,1	97,8	6 300	9500	**NA6907A**	6	0,330
38,1	60,325	32	31,75	1,5	46,037	53,1	98,8	5 600	8 500	**NA386032ABW2**	3	0,372
40	65	22	18	1,1	50	30,4	54,5	5 600	8 500	**NAO406518BLC4**	5	0,268
	72	40	22	0,6	58	45	73,5	4 000	7 000	**NA4910B**	4	0,393
41,275	63,5	32	31,75	1,5	49,7	79,8	174	4 800	8 000	**NA416332ABVW2**	3	0,406
	65,088	32	31,75	1	50,8	56,3	106	5 600	8 500	**490110**	4	0,401
44,45	76,2	44,7	44,45	1,5	57,15	97,3	185	4 500	7 500	**NA447644ABW2**	3	0,899
45	72	40	40	1	52	56,8	138	4 500	7 500	**NA69/45F2**	6	0,698
55,562	88,9	44,7	44,45	2	69,85	106	220	4 800	6 000	**NA568944ABW2**	3	1,14
60	100	38	38	1	78,3	92,9	303	3 400	5 000	**NA6010038VNA**	1	1,44
65	105	38	38	1	83,1	104	319	3 400	5 000	**NA6510538VNA**	2	1,49
70	95	25	25	1,5	80	49,5	108	3 400	5 000	**NA709525**	1	0,545
114,3	177,8	63,5	63,5	4	139,7	283	596	1 700	2 800	**NA114/63A**	3	6,25
120	165	45	45	1,1	135	515	1 601	1 800	3 000	**4xNA4924**	7	11,8
150	215	72	72	1,5	179,3	372	1 450	1 800	3 000	**NA150/72VNAF2**	2	10,0

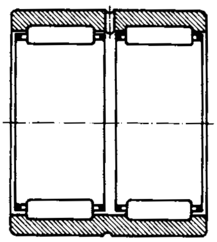
Needle roller bearings without inner ring



RNA, $F_w \leqslant$ 12mm



RNA



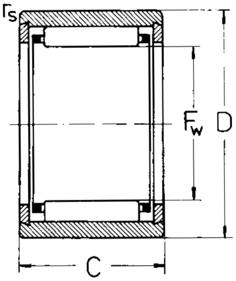
RNA69

Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
8	15	12	0,3	3,7	3,95	19 000	32 000	RNA081512	0,008
	15	16	0,3	4,95	5,65	19 000	32 000	RNA081516	0,012
9	16	12	0,3	4,3	4,8	18 000	30 000	RNA091612	0,010
	16	16	0,3	5,6	6,9	18 000	30 000	RNA091616	0,013
10	17	12	0,3	4,5	5,35	17 000	28 000	RNA101712	0,011
	17	16	0,3	5,8	6,5	17 000	28 000	RNA101716	0,014
12	18	15	0,3	5,6	7,75	16 000	26 000	RNA121815TN	0,012
	19	12	0,3	4,65	5,8	16 000	26 000	RNA121912	0,013
	19	16	0,3	6,15	8,1	16 000	26 000	RNA121916	0,017
	22	12	0,3	5,3	6,65	16 000	26 000	RNA122212	0,021
14	22	13	0,3	8,25	9,1	15 000	24 000	RNA4900	0,017
	22	16	0,3	9,8	11,3	15 000	24 000	RNA142216	0,021
	22	20	0,3	11,8	15,4	15 000	24 000	RNA142220	0,028
16	24	13	0,3	9,1	10,6	15 000	24 000	RNA4901	0,018
	24	22	0,3	14,8	20,2	15 000	24 000	RNA6901	0,032
18	28	15	0,3	9,5	11,9	14 000	22 000	RNA182815	0,036
20	28	13	0,3	10,4	13,2	13 000	20 000	RNA4902	0,022
	28	23	0,3	16,8	24,5	13 000	20 000	RNA6902	0,040
22	30	13	0,3	10,7	13,9	11 000	18 000	RNA4903	0,023
	30	23	0,3	18,2	27,8	11 000	18 000	RNA6903	0,043
25	37	17	0,3	20	24,4	9 500	16 000	RNA4904	0,053
	37	30	0,3	33	47,6	9 500	16 000	RNA6904	0,101
30	40	20	0,3	21	33	8 000	13 000	RNA304020	0,065
	42	17	0,3	22,2	28,3	8 000	13 000	RNA4905	0,068
	42	30	0,3	40,1	60,1	8 000	13 000	RNA6905	0,155
35	45	20	0,3	24,2	38,5	7 000	11 000	RNA354520	0,074
	47	17	0,3	23,7	32,1	7 000	11 000	RNA4906	0,140
	47	30	0,3	43,1	49,3	7 000	11 000	RNA6906	0,131
38	48	20	0,3	24,3	41,4	7 000	11 000	RNA384820	0,080
42	55	20	0,6	29,8	45,5	6 300	9 500	RNA4907	0,109
	55	36	0,6	52,7	95	6 300	9 500	RNA6907	0,214
45	55	30	0,3	40,2	86,9	6 000	9 000	RNA455530	0,137
48	62	22	0,6	38,7	60,9	5 600	8 500	RNA4908	0,147
	62	40	0,6	63,8	116	5 600	8 500	RNA6908	0,266
50	62	22	1	35,5	60,3	5 300	8 000	RNA506222	0,153
	62	25	0,6	36,3	76	5 300	8 000	RNA506225	0,157

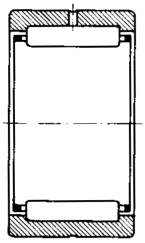
Needle roller bearings without inner ring

Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
50	62	35	0,6	49,4	114	5 300	8 000	RNA506235	0,209
52	68	22	0,6	46,4	73,9	5 000	7 500	RNA4909	0,197
	68	40	0,6	64,5	123	5 000	7 500	RNA6909	0,283
55	68	25	0,6	38,5	82,2	5 000	7 500	RNA556825TN	0,181
58	72	22	0,6	45	73,5	4 800	7 000	RNA4910	0,167
	72	40	0,6	67,3	136	4 800	7 000	RNA6910	0,335
60	72	25	0,6	40,2	87	4 500	6 700	RNA607225TN	0,160
	72	35	0,6	55,7	130	4 500	6 700	RNA607235	0,224
63	80	25	1	59,3	101	4 500	6 700	RNA4911	0,278
	80	45	1	83,8	173	4 500	6 700	RNA6911	0,477
68	85	25	1	62	109	4 000	6 000	RNA4912	0,296
	85	45	1	89,1	175	4 000	6 000	RNA6912	0,493
72	90	25	1	58,3	110	3 800	5 600	RNA4913	0,318
	90	45	1	91,3	193	3 800	5 600	RNA6913	0,545
80	95	25	1	53,4	115	3 400	5 000	RNA809525	0,312
	100	30	1	76,5	148	3 400	5 000	RNA4914TN	0,485
	100	54	1	125	254	3 400	5 000	RNA6914	0,545
85	105	30	1	80,6	158	3 200	4 800	RNA4915	0,504
	105	54	1	127	270	3 200	4 800	RNA6915	0,965
90	110	30	1	84,9	169	3 000	4 500	RNA4916	0,520
	110	54	1	144	316	3 000	4 500	RNA6916	0,973
95	115	26	1	74,3	137	2 800	4 300	RNA95/26	0,523
100	120	35	1,1	98,8	222	2 600	4 000	RNA4917	0,672
	120	63	1,1	143	378	2 600	4 000	RNA6917	1,24
105	125	35	1,1	110	222	2 400	3 800	RNA4918	0,712
	125	63	1,1	144	400	2 400	3 800	RNA6918	1,36
110	130	30	1,1	99,6	210	2 200	3 600	RNA110/30	0,626
	130	35	1,1	105	244	2 200	3 600	RNA4919	0,729
	130	63	1,1	149	411	2 200	3 600	RNA6919	1,48
115	140	40	1,1	124	267	2 200	3 600	RNA4920	1,17
120	140	30	1	102	222	2 000	3 400	RNA4822	0,729
125	150	40	1,1	127	283	2 000	3 400	RNA4922	1,25
130	150	30	1	86,8	228	1 800	3 000	RNA4824	0,730

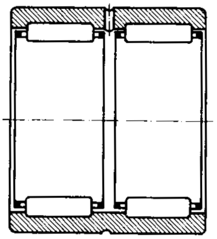
Needle roller bearings without inner ring



RNA, $F_w \leqslant$ 12mm



RNA



RNA69

Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
135	165	45	1,1	170	385	1 800	3 000	**RNA4924**	1,93
145	165	35	1,1	122	316	1 700	2 800	**RNA4826**	1,02
150	180	50	1,5	188	421	1 700	2 800	**RNA4926**	2,25
155	175	35	1,1	128	323	1 600	2 600	**RNA4828**	1,21
	180	32	1,5	116	258	1 600	2 600	**RNA155/32**	1,22
160	190	50	1,5	190	484	1 600	2 600	**RNA4928**	2,50
165	190	40	1,1	150	386	1 500	2 400	**RNA4830**	1,68

Non-standard needle roller bearings without inner ring

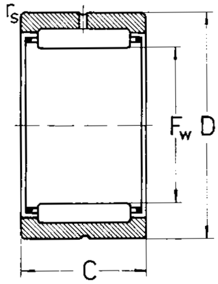


Fig.1

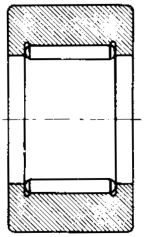


Fig.2

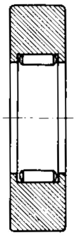


Fig.3

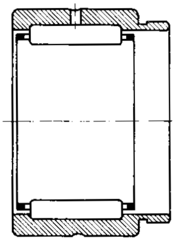


Fig.4

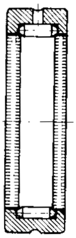


Fig.5

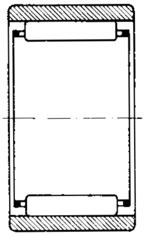


Fig.6

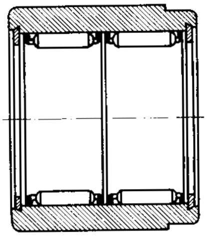


Fig.7

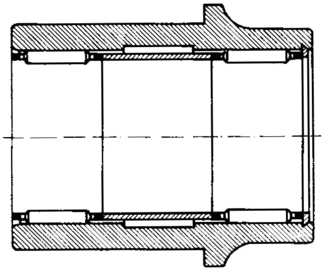


Fig.8

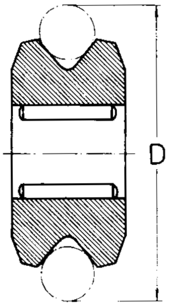


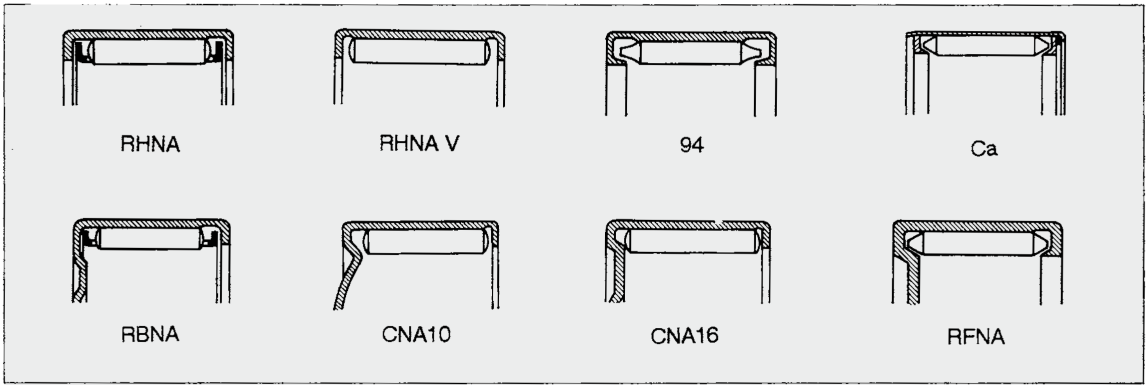
Fig.9

Dimensions				Basic radial load		Speed limit		Fig.	Designation	Weight
d	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil			
mm				kN		min^{-1}		—		kg
12,5	57,81	23		27	35	2 800	5 600	9	**490401**	0,199
19,05	31,75	25,4	1	27,7	33,4	13 000	20 000	1	**RNA193225A**	0,078
22	40	20	0,6	18,6	28,1	9 000	19 000	1	**RNA224020**	0,127
	40	20	0,6	27,2	46,8	4 000	8 000	2	**RNA224020V**	0,127
25	33	16	0,3	11,5	18,5	9 000	16 000	1	**RNA253316**	0,039
25,4	38,1	19,05	0,6	24,5	30,6	9 000	16 000	1	**RNA253819A**	0,070
26,008	46	47,5	1,5	15,2	26,6	9 000	16 000	8	**RNA264647A**	0,274
27	39,688	38,48	0,5	39,5	57,5	9 000	16 000	4	**RNA274038A**	0,133
28	60	12	1	16,3	26,1	3 400	7 000	3	**RNA286012V**	0,200
28,58	41,28	31,75	1	43,5	66,1	9 000	14 000	1	**RNA294132A**	0,133
31,75	44,45	31,75	1	43,2	67,5	8 000	13 000	1	**RNA324432A**	0,140
36,51	49,213	25,4	1,5	37,3	58,4	7 000	11 000	1	**RNA364925A**	0,125
41,275	65,088	31,75	1	82,1	106	6 000	9 000	1	**RNA416532A**	0,378
41,51	55	36	0,6	46,1	97,8	6 300	9 500	7	**RNA6907AP5**	0,269
47,625	61,912	31,75	1,5	66	114	6 000	9 000	1	**RNA486232A**	0,236
69,85	88,9	38,1	2	96,7	196	4 000	6 000	1	**RNA708938A**	0,557
78,3	95	20	2	41,7	108	1 200	2 500	5	**RNA789520AV**	0,290
90	105	26	1,5	59,6	143	3 200	4 800	6	**RNAO 90/26**	0,383

Drawn cup needle roller bearings

Drawn cup needle roller bearings consist of a single row of needle rollers with or without cage and a low cross section outer sleeve of heat treated steel which is the outer ring. Drawn cup needle roller bearings can be open on both ends or only on one end. Those with one closed end are intended to be mounted on shaft ends.

Various designs of drawn cup needle roller bearings are given below:



Suffixes

A - dimensions rounded to whole numbers
RS - sealed bearing
TN - polyamide cage
V - bearing without cage

Drawn cup needle roller bearings are manufactured both with cage and without cage. In case of those without cage, suffix "V" is added to the basic designation. Drawn cup needle roller bearings are also manufactured with seal on one end (RS) or on both ends (2RS).

Drawn cup needle roller bearings should be mounted into the housing bore with an interference fit. For this reason, axial location is not necessary. In most cases, they are mounted without inner ring. Inner rings are used only when the shaft is not hardened and ground.

The specifications regarding shaft raceway for needle roller bearings without inner rings are also available for drawn cup needle roller bearings mounted directly on the shaft.

Dimensions

The dimensions of drawn cup needle roller bearings with open or closed end are in accordance with ISO 3245 and national standard respectively. Drawn cup needle roller bearings of non-standardized designs and dimensions can also be manufactured.

Tolerances

The tolerances of drawn cup needle roller bearings are not internationally standardized. They have thin walls and they assume the housing bore form after being pressed. The needle rollers inscribed circle diameter F_w, should be measured after the drawn cup needle roller bearing with D outside diameter had been pressed in a gauge ring. Gauge ring bore diameter D_0 should have values corresponding to the minimum values of the tolerance class N6. These values are given in table 1.

Gauge ring dimensions

Table 1

D	Do ±0,003	D	Do ±0,003	D	Do ±0,003	D	Do ±0,003
mm							
8	7,984	**20**	19,976	**35**	34,972	**50**	49,972
9	8,984	**21**	20,976	**37**	36,972	**52**	51,967
10	9,984	**22**	21,976	**38**	37,972	**55**	54,967
11	10,980	**23**	22,976	**39**	38,972	**58**	57,967
12	11,980	**24**	23,976	**40**	39,972	**63**	62,967
13	12,980	**25**	24,976	**42**	41,972	**68**	67,967
14	13,980	**26**	25,976	**45**	44,972	**73**	72,967
15	14,980	**28**	27,976	**47**	46,972	**78**	77,976
16	15,980	**30**	29,976	**48**	47,972		
18	17,980	**32**	31,972	**49**	48,972		

Gauge inner ring thickness should be of minimum 20 mm.

The deviation of diameter F_w of the needle roller inscribed circle for drawn cup needle roller bearings pressed into the gauge ring should correspond to the values given in table 2.

Tolerances of diameter F_w

Table 2

F_w over	up to	ΔF_w high	low
mm		μm	
3	**6**	+28	+10
6	**10**	+31	+13
10	**18**	+34	+16
18	**30**	+41	+20
30	**50**	+50	+25
50	**70**	+60	+30

Radial clearance and mounting tolerances

Drawn cup needle roller bearings have normal radial clearance, corresponding to the tolerance class F8, which is determined by the tolerances of housing bore and shaft.

Tolerances of the housing bore and shaft are given in table 3, for various housing materials.

Tolerances of the housing bore and shaft

Table 3

Housing material	Tolerances of: Housing bore	Shaft without inner ring	Shaft with inner ring
Steel or cast iron	N6 (N7)	h5 (h6)	k5 (j6)
Light metals	R6 (R7)	h5 (h6)	k5 (j6)

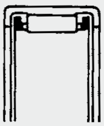
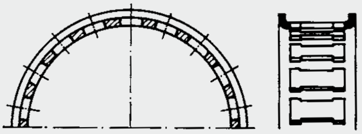
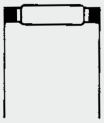
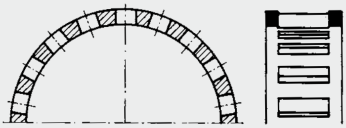
Cages

Drawn cup needle roller bearings are generally fitted with pressed sheet cages. Glass fibre reinforced polyamide 6.6 cages are also suitable up to +120°C.

Cage design and some technical data are given in table 4.

Cage design and some technical data

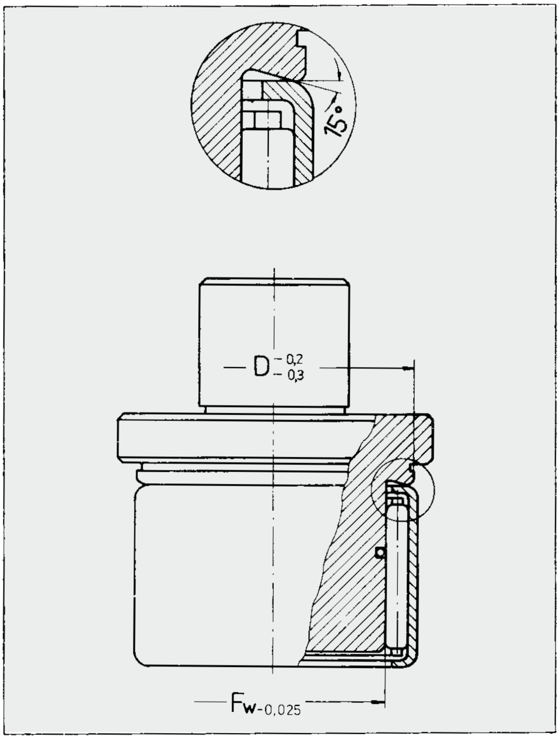
Table 4

Cage	Design Bearing	Cage	Application	Max. value D_m n oil	grease
Pressed sheet cage			- General application - Moderate speeds	300×10³	150×10³
Polyamide cage TN			- General application - Moderate and high speeds	350×10³	200×10³

Mounting instructions

Drawn cup needle roller bearings should be pressed in their seating by means of a special mandrel, as shown in the figure bellow.

When pressing a drawn cup needle roller bearing it should be considered that only one rib, i.e. the marked one has been heat treated. The bearing should be pressed on this rib by means of the mandrel shown in figure bellow.



Paired mounting

Drawn cup needle roller bearings which are to be paired mounted should have the same needle rollers inscribed circle diameter F_w (the same sort), so that an uniform load distribution on both bearings should be achieved.

Bearing minimum radial load

Needle roller bearings must be subjected to a given minimum load especially when being operated at high speeds, so that a proper operation of these bearings can be guaranteed.

The inertia forces which occur in bearing and the friction in the lubricant have a detrimental influence on the rolling conditions in bearing and may cause damaging sliding movements between needle rollers and raceways.

Minimum radial load depends on the bearing size, speed and lubricant viscosity at the operating temperature. It can be approximately calculated using the equation:

$$F_{r\,min} = 0{,}01\ C_r,\ kN$$

where:
$F_{r\,min}$ = minimum radial load, kN
C_r = basic dynamic load, kN

Dynamic and static equivalent load

Considering that drawn cup needle roller bearings with open or closed ends can take only radial loads, these loads can be calculated using the equations:

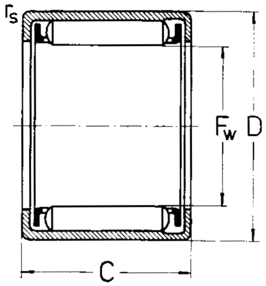
$$P_r = F_r,\ kN,$$
$$P_{0r} = F_r,\ kN$$

For these bearings, the recommendations on page 29, concerning static safety factor s_0, are not valids, and it must be considered $s_0 > 3$.

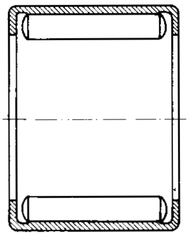
Abutment dimension

Drawn cup needle roller bearings with and without bottom should be mounted with an interference fit. Because of their low cross section, they will assume the housing bore form. The fits are to be chosen so that bearing axial location to be not necessary.

Drawn cup needle roller bearings



RHNA

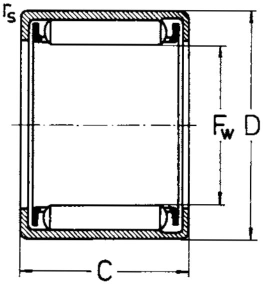


RHNA V

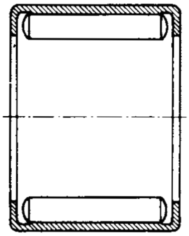
Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
3	6,5	6	0,3	1,2	0,83	38 000	56 000	**RHNA030606TN**	0,001
4	8	8	0,3	1,7	1,25	30 000	45 000	**RHNA040808TN**	0,001
5	9	9	0,4	2,35	1,4	24 000	38 000	**RHNA050909TN**	0,002
6	10	9	0,4	2,7	2,65	22 000	34 000	**RHNA061009TN**	0,003
7	11	9	0,4	3	2,9	19 000	30 000	**RHNA071109TN**	0,003
8	12	10	0,4	3,8	4,35	17 000	26 000	**RHNA081210**	0,003
	12	10	0,4	3,8	4,35	17 000	26 000	**RHNA081210TN**	0,003
9	13	10	0,4	4,1	4,6	16 000	24 000	**RHNA091310**	0,004
	13	12	0,4	5,15	6,3	16 000	24 000	**RHNA091312**	0,004
10	14	10	0,4	4,4	5,6	14 000	22 000	**RHNA101410**	0,004
	16	12	0,4	10,3	13,2	7 000	11 000	**RHNA101612V**	0,005
12	16	10	0,4	4,95	6,9	12 000	19 000	**RHNA121610**	0,005
	17	12	0,4	5,35	6,7	12 000	18 000	**RHNA121712**	0,009
14	20	12	0,8	6,55	7,9	10 000	15 000	**RHNA142012**	0,011
15	20	12	0,8	5,85	9,05	9 500	15 000	**RHNA152012**	0,008
16	22	12	0,8	4,55	10,4	9 000	14 000	**RHNA162212**	0,011
17	23	12	0,8	7,5	10	8 500	13 000	**RHNA172312**	0,012
	23	14	0,8	9,1	12,8	8 500	13 000	**RHNA172314**	0,014
	23	18	0,8	12,1	18,5	8 500	13 000	**RHNA172316**	0,016
	23	18	0,8	11,8	19,2	8 500	13 000	**RHNA172318**	0,018
18	24	12	0,8	7,65	11,1	8 000	12 000	**RHNA182412**	0,012
	24	14	0,8	9,6	14,1	8 000	12 000	**RHNA182414**	0,014
	24	16	0,8	10,8	17,3	8 000	12 000	**RHNA182416A***	0,018
20	26	14	0,8	9	13,4	7 500	11 000	**RHNA202614RS**	0,014
	26	20	0,8	15,7	27,1	7 500	11 000	**RHNA202620**	0,026
22	28	14	0,8	10,7	18,3	6 700	10 000	**RHNA222814**	0,019
	28	14	0,8	19,3	36,1	3 500	5 600	**RHNA222814AV***	0,021
	28	16	0,8	12,5	22,3	6 700	10 000	**RHNA222816**	0,022
25	32	16	0,8	14,1	23	6 000	9 000	**RHNA253216**	0,026
	32	20	0,8	18,3	30,8	6 000	9 000	**RHNA253220**	0,032
	32	22	0,8	20,9	38,5	6 000	9 000	**RHNA253222**	0,040
	32	26	0,8	24,5	47,4	6 000	9 000	**RHNA253226**	0,048
	32	26	0,8	38,6	81,7	3 200	4 800	**RHNA253226V**	0,058
	33	20	0,8	20,2	32,5	5 600	9 000	**RHNA253320A***	0,039

* Special tolerance at D

Drawn cup needle roller bearings



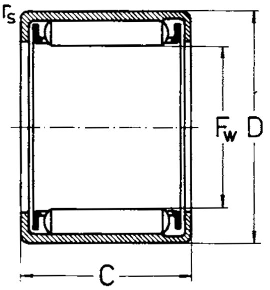
RHNA



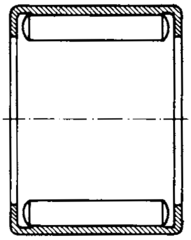
RHNA V

Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
30	37	12	0,8	10,3	15,6	5 000	7 500	**RHNA303712**	0,022
30	37	12	0,8	20,3	37,9	2 600	4 000	**RHNA303712V**	0,027
	37	20	0,8	20,2	39,2	5 000	7 500	**RHNA303720**	0,041
	38	24	0,8	25,5	46,3	5 000	7 500	**RHNA303824**	0,057
	38	25	0,8	26	47,6	5 000	7 500	**RHNA303825**	0,058
35	42	20	0,8	23,7	47,2	4 300	6 700	**RHNA354220**	0,046
	43	25	0,8	29,6	59	4 300	6 700	**RHNA354325**	0,074
37	44	22	0,8	20,6	42,8	4 000	6 300	**RHNA374422RS**	0,049
40	47	20	0,8	21,4	46,1	3 800	6 000	**RHNA404720**	0,053
45	52	20	0,8	25	58,8	3 400	5 300	**RHNA455220**	0,062
	55	38	0,8	59,1	127	3 400	5 000	**RHNA455538**	0,162
50	60	38	0,8	61,1	137	3 000	4 800	**RHNA506038**	0,176

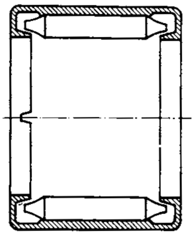
Non-standard drawn cup needle roller bearings



RHNA



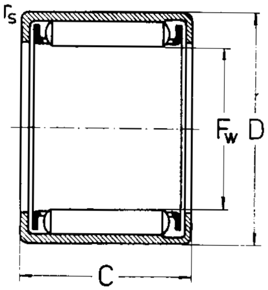
RHNA V



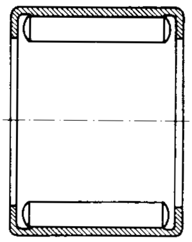
RTNA,94

Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
7,94	12,7	11,13	1	7,2	9,5	8 500	13 000	**RHNA081311AV**	0,005
9,53	14,288	12,7	1	9	13,5	7 000	11 000	**RHNA101413AV**	0,007
	14,288	15,88	1	11,5	17	7 000	11 000	**RHNA101416AV**	0,009
10	16	10	1,7	7,2	11	7 000	11 000	**941/10**	0,007
	16	15	1,7	8,2	12	7 000	11 000	**942/10**	0,009
	16	17	1,7	13	19,5	7 000	11 000	**943/10**	0,011
12	17	12	1,2	5,3	6,7	12 000	18 000	**RHNA121712**	0,009
15	20	12	1,2	8,8	15,5	5 000	8 000	**941/15**	0,010
	20	12	1,2	5,8	9,1	9 500	15 000	**RHNA152012**	0,008
17	23	18	1,2	17	30	4 500	7 000	**942/17**	0,021
	23	22	1,7	21	39,5	4 500	7 000	**943/17**	0,027
18	24	12	1,2	11	17	4 000	6 300	**940/18**	0,013
	24	16	1,2	15,5	27	4 000	6 300	**942/18**	0,019
19,05	25,4	15,875	1,3	12,5	17	7 500	12 000	**RHNA192516A**	0,019
20	26	20	1,2	20,5	41	3 800	6 000	**942/20**	0,028
22	28	14	1,2	14,5	26,5	3 600	5 300	**941/22**	0,020
	28	14	1,2	19,5	36	3 400	5 000	**RHNA222814V**	0,021
22,22	30,1	20,62	1,1	17,5	25,5	6 700	10 000	**RHNA223021A**	0,034
22,225	30,12	25,4	1,5	25,5	39	6 700	10 000	**RHNA223025A**	0,045
25	32	22	1,5	27,5	56	3 200	4 800	**942/25**	0,025
	32	22	1,5	21	38,5	6 000	9 000	**RHNA253222**	0,040
	32	25	1,5	32,5	66	3 200	4 800	**943/25**	0,047
	32	26	1,5	24,5	47,5	6 000	9 000	**RHNA253226**	0,048
	32	26	1,5	38,5	82	3 000	4 500	**RHNA253226V**	0.058
	33	20	1,5	26,5	45	3 200	4 800	**940/25**	0,043
	33	20	1,5	20	32,5	5 600	9 000	**RHNA253320A**	0,039
25,4	31,75	12,7	1,3	19	36,5	3 000	4 500	**RHNA253213AV**	0,024
28,575	38,1	31,750	2	46	56	2 600	4 000	**RTNA293832A**	0,095
	38	24	1,5	35	70	2 600	4 000	**942/30**	0,061
30	38	24	1,5	25,5	46,5	5 000	7 500	**RHNA303824**	0,057
	38	25	1,5	36,5	74	2 600	4 000	**940/30**	0,064
	38	25	1,5	26	47,5	5 000	7 500	**RHNA303825**	0,058
35	43	25	1,5	29,5	59	4 300	6 700	**RHNA354325**	0,074
	43	32	1,6	60	145	2 400	3 600	**943/35**	0,093

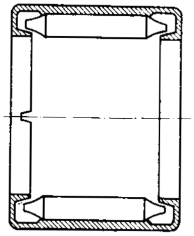
Non-standard drawn cup needle roller bearings



RHNA



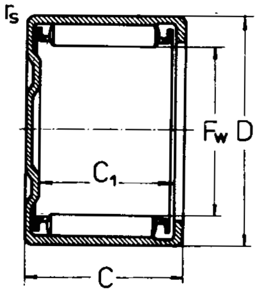
RHNA V



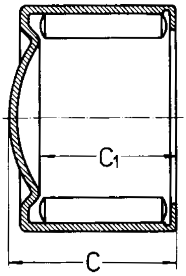
94

Dimensions				Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	dyn. C_r	stat. C_{0r}	grease	oil		
mm				kN		min^{-1}		—	kg
37	44	22	1,5	20,5	43	4 000	6 300	**RHNA374422RS**	0,049
	45	18	1,5	19	20	4 000	6 300	**RHNA374518RS**	0,049
38	47,625	25,400	1,5	55	120	3 800	6 000	**RHNA384825AV**	0,107
45	55	38	2,5	77	190	1 800	2 800	**943/45**	0,181
	59	38	1,5	59	125	3 200	5 000	**RHNA455538**	0,162
50	60	38	1,8	82	210	1 700	2 600	**943/50**	0,207
	60	38	1,5	61	135	3 000	4 800	**RHNA506038**	0,176

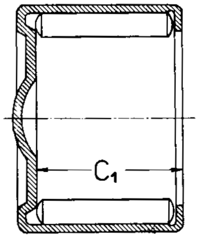
Non-standard drawn cup needle roller bearings



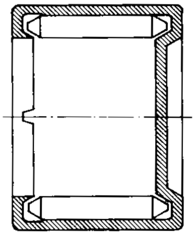
RBNA



CNA10



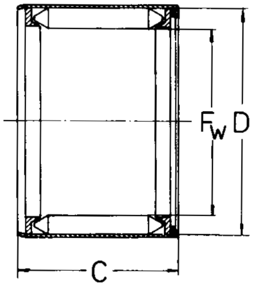
CNA16



RFNA

Dimensions					Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	C_1	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		—	kg
10	16	10,15	1	7,4	6,839	7,776	7 000	11 000	**CNA101610V**	0,007
	16	12	1	9,8	8,25	9,924	7 000	11 000	**RFNA101612V**	0,009
11,113	15,785	12,705	0,8	11,9	5,9	7,8	12 000	19 000	**RBNA111613A**	0,007
16	22	13	1,1	10,8	12,572	20,69	4 800	7 500	**CNA162213V**	0,017
17	23	12	1,5	9,8	7,1	5,8	8 500	13 000	**RBNA172312**	0,015
17,065	23,88	17,462	1,2	16,7	6,8	7,7	8 000	13 000	**RBNA172417RS**	0,015
30	37	20	1,3	17,3	19,5	38	5 000	7 500	**RBNA303720**	0,045

Non-standard drawn cup needle roller bearings



Ca

Dimensions					Basic radial load		Speed limit		Designation	Weight
F_w	D	C	r_s min.	C_1	dyn. C_r	stat. C_{0r}	grease	oil		
mm					kN		min^{-1}		—	kg
25	31	21			32,135	60,02	3 000	4 800	**Ca253121V**	0,032
29	35	25			35,407	70,98	2800	4 300	**Ca293525V**	0,052

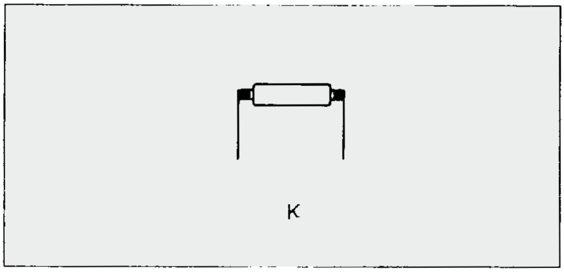
Needle roller and cage assemblies

The low cross section of needle roller and cage assemblies allows compact and stiff bearing arrangements. As the ratio between needle roller length to its diameter has high values, needle rollers have high load carrying capacity in limited space.

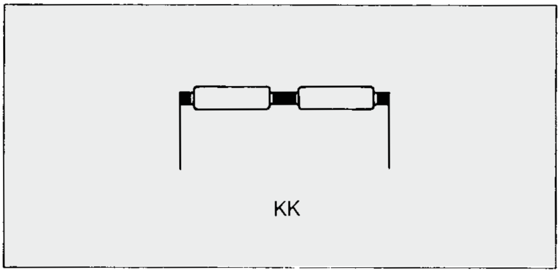
Needle roller and cage assemblies are manufactured in the following constructive versions:

Needle roller and cage assemblies

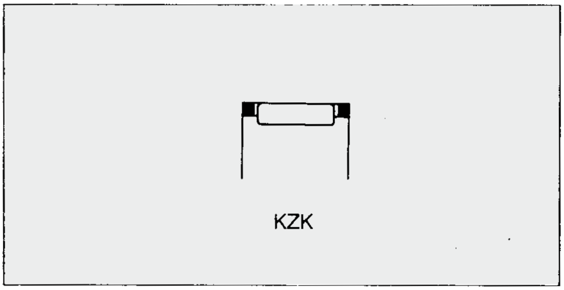
single row

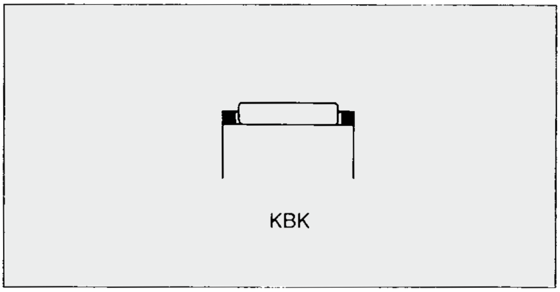


double row



Needle roller and cage assemblies for connecting rod application





Suffixes

A	- dimensions rounded to whole numbers
F	- machined steel cage
L	- machined light alloy cage
TN	- polyamide moulded cage

Cages

Cages are generally machined of steel and have "M" profile. Needle rollers are located in their seatings which provide an axial guiding parallel to the axis. Therefore, they can be used at high speeds.

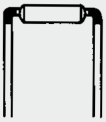
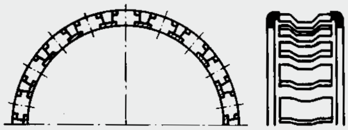
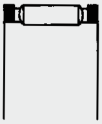
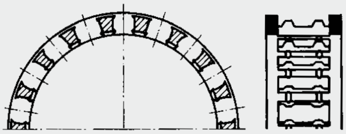
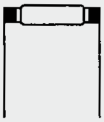
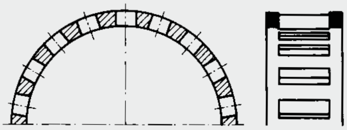
The cages are machined of steel or of glass fibre reinforced polyamide 6.6.

In case of polyamide cages, the operating temperature should not exceed +120°C.

Cage design and some technical data are given in table 1.

Cage design and some technical data

Table 1

Cage	**Design** bearing	cage	**Application**	**Max. value** D_m n oil	grease
Pressed sheet cage			- General application	400×10^3	250×10^3
Machined steel cage F			- General application	450×10^3	300×10^3
Polyamide cage TN			- General application	500×10^3	350×10^3

Tolerances

The needle rollers in a cage should be of the same sort and having a diameter deviation of 2 µm. They are in accordance with international standards.

Labels showing different colours are to be applied on each package containing needle rollers, so that their sort can be identified (see table 2).

Needle rollers sort codification

Table 2

Colour	**Sort** µm	
red	0/−2	−1/−3
blue	−2/−4	−3/−5
white (grey)	−4/−6	−5/−7

Radial clearance and adjoint parts tolerances

Needle cages operate directly on the shaft and into the housing bore. Bearing radial clearance is determined by the tolerance of the needle roller raceways.

Shaft tolerances for needle rollers of the sorts in table 2 and for housing bore manufactured to the tolerance class G6, are given in table 3.

Shaft tolerances for housing bore in G6

Table 3

Shaft diameter	**Shaft tolerances for radial clearance:** smaller than normal	normal	larger than normal
mm			
≤ 80	j5	h5	g6
> 80	h6	g5	f6

Since the needle rollers roll directly on the shaft and into the housing bore, raceway hardness should be 58 - 65 HRC and surface roughness $R_a \leq 0{,}2\,\mu m$ for high exigence and $R_a \leq 0{,}3\,\mu m$ for moderate exigence.

If the above mentioned hardness is not assured or the shaft and housing are of other materials than RUL, the bearing cannot carry the initial basic load. This should be decreased according to the specifications on page 288, table 1.

Tolerances of the needle roller cages adjoint parts, shaft and housing bore, respectively, are given in table 4, for normal and high accuracy.

Tolerances of cages adjoint parts

Table 4

Rotation accuracy	Raceway	Tolerance	Cylindricity, roundness	Shoulder runout
normală	Shaft	IT5	$\frac{IT3}{2}$	IT3
	Housing	IT6	$\frac{IT3}{2}$	IT3
high	Shaft	IT4	$\frac{IT1}{2}$	IT1
	Housing	IT5	$\frac{IT2}{2}$	IT2

Pair mounted cages

If the basic load of a needle cage is not satisfactory for bearing loading and pair mounting is necessary, cages should have the same sort of needle rollers so that the load can be uniformly distributed on both cages.

Equivalent dynamic and static load

Needle cages can carry only pure radial loads. These can be calculated using the equations:

$P_r = F_r$, kN

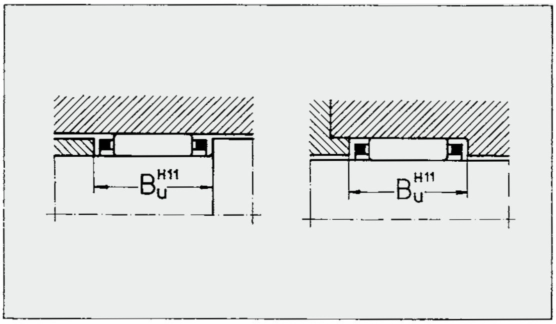
$P_{0r} = F_r$, kN

Abutment dimensions

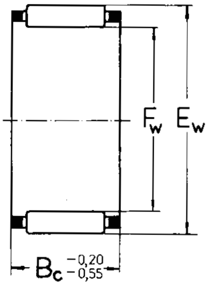
A large enough clearance should be between the side contact surfaces, so that needle cages won't be blocked. A mounting distance width in tolerance class H11 provides an axial clearance large enough for proper operation. The side contact surfaces should be manufactured accurately enough to avoid blocking and in case of high speeds, they should be heat treated and ground.

If needle cages are in direct contact with the shaft shoulder on one side and with the seating shoulder on the other side, the shaft should be axially guided to avoid blocking of the needle cage.

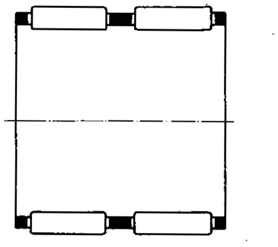
The height of the shaft and seating shoulders in case of side guidance of needle cages should be 70 - 90% of the needle roller diameter, as shown below.



Needle roller and cage assemblies



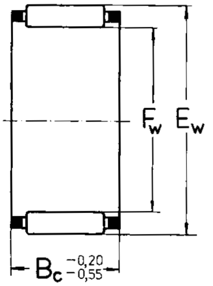
K



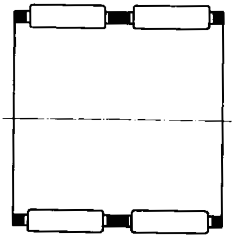
KK

Dimensions			Basic radial load		Speed limit		Designation	Weight
F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	grease	oil		
mm			kN		min^{-1}	-	—	kg
3	5	9	1,7	1,45	34 000	50 000	K030509TN	0,0003
	6	7	1,4	1,45	34 000	50 000	K030607TN	0,0004
4	7	7	1,7	1,25	30 000	45 000	K040707TN	0,0005
5	8	10	2,9	2,6	26 000	40 000	K050810TN	0,0009
	8	8	2,3	1,85	26 000	40 000	K050808TN	0,0007
6	9	8	2,55	2,2	22 000	36 000	K060908TN	0,0009
7	10	8	2,8	2,5	20 000	34 000	K071008TN	0,0010
8	11	10	3,85	4	19 000	32 000	K081110	0,0015
	11	10	4	4,7	19 000	32 000	K081110TN	0,0018
	12	10	4,85	4,6	19 000	32 000	K081210	0,0020
9	12	10	4,4	2,85	18 000	30 000	K091210	0,0015
10	13	10	4,65	5,4	17 000	28 000	K101310	0,0017
	13	13	6,05	7,75	17 000	28 000	K101313	0,0026
	14	10	5,6	5,85	17 000	28 000	K101410	0,0035
	16	12	7,8	7	17 000	28 000	K101612	0,0060
12	15	15	5,75	8,2	16 000	26 000	K121515	0,005
	17	13	8,1	9,3	16 000	26 000	K121713	0,008
13	20	10	8,5	11,3	15 000	24 000	K132010	0,005
14	18	10	5,55	6,8	15 000	24 000	K141810	0,006
	18	13	8,1	9,9	15 000	24 000	K141813	0,007
16	22	12	8,4	9,25	15 000	24 000	K162212	0,011
	22	16	12,1	14,9	15 000	24 000	K162216	0,013
18	22	10	6,25	8,5	14 000	22 000	K182210	0,008
20	24	17	12,5	21,7	13 000	20 000	K202417	0,011
	26	20	17,1	24,6	13 000	20 000	K202620	0,026
	30	18	19,8	21,6	13 000	20 000	K203018L	0,040
22	26	10	7,3	6	13 000	20 000	K222610	0,065
	38	19	30,2	29,5	11 000	18 000	K223819	0,066
	38	19	25,7	27,5	11 000	18 000	K223819L	0,052
24	28	10	7,5	11,8	10 000	17 000	K242810	0,010
25	30	17	15,8	26,8	9 500	16 000	K253017	0,019
	30	20	15	22	10 000	17 000	K253020	0,028
	31	17	16,2	24,5	9 500	16 000	K253117	0,025
	32	24	24,3	37,5	9 500	16 000	K253224	0,038
	38	25	37,2	43,8	9 500	16 000	K253825	0,070
	38	25	34,7	41	9 500	16 000	K253825L	0,063

Needle roller and cage assemblies



K



KK

Dimensions			Basic radial load		Speed limit		Designation	Weight
F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	grease	oil		
mm			kN		min^{-1}	-	—	kg
26	30	17	13,8	26,6	9 000	15 000	**K263017**	0,017
28	32	15	11,8	22,4	8 500	14 000	**K283215**	0,025
29	32	30	21,3	52,5	8 500	14 000	**KK293230**	0,026
30	35	13	114	25,3	8 000	13 000	**K303513**	0,018
	35	13	14,3	23,1	8 000	13 000	**K303513L**	0,011
	35	15	14,3	23,1	8 000	13 000	**K303515**	0,018
	40	30	42,3	63,2	8 000	13 000	**K304030**	0,071
	42	44	65,9	99,5	8 000	13 000	**K304244**	0,132
	42	44	63,5	97	8 000	13 000	**K304244L**	0,159
33	47	22	38,2	46	7 500	12 000	**K334722**	0,073
	47	22	37,2	44,5	7 500	12 000	**K334722L**	0,076
35	40	17	19,2	38,5	7 000	11 000	**K354017**	0,024
	42	18	25,8	42,5	7 000	11 000	**K354218**	0,041
36	44	20	27,8	45	7 000	11 000	**K364420**	0,066
40	48	20	34,5	51,8	6 700	10 000	**K404820**	0,058
42	47	27	31,1	76	6 300	9 500	**K424727**	0,060
	48	27	31	75	6 300	9 500	**K424827**	0,068
45	49	19	19,2	49,1	6 000	9 000	**K454919**	0,032
	50	17	22,2	50,3	6 000	9 000	**K455017**	0,030
	53	21	33,3	60,6	6 000	9 000	**K455321**	0,056
50	57	18	27,7	54,5	5 300	8 000	**K505718**	0,068
	58	25	39,3	77,8	5 300	8 000	**K505825**	0,092
	60	32	57,5	108	5 300	8 000	**K506032**	0,136
52,39	61,91	25,4	49,8	95	5 000	7 500	**K526225A**	0,093
55	60	20	25,2	63,4	5 000	7 500	**K556020**	0,055
	60	30	38,9	97,9	5 000	7 500	**KK556030TN**	0,045
	63	20	33,2	64,4	5 000	7 500	**K556320**	0,080
	63	24	42,1	87,8	5 000	7 500	**K556324**	0,101
57	63	43	61,5	157	4 800	7 000	**KK576343**	0,111
58	65	36	54,7	121	4 800	7 000	**KK586536**	0,112
60	65	20	28,4	69,7	4 500	6 700	**K606520**	0,032
	68	20	37	76,5	4 500	6 700	**K606820**	0,096
	68	23	40	84,3	4 500	6 700	**K606823**	0,120
	68	30	54,2	125	4 500	6 700	**K606830**	0,115
	68	30	42,8	81,6	4 500	6 700	**KK606830**	0,132
	68	34	60,9	145	4 500	6 700	**K606834**	0,128

Needle roller and cage assemblies

Dimensions			Basic radial load		Speed limit		Designation	Weight
			dyn.	stat.	grease	oil		
F_w	E_w	B_c	C_r	C_{0r}				
mm			kN		min^{-1}	-	—	kg
60	68	34	48	94,5	4 500	6700	**KK606834**	0,147
65	77	23	56,3	97,5	4 000	6 000	**K657723L**	0,119
68	74	45	66,6	184	4 000	6 000	**KK687445**	0,171
70	78	37	68,5	177	3 800	5 600	**K707837**	0,326
75	83	23	46	109	3 800	5 600	**K758323**	0,145
80	88	40	81,4	206	3 400	5 000	**KK808840**	0,255
	88	46	94,3	248	3 400	5 000	**KK808846**	0,253
84	96	37	94,5	214	3 200	4 800	**K849637**	0,302
85	92	20	38,9	101	3 200	4 800	**K859220**	0,118
95	103	40	88,5	242	2 800	4 300	**KK9510340**	0,259
105	112	21	46,2	135	2 400	3 800	**K10511221**	0,157

Needle rollers and cage assemblies for connecting rod applications

Needle rollers and cage assemblies for connecting rod applications of small and medium sized internal combustion engines have special designs because of the severe operating conditions. For crankpin bearings, M type needle cages are used with external guidance, i.e. in the connecting rod and for piston pin bearings they are used with internal guidance, i.e. on the pin. The designations of these cages are KZK for crankpins and KBK for piston pins.

The materials used for connecting rods, crankpins and piston pins should be case-hardening steels. The thickness of the case-hardened layer after grinding should be of 0,4...1 mm and minimum hardness should be 60 HRC. The tensions in connecting rods should be released after hardening, at a temperature between 160°... 180°C, for 2-4 hours.

Raceway hardness should be $R_a \leq 0{,}16\,\mu m$.

The coaxiality deviations between piston pin and crankpin should not exceed 0,03 mm on a length of 100 mm.

Form deviations for the adjoint parts are given in table 5.

Approximate values of piston pin and crankshaft form deviations

Table 5

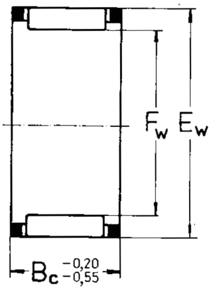
Nominal diameter of crankshaft and piston pin, mm	over	**10**	**14**	**18**	**25**	**30**
	up to	**14**	**18**	**25**	**30**	**40**
	Permissible values in micrometers (μm)					
Taper[1]	Pin	1	1	2	2	3
	Bore	2	3	3	4	4
Ovalness	Pin	1	1	1, 5	1, 5	2
	Bore	1, 5	2	2	2, 5	2, 5

1) The values of the taper are related to the needle roller length.

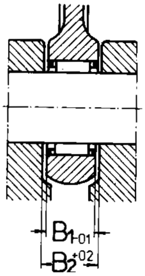
Radial clearance for crankpin should be of 0,02...0,029 and for piston pin should be of 0,002...0,010 mm.

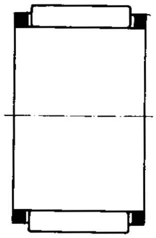
The minimum value of the clearance for crankpin should be of 1/1000 of the crankpin diameter.

Needle roller and cage assemblies for connecting rod applications

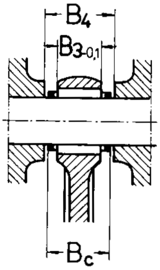


KZK





KBK

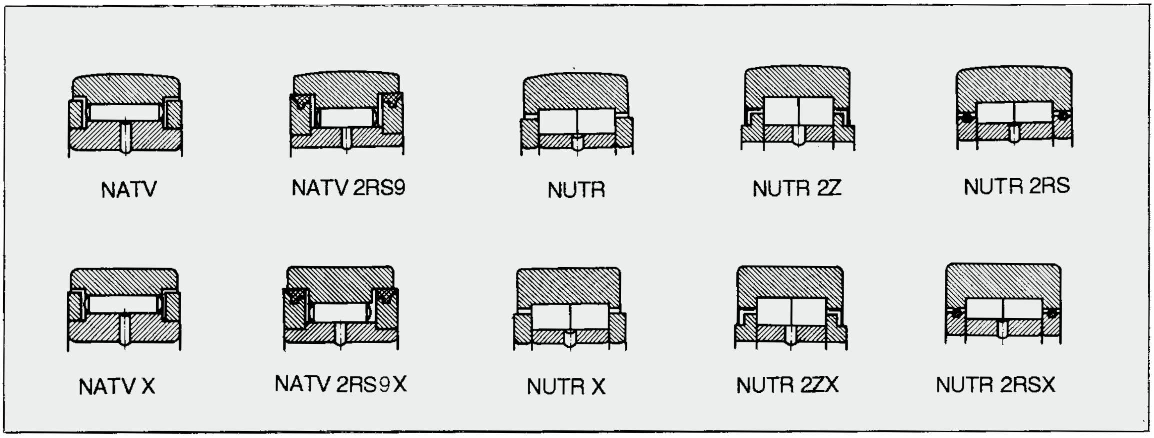


Dimensions			Basic radial load		Weight	Designation	Mounting dimensions						
			dyn.	stat.			inferior			superior			
F_w	E_w	B_c	C_r	C_{0r}			B_1	B_3	B_4	B_1	B_3	B_4	B_2
mm			kN		kg	-	mm						
12	15	15	6,25	8,1	0,005	**KBK121515**		12	15+0,4		15	15+0,2	
14	18	10	6,65	8,1	0,006	**KZK141810**	10		10+0,4			10+0,2	10,2
	18	13	8,25	10	0,008	**KZK141813**	13		13+0,4	11		13+0,2	13,2
18	24	13	12,2	13,7	0,012	**KZK182413**	13		13+0,4	11		13+0,2	13,2

Support rollers, cam followers and rolling mill support rollers

Support rollers

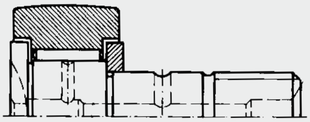
Support rollers have thick-walled outer rings which roll directly on the adjoint surface. The outside surface of the outer ring is cylindrical or convex. Support rollers with convex ring can accomodate some errors of alignment. They are manufactured in the following constructive versions:

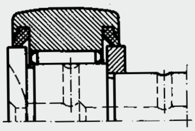


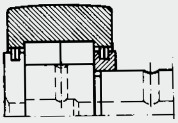
Support rollers with outside diameters D ≤ 32 mm, NATV designation are manufactured only with needle rollers, without cages and those with outside diameters D > 32 mm are manufactured with double row cylindrical rollers, without cages, NUTR designation. Support rollers with cylindrical rollers can carry heavy radial loads and shock loads.

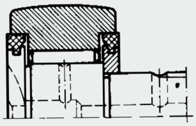
Cam followers

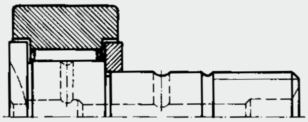
Cam followers have the outer ring as that of support rollers, but have a solid stud instead of an inner ring. The raceway is on the stud, which guide the outer ring by means of a collar and a flange. The cam followers are manufactured in the following constructive versions:

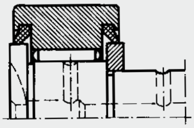

KRV

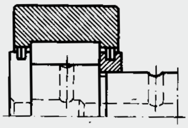

KRV 2RS

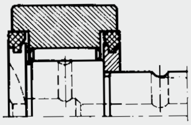

NUTR


NUTR 2RS


KRV X


KRV 2RSX

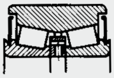

NUTR X

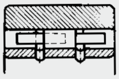

NUTR 2RSX

Cam followers with outside diameters D ≤ 32 mm are also manufactured only with needle rollers, KRV designation and those with outside diameters D > 32 mm are manufactured with cylindrical rollers, without cages, NUKR designation and have a high load carrying capacity.

Rolling mill support rollers

Support rollers for cold rolling are manufactured both with cylindrical and tapered rollers. They have the outer ring with large cross section and thus they can carry very high loads. Their dimensions are not standardized.


35


3 NN

Support rollers and cam followers are manufactured both in sealed and shielded versions. They are sealed with rubber seals or labyrinth seals. Support rollers and cam followers are lubricated with lithium based grease and can operate between -30°C and +80°C.

Generally, support rollers and cam followers are filled with grease for the entire operating period, excepting the rollers which have relubrication holes.

Tolerances

The tolerances of the cylindrical outside surfaces of the support rollers and cam followers correspond to those of the cylindrical roller bearings manufactured to the normal tolerance class, excepting those with convex outside surfaces. In this case, the outside diameter tolerance is of 0/-0,05 mm. Mounting diameter d of cam rollers is manufactured to the tolerance class h7.

Rolling mill support rollers are manufactured to the tolerance classes P4 and P5, respectively.

Misalignment

Support rollers and cam followers with cylindrical outer ring can take errors of alignment up to 3'...4' in case of light loads and up to 5'...7' in case of moderate and heavy loads. Cam followers with convex outside surface can take errors of alignment of 15' - 20'. For greater errors of alignment, high additional efforts can occur which reduce the basic static load and rating life.

Support rollers and cam followers in applications

If the cam follower is used as a bearing mounted in the housing, the values of the basic static and dynamic loads C_r and C_{0r} according to ISO 281

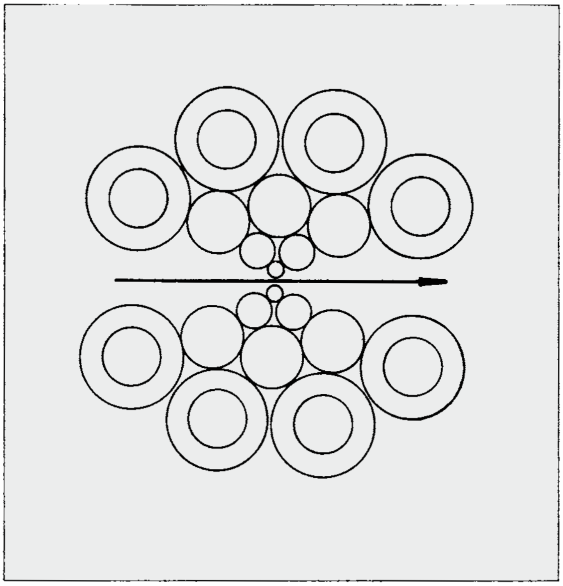
If the cam follower rolls directly on the adjoint surface, the radial load causes elastic deformations in the outer ring. This leads to modifications in load distribution on the rolling elements and thus the permissible values of the dynamic and static load decrease. Moreover, the bending strains which occur in the outer ring due to the deformation should not exceed the permissible values for a certain material. Therefore, the maximum dynamic radial load should be limited to the values for C_{rc} and maximum static radial load should be limited to the values of C_{0rc}.

Maximum radial load should also be limited in dynamic conditions (F_r) and static conditions (F_{0r}) to the values in the tables, so that proper stiffness of the outer ring and load distribution should be assured. At that, in case of cam followers, shaft and housing stiffness limits F_r and F_{0r} values.

Rolling mill support rollers in applications

Support rollers for cold rolling Sendzimir process are used as shown in figure bellow. While operating, these rollers wear and their outside surface should be ground.

Support rollers with taper rollers are sidewise shielded by two sheet lids. In case of dynamic operating conditions, dynamic load should not exceed 0,5 C_r and static load should not exceed 0,75 C_{0r}.



Abutment dimensions

In most cases, a constant load acts upon the outer ring of a support roller, thus it is not necessary to be mounted too tightly. The shaft tolerance is recommended to be j6 and j5 in case of those without inner ring.

For support rollers without inner ring, the specifications for the adjoint parts should be observed.

Cam followers should be mounted into a housing bore with tolerance class H7.

Other mounting dimensions are given in tables containing rollers (see figure bellow).

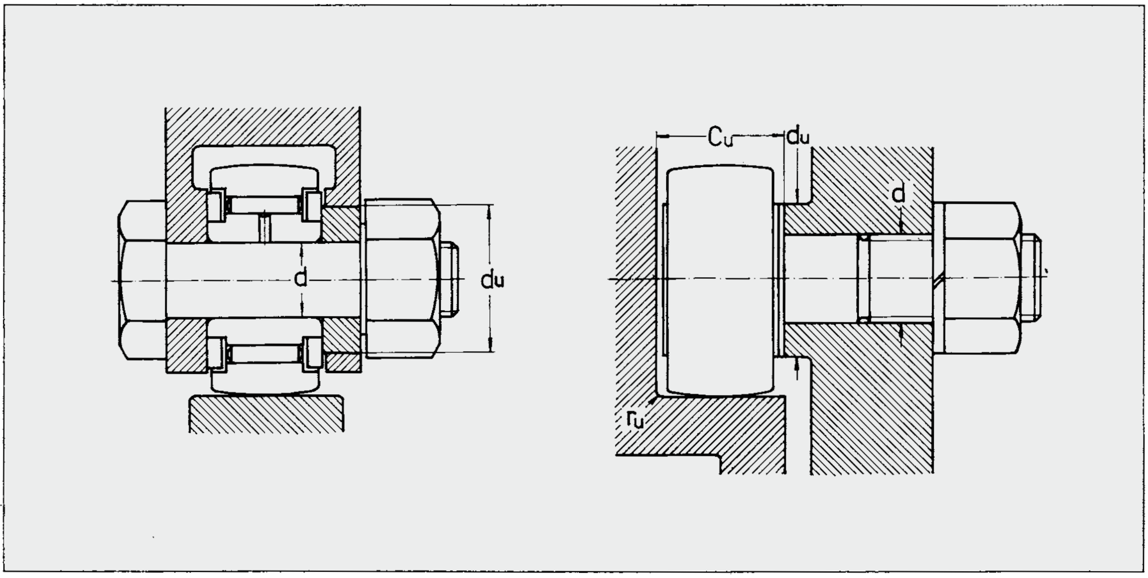
Example

A cam follower operates at a speed of 1 000 r/min and carries a radial load $F_r = 4$ kN. It is necessary to determine the roller size so that the cam follower rating life would be $L_{10h} = 2\,000$ operating hours.

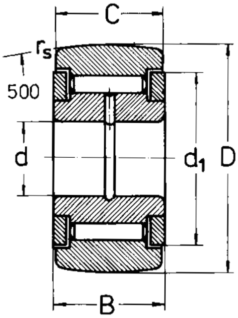
Using the equation on page 18, we can calculate C_r.

$C_r = 16{,}8$ kN

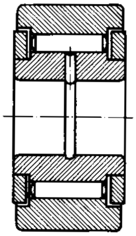
From the table, we select the roller with the next greater basic dynamic load C_r. This is KRVT40 with $C_r = 19{,}1$ kN.



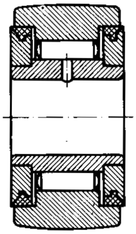
Support rollers



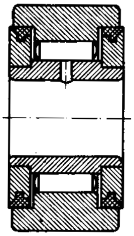
NATV



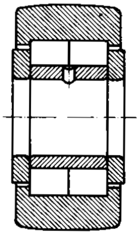
NATV X



NATV 2RS9

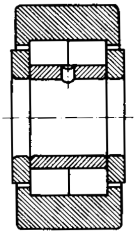


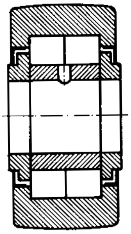
NATV 2RS9X

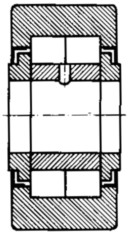


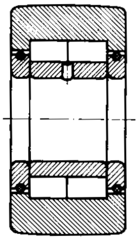
NUTR

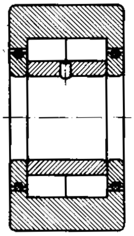
Dimensions							Designation new		old
D	C	B	d	d_1	r_s min.	r_{1s} min.	convex surface	cylindrical surface	
mm							—		
24	14	15	8	20	0,3		**NATV8-2RS9**	**NATV8-2RSX**	
30	14	15	10	24	0,6		**NATV10-2RS9**	**NATV10-2RSX**	
32	14	15	12	26	0,6		**NATV12-2RS9**	**NATV12-2RSX**	
35	18	19	15	20	0,6	0,3	**NATV15-2Z**	**NATV15X**	NNUP5103V2Z
42	18	19	15	20	0,6	0,3	**NUTR1542-2Z**	**NUTR1542-2ZX**	NNUP5203V2Z
47	24	25	20	30	1	0,3	**NUTR20**	**NUTR20X**	NNUP5104V
	24	25	20	30	1	0,3	**NUTR20-2Z**	**NUTR20-2ZX**	NNUP5104V2Z
52	24	25	25	33,8	1	0,3	**NUTR25**	**NUTR25X**	NNUP5105V
62	24	25	25	39,3	1	0,3	**NUTR25-2Z**	**NUTR25-2ZX**	NNUP5205V2Z
	24	25	25	39,3	1	0,3	**NUTR2562**	**NUTR256-2X**	NNUP5205V
	28	29	30	39,3	1	0,3	**NUTR30**	**NUTR30X**	NNUP5206V
72	28	29	30	47	1	0,3	**NUTR3072**	**NUTR307-2X**	NNUP5106V
	28	29	35	47	1,1	0,3	**NUTR35**	**NUTR35X**	NNUP5107V
	28	29	35	47	1,1	0,3	**NUTR35-2Z**	**NUTR35-2ZX**	NNUP5107V2Z
80	30	32	40	52	1,1	0,3	**NUTR40**	**NUTR40X**	NNUP5108V
	30	32	40	53	1,1	0,3	**NUTR402Z**	**NUTR402ZX**	NNUP5108V2Z
90	30	32	40	55	1,1	0,3	**NUTR4090**	**NUTR4090X**	NNUP5208V
	30	32	40	55	1,1	0,3	**NUTR40902Z**	**NUTR4090X2ZX**	NNUP5208V2Z
100	30	32	45	61	1,1	0,3	**NUTR45100**	**NUTR45100X**	NNUP5109V
	30	32	45	61	1,1	0,3	**NUTR45100-2Z**	**NUTR45100-2ZX**	NNUP5109V2Z
250	114	114	140	183	4,5	1,5	**NUTR140-2RS**	**NUTR140-2RSX**	NNUP5228VC3
300	120	120	150	210,6	4,5	1,5	**NUTR150-2RS**	**NUTR150-2RSX**	NNUP5130VC3


NUTR X


NUTR 2Z

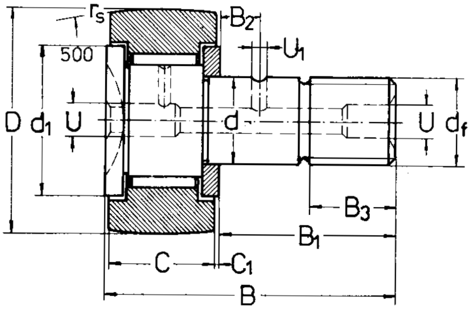

NUTR 2ZX


NUTR 2RS

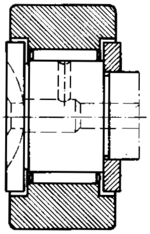

NUTR 2RSX

Basic radial load				**Maximal radial load**		**Speed limit**	**Mounting dimension**	**Weight**
Bearing		Roller						
dyn.	stat.	dyn.	stat.	dyn.	stat.			
C_r	C_{0r}	C_{rc}	C_{0rc}	F_r	F_{0r}	grease	d_u	
kN						min^{-1}	mm	kg
10,4	16,9	8,3	11,8	7,5	10,6	8 500	14	0,043
13,9	18	11	12,6	10	11,3	7 500	20	0,066
15,1	20,7	13,3	14,5	12	13	7 000	20	0,075
25,8	29,2	18	20,5	16,2	18,4	6 700	26	0,100
19,1	20,6	14	14,5	12,5	13	5 600	26	0,160
31	54	22	39	19,8	35	4 500	36	0,221
31	54	22	39	19,8	35	4 500	36	0,221
44,5	60,7	31	42	28	38	4 500	44	0,268
34,5	68	24,5	47,5	22	42,5	4 000	44	0,455
44,5	60,7	31	42	28	38	4 000	44	0,455
58,7	76,3	41	53,5	37	48	3 200	53	0,446
58,7	76,3	41	53,5	37	48	3 200	53	0,666
64,5	89,9	42	60	38	54	2 800	53	0,608
64,5	89,9	42	60	38	54	2 800	53	0,608
87,1	123	61	86	55	77,5	2 400	62	0,837
87,1	123	61	86	55	77,5	2 400	62	0,837
86,5	123	60,5	86	54,5	77,5	2 400	62	0,867
86,5	123	60,5	86	54,5	77,5	2 400	62	0,867
94,7	143	66,3	100	60	90	2 000	62	1,38
94,7	143	66,3	100	60	90	2 000	62	1,38
837	1 618	586	1 133	527,5	1 020	1 600	190	26,9
980	1 635	685	1 145	617	1 030	1 400	210	45,2

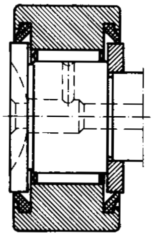
Cam followers



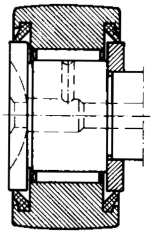
KRV



KRV X



KRV 2RS



KRV 2RSX

Dimensions													Designation	
D	C	d	B	B_1	B_2	B_3	C_1	d_1	d_f	U	U_1	r_s min.	convex surface	cylindrical surface
mm													—	
22	12	10	36	23		12	0,6	17	M10×1		4	0,5	**KRV22**	**KRV22X**
30	14 14	12 12	40 40	25 25	6 6	13 13	0,6 0,6	23 24	M12×1,5 M12×1,5	6 6	3 3	0,6 1	**KRV30** **KRV302RS9**	**KRV30X** **KRV302RS9X**
35	18	16	52	32,5	8	17	0,8	27	M16×1,5	6	3	1	**KRV352RS**	**KRV352RSX**
38	22	19	55	32	7,5		0,8	28	G1/4	6	3	1	**KRV38XF2**	**KRV38XF2X**
40	20	18	58	36,5	8	19	0,8	32	M18×1,5	6	3	1	**KRV40**	**KRV40X**
52	24	20	66	40,5	9	21	0,8	37	M20×1,5	8	4	1	**KRV52**	**KRV52X**
80	35 35	30 30	100 100	63 63		15 15	1 1	52 53	M30×1,5 M30×1,5	8 8	4 4	1,1 1,1	**NUKR80** **KRV80**	**NUKR80X** **KRV80X**

Rolling mill support rollers

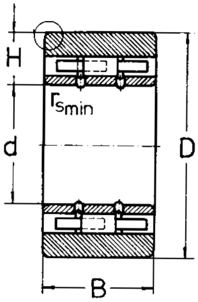


Fig.1

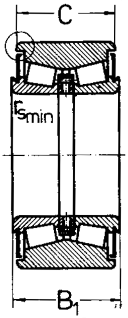
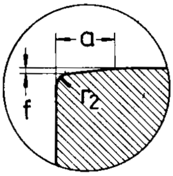
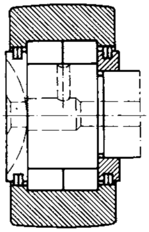


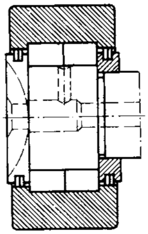
Fig.2



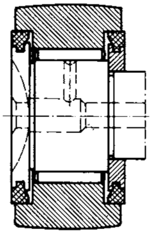
Dimensions						Basic radial load		Fig.	Designation
d	D	B	B_1	r_s min.	r_2	dyn. C_r	stat. C_{0r}		
mm						kN		—	
130	300	172,644	172,644	3,5	1.5	1 450	2 600	1	**3NN5126MP4NAS1W26**
179,984	406,4	223,830	220,665	3,2	3,2	2 450	4 420	2	**T-35336BJP5**



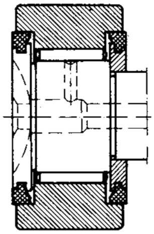
NUTR



NUTR X



NUTR 2RS



NUTR 2RSX

Designation	Basic load rating				Maximal radial load		Speed limit	Weight	Abutment dimensions		
convex surface	Bearing dyn. C_r	stat. C_{0r}	Roller dyn. C_{rc}	stat. C_{0rc}	dyn. F_r	stat. F_{0r}			C_u	d_u	r_u
—	kN						min^{-1}	kg	mm		
KRV22	10,06	12,9	8,5	9,7	7,08	7,96	9 000	0,04	14,7	15	0,3
KRV30	13,53	19,85	11,10	16,3	13,0	16,1	7 500	0,09	16,7	18	1,0
KRV302RS9	13,53	19,85	11,10	16,3	13,0	16,1	7 500	0,09	16,7	18	1,0
KRV352RS	20,26	31,07	15,60	23,2	17,2	18,2	6 700	0.17	21,1	29	1,0
KRV38XF2	31,88	59,38	25,50	44,5	19,5	18,3	5 600	0,24	25,1	31	1,0
KRV40	24,07	30,63	19,10	29,7	21,1	18,8	6 000	0,25	23,1	32	1,0
KRV52	31,88	59,38	26,80	44,3	55,2	62,9	5 300	0,47	27,1	30	1,0
NUKR80	93,5	128	72	97	79	110	2 600	1,66	38,5	44	1,0
KRV80	68,19	142,9	59,60	120	148	176	3 600	1,66	38,5	44	1,0

Outer diameter unload a	f	Bearing cross section H	Weight	Equivalence	
mm			kg	—	
12,7	0,2	84,955+0,010	71	26DC30160	KOYO
15	0,140		159	46T364122	KOYO
				EH239549NA/K107552	TIMKEN

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Tapered roller bearings

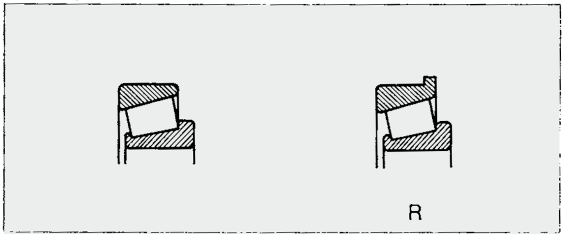
Tapered roller bearings have the rolling elements under the form of frustra of cones. They roll on tapered surfaces which, if extended, converge towards a single point on the bearing axis.

The rollers are guided tangentially by the cage and axially by the big rib of the outer ring, on which they have point contact. As between rollers and raceways there is linear contact, tapered roller bearings can take heavy radial loads. They can also take heavy axial or combined loads, depending on the contact angle caused by the tapered rolling elements. The contact angle is the angle of the outer raceway generatrix.

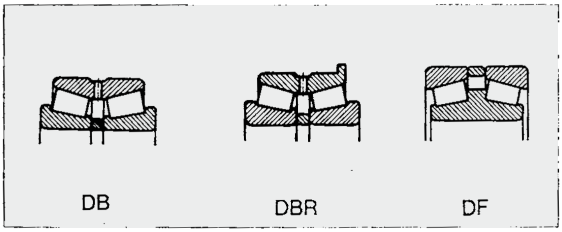
Tapered roller bearings can be manufactured in the versions : single, double and four row rollers.

Basic types and constructive versions:

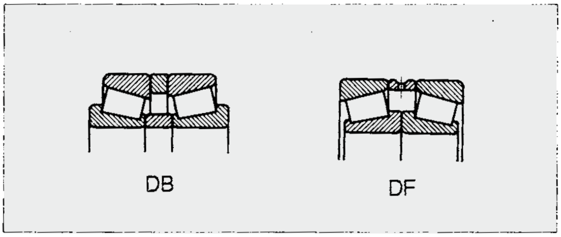
- single row



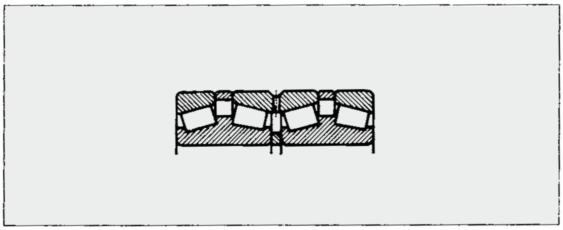
- double row



- paired



- four-row



Suffixes

A	- increased basic load
A...	- axial clearance of bearing set
B	- enlarged contact angle
DB	- set of two bearings mounted in back-to-back arrangement (O)
DF	- set of two bearings mounted in face-to-face arrangement (X)
DF	- bearings with double row of rollers in face-to-face arrangement (X)
F	- machined cage of hardened steel or special cast iron
F2	- constructive modifications
F32	- bearings with double row rollers in face-to-face arrangement, without distance ring between the outer rings
J	- pressed cage of not hardened steel sheet
K	- tapered bore 1:12
M	- machined brass cage
P6X	- tolerance class with smaller values than normal
P5	- tolerance class with smaller values than P6X
P4	- tolerance class with smaller values than P5
P2	- tolerance class with smaller values than P4
R	- rib on the outer ring

2RSR - two rubbing seals on the inner ring
S0 - operating temperature up to +150°C
S1 - operating temperature up to +200°C
T... - bearing set width
TN - polyamide cage
W6 - keygroove on the bore
W7 - locating hole on the outer ring
W28 - helical groove on bore surface
W67 - locating groove on the inner ring face

W69 - keygroove on the bore and locating ring on the inner ring face
X - modified main dimensions according to ISO

Single row tapered roller bearings

Single row tapered roller bearings are of separable design, i.e. the outer ring and the inner ring with rollers and cage assembly can be separately mounted. These two assemblies are interchangeable.

Tapered roller bearings can be manufactured both in standardized constructive versions with dimensions series 320, 302, 322, 303, 323, 313 and with non-standardized dimensions, mm or inch.

Tapered roller bearings can carry only single direction axial loads. Under pure radial loads, an axial force occurs which is supposed to distance the bearing rings in axial direction. Therefore, tapered roller bearings are generally pair mounted on both ends of the shaft, in "X' or "O" arrangements, so that the shaft will be axially located in both directions (table 4). Thus, the optimum clearance in these two bearings can be adjusted.

Single row tapered roller bearings can also be manufactured with rib on the outer ring. This design is to be used when the housing cannot be manufactured with shoulder, but only with a passed through bore. In this case, axial location can be provided by the bearing ring.

Paired single row tapered roller bearings

If tapered roller bearings are pair mounted in "X" or "O" arrangements, the load carrying capacity increases and loads can be taken in both directions in the same bearing.

These bearing sets have guaranteed clearance after mounting since the distance rings are mounted between the bearing rings.

For certain applications, paired bearings can be delivered with small clearance or lightly preloaded.

Double row tapered roller bearings

Double row tapered roller bearings are used where load carrying capacity should be greater, loads should be taken in both directions and axial space is smaller than in case of a set of two single row tapered roller bearings.

Double row tapered roller bearings can have the rollers in face- to-face arrangement, double inner ring and two outer rings respectively or the rollers in back-to-back arrangement, i.e. double outer ring and two inner rings.

The first design provides greater stiffness, can take tilting moments and shaft expansions can be compensated.

The bearings of the second design can be manufactured with tapered bore so that they can be frequently mounted /dismounted.

Double row tapered roller bearings can have or not distance rings with lubrication holes, mounted between the simple rings.

In case of bearings with distance rings, the bearing clearance or preload are pre-adjusted; in case of those without distance rings, bearing clearance and preload can and should be adjusted while mounting.

Double row tapered roller bearings with rollers in back-to-back arrangement can also be manufactured in the following two versions:

- with rib on the outer ring; the housing has no shoulder and the bearing is axially located by the rib
- with two seals; this design is used in motor vehicles construction. The bearings are delivered filled with grease and relubrication is not needed.

Four-row tapered roller bearings

Four row tapered roller bearings are used where heavy axial and radial loads are to be taken, particularly in case of heavy duty equipments. They have two double inner rings and three outer rings, one of them being double.

Between rings, there are mounted distance rings provided with lubrication holes which ensure the pre-adjusted value of clearance.

Dimensions

Tapered roller bearings are manufactured with the following dimensions:

- standardized:
  - according to ISO 355 and national standard 3920, respectively - single row tapered roller bearings
  - according to national standard double row tapered roller bearings
  - according to national standard four-row tapered roller bearings
- non-standardized, metric dimensions (mm)
- non-standardized, inch dimensions

Misalignment

As between rollers and raceway there is a linear contact, tapered roller bearings have low capacity to compensate for errors of alignment between shaft and housing.

Permissible values of misalignment between shaft and housing are given in table 1, depending on bearing size and load magnitude.

Permissible misalignment

Table 1

Bearing series	**Load magnitude**	**Permissible misalignment**
329, 320, 302, 322, 303, 313	$F_r/C_{0r} < 0{,}1$ $F_r/C_{0r} > 0{,}1$	2' 4'
323, 34	$F_r/C_{0r} < 0{,}1$ $F_r/C_{0r} > 0{,}1$	1'30" 3'
35, 36 seturi DB, DF	$F_r/C_{0r} < 0{,}1$ $F_r/C_{0r} > 0{,}1$	1' 2'

Tolerances

Tapered roller bearings are generally manufactured to the normal tolerance class ISO and AFBMA, respectively (for bearings with inch dimensions).

For certain applications (e.g. bearings for machine-tools), they can be also manufactured to tolerance classes P5 and P6X or 3 AFBMA.

At request, they can be manufactured to tolerance class P4.

Single row tapered roller bearings have the outer rings interchangeable with the inner ring - rollers - cage assembly (if they have the same mark) and also with bearings produced by other companies, according to ISO and AFBMA respectively.

The parts of the two and four row tapered roller bearings are non-interchangeable.

The tolerances for bearings overall dimensions are given in tables on page 37 for tapered roller bearings, both with metric and inch dimensions. Tolerances for mounting chamfer are given in tables

Radial and axial clearance

In case of tapered roller bearings, clearance should be in radial direction, but it is measured and adjusted in axial direction. As tapered roller bearings are dismountable, their clearance is not guaranteed by design and it is adjusted while mounting. Thus, optimum clearance can be obtained for that application.

In case of double and four row tapered roller bearings with distance rings between bearing rings, the clearance is guaranteed and its values are given in table 2. The bearing parts are numbered for each bearing so that the prescribed clearance on each row should be observed while mounting.

In case of bearings without distance rings, clearance is adjusted as for single row tapered roller bearings: for DB design - by the inner rings and for DF design by the outer rings. The above specifications are also available for bearings matched in sets.

The values of the axial clearance can be calculated using the equation:

$$\text{axial clearance} = \frac{\text{radial clearance}}{2 \text{ tg } \alpha}$$

where α is the contact angle.

In case of certain applications where clearance between shaft and housing should be avoided, tapered roller bearings can also be pre-tightened. This can be adjusted while mounting or is pre- adjusted by distance rings, in case of two or four row tapered roller bearings.

Radial clearance of double and four-row tapered roller bearings

Table 2

Bore diameter d		**Radial clearance symbol**											
		C1		**C2**		**Normal**		**C3**		**C4**		**C5**	
over	up to	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
mm		µm											
50	**65**	0	15	15	30	30	50	50	70	70	90	90	120
65	**80**	0	20	20	40	40	60	60	80	80	110	110	150
80	**100**	0	20	20	45	45	70	70	100	100	130	130	170
100	**120**	0	25	25	50	50	80	80	110	110	150	150	200
120	**140**	0	30	30	60	60	90	90	120	120	170	170	230
140	**160**	0	30	30	65	65	100	100	140	140	190	190	260
160	**180**	0	35	35	70	70	110	110	150	150	210	210	280
180	**200**	0	40	40	80	80	120	120	170	170	230	230	310
200	**225**	0	40	40	90	90	140	140	190	190	260	260	340
225	**250**	0	50	50	100	100	150	150	210	210	290	290	380
250	**280**	0	50	50	110	110	170	170	230	230	320	320	420
280	**315**	0	60	60	120	120	180	180	250	250	350	350	460
315	**355**	0	70	70	140	140	210	210	280	280	390	390	510
355	**400**	0	70	70	150	150	230	230	310	310	440	440	580
400	**450**	0	80	80	170	170	260	260	350	350	490	490	650
450	**500**	0	90	90	190	190	290	290	390	390	540	540	720
500	**560**	0	100	100	210	210	320	320	430	430	590	590	790
560	**630**	0	110	110	230	230	350	350	480	480	660	660	880
630	**710**	0	130	130	260	260	400	400	540	540	740	740	910
710	**800**	0	140	140	290	290	450	450	610	610	830	830	1 100
800	**900**	0	160	160	330	330	500	500	670	670	920	920	1 240

Contact angle

Contact angle of tapered roller bearings is the angle of the outer ring raceway generatrix. In case of standardized single row tapered roller bearings, this angle can be found in the standard of dimensions Bearings series 329, 302, 322, 303 and 323 have a contact angle between 10° and 17° and those of series 313 have a contact angle of 28° 48' 39", so that they can take heavier axial loads. Non-standardized single row tapered roller bearings and also all double and four-row tapered roller bearings have the contact angle between 9° and 30°.

Cages

Small and medium sized tapered roller bearings are generally fitted with pressed sheet cages. Large sized bearings are generally fitted with machined steel or brass cages, with welded pins. In some cases, median or large sized bearings can also be fitted with machined steel or brass cages. In all cases, the cage is guided on rollers.

For small and medium sized bearings, glass fibre reinforced polyamide 6.6 cages can be successfully used if the operating temperature doesn't exceed +120°C. They have low weight, are noiseless in operation and have low coefficient of friction.

Designs and some technical data are given in table 3.

Equivalent dynamic radial load

Equivalent dynamic radial load can be calculated using the following equations:

- for single row tapered roller bearings:

$P_r = F_r$, kN, when $F_a/F_r \leq e$
$P_r = 0{,}4\ F_r + Y\ F_a$, kN, when $F_a/F_r > e$

- for paired bearings and double or four-row tapered roller bearings:

$P_r = F_r + Y_1\ F_a$, kN, when $F_a/F_r \leq e$
$P_r = 0{,}67\ F_r + Y_2\ F_a$, kN, when $F_a/F_r > e$

For single row tapered roller bearings, the F_a values can be calculated using the equations in table 4. These equations are available when bearings are mounted so that axial clearance is in fact zero without preloading. F_{rA} and F_{rB} should always be considered as being positive, even if they act in the opposite direction to that in the figure.

In case of paired bearings and of double or four row tapered roller bearings, F_a and F_r are the loads acting upon the paired bearings or single bearings.

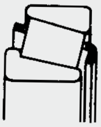
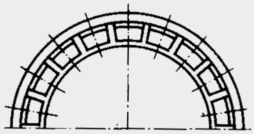
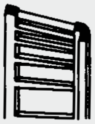
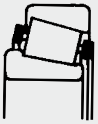
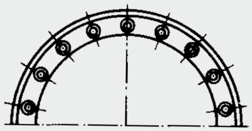
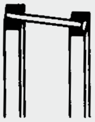
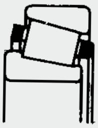
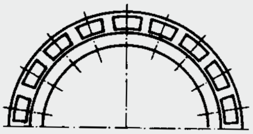
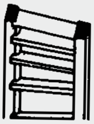
The values of e, Y, Y_1 and Y_2 are given in bearing tables.

Equivalent static radial load

Equivalent static radial load can be calculated using the equations:

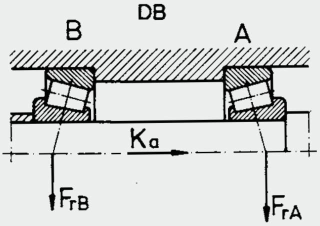
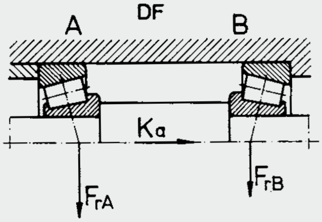
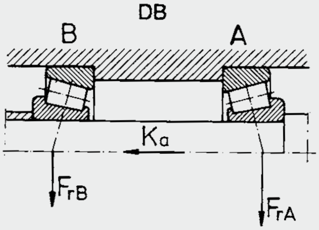
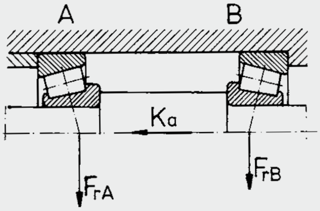
Cage designs and some technical data

Table 3

Cage	**Design**		**Application**	**Max. value** $D_m\,n$	
	Bearing	Cage		oil	grease
Pressed sheet cage		 	- General application - Small and medium sized bearings d ≤ 250 mm	350×10^3	245×10^3
Pin cages		 	- General application - Large sized bearings d > 250 mm	350×10^3	245×10^3
Machined brass cage M		 	- General application - Median and large sized bearings d > 150 mm	450×10^3	315×10^3

Calculating relations for axial loadings F_a

Table 4

		Loading versions	Axial load
Back to back DB  Face to face DF  	1a)	$\frac{F_{rA}}{Y_A} \geq \frac{F_{rB}}{Y_B}$ $K_a \geq 0$	$F_{aA} = \frac{0,5\ F_{rA}}{Y_A}$ $F_{aB} = F_{aA} + K_a$
	1b)	$\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ $K_a \geq 0,5 \left(\frac{F_{rB}}{Y_B} - \frac{F_{rA}}{Y_A}\right)$	$F_{aA} = \frac{0,5\ F_{rA}}{Y_A}$ $F_{aB} = F_{aA} + K_a$
	1c)	$\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ $K_a < 0,5 \left(\frac{F_{rB}}{Y_B} - \frac{F_{rA}}{Y_A}\right)$	$F_{aA} = F_{aB} - K_a$ $F_{aB} = \frac{0,5\ F_{rB}}{Y_B}$
Back to back DB  Face to face DF  	2a)	$\frac{F_{rA}}{Y_A} \leq \frac{F_{rB}}{Y_B}$ $K_a \geq 0$	$F_{aA} = F_{aB} + K_a$ $F_{aB} = \frac{0,5\ F_{rB}}{Y_B}$
	2b)	$\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$ $K_a \geq 0,5 \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	$F_{aA} = F_{aB} + K_a$ $F_{aB} = \frac{0,5\ F_{rB}}{Y_B}$
	2c)	$\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$ $K_a < 0,5 \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	$F_{aA} = \frac{0,5\ F_{rA}}{Y_A}$ $F_{aB} = F_{aA} - K_a$

- for single row tapered roller bearings:

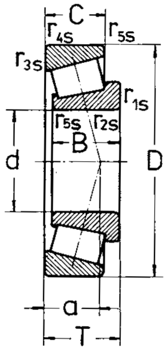
$P_{0r} = F_r$, kN, when $F_a/F_r \leq 1/2\ Y_0$
$P_{0r} = 0,5\ F_r + Y_0\ F_a$, kN, when $F_a/F_r > 1/2\ Y_0$

- for paired double or four row tapered roller bearings

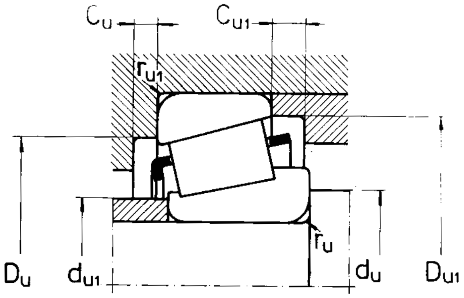
$P_{0r} = F_r + Y_0\ F_a$, kN

F_a is calculated as in case of equivalent dynamic radial load. The values of Y_0 are given in bearing tables.

Single-row tapered roller bearings (Metric Series)

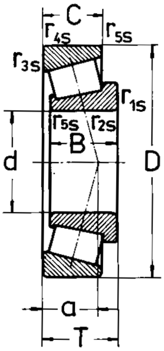


Dimensions									Designation	ISO series	Basic radial load. Factors				
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	r_{s5} min.	a			dyn. C_r	e	Y	stat. C_{0r}	Y_0
mm									—		kN	—		kN	—
15	42	13	11	14,25	1	1	0,3	9	**30302A**	2FB	21,5	0,28	2,1	19,8	1,1
17	40	12	11	13,25	1	1	0,3	10	**30203A**	2DB	18,3	0,35	1,7	19	0,9
	47	14	12	15,25	1	1	0,3	10	**30303A**	2FB	26	0,28	2,1	24,5	1,1
	47	19	16	20,25	1	1	0,3	12	**32303A**	2FD	34	0,28	2,1	35,5	1,1
20	42	15	12	15	0,6	0,6	0,3	10	**32004XA**	3CC	26	0,37	1,6	28,5	0,9
	47	14	12	15,25	1	1	0,3	11	**30204A**	2DB	25,8	0,35	1,7	26,4	0,9
	52	15	13	16,25	1,5	1,5	0,6	11	**30304A**	2FB	32	0,3	2	32	1,1
	52	21	18	22,25	1,5	1,5	0,6	14	**32304A**	2FD	42,5	0,3	2	47	1,1
25	47	15	11,5	15	0,6	0,6	0,3	11	**32005XA**	4CC	26	0,43	1,4	33,5	0,8
	52	15	13	16,25	1	1	0,3	12	**30205A**	3CC	30,1	0,37	1,6	32,9	0,9
	52	18	15	19,25	1	1	0,3	16	**32205A**	2CD	31	0,33	1,8	37	1
	62	17	15	18,25	1,5	1,5	0,6	13	**30305A**	2FB	43	0,3	2	43	1,1
	62	17	13	18,25	1,5	1,5	0,6	20	**31305A**	7FB	39	0,83	0,7	41	0,4
	62	24	20	25,25	1,5	1,5	0,6	15	**32305A**	2FD	58,3	0,3	2	60,3	1,1
30	55	17	13	17	1	1	0,3	13	**32006XA**	4CC	34	0,43	1,4	45,5	0,8
	62	16	14	17,25	1	1	0,3	14	**30206A**	3DB	40,5	0,37	1,6	45,1	0,9
	62	20	17	21,25	1	1	0,3	15	**32206A**	3DC	49	0,37	1,6	61	0,9
	72	19	16	20,75	1,5	1,5	0,6	15	**30306A**	2FB	52,9	0,31	1,9	51,8	1,1
	72	19	14	20,75	1,5	1,5	0,6	22	**31306A**	7FB	46,5	0,83	0,7	49,5	0,4
	72	27	23	28,75	1,5	1,5	0,6	18	**32306A**	2FD	75,8	0,31	1,9	82,7	1,1
35	62	18	14	18	1	1	0,3	15	**32007XA**	4CC	35,9	0,46	1,3	52,4	0,7
	72	17	15	18,25	1,5	1,5	0,6	15	**30207A**	3DB	50,5	0,37	1,6	54,7	0,9
	72	23	19	24,25	1,5	1,5	0,6	17	**32207A**	3DC	66,2	0,37	1,6	77,5	0,9
	80	21	18	22,75	2	1,5	0,6	16	**30307A**	2FB	71,2	0,31	1,9	72,5	1,1
	80	21	15	22,75	2	1,5	0,6	25	**31307A**	7FB	58,1	0,83	0,7	64	0,4
	80	31	25	32,75	2	1,5	0,6	20	**32307A**	2FE	95,3	0,31	1,9	106	1,1
40	68	19	14,5	19	1	1	0,3	15	**32008XA**	3CD	48,8	0,37	1,6	65,6	0,9
	80	18	16	19,75	1,5	1,5	0,6	16	**30208A**	3DB	57,9	0,37	1,6	62,4	0,9
	80	23	19	24,75	1,5	1,5	0,6	19	**32208A**	3DC	66,2	0,37	1,6	79,5	0,9
	90	23	20	25,25	2	1,5	0,6	19	**30308A**	2FB	83,9	0,35	1,7	91,3	0,9
	90	23	17	25,25	2	1,5	0,6	28	**31308A**	7FB	74,6	0,83	0,7	60,8	0,4
	90	33	27	35,25	2	1,5	0,6	23	**32308A**	2FD	105	0,35	1,7	122	0,9
45	75	20	15,5	20	1	1	0,3	16	**32009XA**	3CC	57	0,4	1,5	82,2	0,8
	85	19	16	20,75	1,5	1,5	0,6	18	**30209A**	3DB	60,1	0,4	1,5	67,1	0,8
	85	23	19	24,75	1,5	1,5	0,6	20	**32209A**	3DC	76,5	0,4	1,5	91,6	0,8
	100	25	22	27,25	2	1,5	0,6	21	**30309A**	2FB	106	0,35	1,7	118	0,9
	100	25	18	27,25	2	1,5	0,6	31	**31309A**	7FB	88,9	0,83	0,7	97,1	0,4
	100	36	30	38,25	2	1,5	0,6	25	**32309A**	2FD	133	0,35	1,7	159	0,9
50	80	20	15,5	20	1	1	0,3	18	**32010XA**	3CC	58,5	0,43	1,4	88,5	0,8

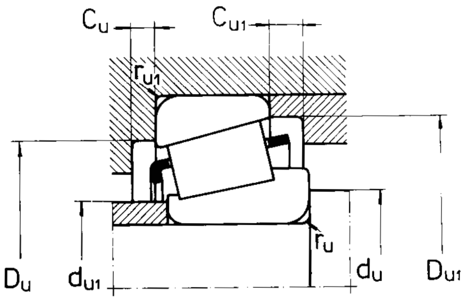


Speed limit		**Weight**	**Mounting dimensions**								
grease	oil		d_{u1} max.	d_u min.	D_u min.	max.	D_{u1} min.	C_u min.	C_{u1} min.	r_u max.	r_{u1} max.
min^{-1}		kg	mm								
9 000	13 000	0,090	22	21	36	36	38	2	3	1	1
9 000	13 000	0,074	23	23	34	34	37	2	2	1	1
8 500	12 000	0,130	25	23	40	41	42	2	3	1	1
8 000	11 000	0,170	24	23	39	41	43	3	4	1	1
8 500	12 000	0,097	25	25	36	37	39	3	3	0,6	0,6
8 000	11 000	0,120	27	26	40	41	43	2	3	1	1
8 000	11 000	0,170	28	27	44	45	47	2	3	1,5	1,5
7 500	10 000	0,221	27	27	43	45	47	3	4	1,5	1,5
8 000	11 000	0,113	30	30	40	42	44	3	3,5	0,6	0,6
7 500	10 000	0,150	31	31	44	46	48	2	3	1	1
7 500	10 000	0,182	31	31	44	46	48	3	4	1	1
6 700	9 000	0,250	34	32	54	55	57	2	3	1,5	1,5
5 600	7 500	0,255	34	32	47	55	59	3	5	1,5	1,5
6 000	8 000	0,360	33	32	53	55	57	3	5	1,5	1,5
6 700	9 000	0,017	35	36	48	49	52	3	4	1	1
6 300	8 500	0,220	37	36	53	56	57	2	3	1	1
6 300	8 500	0,280	37	36	52	56	59	3	4	1	1
5 600	7 500	0,380	40	37	62	65	66	3	4,5	1,5	1,5
5 000	6 700	0,390	40	37	55	65	68	3	6,5	1,5	1,5
5 300	7 000	0,550	39	37	59	65	66	4	5,5	1,5	1,5
6 000	8 000	0,220	40	41	54	56	59	4	4	1	1
5 300	7 000	0,320	44	42	62	65	67	3	3	1,5	1,5
5 300	7 000	0,420	43	42	61	65	67	3	5,5	1,5	1,5
5 000	6 700	0,520	45	44	70	71	74	3	4,5	2	1,5
4 500	6 000	0,520	44	44	62	71	76	4	7,5	2	1,5
4 800	6 300	0,730	44	44	66	71	74	4	7,5	2	1,5
5 300	7 000	0,270	46	46	60	62	65	4	4,5	1	1
4 800	6 300	0,420	49	47	69	73	74	3	3,5	1,5	1,5
4 800	6 300	0,510	48	47	68	73	75	3	5,5	1,5	1,5
4 500	6 000	0,700	52	49	77	81	82	3	5	2	1,5
4 000	5 300	0,685	51	49	71	81	86	4	8	2	1,5
4 000	5 300	0,993	50	49	73	81	82	4	8	2	1,5
4 800	6 300	0,330	51	51	67	69	72	4	4,5	1	1
4 500	6 000	0,470	54	52	74	78	80	3	4,5	1,5	1,5
4 500	6 000	0,560	53	52	73	78	80	3	5,5	1,5	1,5
4 000	5 300	0,920	59	54	86	91	92	3	5	2	1,5
3 400	4 500	0,915	56	54	79	91	95	4	9	2	1,5
3 600	4 800	1,25	56	54	82	91	93	4	8	2	1,5
4 500	6 000	0,360	56	56	72	74	77	4	4,5	1	1

Single-row tapered roller bearings (Metric Series)

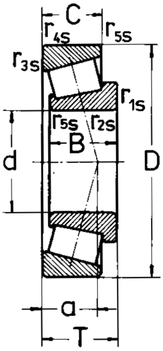


Dimensions									Designation	ISO series	Basic radial load. Factors				
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	r_{5s} min.	a			dyn. C_r	e	Y	stat. C_{0r}	Y_0
mm									—		kN	—		kN	—
50	90	20	17	21,75	1,5	1,5	0,6	19	**30210A**	3DB	69,7	0,43	1,4	81,3	0,8
	90	23	19	24,75	1,5	1,5	0,6	21	**32210A**	3DC	79,1	0,43	1,4	95,8	0,8
	110	27	23	29,25	2,5	2	0,6	23	**30310A**	2FB	120	0,35	1,7	133	0,9
	110	27	19	29,25	2,5	2	0,6	34	**31310A**	7FB	102	0,83	0,7	112	0,4
	110	40	33	42,25	2,5	2	0,6	27	**32310A**	2FD	160	0,35	1,7	194	0,9
55	90	23	17,5	23	1,5	1,5	0,6	20	**32011XA**	3CC	77	0,4	1,5	117	0,8
	100	21	18	22,75	2	1,5	0,6	20	**30211A**	3DB	83	0,4	1,5	95,2	0,8
	100	25	21	26,75	2	1,5	0,6	22	**32211A**	3DC	96,2	0,4	1,5	115	0,8
	120	29	25	31,5	2,5	2	0,6	24	**30311A**	2FB	146	0,35	1,7	166	0,9
	120	29	21	31,5	2,5	2	0,6	37	**31311A**	7FB	118	0,83	0,7	133	0,4
	120	43	35	45,5	2,5	2	0,6	29	**32311A**	2FD	191	0,35	1,7	235	0,9
60	95	23	17,5	23	1,5	1,5	0,6	21	**32012XA**	4CC	78,5	0,43	1,4	119	0,8
	110	22	19	23,75	2	1,5	0,6	22	**30212A**	3EB	91,6	0,4	1,5	105	0,8
	110	28	24	29,75	2	1,5	0,6	24	**32212A**	3EC	122	0,4	1,5	152	0,8
	130	31	26	33,5	3	2,5	1	26	**30312A**	2FB	164	0,35	1,7	187	0,9
	130	31	22	33,5	3	2,5	1	39	**31312A**	7FB	140	0,83	0,7	158	0,4
	130	46	37	48,5	3	2,5	1	31	**32312A**	2FD	229	0,35	1,7	288	0,9
65	100	23	17,5	23	1,5	1,5	0,6	22	**32013XA**	4CC	80,6	0,46	1,3	123	0,7
	120	23	20	24,75	2	1,5	0,6	23	**30213A**	3EB	111	0,4	1,5	129	0,8
	120	31	27	32,75	2	1,5	0,6	27	**32213A**	3EC	149	0,4	1,5	189	0,8
	140	33	28	36	3	2,5	1	28	**30313A**	2GB	191	0,35	1,7	220	0,9
	140	33	23	36	3	2,5	1	42	**31313A**	7GB	164	0,83	0,7	189	0,4
	140	48	39	51	3	2,5	1	33	**32313A**	2GO	256	0,35	1,7	322	0,9
70	110	25	19	25	1,5	1,5	0,6	23	**32014XA**	4CC	95,6	0,43	1,4	143	0,8
	125	24	21	26,25	2	1,5	0,6	25	**30214A**	3EB	119	0,43	1,4	143	0,8
	125	31	27	33,25	2	1,5	0,6	28	**32214A**	3EC	157	0,43	1,4	204	0,8
	150	35	30	38	3	2,5	1	29	**30314A**	2GB	224	0,35	1,7	264	0,9
	150	35	25	38	3	2,5	1	45	**31314A**	7GB	185	0,83	0,7	215	0,4
	150	51	42	54	3	2,5	1	36	**32314A**	2GD	297	0,35	1,7	381	0,9
75	115	25	19	25	1,5	1,5	0,6	25	**32015XA**	4CC	97,3	0,46	1,3	149	0,7
	130	25	22	27,25	2	1,5	0,6	27	**30215A**	4DB	134	0,43	1,4	166	0,8
	130	31	27	33,25	2	1,5	0,6	29	**32215A**	4DC	157	0,43	1,4	205	0,8
	160	37	31	40	3	2,5	1	31	**30315A**	2GB	246	0,35	1,7	289	0,9
	160	37	26	40	3	2,5	1	48	**31315A**	7GB	213	0,83	0,7	251	0,4
	160	55	45	58	3	2,5	1	38	**32315A**	2GD	350	0,35	1,7	460	0,9
80	125	29	22	29	1,5	1,5	0,6	27	**32016XA**	3CC	130	0,43	1,4	198	0,8
	140	26	22	28,25	2,5	2	0,6	28	**30216A**	3EB	145	0,43	1,4	177	0,8
	140	33	28	35,25	2,5	2	0,6	30	**32216A**	3EC	180	0,43	1,4	232	0,8
	170	39	33	42,5	3	2,5	1	33	**30316A**	2GB	277	0,35	1,7	329	0,9
	170	39	27	42,5	3	2,5	1	52	**31316A**	7GB	222	0,83	0,7	275	0,4

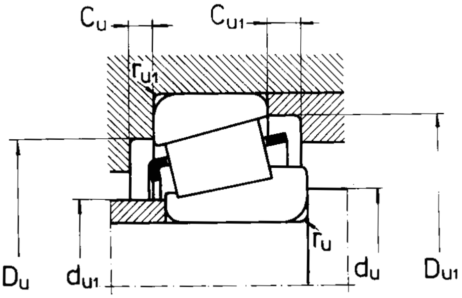


Speed limit		Weight	Mounting dimensions								
grease	oil		d_{u1} max.	d_u min.	D_u min.	max.	D_{u1} min.	C_u min.	C_{u1} min.	r_u max.	r_{u1} max.
min^{-1}		kg	mm								
4 300	5 600	0,530	58	57	79	83	85	3	4,5	1,5	1,5
4 300	5 600	0,600	58	57	78	83	85	3	5,5	1,5	1,5
3 600	4 800	1,19	65	60	95	100	102	4	6	2,5	2
3 200	4 300	1,16	62	60	87	100	104	4	10	2,5	2
3 200	4 300	1,83	62	60	90	100	102	5	9	2,5	2
4 000	5 300	0,540	63	62	81	83	86	4	5,5	1,5	1,5
3 800	5 000	0,690	64	64	88	91	94	4	4,5	1,5	1,5
3 800	5 000	0,820	63	64	87	91	95	4	5,5	1,5	1,5
3 200	4 300	1,53	71	65	104	110	111	4	6,5	2	2
2 800	3 800	1,49	68	65	94	110	113	4	10,5	2	2
3 000	4 000	2,21	68	65	99	110	111	5	10,5	2	2
3 800	5 000	0,580	67	67	85	88	91	4	5,5	1,5	1,5
3 400	4 500	0,860	70	69	96	101	103	4	4,5	2	1,5
3 400	4 500	1,10	69	69	95	101	104	4	5,5	2	1,5
3 000	4 000	1,90	77	72	112	118	120	5	7,5	3	2,5
2 600	3 600	1,83	73	72	103	118	123	5	11,5	3	2,5
2 600	3 600	2,80	74	72	107	118	120	6	11,5	3	2,5
3 400	4 500	0,620	72	72	90	93	97	4	5,5	1,5	1,5
3 000	4 000	1,10	77	74	106	111	113	4	4,5	2	1,5
3 000	4 000	1,48	76	74	104	111	115	4	5,5	2	1,5
2 600	3 600	2,30	83	77	122	128	130	5	8	3	2,5
2 200	3 200	2,25	79	77	111	128	132	5	13	3	2,5
2 400	3 400	3,49	80	77	117	128	130	6	12	3	2,5
3 200	4 300	0,830	78	77	98	103	105	5	6	1,5	1,5
3 000	4 000	1,22	81	79	110	116	118	4	5	2	1,5
2 800	3 800	1,56	80	79	108	116	119	4	6	2	1,5
2 400	3 400	3,00	89	82	130	138	140	5	8	3	2,5
2 000	3 000	2,82	84	82	118	138	141	5	13	3	2,5
2 200	3 200	4,10	86	82	125	138	140	6	12	3	2,5
3 000	4 000	0,880	83	82	103	108	110	5	6	1,5	1,5
2 800	3 800	1,33	86	84	115	121	124	4	5	2	1,5
2 600	3 600	2,62	85	84	115	121	124	4	6	2	1,5
2 600	3 600	3,40	95	87	139	148	149	5	9	3	2,5
1 900	2 800	3,50	91	87	127	148	151	6	14	3	2,5
2 000	3 000	5,00	91	87	133	148	149	7	13	3	2,5
2 600	3 600	1,24	89	87	112	117	120	6	7	1,5	1,5
2 400	3 400	1,59	91	90	124	130	132	4	6	2,5	2
2 400	3 400	2,00	90	90	122	130	134	5	7	2,5	2
2 000	3 000	4,00	102	92	148	158	159	5	9,5	3	2,5
1 900	2 800	4,07	97	92	134	158	159	6	15,5	3	2,5

Single-row tapered roller bearings (Metric Series)

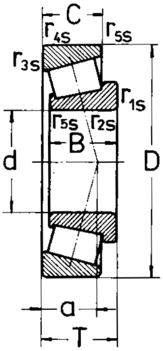


Dimensions									**Designation**	**ISO series**	**Basic radial load. Factors**				
d	D	B	C	T	r_{1s}, r_{2s} min.	r_{3s}, r_{4s} min.	r_5 min.	a			dyn. C_r	e	Y	stat. C_{0r}	Y_0
mm									—		kN	—		kN	—
80	170	58	48	61,5	3	2,5	1	41	**32316A**	2GD	383	0,35	1,7	503	0,9
85	130	29	22	29	1,5	1,5	0,6	28	**32017XA**	4CC	136	0,44	1,4	213	0,8
	150	28	24	30,5	2,5	2	0,6	30	**30217A**	3EB	167	0,43	1,4	206	0,8
	150	36	30	38,5	2,5	2	0,6	33	**32217A**	3EC	213	0,43	1,4	283	0,8
	180	41	34	44,5	4	3	1	35	**30317A**	2GB	298	0,35	1,7	354	0,9
	180	41	28	44,5	4	3	1	55	**31317A**	7GB	245	0,83	0,7	298	0,4
	180	60	49	63,5	4	3	1	42	**32317A**	2GD	400	0,35	1,7	555	0,9
90	140	32	24	32	2	1,5	0,6	30	**32018XA**	3CC	159	0,43	1,4	246	0,8
	160	30	26	32,5	2,5	2	0,6	31	**30218A**	3FB	190	0,43	1,4	238	0,8
	160	40	34	42,5	2,5	2	0,6	36	**32218A**	3FC	251	0,43	1,4	340	0,8
	190	43	36	46,5	4	3	1	36	**30318A**	2GB	328	0,35	1,7	394	0,9
	190	43	30	46,5	4	3	1	57	**31318A**	7GB	270	0,83	0,7	330	0,4
	190	64	53	67,5	4	3	1	44	**32318A**	2GD	461	0,35	1,7	612	0,9
95	145	32	24	32	2	1,5	0,6	31	**32019XA**	4CC	163	0,44	1,4	257	0,8
	170	32	27	34,5	3	2,5	1	33	**30219A**	2FB	210	0,43	1,4	264	0,8
	170	43	37	45,5	3	2,5	1	39	**32219A**	3FC	281	0,43	1,4	390	0,8
	200	45	38	49,5	4	3	1	39	**30319A**	2GB	350	0,35	1,7	449	0,9
	200	45	32	49,5	4	3	1	60	**31319A**	7GB	300	0,83	0,7	365	0,4
	200	67	55	71,5	4	3	1	47	**32319A**	2GD	500	0,35	1,7	670	0,9
100	150	32	24	32	2	1,5	0,6	32	**32020XA**	4CC	171	0,46	1,3	277	0,7
	180	34	29	37	3	2,5	1	35	**30220A**	3FB	238	0,43	1,4	303	0,8
	180	46	39	49	3	2,5	1	41	**32220A**	3FC	320	0,43	1,4	444	0,8
	215	47	39	51,5	4	3	1	40	**30320A**	2GB	404	0,35	1,7	492	0,9
	215	73	60	77,5	4	3	1	53	**32320A**	2GD	578	0,35	1,7	780	0,9
105	160	35	26	35	2,5	2	0,6	34	**32021XA**	4DC	204	0,44	1,4	334	0,8
	190	36	30	39	3	2,5	1	37	**30221A**	3FB	270	0,43	1,4	350	0,8
	190	50	43	53	3	2,5	1	44	**32221A**	3FC	358	0,43	1,4	510	0,8
	225	77	63	81,5	4	3	1	53	**32321A**	2GD	405	0,35	1,7	815	0,9
110	170	38	29	38	2,5	2	0,6	36	**32022XA**	4DC	235	0,43	1,4	382	0,8
	200	38	32	41	3	2,5	1	39	**30222A**	3FB	304	0,43	1,4	396	0,8
	200	53	46	56	3	2,5	1	46	**32222A**	3FC	406	0,43	1,4	580	0,8
	240	50	42	54,5	4	3	1	43	**30322A**	2GB	479	0,35	1,7	588	0,9
	240	80	65	84,5	4	3	1	55	**32322A**	2GD	699	0,35	1,7	956	0,9
120	180	38	29	38	2,5	2	0,6	39	**32024XA**	4DC	238	0,46	1,3	397	0,7
	215	40	34	43,5	3	2,5	1	43	**30224A**	4FB	340	0,43	1,4	459	0,8
	215	58	50	61,5	3	2,5	1	51	**32224A**	4FD	446	0,43	1,4	653	0,8
	260	55	46	59,5	4	3	1	47	**30324A**	2GB	568	0,35	1,7	712	0,9
	260	86	69	90,5	4	3	1	60	**32324A**	2GD	799	0,35	1,7	1104	0,9
130	200	45	34	45	2,5	2	0,6	42	**32026XA**	4EC	315	0,43	1,4	526	0,8
	230	40	34	43,75	4	3	1	45	**30226A**	4FB	367	0,43	1,4	485	0,8
	230	64	54	67,75	4	3	1	56	**32226A**	4FD	551	0,43	1,4	836	0,8

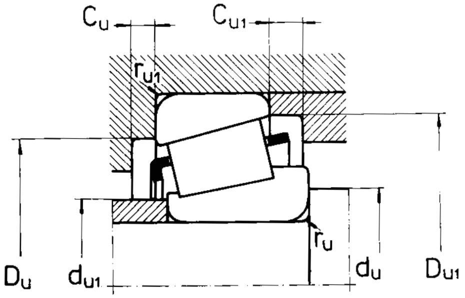


Speed limit		**Weight**	**Mounting dimensions**								
grease	oil		d_{u1} max.	d_u min.	D_u min.	max.	D_{u1} min.	C_u min.	C_{u1} min.	r_u max.	r_{u1} max.
min^{-1}		kg	mm								
1 900	2 800	5,90	98	92	142	158	159	7	13,5	3	2,5
2 400	3 400	1,30	94	92	117	122	125	6	7	1,5	1,5
2 200	3 200	2,00	97	95	132	140	141	5	6,5	2,5	2
2 200	3 200	2,50	96	95	130	140	142	5	8,5	2,5	2
1 900	2 800	4,70	107	99	156	166	167	6	10,5	4	3
1 800	2 600	5,08	103	99	143	166	169	6	16,5	4	3
1 800	2 600	6,85	103	99	150	166	167	8	14,5	4	3
2 200	3 200	1,70	100	99	125	131	134	6	8	2	1,5
2 200	3 000	2,49	103	100	140	150	150	5	6,5	2,5	2
2 000	3 000	3,30	102	100	138	150	152	5	8,5	2,5	2
1 700	2 400	5,50	113	104	165	176	176	6	10,5	4	3
1 700	2 400	5,92	109	104	151	176	179	6	16,5	4	3
1 700	2 400	8,21	108	104	157	176	177	8	14,5	4	3
2 200	3 200	1,80	105	104	130	136	140	6	8	2	1,5
1 900	2 800	2,96	110	107	149	158	159	5	7,5	3	2,5
1 900	2 800	4,00	108	107	145	158	161	5	8,5	3	2,5
1 800	2 600	6,70	118	109	172	186	184	6	11,5	4	3
1 700	2 400	6,95	114	109	157	186	187	6	17,5	4	3
1 700	2 400	11,0	115	109	166	186	186	8	16,5	4	3
2 000	3 000	1,85	109	109	134	141	144	6	8	2	1,5
1 900	2 800	3,54	116	112	157	168	168	5	8	3	2,5
1 800	2 600	4,76	114	112	154	168	171	5	10	3	2,5
1 700	2 400	7,90	127	114	184	201	197	6	12,5	4	3
1 600	2 200	14,0	123	114	177	201	200	8	17,5	4	3
1 900	2 800	2,42	116	115	143	150	154	6	9	2,5	2
1 800	2 600	4,26	122	117	165	178	177	6	9	3	2,5
1 800	2 600	5,90	120	117	161	178	180	5	10	3	2,5
1 500	2 000	14,5	128	119	185	211	209	9	18,5	4	3
1 800	2 600	3,06	122	120	152	160	163	7	9	2,5	2
1 700	2 400	5,00	129	122	174	188	187	6	9	3	2,5
1 700	2 400	6,90	126	122	170	188	190	6	10	3	2,5
1 600	2 200	12,5	141	124	206	226	220	8	12,5	4	3
1 400	1 900	16,4	137	124	198	226	222	9	19,5	4	3
1 700	2 400	3,25	131	130	161	170	173	7	9	2,5	2
1 600	2 200	6,01	140	132	187	203	201	6	9,5	3	2,5
1 600	2 200	8,59	136	132	181	203	204	7	11,5	3	2,5
1 500	2 000	13,6	152	134	221	246	237	10	13,5	4	3
1 300	1 800	24,5	148	134	213	246	239	9	21,5	4	3
1 600	2 200	4,93	144	140	178	190	192	8	11	2,5	2
1 500	2 000	7,60	152	144	203	216	217	7	9,5	4	3
1 500	2 000	10,7	146	144	193	216	219	7	13,5	4	3

Single-row tapered roller bearings (Metric Series)

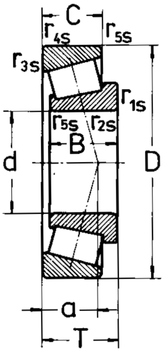


Dimensions									Designation	ISO series	Basic radial load. Factors				
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	r_5 min.	a			dyn. C_r	e	Y	stat. C_{0r}	Y_0
mm									—		kN	—		kN	—
130	280	58	49	63,75	5	4	1,5	51	**30326A**	2GB	640	0,35	1,7	820	0,9
	280	66	44	72	5	4	1,5	87	**31326XA**	7GB	597	0,83	0,7	761	0,4
	280	93	78	98,75	5	4	1,5	66	**32326A**		947	0,35	1,7	1333	0,9
140	210	45	34	45	2,5	2	0,6	46	**32028XA**	4DC	312	0,46	1,3	529	0,7
	250	42	36	45,75	4	3	1	47	**30228A**	4FB	396	0,43	1,4	527	0,8
	250	68	58	71,75	4	3	1	60	**32228A**	4FD	602	0,43	1,4	907	0,8
	300	70	47	77	5	4	1,5	90	**31328XA**	7GB	714	0,83	0,7	935	0,4
150	225	48	36	48	3	2,5	1	49	**32030XA**	4EC	355	0,46	1,3	620	0,7
	270	45	38	49	4	3	1	50	**30230A**	4GB	457	0,43	1,4	618	0,8
	270	73	60	77	4	3	1	64	**32230A**	4GD	705	0,43	1,4	1 080	0,8
160	240	51	38	51	3	2,5	1	52	**32032XA**	4EC	402	0,46	1,3	696	0,7
	290	48	40	52	4	3	1	54	**30232A**	4GB	520	0,43	1,4	710	0,8
	290	80	67	84	4	3	1	70	**32232A**	4GD	840	0,43	1,4	1 400	0,8
170	230	38	30	38	2,5	2	0,6	42	**32934A**	3DC	280	0,37	1,6	572	0,9
	260	57	43	57	3	2,5	1	56	**32034XA**	4EC	480	0,44	1,4	865	0,8
	310	52	43	57	5	4	1,5	58	**30234A**	4GB	610	0,43	1,4	844	0,8
	310	86	71	91	5	4	1,5	75	**32234A**	4GD	889	0,43	1,4	1 377	0,8
180	250	45	34	45	2,5	2	0,6	53	**32936A**	4DC	350	0,48	1,3	727	0,7
	280	64	48	64	3	2,5	1	59	**32036XA**	3FD	599	0,43	1,4	1 037	0,8
	320	52	43	57	5	4	1,5	61	**30236A**	4GB	584	0,46	1,3	825	0,7
	320	86	71	91	5	4	1,5	78	**32236A**	4GD	974	0,46	1,3	1 571	0,7
190	260	45	34	45	2,5	2	0,6	55	**32938A**	4DC	358	0,48	1,3	772	0,7
	290	64	48	64	3	2,5	1	62	**32038XA**	4FD	609	0,44	1,4	1 077	0,8
	340	92	75	97	5	4	1,5	81	**32238A**	4GD	1 080	0,43	1,4	1860	0,8
200	280	51	39	51	3	2,5	1	53	**32940A**	3EC	474	0,4	1,5	950	0,8
	310	70	53	70	3	2,5	1	66	**32040XA**	4FD	716	0,43	1,4	1 356	0,8
	310	70	53	70	3	2,5	1	66	**T-32040X**	4FD	716	0,43	1,4	1 356	0,8
	310	70	53	70	3	2,5	1	66	**T-32040XP5**	4FD	716	0,43	1,4	1 356	0,8
	360	98	82	104	5	4	1,5	83	**32240A**	3GD	1 220	0,4	1,5	2 020	0,8
220	300	51	39	51	3	2,5	1	58	**32944M**	3EC	407	0,43	1,4	827	0,8
	340	76	57	76	4	3	1	72	**32044XA**	4FD	850	0,43	1,4	1 537	0,8
	340	76	57	76	4	3	1	72	**T-32044X**	4FD	850	0,43	1,4	1 537	0,8
	340	76	57	76	4	3	1	72	**T-32044XP5**	4FD	850	0,43	1,4	1 537	0,8
240	360	76	57	76	4	3	1	78	**32048XA**	4FD	870	0,46	1,3	1 690	0,7
	360	76	57	76	4	3	1	78	**T-32048XM**	4FD	804	0,46	1,3	1 447	0,7
	360	76	57	76	4	3	1	78	**T-32048XMP5**	4FD	804	0,46	1,3	1 447	0,7
	360	76	57	76	4	3	1	78	**T-32048XMP6**	4FD	804	0,46	1,3	1 447	0,7
	440	120	100	127	5	4	1,5	105	**T-32248**		1 750	0,43	1,4	2 869	0,8
260	400	87	65	87	5	4	1,5	84	**32052XA**	4FC	1 153	0,43	1,4	2 141	0,8
280	420	87	65	87	5	4	1,5	89	**32056XA**	4FC	1 150	0,46	1,3	2 250	0,7

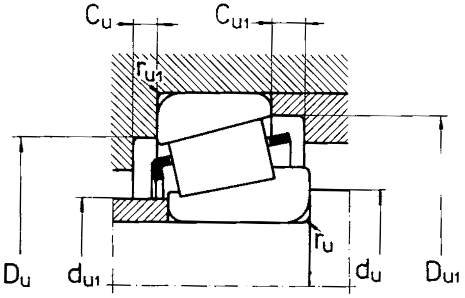


Speed limit		Weight	Mounting dimensions								
grease	oil		d_{u1} max.	d_u min.	D_u min.	max.	D_{u1} min.	C_u min.	C_{u1} min.	r_u max.	r_{u1} max.
min^{-1}		kg	mm								
1 300	1 800	19,5	164	148	239	262	255	8	14,5	5	4
1 200	1 700	18,6	157	148	218	262	261	9	28	5	4
1 100	1 600	27,6	160	148	230	262	260	10	20,5	5	4
1 600	2 200	5,23	153	150	187	200	202	8	11	2,5	2
1 400	1 900	8,50	163	154	219	236	234	9	9,5	4	3
1 400	1 900	13,9	159	154	210	236	238	8	13,5	4	3
1 200	1 700	23,9	169	158	235	282	280	9	30	5	4
1 500	2 000	6,35	164	162	200	213	216	8	12	3	2,5
1 300	1 800	10,7	175	164	234	256	250	9	11	4	3
1 200	1 700	17,9	171	164	226	256	254	8	17	4	3
1 300	1 800	7,75	175	172	213	228	231	8	13	3	2,5
1 100	1 600	13,6	189	174	252	276	269	9	12	4	3
1 100	1 600	25,5	183	174	242	276	274	10	17	4	3
1 400	1 900	4,50	183	180	213	220	222	7	8	2,5	2
1 200	1 700	10,5	187	182	230	248	249	10	14	3	2,5
1 000	1 500	19,0	203	188	269	292	288	8	14	5	4
1 000	1 500	29,3	196	188	259	292	294	10	20	5	4
1 200	1 700	6,65	193	190	225	240	241	8	11	2,5	2
1 100	1 600	14,5	199	192	247	268	267	10	16	3	2,5
1 000	1 500	20,0	211	198	278	302	297	9	14	5	4
950	1 400	27,4	204	198	267	302	303	10	20	5	4
1 100	1 600	7,00	204	200	235	249	251	8	11	2,5	2
1 000	1 500	15,0	209	202	257	278	279	10	16	3	2,5
900	1 300	39,5	216	207	286	322	323	10	22	5	4
1 000	1 500	9,50	216	212	257	268	271	9	12	3	2,5
950	1 400	19,5	221	212	273	298	297	11	17	3	2,5
950	1 400	19,5	221	212	273	298	297	11	17	3	2,5
950	1 400	19,5	221	212	273	298	297	11	17	3	2,5
900	1 300	33,0	226	217	302	342	340	11	22	5	4
950	1 400	11,2	234	232	275	288	290	9	12	3	2,5
900	1 300	25,5	243	234	300	326	326	12	19	4	3
900	1 300	25,5	243	234	300	326	326	12	19	4	3
900	1 300	25,5	243	234	300	326	326	12	19	4	3
850	1 200	27,5	261	254	318	346	346	12	19	4	3
850	1 200	26,5	261	254	318	346	346	12	19	4	3
850	1 200	26,5	261	254	318	346	346	12	19	4	3
850	1 200	26,5	261	254	318	346	346	12	19	4	3
750	1 000	81,0	276	258	365	422	415	14	27	5	4
800	1 100	40,0	287	278	352	382	383	14	22	5	4
750	1 000	40,5	305	298	370	402	402	14	22	5	4

Single-row tapered roller bearings (Metric Series)

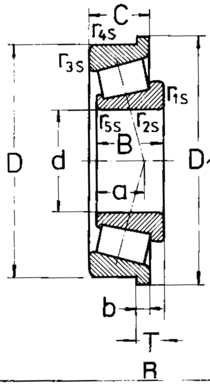


Dimensions									Designation	ISO series	Basic radial load. Factors				
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	r_5 min.	a			dyn. C_r	e	Y	stat. C_{0r}	Y_0
mm									—		kN	—		kN	—
300	420	76	57	76	4	3	1	65	**T-32960M**	3FD	1 006	0,29	2,1	1 973	1,1
	420	76	57	76	4	3	1	65	**T-32960MP5**	3FD	1 006	0,29	2,1	1 973	1,1
	540	85	71	96	6	5	1,5	103	**T-30260**	4GB	1 350	0,43	1,4	1 900	0,8
320	480	100	74	100	5	4	1,5	103	**T-32064X**	4GD	1 535	0,46	1,3	2 935	0,7
360	480	76	57	76	4	3	1	77	**T-32972**	4FD	1 130	0,31	1,9	2 411	1,1
	480	76	57	76	4	3	1	77	**T-32972P5**	4FD	1 130	0,31	1,9	2 411	1,1

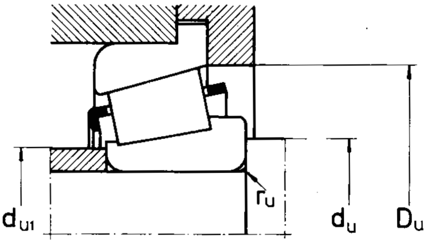


Speed limit		**Weight**	**Mounting dimensions**								
grease	oil		d_{u1} max.	d_u min.	D_u min.	max.	D_{u1} min.	C_u min.	C_{u1} min.	r_u max.	r_{u1} max.
min^{-1}		kg	mm								
700	950	31,5	324	314	383	406	405	12	19	4	3
700	950	31,5	324	314	383	406	405	12	19	4	3
600	800	86,0	352	321	468	519	500	12	25	6	5
630	85	63,0	350	338	424	462	461	15	26	5	4
600	800	40,5	380	374	439	466	466	14	19	4	3
600	800	40,5	380	374	439	466	466	14	19	4	3

Single-row tapered roller bearings with flanged outer ring (Metric Series)

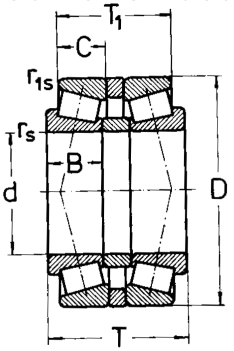


Dimensions										Designation	ISO series
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	D_1	b	a		
mm										—	
20	47	14	12	6,25	1	1	51	3	11	30204AR	2DB
25	52	15	13	6,25	1	1	57	3,5	12	30205AR	3CC
30	62	16	14	6,75	1	1	67	3,5	14	30206AR	3DB
	62	20	17	8,25	1	1	67	4	15	32206AR	3DC
	72	19	16	8,75	1,5	1,5	77	4	15	30306AR	2FB
	72	27	23	11,75	1,5	1,5	77	6	18	32306AR	2FD
35	72	17	15	7,25	1,5	1,5	77	4	15	30207AR	3DB
	72	23	19	10,25	1,5	1,5	77	4,5	17	32207AR	3DC
	80	21	18	8,25	2	1,5	85	4,5	16	30307AR	2FB
	80	31	25	13,75	2	1,5	85	6	20	32307AR	2FE
40	80	18	16	7,75	1,5	1,5	85	4	16	30208AR	3DB
	80	23	19	10,25	1,5	1,5	85	4,5	19	32208AR	3DC
	90	23	20	9,75	2	1,5	95	4,5	19	30308AR	2FB
	90	33	27	14,25	2	1,5	95	6	23	32308AR	2FD
45	85	19	16	8,75	1,5	1,5	90	4	18	30209AR	3DB
	85	23	19	10,25	1,5	1,5	90	4,5	20	32209AR	3DC
	100	25	22	10,25	2	1,5	106	5	21	30309AR	2FB
	100	36	30	15,25	2	1,5	106	7	25	32309AR	2FD
50	90	20	17	8,75	1,5	1,5	95	4	19	30210AR	3DB
	90	23	19	10,25	1,5	1,5	95	4,5	21	32210AR	3DC
	110	27	23	11,25	2,5	2	116	5	23	30310AR	2FB
	110	40	33	17,25	2,5	2	116	8	27	32310AR	2FD
55	100	21	18	9,25	2	1,5	106	4,5	20	30211AR	3DB
	100	25	21	10,75	2	1,5	106	5	22	32211AR	3DC
	120	43	35	18,5	2,5	2	127	8	29	32311AR	2FD
60	110	22	19	9,25	2	1,5	116	4,5	22	30212AR	2EB
	110	28	24	10,75	2	1,5	116	5	24	32212AR	2EC
	130	46	37	19,5	3	2,5	137	8	31	32312AR	2FD
65	120	23	20	9,25	2	1,5	127	4,5	23	30213AR	3EB
	120	31	27	11,75	2	1,5	127	6	27	32213AR	3EC
70	125	24	21	10,25	2	1,5	132	5	25	30214AR	3EB
	125	31	27	12,25	2	1,5	132	6	28	32214AR	3EC

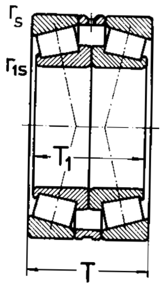


Basic radial load. Factors					Speed limit		Weight	Mounting dimensions			
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		d_{u1} max.	d_u min.	D_u min.	r_u max.
kN	—		kN	—	min^{-1}		kg	mm			
26	0,35	1,7	29	0,9	8 000	11 000	0,127	27	26	43	1
29,5	0,37	1,6	36	0,9	7 500	10 000	0,161	31	31	48	1
38	0,37	1,6	48	0,9	6 300	8 500	0,233	37	36	57	1
47,5	0,37	1,6	65	0,9	6 300	8 500	0,290	37	36	59	1
53	0,31	1,9	65	1,1	5 600	7 500	0,398	39	37	66	1,5
72,3	0,31	1,9	97	1,1	5 300	7 000	0,577	40	37	66	1,5
49,4	0,37	1,6	58	0,9	5 300	7 000	0,338	44	42	67	1,5
61,6	0,37	1,6	80	0,9	5 300	7 000	0,422	43	42	67	1,5
68,2	0,31	1,9	83	1,1	5 000	6 700	0,543	45	44	74	2
88,2	0,31	1,9	120	1,1	4 800	6 300	0,760	44	44	74	2
58,5	0,37	1,6	70	0,9	4 800	6 300	0,440	49	47	74	1,5
71	0,37	1,6	95	0,9	4 800	6 300	0,533	48	47	75	1,5
81	0,35	1,7	105	0,9	4 500	6 000	0,725	52	49	82	2
110	0,35	1,7	156	0,9	4 000	5 300	1,027	50	49	82	2
63	0,4	1,5	83	0,8	4 500	6 000	0,491	54	52	80	1,5
75	0,4	1,5	103	0,8	4 500	6 000	0,584	53	52	80	1,5
101	0,35	1,7	130	0,9	4 000	5 300	0,958	59	54	92	2
132	0,35	1,7	188	0,9	3 600	4 800	1,30	56	54	93	2
70,5	0,43	1,4	95	0,8	4 300	5 600	0,552	58	57	85	1,5
76,5	0,43	1,4	106	0,8	4 300	5 600	0,625	58	57	85	1,5
120	0,35	1,7	156	0,9	3 600	4 800	1,23	65	60	102	2,5
165	0,35	1,7	239	0,9	3 200	4 300	1,89	62	60	102	2,5
84,5	0,4	1,5	112	0,8	3 800	5 000	0,724	64	64	94	1,5
99	0,4	1,5	138	0,8	3 800	5 000	0,858	63	64	95	1,5
187	0,35	1,7	276	0,9	3 000	4 000	2,29	68	65	111	2
91,5	0,4	1,5	122	0,8	3 400	4 500	0,897	70	69	103	2
120	0,4	1,5	170	0,8	3 400	4 500	1,14	69	69	104	2
216	0,35	1,7	318	0,9	2 600	3 600	1,92	74	72	120	3
110	0,4	1,5	147	0,8	3 000	4 000	1,14	77	74	113	2
142	0,4	1,5	206	0,8	3 000	4 000	1,54	76	74	115	2
120	0,43	1,4	163	0,8	3 000	4 000	1,27	81	79	118	2
150	0,43	1,4	220	0,8	2 800	3 800	1,62	80	79	119	2

Single-row tapered roller bearings (Paired mounting)

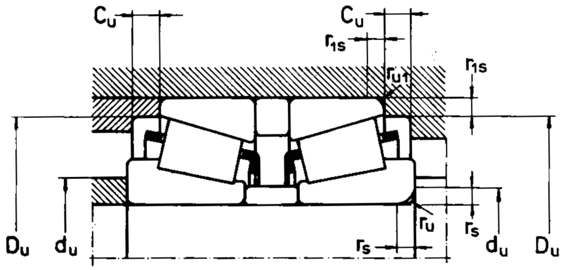


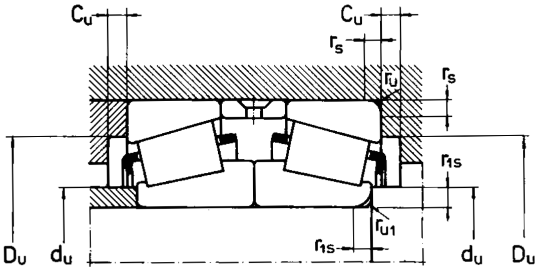
DB



DF

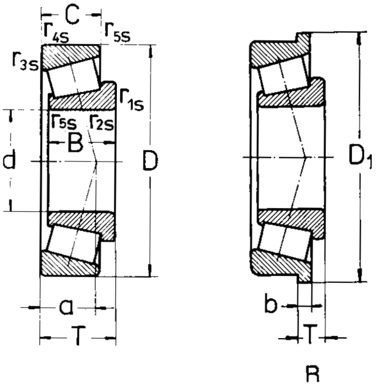
Dimensions								Designation	Speed limit		Weight
d	D	B	C	T	T_1	r_s min.	r_{1s} min.		grease	oil	
mm								—	min^{-1}		kg
45	85	21	19	57,5	46	1,5	0,6	**32209AP2F2DBT57,5**	3 600	4 800	1,28
	85	23	19	55	43,5	1,5	0,6	**32209AP4DBT55**	3 600	4 800	1,26
55	100	22,52	21	69,5	57,66	2	0,6	**32211AP2F2DBT69,5**	3 000	4 000	2,06
	100	25	21	69,5	58	2	0,6	**32211AUPDBT69,5**	3 000	4 000	1,15
70	110	25	19	58	46	1,5	0,5	**32014XADBT58**	2 600	3 400	1,87
80	125	29	22	70	56	1,5	0,6	**32016XADBT70**	2 000	2 800	3,08
90	140	32	24	75	59	2	0,6	**32018XADBT75**	1 800	2 600	3,95
100	180	46	39	140	120	3	0,8	**32220AS1DBT140**	1 400	2 000	12,6
110	200	52,5	46	112	105	0,6	2,5	**32222ADFT112**	1 400	1 900	7,77
	240	50	42	109	100	1	3	**30322ADFT109**	1 300	1 800	12,6
120	215	58	50	123	116	0,6	2	**32224ADFTT123**	1 300	1 800	18,7
	260	55	46	119	110	1	3	**30324ADFT119**	1 200	1 600	29,8
	260	86	69	181	172	1	3	**32324ADFT181**	1 000	1 400	46,2
130	200	45	34	90	90	0,6	2	**32026XAP5S0DFT90**	1 300	1 800	10,6
	230	64	54	135,5	128	1	3	**32226ADFT135,5**	1 200	1 600	23,1
	280	66	45	144	132	2	4	**31326ADFT144**	950	1 400	40,5
140	250	68	58	163,5	136	3	1	**32228ADBT164**	1 100	1 500	30,9
170	310	86	71	202	162	5	1,5	**32234AMDBT202**	800	1 200	64,1
	310	86	71	202	162	5	1,5	**32234AMP5DBT202**	800	1 200	64,1





Basic radial load. Factors						Mounting dimensions					
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	d_u min./max.	D_u min.	max.	C_u min.	r_u max.	r_{u1} max.
kN	—			kN	—	mm					
125	0,4	1,7	2,5	185	1,6	52	80		5,5	1,5	0,6
125	0,4	1,7	2,5	185	1,6	52	80		5,5	1,5	0,6
155	0,4	1,7	2,5	230	1,6	64	95		5,5	1,5	0,6
155	0,4	1,7	2,5	230	1,6	64	95		5,5	1,5	0,6
155	0,43	1,6	2,3	285	1,6	77	105		6	1,5	0,6
210	0,43	1,6	2,3	395	1,6	87	120		7	1,5	0,6
260	0,43	1,6	2,3	490	1,6	99	134		8	2	0,6
520	0,43	1,6	2,3	890	1,6	112	171		10	3	1
660	0,43	1,6	2,3	1 160	1,6	126	170	188	6	2,5	1
780	0,35	1,9	2,8	1 180	1,8	141	206	226	8	3	1
720	0,43	1,6	2,3	1 310	1,6	136	181	203	7	2,5	1
920	0,35	1,9	2,8	1 420	1,8	152	221	246	10	3	1
1 290	0,35	1,9	2,8	2 210	1,8	148	213	246	9	3	1
510	0,43	1,6	2,3	1 050	1,6	144	178	190	8	2	0,6
890	0,43	1,6	2,3	1 670	1,6	146	193	216	7	3	1
970	0,83	0,8	1,2	1 520	0,8	157	218	262	9	4	1,5
980	0,43	1,6	2,3	1 810	1,6	154	238		13,5	4	1
1 440	0,43	1,6	2,3	2 750	1,6	188	294		20	5	1,5
1 440	0,43	1,6	2,3	2 750	1,6	188	294		20	5	1,5

Non-standard single-row tapered roller bearings



Dimensions										Designation
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	D_1	b	a	
mm										—
20	42	12	11	13,25	1	1			10	**34104**
21	62	17	13	18,25	1,5	1,5			21	**313/21**
25	52	15	13	16,25	3,3	1			12	**34005**
37	72	17	15	18,25	1,5	1,5			1,5	**302/37A**
41	68	18,1	13,55	17,6	3,6	1,5			16,4	**34108**
42	100	36	30	15,5	1,5	1,5	106	7	25	**323/42R**
46	75	18,1	14,05	18	2,25	1,6			15	**34409**
50	120	32	23,5	37	2,5	2			32	**34110**
65	110 120	30 31	24 27	30,25 32,75	2 2	2 0,3			23,7 28	**34513** **34913**
70	120	42	37	44,75	2	2			30,5	**34014**
75	135	46	35	44,25	2	2			32,9	**34015**
115	190	49	35	48,75	2	2			42,7	**34023**
140	230	57	45	22,75	3	3	238	10	39,2	**34128R**
260	540	102	80	110	6	6			79	**34052F**
280	420	82	71	87,7	4	4			80	**T-34156**
420	620	90	70	95	5	5			110	**T-34084**
460	620 620 620	74 74 74	58 58 58	80 80 80	4 4 4	4 4 4			105 105 105	**T-34092** **T-34092P5** **T-34092MP5**
710	950	106	80	114	6	6			167	**T-340/710**

Basic radial load. Factors					Speed limit		Weight	Equivalence
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		Designation
kN	—		kN	—	min^{-1}		kg	—
18,3	0,35	1,7	19	0,9	8 000	11 000	0,125	
33,5	0,83	0,7	30,2	0,4	6 000	8 500	0,276	
30,1	0,37	1,6	32,9	0,9	6 300	9 000	0,144	10R30205A
49,4	0,37	1,6	58	0,9	4 500	6 300	0,320	
48,8	0,35	1,7	67,8	0,9	4 500	6 300	0,244	
121	0,35	1,7	170	1	3400	5 000	1,45	
52,5	0,4	1,5	73,7	0,8	4 000	5 600	0,296	
152	0,8	0,8	160	0,8	2 800	4 000	1,87	
106	0,4	1,5	154	0,8	2 800	4 000	0,960	807813
149	0,4	1,5	189	0,8	2 600	3 800	1,65	
156	0,39	1,5	232	0,8	2 600	3 600	1,98	
183	0,44	1,4	278	0,7	2 400	3 400	2,68	7815
300	0,5	1,2	450	0,7	1 600	2 200	5,07	7723
419	0,4	1,5	678	0,8	1 300	1 900	9,20	67728K
1 740	0,25	2,4	2 370	1,3	600	900	11,0	7352
1 200	0,35	1,7	2 173	0,9	700	1 000	48,0	2007156
1 863	0,4	1,5	3 455	0,8	480	670	96,5	7184
1 370	0,4	1,5	2 850	0,8	450	630	62,5	1007992
1 370	0,4	1,5	2 850	0,8	450	630	62,5	
1 370	0,4	1,5	2 850	0,8	450	630	62,5	
2 865	0,43	1,4	6 123	0,8	300	430	204	10079/710

Non-standard single-row tapered roller bearings

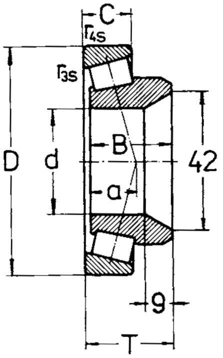


Fig.1

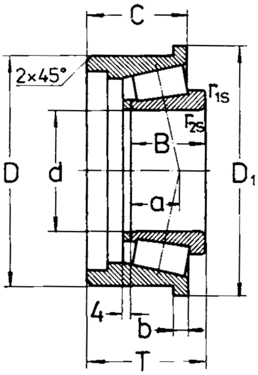


Fig.2

Dimensions										Designation
d	D	B	C	T	r_{1s}, r_{2s} min.	r_{3s}, r_{4s} min.	D_1	b	a	
mm										—
32	72	28,5	15	30		1			21	**34305**
75	150	51	67	22,5	3		165	10	61	**34215R**

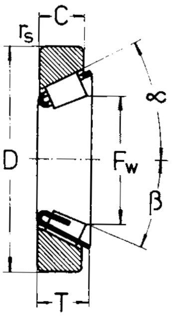


Fig.3

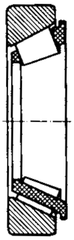


Fig.4

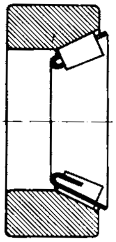


Fig.5

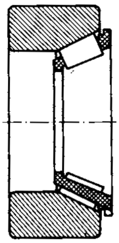
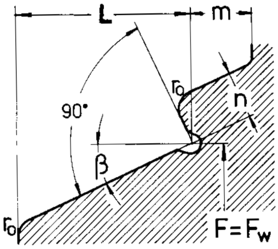


Fig.6

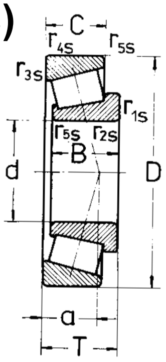
Dimensions						Designation	Basic radial load. Factors				
F_w	D	C	T	r_s min.	α		dyn. C_r	e	Y	stat. C_{0r}	Y_0
mm					degrees	—	kN	—		kN	—
28,313	44,475	9,525	10,063	1,6	17°43'	**R34006**	18,6	0,48	1,3	18	0,7
	49,171	19,05	19,468	2,8	17 43'	**R34106**	18,6	0,48	1,3	18	0,7
33,02	49,25	11	12,4	1	20	**R34007**	21,32	0,55	1,1	22,4	0,6
46,673	72	17,2	14	1,5	27	**R34309**	40,7	0,76	0,8	40,8	0,4
	72	17,2	14	1,5	27	**R34309TN**	40,7	0,76	0,8	40,8	0,4
56,469	79,39	13,2	14,605	1	26	**R34111**	35,8	0,73	0,8	44,7	0,5
	79,39	13,2	14,605	1	26	**R34111TN**	35,8	0,73	0,8	44,7	0,5
	87,325	25,7	27,2	1	26	**R34211**	35,8	0,73	0,8	44,7	0,5
	87,325	25,7	27,2	1	26	**R34211TN**	35,8	0,73	0,8	44,7	0,5

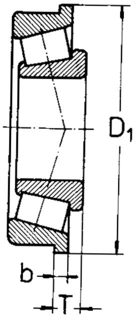
Basic radial load. Factors					**Speed limit**		**Weight**	**Fig.**
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		
kN	—		kN	—	min^{-1}		kg	—
50,5	0,37	1,6	54,7	0,9	5 000	6 700	0,45	1
297	0,35	1,7	381	1	2 200	3 200	5,13	2

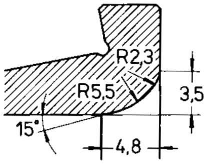


Speed limit		**Weight**	**Fig.**	**Mounting dimensions**				
grease	oil			L	n	m	β	r_0
min^{-1}	mm	kg	—	mm			degrees	mm
7 500	11 000	0,196	3	7,854	1,727	3,43	12°42'	0,5
7 000	10 000	0,284	5	7,854	1,727	3,43	12°42'	0,5
6 700	9 500	0,086	3	8,1	1,7	3	14°59'	1,5
4 800	7 000	0,055	3	13	3,2	5	19	2
4 800	7 000	0,042	4	13	3,2	5	19	2
4 000	6 000	0,248	3	11,1	2,8	3,5	20°48'	1,5
4 000	6 000	0,233	4	11,1	2,8	3,5	20°48'	1,5
3 800	5 600	0,648	5	11,1	2,8	3,5	20°48'	1,5
3 800	5 600	0,625	6	11,1	2,8	3,5	20°48'	1,5

Non-standard single-row tapered roller bearings (Inch Series)





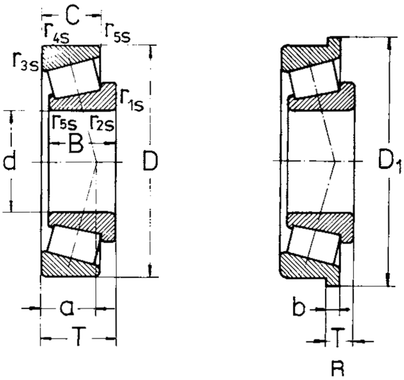


Dimensions										Designation
d	D	B	C	T	r1s,r2s min.	r3s,r4s min.	D1	b	a	
mm										—
11,112	34,988	10,988	8,73	10,998	1,3	1,3			9	34101
12,7	34,988	10,988	8,73	10,998	1,3	1,3			9	34001
14,989	34,988	10,988	8,73	10,998	0,8	1,3			9	34002
17,462	39,878	14,605	10,668	13,843	1,3	1,3			9	34103
19,05	45,237	16,637	12,065	15,494	1,3	1,3			10	34004
	45,237	16,637	12,065	15,494	1,3	1,3			10	T-34004
	49,225	19,05	14,288	18,034	1,3	1,3			11	34404
21,43	50,005	18,288	13,97	17,526	1,3	1,3			11	34204
	50,005	18,288	13,97	17,526	1,3	1,3			11	T-34204
21,986	45,237	16,637	12,065	15,494	1,3	1,3			10	34304
	45,237	16,637	12,065	15,494	1,3	1,3			10	T-34304
	45,974	16,637	12,065	15,494	1,3	1,3			10	34504
25	51,994	14,26	12,7	15,011	1,5	1,3			12	34405
25,4	50,005	14,26	9,525	13,495	1	1			11	34305
	50,292	14,732	10,668	14,224	1,3	1,3			11	34105
	50,292	14,732	10,668	14,224	1,3	1,3			11	T-34105
26,988	50,292	14,732	10,668	14,224	3,5	1,3			11	34205
	50,292	14,732	10,668	14,224	3,5	1,3			11	T-34205
29	50,292	14,732	10,688	14,224	3,5	1,3			11	34406
31,75	59,131	16,764	11,811	15,875	*	1,3			13	34206
	59,131	16,764	11,811	15,875	*	1,3			13	T-34206
	62	19,05	14,288	18,161	3,5	1,3			13	T-34606
34,925	65,088	18,288	13,97	18,034	*	1,3			14	34107
	65,088	18,288	13,97	18,034	*	1,3			14	T-34107
	72,233	25,4	19,842	25,4	2,3	2,3			21	34207
	76,2	28,575	23,02	29,37	3,5	3,3			23	34407
34,988	59,131	16,764	11,938	15,875	*	1,3			13	34307
	59,131	16,764	11,938	15,875	*	1,3			13	T-34307
	59,974	16,764	11,938	15,875	*	1,3			13	34507
	59,974	16,764	11,938	15,875	*	1,3			13	T-34507
38	63	17	13,5	17	*	1,3			14	34408
	63	17	13,5	17	*	1,3			14	T-34408
38,1	65,088	18,288	13,97	18,04	2,3	1,3			13	34008
	79,375	29,771	23,812	29,37	3,5	3,3			20	34208

* Special mounting chamfer.

Basic radial load. Factors					Speed limit		Weight	Equivalence
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		TIMKEN designation
kN	—		kN	—	min^{-1}		kg	—
12,0	0,45	1,3	11,85	0,7	11 000	15 000	0,055	A4044/A4138
12,0	0,45	1,3	11,85	0,7	10 000	15 000	0,058	A4050/4138
12,0	0,45	1,3	11,85	0,7	10 000	14 000	0,063	A4059/4138
19,8	0,29	2,1	21,1	1,2	8 500	12 000	0,081	LM11749/LM11710
25,5	0,30	2,0	25,104	1,1	7 500	11 000	0,123	LM11949/LM11910
25,5	0,30	2,0	25,104	1,1	7 500	11 000	0,123	LM11949/LM11910
31,1	0,27	2,3	33,1	1,2	7 000	10 000	0,160	09067/09195
34,1	0,28	2,2	38	1,2	7 000	10 000	0,160	M12649/M12610
34,9	0,28	2,2	35,265	1,2	7 000	10 000	0,180	M12649/M12610
25,2	0,31	2,0	27,7	1,1	7 500	10 000	0,122	LM12749/LM12710
25,2	0,31	2,0	27,70	1,1	7 500	10 000	0,122	LM12749/LM12710
25,2	0,31	2,0	27,7	1,1	7 000	10 000	0,123	LM12749/LM12711
23,7	0,4	1,5	27,5	0,8	6 300	9 000	0,140	07097/07204
23,7	0,4	1,5	27,5	0,8	6 300	9 500	0,115	07100/07196
23,4	0,37	1,6	25,913	0,9	6 300	9 000	0,125	L44643/L44610
23,4	0,37	1,6	25,913	0,9	6 300	9 000	0,125	L44643/L44610
23,4	0,37	1,6	25,913	0,9	6 300	9 000	0,115	L44649/L44610
23,4	0,37	1,6	25,913	0,9	6 300	9 000	0,115	L44649/L44610
24,1	0,37	1,6	32,2	0,9	6 300	9 000	0,115	L45449/L45410
31,1	0,41	1,5	35,912	0,8	5 300	7 500	0,180	LM67048/LM67010
31,1	0,41	1,5	35,912	0,8	5 300	7 500	0,180	LM67048/LM67010
43,9	0,35	1,7	49,708	0,9	5 300	7 500	0,228	15123/15245
42,9	0,38	1,6	50,696	0,9	4 800	7 000	0,248	LM48548/LM48510
42,9	0,38	1,6	50,696	0,9	4 800	7 000	0,248	LM48548/LM48510
66,5	0,55	1,1	86,61	0,6	4 500	6 700	0,487	HM88649/HM88610
72,5	0,55	1,1	97,9	0,6	4 500	6 300	0,570	HM89446/HM89410
30,1	0,42	1,4	38,841	0,8	5 300	7 500	0,170	L68149/L68110
30,1	0,42	1,4	38,841	0,8	5 300	7 500	0,170	L68149/L68110
30,1	0,42	1,4	38,841	0,8	5 300	7 500	0,180	L68149/L68111
30,1	0,42	1,4	38,841	0,8	5 300	7 500	0,180	L68149/L68111
32,9	0,42	1,4	43,8	0,8	4 800	7 000	0,221	JL69349/JL69310
32,9	0,42	1,4	43,785	0,8	4 800	7 000	0,221	JL69349/JL69310
38,4	0,33	1,8	48,72	1,0	4 800	6 700	0,227	LM29749/LM29710
79,3	0,36	1,6	103	0,9	4 300	6 000	0,550	3490/3420

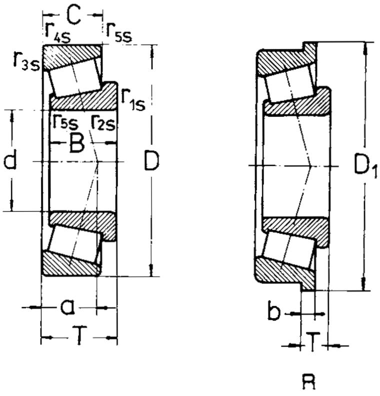
Non-standard single-row tapered roller bearings (Inch Series)



Dimensions										Designation
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	D_1	b	a	
mm										—
39,688	73,025	22,098	21,336	25,654	0,8	2,3			18	**34508**
41,275	73,431	19,812	14,732	19,559	3,5	0,8			16	**34608**
44,45	73,025	18,258	15,083	18,258	1,5	1,5			14	**34609**
	82,931	25,4	19,05	23,813	3,6	0,8			18	**T-34009**
	95,25	28,575	22,225	27,783	0,8	0,8			20	**34109**
45,242	73,431	19,812	15,748	19,558	3,5	0,8			15	**34209**
45,618	82,931	25,4	19,05	23,812	3,5	0,8			18	**37009**
	82,931	25,4	22,225	26,988	3,5	2,3			19	**34709**
46,038	85	25,608	20,638	25,4	0,8	1,3			19	**34509**
47,625	93,264	30,302	23,812	30,162	3,5	0,8			21	**34410**
	93,264	30,302	23,812	30,162	3,5	0,8			21	**T-34410**
50	90	22,225	15,875	8,887	2	0,8	94,661	4,762	16	**34010RP5**
50,8	82,55	22,225	16,51	21,59	3,5	1,3			16	**34710**
	92,075	25,4	19,845	24,608	3,5	0,8			20	**34809**
	95,25	28,575	22,225	27,783	3,5	0,8			20	**34210**
	97,63	24,608	19,446	9,124	3,5	0,8	101,549	3,962	21	**34510R**
	107,95	29,317	22,25	27,783	2,3	0,8			21	**34909**
53,975	123,825	32,791	25,4	17,462	3,5	3,3	130,073	6,35	37	**34011R**
57,15	104,775	29,317	24,605	30,162	2,3	3,3			23	**34511**
	110	29,317	27	27,795	3,5	2			24	**34311**
	110	29,317	27	27,795	3,5	2			24	**T-34311**
	112,712	30,162	23,812	30,162	8	3,3			23	**34411**
60,325	127	36,512	26,988	36,512	3,5	3,3			32	**T-34012**
63,485	95	15,5	12	17	1	1			28	**34112**
63,5	92,075	12,7	9,525	13,495	1,5	1,5			16	**34013**
	112,712	30,048	23,812	11,112	3,5	3,3	117,373	4,762	25	**34113R**
	112,712	30,048	23,812	30,162	3,5	3,3			25	**34113**
	112,712	30,048	23,812	30,162	3,5	0,8			25	**34213**
	112,712	30,048	23,812	30,162	3,5	3,3			25	**T-34113**
	112,712	30,048	23,812	30,162	3,5	0,8			25	**T-34213**
	112,712	30,162	23,812	30,162	3,5	3,3			23	**37113**
	120	29,007	23,444	29,007	3,5	3,3			26	**T-34313**
	122,238	38,43	29,77	38,305	3.5	2			27	**T-34413**
66,675	110	25,4	19,05	25,4	3,5	1,3			24	**34713**
	112,712	30,048	23,812	30,162	3,5	3,3			25	**34613**
	122,238	38.354	29,718	38,1	3,5	3,3			27	**34813**

Basic radial load. Factors					Speed limit		Weight	Equivalence
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		TIMKEN designation
kN	—		kN	—	min^{-1}		kg	—
57,5	0,33	1,8	72,0	1,0	4 300	6 300	0,460	M201047/201011
48,6	0,40	1,5	64,3	0,8	4 300	6 000	0,320	LM501349/LM501310
47,0	0,32	1,9	68,9	1,0	4 300	6 000	0,300	L102849/L102810
75,7	0,33	1,8	95,1	1,0	3 800	5 600	0,554	25580/25520
96,8	0,33	1,8	127,0	1,0	3 600	5 000	0,970	33885/33822
48,5	0,31	2,0	66,4	1,1	4 000	6 000	0,300	LM102949/LM102910
70	0,33	1,8	95,2	1,0	3 800	5 300	0,550	25590/25520
70	0,33	1,8	95,2	1,0	3 800	5 300	0,580	25590/25523
68,3	0,35	1,7	97	1,0	3 800	5 300	0,600	2984A/2924
98,0	0,34	1,8	128	1,0	3 400	5 000	0,905	3779/3730
98,0	0,34	1,8	128	1,0	3 400	5 000	0,905	3779/3730
74,3	0,32	1,9	87,26	1,0	3 400	5 000	0,554	365/362B cl.3
65,2	0,31	2,0	86,2	1,1	3 600	5 300	0,411	LM104949/LM104911
71	0,38	1,6	103	0,9	3 400	4 800	0,690	28580/28521
102	0,33	1,8	135	1,0	3 400	4 800	0,860	33889/33822
101	0,40	1,5	147	0,8	3 400	4 800	0,850	28678/28622B
97,8	0,34	1,8	134	1,0	3 000	4 500	1,10	462/453A
143	0,74	0,8	162	0,4	2 800	4 000	2,10	72212/72487B
97,8	0,34	1,8	134	1,0	3 000	4 300	1,10	462A/453X
109	0,34	1,8	139	1,0	3 000	4 300	1,22	462/454
109	0,34	1,8	139	1,0	3 000	4 300	1,22	462/454
130	0,34	1,8	196	1,0	2 800	4 000	1,03	39581/39520
161	0,50	1,2	226	0,7	2 600	3 800	2,16	HM813841/HM813810
42,3	0,78	0,8	56,6	0,4	3 000	4 500	0,400	L910349/L910310
31,2	0,40	1,5	46,0	0,8	3 200	4 500	0,250	LL510749/LL510710
116	0,40	1,5	174	0,8	2 800	4 000	1,26	3982/3920B
116	0,40	1,5	174	0,8	2 800	4 000	1,24	3982/3925
116	0,40	1,5	174	0,8	2 800	4 000	1,24	3982/3920
116	0,40	1,5	174	0,8	2 800	4 000	1,24	3982/3920
116	0,40	1,5	174	0,8	2 800	4 000	1,24	3982/3920
130	0,34	1,8	196	1,0	2 800	4 000	1,22	39585/39520
133	0,38	1,6	167	0,9	2 600	3 800	1,44	483/472A
189	0,34	1,8	248	1,0	2 600	3 800	2,03	X3962/X3963
92,0	0,44	1,4	138	0,7	2 800	4 000	0,900	29590/29521
113	0,40	1,5	172	0,8	2 800	4 000	1,20	3984/3920
189	0,34	1,8	248	1,0	2 600	3 800	1,92	HM212049/HM212011

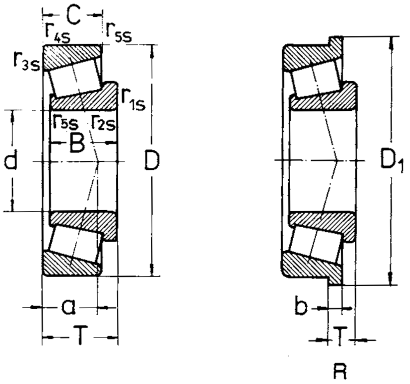
Non-standard single-row tapered roller bearings (Inch Series)



Dimensions										Designation
d	D	B	C	T	r_{1s}, r_{2s} min.	r_{3s}, r_{4s} min.	D_1	b	a	
mm										—
71,438	127	36,17	28,575	36,512	3,5	3,3			28	**34314P5**
	136,525	46,038	36,512	46,038	3,5	3,3			38	**34214**
	136,525	46,038	36,512	46,038	3,5	3,3			38	**T-34214**
73,025	127	36,17	28,575	36,512	3,5	3,3			28	**34414P5**
	146,05	41,275	31,75	41,275	3,5	3,3			34	**34315**
	146,05	41,275	31,75	41,275	3,5	3,3			34	**T-34315**
76,2	139,992	36,098	28,575	36,512	3,5	3,3			31	**34115**
	161,925	55,1	42,862	53,975	3,5	3,3			40	**34415**
	161,925	55,1	42,862	53,975	3,5	3,3			40	**T-34415**
77,788	120	23,012	16	23	3,5	2,3			24	**34316**
	120	23,012	16	23	3,5	2,3			24	**T-34316**
	127	25	22	27,25	2,5	2,5			28	**34016P5**
82,55	133,35	29,769	25,4	33,338	3,5	3,3			31	**34117AP4**
	139,992	36,098	28,575	36,512	3,5	3,3			31	**34616**
	146,05	41,275	31,75	41,275	3,5	3,3			34	**34516**
	161,925	48,26	38,1	47,625	3,5	3,3			35	**34216**
	161,925	48,26	38,1	47,625	3,5	3,3			35	**T-34216**
84,138	133,35	29,769	25,4	33,338	3,5	3,3			31	**34117BP4**
85,725	133,35	29,769	25,4	33,338	3,5	3,3			31	**34117P4**
	146,05	41,275	31,75	41,275	6,4	3,3			34	**34017P4**
88,9	152,4	39,688	30,163	39,688	6,4	3,3			34	**34018**
	190,5	57,531	46,038	57,15	8	3,3			41	**T-34318**
89,974	146,975	40	32,5	40	7	3,5			31	**34118**
92	140	30	22	30	3,5	1,5			32	**34418**
	140	30	22	30	3,5	1,5			32	**T-34418**
	152,4	39,688	30,162	39,688	6,4	3,3			34	**34518**
92,075	152,4	36,322	30,162	39,688	6,4	3,3			35	**34618**
	171,45	48,26	38,1	47,625	3,5	3,3			37	**34218**
	171,45	48,26	38,1	47,625	3,5	3,3			37	**T-34218**
95,25	148,43	28,971	21,433	28,575	3	3			33	**34119**
	148,43	28,971	21,433	28,575	3	3			33	**T-34119**
	152,4	36,322	30,162	15,875	3,5	3,3	158,648	6,35	35	**34019RP4**
96,838	149,225	28,971	24,608	12,7	3,5	3,3	154,681	5,558	34	**34319RP5**
100,012	157,162	36,116	26,195	36,512	3,5	3,3			36	**34120P4**
101,6	180,975	48,006	38,1	17,462	3,5	3,3	188,798	7,938	40	**34020RP4**
	212,725	66,675	53,975	66,675	7	3,3			48	**34220**
	212,725	66,675	53,975	66,675	7	3,3			48	**T-34220**

Basic radial load. Factors					Speed limit		Weight	Equivalence
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		TIMKEN designation
kN	—		kN	—	min^{-1}		kg	—
161	0,36	1,7	226	0,9	2 400	3 600	1,64	567A/563 cl.3
219	0,48	1,2	296	0,7	2 400	3 400	2,91	H715345/H715311
219	0,48	1,2	296	0,7	2 400	3 400	2,91	H715345/H715311
161	0,36	1,7	226	0,9	2 400	3 400	2,68	567/563 cl.3
213	0,41	1,5	307	0,8	2 200	3 200	3,31	657/653
213	0,41	1,5	307	0,8	2 200	3 200	3,31	657/653
184	0,40	1,5	239	0,8	2 200	3 200	2,35	575/572
327	0,40	1,5	448	0,8	2 000	3 000	5,37	6576/6535
327	0,40	1,5	448	0,8	2 000	3 000	5,37	6576/6535
84,91	0,45	1,3	117	0,7	2 400	3 600	0,836	34306/34472X
84,91	0,45	1,3	117	0,7	2 400	3 600	0,836	34306/34472X
142	0,44	1,4	180	0,8	2 400	3 400	1,22	
135	0,45	1,3	203	0,7	2 200	3 200	1,43	
168	0,40	1,5	247	0,8	2 200	3 200	2,13	580/572
201	0,41	1,5	286	0,8	2 200	3 000	2,73	663/653
272	0,34	1,8	358	1,0	2 000	2 800	4,70	757/752
272	0,34	1,8	358	1,0	2 000	2 800	4,70	757/752
135	0,45	1,3	203	0,7	2 200	3 200	1,38	
135	0,45	1,3	203	0,7	2 200	3 200	1,34	497/492W cl.0
213	0,41	1,5	307	0,8	2 200	3 000	2,60	665A/653 cl.0
235	0,40	1,5	338	0,8	2 000	3 000	2,80	HM518445/HM518410
395	0,34	1,8	526	1,0	1 800	2 600	8,85	HM221434/HM221410
220	0,33	1,8	386	1,0	2 000	3 000	2,59	HM218248/HM218210
140	0,48	1,3	213	0,7	2 200	3 000	1,52	LM718947/XC18140D
140	0,48	1,3	213	0,7	2 200	3 000	1,52	LM718947/XC18140D
235	0,40	1,5	338	0,8	2 000	2 800	2,80	
174	0,44	1,4	268	0,7	2 000	2 800	2,59	598A/592A
305	0,37	1,6	416	0,9	1 900	2 600	4,79	77362/77675
305	0,37	1,6	416	0,9	1 900	2 600	4,79	77362/77675
136	0,49	1,2	416	0,7	2 000	2 800	1,72	42375/42584
136	0,49	1,2	416	0,7	2 000	2 800	1,72	42375/42584
204	0,44	1,4	313	0,7	2 000	2 800	2,64	594/592B cl.0
136	0,49	1,2	210	0,7	2 000	2 800	1,74	42381/42587B cl.3
142	0,47	1,3	195	0,7	1 900	2 800	2,47	52393/52618 cl.0
321	0,39	1,6	462	0,9	1 700	2 400	5,50	780/772B cl.0
557	0,33	1,8	783	1,0	1 600	2 200	11,1	HH224335/HH224310
557	0,33	1,8	783	1,0	1 600	2 200	11,1	HH224335/HH224310

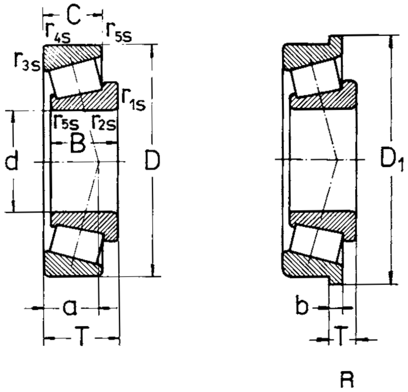
Non-standard single-row tapered roller bearings (Inch Series)



Dimensions										Designation
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	D_1	b	a	
mm										—
120,65	174,625	36,512	27,783	35,72	3,5	1,5			32	34124
	174,625	36,512	27,783	35,72	3,5	1,5			32	T-34124
	206,375	47,625	34,925	47,625	3,5	3,5			45	34024
127	215,9	47,625	34,925	47,625	3,5	3,3			49	34025
130	234,95	63,5	49,213	63,5	6	3,3			50	34026
133,35	215,9	47,625	34,925	20,638	3,5	3,3	223,733	7,938	49	34027RP4
136,525	215,9	47,625	34,925	20,638	3,5	3,3	223,733	7,938	49	34127RP4
139,7	215,9	47,625	34,925	20,638	3,5	3,3	223,733	7,938	49	34028R
	215,9	47,625	34,925	20,638	3,5	3,3	223,733	7,938	49	34028RP4
	215,9	47,625	34,925	47,625	3,5	3,3			49	34028
	215,9	47,625	34,925	47,625	3,5	3,3			49	34028P4
158,75	225,425	39,688	33,338	13,495	3,5	3,3	230,881	5,558	43	34132RP4
	225,425	39,688	33,338	41,275	3,5	3,3			43	34132P4
180	250	45	37	47	3	3			55	34036
196,85	254	27,783	21,433	28,575	1,5	1,5			41	34039
203,2	261,142	27,783	21,433	28,575	1,5	1,5			44	34040P4
209,55	282,575	46,038	36,512	46,038	3,5	3,3			62	34142
	317,5	63,5	46,038	63,5	4,3	3,3			62	T-34042MP5
234,95	327,025	52,388	36,512	52,388	6,4	3,3			59	34047
	327,025	52,388	36,512	52,388	6,4	3,3			59	34047P5
241,3	327,025	52,388	36,512	25,4	6,4	3,3	336,448	9,525	59	34048R
	327,025	52,388	36,512	25,4	6,4	3,3	336,448	9,525	59	34048RP5
265	352,425	34,925	23,813	36,513	3,5	3,3			71	T-34053MP5
273,05	406,4	69,85	46,037	69,85	6,4	6,4			72	T-34055P5
285,75	380,898	65,088	49,212	65,088	3,5	3,3			75	T-34157MP5
292,1	374,65	47,625	34,925	47,625	3,5	3,3			64	T-34059MP5
330,2	415,925	47,625	34,925	47,625	3,5	3,3			82	T-34166MP5
	482,6	80,167	60,325	85,725	6	2,5			86	T-34066
	482,6	80,167	60,325	85,725	6	2,5			86	T-34066P5
355,6	469,9	55,562	38,1	60,325	7	6,4			91	T-34071MP5
381	479,425	47,625	34,925	49,212	6,4	3,3			91	T-34076MP5
406,4	508	61,912	47,625	61,912	3,3	3,3			81	T-34181M

Basic radial load. Factors					Speed limit		Weight	Equivalence
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		TIMKEN designation
kN	—		kN	—	min^{-1}		kg	—
220	0,33	1,8	375	1,0	1 700	2 400	2,70	M224749/M224710
220	0,33	1,8	375	1,0	1 700	2 400	2,70	M224749/M224710
317	0,46	1,3	525	0,7	1 500	2 200	6,10	795/792
308	0,49	1,2	523	0,7	1 400	2 000	6,97	74500/74850
507	0,36	1,6	784	0,9	1 300	1 900	11,3	95512/95925
313	0,49	1,2	528	0,7	1 400	2 000	6,78	74525/74850B cl.0
313	0,49	1,2	528	0,7	1 400	2 000	6,53	74537/74850B cl.0
310	0,49	1,2	531	0,7	1 400	2 000	6,17	74550/74850B
310	0,49	1,2	531	0,7	1 400	2 000	6,17	74550/74850B cl.0
310	0,49	1,2	531	0,7	1 400	2 000	6,08	74550/74850
310	0,49	1,2	531	0,7	1 400	2 000	6,08	74550/74850 cl.0
305	0,38	1,6	541	0,9	1 300	1 800	5,40	46780/46720B cl.0
305	0,38	1,6	541	0,9	1 300	1 800	5,35	46780/46720 cl.0
334	0,48	1,3	703	0,7	1 100	1 600	7,85	JM736149/JM736110
170	0,39	1,5	334	0,9	1 100	1 600	3,32	L540049/L540010
174	0,41	1,5	353	0,8	1 100	1 500	3,56	LL641149/LL641110 cl.0
331	0,51	1,2	661	0,6	1 000	1 400	8,84	67989/67920
651	0,52	1,2	1 098	0,6	950	1 300	18,5	93825/93125 cl.3
468	0,41	1,5	934	0,8	850	1 200	12,3	8575/8520
468	0,41	1,5	934	0,8	850	1 200	12,3	8575/8520 cl.3
468	0,41	1,5	934	0,8	850	1 200	11,9	8578/8520B
468	0,41	1,5	934	0,8	850	1 200	11,9	8578/8520B cl.3
304	0,54	1,1	571	0,6	800	1 100	9,80	L853042/L853010 cl.3
815	0,4	1,5	1 400	0,8	700	1 000	29,0	EE275108/275160 cl.3
610	0,4	1,4	1 277	0,8	750	1 100	19,5	LM654649/LM654610 cl.3
505	0,4	1,5	1 096	0,8	750	1 000	13,3	L555249/L555210 cl.3
480	0,5	1,2	1 064	0,7	670	950	15,0	L860049/L860010 cl.3
1 087	0,39	1,5	2 068	0,8	600	850	47,0	EE526130/EE526190
1 087	0,39	1,5	2 068	0,8	600	850	47,0	EE526130/EE526190 cl.3
635	0,5	1,2	1 239	0,7	600	850	25,0	EE161400/EE161850 cl.3
580	0,5	1,2	1 187	0,7	560	800	19,5	L865547/L865512 cl.3
855	0,37	1,6	2 125	0,9	530	750	29,0	L467549/L467510

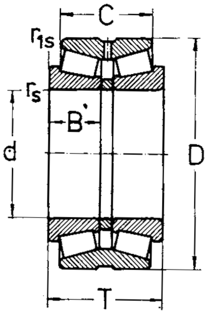
Non-standard single-row tapered roller bearings (Inch Series)



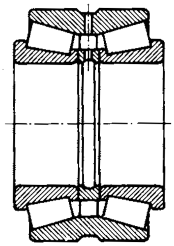
Dimensions										Designation
d	D	B	C	T	r_{1s},r_{2s} min.	r_{3s},r_{4s} min.	D_1	b	a	
mm										—
406,4	508	61,912	47,625	61,912	3,3	3,3			81	**T-34181MP5**
	546,1	87,313	68,263	87,313	6,4	6,4			103	**T-34081MP5**
	549,275	84,138	61,912	85,725	6,4	3,3			99	**T-34281**
431,8	533,4	50,8	36,512	50,8	3,3	3,3			74	**T-34086MP5**
457,2	660,4	85,725	62,704	91,279	8	5			105	**T-34091MP5**
482,6	615,95	46,038	41,275	53,975	3,3	3,3			87	**T-34097MP5**
520,7	736,6	81,758	53,975	88,9	6,4	3,3			133	**T-341/520P5**
558,8	736,6	104,775	80,962	104,775	6,4	2			119	**T-340/558P6**
609,6	762	92,075	71,438	95,25	6,4	6,4			151	**T-340/610**
635	736,6	53,975	41,275	57,15	3,3	3,3			124	**T-340/635P5**
660,4	812,8	95,25	73,025	95,25	6,4	6,4			121	**T-340/660P5**
774,7	965,2	80,962	66,675	93,662	6,4	3,3			155	**T-340/775**
838,2	1 041,4	88,9	66,675	93,662	6,4	6,4			176	**T-340/838P5**
1 016	1 270	101,6	66,675	101,6	9,6	9,6			226	**T-340/1016P5**
1 350	1 630	127,5	95	128,5	6	6			284	**T-340/1350P6S1**

Basic radial load. Factors					**Speed limit**		**Weight**	**Equivalence**
dyn. C_r	e	Y	stat. C_{0r}	Y_0	grease	oil		TIMKEN designation
kN	—		kN	—	min^{-1}		kg	—
855	0,37	1,6	2 125	0,9	530	750	29,0	L467549/L467510 cl.3
1 330	0,42	1,4	2 973	0,8	500	750	56,0	M667944/M667911 cl.3
1 295	0,41	1,5	2 831	0,8	500	750	55,0	LM567949/LM567910
643	0,33	1,8	1 421	1,0	500	750	26,0	L269143/L269110 cl.3
1 440	0,37	1,6	2 852	0,9	430	630	88,5	EE737181/EE737260 cl.3
790	0,35	1,7	1 690	0,9	450	630	34,0	EE80480/EE80425 cl.3
1 702	0,47	1,3	3 232	0,7	380	560	125	EE982051/EE982900 cl.3
2 214	0,35	1,7	5 377	0,9	380	530	119	LM377449/LM377410
1 975	0,49	1,2	4 969	0,7	360	500	95,0	L879947/L879910
985	0,44	1,4	2 755	0,7	360	500	37,0	EE80780/EE80720 cl.3
2 105	0,33	1,8	5 596	1,0	340	480	105	L281148/L281110 cl.3
2 185	0,40	1,5	4 981	0,8	280	400	134	EE752305/EE752380
2 390	0,44	1,4	6 381	0,7	260	380	174	EE763330/EE763410 cl.3
2 790	0,49	1,2	7 677	0,7	220	300	310	EE168400/EE168500 cl.3
4 875	0,46	1,3	14 305	0,7	160	240	536	

Double-row tapered roller bearings (Metric Series)



d≤220



d>220

Dimensions							Designation
d	D	B	C	T	r_1 min.	r_{1s} min.	
mm							–
160	240	48	94	115	3	1	**35032**
180	280	60	108	134	3	1	**35036**
200	310	66	123	152	3	1	**35040**
220	340	72	130	165	4	1	**35044**
240	360	72	130	165	3	1	**T-35048J**
	400	95	168	210	4	1,5	**T-35143**
260	360	60	109	134	3	1	**T-35952**
	400	82	146	186	4	1,5	**T-35052**
	440	106	180	225	4	1	**T-35152**
280	380	60	144	140	2,5	1	**T-35956**
	420	82	154	189	4	1	**T-35056**
	420	82	154	189	4	1	**T-35056P5**
300	420	72	128	160	4	1	**T-35960**
	500	90	152	205	5	1,5	**T-35160**
340	520	82	135	180	5	1,5	**T-35068**
360	480	72	128	160	4	1	**T-35972**
	540	82	140	184	6	1,5	**35072F**
380	520	65	112	150	5	1,5	**T-35976**
	620	106	172	242	5	2	**T-35176**
420	700	122	200	275	6	2	**T-35184**
440	650	94	152	212	8	2,5	**T-35088**
460	620	74	131	175	4	1	**T-35992**
	680	100	175	230	6	2	**T-35092**
480	650	78	130	180	5	2	**T-35996**
500	670	78	130	180	5	1,5	**T-359/500**
560	750	85	156	213	5	1,5	**T-359/560**
	820	115	185	260	6	2	**T-350/560**
630	850	100	182	242	6	2	**T-359/630**
710	950	106	175	240	8	2,5	**359/710**
	1 030	140	220	315	8	3	**T-350/710**
850	1 120	118	190	268	6	2	**T-359/850**

Basic radial load. Factors						Speed limit		Weight
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil	
kN	—			kN	—	min^{-1}		kg
662	0,37	1,8	2,7	1 288	1,8	950	1 400	17,0
1 154	0,29	2,3	3,5	2 352	2,3	850	1 200	29,9
1268	0,37	1,0	2,7	2 526	1,8	800	1 100	39,3
1 469	0,34	2,0	2,9	3 032	1,9	750	1 000	50,1
1 400	0,35	2,3	3,5	3 040	2,3	670	900	54,0
2 171	0,49	1,4	2,0	4 215	1,3	670	900	98,0
1 337	0,37	1,8	2,7	3 100	1,8	670	900	36,8
1 877	0,44	1,5	2,3	3 790	1,5	630	850	77,0
2 778	0,24	2,8	4,2	5 605	2,8	600	800	127
1 446	0,37	1,8	2,7	3 441	1,8	630	850	42,2
2 060	0,35	1,9	2,9	4 390	1,9	600	800	85,0
2 060	0,35	1,9	2,9	4 390	1,9	600	800	85,0
1 878	0,31	2,1	3,2	4 337	2,1	600	800	62,9
2 552	0,32	2,1	3,2	5 035	2,1	480	630	148
2 478	0,29	2,3	3,4	4 975	2,3	480	630	133
1 888	0,31	2,2	3,3	4 685	2,2	480	630	74,0
2 088	0,28	2,4	3,6	4 235	2,4	480	630	123
2 248	0,29	2,3	3,5	5 069	2,3	450	600	84,4
3 535	0,45	1,5	2,2	6 850	1,4	430	560	243
4 922	0,46	1,5	2,2	9 605	1,4	630	480	390
4 050	0,43	1,6	2,3	10 644	1,5	380	500	213
2 319	0,39	1,7	2,5	5 640	1,7	380	500	134
3 694	0,50	1,3	2,0	8 022	1,3	360	480	253
2 445	0,51	1,3	2,0	5 785	1,3	360	480	151
2 750	0,53	1,6	2,3	6 685	1,5	380	500	161
3 447	0,43	1,6	2,3	8 545	1,5	300	400	235
4 693	0,49	1,4	2,1	10 345	1,4	280	380	410
4 467	0,40	1,7	2,5	11 675	1,6	260	360	356
7 036	0,45	1,5	2,2	14 777	1,4	220	320	475
7 162	0,43	1,6	2,3	16 985	1,5	200	300	804
6 307	0,46	1,5	2,2	18 004	1,4	180	240	635

Non-standrard double-row tapered roller bearings (Metric Series)

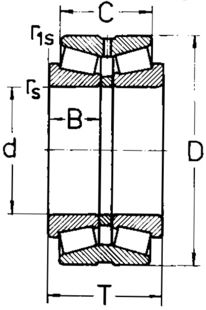


Fig.1

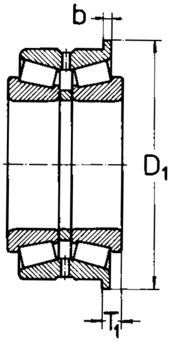


Fig.2

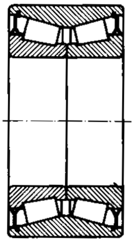


Fig.3

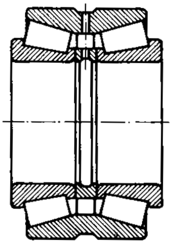


Fig.4

Dimensions										Designation
d	D	B	C	T	r_s min.	r_{1s} min.	D_1	b	T_1	
mm										—
25	52	15	28,5	35	0,6	0,6	58	3	6,25	35405R
	52	18,5	37	37	3	0,3				35605-2RSR
	67	17	29,3	40,5	1	0,6	75	2	7,6	35305R
	67	17	29,3	40,5	1	0,6	75	6	11,6	35505R
	67	17	29,3	40,5	1	0,6	75	2	7,6	T-35305R
28	67	17	29,3	40,5	1	0,6	75	2	7,6	35306R
34	64	18,4	37	37	3,3	0,3				35307-2RSR
35	80	19	31	43,5	2	0,6	88	6,5	12,75	35407R
39	68	18,5	37	37	3,3	3,3				35508-2RSR
40	90	33	55,5	72,5	1,5	0,6				35308
75	140	46	81	100	3	0,6				35415
90	140	32	56	72	2	0,6	146	6	14	35418RP5
100	180	34	64	80	3	1				35220
150	225	46,8	76,2	100	3	0,6				T-35530
	250	60	112	135,25	3	1				35130
	270	73	138	172	4	2				35230
160	270	66	120	150	3	1				35132
180	300	72	134	164	3	1				35136
230	355	65	110	145	5	1,5				T-35346M
	355	65	110	145	5	1,5				T-35346MP5
260	360	46,5	76	105	3	1				35452
	360	46,5	76	105	3	1				35452P6A80..100
	360	46,5	76	105	3	1				T-35452
	360	46,5	76	105	3	1				T-35452P5A80..100
280	420	130	44	130	2	5				35456MP5DF
300	440	105	35	105	4	4				T-35360W6F32DF
330	420	43	75	100	4	1				35366
	420	43	75	100	4	1				T-35366
370	500	43	74	100	5	3				T-35474
400	650	240	80	240	6,5	6,5				T-35380W69F32DF
560	820	242	80	242	6	6				T-353/560MDF
635	940	304,8	107,95	304,8	6,4	3,3				T-345/635W67F32DF

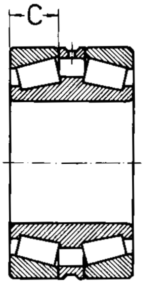


Fig.5

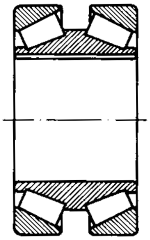


Fig.6

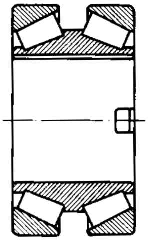


Fig.7

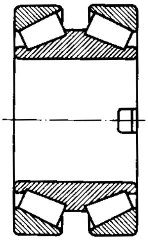


Fig.8

Basic radial load. Factors						**Speed limit**		**Weight**	**Fig.**	**Equivalence**
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil			Designation
kN	—			kN	—	min^{-1}		kg	—	
46	0,43	1,6	2,3	74	1,5	5 600	7 000	0,382	2	
48,8	0,45	1,5	2,2	68,6	1,5	5 600	7 000	0,385	3	
73	0,83	0,8	1,2	118	0,8	4 800	6 000	0,687	2	FC10558V
73	0,83	0,8	1,2	118	0,8	4 800	6 000	0,752	2	
73	0,83	0,8	1,2	118	0,8	4 800	6 000	0,687	2	
73	0,83	0,8	1,2	118	0,8	4 500	5 600	0,687	2	
63,3	0,43	1,6	2,3	84,8	1,5	4 500	5600	0,829	3	A43719
84	0,83	0,8	1,2	162	0,8	3 800	4 800	0,997	2	FC10592
26	0,45	1,4	2,1	47,8	1,4	4 000	5 000	0,923	3	
105	0,35	2,0	2,9	122	1,9	3 400	4 300	2,12	1	
363	0,38	1,8	2,6	579	0,9	2 000	2 600	6,28	1	510861A/510862A
284	0,48	1,4	2,1	518	1,4	1 900	2 400	3,86	2	
265	0,42	1,6	2,4	340	0,8	1 500	1 900	6,82	1	30220A/510860A
545	0,33	2,0	3,0	1 189	1,0	1 200	1 400	12,7	1	
829	0,24	2,8	4,1	1 496	2,7	1 200	1 400	25,8	1	2097730M
1 216	0,44	1,6	2,3	2 164	0,8	1 000	1 300	39,5	1	97530M
942	0,32	2,1	3,1	1 949	2,0	950	1200	34,9	1	2097732
1 279	0,29	2,4	3,5	2 559	2,3	850	1 000	47,5	1	2097736
1 331	0,33	2,1	3,1	2 545	2,0	750	900	48,0	4	
1 331	0,33	2,1	3,1	2 545	2,0	750	900	48,0	4	97746
827	0,37	1,8	2,7	1 747	0,9	700	850	31,1	4	
827	0,37	1,8	2,7	1 747	0,9	700	850	31,1	4	
827	0,37	1,8	2,7	1 747	0,9	700	850	31,1	4	
827	0,37	1,8	2,7	1 747	0,9	700	850	31,1	4	
995	0,75	0,9	1,4	2 030	0,8	630	750	85,0	5	847156L
1 021	0,87	0,8	1,2	2 145	0,8	600	750	50,9	6	118TDIE539AA650
971	0,32	2,1	3,1	2 336	2,0	560	700	28,3	1	
971	0,32	2,1	3,1	2 336	2,0	560	700	28,3	1	
1 200	0,32	2,1	3,2	2 760	2,1	500	630	49,0	4	
3 647	0,87	0,8	1,2	8 210	0,8	400	500	293	7	332167
3 644	0,82	0,8	1,2	8 985	0,8	320	400	440	5	8471/560XM
5 943	0,88	0,8	1,2	15 100	0,8	280	340	702	8	250TDIE789AA798

Non-standrard double-row tapered roller bearings (Inch Series)

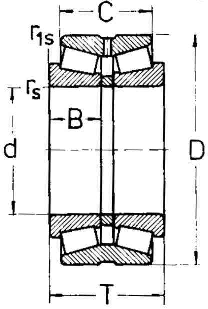


Fig.1

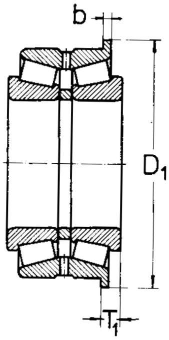


Fig.2

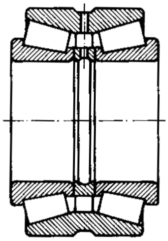


Fig. 4

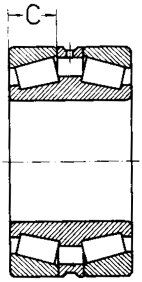


Fig.5

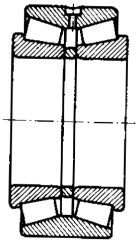


Fig.9

Dimensions							**Designation**
d	D	B	C	T	r_s min.	r_{1s} min.	
mm							—
69,85	114,287	25,4	46,038	58,738	1,5	0,8	**35314W7**
	114,287	25,4	46,038	58,738	1,5	0,8	**T-35314W7**
	120	29,007	53,975	65,09	3,5	0,8	**35514**
73,025	114,287	25,4	46,038	58,738	3,5	0,8	**35315**
	114,287	25,4	46,038	58,738	3,5	0,8	**T-35315**
82,55	136,525	29,769	53,975	69,85	3,5	0,8	**35317**
85,725	136,525	29,769	53,975	69,85	3,5	0,8	**35417W7**
92,075	149,225	28,971	52,387	66,672	3,5	0,8	**35318**
107,95	158,75	21,4	39,688	53,978	3,5	0,8	**35422P5**
	159,987	21,4	39,688	53,978	2	1	**35322W7**
	159,987	34,925	58,738	74,89	3,6	0,8	**35522W7**
	159,987	34,925	58,738	74,89	3,6	0,8	**T-35522W7**
114,3	190,5	49,2	80,962	106,362	3,5	1,5	**35323**
	190,5	49,2	80,962	106,362	3,5	1,5	**T-35323**
115	190,5	50	82,6	108	3,5	1	**35423P4**
	190,5	45	82,6	108	3	1	**35523P4**
127	196,85	46	85,725	101,6	3,5	0,8	**35325**
	196,85	46	85,725	101,6	3,5	0,8	**T-35325**
136,525	190,5	39,7	73,025	85,725	3,5	0,8	**35427**
	215,9	51	92	110	2,5	1	**35327RP4**1)
152,4	222,25	46,8	76,2	100,01	3,5	0,8	**35330**
	222,25	46,8	76,2	100,01	3,5	0,8	**T-35330**
	222,25	46,8	76,2	100,01	3,5	0,8	**T-35330P5**
203,2	282,575	46,038	82,55	101,6	3,5	0,8	**35340**
	282,575	46,038	82,55	101,6	3,5	0,8	**35340P4**
206,375	336,55	100,010	169,862	211,138	3,3	1,5	**T-35341M**
219,075	358,775	200,025	86	196,85	6,4	1,5	**T-35344DF**
228,6	355,6	69,85	111,125	152,4	6,8	1,5	**T-35446MP6**
254	533,4	120,65	165,1	276,225	6,4	1,5	**T-35451**
260,35	400,05	73,025	107,95	146,05	6,4	1,5	**T-35552M**
300,038	422,275	82,55	136,525	174,625	6,4	1,5	**T-35460W7**
317,5	422,275	128,588	53,975	128,588	1,5	3,5	**T-35463F32DF**

1) Bearing with rib on outer ring: D_1 = 224 mm, b = 8 mm, T_1 = 17 mm

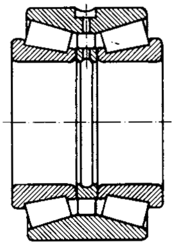


Fig. 10

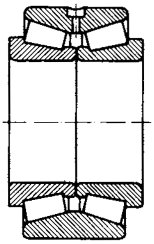


Fig. 11

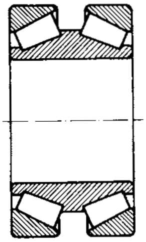


Fig. 14

Basic radial load. Factors						Speed limit		Weight	Fig.	Equivalence
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil			Designation
kN	—			kN	—	min^{-1}		kg	—	
180	0,49	1,4	2,1	295	1,4	2 400	3 000	2,05	9	29675/29622DC
180	0,49	1,4	2,1	295	1,4	2 400	3 000	2,05	9	29675/29622DC
255	0,38	1,8	2,6	415	1,7	2 200	2 800	2,45	1	482/472D
180	0,49	1,4	2,1	295	1,4	2 400	2 800	1,91	1	29685/29622D
180	0,49	1,4	2,1	295	1,4	2 400	2 800	1,91	1	29685/29622D
255	0,44	1,5	2,3	450	1,5	2 000	2 400	3,84	1	495/493D
255	0,44	1,5	2,3	450	1,5	1 900	2 400	3,72	9	497/493DC
275	0,49	1,4	2,1	510	1,4	1 800	2 200	4,37	1	42362/42587D
170	0,61	1,1	1,7	335	1,1	1 600	2 000	3,26	1	37425/37626D cl.3
170	0,61	1,1	1,7	335	1,1	1 600	2 000	3,38	9	
280	0,40	1,7	2,5	630	1,6	1 600	2 000	4,97	9	LM4522546/LM522510DC
280	0,40	1,7	2,5	630	1,6	1 600	2 000	4,97	9	LM4522546/LM522510DC
530	0,42	1,6	2,4	980	1,6	1 400	1 800	10,8	1	71450/71751D
530	0,42	1,6	2,4	980	1,6	1 400	1 800	10,8	1	71450/71751D
435	0,26	2,6	3,8	750	2,5	1 400	1 800	10,1	1	181115/181190XG
500	0,26	2,6	3,8	900	2,5	1 400	1 800	10,7	1	
540	0,34	2,0	2,9	1 130	1,9	1 300	1 700	10,6	1	67388/67322D
540	0,34	2,0	2,9	1 130	1,9	1 300	1 700	10,6	1	67388/67322D
395	0,33	2,1	3,1	940	2,0	1 300	1 700	6,88	1	48393/48320D
540	0,25	2,7	4,1	960	2,7	1 200	1 500	12,2	2	200136X/200215XH
540	0,33	2,0	3,0	1 190	2,0	1 200	1 400	11,7	1	M231649/M231610D
540	0,33	2,0	3,0	1 190	2,0	1 200	1 400	11,7	1	M231649/M231610D
540	0,33	2,0	3,0	1 190	2,0	1 200	1 400	11,7	1	M231649/M231610D cl.3
600	0,51	1,3	2,0	1 410	1,3	900	1 100	17,8	1	67983/67920DC cl.0
600	0,51	1,3	2,0	1 410	1,3	900	1 100	17.8	1	67983/67920DC cl.0
1 810	0,33	2,0	3,0	3 864	2,0	800	1 000	70,0	4	H242649/H242610D
2 152	0,33	2,0	3,0	4 728	2,0	750	950	81,5	5	H24849D/H244810D
1 040	0,33	2,0	3,0	2 020	2,0	750	900	52,0	4	EE13092/EE131401D
3 157	0,94	0,7	1,1	5 340	0,7	560	700	265	4	HH953749/HH953710D
1 155	0,39	1,7	2,6	2 280	1,5	670	800	63,6	11	NA221026/221576CDTM
1 846	0,34	2,0	3,0	4 300	2,0	600	750	80,5	10	HM256849/HM256810DC
1 343	0,32	2,1	3,2	3 235	2,1	600	750	42,5	14	LM258649D/LM258610

Non-standrard double-row tapered roller bearings (Inch Series)

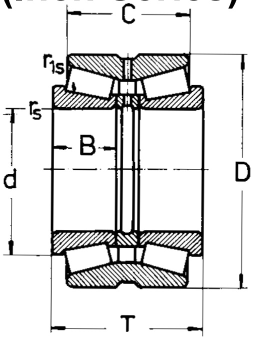


Fig.4

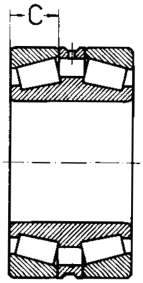


Fig.5

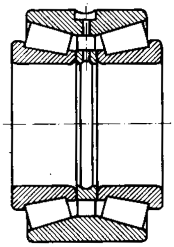


Fig.10

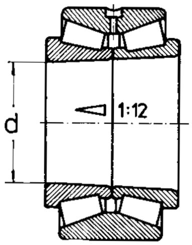


Fig.12

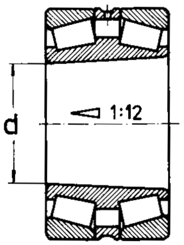


Fig.13

Dimensions							Designation
d	D	B	C	T	r_s min.	r_{1s} min.	
mm							—
321,17	469,9	95,25	152,4	190,5	6,4	1,5	**T-35464KW7**
331,523	488,95	174,6	74,6	174,625	3,5	3,5	**T-35466DF**
	488,95	174,6	74,6	174,625	3,5	3,5	**T-35466KDF**
333,375	469,9	90,488	152,4	190,5	6,4	1,5	**T-35467W7**
406,4	546,1	138,112	53,975	138,112	1,5	7,5	**T-35480F32DF**
482,6	615,95	85,725	146,05	184,15	6,4	3,3	**T-35396P5**
1 350(1)	1 630	113,5	127	275	6	3	**354/1350AS1B**
1 900	2 200	113,5	127	275	6	3	**354/1900S1B**
2 184,4	2 527,3	123,825	165,1	304,8	16	5	**354/2184**

1) Tolerance $^{+0,470}_{+0,345}$

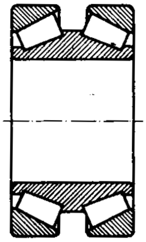


Fig.14

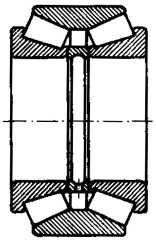
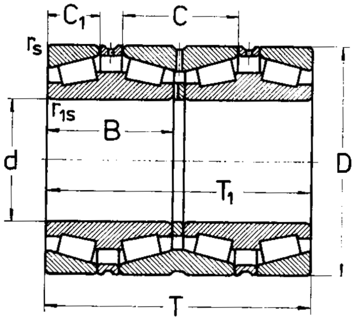


Fig.15

Basic radial load. Factors						Speed limit		Weight	Fig.	Equivalence
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil			Designation
kN	—			kN	—	min^{-1}		kg	—	
2 101	0,34	2,0	3,0	4 860	2,0	560	670	95,5	12	HM26047TA/HM26010
2 535	0,34	2,0	3,0	6 100	2,0	530	670	119	5	HM262749D/HM262710
2 535	0,34	2,0	3,0	6 100	2,0	530	670	113	13	HM262749TD/HM262710
2 269	0,34	2,0	3,0	5 340	2,0	530	670	100	10	HM261049/HM261010DC
2 058	0,47	1,4	2,1	5 165	1,4	450	560	94,5	14	LM767749D/LM767710
2 622	0,33	2,0	3,0	7 270	2,0	400	500	124,6	4	LM272248DW/LM272210 cl.3
5 775	1,17	0,6	0,9	18 475	0,6	140	180	963	15	
7 205	1,17	0,6	0,9	25 250	0,6	110	130	1 425	15	
9 310	1,17	0,6	0,9	39 650	0,6	90	110	2 328	15	

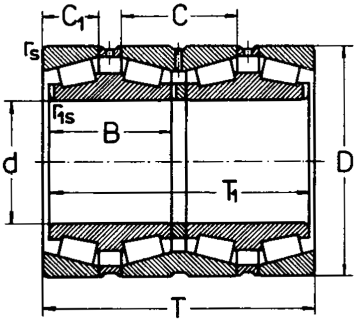
Four-row tapered roller bearings



Dimensions									Designation
d	D	B	C	C_1	T	T_1	r_s min.	r_{1s} min.	
mm									—
260	400	167,2	146	71	345	345	4	4	**36052**
280	420	165	154	71	345	345	4	4	**T-36056**
300	460	188	178	82	390	390	4	4	**T-36060M**
380	620	200	172	76	420	420	5	5	**T-36176**
420	620	170	150	67	355	355	5	6	**T-36084**
560	920	300	250	115	620	620	7,5	7,5	**T-361/560**

Basic radial load. Factors						Speed limit		Weight
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil	
kN	—			kN	—	min^{-1}		kg
3 055	0,64	1,1	1,6	7 605	1,1	400	530	150
3 505	0,35	1,9	2,9	8 690	1,9	380	500	171
4 135	0,29	2,3	3,5	10 580	2,3	320	430	241
6 072	0,45	1,5	2,2	13 735	1,4	260	360	505
5 335	0,4	1,7	2,5	13 342	1,6	260	360	377
13 915	0,4	1,7	2,5	33 495	1,6	170	240	1 757

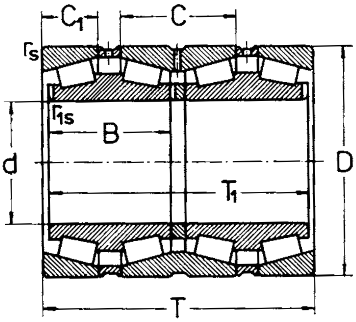
Non-standard four-row tapered roller bearings

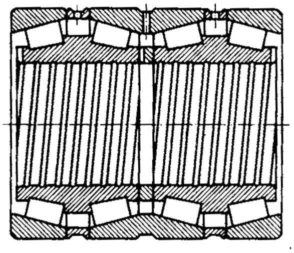


Dimensions									Designation
d	D	B	C	C$_1$	T	T$_1$	r$_s$ min.	r$_{1s}$ min.	
mm									—
240	410	128	114	50	270	270	4	4	**T-36248**
260	440	140	130	51	300	300	6	3	**T-36452M**
300	500	165	148	64	350	350	5	5	**T-36360**
380	620	184	170	75	388	388	5	5	**T-36476J**
400	540	130	116	48	280	280	5	5	**T-36980**
440	650	172	142	67	355	355	5	5	**T-36288**
460	730	210	180	80	440	440	10	5	**T-36492**
480	678	236	204	90	494	494	8	8	**36496**
500	720	202	180	82	420	420	5	5	**T-362/500**
600	800	171,5	164	71	365	365	5	5	**T-362/600**
630	920	245	213	94	515	515	7,5	7,5	**T-360/630**
660	1070	312	276	135	650	640	7,5	7,5	**T-362/660**

Basic radial load. Factors					Speed limit		Weight	Equivalence	
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil		Designation
kN	—			kN	—	min^{-1}		kg	—
2 735	0,46	1,5	2,2	5 432	1,4	400	530	107	77748
2 490	0,70	1,0	1,4	5 420	0,9	380	500	181	777752M
4 105	0,46	1,5	2,2	8 695	1,5	320	430	280	77760
4 840	0,42	1,6	2,4	12 510	1,6	260	360	473	3077776
3 110	0,45	1,5	2,2	8 510	1,4	280	380	173	77880
5 370	0,46	1,5	2,2	13 305	1,4	240	320	412	77788
6 185	0,73	0,9	1,4	15 305	0,9	220	300	699	777792
7 582	0,33	2,0	3,0	22 050	2,0	220	300	536	3726WH2-G2
6 985	0,32	2,1	3,2	18 670	2,1	220	280	553	771/500
6 460	0,38	2,1	3,1	18 645	2,0	190	260	518	779/600
10 515	0,30	2,2	3,3	27 595	2,2	170	220	1 153	771/630
16 565	0,31	2,2	3,3	40 470	2,2	150	200	2 410	777/660

Non-standard four-row tapered roller bearings (Inch Series)





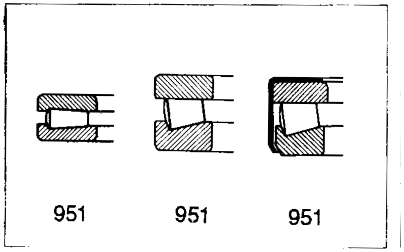
W28

Dimensions									Designation
d	D	B	C	C_1	T	T_1	r_s min.	r_{1s} min.	
mm									—
139,7	200,025	75,408	73,02	34,13	160,338	157,162	3,2	0,8	**T-36428P6W28**
190,5	266,7	89,695	84,138	38,1	188,912	187,325	3,3	1,5	**T-36438**
206,375	282,575	87	89,5	36,5	190,5	190,5	3,2	0,8	**T-36441**
215,9	336,55	127	117,475	53,925	266,7	266,7	3,2	6,35	**T-36443JP6**
241,478	349,148	108	101,6	44,5	228,6	228,6	3,5	1,6	**T-36348**
254	358,775	130,175	117,475	53,975	269,875	269,875	3,3	3,3	**T-36451**
266,7	355,6	109,538	101,6	44,448	228,6	230,1	3,2	1,5	**T-36253M**
285,75	380,898	117,5	107,9	49,3	244,475	244,475	1,6	1,6	**T-36257M**
343,052	457,098	122,5	103	47	254	254	3,3	1,5	**T-36069AJP5**
384,175	546,1	193,675	177,8	82,55	400,05	400,05	6,5	3,2	**T-36477M**
447,675	635	223,838	206,3	95,25	463,55	463,55	7,5	4	**T-36490MP6W28**
482,6	615,95	158,8	146	66,7	330,2	330,2	6,4	3,3	**T-36296BJP6**
558,8	736,6	196,9	177,8	81	409,575	409,575	8	4,5	**T-362/559**
584,2	762	188,9	169,6	77,75	401,638	396,875	8	4,5	**T-362/584**
660,4	812,8	176,15	158,8	73	365,125	365,125	6,4	3,3	**T-363/660**
938,212	1 270	403	355,5	168	825,5	825,5	15	6	**T-362/938**

Basic radial load. Factors						Speed limit		Weight	Fig.	Equivalence
dyn. C_r	e	Y_1	Y_2	stat. C_{0r}	Y_0	grease	oil			Designation
kN	—			kN	—	min^{-1}		kg	-	
767	0,34	2,0	3,0	1 949	2,0	750	1 000	16,6	2	331138A
1 031	0,47	1,5	2,2	2 954	1,4	560	750	33,8	1	67885/67820-820D
1 107	0,51	1,3	2,0	3 326	1,3	530	700	36,0	1	331486
2 065	0,50	1,3	2,0	4 636	1,2	480	630	93,0	1	
1 995	0,35	1,9	2,8	4 805	1,9	450	600	72,5	1	EE127097D/EE127135-136D
2 415	0,33	2,0	3,0	6 651	2,0	430	560	100	1	M249748D/M249710-710D
1 740	0,49	1,4	2,1	5 160	1,4	430	560	61,0	1	105TQO503AA229
1 850	0,43	1,6	2,3	5 460	1,5	400	530	79,0	1	LM654648D/LM654610-610D
2 405	0,47	1,4	2,1	6 580	1,4	320	430	112	1	330661C
4 780	0,35	2,0	2,9	11 880	1,9	280	380	295	1	151TQO647AA229
7 015	0,33	2,0	3,0	21 730	2,0	240	320	482	2	330608C
4 020	0,44	1,5	2,3	12 260	1,5	240	320	237	1	4TR19A
6 750	0,34	2,0	2,9	21 300	1,9	200	280	456	1	LM377449D/LM377410-410D
6 405	0,52	1,3	1,9	20 670	1,3	190	260	482	1	LM778549D/LM7778510-510D
6 075	0,31	2,2	3,3	21 405	2,2	180	240	405	1	L221149D/L281110-110D
23 340	0,34	2,0	2,9	78 835	1,9	120	160	3 160	1	LM287649D/LM287610-610D

Tapered roller thrust bearings

Tapered roller thrust bearings



Suffixes

AR - grinding addition on raceways
M - machined cage guided on rolling elements and shaft
V - bearing without cage
P6 - tolerance class more accurate than normal
P5 - tolerance class more accurate than P6
P4 - tolerance class more accurate than P5

Tapered roller thrust bearings

Tapered roller thrust bearings have the same parts as cylndrical roller thrust bearings. They are manufactured in two constructive versions, i.e. with tapered raceways on both washers or on only one. The rollers are radially guided by the rib of one washer. These bearings can also be manufactured in the version without cage. In this case, they have maximum axial load carrying capacity.

Tolerances

Tapered roller thrust bearings are generally manufactured to the normal tolerance class and P6 and P5, at request. The values of the tolerances for d and D are give on page 37.

Tapered roller bearings are fitted with machined brass or steel cages.

Tapered roller thrust bearings

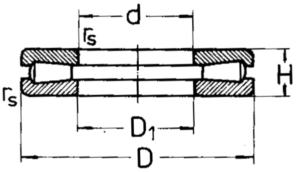


Fig.11

Fig.12

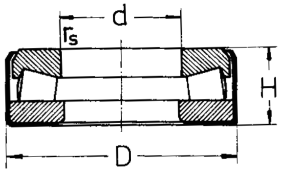


Fig.13

Dimensions					Basic axial load		Speed limit oil	Designation	Fig.	Weight	Equivalence TIMKEN
d	D	H	r_s min.	D_1	dyn. C_a	stat. C_{0a}					
mm					kN		min^{-1}	—		kg	—
40	67,8	19	1,5	40,4	73	300	4 000	**951Z08**	13	0,270	
50	78	22	1,5	50,4	93	382	3 600	**951Z10A**	13	0,390	
152,4	317,5	69,85	7,5	154	1 570	6 852	950	**T-95130A**	11	29,0	T-611
168,275	304,8	69,85	7,5	170	1 340	5 616	1 000	**T-95134A**	11	24,0	T-661
174,62	358,77	82,55	7,5	176	1 900	6 680	850	**T-95135A**	11	36,0	T-691
177,8	368,3	82,55	9,5	179,5	2 070	8 690	850	**T-95136A**	11	46,0	T-711
203,2	419,1	92,075	12	205	2 640	11 655	750	**T-95140A**	11	67,0	T-811
228,6	482,6	104,775	12	230	3 410	15 965	630	**T-95146A**	11	103	T-911
234,95	482,6	104,775	12	236,5	3 410	15 965	630	**T-95247A**	11	101	T-911A
	546,1	127	16	236,5	4 495	21 214	560	**T-95147A**	11	171	T-921
254	539,75	117,475	12	255,5	4 210	20 037	560	**T-95151A**	11	145	T-1011
279,4	603,25	136,525	12	281	5 208	24 530	500	**T-95156A**	11	214	T-1120
406,4	711,2	146,05	9,7	408	5 986	30 370	450	**T-95181A**	11	275	T-16021
550	710	51	3	554	2 320	15 775	750	**951/550P4AR**	12	52,4	T-16021

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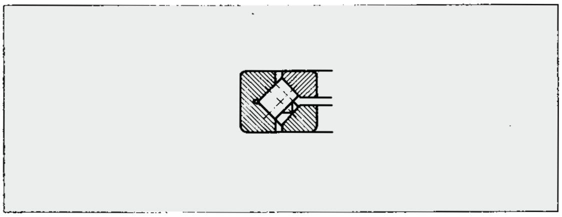
Crossed tapered roller bearings

Crossed tapered roller bearings have smaller width and can take over purely axial loads in both directions, purely radial loads or combined loads, as normal tapered roller bearings.

These bearings consist of an outer ring, two inner rings and tapered rollers arranged alternatively at 90° between rings, as shown below:



Two tapered rollers are separated by plastics washers (distance washers).

The generatrix of the tapered rollers intersects bearing axis as in case of a normal tapered roller bearing; thus perfect rolling is achieved and friction between raceways and rollers is reduced. Roller diameter is larger than its length and the taper has small values which leads to minimum friction on roller front faces and low operating temperature.

In case of crossed tapered roller bearings, the loads are transmitted under an angle of 45° from one raceway to the other. Crossed tapered roller bearings are considered as thrust bearings. For that reason, in bearing tables one can find the basic axial load for each bearing, besides the basic radial load.

Crossed tapered roller bearings provide many benefits such as simple bearing design and spare parts supply. The relatively high preload and great distance between the pressure centers provide high stiffness. These bearings can be easily mounted and dismounted.

Crossed tapered roller bearings are used for main shaft bearings of vertical lathes, large sized milling and drilling machines, radar shaft bearings, welding manipulators.

Tolerances and rotation accuracy

Crossed tapered roller bearings are manufactured to high accuracy tolerance class. The values of tolerances for bore diameter, outside diameter, rotation accuracy K_{ia}, K_{ea} and side surface runout related to the bore diameter S_d and outer diameter S_D are given in table 1(see chapter 5).

Tolerances and rotating accuracy

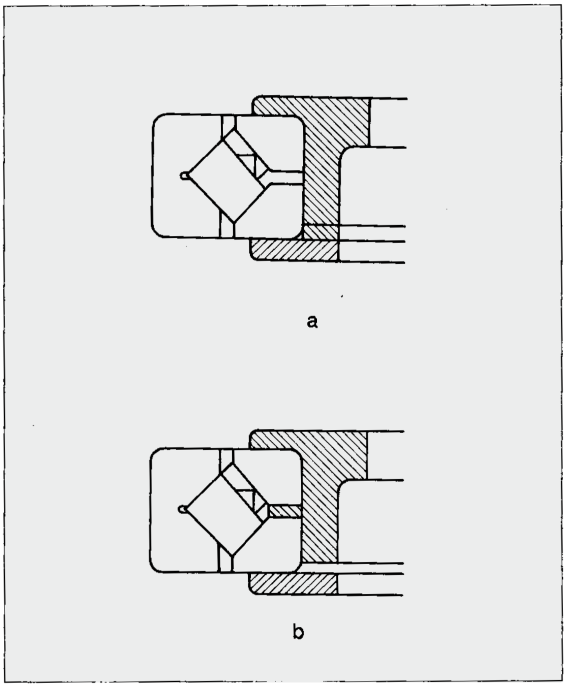
Table 1

Bearing symbol	**Diameter medium** d_{mp} max.	min.	**outside** Dmp max.	min.	**Radial runout** K_{ia},	K_{ea}
–	µm					
XD.10.0230P5	+13	0	+13	0	6	6
XD.10.0300P5	+13	0	+25	0	7	7
XD.10.0330P5	+25	0	+25	0	8	8
XD.10.0457P5	+25	0	+25	0	9	9
XD.10.0580P5	+25	0	+38	0	10	10
XD.10.0686P5	+38	0	+38	0	12	12
XD.10.0902P5	+38	0	+38	0	14	14
XD.10.1029P5	+51	0	+76	0	16	16
XD.10.1270P5	+76	0	+76	0	19	19
XD.10.1549P5	+76	0	+76	0	22	22
XD.40.1880P5	+76	0	+76	0	25	25

Considering the importance of the values of bore diameter, outside diameter, outer ring width and inner ring width for each bearing, they will be noted in a document which should accompany each bearing, according to the model

Preloading, stiffness

Due to the great number of rollers and the linear contact between the raceway and rollers, the elastic strain in crossed tapered roller bearings is very low. In order to increase stiffness, these bearings are loaded before mounting. We recommend as an approximate value for this preload 0,04 mm, for all bearing sizes.



a

b

Crossed tapered roller bearings can be preloaded if the inner rings are frontally approached. The magnitude of the preload is given by the washer width. For this purpose, the washer is adjusted by the machine-tool producer, the user respectively.

In the figure above, a and b, there are given the two versions of bearing preloading: with washer on the main shaft (a) and with washer between the two inner rings (b).

The bearing adjoint parts, the shaft and housing respectively, should be also properly sized, so that desired stiffness can be ensured.

Their thickness should be at least as bearing rings thickness.

The stiffness of these bearings can be calculated using the equation:

$$C_a = 39\ d^{1,1} \Delta_a^{0,6},\ N/\mu m$$

where

C_a - axial stiffness, N/μm

d - bore diameter, mm

Δ_a - bearing preload, mm

Lubrication

Crossed tapered roller bearings can be lubricated with grease or oil. In case of horizontal shafts and low speeds, grease lubrication is preferable.

In ordinary cases, oil bath lubrication or pressure oil lubrication should be provided. In case of high speeds and generally for bearings used for machine-tools, pressurized oil lubrication should be used since thus the gear boxes are lubricated. Oil penetrates through the space between the two inner half-rings, but it should be considered that the rollers should be adequately lubricated when starting.

Equivalent dynamic radial load

This can be calculated using the equations:

$$P_r = F_r + Y_1 F_a, \quad \text{when } F_a/F_r \leq e$$
$$P_r = 0{,}67\ F_r + Y_2 F_a, \text{ when } F_a/F_r > e$$

Equivalent static radial load

This can be calculated using the equations:

$$P_0 = F_r + Y_0 F_a$$

Fits

As crossed tapered roller bearings can take over both radial and axial loads in both directions, another bearing is not needed in a bearing arrangement.

Dimensional variations, e.g. thermal expansion caused by bearing heating, do not influence upon the bearing. For this reason, the rings can be mounted with interference fits without any influence upon bearing operation.

As an approximate unitary value for bearing rings tightening with their adjoint parts, 0,05 mm for each 1 000 mm of outside ring diameter is recommended. When determining the shaft and housing dimensions, the effective values of d and D should be considered. These values are noted for each bearing in the accompanying document.

Bearing mounting

For easy bearing mounting, the outer ring should be cooled and the inner ring heated or conversely, the shaft should be cooled and the housing heated, the inner ring and the housing should be heated, respectively.

For easy handling, all bearing rings with $d > 500$ mm are provided with threaded holes for screws with raising rings, which are removed after mounting.

Abutment dimensions

For a proper location of bearing rings on the shaft and housing shoulder respectively, shaft (housing) maximum connection radius $r_{u\ max}$ should be less than bearing minimum mounting chamfer $r_{s\ min}$.

Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

The values of the connection radius r_u and mounting dimensions are given in table 2.

Crossed tapered roller bearings

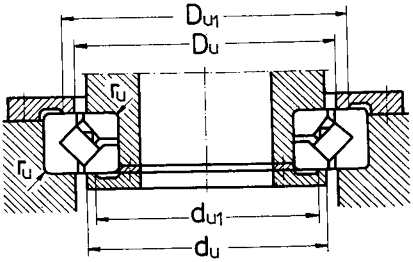
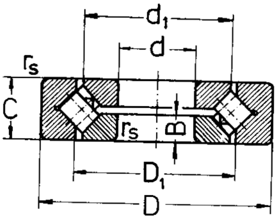


Table 2

Bearing symbol	Bore diameter	Abutment dimensions				
	d	d_u	d_{u1}	D_u	D_{u1}	r_u max.
–	mm					
XD.10.0457P5	457,2	525	495	545	580	1,8
XD.10.0580P5	580	655	615	685	725	5,4
XD.10.0686P5	685,8	800	755	825	870	3,3
XD.10.0902P5	901,7	1 010	965	1 035	1 075	1,8
XD.10.1029P5	1 028,7	1 165	1 110	1 200	1 255	1,8
XD.10.1549P5	1 549,4	1 690	1 630	1 720	1 775	1,8
XD.10.1880P5	1 879,6	2 035	1 975	2 065	2 120	5,4

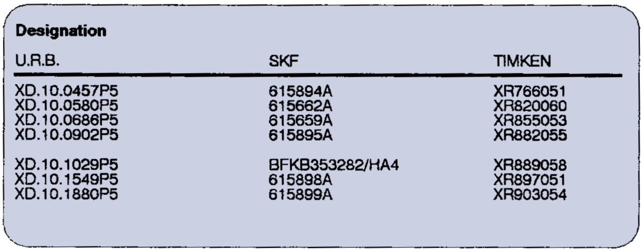
Non-standard crossed tapered roller bearings



Dimensions				Basic load				Speed limit grease	Weight	Designation
d	D	T	r_s min.	dyn. rad. C_r	ax. C_a	stat. rad. C_{0r}	ax. C_{0a}			
mm				kN				min^{-1}	kg	—
457,2	609,6	63,5	3,5	410	435	770	1 660	300	51	**XD.10.0457P5**
580	760	80	6,4	810	840	1 530	3 240	190	100	**XD.10.0580P5**
685,8	914,4	79,375	3,5	970	1 030	2 030	4 380	150	150	**XD.10.0686P5**
901,7	1 117,6	82,55	3,5	1 120	1 220	2 560	5 650	110	185	**XD.10.0902P5**
1 028,7	1 327,5	114,3	3,5	1 940	2 070	4 520	9 850	90	400	**XD.10.1029P5**
1 549,4	1 828,8	101,6	3,5	1 800	2 060	4 970	11 700	48	500	**XD.10.1549P5**
1 879,6	2 197,1	101,6	6,4	2 670	2 900	8 000	17 800	32	675	**XD.10.1880P5**

Dimensions					Factors			
d	d_1	D_1	B	C	Y_1	Y_2	e	Y_0
mm					—			
457,2	530	540	28	63,5	0,52	0,77	1,9	0,51
580	659	677	36,5	80	0,55	0,82	1,23	0,54
685,8	798	813	36,5	79,375	0,52	0,77	1,3	0,51
901,7	1 004	1 016	38,1	82,55	0,49	0,74	1,36	0,48
1 028,7	1 177	1 194	52,4	114,3	0,52	0,77	1,3	0,51
1 549,4	1 681	1 703	47	101,6	0,49	0,74	1,36	0,48
1 879,6	2 040	2 059	47	101,6	0,49	0,74	1,36	0,48

Crossed tapered roller bearings (Equivalent designation)

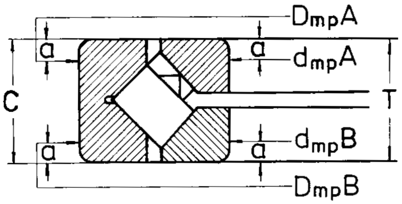


Designation

U.R.B.	SKF	TIMKEN
XD.10.0457P5	615894A	XR766051
XD.10.0580P5	615662A	XR820060
XD.10.0686P5	615659A	XR855053
XD.10.0902P5	615895A	XR882055
XD.10.1029P5	BFKB353282/HA4	XR889058
XD.10.1549P5	615898A	XR897051
XD.10.1880P5	615899A	XR903054

Test record for crossed taper roller bearing

Bearing designation . . . .



Measuring distance (a): . . . . mm

Measuring load: . . . . N

Actual values for:

1. Outside diameter: D_{mpA} . . . . mm

D_{mpB} . . . . mm

2. Bore diameter: d_{mpA} . . . . mm

d_{mpB} . . . . mm

3. Width of outer diameter: C . . . . mm

4. Width of bearing: T . . . . mm

Date:

Checked by:

Approved by:

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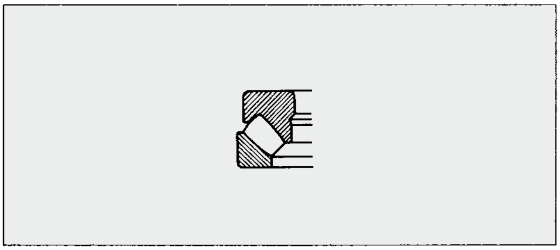
Spherical thrust roller bearings

Spherical roller thrust bearings can take over heavy axial loads. Since the load is transmitted from one raceway to the other under an angle of about 50° related to the bearing axis., these bearings can also take over, besides axial loads, radial loads with magnitude values of up to 55% of the axial load magnitude.

Spherical roller thrust bearings are dismountable: shaft washer - rollers - cage assembly and housing washer, respectively can be separately mounted.



Suffixes

E - E-design (increased basic load)
F - machined steel cage
M - machined brass cage

Tolerances

Spherical roller thrust bearings are generally manufactured to the normal tolerance class. The values of tolerances are given on page 37.

Dimensions

Overall dimensions of sphered bearings are in accordance with ISO 104 and national standard STAS 7651 respectively.

Misalignment

Because of the spherical design of the housing washer raceway, sphered roller thrust bearings are self-aligning, i.e. they permit relative high errors of alignment of the shaft relative to the housing.

In case of rotating shaft washers and normal loads: $F_a + 2{,}7\ F_r \leq 0{,}05\ C_0$ the values of permissible misalignment are given in the table below:

Permissible misalignment

Table 1

Bearing series	**Permissible misalignment**
	degrees
292	2
293	2,5
294	3

Lubrication

In most cases, spherical roller thrust bearings are lubricated with oil.

Cage

Spherical roller thrust bearings are fitted with machined brass or steel cage.

Minimum axial load

Spherical roller thrust bearings should be subjected to a minimum axial load, to ensure proper operation.

Minimum axial load can be calculated using the equation:

$$F_{a\,min} = \frac{1{,}25\ C_0}{1\ 000},\ kN$$

where:
$F_{a\,min}$ - minimum axial load
C_0 - basic static load, from tables

If the minimum axial load is not ensured, bearings should be preloaded (e.g. with springs)

Equivalent dynamic load

$P_a = F_a + 1{,}2\ F_r$, kN,

on the condition that: $F_r \leq 0{,}55\ F_a$.

Equivalent static load

$P_{0a} = F_a + 2{,}7\ F_r$, kN,

on the condition that: $Fr \leq 0{,}55\ F_a$.

Abutment dimensions

For a proper location of washers on the shaft and housing shoulder respectively, shaft (housing) maximum connection radius $r_{u\,max}$ should be less than bearing minimum mounting chamfer $r_{s\,min}$.

Shoulder height should also be properly sized in case of bearing maximum mounting chamfer.

The values of the connection radius r_u and mounting dimensions are given in table 2.

Spherical thrust roller bearings

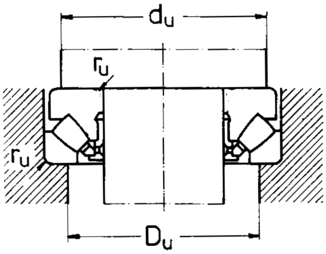
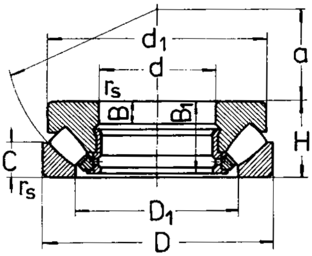


Table 2

Bore diameter d	Bearing series 292			293			294		
	d_u min.	D_u max.	r_u	d_u min.	D_u max.	r_u	d_u min.	D_u max.	r_u
mm									
150	180	193	1,5	195	219	2	220	253	3
160	190	204	1,5	210	235	2,5	235	270	4
170	205	218	1,5	220	245	2,5	250	286	4
180	215	227	1,5	235	262	2,5	265	304	4
190	225	243	2	250	280	3	280	321	4
200	240	254	2	265	297	3	295	337	4
220	260	273	2	285	316	3	315	358	5
240	290	308	2	305	336	3	335	378	5
260	310	326	2	335	370	4	365	412	5
280	325	347	2	355	390	4	395	446	5
300	360	380	2,5	385	423	4	415	465	5
320	380	400	2,5	405	442	4	450	500	6
340	400	422	2,5	440	479	4	475	530	6
360	430	453	3	460	500	4	495	550	6
380	450	473	3	495	535	5	525	580	6
400	470	493	3	510	550	5	550	615	6
420	500	525	4	535	580	5	575	635	6
440	520	545	4	560	605	5	605	675	8
460	540	565	4	585	630	5	630	695	8
480	570	595	4	610	655	5	660	735	8
500	585	615	4	630	675	5	685	755	8
530	620	650	4	670	715	6	725	800	8
560	655	685	4	710	760	6	770	850	10
600	700	735	4	755	805	6	815	900	10
630	740	780	5	795	860	8	860	950	10
670	790	825	5	835	905	8	905	1 000	12
710	835	875	5	890	960	8	965	1 070	12
750	880	925	5	935	1 000	8	1 015	1 120	12
800	935	980	6	995	1 060	8	1 080	1 185	12

Spherical thrust roller bearings

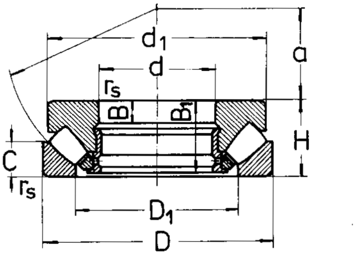


Dimensions										Basic axial load		Speed limit oil	Designation	Weight
d	D	H	d_1	D_1	B	B_1	C	r_s min.	a	dyn. C_a	stat. C_{0a}			
mm										kN		min^{-1}	—	kg
150	215	39	208	177	11	37	20	1,5	80	395	1 570	1 800	**29230M**	4,55
	250	60	240	190	20	57	28	2,1	87	800	2 850	1 400	**29330EM**	11,5
	300	90	285	207	32	86	43,4	4	92	1510	5 085	1 100	**29430EM**	30,0
160	225	39	220	188	11	37	20	1,5	87	410	1 680	1 700	**29232M**	4,80
	270	67	260	203	23	64	33	3	92	910	3 470	1 200	**29332EM**	16,0
	320	95	300	223	34	91	45,5	5	99	1 655	5 650	1 000	**29432EM**	35,0
170	240	42	235	201	13	40	22	1,5	93	470	1 900	1 600	**29234M**	5,95
	280	67	270	215	23	64	30,5	3	96	980	3 550	1 200	**29334EM**	16,5
	340	103	324	236	37	99	50	5	104	1 880	6 550	950	**29434EM**	45,8
180	250	42	245	211	14	40	21	1,5	97	485	2 020	1 600	**29236M**	6,25
	300	73	290	227	25	69	35,5	3	103	1 150	4 300	1 100	**29336EM**	20,5
	360	109	342	250	39	105	53	5	110	2 135	7 435	900	**29436EM**	52,0
190	270	48	262	226	14	45	25,5	2	103	500	2 200	1 400	**29238EM**	8,7
	320	78	308	243	27	74	36	4	110	1 305	4 820	1 000	**29338EM**	25,5
	380	115	360	264	41	111	55,5	5	117	2 345	8 220	850	**29438EM**	61,0
200	280	48	270	236	15	45	24	2	108	610	2 620	1 400	**29240M**	8,90
	340	85	325	257	29	81	40	4	116	1 500	5 605	950	**29340EM**	32,0
	400	122	380	277	43	117	59,4	5	122	2 580	9 160	800	**29440EM**	72,0
220	300	48	292	254	15	45	24	2	117	630	2 760	1 300	**29244M**	10,0
	360	85	345	273	29	81	41	4	125	1540	6 190	950	**29344EM**	34,5
	420	122	400	300	43	117	58,5	6	132	2660	9 630	750	**29444EM**	76,5
240	340	60	330	283	19	57	30	2,1	130	920	3 970	1 100	**29248M**	16,5
	380	85	365	295	29	81	40,5	4	135	1 580	6 420	900	**29348EM**	36,5
	440	122	420	322	43	117	59	6	142	2 720	10 040	700	**29448EM**	81,5
260	360	60	350	302	19	57	30	2,1	139	960	4 355	1 100	**29252M**	18,5
	420	95	405	324	32	91	46	5	148	1 995	8 175	800	**29352EM**	51,0
	480	132	460	346	48	127	63	6	154	3 210	12 125	670	**29452EM**	106
280	380	60	370	323	19	57	30	2,1	150	975	4 465	1 000	**29256M**	19,5
	440	95	423	343	32	91	45,5	5	158	2 070	8 705	800	**29356EM**	54,0
	520	145	495	372	52	140	70	6	166	3 810	14 675	630	**29456EM**	137
300	420	73	405	353	21	69	38	3	162	1 230	5 500	900	**29260M**	30,5
	480	109	460	372	37	105	51	5	168	2 580	10 510	700	**29360EM**	76,0
	540	145	515	392	52	140	70,5	6	175	3 930	15 580	600	**29460EM**	145
320	440	73	430	372	21	69	38	3	172	1 325	6 230	850	**29264M**	34,0
	500	109	482	391	37	105	53	5	180	2 555	10 770	670	**29364EM**	81,0
	580	155	555	422	55	149	74,5	7,5	191	4 450	17 246	560	**29464EM**	178
340	460	73	445	395	21	69	37	3	183	1 330	6 300	850	**29268M**	33,5
	540	122	520	428	41	117	59	5	192	3 125	12 430	630	**29368M**	106
	620	170	590	445	61	164	84	7,5	201	5 160	20 390	500	**29468EM**	226

Spherical thrust roller bearings

Dimensions										Basic axial load		Speed limit oil	Designation	Weight
										dyn.	stat.			
d	D	H	d_1	D_1	B	B_1	C	r_s min.	a	C_a	C_{0a}			
mm										kN		min^{-1}	—	kg
360	500	85	485	423	25	81	44	4	194	1 710	7 765	750	**29272M**	51,0
	560	122	540	448	41	117	59	5	202	3 150	12 800	600	**29372M**	110
	640	170	610	474	61	164	82	7,5	210	5 205	20 202	500	**29472EM**	234
380	520	85	505	441	27	81	42	4	202	1 820	8 800	700	**29276M**	53,0
	600	132	580	477	44	127	63	6	216	3 805	15 475	530	**29376M**	140
	670	175	640	494	63	168	85	7,5	222	5 695	23 120	480	**29476EM**	263
400	540	85	526	460	27	81	42	4	212	1 900	9 570	700	**29280M**	57,0
	620	132	596	494	44	127	64	6	225	3 805	16 140	530	**29380M**	146
	710	185	680	525	67	178	89,5	7,5	234	6 450	26 000	450	**29480EM**	310
420	580	95	564	489	30	91	46	4	225	2 290	11 200	630	**29284M**	75,5
	650	140	626	520	48	135	68	6	235	4 260	17 700	500	**29384M**	170
	730	185	700	545	67	178	90,5	7,5	244	6 600	27 000	430	**29484EM**	325
440	600	95	585	508	30	91	46	5	235	2 380	11 900	630	**29288M**	78,0
	680	145	655	540	49	140	70,5	6	249	4 360	19 300	480	**29388EM**	180
	780	206	745	577	74	199	100	9,5	257	7 805	31 530	380	**29488EM**	420
460	620	95	605	530	30	91	46	5	245	2 380	12 100	600	**29292M**	81,0
	710	150	685	567	51	144	72	6	257	4 910	21 000	450	**29392M**	215
	800	206	765	596	74	199	101,5	9,5	268	7 850	32 800	380	**29492EM**	425
480	650	103	635	556	33	99	53	5	259	2 700	13 500	560	**29296M**	98,0
	730	150	705	591	51	144	73,5	6	270	4 950	21 700	450	**29396M**	220
	850	224	810	625	81	216	108	9,5	280	9 455	38 865	340	**29496EM**	542
500	670	103	654	574	33	99	55	5	268	2 755	14 260	560	**292/500M**	105
	750	150	725	611	51	144	74	6	280	5 100	22 600	430	**293/500M**	235
	870	224	830	648	81	216	110	9,5	290	9 200	39 200	340	**294/500EM**	560
530	710	109	692	610	35	105	57	5	288	3 010	15 900	530	**292/530M**	125
	800	160	772	648	54	154	76	7,5	295	5 950	26 200	400	**293/530M**	270
	920	236	880	686	86	228	116	9,5	308	10 300	43 100	320	**294/530EM**	650
560	750	115	732	644	37	111	61	5	302	3 440	18 400	480	**292/560M**	140
	850	175	822	690	60	168	85	7,5	310	6 500	28 800	380	**293/560M**	320
	980	250	940	727	92	242	122	12	328	11 800	50 000	300	**294/560EM**	810
600	800	122	780	688	39	117	60	5	321	3 570	18 600	450	**292/600EM**	170
	900	180	870	731	61	173	87	7,5	335	7 200	33 300	340	**293/600M**	400
	1030	258	990	769	92	249	128	12	349	12 940	55 555	280	**294/600EF**	900
630	850	132	830	723	42	127	67	6	338	4 620	23 600	400	**292/630EM**	210
	950	190	918	761	68	183	92	9,5	359	8 200	38 000	320	**293/630EM**	485
	1 090	280	1 040	815	100	270	137	12	365	14 100	60 800	260	**294/630EM**	1 100
670	900	140	880	773	45	135	73	6	361	4 830	26 200	380	**292/670M**	255
	1 000	200	968	813	68	193	96	9,5	372	8 350	38 800	300	**293/670M**	545
	1 150	290	1 105	864	106	280	141	15	387	15 100	66 700	240	**294/670EM**	1 260

Spherical thrust roller bearings



Dimensions										Basic axial load		Speed limit oil	Designation	Weight
d	D	H	d_1	D_1	B	B_1	C	r_s min.	a	dyn. C_a	stat. C_{0a}			
mm										kN		min^{-1}	—	kg
710	950	145	930	815	46	140	73	6	380	6 000	29 300	340	**292/710M**	290
	1060	212	1 028	855	72	204	103	9,5	405	9 650	45 500	280	**293/710EM**	660
	1220	308	1 165	917	112	298	149	15	415	17 200	75 000	220	**294/710EM**	1 500
750	1 000	150	977	858	48	144	74	6	409	5 900	31 000	340	**292/750EM**	325
	1 120	224	1 086	910	76	216	109	9,5	415	10 600	49 900	260	**293/750M**	770
	1 280	315	1 220	964	116	305	153	15	436	18 300	83 300	200	**294/750EM**	1 650
800	1 060	155	1 035	911	52	149	77	7,5	434	6 390	35 335	320	**292/800EM**	388
	1 180	230	1 146	965	78	222	111	9,5	440	11 300	54 400	240	**293/800M**	865
	1 360	335	1 300	1034	120	324	165	15	462	19 800	91 100	190	**294/800EM**	2 025

Bearings for various applications

Bearings for various applications were required by special designs and also for the simplification of bearing joints. These bearings are referred to as bearings for:

- **agricultural machines,**
- **textile machinery,**
- **water pumps of motor vehicles,**
- **cardan drives and**
- **special sleeves.**

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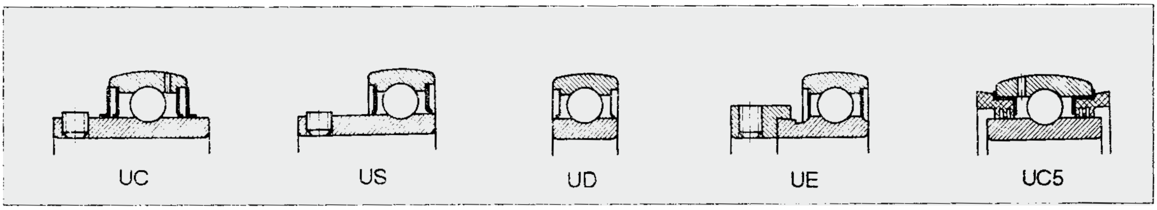
Deep groove ball bearings with spherical outer ring and extended inner ring

These bearings are simple in design, sealed on both sides and have spherical outer ring and extended inner ring. They can be manufactured in various designs.



Design

Deep groove ball bearings with spherical outer ring and extended inner ring are manufactured with metric and inch dimensions. The spherical outer ring permits errors of alignment up to 2,5°, on both sides. These bearings are generally used for agricultural machines. They are fastened on the shaft either with special screws without heads, UC2 and US types or with an eccentric clutch, UE type. These bearings are sealed on both sides and lubricated with lithium based grease of consistency 3. Relubrication is not necessary but due to the arduous operating conditions, i.e. dust and impurities, bearings are provided with relubrication holes

Bearings UD type are of the same design as standardized bearings series 62, excepting the spherical outer surface.

Tolerances

Deep groove ball bearings UC, US and UE type, with metric or inch dimensions are manufactured with bore tolerances according to table 1. The tolerances of the bore diameter for bearings UD type and also tolerances of the outer diameter for all types of bearings are in accordance with the tolerance class P0 for deep groove ball bearings and are given in table 1.

For the designations Δ_{dmp} and Δ_{Dmp}, see page 37.

If the shaft is manufactured in a tolerance class "h" and the tolerances for bearings UC, US and UE types are those in table 1, the fit will be a clearance fit.

Abutment dimensions tolerances

Table 1

Nominal diameter **d,D** over	up to	over	up to	**Inner ring** **type UC,US,UE** Δ_{dmp} high	low	**type UD** Δ_{dmp} high	low	**Outer ring** **All bearings** Δ_{Dmp} high	low
mm		inch		µm					
10	**18**	0,3937	0,7087	+15	0	0	−8	–	–
18	**30**	0,7087	1,1811	+18	0	0	−10	–	–
30	**50**	1,1811	1,9685	+21	0	0	−12	0	−10
50	**80**	1,9685	3,1496	+24	0	0	−15	0	−10
80	**120**	3,1496	4,7244	+28	0	–	–	0	−15
120	**150**	4,7244	5,9055	–	–	–	–	0	−15

Radial and axial clearance

Deep groove ball bearings UC, US, UE and UD types have a radial clearance C3 as that of deep groove ball bearings on page 118. Axial clearance of these bearings is 6 - 8 times larger than the radial clearance.

Speeds

The speeds of these bearings depend mainly on the fit. In case of shafts manufactured to less accurate tolerance classes, the bearings operate at low speeds and in case of shafts manufactured to more accurate tolerance classes, the speeds are higher. The speeds as functions of shaft tolerances are given in table 2.

Values for speed limit

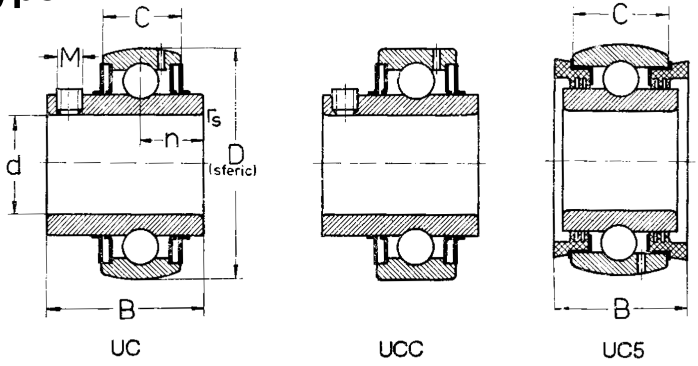
Table 2

Bore symbol	**Shaft diameter**	**Speeds** for shaft tolerance **m7, k7**	**j7**	**h7**	**h8**	**h9**	**h10**
-	mm	min^{-1}					
03	**17**	12 000	9 500	6 000	4 300	1 500	900
04	**20**	10 000	8 000	5 000	3 600	1 200	800
05	**25**	9 000	7 200	4 500	3 100	1 100	720
06	**30**	7 500	6 000	3 800	2 600	900	600
07	**35**	6 300	5 000	3 200	2 200	750	500
08	**40**	5 600	4 500	2 800	1 900	670	450
09	**45**	5 300	4 300	2 600	1 800	630	430
10	**50**	4 800	3 800	2 400	1 700	580	380
11	**55**	4 300	3 400	2 200	1 500	520	340
12	**60**	4 000	3 200	2 000	1 400	480	320
13	**65**	3 700	3 000	1 800	1 300	450	300

Equivalent dynamic and static load

Equivalent dynamic and static load of these bearings can be calculated as in case of deep groove ball bearings,

Deep groove ball bearings with extended inner ring UC and UCC type



UC UCC UC5

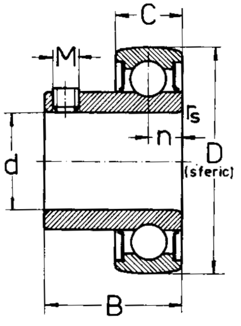
Dimensions								Basic radial load		Designation	Weight
d		D	B	C	n	r_s min.	M1)	dyn. C_r	stat. C_{0r}		
mm	inch	mm						kN		—	kg
17		46	31	16	12,7	0,6	1/4"-28UNF	12,8	6,65	**UC203**	0,152
20		47	31	16	12,7	1	1/4"-28UNF	12,8	6,65	**UC204**	0,152
22,225	**7/8"**	52	34	17	14,3	1	1/4"-28UNF	14	7,85	**UC205-14**	0,226
25		52	34	17	14,3	1	M6×1	14	7,85	**UC205**	0,199
		52	34	17	14,3	1	M6×1	14	7,85	**UCC205**	0,202
25,4	**1"**	52	34	17	14,3	1	M6×1	14	7,85	**UC205-16**	0,195
28,575	**1"1/8**	62	38,1	19	15,9	1	M6×1	19,5	11,3	**UC206-18**	0,306
30		62	38,1	19	15,9	1	M6×1	19,5	11,3	**UC206**	0,320
		62	38,1	19	15,9	1	M6×1	19,5	11,3	**UCC206**	0,320
30,162	**1"3/16**	62	38,1	19	15,9	1	1/4"-28UNF	19,5	11,3	**UC206-19**	0,318
31,75	**1"1/4**	72	42,9	20	17,5	1,1	M8×1	25,7	15,4	**UC207-20**	0,530
35		72	42,9	20	17,5	1,1	M8×1	25,7	15,4	**UC207**	0,510
		72	42,9	20	17,5	1,1	M8×1	25,7	15,4	**UCC207**	0,510
38,1	**1"1/2**	80	49,2	21	19	1,1	M8×1	32	17,8	**UC208-24**	0,699
40		80	49,2	21	19	1,1	M8×1	32	17,8	**UC208**	0,642
		80	49,2	21	19	1,1	M8×1	32	17,8	**UCC208**	0,642
41,275	**1"5/8**	85	49,2	22	19	1,1	5/6"-24UNF	32,7	20,2	**UC209-26**	0,757
42,862	**1"11/16**	85	49,2	22	19	1,1	5/6"-24UNF	32,7	20,2	**UC209-27**	0,717
44,45	**1"3/4**	85	49,2	22	19	1,1	M8×1	32,7	20,2	**UC209-28**	0,690
45		85	49,2	22	19	1,1	M8×1	32,7	20,2	**UC209**	0,717
		85	49,2	22	19	1,1	M8×1	32,7	20,2	**UCC209**	0,717
47,625	**1"7/8**	90	51,6	23	19	1,1	3/8"-24UNF	35,1	23,1	**UC210-30**	0,886
49,212	**1"15/16**	90	51,6	23	19	1,1	3/8"-24UNF	35,1	23,1	**UC210-31**	0,838
50		90	51,6	23	19	1,1	M10×1,25	35,1	23,1	**UC210**	0,813
		90	51,6	23	19	1,1	M10×1,25	35,1	23,1	**UCC210**	0,813
50,8	**2"**	90	51,6	23	19	1,1	3/8"-24UNF	35,1	23,1	**UC210-32**	0,788
		100	55,6	25	22,2	1,5	3/8"-24UNF	43,4	29,3	**UC211-32**	1,15
55		100	55,6	25	22,2	1,5	M10×1,25	43,4	29,3	**UC211**	1,03
		100	46	33		1		43,4	29,3	**UC511**	1,03
60		110	65,1	27	25,4	1,5	M10×1,25	52,4	36	**UC212**	1,62
65		120	65,1	27	25,4	1,5	M10×1,25	57,2	40	**UC213**	2,01

1) Inch-UNF or milimeters dimensions, on request.

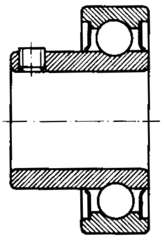
Equivalence

KOYO	ASAHI	FAG
—		
UC205	UC205	56205
UC205-16	UC205-16	56205.100
UC206	UC206	56206
UC207-20	UC207-20	56207.104
UC207	UC207	56207
UC208	UC208	56208
UC209-28	UC209-28	56209.112
UC209	UC209	56209
UC210		56210
	UC211	
UC213	UC213	

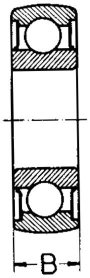
Deep groove ball bearings with extended inner ring
UC, USC and UD type



US



USC



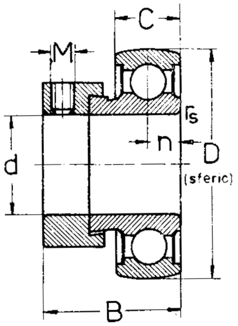
UD

Dimensions								Basic radial load		Designation	Weight
d		D	B	C_1	n	r_s min.	M	dyn. C_r	stat. C_{0r}		
mm	inch	mm					—	kN		—	kg
19,05	3/4"	47	25	14	7	1	M5×0,8	12,8	6,65	**US204-12**	0,132
		47	25	14	7	1	M5×0,8	12,8	6,65	**USC204-12**	0,134
20		47	14			1		12,8	6,65	**UD204**	0,104
		47	25	14	7	1	M5×0,8	12,8	6,65	**US204**	0,138
		47	25	14	7	1	M5×0,8	12,8	6,65	**USC204**	0,140
22,225	7/8"	52	27,5	15	7,5	1	M6×1	14	7,85	**US205-14**	0,150
		52	27,5	15	7,5	1	M6×1	14	7,85	**USC205-14**	0,153
25		52	15			1		14	7,85	**UD205**	0,128
		52	27,5	15	7,5	1	M6×1	14	7,85	**US205**	0,147
		52	27,5	15	7,5	1	M6×1	14	7,85	**USC205**	0,150
25,4	1"	52	15			1		14	7,85	**UD205-16**	0,130
		52	27,5	15	7,5	1	M6×1	14	7,85	**US205-16**	0,144
		52	27,5	15	7,5	1	M6×1	14	7,85	**USC205-16**	0,147
28,575	1" 1/8	62	28,5	16	8	1	M6×1	19,5	11,3	**US206-18**	0,266
		62	28,5	16	8	1	M6×1	19,5	11,3	**USC206-18**	0,269
30		62	28,5	16	8	1	M6×1	19,5	11,3	**US206**	0,252
		62	28,5	16	8	1	M6×1	19,5	11,3	**USC206**	0,255
30,163	1"3/16	62	28,5	16	8	1	M6×1	19,5	11,3	**US206-19**	0,250
		62	28,5	16	8	1	M6×1	19,5	11,3	**USC206-19**	0,253
35		72	17			1,1		25,7	15,4	**UD207**	0,277
		72	34	17	8,5	1,1	M8×1	25,7	15,4	**US207**	0,420
		72	34	17	8,5	1,1	M8×1	25,7	15,4	**USC207**	0,420
45		85	21			1,1		32,7	20,4	**UD209F2**	0,457

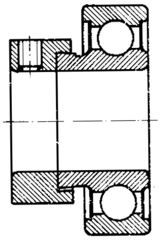
Equivalence

KOYO	NTN	ASAHI NACHI
	AS04-3/4	B4-12
	CS04LL AS04	B4
PB14 RB14		B5-14
PB16M RB16M	CS05LL	B5
PB16 RB16		B5-16
PB18 RB18		
PB19M RB19M		
PB19 RB19		

Deep groove ball bearings with extended inner ring
UE and UEC type



UE



UEC

Dimensions								Basic radial load		Designation	Weight
d		D	B	C	n	r_s min.	M	dyn. C_r	stat. C_{0r}		
mm	inch	mm					—	kN		—	kg
19,05	**3/4"**	47	31	15	7,5	1	1/4"-28UNF	12,8	6,65	**UE204-12**	0,162
		47	31	15	7,5	1	1/4"-28UNF	12,8	6,65	**UEC204-12**	0,165
20		47	31	15	7,5	1	1/4"-28UNF	12,8	6,65	**UE204**	0,155
		47	31	15	7,5	1	1/4"-28UNF	12,8	6,65	**UEC204**	0,158
22,225	**7/8"**	52	31	15	7,5	1	1/4"-28UNF	14	7,85	**UE205-14**	0,220
		52	31	15	7,5	1	1/4"-28UNF	14	7,85	**UEC205-14**	0,223
25		52	31	15	7,5	1	1/4"-28UNF	14	7,85	**UE205**	0,200
		52	31	15	7,5	1	1/4"-28UNF	14	7,85	**UEC205**	0,203
25,4	**1"**	52	31	15	7,5	1	1/4"-28UNF	14	7,85	**UE205-16**	0,190
		52	31	15	7,5	1	1/4"-28UNF	14	7,85	**UEC205-16**	0,193
28,575	**1"1/8**	62	35,7	18	9	1	5/16"-24UNF	19,5	11,3	**UE206-18**	0,331
		62	35,7	18	9	1	5/16"-24UNF	19,5	11,3	**UEC206-18**	0,335
30		62	35,7	18	9	1	5/16"-24UNF	19,5	11,3	**UE206**	0,313
		62	35,7	18	9	1	5/16"-24UNF	19,5	11,3	**UEC206**	0,317
30,163	**1"3/16**	62	35,7	18	9	1	5/16"-24UNF	19,5	11,3	**UE206-19**	0,311
		62	35,7	18	9	1	5/16"-24UNF	19,5	11,3	**UEC206-19**	0,315

Equivalence

KOYO	ASAHI	FAG	FAFNIR
RA012	FH204-12 FHR204-12		RA012RR RA012RRB
RA012M	FH204 FHR204		RAE20RR RAE20RRB
RA014	FH205-14 FHR205-14	16205.014 26205.014	RA014RR RA014RRB
RA100M	FH205 FHR205	16205 26205	RAE25RR RAE25RRB
RA100	FH205-16 FHR205-16	16205.100 26205.100	RA100RR RA100RRB
RA102	FH206-18 FHR206-18		RA102RR RA102RRB
RA103M	FH206 FHR206		RAE30RR RAE30RRB
RA103	FH206-19 FHR206-19		RA103.RR RA103.RR

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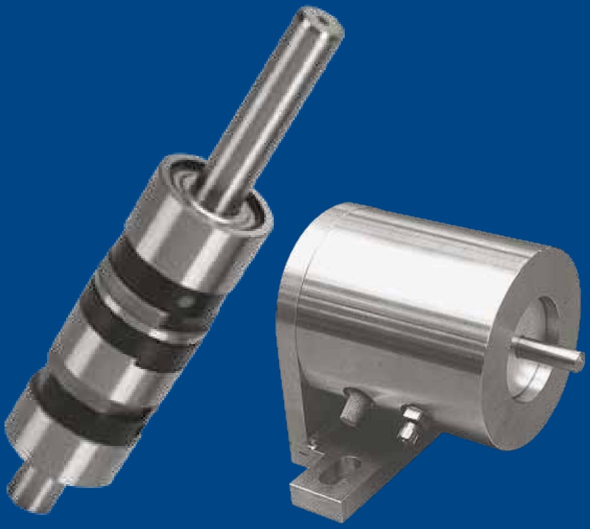
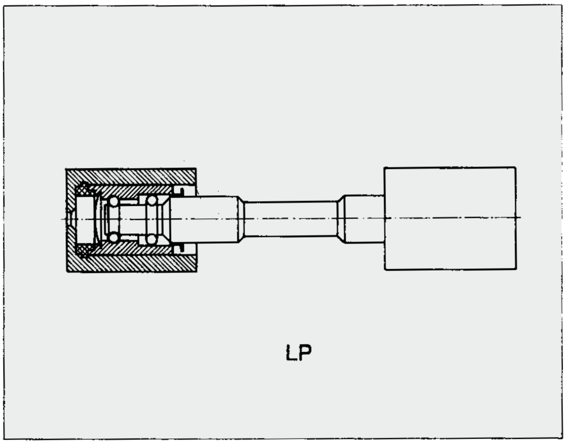


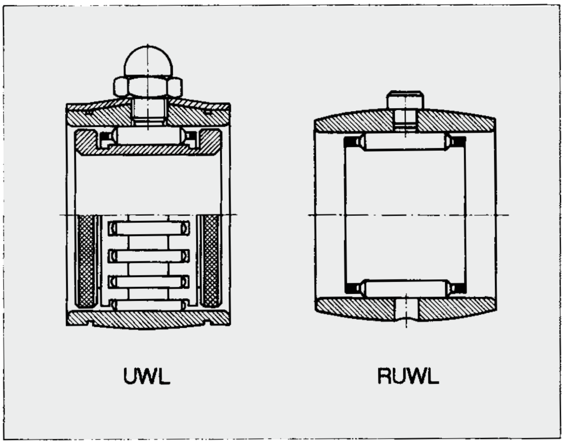
Bearings for textile machines

Bearings for textile machines have various designs, depending on the application. Some of them are as follows:

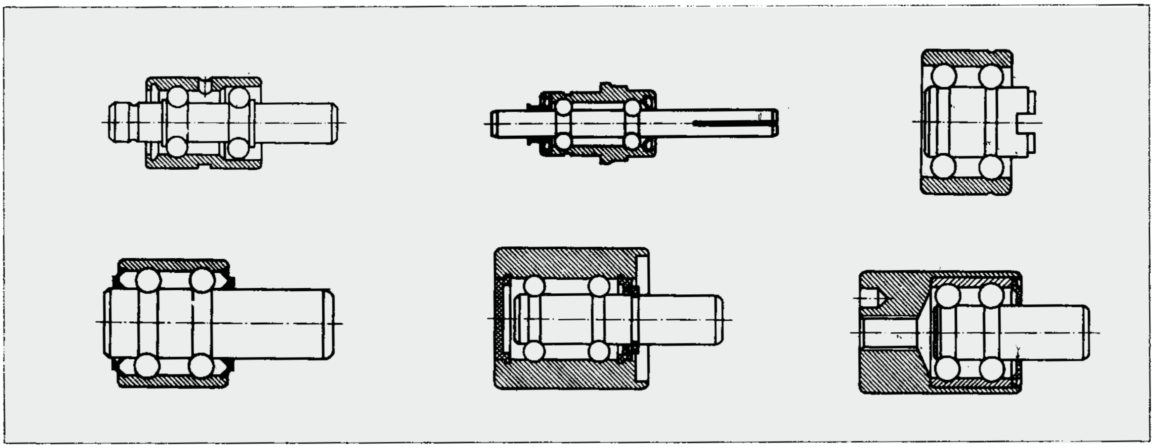
- pressure cylinder bearings



- lower pressure cylinder bearings for spinning machines



- deep groove ball bearings, double row



Designation

The designations of the bearings for textile machinery depend on their design and application, as follows:

- Designations for pressure cylinder bearings consist of the prefix LP followed by bearing series and mean distance between the two bearings on shaft ends.
  Example: LP101-90

- Designations for lower pressure cylinder bearings for spinning machines consist of the prefix UWL, followed by the outside diameter and the locating seating width according to table 1 (see figure on next page).

- deep groove ball bearings, double row, of various designs are designated by the prefix RT followed by the value of the outer ring diameter and its width.
  Bearings fitted with plastics cages TN are designated by the suffix TN.
  Example: RT 1625 TN

Designation for lower pressure cylinder bearings for spinning machines

Table 1

Seating width B_2	Lid width W	Bearing designation				
20	20,2	UWL 2820	UWL 3220	UWL 3620		
22	22,2	UWL 2822	UWL 3222	UWL 3622		
24	24,2	UWL 2824	UWL 3224	UWL 3624	UWL 4024	UWL 4524
25	25,2				UWL 4025	UWL 4525
26	26,2			UWL 3626	UWL 4026	
28	28,2		UWL 3228			UWL 4528
30	30,2				UWL 4030	UWL 4530

Design

Pressure cylinder bearings consist of a shaft which has on each end a deep groove ball bearing, double row . The bearing outer ring is just the top roller or the top roller is to be mounted on it. In this case, the shaft is the inner ring.
These bearings are shielded on both sides against the penetration of impurities or foreign bodies during operation.

Lower pressure cylinder bearings for spinning machines consist of an inner ring with two ribs, an outer ring, a needle roller polyamide cage and side location lid.
The rings are manufactured by steels for bearings with hardness between 59 and 63 HRC.
The cage is of plastics and the locating lid of pressed sheet.

Deep groove ball bearings, double row, RT type, consist of an outer ring of various designs, a shaft with raceways instead of inner ring, two ball cages and, in case of some bearings, various seals. They are used for gears, guiding and locating rollers, shaft washers of warp winders, spinning machines etc.

Tolerances and radial clearance

The tolerances for pressure cylinder bearings, LP type are not standardized by national and international standards, but the runout values are given in dependence to the top rollers.
The values of the outer ring runout K_{ea} and radial clearance are given in table 2.

Values for the outer ring runout K_{ea} and radial clearance

Table 2

Top roller designation	K_{ea}	Radial clearance min.	Radial clearance max.
–	µm		
LP 101; LP 132; LP 315; LP 316; LP 317	8	5	30
LP 302; LP 314; LP 701	20	0	20

The tolerances of the lower pressure cylinder bearings for spinning machines are given in table 3.

Pressure cylinder bearings deviations

Table 3

Parameter	Deviation high	Deviation low
–	µm	
Outside diameter deviation, Δ_{Dmp}	0	−25
Bore diameter deviation, Δ_{dmp}	0	−10
Inner ring width deviation, Δ_{BS}	+25	−25
Inner ring raceway runout, K_{ia}	max. 13	

The abutment dimensions are given in table 4, considering the side location lid and bearing seating.

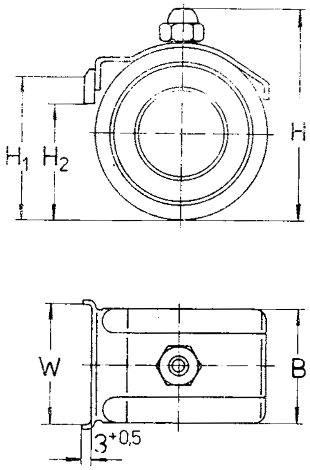


Fig.1

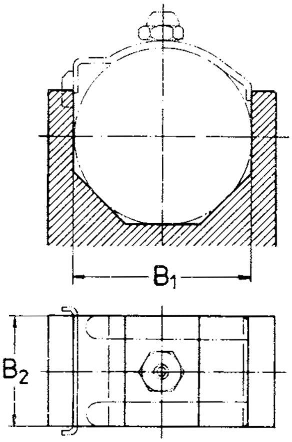


Fig.2

Abutment dimensions for the lower pressure cylinder bearings

Table 4

Parameter		**Abutment dimensions for**				
		UWL 28	UWL 32	UWL 36	UWL 40	UWL 45
–		mm				
Total height H_{max}		42	48	52	58	63
Side groin height	H_2 max.	16	19	21	24	29
	H_1 max.	24	27	29	32	37
Bearing seating B_1	$^{+0,15}_{+0,05}$	28	32	36	40	45

Pressure cylinder bearings for textile machines

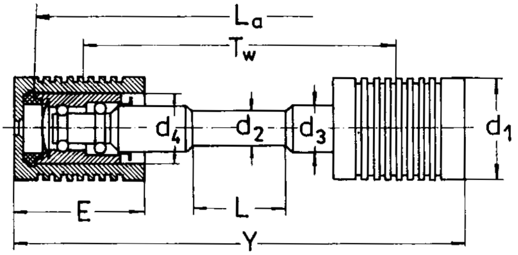


Fig.1

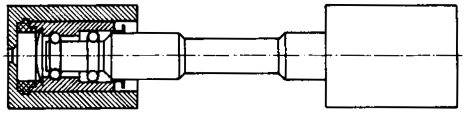


Fig.2

Dimensions									Fig.	Designation	Weight
Tw	La	Y	E	L	d1	d2	d3	d4			
mm									—		kg
68,4	89,9	98,4	30	16,2	25	9,5	11,36	16	2	LP102-68,4	0,216
	89,9	98,4	30	28,2	30	11	12,6	16	1	LP110-68,4	0,331
75	96,5	109	34	16,2	25	9,5	11,36	16	2	LP102-75	0,246
	96,5	109	34	28,2	30	11	12,6	16	1	LP110-75	0,372
82,5	104	124,3	42	28,2	30	11	12,6	16	1	LP110-82,5	0,379
	104	124,5	42	22,2	19	11	12,6	16	1	LP113-82,5	0,177
100	121,5	150	50	35,2	25	11	12,6	16	1	LP101A-100	0,338
110	131,5	172	62	35,2	25	11	12,6	16	1	LP101-110	0,442
120	141,5	181,8	62	35,2	25	11	12,6	16	1	LP101-120	0,452
130	151,5	172	42	28,2	30	11	12,6	16	1	LP110-130	0,434
	151,5	172	42	22,5	19	9,5	12,6	16	1	LP110-130F2	0,187
	151,5	172	42	22,2	19	11	12,6	16	1	LP113-130	0,191
	151,5	192	62	35,2	25	11	12,6	16	1	LP101-130	0,462
140	161,5	201,8	62	35,2	25	11	12,6	16	1	LP101-140	0,472
150	171,5	212	62	35,2	25	11	12,6	16	1	LP101-150	0,482
160	181,5	222	62	35,2	25	11	12,6	16	1	LP101-160	0,492
180	201,5	242	62	35,2	25	11	12,6	16	1	LP101-180	0,512
200	221,5	262	62	35,2	25	11	12,6	16	1	LP101-200	0,532

Pressure cylinder bearings for textile machines

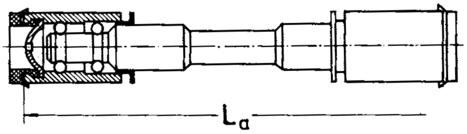


Fig.3

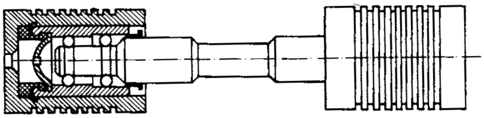


Fig.4

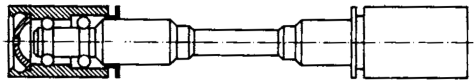


Fig.5

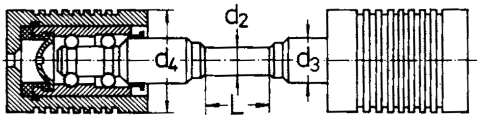


Fig.6

Dimensiuni									Fig.	Designation	Weight
T_w	L_a	Y	E	L	d_1	d_2	d_3	d_4			
mm									—		kg
75	96,5		21,5	22,5	16	11	12,6		3	**LP101-75F2**	0,077
	96,5		21,5	16,2	16	9,5	11,36		3	**LP102-75F20**	0,080
82,5	104		21,5	22,5	16	11	12,6		3	**LP101-82,5F2**	0,077
	104	124,5	42	22,5	19	11	12,6	16	4	**LP101-82,5F26**	0,153
	104		21,5	16	16	9,5	12,6		5	**LP101-82,5F4**	0,061
	104	124,5	42	16	19	9,5	12,6	16	6	**LP101-82,5F46**	0,153
90	111,5		21,5		16	12,6	12,6		3	**LP101-90F2**$^{1)}$	0,131

1) Locked with central sleeve with d = 14,8 and L = 8,6

Pressure cylinder bearings for textile machines

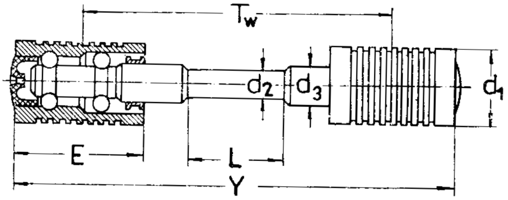


Fig.7

Fig.8

Dimensions							Fig.	Designation	Weight
T_w	Y	E	L	d_1	d_2	d_3			
mm							—		kg
Series LP132									
65	97	32	16,2	25	9,5	11,36	8	**LP132-65**	0,216
68,4	100,4	32	16,2	25	9,5	11,36	8	**LP132-68,4**	0,224
75	107	32	16,2	25	9,5	11,36	8	**LP132-75**	0,229
82,5	114,5	32	16,2	25	9,5	11,36	8	**LP132-82,5**	0,235
90	122	32	16,2	25	9,5	11,36	8	**LP132-90**	0,241
100	132	32	16,2	25	9,5	11,36	8	**LP132-100**	0,249
Series LP302									
65	95	30	16,2	19	9,5	11,36	7	**LP302-65**	0,115
68,4	98,4	30	16,2	19	9,5	11,36	7	**LP302-68,4**	0,118
	100,4	32	16,2	25	9,5	11,36	8	**LP302A-68,4**	0,223
75	105	30	16,2	19	9,5	11,36	7	**LP302-75**	0,123
	107	32	16,2	25	9,5	11,36	8	**LP302A-75**	0,228
82,5	112,5	30	16,2	19	9,5	11,36	7	**LP302-82,5**	0,129
90	120	30	16,2	19	9,5	11,36	7	**LP302-90**	0,135
100	130	30	16,2	19	9,5	11,36	7	**LP302-100**	0,143

Pressure cylinder bearings for textile machines

Dimensions							Fig.	Designation	Weight
T_w	Y	E	L	d_1	d_2	d_3			
mm							—		kg
Series LP314									
68,4	102,4	34	22,2	19	11	12,6	7	**LP314-68,4**	0,129
75	109	34	22	19	11	12,6	7	**LP314-75**	0,135
	109	34	21	19	11,5	12,6	7	**LP314A-75F2**	0,136
82,5	116,5	34	22,2	19	11	12,6	7	**LP314-82,5**	0,142
90	124	34	22,2	19	11	12,6	7	**LP314-90**	0,149
100	134	34	22,2	19	11	12,6	7	**LP314-100**	0,158
Series LP315									
82,5	122,5	40	22,5	19	11	12,6	7	**LP315-82,5**	0,157
100	140	40	22,5	19	11	12,6	7	**LP315-100**	0,175
110	150	40	22,5	19	11	12,6	7	**LP315-110**	0,185
130	170	40	22,5	19	11	12,6	7	**LP315-130**	0,204
Seria LP316									
68,4	102,4	34	28,2	19	11	12,6	7	**LP316-68,4**	0,127
75	109	34	28,2	19	11	12,6	7	**LP316-75**	0,133
Series LP317									
82,5	122,5	40	28,2	19	11	12,6	7	**LP317-82,5**	0,156
90	130	40	28,2	19	11	12,6	7	**LP317-90**	0,164
100	140	40	28,2	19	11	12,6	7	**LP317-100**	0,174
110	150	40	28,2	19	11	12,6	7	**LP317-110**	0,184
130	170	40	28,2	19	11	12,6	7	**LP317-130**	0,203

Pressure cylinder bearings for textile machines

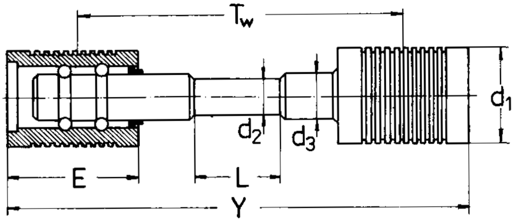
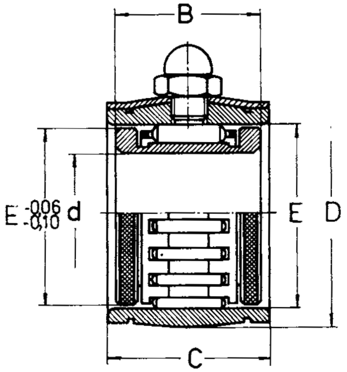


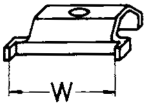
Fig.9

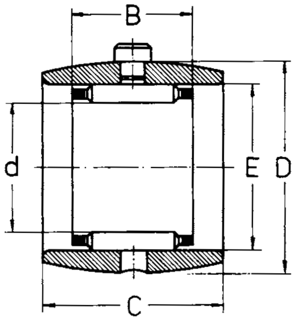
Dimensions							Fig.	Designation	Weight
T_w	Y	E	L	d_1	d_2	d_3			
mm							—		kg
75	114	39	28	40	12,6	15	9	**LP701-75**	0,733
82,5	121,5	39	28	40	12,6	15	9	**LP701-82,5**	0,743
100	145	45	28	40	12,6	15	9	**LP701-100**	0,754
120	165	45	28	40	12,6	15	9	**LP701-120**	0,768
140	185	45	28	40	12,6	15	9	**LP701-140**	0,796
150	195	45	28	40	12,6	15	9	**LP701-150**	0,810
160	205	45	28	40	12,6	15	9	**LP701-160**	0,874
180	225	45	28	40	12,6	15	9	**LP701-180**	0,852

Lower pressure cylinder bearings for spinning machines



UWL





RUWL

Dimensions						Basic radial load		Designation	Weight
d	D	D_1	C	B	W	dyn. C_r	stat. C_{0r}		
mm						kN		—	kg
14,2	28	24	22	16,6	20,2	8,5	10,5	UWL28A20	0,065
	28	24	22	16,6	22,2	8,5	10,5	UWL28A22	0,065
	28	24	22	16,6	24,2	8,5	10,5	UWL28A24	0,065
	28	24	22	16,6	25,2	8,5	10,5	UWL28A25	0,065
16	24	20	21	13		9,1	11,8	RUWL2421TN	0,026
16,5	28	24	22	19	20,2	10,4	13,5	UWL2820	0,059
	28	24	22	19	22,2	10,4	13,5	UWL2822	0,059
	28	24	22	19	24,2	10,4	13,5	UWL2824	0,059
	28	24	22	19	25,2	10,4	13,5	UWL2825	0,059
19	32	27	23	20	20,2	12,2	16,3	UWL3220	0,080
	32	27	23	20	22,2	12,2	16,3	UWL3222	0,080
	32	27	23	20	24,2	12,2	16,3	UWL3224	0,080
	32	27	23	20	25,2	12,2	16,3	UWL3225	0,080
	32	27	23	20	28,2	12,2	16,3	UWL3228	0,080
	36	30	25	22	20,2	14,1	17,8	UWL3620	0,125
	36	30	25	22	22,2	14,1	17,8	UWL3622	0,125
	36	30	25	22	24,2	14,1	17,8	UWL3624	0,125
	36	30	25	22	26,2	14,1	17,8	UWL3626	0,125
23	40	33	27	23,5	24,2	15,8	21,2	UWL4024	0,165
	40	33	27	23,5	25,2	15,8	21,2	UWL4025	0,165
	40	33	27	23,5	26,2	15,8	21,2	UWL4026	0,165
	40	33	27	23,5	30,2	15,8	21,2	UWL4030	0,165
25	45	37	30	25	28,2	21,1	28,8	UWL4528	0,220

Deep groove ball bearing, double row, for textile machines

Non-standardized

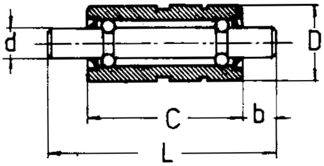


Fig.1

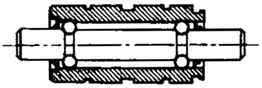


Fig.2

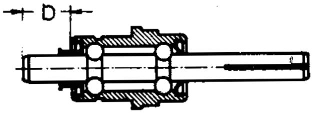


Fig.3

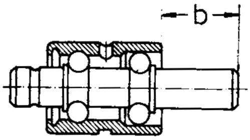


Fig.4

Dimensions					Basic radial load		Fig.	Designation	Weight
d	D	L	C	b	dyn. C_r	stat. C_{0r}			
mm					kN		—		kg
7,5	16	50	25	17	1,05	0,2	4	**RT1625TN**	0,033
8,1	24	86	34,6	15,4	2,4	1,4	3	**RT2134TN**	0,094
	24	114,5	44,5	19	2,4	1,4	3	**RT2144TN**	0,129
9	19	51	25	18	1,75	0,3	4	**RT1925TN**	0,048
11	24,9	95	55,1	19,95	4,75	3,5	2	**RT2555ATN**	0,179
	24,9	95	55,1	19,95	4,75	3,5	1	**RT2555TN**	0,178
	24,9	95	55,1	19,95	4,75	3,5	1	**RT2555TNW7**	0,179
14,15	30	94	57,5	17,5	5,1	3,9	1	**RT3057TN**	0,286
	30	94	57,5	17,5	5,1	3,9	1	**RT3057TNW7**	0,286

Deep groove ball bearing, double row, for textile machines

Non-standardized

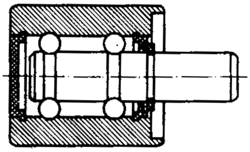


Fig.5

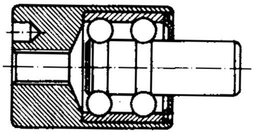


Fig.6

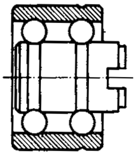


Fig.7

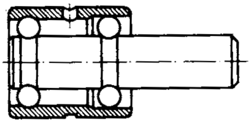


Fig.8

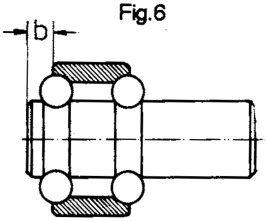


Fig.9

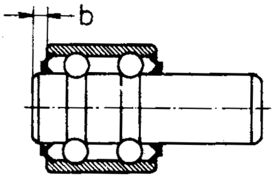


Fig.10

Dimensions					Basic radial load		Fig.	Designation	Weight
d	D	L	C	b	dyn. C_r	stat. C_{0r}			
mm					kN		—		kg
8	23	37	25	12	2,4	1,5	5	RT2325TN	0,067
9	19	39,5	21	18,5	3,5	2,3	8	RT1921TN	0,038
11	24	34	21	13	4,7	3,5	5	RT2421TN	0,058
	25,5	48	34	14	4,75	3,5	6	RT2534ATN	0,118
11,2	22	33,5	10,15	4,1	4,8	3,3	9	RT2210TN	0,044
13,75	28	21,5	17,5	4	5,8	4	7	RT2817TN	0,063
	28	21,5	17,5	4	5,8	4	7	RT2817TNC6	0,063
15,92	30	53,2	25	3	7	5,2	10	RT3025-2RS	0,138

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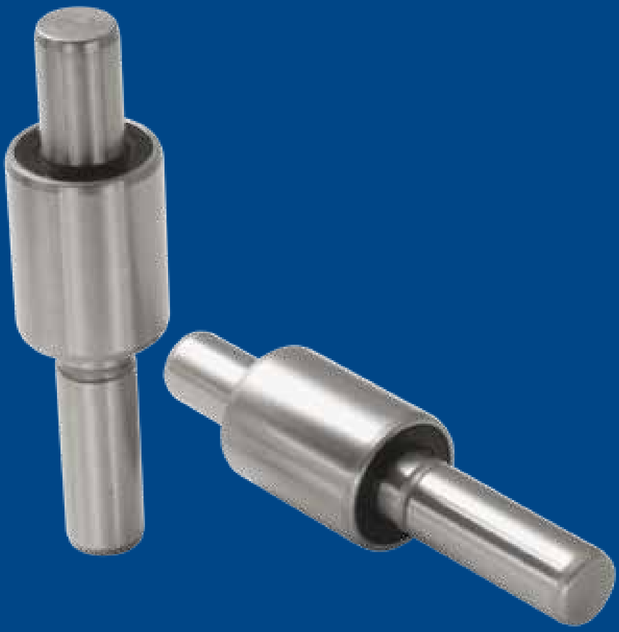
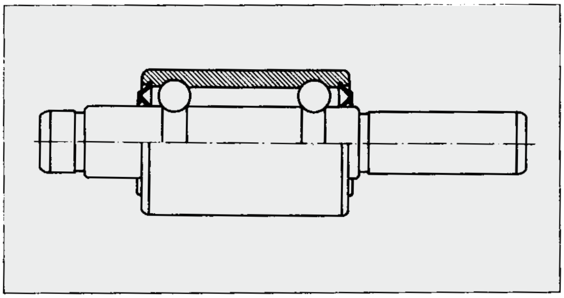


Water pumps bearings

Bearings for water pumps are economical, simple in design and provide satisfactory reliability for the industry of motor vehicles (cars, trucks and tractors).

The figure below shows their design:



Designation

The designation of bearings for water pumps consist of the prefix P followed by the value of the shaft diameter rounded to a whole number, outside diameter rounded to a whole number, suffix 01...10 which represents various lengths L for the same shaft dimensions and outside diameter.

Suffix A represents the repair dimension d of the shaft (increased with 0,047 or 0,051).

Design

Bearings for water pumps consist of a shaft which substitutes the inner ring. It is manufactured of case-hardening alloy steels with a minimum layer of 0,3 mm after grinding. It also has an outer ring manufactured of steels for bearings, two ball cages and seals.

As these bearings are sealed, the producers supplies them filled with the grease necessary for all the operating period.

Bearings for water pumps are manufactured in two versions, namely:

- basic design
- maintenance design, suffix A

Tolerances and radial clearance

The tolerance for all dimensions of these are the same and are given on bearing design.

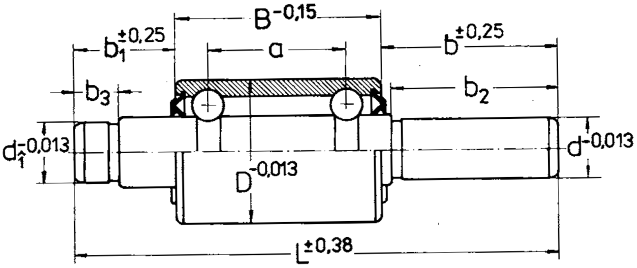
Radial clearance is also the same for the entire bearing range and corresponds to the radial clearance C3 of deep groove ball bearings,single row, of 0,005 - 0,020 mm respectively. At request, these bearings can be manufactured with other values of the radial clearance.

Equivalent dynamic and static radial loads

Equivalent dynamic and static radial loads can be calculated considering the bearing for water pumps as an assembly of two single row deep groove ball bearings having distance "a" between their raceway.

Basic dynamic and static loads C_r and C_{0r} of both bearings are given in tables. The equations and factors are identical to those for single row deep groove ball bearings and are given

Water pump bearings



Dimensions									Basic radial load		Speed limit	Designation	Weight
d	D	d_1	L	B	b	b_1	b_2	b_3	dyn. C_r	stat. C_{0r}	grease		
mm									kN		min^{-1}	—	kg
15,918	30	15,918	105,5	38,9	41,8	24,8			10	5,35	8 500	**P1630-02**	0,24
	30	15,918	110,9	38,9	47	25			10	5,35	8 500	**P1630-03**	0,25
	30	15,918	98	38,9	42,1	17			10	5,35	8 500	**P1630-01**	0,23
	38,1	15,918	112,65	41,4	42,68	28,57	39,62	25,4	15	8,45	8 500	**P1638-01**	0,39
	38,1	15,918	120,65	41,4	45,85	33,4	43,31	15,87	15	8,45	8 500	**P1638-02**	0,41
	38,1	15,918	132,08	54,1	48,14	29,84	43,18	12,32	15	8,45	8 500	**P1638-03**	0,32
	38,1	15,918	136,4	54,1	46,1	36,2	43,43	12,32	15	8,45	8 500	**P1638-05**	0,46
	38,1	15,918	143,51	54,1	58,55	30,86	42,67	12,32	15	8,45	8 500	**P1638-06**	0,48
	38,1	15,918	146,05	54,1	55,63	36,32	51,56	13,72	15	8,45	8 500	**P1638-07**	0,48
	38,1	15,918	152,9	54,1	53,59	45,21	41,48	28,45	15	8,45	8 500	**P1638-08**	0,48
	38,1	15,918	152,9	54,1	52,45	46,35	37,7	28,57	15	8,45	8 500	**P1638-09**	0,49
	38,1	15,918	161,92	54,1	72,26	35,56	70,1	15,24	15	8,45	8 500	**P1638-10**	0,50
	38,1	18,96	135,64	54,1	49,66	31,88	47,24		15	8,45	8 500	**P1638-04**	0,48
15,965	30	15,965	108,74	38,9	42	27,84	37,5		10	5,35	8 500	**P1630-05A**	0,25
15,969	38,1	15,918	120,65	41,4	45,85	33,4	43,31	15,87	15	8,45	8 500	**P1638-02A**	0,41
	38,1	15,918	132,08	54,1	48,14	29,84	43,18	12,32	15	8,45	8 500	**P1638-03A**	0,42
	38,1	15,918	136,4	54,1	46,1	36,2	43,43	12,32	15	8,45	8 500	**P1638-05A**	0,46
	38,1	15,918	143,51	54,1	58,55	30,86	42,67	12,32	15	8,45	8 500	**P1638-06A**	0,48
	38,1	15,918	146,05	54,1	55,63	36,32	51,56	13,72	15	8,45	8 500	**P1638-07A**	0,48
	38,1	15,918	152,9	54,1	53,59	45,21	41,48	28,45	15	8,45	8 500	**P1638-08A**	0,48
	38,1	15,918	152,9	54,1	52,45	46,35	37,7	28,57	15	8,45	8 500	**P1638-09A**	0,49
	38,1	15,918	161,92	54,1	72,26	35,56	70,1	15,24	15	8,45	8 500	**P1638-10A**	0,50
	38,1	15,969	112,65	41,4	42,68	28,57	39,62	25,4	15	8,45	8 500	**P1638-01A**	0,39
	38,1	19,012	135,64	54,1	49,66	31,88	47,24		15	8,45	8 500	**P1638-04A**	0,48
20	47	20	143	58	56,5	28,5	54,5	26,5	13,8	6,29	8 500	**P2047-01**	0,81

Equivalence

HOOVER	KOYO	FAG	SKF
			BBWD395807B
			BBWD393959AE
885841	885841	WS2443	
885861	885825A		BBWD395985
885821B	885821HB	WK2520	BBWD395969
885735		WK2528-2	
885737	885737	WK2537-1	BBWD395981
885862		WK2564-3	BBWD395899
885747	8885747	WK2575-1	BBWD395898
885857			
885865			
885858		WK2637	BBWD395900
885111D-OS2	885111D	WK6428-1	
885861OS			
885852OS		WK6520B	BBWD395969/VU005
885737OS		WK6537-1B	
885862OS		WK6564-3B	
885747OS		WK6575-1B	
885857OS		WK6602-B	
885865OS		WK6602-2B	
885858OS		WK6637B	BBWD395900/VU005
885841OS			
885735OS		WK6534	
			614977

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Bearings for cardan drives

Bearings for cardan drives are needle roller bearings with one-piece rings or pressed sheet rings. They are used in links which transmit rotation movements from one shaft to another under a certain angle with values up to 34°.

Cardan links should meet the following requirements:

- safety operation under proper load
- long rating life without maintenance during operation
- smooth running without working clearance and vibrations
- proper sealing so that lubricant losses and water or impurities penetration should be avoided
- $n\varphi < 18\,000$

where:

n - cardan drive speed, r/min,

φ - bending angle of the cardan drive, degrees

Bearings for cardan drives are generally used in motor vehicle industry (cars, trucks, tractors etc.) and also in other industries, e.g. for agricultural machines, various assemblies, railway vehicles etc.

The needle rollers inscribed envloping diameter, F_W is manufactured to the tolerance class H8 or F8 and the outside diameter D of the rings is manufactured to the tolerance class h5 or p6.

These tolerance classes are selected in dependence to the place of mounting and requirements in operation.

The designs and dimensions given in the catalogue show the wide range of bearings for cardan drives manufactured.

Bearings for cardan drives

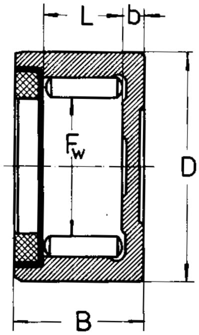


Fig.1

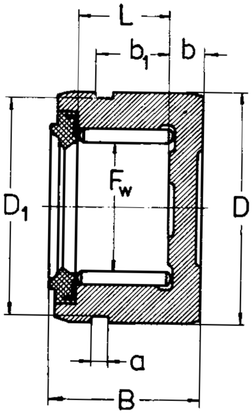


Fig.2

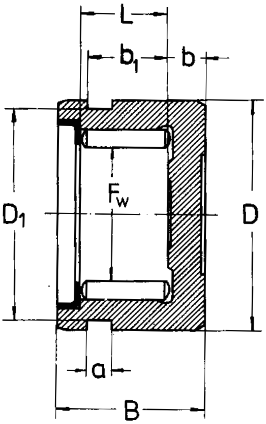


Fig.3

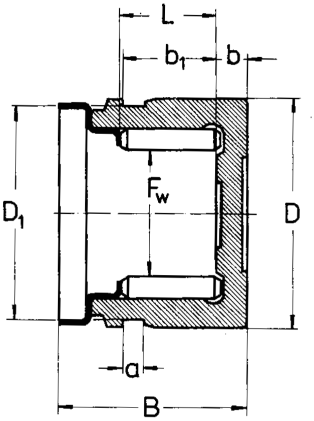


Fig.4

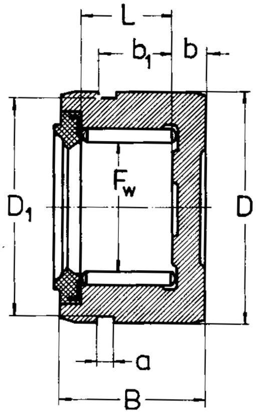


Fig.5

Dimensions								**Basic radial load**		**Fig.**	**Designation**	**Weight**
F_w	D	B	L	b	b_1	D_1	a	dyn. C_r	stat. C_{0r}			
mm								kN		—		kg
12,6	25	16	10	3,9	8,8	23	2,7	12,8	15,4	3	**704901K**	0,044
	25	15	9	3,9	7,8	23	2,7	11,9	14	3	**704901K1**	0,041
14,6	25	16,6	10	3,9	8,8	23	2,7	12	19	5	**704901A**	0,041
	25	16	10	3,9	8,8	23	2,7	12	19	3	**704901B**	0,04
15,2	28	19	13	4,4	11	25,7	2,5	16,6	25,1	2	**704902**	0,06
16,3	30	21	14	4	12,5	27,5	3	20,3	29,5	2	**704702A**	0,075
	30	25	14	4	12,5	27,5	3	20,1	29	4	**704702K**	0,073
18,6	30	21	14	4	12,5	27,5	3	18	34,4	2	**704702B**	0,068
	30,15	21	14	4				18	34,4	2	**704702C**	0,072
19,2	32	18	12	3				19,1	28,5	1	**704903**	0,062

Bearings for cardan drives

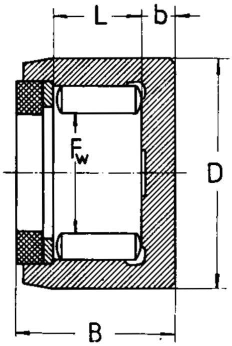


Fig.6

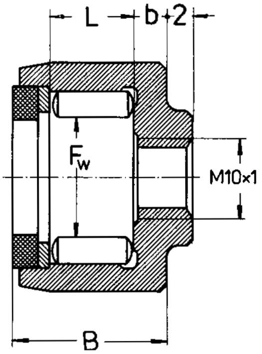


Fig.7

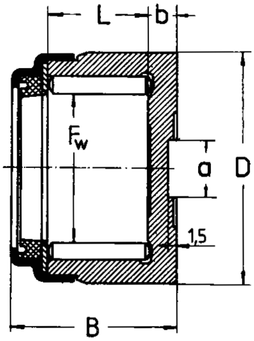


Fig.8

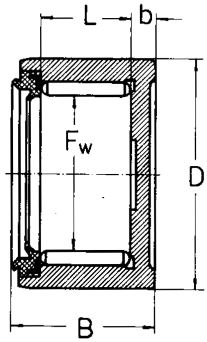


Fig.9

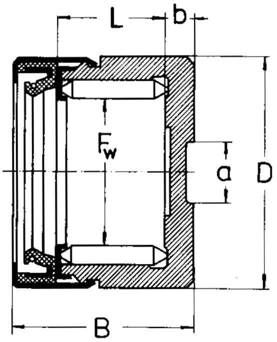


Fig.10

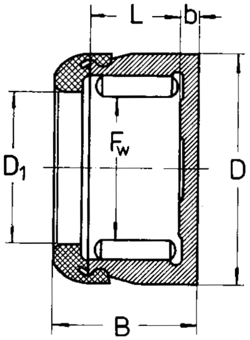


Fig.11

Dimensions							**Basic radial load**		**Fig.**	**Designation**	**Weight**
F_w	D	B	L	b	D_1	a	dyn. C_r	stat. C_{0r}			
mm							kN		—		kg
8,9	17	11,8	6,5	2,5			6,13	7,06	6	**491600**	0,012
	17	11,8	6,5	2,5			6,13	7,06	7	**491700**	0,013
12	22	16,8	10	3			11,7	15,2	8	**804701A**[1)]	0,030
13,5	22	14	8	2	15,3		9,39	13,6	11	**490301**	0,020
14,6	25	18	10	3,9	16,6		12	19	11	**490203**	0,035
16,8	27	17,8	10	2,3	17,7		14,3	21,3	11	**490103**	0,037
20	32	24,5	16	3,5	20		25,7	42,2	11	**704904**	0,072
20,67	32	19	12	3			18,4	31,4	8	**804103**	0,064
22	35	26,5	18	4		10	29,8	52,4	8	**804704A**	0,104
25	39	28	18	5		10	31,8	59,3	8	**804705A**	0,134
	39	30,5	17	5		10	25,9	45,1	10	**804805K1**	0,136
25,42	38	21,9	14	3,5			24	47	9	**490705**	0,100
	38	23,9	16	3,5			26,8	54,2	9	**490805**	0,110
29,54	44	25,5	16	4			31,8	62,4	9	**490906**	0,155
	44	27,5	18	4			35	70,7	9	**491006**	0,167

1) Without seal

Bearings for cardan drives

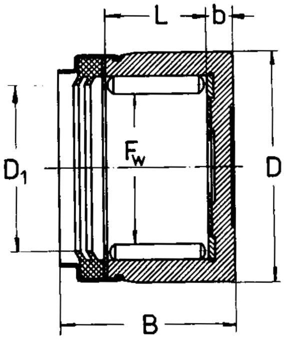


Fig.12

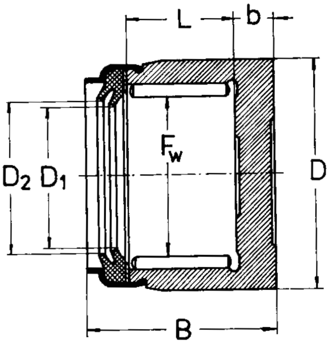


Fig.13

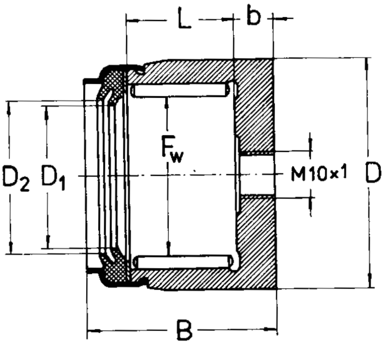


Fig.14

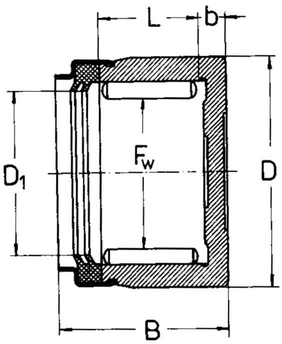


Fig.15

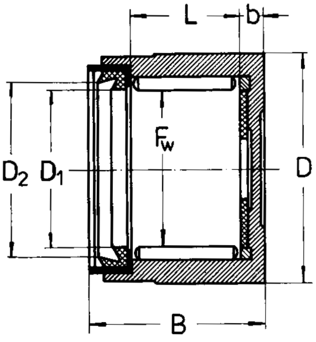
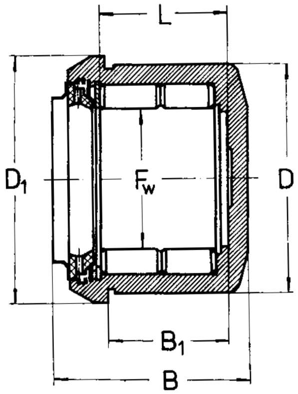


Fig.16

Dimensions							**Basic radial load**		**Fig.**	**Designation**	**Weight**
F_w	D	B	L	b	D_1	D_2	dyn. C_r	stat. C_{0r}			
mm							kN		—		kg
23,83	38	32,15	20	4,55	27,2	27,7	34	63,7	16	**490405**	0,140
	38	32,15	20	4,55	27,5		34	63,7	15	**490405B**	0,104
26,25	38	32,3	20	5	27,2	27,7	32,6	70,6	13	**490505**	0,162
	38	32,3	20	5	27,2	27,7	32,6	70,6	14	**490505K**	0,157
27,82	44	32,5	20	3,5	32,9	33,6	33,7	74,9	16	**490306**	0,180
	44	32,5	20	3,5	33		33,7	75	15	**490306B**	0,180
28,61	44	35,7	24	3,9	31,2	32,3	43,5	92,5	13	**490106**	0,212
31	45	37,5	20	7,5	32,9	33,6	35,7	83,4	13	**490606**	0,196
	45	37,5	20	7,5	32,9	33,6	35,7	83,4	14	**490606K**	0,191
34,34	50	39,8	24	5,5	35,2	38,4	48	111	17	**491107**	0,272
	50	39,7	24	5,5	38,5		48	111	12	**491107A**	0,262
37,17	57	43,1	25	7	41,5		63,6	123	12	**490107**	0,407
41,3	60	46	30	6,5	47,5		82,4	165	12	**490608**	0,444

Bearings for cardan drives



Dimensions							Basic radial load		Desig-nation	Weight
F_w	D	B	L	B_1	D_1	D_2	dyn. C_r	stat. C_{0r}		
mm							kN		—	kg
40,1	65	55,2	33	31,5	72	44,4	96,9	143	**491808A**	0,778
51,5	83	71,2	45	44,5	90	57,4	164	255	**492210A**	1,55
60,5	95	79,3	51	49,5	105	66,6	213	349	**491912A**	2,28
70	110	88,5	58	56	122	76,8	264	450	**492314A**	3,28
76,31	120	96	65	62,5	135	84,8	314	544	**490115**	4,45
82,7	130	107,5	74	70	147	93	388	691	**490117**	6,13

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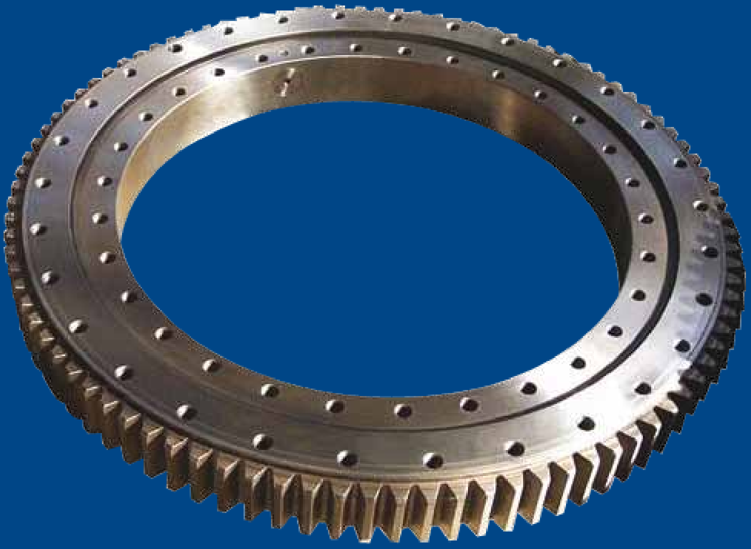
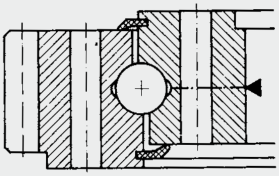


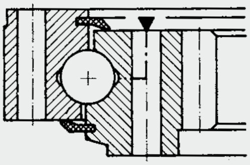
Slewing bearings

Slewing bearings are manufactured in a wide range of constructive designs, with various dimensions. We further mention the most usual bearing sizes:

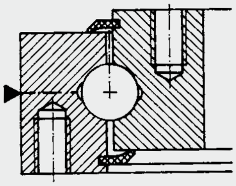
- ball bearings, single row



with external
gear VE.10

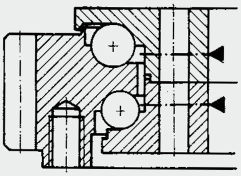


with internal
gear VI.10

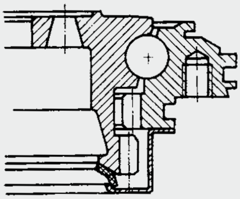


without
gear VU.10

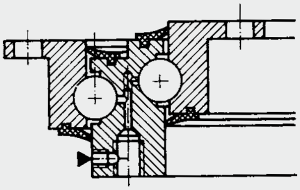
- ball bearings, single and double row



with external
gear VE.20

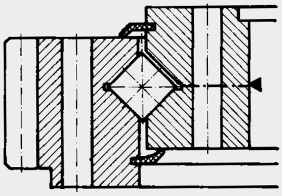


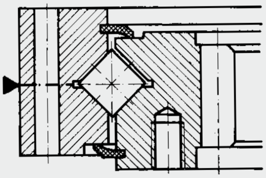
with internal and
external gear VIE.10

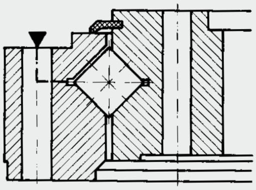


without
gear VU.20

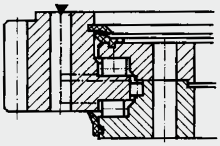
Crossed tapered roller bearings

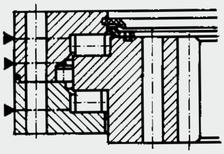

with external
gear XE.10


with internal
gear XI.10


without
gear XU.10

- cylindrical roller bearings, three row

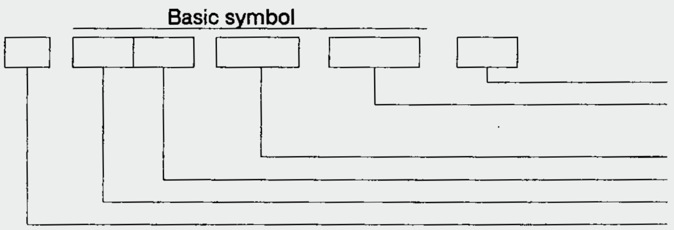

with external
gear YE.30


with internal
gear YI.30

Slewing bearings can take over heavy axial loads with magnitudes up to 10% of the axial loads and also tilting moments.

Designation

These bearings are differently designated in comparison to the internationally standardized bearings. In case of the bearings manufactured by the designation consists of:



Suffixes
Diameter of the rolling elements centers circle (T), mm
Number of rolling element rows
Emplacement of gear
Raceway form
Prefixes

Prefixes

If other materials than heat treatment steels are used, the prefixes are the same as in case of standardized bearings (see page 110).

Basic symbols

Considering the raceway form:

V	- ball bearings
X	- crossed cylindrical roller bearings
Y	- cylindrical roller bearings, three row

Considering gearing emplacement:

E	- with external gear
I	- with internal gear

EI - with internal and external gearing
U - without gearing

Considering the number of rolling elements rows:

10 - single row
20 - double row
30 - three row

Suffixes

A, B, C, D - versions of basic constructive designs
F - steels or sinterized powders distance rings between rolling elements
TN - plastics distance rings between the rolling elements
V - no distance rings between rolling elements
L - light alloy cages of separable design
F81 - surface hardened gearing

Example of designation:

VI.10.1380ATNF81 Slewing ball bearings (V) with internal gear (I) single row balls (10), with ball centers circle diameter of 1380 mm, design (A), with plastics distance rings (TN) between balls and surface hardened gear (F81).

Design

Slewing bearings consist of one or two inner rings and one or two outer rings made generally of heat treatment alloy steels 41MoCr11, according to the national standard To obtain an increased strength, the semi-finished rings are quenched and tempered.

The rolling elements (balls or rollers) are placed between the two rings. They are manufactured of bearings steels and are separated by steel or plastics (TN) distance rings. The chemical content of these materials is given in the chapter "Materials for rolling bearings"

To avoid the foreign bodies to penetrate the bearings, these are sealed with rubber seals or, sometimes, with labyrinth seals.

Lubrication during operation is provided by greasers either on the outer ring or on the inner ring. Their emplacement is simply designated by the symbol "▸".

These bearings can also be manufactured with gear on the outer or inner ring, depending on application. Gear material can be only quenched and tempered or high frequency surface hardened.

The raceways of these bearings are also high frequency surface hardened. Ready made slewing bearings are protected against corrosion by painting all surfaces, excepting the gear which is coated with a thin uniform layer of grease. Usually, these surfaces are coated with ground. In this case, the user will paint the bearing after mounting with the same colour as the equipment.

Slewing bearings are fastened to the rotating assemblies by screws. For this purpose, there are some holes provided in the rings.

Fastening screws

The screws used for bearing fastening should be selected from the groups of mechanical characteristics 8.8, 10.9 or even 12.9.

The passing hole diameter for screws , clamping load and tightening torque are given in table 1.

Considering the friction between nut and screw, the nut

Mechanical characteristics of fastening screws

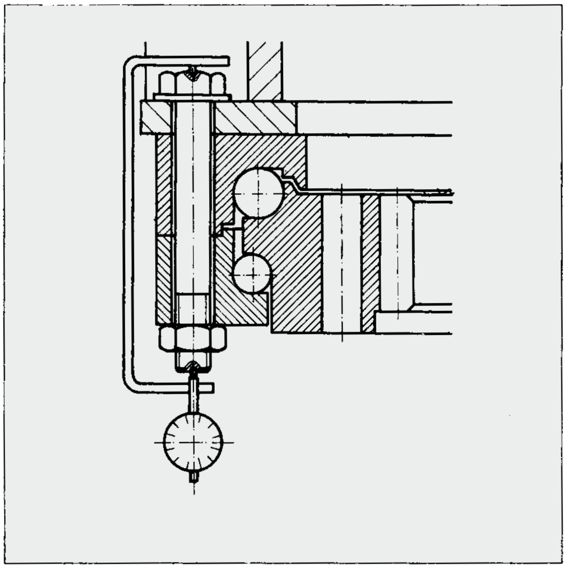
Table 1

Strenght class			**8.8**		**10.9**		**12.9**	
Yield limit, $R_{p0,2}$, N/mm^2			640 for ≤ M16 660 for > M16		940		1100	
Metric ISO thread	Cross sectional area of minor dia.	Passing hole diameter	Clamping load	Theoretical tightening torque	Clamping load	Theoretical tightening torque	Clamping load	Theoretical tightening torque
–	mm^2	mm	kN	N m	kN	N m	kN	N m
M16	144	18	72	215	106	310	124	370
M18	175	20	91	300	129	430	151	510
M20	225	22	117	430	166	620	194	720
M22	282	24	146	580	208	830	243	970
M24	324	26	168	740	239	1 060	280	1 240
M27	427	30	221	1 100	315	1 550	370	1 850
M30	519	33	270	1 500	385	2 100	450	2 500
M33	647	36	335		480		560	
M36	759	39	395		560		660	
M39	913	42	475		670		790	
M42	1 045	45	542		772		904	
M45	1 224	48	635		905		1 059	
M48	1 377	52	714		1 018		1 191	
M52	1 652	56	857		1 221		1 429	
M56	1 905	62	989		1 408		1 648	
M60	2 227	66	1 156		1 647		1 927	

frontal surface and its adjoint part, the actual value of the nut tightening torque can be approximated to 90% of the theoretical tightening moment.

Considering that the extension of the screws with dimensions greater than M30 cannot be well enough controlled by the tightening torque, they should be tightened until the value of 70% of the material yield limit reached.

Screw extension can be checked by means of a device as shown in the figure below.



Tolerance and clearance

The tolerances of slewing bearings are not standardized. Maximum ovalness for external gear and minimum ovalness for internal gear are marked with colour on three neighboring teeth. The value of ovalness depends on the bearing size, section and heat treatment.

Slewing bearings are manufactured with radial and axial clearance which should be according to the values given in table 2. These clearances are theoretical values and are determined considering the median sizes of the component parts, which are measured before mounting. (Raceway mean diameters and rolling elements emplacement mean diameters).

Radial and axial clearance

Table 2

Emplacement mean diameter of rolling elements, T over	up to	Axial clearance min.	max.	Radial clearance min.	max.
mm					
500	**630**	0,1	0,3	0,12	0,26
630	**800**	0,1	0,3	0,20	0,35
800	**1 000**	0,2	0,4	0,25	0,45
1 000	**1250**	0,2	0,5	0,30	0,55
1 250	**1600**	0,2	0,5	0,35	0,65
1 600	**2 000**	0,3	0,6	0,40	0,80
2 000	**2 500**	0,4	0,8	0,45	0,90
2 500	**3150**	0,5	0,9	0,50	1,00
3 150	**4 000**	0,5	0,9	0,55	1,10
4 000	**5 000**	0,5	1,0	0,60	1,20
5 000	**6300**	0,5	1,0	0,65	1,30
6300	**8 000**	0,6	1,2	0,70	1,40
8 000	**10 000**	0,6	1,2	0,75	1,50
10 000	**—**	0,7	1,4	0,80	1,60

Basic static axial load

Basic static axial load can be calculated depending on the bearing type, using the following equations:

- for ball bearings:

$$C_{0a} = f_0\, f_{0H}\, Z\, D_w^2 \sin\alpha \times 10^{-3},\ \mathrm{kN}$$

where:

f_0 = coefficient, table 3
f_{0H} = coefficient, table 4
Z = number of balls arranged on a single row
D_w = roller diameter, mm
α = contact angle, degrees

- for cylindrical roller bearings

$$C_{0a} = 220\, f_{0H} \left(1 - \frac{D_w \cos\alpha}{T}\right) Z\, D_w\, L_w \sin\alpha \times 10^{-3},\ \mathrm{kN}$$

where:

f_{0H} = coefficient, table 4
D_w = roller diameter, mm
T = rollers emplacement diameter, mm
L_w = roller lenght, mm
Z = number of cylindrical rollers
α = contact angle, degrees

Values for coefficient f_0

Table 3

$\frac{D_w \cos\alpha}{T}$	f_0
0	61,6
0,01	60,8
0,02	59,9
0,03	59,1
0,04	58,3
0,05	57,3
0,06	56,7

Values for coefficient f_{0H}

Table 4

Hardness HRC		**60**	**58**	**55**	**50**	**45**	**40**	**35**
f_{0H}	Ball bearings	1,0	1,0	0,95	0,75	0,60	0,50	0,40
	Roller bearings	1,0	1,0	1,0	0,95	0,80	0,65	0,50

Tilting moment

Tilting moment can be calculated depending on the basic static axial load and emplacement diameter of rolling elements, using the equation:

$$M_r = \frac{C_{0a}\,T}{4},\ \text{kN m}$$

where:
C_{0a} = basic static axial load, kN
T = emplacement mean diameter of rolling elements, m

Transport and storing

Considering the specific features of these bearings, their dimensions respectively which exceed in most cases 1 meter and reach even more than 5 meters, some special conditions are required for transport and storing. The main condition which have to be observed during transport is to fasten all bearing parts so that no clearance should exist between them. Thus, contact imprints, which have detrimental influence on bearing operation and its rating life, will be avoided. These bearings should be transported and stored only in horizontal position. Shocks should be avoided.

Mounting of slewing bearings

Special care should be given while mounting these bearings.

The flatness of surfaces on which bearings are to be mounted should be checked by means of a thickness gauge set, after the slewing bearing has been placed on the mounting surface.

When mounting the bearing, the non-hardened area of the raceway (the distance between the beginning and end of the high-frequency surface hardened area) should be considered. It is marked by "C" on the outside or inner surface of both rings.

This part of bearing must be outside the maximum loaded area. The place where the pitch diameter of gear has maximum ovalness, in case of external gear and minimum ovalness, in case of internal gear, which are marked with paint on three neighboring teeth should be mounted near the differential-drive pinion. The permissible values of flatness deviations depending on bearing size and type are given in table 5.

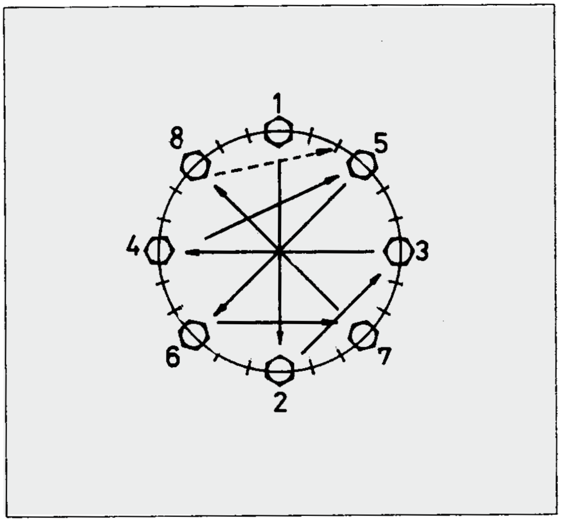
Permissible flatness deviations

Table 5

Pitch diameter T		**Permissible deviations**		
over	up to	Double row ball slewing bearing	Single row ball slewing bearing	Cylindrical roller slewing bearing
mm				
—	**1 000**	0,20	0,15	0,10
1 000	**1 500**	0,25	0,19	0,12
1 500	**2 000**	0,30	0,22	0,15
2 000	**2 500**	0,35	0,25	0,17
2 500	**4 000**	0,40	0,30	0,20
4 000	**6 000**	0,50	0,40	0,30
6 000	**8 000**	0,60	0,50	0,40

If these values cannot be obtained either from the manufacturing point of view or from the economical one, fluid plastics are allowed to be used, as they bind by cooling and compensate for flatness deviations.

After suitable bearing placing the fastening screws should be tightened until the above mentioned values of force and moment are reached following the succession shown below (see table 1). A dynamometrical wrench can be used for tightening.



Lubrication and maintenance

At delivery (if no special prescriptions mentioned) bearings will be lubricated with grease U 170 Li 2, national standard STAS 8961 both on raceways and gear. The first relubrication of raceways and gear should be done immediately after mounting. Plenty of grease should be used in order to create a continuous layer all over the circumference and also a grease rib under seals or labyrinth.

Grease is necessary to be uniformly distributed. For that reason, bearing should rotate during lubrication. The relubrication interval should be chosen depending on the operating conditions as follows: for ball bearings it is generally of 100 operating hours and for roller bearings of 50 operating hours. In tropical and high moisture environment and in case of continuous rotating movement relubrication should be done once in a week. Lubrication can be less frequent in case of turning machines, e.g. road trailers, tram bogie joints. Relubrication is absolutely necessary before and after a long non-operating period, especially during winter-time. Water should be prevented from penetrating to the raceways, while cleaning the machinery. Then it must be greased abundantly. No further control is necessary excepting the periodical control of fastening screws.

Slewing bearings in applications. Selection of bearing type

Slewing bearings are used in various applications, such as motor cranes, harbour cranes, hydraulic excavators, various rotating platforms, siderurgical equipments, bogies for metropolitan and tram cars, manipulators, foundry equipments etc.

Beside bearing dimensions and technical data, in this catalogue one can also find diagrams showing the tilting moment and limit values of static loads which are helpful when selecting the proper bearing for certain operating conditions.

After calculating the force F_a and resultant moment M_r, the bearing is selected so that the intersection point of the values of resultant force F_a and moment M_r to be placed under the respective curve (see the following example), also considering the screws used for bearing mounting on the assembly (strenght class 8.8, 10.9 or 12.9).

Example

It is necessary to determine the type and size of a slewing bearing used for a crane, as shown in the adjoint figure. The bearing has to support the following forces:

$F_1 = 3 \times 10^4$ N
$F_2 = 0{,}8 \times 10^4$ N
$F_3 = 4 \times 10^4$ N
$F_4 = 1{,}2 \times 10^4$ N
$F_5 = 2 \times 10^4$ N
$F_6 = 2 \times 10^4$ N
$F_7 = 0{,}8 \times 10^4$ N

$l_1 = 45$ m
$l_2 = 20$ m
$l_3 = 2$ m
$l_4 = 12$ m
$l_5 = 20$ m
$l_6 = 1{,}5$ m

1. For maximum bearing loading, including the wind force:

$$F_a = \sum_{i=1}^{n} F_n = F_1 + F_2 + F_3 + F_4 + F_5 + F_6 = (3 + 0{,}8 + 4 + 1{,}2 + 2 + 2)\times 10^4 = 13\times 10^4 \text{ N}$$

$$M_r = [(F_1 + F_2)l_{1max} + F_3 l_3 - F_4 l_4 - F_5 l_5 - F_6 l_6 + F_7 l_7]\times 10^4 =$$
$$= [(3 + 0{,}8)\times 45 + 4\times 20 - 1{,}2\times 2 - 2\times 12 - 6\times 20 + 0{,}5\times 1{,}5]\times 10^4 = 105{,}35\times 10^4 \text{ N m}$$

2. For maximum bearing loading with an overload of 25%, without wind force:

$$F_a = \sum_{i=1}^{n} F_n = F_1\times 1{,}25 + F_2 + F_3 + F_4 + F_5 + F_6 = (3\times 1{,}25 + 0{,}8 + 4 + 1{,}2 + 2 + 2)\times 10^4 = 13{,}75\times 10^4 \text{ N}$$

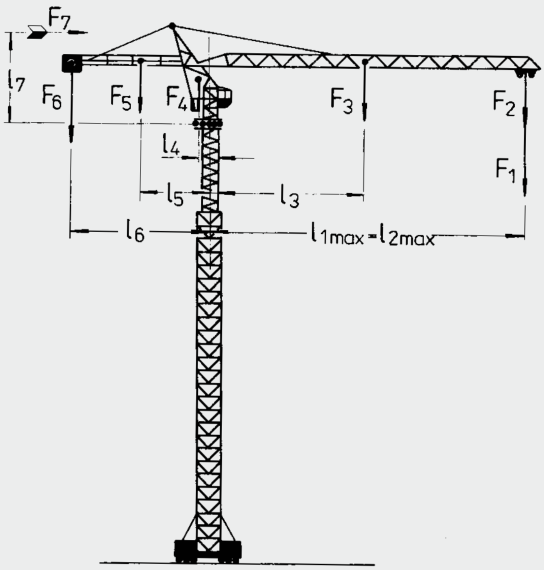
$$M_r = [(F_1\times 1{,}25 + F_2)l_{1max} + F_3 l_3 - F_4 l_4 - F_5 l_5 - F_6 l_6]\times 10^4 =$$
$$= [(3\times 1{,}25 + 0{,}8)\times 45 + 4\times 20 - 1{,}2\times 2 - 2\times 12 - 6\times 20]\times 10^4 = 138{,}35\times 10^4 \text{ N m}$$

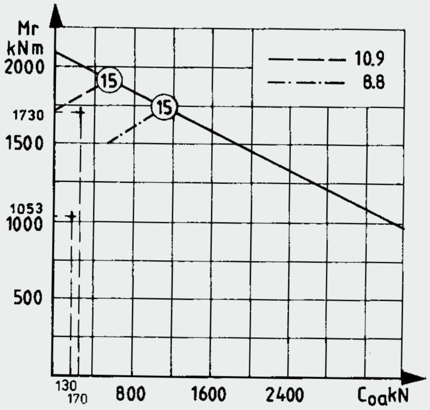
The adequate results obtained at point 2 will be multiplied by an overload coefficient $c = 1{,}25$.

$$F_a' = F_a c = 13{,}75\times 1{,}25\times 10^4 = 17{,}1875\times 10^4 \text{ N,}$$

$$M_r' = M_r c = 138{,}35\times 1{,}25\times 10^4 = 172{,}9375\times 10^4 \text{ N m.}$$

The values resulting from the calculation of crane load should be placed under the diagram of the bearing which is to be selected. In this case, the designation of one of the bearings which can support these loads is VI.10.1380TNF81. This bearing can be used with screws from the strenght class 8.8, in case 1. In case 2, when the value of the overload coefficient is c= 1,25,the bearing should be tightened with screws from the class 10.9, as it results from the diagram


F7
l7
F6
F5
F4
F3
F2
F1
l4
l5
l3
l6
l1max = l2max


Mr
kNm
2000
1730
1500
1053
1000
500
130
170
800
1600
2400
CoakN
10.9
8.8
⑮
⑮

Single row ball slewing bearings with external gear, VE.10 type

Non-standardized

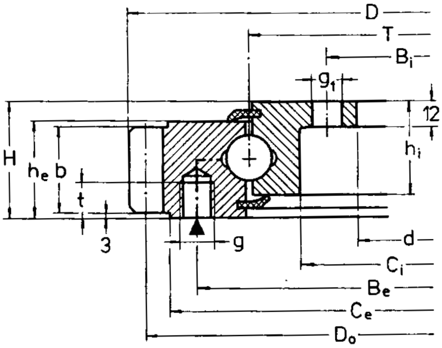


Fig.1

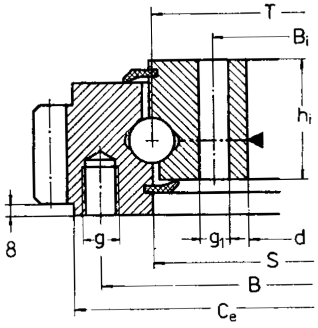


Fig. 2

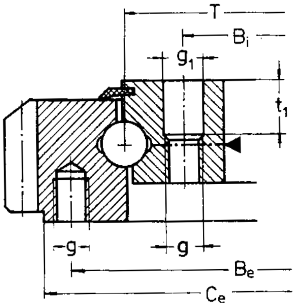


Fig.3

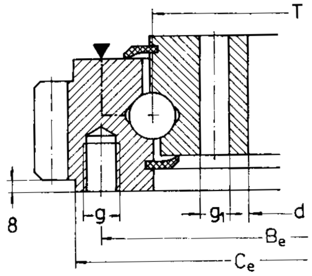


Fig.4

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t	t_1
mm														
544	434	642	56	462		609	505	46	585	46	M12	18	20	
744	634	834	56	662		807	703	45,5	785	45,5	M12	18	20	
980	886	1 080	82	922	979	1 042		55	1 015	73	M16	18	30	
	886	1 082	82	922	979	1 045		55	1 015	73	M16	18	30	30
	886	1 080	82	922	979	1 042		55	1 015	73	M16	18	30	
1 047	915	1 220	100	960	1 048		930	90	1 130	90	M24		50	
1 114	980	1 290	114	1 035		1 240	985	85	1 198	90		22		
	980	1 289	114	1 035		1 240	985	85	1 198	90		22		
1 140	990	1 296	135	1 026	1 170	1 255		125	1 220	90		23		
1 205	1 075	1 392	100	1 125	1 230	1 207	1 090	90	1 285		M24		50	

▶ grease nipple
1) non equidistant holes

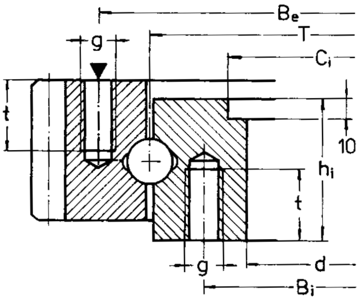


Fig.5

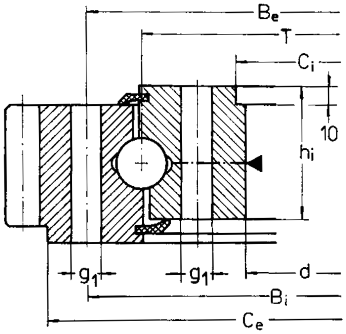


Fig.6

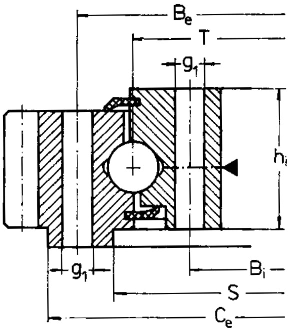


Fig.7

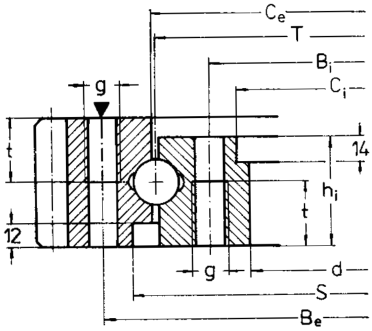


Fig.8

n_i	n_e	D_0	m	Z	b	x m	Grease nipples no.	Grease nipples type	Designation	Fig.	Diagram position	Weight
							pcs.	—				kg
14	14	630	6	105	40		4	A2	**VE.10.0544F**	1	1	40,2
16	16	828	6	138	40	–3	4	A2	**VE.10.0744V**	1	2	56
30	30	1 064	8	133	50		5	A3	**VE.10.0980F**	2	3	120
30	30	1 048	8	131	70	+10	3	A3	**VE.10.0980AF**	3	3	120
30	30	1 064	8	133	50		5	A3	**VE.10.0980BF**	4	3	120
36	36	1 200	10	120	90		6	A3	**VE.10.1047V**	5	4	308
20	20	1 280	5	256	75		4	A3	**VE.10.1114ATN**	6	6	322
32 1)	20	1 250	10	125	75	+10,5	4	A3	**VE.10.1114TN**	6	5	319
24	24	1 280	8	160	80		4	A3	**VE.10.1140V**	7	7	314
36	36	1 368	12	114	100		4	A1+U3	**VE.10.1205V**	8	8	406

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Single row ball slewing bearings with external gear, VE.10 type

Non-standardized

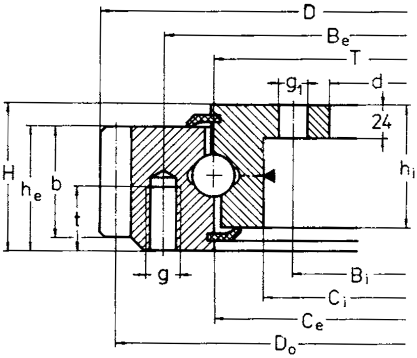


Fig. 9

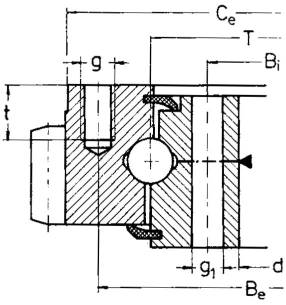


Fig. 10

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t	t_1
mm														
1 249,837	1 107	1 400	88,5	1 145		1 247	1 190	72	1 305	68	M16	22	30	
1 275	1 155	1 456	135	1 195		1 395		130	1 355	112	M24x2	26	40	
1 462	1 330	1 644	142	1 385		1 585		132	1 540	104	M24	30	70	65
1 490	1 300	1 737,6	123	1 372		1 680		118	1 608	113		36		
1 810	1 655	2 020	153	1 695		1 970		142	1 930	105		27		
	1 656,5	2 020	163	1 695		1 970		152	1 930	105		27		
2 335	2 220	2 484	120	2 290	2 340	2 425		100	2 384	100	M22		30	
2 348	2 230	2 500	120	2 270		2 450	2 235	105	2 410	100	M20	22	45	
2 660	2 500	2 855,2	185	2 560		2 810	2 610	160	2 760	160		22		
2 985	2 790	3 228	200	2 844				180	3 124	140		33		
3 210	2 990	3 509	190	3 080		3 395	3 000	165	3 340	155		34		
4 320	4 150	4 564	162	4 215				112,5	4 425	145	M24		25	

▶ grease nipple
n_i = number of holes in inner ring
n_e = number of holes in outer ring

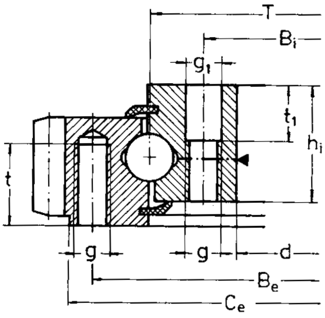


Fig.11

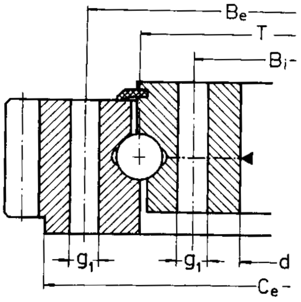


Fig.12

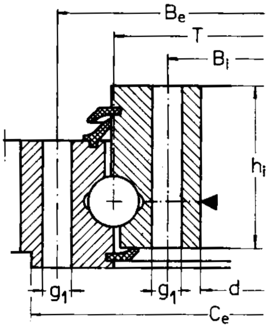


Fig.13

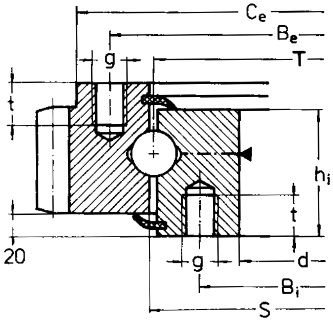
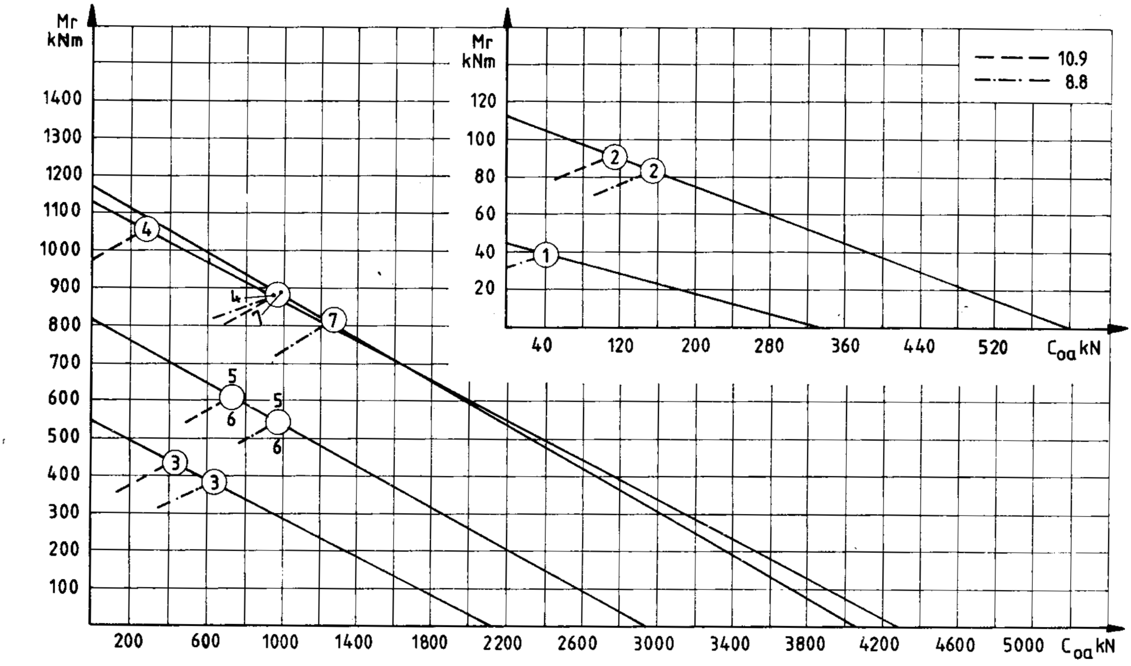


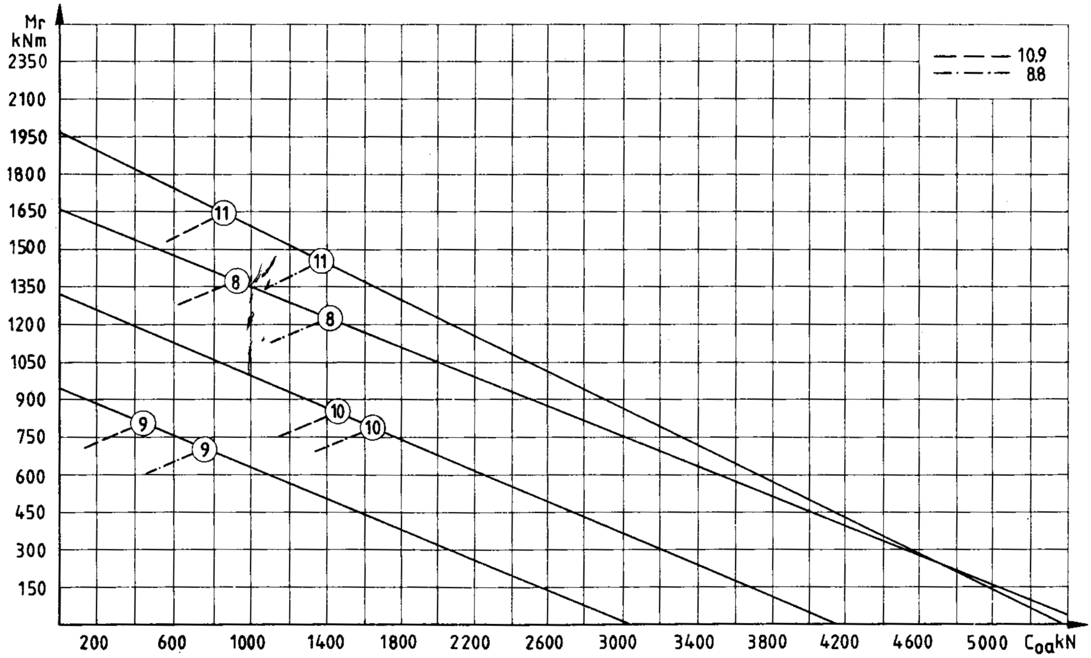
Fig.14

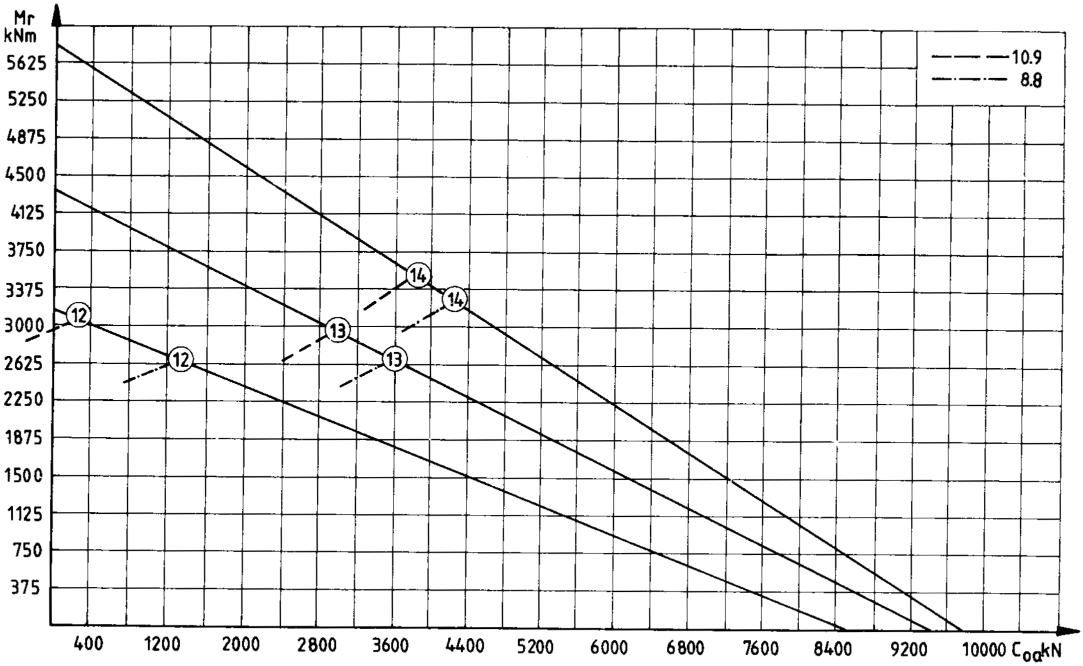
n_i	n_e	D_0	m	Z	b	x m	Grease nipples no.	Grease nipples type	Designation	Fig.	Diagram position	Weight
							pcs.	—				kg
28	48	1 380	10	138	65		4	A3	**VE.10.1250TN**	9	9	225
24	12	1 430	14	102	80	–0,5	8	A3	**VE.10.1275F**	10	10	513
36	36	1 620	12	135	94		4	A3	**VE.10.1462TN**	11	11	560
39$^{1)}$	40	1 704	12	142	96	+6	5	A3	**VE.10.1490TN**	12	12	740
32	32	2 000	10	200	90		4	A3	**VE.10.1810TN**	13	13	856
32	32	2 000	10	200	90		4	A3	**VE.10.1810ATN**	13	13	888
24	24	2 466	9	274	80		4	A3	**VE.10.2335V**	14	14	633
40	40	2 480	10	248	80		6	A3	**VE.10.2348**	4	15	694
48	48	2 839,2	8	354	80	–3,6	4	A3	**VE.10.2660V**	6	16	1 520
44	44	3 204	12	267	130		8	A3	**VE.10.2985**	6	17	2 460
60	60	3 456	18	192	125	+9	6	A3	**VE.10.3210**	6	18	2 740
8	8	4 536	14	324	85		3	A3	**VE.10.4320**	5	19	2 124

1) non equidistant holes

Single row ball slewing bearings with external gear, VE.10 type



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4875
4500
4125
3750
3375
3000
2625
2250
1875
1500
1125
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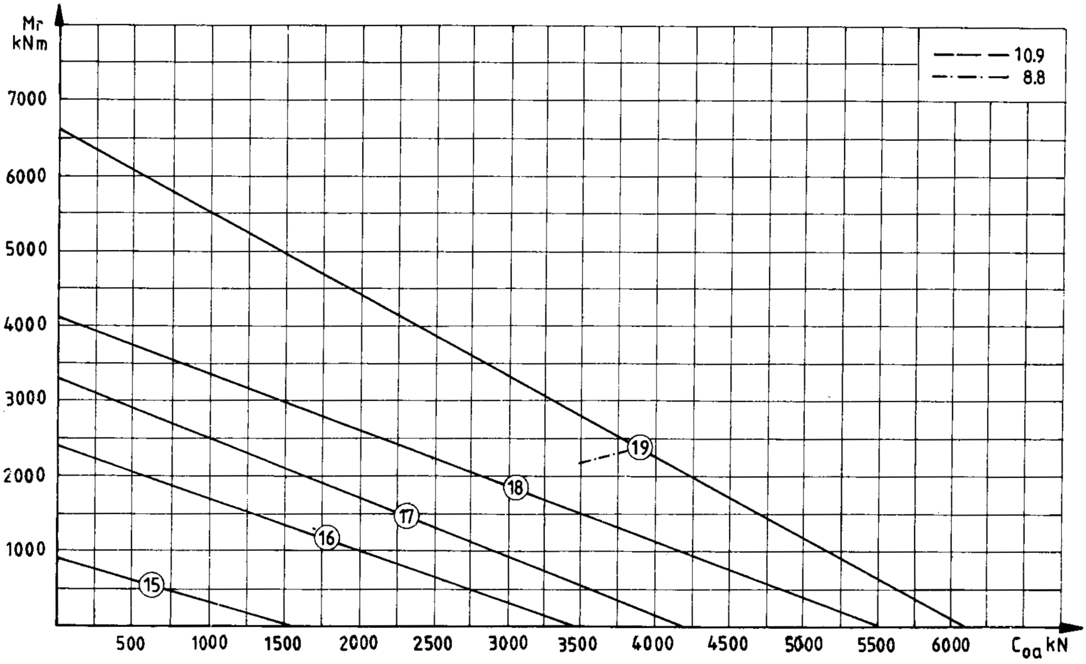
375
400
1200
2000
2800
3600
4400
5200
6000
6800
7600
8400
9200
10000 C_{oa} kN
10.9
8.8
12
12
13
13
14
14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kNm
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6000
5000
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
C_{oa} kN
10.9
8.8
15
16
17
18
19

Single row ball slewing bearings with internal gear, VI.10 type

Non-standardized

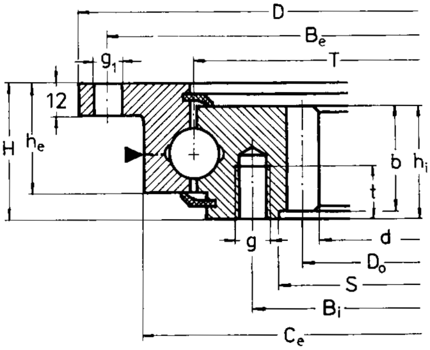


Fig.1

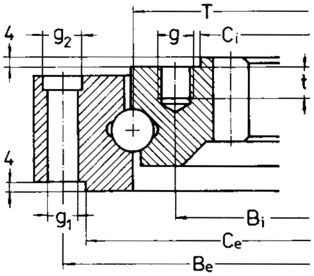


Fig.2

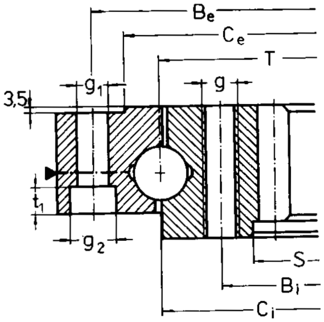


Fig.3

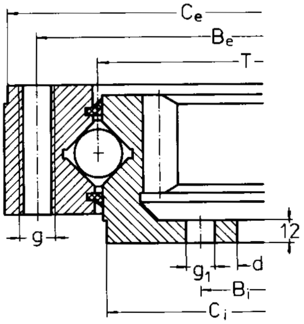


Fig. 4

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	g_2	t	t_1
mm															
414	326,5	518	56	375	355			45,5	490	45,5	M12	18		20	
525	449,36	595	47	495		560	475	43	575	40	M8	8,5	14	13	10
544	445,2	648	56	505	476			45,5	620	45,5	M12	18		20	
625	496	740	59	560	520	660	626	59	700	54	M16	17,5	26		18
768	650	842	77	686		840	758	75	810	59	M12	13			
895	785,2	972	82	845	820	970	892	63	945	78	M16	18		40	39
978	854	1 066	102	926		1 065	957	85	1 035	96	M16	18		35	
980	854	1 066	75	926		1 065	970	65	1 035	70	M16	18			35
	856	1 066	75	926	880	1 065	970	65	1 035	70	M16	18			35

▶ grease nipple
1) non equidistant holes

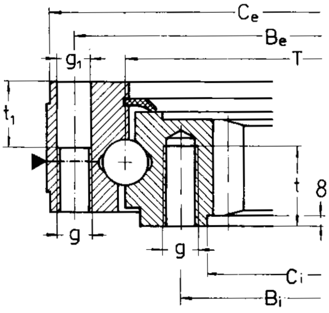


Fig.5

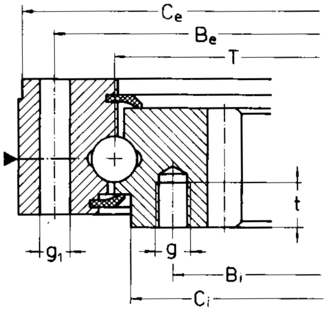


Fig.6

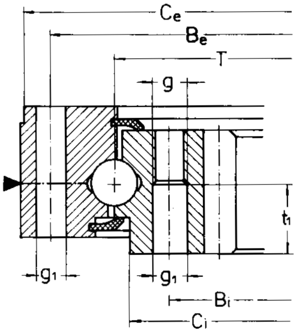


Fig.7

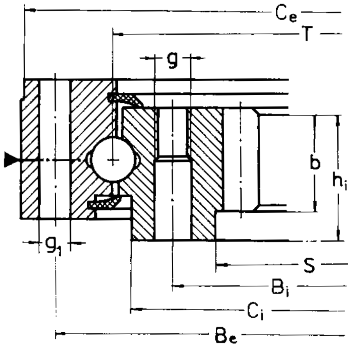


Fig.8

n_i	n_e	D_0	m	Z	b	x m	Grease nipples no.	type	Designation	Fig.	Diagram position	Weight
							pcs.	—				kg
16	15	335	5	67	37,5		4	A2	**VI.10.0414V**	1	1	28,1
12	12	455	3,5	130	35	–0,525			**VI.10.0525F**	2	2	33,3
25	13	456	6	76			4	A2	**VI.10.0544F**	1	3	41,4
16	16	504	4	126	50,5		4	A3	**VI.10.0625F**	3	4	92,1
16	14$^{1)}$	720	4	180	50		4	A3	**VI.10.0768F**	4	5	75,4
30	30	800	8	100	50		6	A3	**VI.10.0895FF81**	5	6	116
26$^{1)}$	24$^{1)}$	870	10	87	85		4	A3	**VI.10.0978TNF81**	6	7	178
26$^{1)}$	24$^{1)}$	870	10	87	65		4	A3	**VI.10.0980FF81**	7	8	137
26$^{1)}$	24$^{1)}$	864	4	216	50		4	A3	**VI.10.0980AF**	8	8	143

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Single row ball slewing bearings with internal gear, VI.10 type

Non-standardized

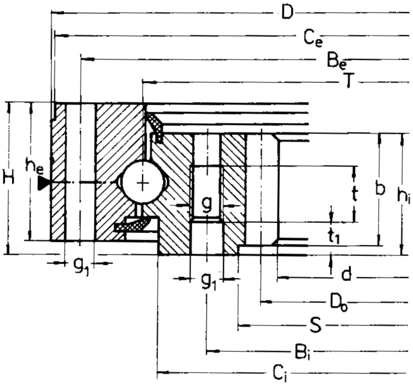


Fig.9

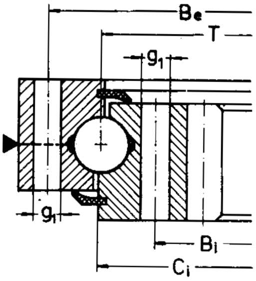


Fig. 10

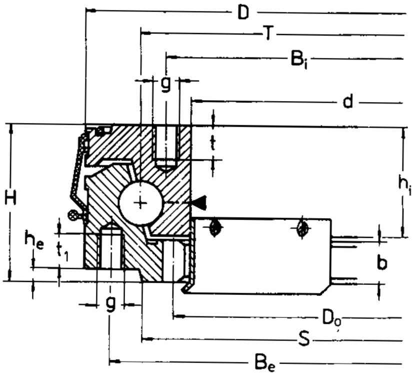


Fig.11

Dimensions

T	d	D	H	Bi	S	Ce	Ci	hi	Be	he	g	g1	t	t1
mm														
1 150	986,4	1 256	102	1 085	1 045	1255	1 132	85	1 215	96	M20	22	40	15
	988,8	1 256	102	1 085	1 045	1255	1 132	85	1 215	96	M20	22	40	15
1 250	1 090	1 362	79	1 182			1 251	70	1 318	63		22		
1 300	1 250	1 350	85	1 274	1 282			60	1 330	12	M8		22	16
	1 250	1 350	85	1 274	1 282			60	1 330	12	M8		22	16
1 380	1 171,268	1 530	127	1 290		1410	1 360	107	1 480	114		30		
	1 172	1 530	127	1 290		1410	1 360	107	1 480	114		27		
	1 172	1 530	127	1 280		1410	1 360	107	1 480	114		33		
	1 172	1 550	137	1 285	1 240	1410	1 360	114	1 480	114		30		
1 595	1 505	1 650	90	1 540	1 560			64,6	1 620	5,6	M10		15	
1 615	1 408	1 752	140	1 525	1 473	1750	1 610	122	1 705	134		26		

▶ grease nipple
1) non equidistant holes

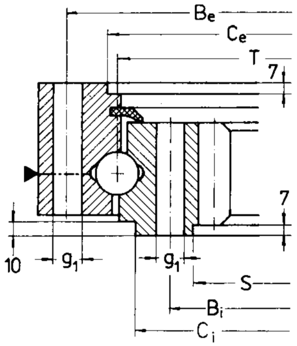


Fig.12

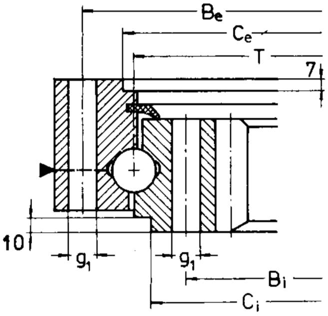


Fig.13

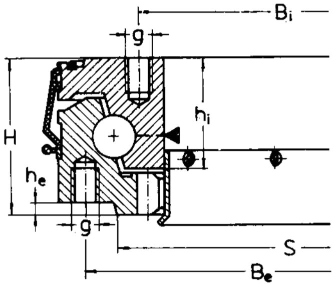


Fig.14

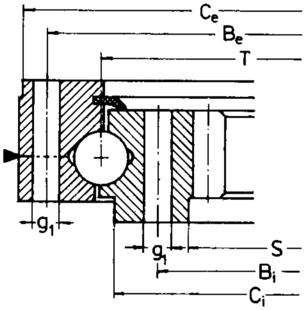


Fig.15

							Grease nipples		Designation	Fig.	Diagram position	Weight
n_i	n_e	D_0	m	Z	b	x m	no.	type				
							pcs.	—				kg
30	30	1 008	12	84	79		5	A3	**VI.10.1150TNF81**	9	9	268
30	30	996	4	249	79		5	A3	**VI.10.1150ATN**	9	9	265
40	40	1 100	10	110	70	−5	8	A3	**VI.10.1250TN**	10	10	237
30	32	1 260	3	420	22	+2,55	1	B1	**VI.10.1300AL**	11	11	78
29 1)	32	1 260	3	420	22	+2,55	1	B1	**VI.10.1300L**	11	11	78
24	24	1 190	10	119	107		4	A3	**VI.10.1380ATNF81**	12	13	575
24	24	1 176	14	84	107	−10,75	4	A3	**VI.10.1380TNF81**	12	12	561
38	38	1 188	12	99	107		4	A3	**VI.10.1380CTNF81**	12	14	560
36	36	1 176	14	84	107	−10,75	4	A3	**VI.10.1380DTNF81**	13	15	615
30	30	1 520	4	380	30		1	B1	**VI.10.1595L**	14	16	99
40	40	1 428	14	102	115	+3,5	4	A3	**VI.10.1615ATNF81**	15	17	656

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Single row ball slewing bearings with internal gear, VI.10 type

Non-standardized

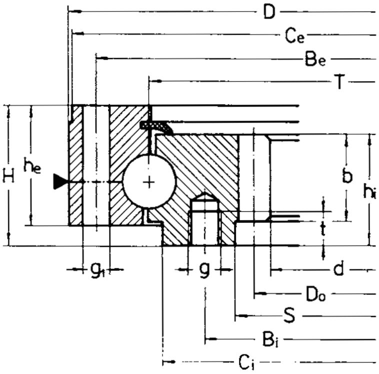


Fig.16

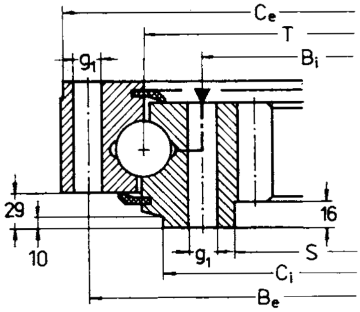


Fig.17

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t	n_i
mm														
1 615	1 418,4	1 752	140	1 525	1 473	1 750	1 610	122	1 705	134	M24	26	50	40
	1 418,4	1 752	140	1 525	1 473	1 750	1 610	122	1 705	134	M24	26	50	40
1 740	1 510	1 908	159	1 634	1 580	1 905	1 705	143	1 850	130		27		40
	1 520	1 908	178	1 655	1 600	1 905	1 705	142	1 850	150	M24	27	50	40
1 750	1 548	1 860	125	1 675	1 610		1 636	125	1 820	90	M16		20	36
1 895,2	1 825	1 990	125	1 925			1 880	32	1 865		M24			34 1)
2 127,5	2 024	2 275	91	2 076	2 048	2 140	2 050	66	2 206	88	M14		24	35 1)
2 234	1 974,5	2 414	169	2 120	2 045	2 410	2 206	149	2 345	140		33		48

▶ grease nipple
1) non equidistant holes

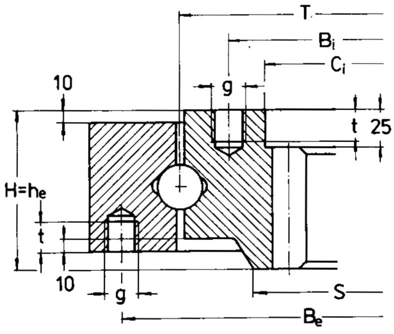


Fig.18

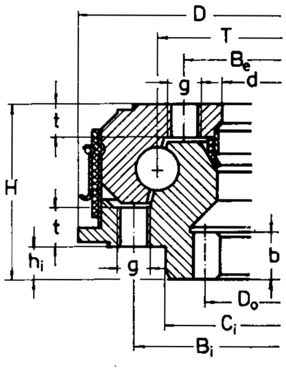


Fig.19

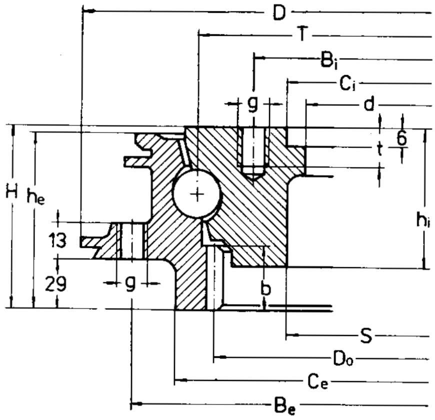


Fig.20

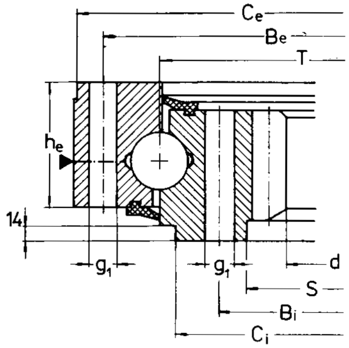
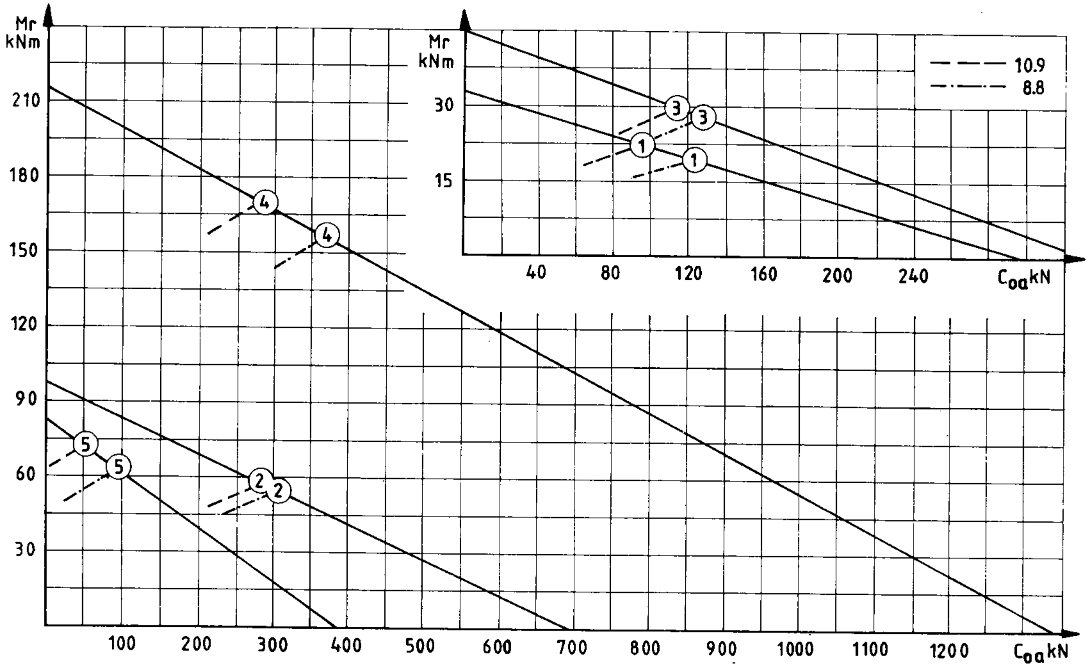


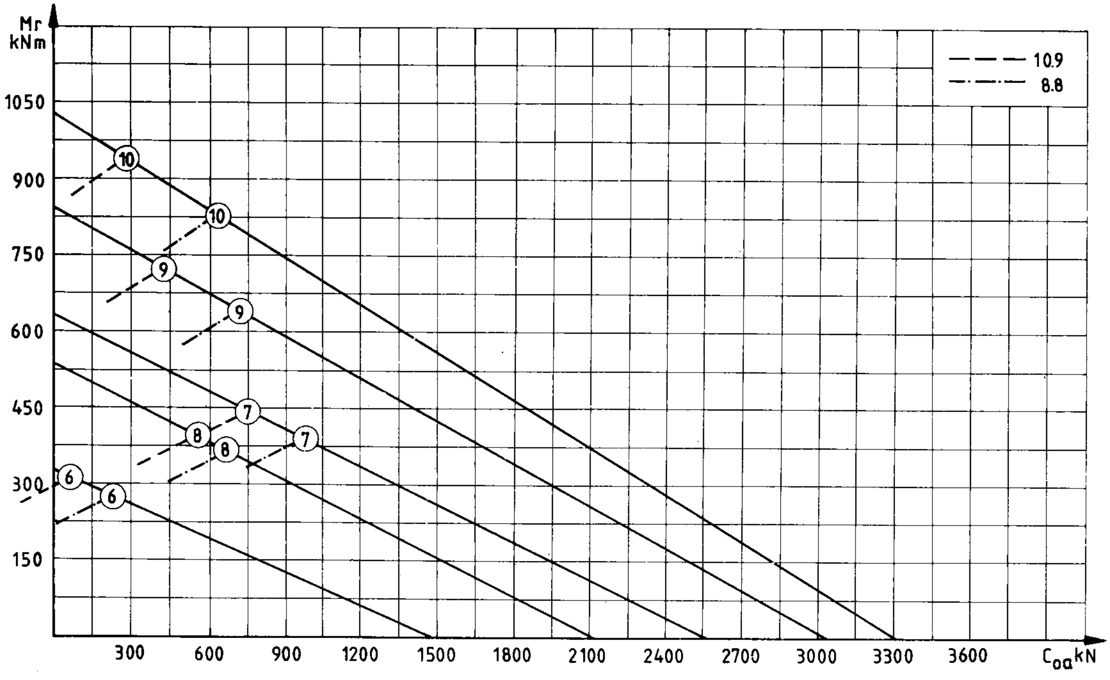
Fig.21

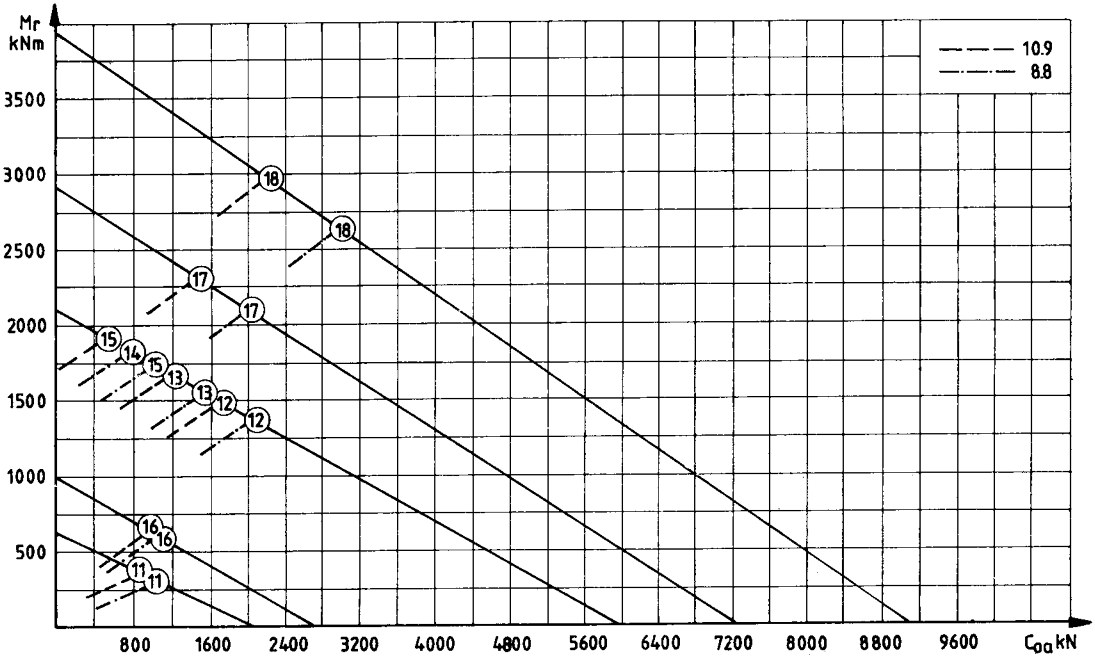
n_e	D_0	m	Z	b	x m	Grease nipples no.	Grease nipples type	Designation	Fig.	Diagram position	Weight
						pcs.	—				kg
40	1 440	12	120	115		4	A3	**VI.10.1615TN**	16	17	670
40	1 440	12	120	115		4	A3	**VI.10.1615TNF81**	16	17	670
40	1 512	14	108	127	+11,48	4	A3	**VI.10.1740ATNF81**	17	18	922
40	1 504	16	94	127	+24	4	A3	**VI.10.1740TN**	16	18	953
36	1 566	9	174	100				**VI.10.1750FF81**	18	19	585
36	1 840	5	368	44				**VI.10.1895F**	19	20	282
35	2 100	5	420	32	+5			**VI.10.2128F**	20	21	286
48	1 988	14	142	123	+7	6	A3	**VI.10.2234TNF81**	21	22	1 438

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Single row ball slewing bearings with internal gear, type VI.10



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8800
9600
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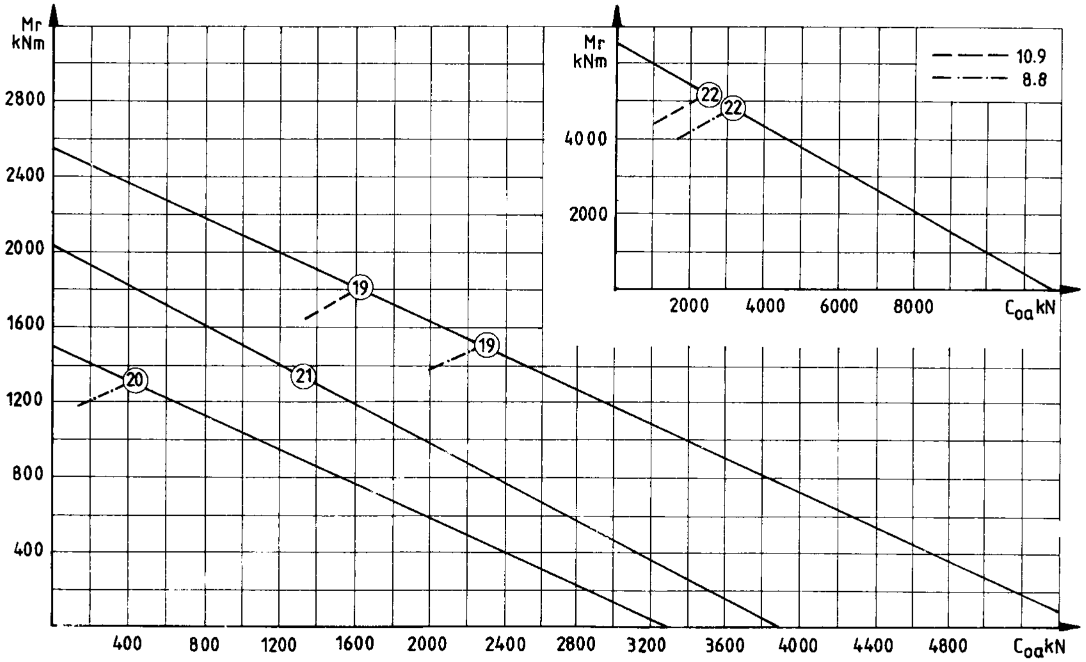
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3200
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4400
4800
Coa kN
19
19
20
21
Mr
kNm
4000
2000
2000
4000
6000
8000
Coa kN
10.9
8.8
22
22

Single row ball slewing bearings, without gear, VU.10 type

Non-standardized

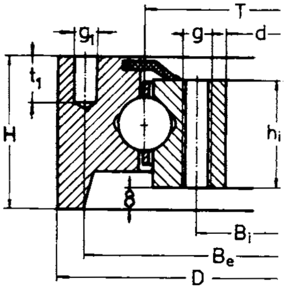


Fig.1

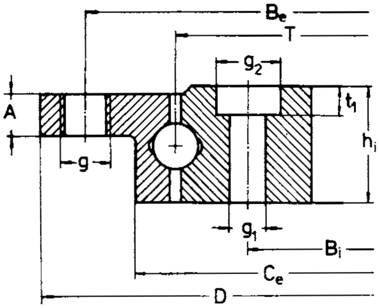


Fig.2

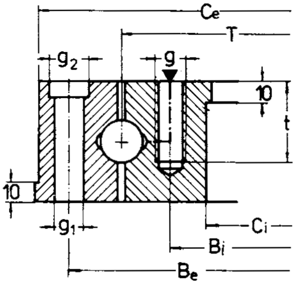


Fig.3

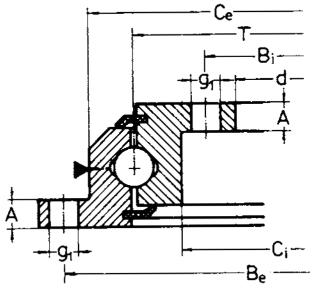


Fig.4

Dimensions

T	d	D	H	B_i	C_e	C_i	h_i	B_e	h_e	A	g	g_1	g_2	t
mm														
380	324	444	54	344			38	424	54		M10			14
387	300	475	50	340	420		50	450	48	20	M14	11	18	
407	315	500	60	345	498	317		470			M12	14	20	35
414	304	518	56	332	453	375	45,5	490	45,5	12		18		
544	434 505	648 648	56 56	462	583 583	505 505	46 46	620 620	46 46	12 12		18 18		
570	470	670	62	520		488	50	630	50			9	15	
641	534	748	56	562	687	595	46	720	46	12		18		
741	634	848	56	662	787	695	46	820	46	12		18		
782	680	880	90	715							M16			15
844	734	948	56	762	883	805	45,5	920	45,5	12		18		
870	650	1 170	104	730	960	770	104	1110	73		M20	22		

▶ grease nipple
1) non equidistant holes

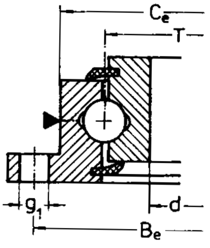


Fig.5

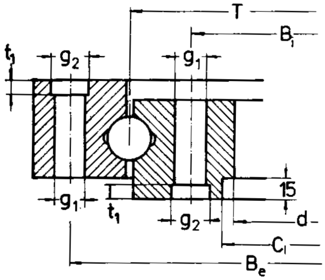


Fig.6

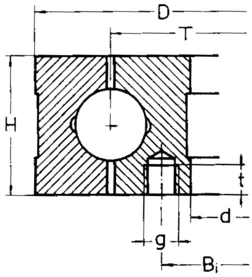


Fig.7

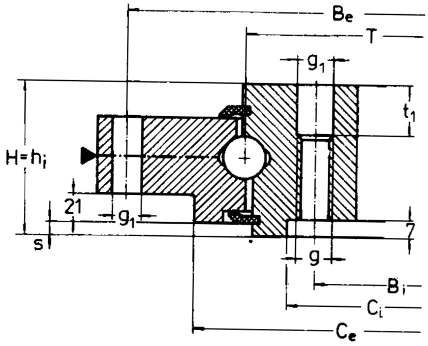


Fig.8

t_i	n_i	n_e	Grease nipples no.	Grease nipples type	**Designation**	Fig.	Dia-gram posi-tion	Weight	Pro-ducer
			pcs.	—				kg	—
	5[1)]	2			**VU.10.0380**	1	2	19,2	
11	12	12			**VU.10.0387V**	2	2	29,7	4
14	16	16	4	A2	**VU.10.0407TN**	3	3	50,7	4
	12	8	4	A2	**VU.10.0414V**	4	4	24,7	4
	14	10	4	A2	**VU.10.0544V**	4	5	35,5	4
		10	4	A2	**VU.10.0544AV**	5	5	31,0	4
10	10	10			**VU.10.0570FP4**	6	6	66,0	4
	16	12	4	A2	**VU.10.0641V**	4	7	40,0	4
	16	12	4	A2	**VU.10.0741V**	4	8	46,5	4
	6				**VU.10.0782V**	7	9	164	4
	18	14	4	A2	**VU.10.0844V**	4	10	50,5	4
45	12	12	4	A3	**VU.10.0870TN**	8	11	404	4

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Single row ball slewing bearings, without gear, VU.10 type

Non-standardized

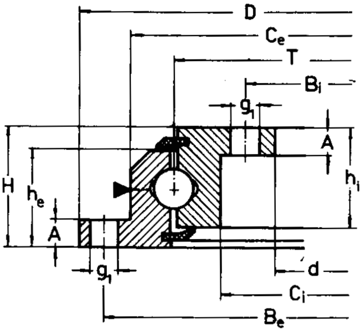


Fig.4

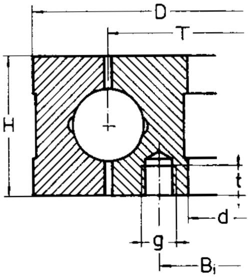


Fig.7

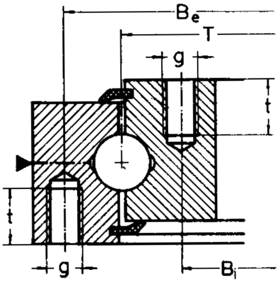


Fig.9

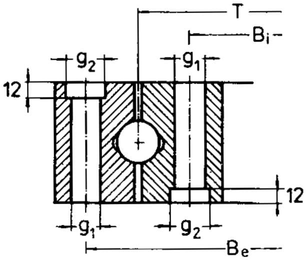


Fig.10

Dimensions

T	d	D	H	B_i	C_e	C_i	h_i	B_e	h_e	A	g
mm											
875	740	1 000	124	780			114	960	114		M24
890	800	980	57	830				950		21	
942	834	1 048	56	862	988	896	46	1 020	46	12	
952,5	805	1 100	90	845	1 017	893	71	1 060	71	21	
1 048	950	1 150	80	995							M16
1 093	985	1 200	56	1 015	1 134	1 052	46	1 170	46	15	
1 235	1 093	1 377	140	1 135	1 375	1 095	120	1 335	120		M20
1 355	1 205	1 500	90	1 245	1 417	1 293	71	1 460	71	21	M12
2 920	2 690	3 155	250	2 750		3 018	235	3 085	185		

▶ grease nipple
1) non equidistant holes

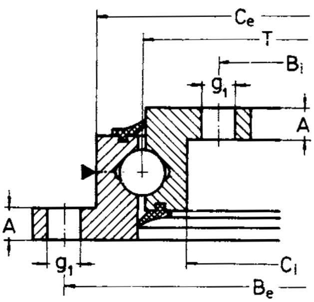


Fig.11

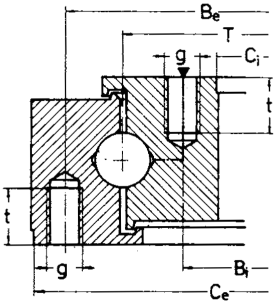


Fig.12

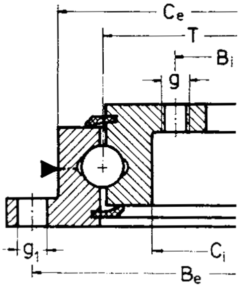


Fig.13

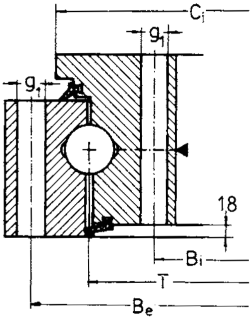
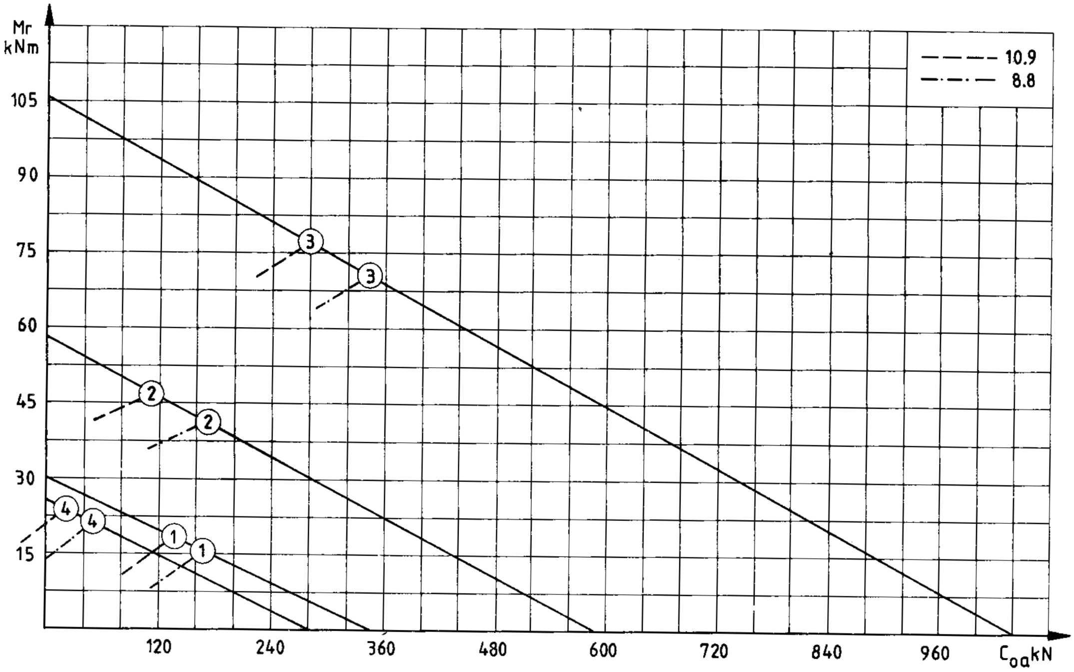


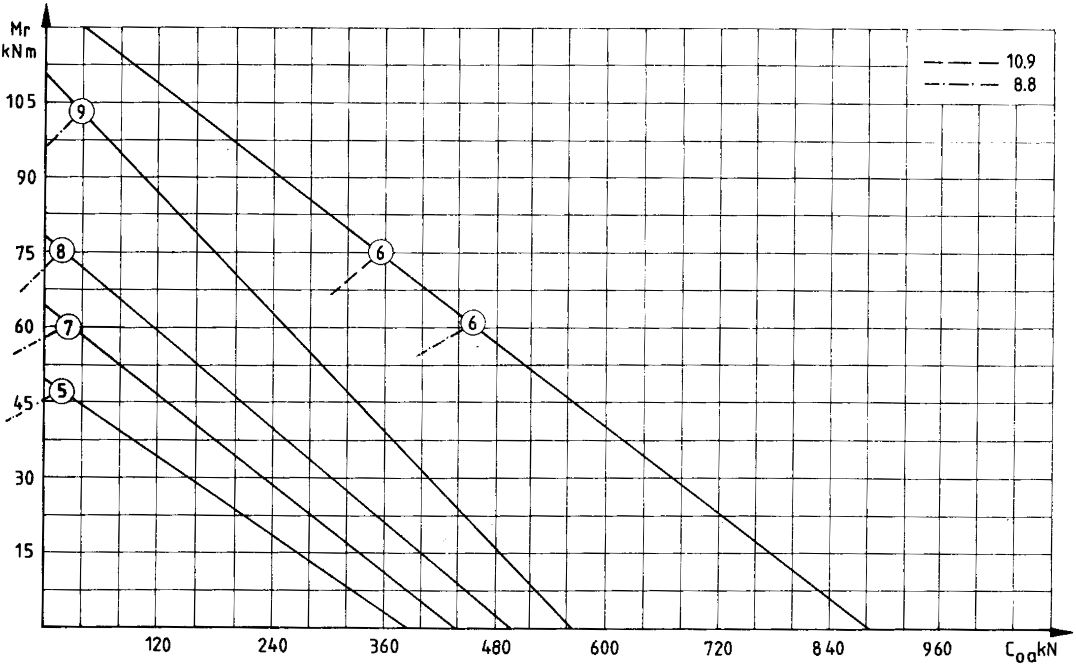
Fig.14

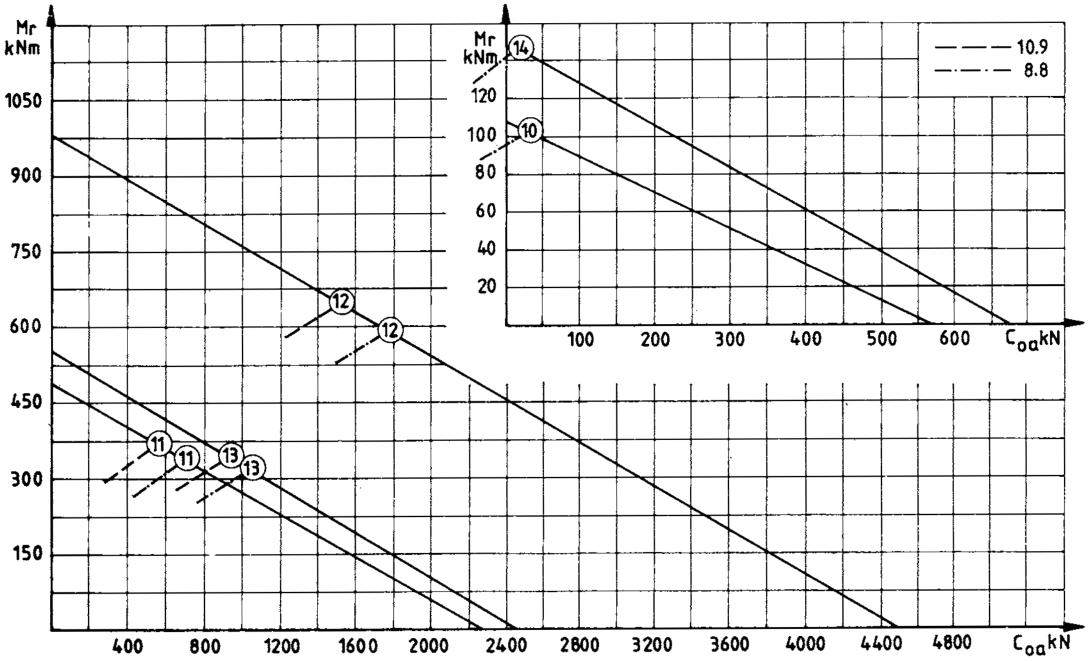
					Grease nipples		Designation	Fig.	Diagram position	Weight	Producer
g_1	g_2	t	n_i	n_e	no.	type					
					pcs.	—				kg	—
		45	12	12	4	A3	**VU.10.0875V**	9	12	291	4
11	18		10	20			**VU.10.0890ATNP4**	10	13	101	4
18			20	16	4	A2	**VU.10.0942V**	4	14	59,0	4
22			30	30	4	A2	**VU.10.0952V**	4	15	133	4
		15	6				**VU.10.1048V**	7	16	202	4
18			32[1]	32[1]	4	A1+A2	**VU.10.1093AV**	11	17	71,5	4
		50	42	42	6	A3	**VU.10.1235F**	12	18	367	4
18			18	12	6	A2	**VU.10.1355V**	13	19	214	4
39			52	52	9	A3	**VU.10.2920**	14	20	3 415	

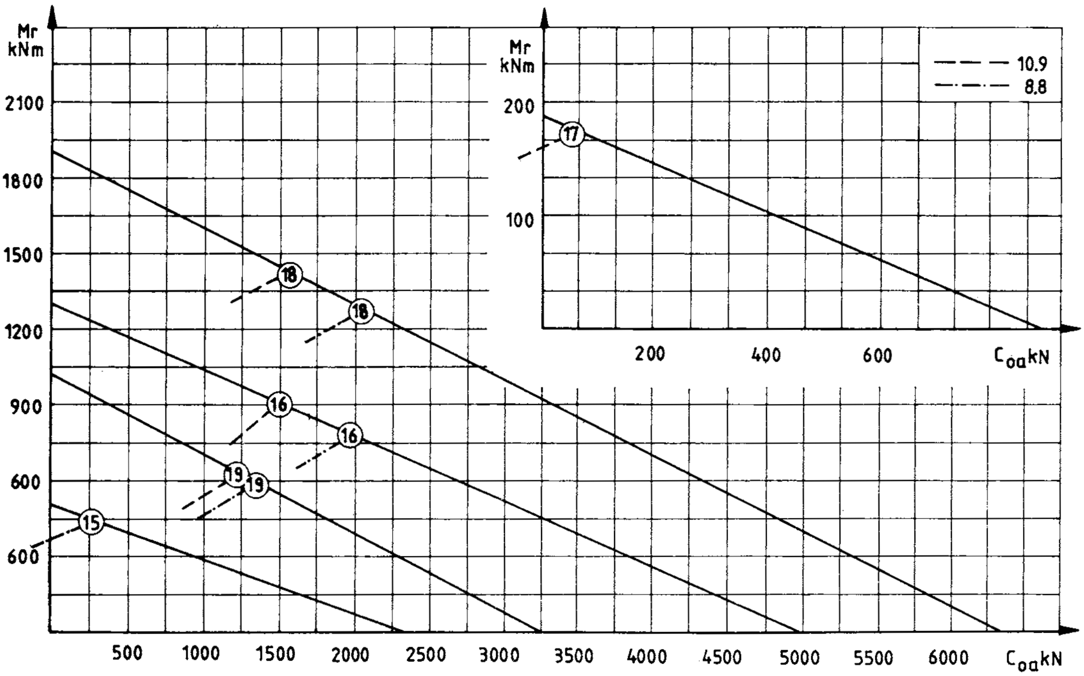
n_i = number of holes in inner ring
n_e = number of holes in outer ring

Single row ball slewing bearings, without gear, VU.10 type






Mr
kNm
1050
900
750
600
450
300
150
400
800
1200
1600
2000
2400
2800
3200
3600
4000
4400
4800
C_{oa}kN
12
12
11
11
13
13
Mr
kNm
14
10
120
100
80
60
40
20
100
200
300
400
500
600
C_{oa}kN
10.9
8.8


Mr
kNm
2100
1800
1500
1200
900
600
600
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
C_{oa}kN
18
18
16
16
19
19
15
Mr
kNm
17
200
100
200
400
600
C_{oa}kN
10.9
8.8

Single row ball slewing bearings

Non-standardized

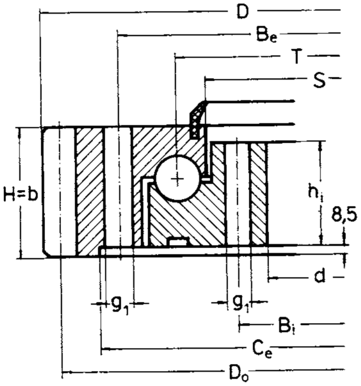


Fig.1

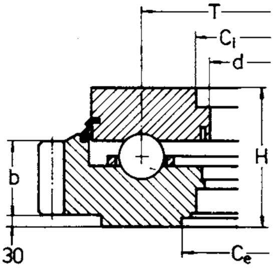


Fig.2

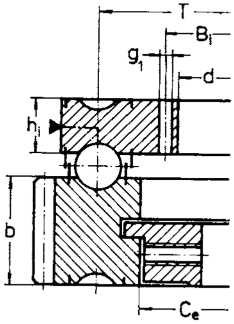


Fig.3

- with external gear, VE.10 type

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	g_2	t	t_1
mm															
1 338	1 225	1 542	65	1 265	1 306	1 456		46	1 415			18		24	24
3 700	3 370	4 200	340			3 510	3 445			225					
5 000	4 730	5 218	310	4 770		4 360		90				22		60	

- without gear, VU.10 type

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t	n_i	n_e
mm															
1 500	1 380	1 620	120	1 420		1 400	1 600	72	1 580	72	M16		25	24	24
1 600		1 880	240	1 950								26		$12^{1)}$	$12^{1)}$
2 115	2 030	2 200	65	2 060					2 170			18		36	$18^{1)}$

▶ grease nipple
1) non equidistant holes

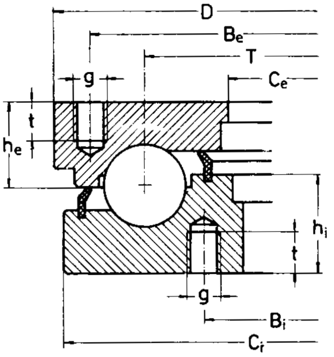


Fig.4

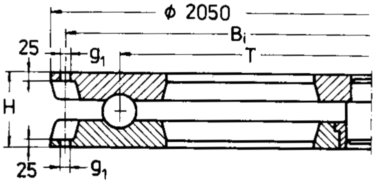


Fig.5

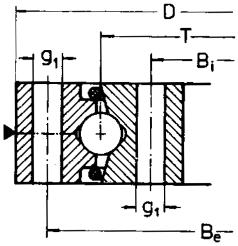


Fig.6

					Grease nipples		Designation	Axial load stat. C_{0a}	Weight	Fig.
D_0	m	Z	b	x m	no.	type				
	-				pcs.	—		kN	kg	—
1 530	6	255	65				**VE.10.1338VF81**	400	302	1
4 140	30	138	180				**VE.10.3700**	1 000	8794	2
5 192	22	236	180	-9	12	A3	**VE.10.5000**	1 090	7200	3

					Grease nipples		Designation	Axial load stat. C_{0a}	Weight	Fig.	Diagram position
D_0	m	Z	b	x m	no.	type					
					pcs.	—		kN	kg	—	
							VU.10.1500TN	2 100	475	4	21
							M-VU.10.1600V		264	5	
					2	A3	**VU.10.2115F**		261	6	22

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Ball slewing bearings

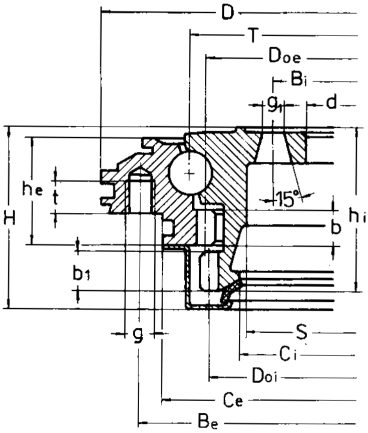


Fig.1

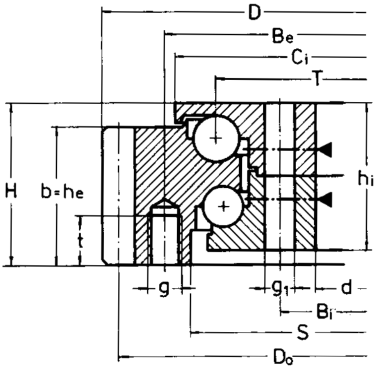


Fig.2

- single row, with internal and external gear, VIE.10 type

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t
mm													
2 127,4	1 924	2 275	165	1 978	2 048	2 158	2 066	150	2 208	94	M24	34	27

- double row, with external gear, VE.20 type

Dimensions

T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t	n_i
mm														
1 735	1 625	1 906	128	1 665	1 765	-	1 785	118	1 805	99	M24	26	45	44
1 790	1 695	1 965	107	1 730	1 820	1 890	1 840	94	1 850	85	M20	22	45	44

- double row, without gear, VU.20 type

Dimensions

T	d	D	H	B_i	C_i	C_e	h_i	B_e	B	S_i	S_e	h_e	A	A_1
mm														
884	700	1 000	86	730	768	932	47	970	850	812	888	47	8	9

► grease nipple
1) non equidistant holes

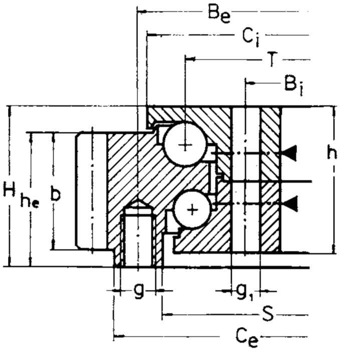


Fig. 3

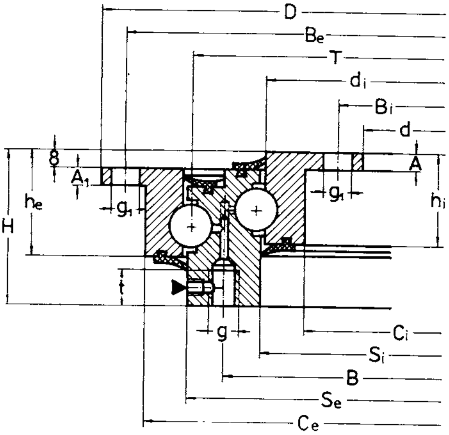


Fig. 4

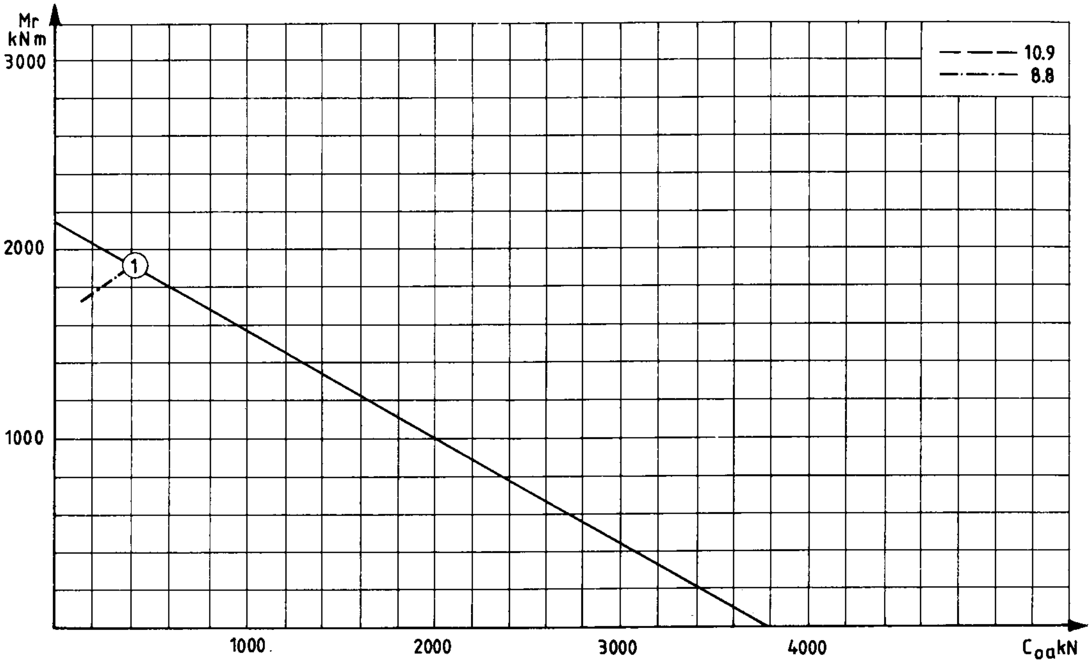
n_i	n_e	D_{0i}	D_{0e}	$m_{i,e}$	$Z_{i,e}$	b	b_1	$x_{i,e}$ m	Designation	Fig.	Dia-gram posi-tion	Weight
												kg
44$^{1)}$	46$^{1)}$	2 100	2 100	5	420	38	45	+5	**VIE.10.2128F**	1	1	450

						Grease nipples		Designation	Fig.	Dia-gram posi-tion	Weight
n_e	D_0	m	Z	b	x m	no.	type				
						pcs.	—				kg
44	1 872	12	156	99	+5	8+8	A3	**VE.20.1735F**	2	1	596
44	1 935	15	129	80	-	3+3	A3	**VE.20.1790F**	3	2	440

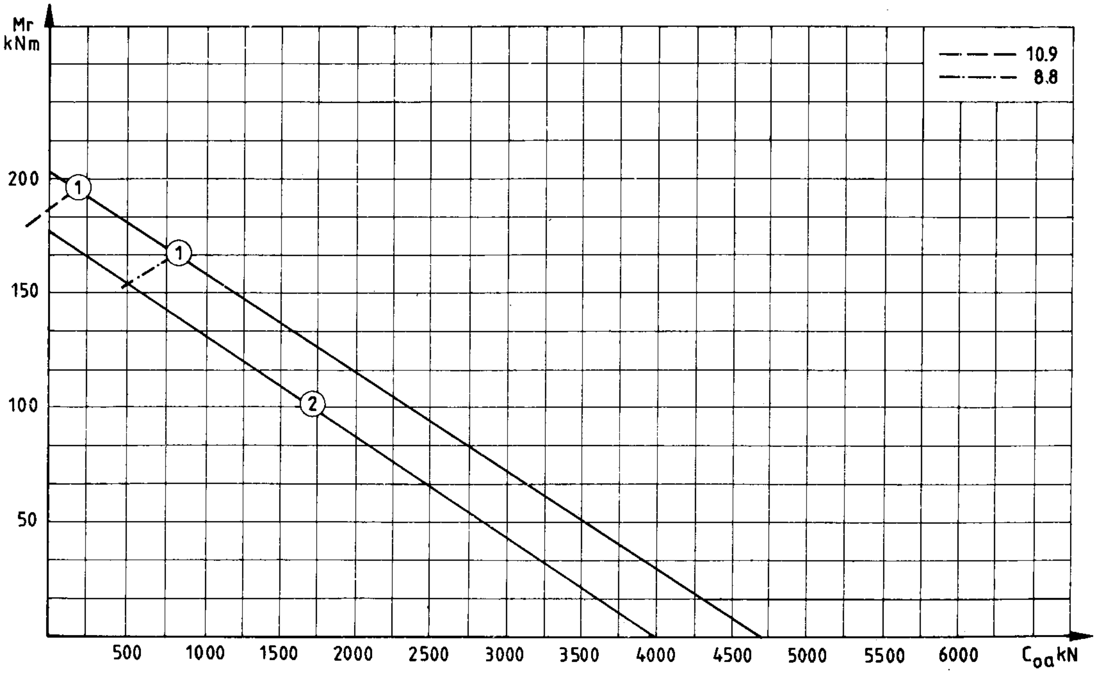
						Grease nipples		Designation	Fig.	Dia-gram posi-tion	Weight
g	g_1	t	n_i	n_0	n_e	no.	type				
						pcs.	—				kg
M16	16,5	22	8$^{1)}$	12$^{1)}$	8	6+6	(A1+U2)+A2	**VU.20.0884AV**	4	1	99

n_i = number of holes in inner ring
n_0 = number of holes in intermediate ring
n_e = number of holes in outer ring

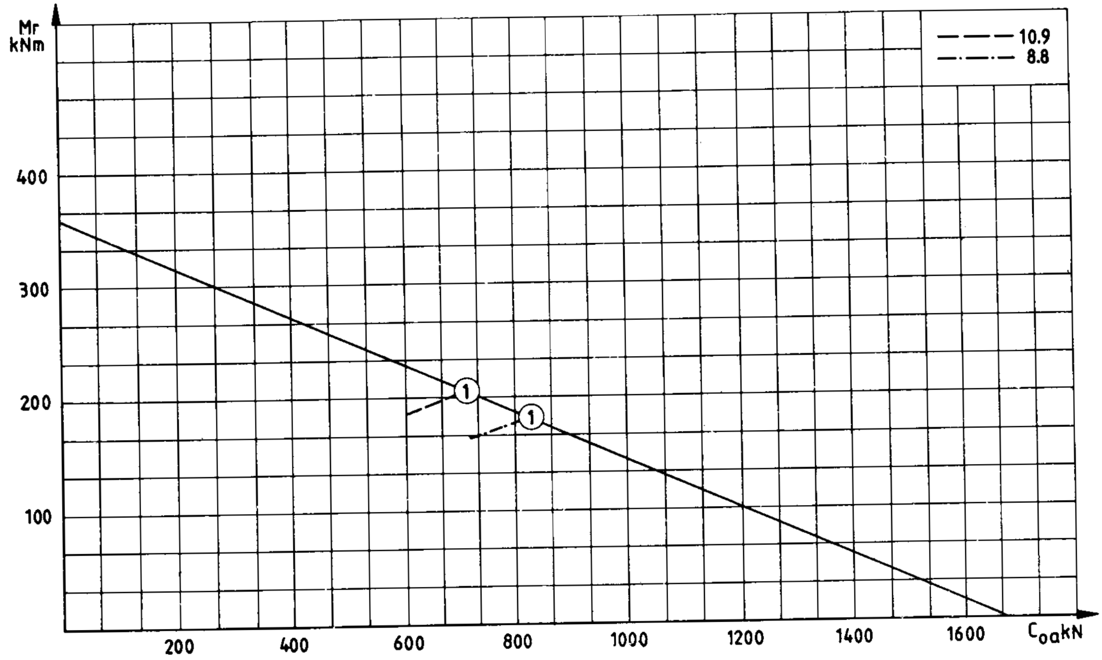
Single row ball slewing bearings with internal and external gear, type VIE.10



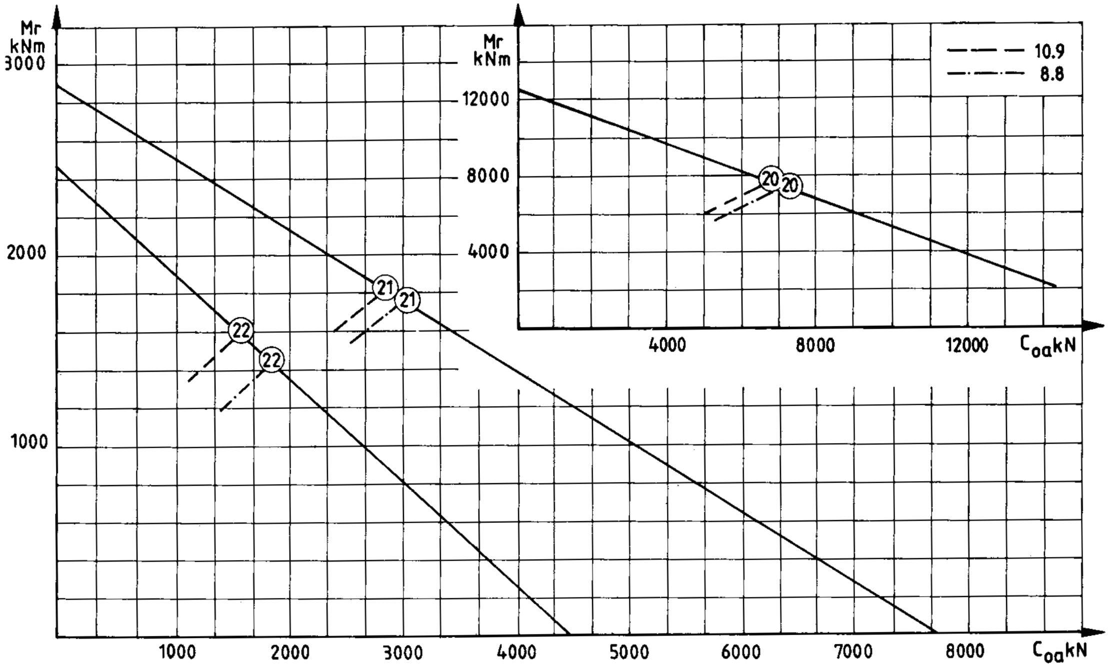
Double row ball slewing bearings with external gear, type VE.20



Double row ball slewing bearings without gear, type VU.20



Single row ball slewing bearins without gear, type VU.10



Crossed cylindrical roller slewing bearings with internal gear, XE.10 type

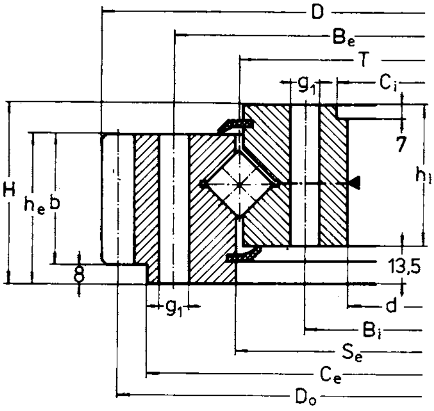


Fig.1

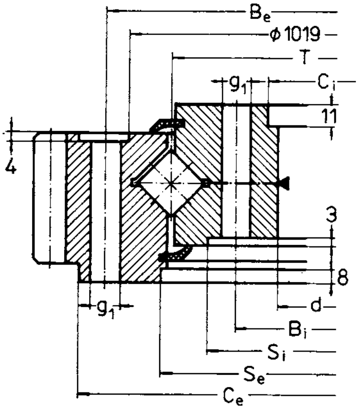


Fig.2

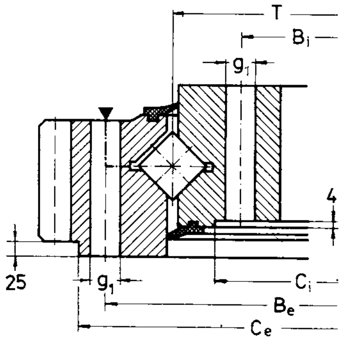


Fig.3

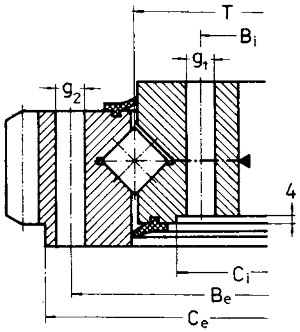


Fig.4

Dimensions

T	d	D	H	B_i	S_e	C_e	S_i	C_i	h_i	B_e	h_e	g_1	g_2	t
mm														
675	570	822	93	605	678	782		575	79,5	754	79,5	22		
980	868	1 144	100	910	993	1 090	943	870	80	1 050	79	22		
	868	1 144	100	910	993	1 088		870	88	1 050	81	22		
1 418	1 270	1 620	134	1 330	1 570			1 375	118	1 510	117	33	26	
1 782	1 580	2 040	142	1 650	1 782	1 470		1 585	126	1 910	120	39		
	1 580	2 040	142	1 650	1 782	1 470		1 585	126	1 910	120	39		
2 236	2 042	2 492	164	2 112	2 260	2 420		2 049	142	2 360	148	34	M30	59

▶ grease nipple
*) greasing by pipe
1) non equidistant holes

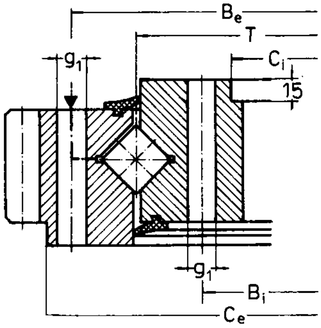


Fig.5

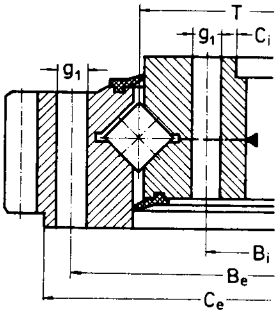


Fig.6

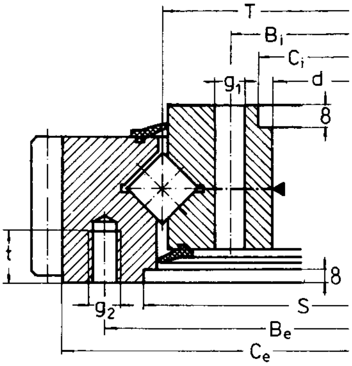
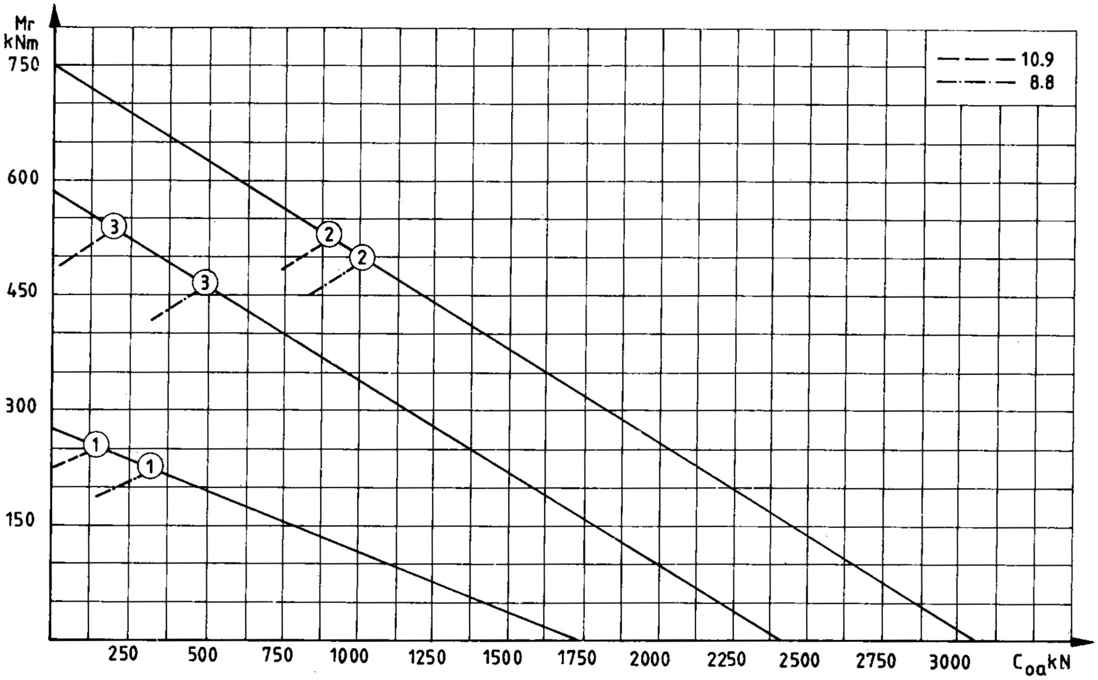


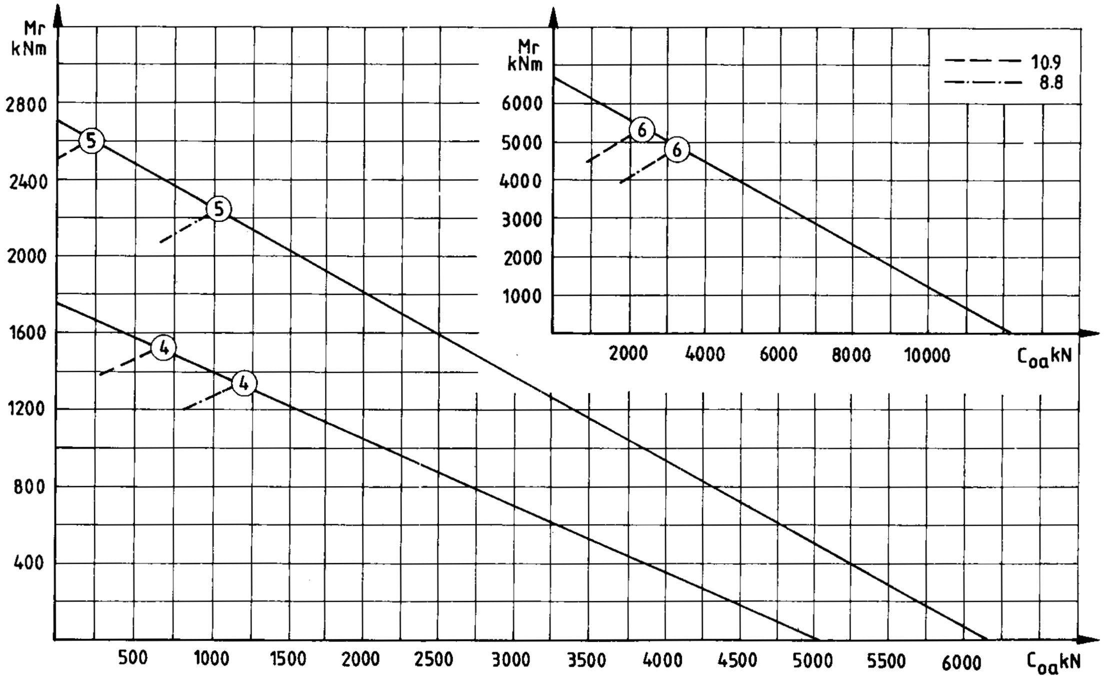
Fig.7

n_i	n_e	D_0	m	Z	b	x m	Grease nipples		Designation	Fig.	Diagram position	Weight
							no.	type				
							pcs.	—				kg
18	18	810	6	135	71,5		4	A2	**XE.10.0675F**	1	1	147
24 1) 26 1)	18 28 1)	1 136 1 122	8 11	142 102	66 68	-4	3 4+4	*) A2+A3	**XE.10.0980V** **XE.10.0980ATNF81**	2 3	2 3	226 232
23	36	1 600	10	160	85		3	*)	**XE.10.1418V**	4	4	537
24 24	24 24	2 016 2 016	12 12	168 168	110 110		6 6	A1+U3 A3	**XE.10.1782FF81** **XE.10.1782AFF81**	5 6	5 5	1 060 1 060
45	45	2 464	14	176	147		4	A3	**XE.10.2236V**	7	6	1 668

ni = number of holes in inner ring
n_e = number of holes in outer ring

Crossed cylindrical roller slewing bearings with external gear, XE.10 type





Crossed cylindrical roller slewing bearings with internal gear, XI.10 type

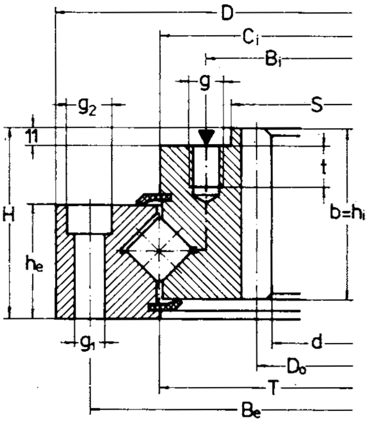


Fig.1

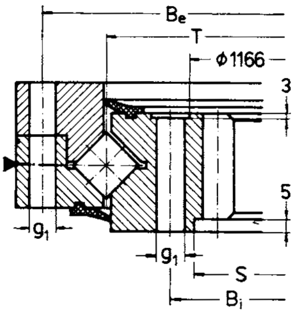


Fig.2

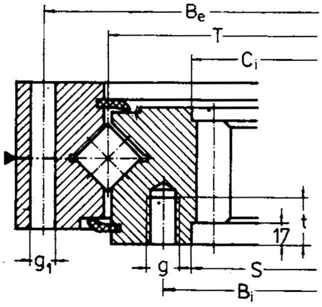
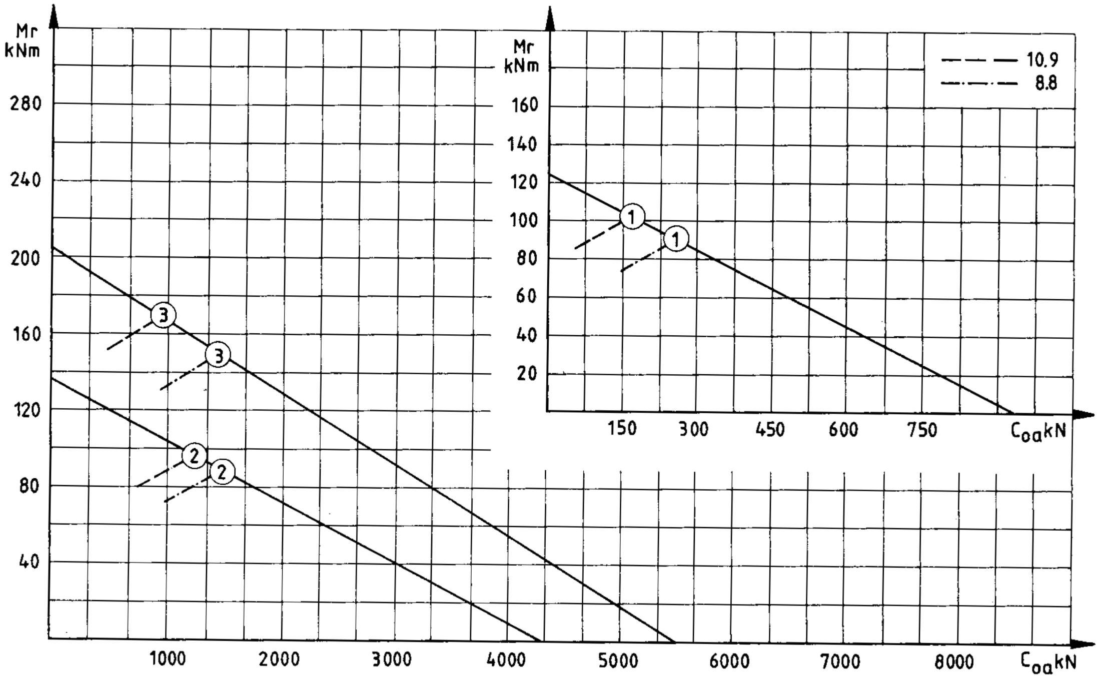


Fig.3

Dimensions

T	d	D	H	B_i	S	C_i	h_i	B_e	h_e	g	g_1	g_2	t	n_i
mm														
543	441,5	632	102	508	477	543	92	602	46	M12	18	26	25	20
1 277	1 088	1 400	95	1 195	1 165		80	1 360	80		22			24
1 465	1 308	1 600	120	1 404	1 360	1 392	110	1 550	110	25,4	27		30	36

▶ grease nipple
*) greasing by pipe



n_e	D_0	m	Z	b	x m	Grease nipples no.	type	**Designation**	**Fig.**	**Dia-gram posi-tion**	**Weight**
						pcs.	—				kg
12	450	4,5	100	92	+0,37	4	*)	**XI.10.0543TNP4**	1	1	73,4
24	1 104	12	92	75		8	A1	**XI.10.1277V**	2	2	357
36	1 320	12	110	88	-6	4	A3	**XI.10.1465TN**	3	3	505

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Crossed cylindrical roller slewing bearings without gear, XU.10 type

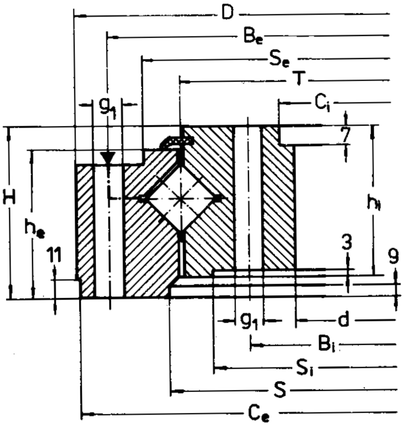


Fig.1

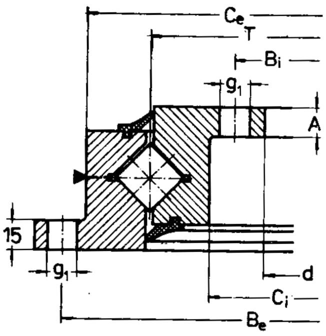


Fig.3

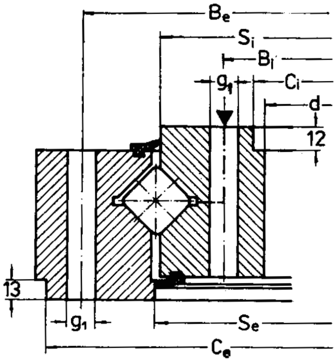
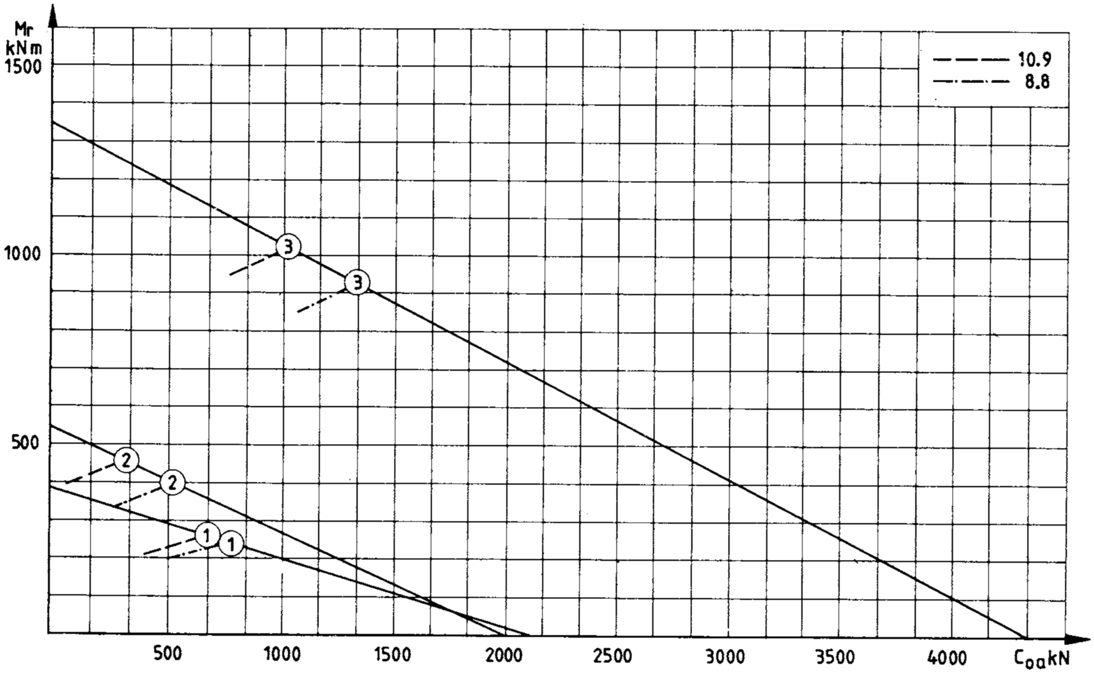


Fig.2

Dimensions

T	d	D	H	B_i	S	S_i	S_e	C_e	C_i	h_i	B_e	h_e
mm												
675	570	783	91,5	605	683	645	717	782	575	79,5	754	78
1 093	985	1 200	56	1 015				1 134	1 052	46	1 170	46
1 250	1080	1 475,5	110	1 150		1 247	1 249	1 415	1 085	100	1 350	89

▶ grease nipple
*) greasing by pipe
1) non equidistant holes



g_1	n_i	n_e	Grease nipples		Designation	Fig.	Diagram position	Weight
			no.	type				
mm			pcs.	—				kg
21	18	18	4	A2	**XU.10.0675V**	1	1	120
18	32[1])	32[1])	4	A1+U2	**XU.10.1093V**	2	2	71
27	24	24	4	*)	**XU.10.1250TN**	3	3	557

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Three-row cylindrical roller slewing bearings

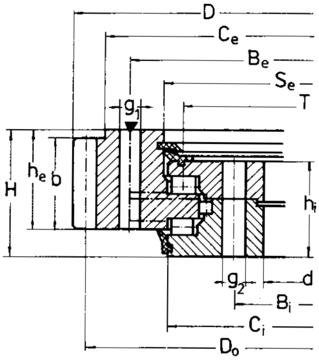


Fig.1

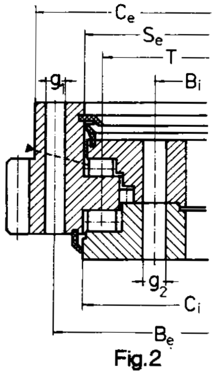


Fig.2

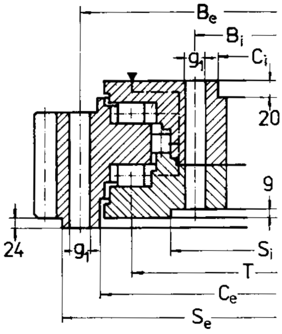


Fig.3

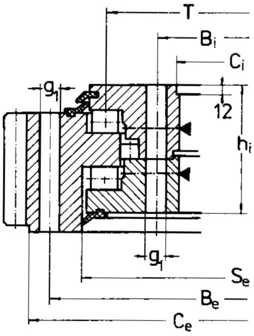


Fig.4

- with external gear, type YE.30

Dimensions													
T	d	D	H	B_i	S_i	S_e	C_e	C_i	h_i	B_e	h_e	g_1	g_2
mm													
1 228	1 070	1 440	137	1 125		1 258	1 385	1 256	112	1 320	107	26	33
1 320	1 115	1 584	223	1 195		1 371	1 520	1 378	179	1 455	179	33	45
1 763,5	1 616	1 988	138	1 670	1 706	1 913	1 812	1 618	129	1 860	104	26	
2 106	1 882	2 394	172	1 962		2 320	2 142	1 890	150	2 242	142	33	

- with internal gear, type YI.30

Dimensions														
T	d	D	H	B_i	S	C_e	C_i	h_i	B_e	h_e	g	g_1	t	t_1
mm														
1 400	1 164,46		1 547	128	1 295		1 373	1 379	102	1495	123		26	
1 563	1 255,2	1 790	218	1 400	1 312	1 519	1 532	170	1 704	205	-	42		
	1 255,2	1 790	218	1 400	1 312	1 519	1 532	170	1 704	205	M39	42		120
1 800	1 524	1 981	147	1 675	1 600	1 763	1 774	117	1 915	138	-	33		
2 233	1 980	2 410	183	2 140		2 195	2 206	153	2 345	138	M30	33	60	45

▶ grease nipple
*) greasing by pipe

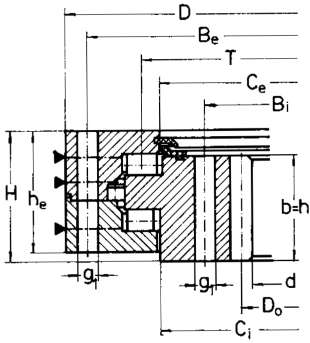


Fig.5

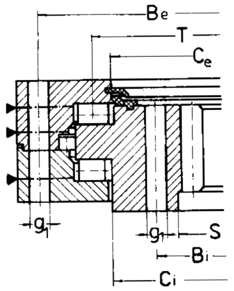


Fig.6

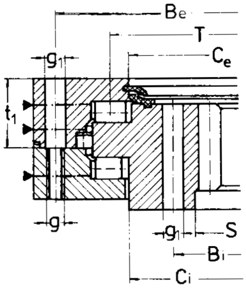


Fig.7

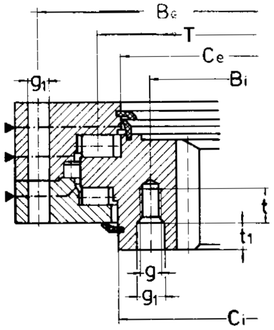


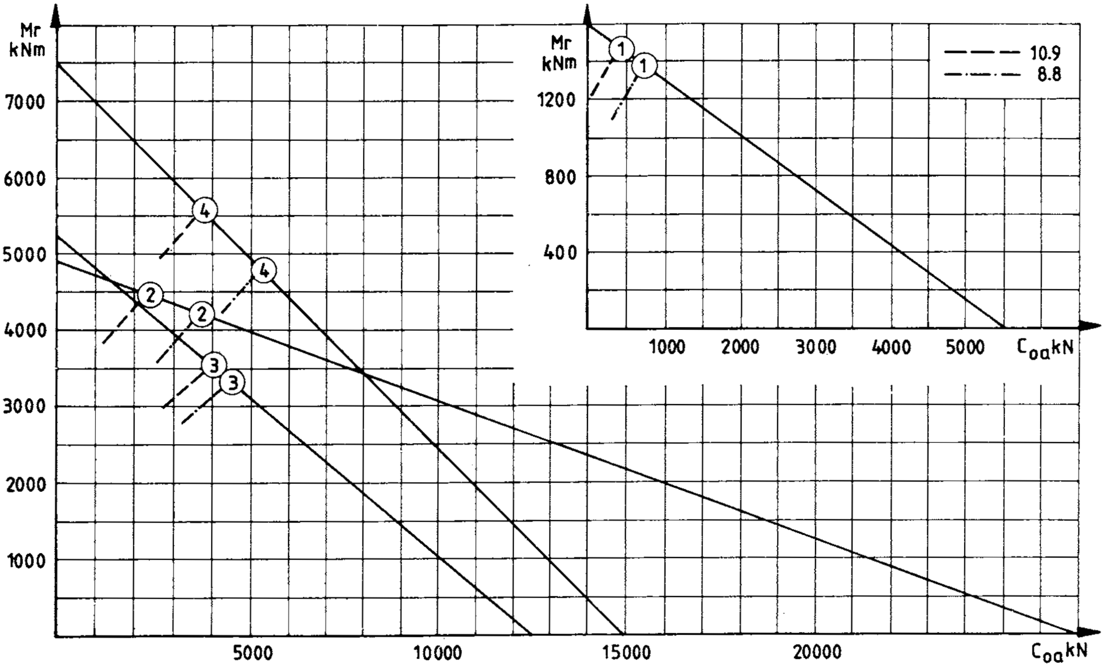
Fig.8

n_i	n_e	D_o	m	Z	b	Grease nipples no.	Grease nipples type	Designation	Fig.	Diagram position	Weight
		mm	—			pcs.	—				kg
26	36	1 420	10	142	100	3+3+3	A3	**YE.30.1228TN**	1	1	532
36	56	1 560	12	130	100	3+3	A3	**YE.30.1320TN**	2	2	1 042
44	44	1 960	14	140	80	10+5	*)	**YE.30.1765F**	3	3	760
40	40	2 366	14	169	130	6+6	A3	**YE.30.2100F**	4	4	1 657

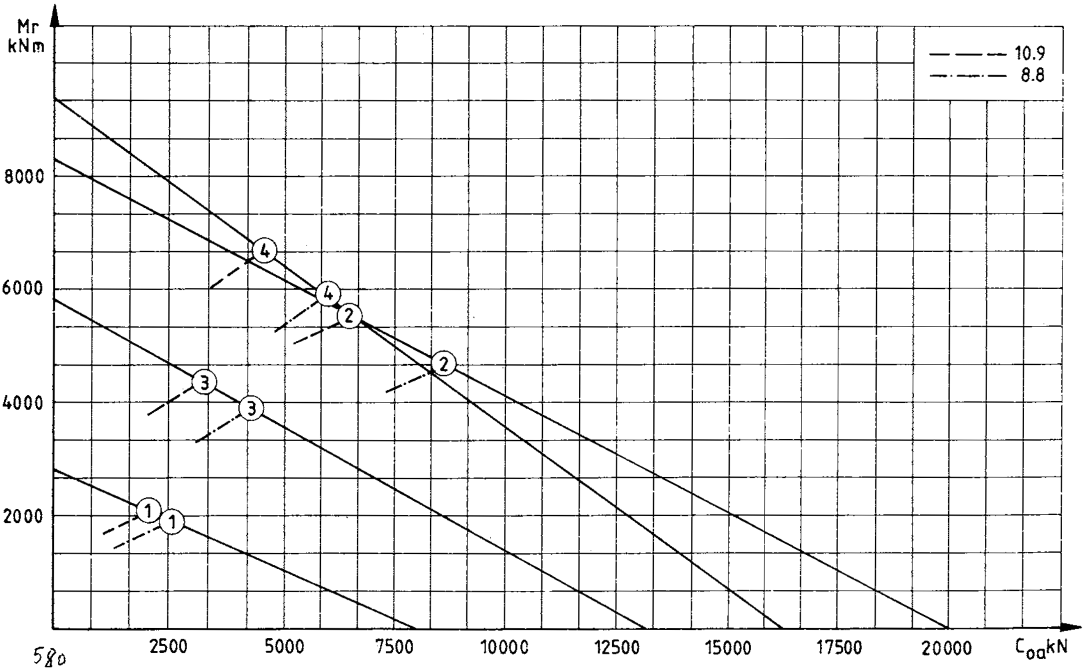
n_i	n_e	D_o	m	Z	b	x m	Grease nipples no.	Grease nipples type	Designation	Fig.	Diagram position	Weight
		mm	—				pcs.	—				kg
36	36	1 176	12	98	102	-6	3+3+3	A3	**YI.30.1400FF81**	5	1	631
40	25	1 260	12	105	145	-9,6	2+2+2	A3	**YI.30.1563ATNF81**	6	2	1 610
40	25	1 260	12	105	145	-9,6	2+2+2	A3	**YI.30.1563TNF81**	7	2	1 617
36	36	1 536	12	128	108	-6	6+6+6	A3	**YI.30.1800F**	7	3	1 124
48	48	1 980	18	110	150	-18	6+6+6	A3	**YI.30.2233FF81**	8	4	1 433

n_i = number of holes in inner ring
n_e = number of holes in outer ring

Three-row cylindrical roller slewing bearings with external gear, type YE.30



Three-row cylindrical roller slewing bearings with internal gear, type YI.30



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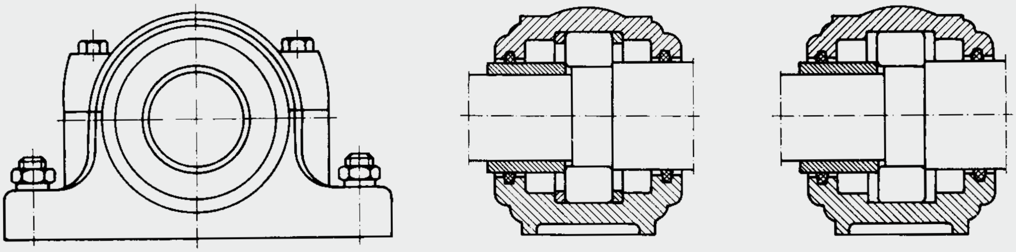
Bearing housing units

Bearing housings produced by us are intended to bearing fitting in assemblies used for various machines, equipments and apparata. These housings are generally machined of grey cast iron or pressed sheet. The bearing housing designs include: two or one- piece housing, plummer block housings, flanged housings, as shown below:

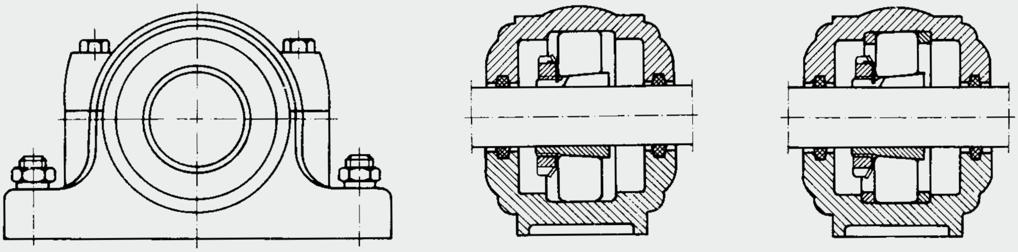
Grey cast iron, plummer block housings, for bearings with adapter sleeve:



Locating bearing

Non-locating bearing

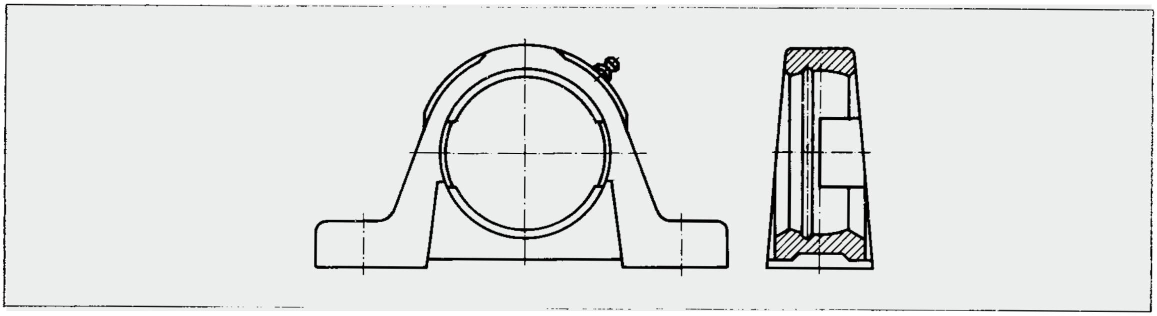
Grey cast iron, plummer block housings, for bearings with cylindrical bore:



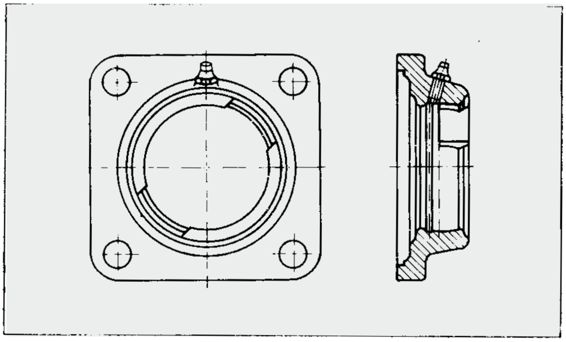
Locating bearing

Non-locating bearing

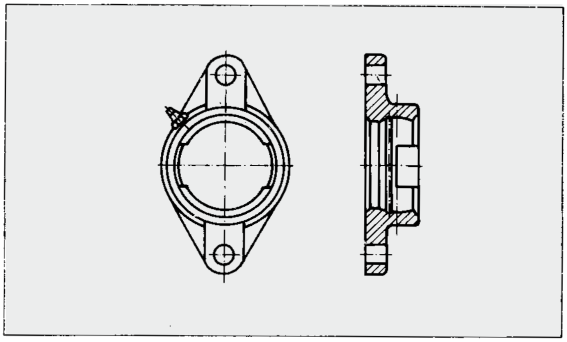
Grey cast iron housings, unsplit, for bearings with spherical outside surface and extended inner ring:
- plummer block housings, S type



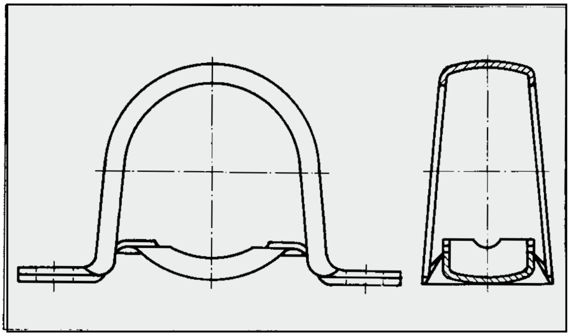
- flanged housings, F type



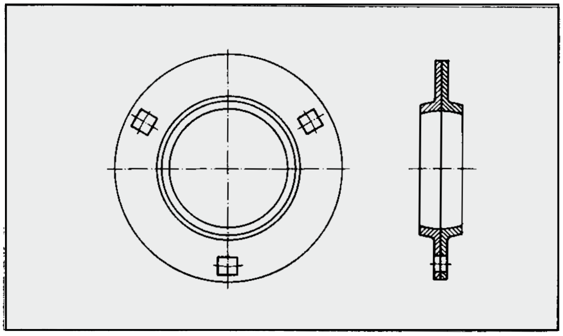
- flanged housings, OF type



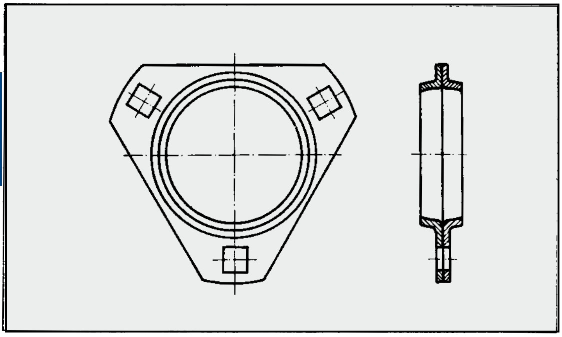
Pressed sheet housings for bearings with spherical outside surface and extended inner ring:
- plummer block housings, PT type



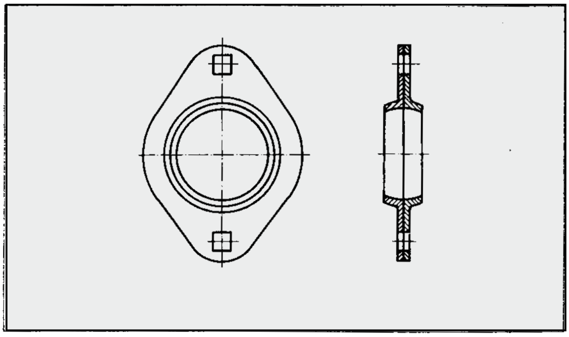
- flanged housings, PFR type (circular flange)



- flanged housings, PFT type (triangular flange)



- flanged housings, PFO type (oval flange)



Design

Two or one-piece bearing housings are generally casted of grey cast iron (Fc 200), according to national standard The seating in the housing is used for bearing mounting It can be manufactured for locating bearings, when the bearing is axially located by one or two rings, according to the specifications in the bearing housing tables. It can also be manufactured for non- locating bearings.

The housings are sealed by oil impregnated felt seals, according to the specifications in chapter "Sealing of rolling bearings" on page 83.

At request, they can also be manufactured with other types of seals, depending on the lubricant, e.g. labyrinth seal, rubbing seal with a spring incorporated, V-ring seal etc.

Grease lubrication of bearing housings

In most cases, bearings housings are grease lubricated. For this reason, they are provided with threaded holes for grease nipple.

When mounting the grease nipples, it should be considered if the bearings are mounted with adapter sleeves; in this case, the adapter sleeves should be opposite to the lock nuts. In case of spherical roller bearings with lubrication groove and holes in the outer ring (W33), they should be placed in central position, face to face with the lubrication groove.

The grease quantity which is to be introduced in the housing initially and when bearings should be lubricated is given in table 1, depending on the bearing operating conditions and the free space in the housing. If the operating speed is $n/n_{ef} < 0,8$, the operating temperature < 100°C and the load value $P/C < 0,3$, the free space in the housing will be 60% filled. If the operating speed is $n/n_{ef} < 0,2$, the free space in the housing can be completely filled with grease. The most usual grease used for bearing lubrication is lithium soap based grease UM 185 Li2 (see chapter 8).

Grease quantity

Table 1

Housing designation Tapered bore	Cylindrical bore	Quantity initial	re-lubrication
		g	
CT - 505 -	CT - 205	30	5
CT - 506; CT - 605	CT - 206	40	5
CT - 507; CT - 606	CT - 207	50	8
CT - 508; CT - 607	CT - 208	60	8
CT - 509 -	CT - 209	65	8
CT - 510; CT - 608	CT - 210	75	10
CT - 511; CT - 609	CT - 211	100	10
CT - 512; CT - 610	CT - 212	150	12
CT - 513; CT - 611	CT - 213	180	15
CT - 515; CT - 612	CT - 215	230	15
CT - 516; CT - 613	CT - 216	280	20
CT - 517 -	CT - 217	330	20
CT - 518; CT - 615	CT - 218	430	25
CT - 519; CT - 616	CT - 219	480	30
CT - 520; CT - 617	CT - 220	630	40
CT - 522; CT - 619	CT - 222	850	50

Dimensions, tolerances

The dimensions of bearing housings, both in case of casted or pressed housings, are in accordance with ISO 113/II;3228 and national standards, so that housings are interchangeable.

The tolerances are also in accordance with international norms and correspond for the bearing seating, considering the specifications in chapter "Bearing application" on page 74. The seating for bearing is generally manufactured to the tolerance class H7. In case of housings, it can be also manufactured to other tolerance classes.

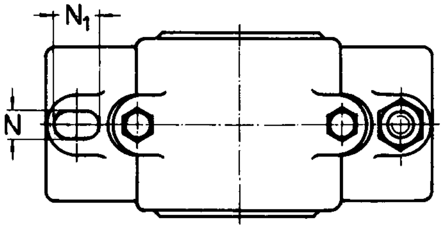
The dimensions of these bearing housings, of axial location rings and also the bearing designations for which each bearing housing corresponds are given in tables.

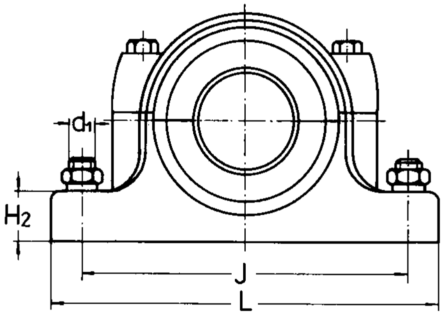
Casted housings for bearings with spherical outside surface and extended inner ring

These housings are used for simple mounting designs, in case of unpretentious assemblies such as agricultural machines. The housings for agricultural machines are generally fixed housings. Bearings mounted in these housings are deep groove ball bearings, single row, with spherical outside surface and extended inner ring. Due to their spherical outside surface, they allow misalignments up to 5°.

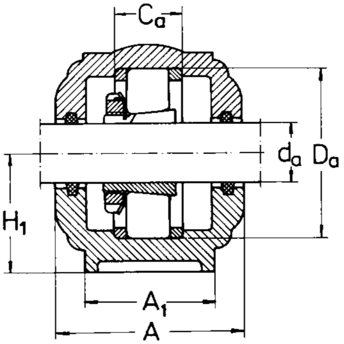
The bearings are sealed on both ends and are greased, but they are also provided with relubrication holes. For this reason, the housings are also provided with a threaded hole M8×1 for mounting of the grease nipple.

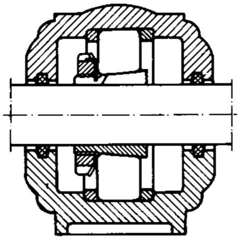
Grey cast iron, plummer block housings, split, for bearings with tapered bore and adapter sleeve





Desig-nation	Dimensions												Locating ring		Bearing type
	d_a	D_a	L	A_1	H_2	C_a	H_1	A	J	d_1	N	N_1	pcs.	outer dia. × width	
—	mm												—	mm × mm	—
CT505	20	52	165	46	19	25	40	67	130	M10	11	20	2 1	52×5 52×7	1205K 2205K;22205K
CT506	25	62	185	52	22	32	50	77	150	M10	11	22	2 2	62×8 62×6	1206K 2206K;22206K
CT507	30	72	185	52	22	34	50	82	150	M10	11	20	2 2	72×8,5 72×5,5	1207K 2207K;22207K
CT508	35	80	205	60	25	39	60	85	170	M12	14	20	2 2	80×10,5 80×8	1208K 2208K;22208K
CT509	40	85	205	60	25	30	60	85	170	M12	14	20	2 1	85×5,5 85×7	1209K 2209K;22209K
CT510	45	90	205	60	25	41	60	90	170	M12	14	20	2 2	90×10,5 90×9	1210K 2210K;22210K
CT511	50	100	255	70	28	44	70	95	210	M16	18	23	2 2	100×11,5 100×9,5	1211K 2211K;22211K
CT512	55	110	255	70	30	48	70	105	210	M16	18	23	2 2	110×13 110×10	1212K 2212K;22212K
CT513	60	120	275	80	30	51	80	110	230	M16	18	24	2 2	120×14 120×10	1213K 2213K;22213K
CT515	65	130	280	80	30	56	80	115	230	M16	18	26	2 2	130×15,5 130×12,5	1215K 2215K;22215K
CT516	70	140	315	90	32	58	95	120	260	M20	22	30	2 2	140×16 140×12,5	1216K 2216K;22216K
CT517	75	150	320	90	32	61	95	125	260	M20	22	30	2 2	150×16,5 150×12,5	1217K 2217K;22217K
CT518	80	160	345	100	35	65	100	140	290	M20	22	30	1 2 2	160×12,5 160×17,5 160×12,5	23218K 1218K 2218K;22218K
CT519	85	170	345	100	35	68	112	145	290	M20	22	30	2 2	170×18 170×12,5	1219K 2219K;22219K
CT520	90	180	380	110	40	70	112	160	320	M24	26	32	1 2 2	180×9,7 180×18 180×12	23220K 1220K 2220K;22220K
CT522	100	200	410	120	45	80	125	175	350	M24	26	32	1 2 2	200×10,2 200×21 200×18,5	23222K 1222K 2222K;22222K

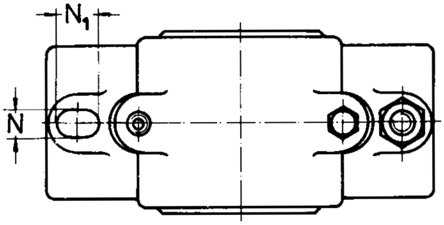


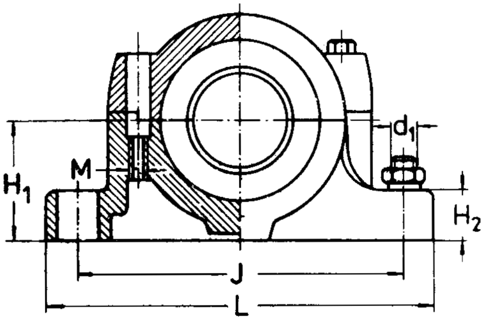


Designation	Dimensions												Locating ring		Bearing type
	d_a	D_a	L	A_1	H_2	C_a	H_1	A	J	d_1	N	N_1	pcs.	outer dia. × width	
—	mm												—	mm × mm	—
CT605	20	62	185	52	22	32	50	77	150	M10	11	20	2	62×7,5	1305K
													1	62×10	2305K
CT606	25	72	185	52	22	34	50	82	150	M10	11	20	2	72×7,5	1306K
													1	72×7	2306K
CT607	30	80	205	60	25	39	60	85	170	M12	14	20	2	80×9	1307K
													1	80×8	2307K
CT608	35	90	205	60	25	41	60	90	170	M12	14	20	2	90×9	1308K;21308K
													1	90×8	2308K;22308K
CT609	40	100	255	70	28	44	70	95	210	M16	18	23	2	100×9,5	1309K,21309K
													1	100×8	2309K;22309K
CT610	45	110	255	70	30	48	70	105	210	M16	18	23	2	110×10,5	1310K;21310K
													1	110×8	2310K;22310K
CT611	50	120	275	80	32	51	80	110	230	M16	18	24	2	120×11	1311K;21311K
													1	120×8	2311K;22311K
CT612	55	130	280	80	30	56	80	115	230	M16	18	26	2	130×12,5	1312K;21312K
													1	130×10	2312K;22312K
CT613	60	140	315	90	32	58	95	120	260	M20	22	29	2	140×12,5	1313K;21313K
													1	140×10	2313K;22313K
CT615	65	160	345	100	35	65	100	140	290	M20	22	29	2	160×14	1315K;2315K
													1	160×10	2315K;22315K
CT616	70	170	345	100	35	68	112	145	290	M20	22	29	2	170×14,5	1316K;2316K
													1	170×10	2316K;22316K
CT617	75	180	380	110	40	70	112	160	320	M24	26	32	2	180×14,5	1317K;21317K
													1	180×10	2317K;22317K
CT619	85	200	410	120	45	80	125	175	350	M24	26	32	2	200×15,8	1319K
													1	200×13	2319K;22319K
CT620	90	215	410	120	45	86	140	185	350	M24	26	32	2	215×17,8	1320K
													1	215×13	2320K;22320K
CT622	100	240	460	130	40	90	150	190	390	M24	28	38	2	240×19,8	1322K
													1	240×9,5	2322K;22322K

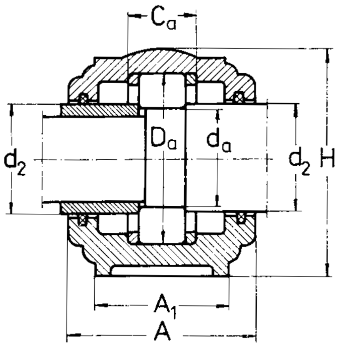
Grey cast iron, plummer block housings, split, for bearings with cylindrical bore

Non-standardized

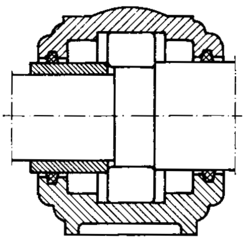




Desig-nation	Dimensions d_a	D_a	d_2	D	L	A	A_1	H_1	H_2	H max	C_a	J	d_1	N	N_1	Locating ring pcs.	outer dia. × width	Bearing type
-	mm															—	mm × mm	
CT204	20	47	28	M8	155	67	45	35	19	75	25	113	M10	12	15	2	47×5,5	1204
																1	47×7	2204
CT304	20	52	25	M10	165	67	46	40	22	75	29	130	M12	15	20	2	52×7	1304
																1	52×8	2304
CT205	25	52	30	M10	165	67	46	40	22	75	25	130	M12	15	20	2	52×5	1205
																1	52×7	2205; 22205
CT305	25	62	30	M10	185	80	52	50	22	90	34	150	M12	15	20	2	62×8,5	1305
																1	62×10	2305
CT206	30	62	35	M10	185	77	52	50	22	90	30	150	M12	15	20	1	62×10	1206
																2	62×7	2206; 22206
CT306	30	72	35	M10	185	82	52	50	22	95	37	150	M12	15	20	2	72×9	1306
																1	72×10	2306
CT207	35	72	45	M10	185	82	52	50	22	95	33	150	M12	15	20	2	72×8	1207
																1	72×10	2207; 22207
CT307	35	80	45	M10	205	90	60	60	25	110	41	170	M12	15	20	2	80×10	1307
																1	80×10	2307
CT208	40	80	50	M10	205	85	60	60	25	110	33	170	M12	15	20	2	80×7,5	1208
																1	80×10	2208; 22208
CT308	40	90	50	M10	205	95	60	60	25	115	43	170	M12	15	20	2	90×10	1308
																1	90×10	2308; 22308
CT209	45	85	55	M10	205	85	60	60	25	112	31	170	M12	15	20	2	85×6	1209
																1	85×8	2209
CT309	45	100	55	M14	255	105	70	70	28	130	46	210	M16	18	23	2	100×10,5	1309
																1	100×10	2309; 22309
CT210	50	90	60	M10	205	90	60	60	25	112	33	170	M12	15	20	2	90×6,5	1210
																1	90×10	2210; 22210
CT310	50	110	60	M14	255	115	70	70	30	135	50	210	M16	18	23	2	110×11,5	1310
																1	110×10	2310; 22310
CT211	55	100	65	M14	255	95	70	70	28	130	33	210	M16	18	23	2	100×6	1211
																1	100×6	2211; 22211
CT311	55	120	65	M14	275	120	80	80	30	150	53	230	M16	18	23	2	120×12	1311; 21311
																1	120×10	2311; 22311
CT212	60	110	70	M14	255	105	70	70	30	135	38	210	M16	18	23	2	110×8	1212
																1	110×10	2212; 22212
CT312	60	130	70	M14	280	125	80	80	30	155	56	230	M16	18	23	2	130×12,5	1312; 21312
																1	130×10	2312; 22313



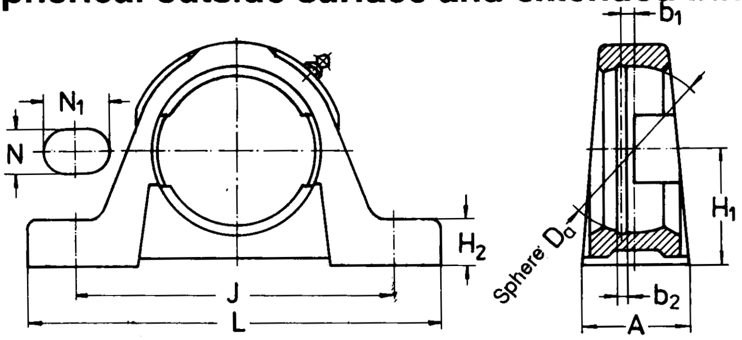
Locating bearing



Non-locating bearing

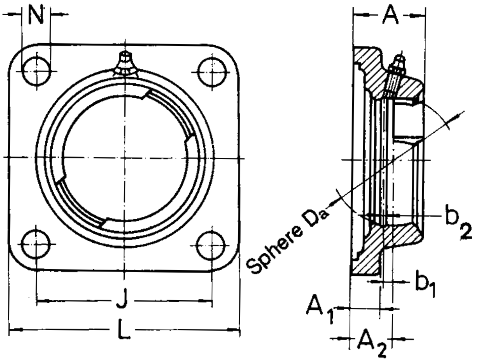
Designation	Dimensions d_a	D_a	d_2	D	L	A	A_1	H_1	H_2	H max	C_a	J	d_1	N	N_1	Locating ring pcs.	outer dia. × width	Bearing type
-	mm															—	mm × mm	—
CT213	65	120	75	M14	275	110	80	80	30	150	43	230	M16	18	23	2 1	120×10 120×12	1213 2213; 22213
CT313	65	140	75	M18	315	130	90	95	32	175	58	260	M20	22	27	2 1	140×12,5 140×10	1313; 21313 2313; 22313
CT214	70	125	80	M14	275	115	80	80	30	155	44	230	M16	18	23	2 1	125×10 125×13	1214 2214; 22214
CT314	70	150	80	M18	320	130	90	95	32	185	61	260	M20	22	27	2 1	150×13 150×10	1314; 21314 2134; 22314
CT215	75	130	85	M14	280	115	80	80	30	155	41	230	M16	18	23	2 1	130×8 130×10	1215 2215; 22215
CT315	75	160	85	M18	345	140	100	100	35	195	65	290	M20	22	27	2 1	160×14 160×10	1315; 21315 2315; 22315
CT216	80	140	90	M18	315	120	90	95	32	185	43	260	M20	22	27	2 1	140×8,5 140×10	1216 2216; 22216
CT316	80	170	90	M18	345	145	100	112	35	212	68	290	M20	22	27	2 1	170×14,5 170×10	1316; 21316 2316; 22316
CT217	85	150	95	M18	320	125	90	95	32	185	46	260	M20	22	27	2 1	150×9 150×10	1217 2217; 22217
CT317	85	180	95	M22	380	155	110	112	40	218	70	320	M24	26	32	2 1	180×14,5 180×10	1317; 21317 2317; 22317
CT218	90	160	100	M18	345	145	100	100	35	195	62,4	290	M20	32	27	2 2 2	160×16,2 160×11,2 160×10	1218 2218; 22218 23218;
CT318	90	190	100	M22	380	160	110	112	40	230	74	320	M24	26	32	2 1	190×15,5 190×10	1318 2318; 22318
CT220	100	180	115	M22	380	160	110	112	40	218	70,3	320	M24	26	32	2 2 1	180×18,1 180×12,1 180×10	1220 2220; 22220 23220
CT320	100	215	115	M22	410	175	120	140	45	280	83	350	M24	26	32	2 1	215×18 215×10	1320 2320; 22320

Grey cast iron, plummer block housings, unsplit, for bearings with spherical outside surface and extended inner ring



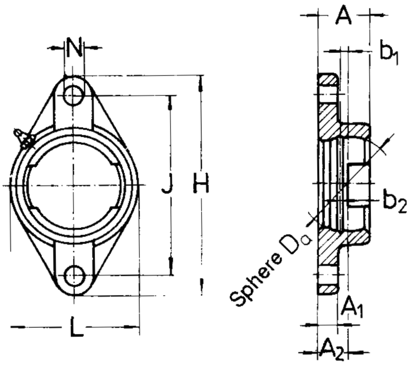
Designation	Dimensions										Fastening screw	Bearing
	Da H18	L max.	A max.	J	H_2 max.	H_1	N H13	N_1 H13	b_1	b_2		
—	mm											
S40	40	128	39	96	16	30,2	11,5	16	3,4	2	M10	UC 203
S47	47	128	39	96	16	33,3	11,5	16	3,7	2	M10	UC 204
S52	52	140	39	105	17	36,5	11,5	16	3,9	2,5	M10	UC 205
S62	62	166	48	121	19	42,9	14	19	5,0	2,5	M12	UC 206
S72	72	167	48	126	20	47,6	14	19	5,7	3	M12	UC 207
S80	80	185	55	136	20	49,2	14	19	6,2	3	M12	UC 208
S85	85	191	55	146	22	54	14	19	6,4	3	M12	UC 209
S90	90	207	61	159	23	57,2	18	20,5	6,5	3,5	M16	UC 210
S100	100	220	61	172	25	63,5	18	20,5	7,0	3,5	M16	UC 211
S110	110	242	71	186	27	69,9	18	22	7,6	4	M16	UC 212

Grey cast iron, flanged housings, for bearings with spherical outside surface and extended inner ring



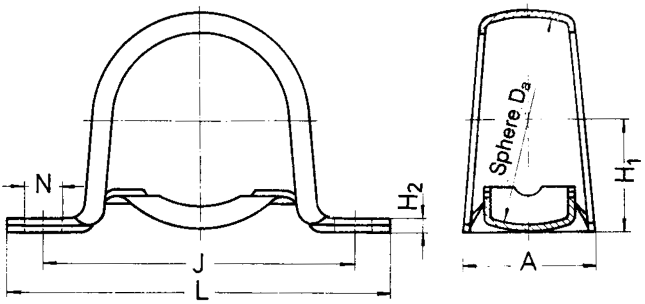
Designation	Dimensions									Fastening screw	Bearing
	D_a H18	L max.	A max.	J	A_1 max.	A_2	N H13	b_1	b_2		
—	mm									—	
F40	40	77	28	54	13	17	11,5	3,4	2	M10	UC 203
F47	47	86	34	63,5	15	19	11,5	3,7	2	M10	UC 204
F52	52	96	35	70	15	19	11,5	3,9	2,5	M10	UC 205
F62	62	109	38	82,5	16	20	11,5	5,0	2,5	M10	UC 206
F72	72	118	38	92	17	21	14	5,7	3	M12	UC 207
F80	80	131	42	101,5	17	24	14	6,2	3	M12	UC 208
F85	85	137	42	105	18	24	16	6,4	3	M14	UC 209
F90	90	144	46	111	20	28	18	6,5	3,5	M16	UC 210
F100	100	163	50	130	21	31	18	7,0	3,5	M16	UC 211
F110	110	175	55	143	21	34	18	7,6	4	M16	UC 212

Grey cast iron, flanged housings, unsplit, for bearings with spherical outside surface and extended inner ring



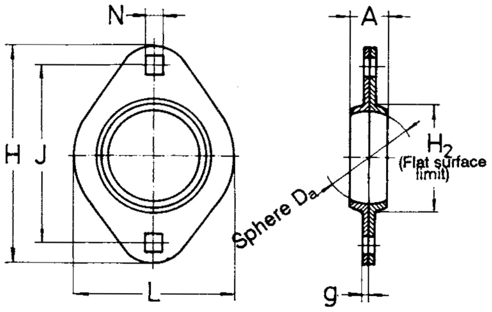
Designation	Dimensions										Fastening screw	Bearing
	D_a H8	H max.	L max.	A max.	J	A_1 max.	A_2	N H13	b_1	b_2		
—	mm											—
OF40	40	99	57	28	76,5	13	17	11,5	3,4	2	M10	UC 203
OF47	47	113	61	34	90	15	19	11,5	3,7	2	M10	UC 204
OF52	52	125	70	35	99	15	19	11.5	3,9	2,5	M10	UC 205
OF62	62	142	83	38	116,5	16	20	11,5	5,0	2,5	M10	UC 206
OF72	72	156	96	38	130	17	21	14	5,7	3	M12	UC 207
OF80	80	172	105	42	143,5	17	24	14	6,2	3	M12	UC 208
OF85	85	180	111	42	148,5	18	24	16	6,4	3	M14	UC 209
OF90	90	190	116	46	157	20	28	18	6,5	3,5	M16	UC 210
OF100	100	217	134	50	184	21	31	18	7,0	3,5	M16	UC 211
OF110	110	235	138	55	202	21	34	18	7,6	4	M16	UC 212

Pressed sheet, plummer block housings, for bearings with spherical outside surface and extended inner ring

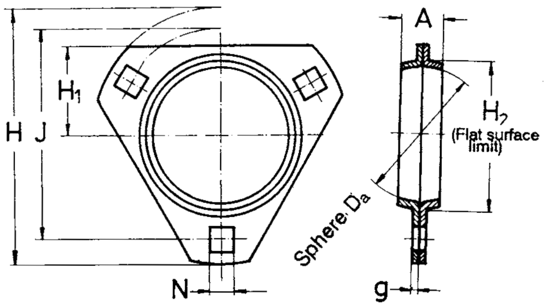


Desig-nation	Dimensions D_a H18	L max.	A max.	J	H_2 max.	H_1	N H13	Fas-tening screw	Bearing
—	mm								—
PT40	40	86	26	68	3,5	22,2	9	M8	UC 203
PT47	47	99	32	76	3,5	25,4	9	M8	UC 204
PT52	52	108	32	86	4	28,6	11	M10	UC 205
PT62	62	119	38	95	4	33,3	11	M10	UC 206
PT72	72	130	41	100	5	30,7	11	M10	UC 207
PT80	80	148	43	120	5	43,7	13,5	M12	UC 208
PT85	85	156	45	128	6	46,8	13,5	M12	UC 209

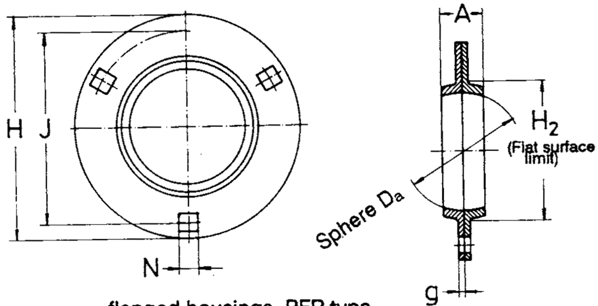
Pressed sheet, flanged housings, for bearings with spherical outside surface and extended inner ring



flanged housings, PFO type



flanged housings, PFT type



flanged housings, PFR type

Designation	Dimensions D_a H18	H max.	L max.	A max.	J	H_1 max.	H_2 max.	N H13	g	Fastening screw	Bearing
-	mm										—
PFO40; PFT40; PFR40	40	81	59	15	63,5	29	49	6,6	2	M6	UC 203
PFO47; PFT47; PFR47	47	91	67	16	71,5	34	55	9	2	M8	UC 204
PFO52; PFT52; PFR52	52	96	71	18	76	35	60	9	2	M8	UC 205
PFO62; PFT62; PFR62	62	113	85	20	90,5	41	71	11	2,5	M10	UC 206
PFO72; PFT72; PFR72	72	123	94	21	100	45	81	11	2,5	M10	UC 207
PFO80; PFT80; PFR80	80	148		23	119		91	13,5	3,5	M12	UC 208
PFO85; PFT85; PFR85	85	150		23	120,5		97	13,5	3,5	M12	UC 209
PFO90; PFT90; PFR90	90	156		25	127		102	13,5	4	M12	UC 210
PFO100;PFT100;PFR100	100	167		26	138		113	13,5	4	M12	UC 211

Special sleeves

Non-standardized

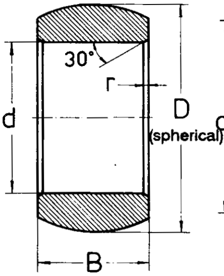


Fig.1

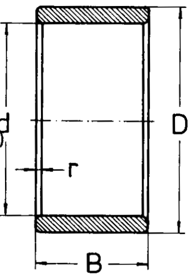


Fig.2

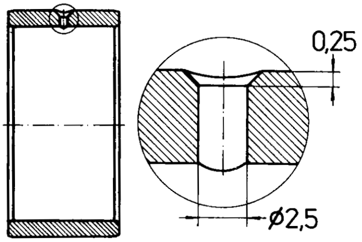


Fig.3

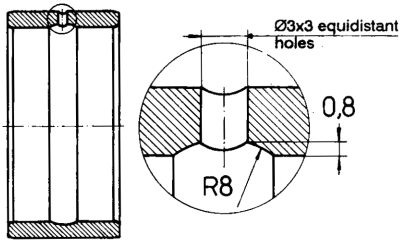


Fig.4

Dimensions				Fig.	Designation	Weight
d	D	B	r			
mm				—		kg
12,5	21,77	11,8	0,3	1	**BS122212/1**	0,023
	21,87	11,8	0,3	1	**BS122212/2**	0,023
	21,94	11,8	0,3	1	**BS122212/3**	0,023
14	24,64	13,7	0,3	1	**BS142514/4**	0,030
	24,74	13,7	0,3	1	**BS142514/1**	0,030
	24,84	13,7	0,3	1	**BS142514/2**	0,030
	24,94	13,7	0,3	1	**BS142514/3**	0,030
16	28,3	15,6	0,3	1	**BS162816/3**	0,046
	28,4	15,6	0,3	1	**BS162816/2**	0,046
	28,5	15,6	0,3	1	**BS162816/1**	0,046
20	29,95	12	0,5	1	**BS203012**	0,033
22	26	35	0,9	3	**BM222635**	0,040
22,05	34,15	13,4	0,3	1	**BS223413**	0,051
22,51	27,953	30,244	0,3	2	**BM222830**	0,051
25	28	20		2	**BM252820**	0,020
25,518	32,947	19	1	2	**BT253319**	0,049
29	32	38		2	**BM293238**	0,043
31	34	25		2	**BM313425**	0,030
35	40	19,5	0,5	2	**BM354020**	0,044
	40	50	0,5	2	**BM354050**	0,113
44,972	56,939	43,7	0,6	2	**BM455744**	0,330
45	60	20	4	2	**BM456020**	0,197
48	52	28		2	**BM485228**	0,069
55	70	27	4	2	**BM557027**	0,312
58,5	68	45,6	1	4	**BM586846**	0,354
60	70	32,5	1,2	2	**BM607033**	0,250
	80	28	4	2	**BM608028**	0,483
70	80	40,1	1	4	**BM708040**	0,370
	80	46,4	1	4	**BM708046**	0,428

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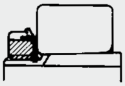
Accessories

The accessories for bearings include: adapter sleeves, withdrawal sleeves, lock nuts, locking washers and locking clamps.

Withdrawal sleeves

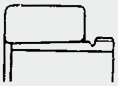


◁ 1:12
H 30, $d_1 \leq 180$ mm
H 31, $d_1 \leq 260$ mm
H 2, H 3, H 23

◁ 1:12
H 30, $d_1 > 180$ mm
H 31, $d_1 > 260$ mm
H 39, H 32

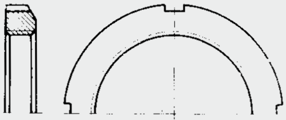
Adapter sleeves

◁ 1:12
AH 39, AH 30
AH 31, AH 32
AH 3, AH 23

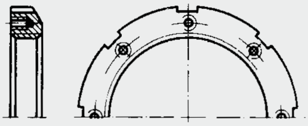


◁ 1:30
AH 240
AH 241

Lock nuts

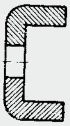


KM, KML, HM, HML



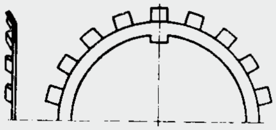
HM30, HM31

Locking washers



MB; MBL

Locking clamps



MS30; MS31

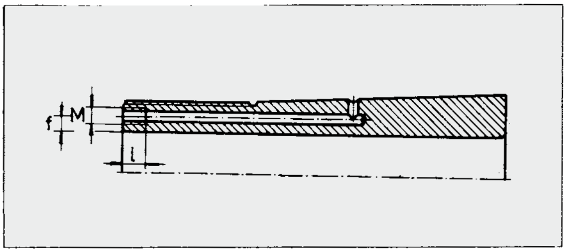
Adapter and withdrawal sleeves

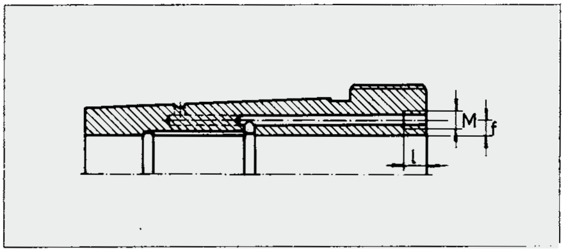
Adapter (H) and withdrawal (AH) sleeves are used when mounting tapered bore bearings on cylindrical shafts. In this case, shaft tolerances are larger than in case of bearings seated directly on the shaft. The tolerance classes recommended for shafts are h9 and h10. Form and position deviations will be in accordance with tolerance classes IT5/2 and IT7/2

Adapter sleeves are manufactured according to national standard 5814 and withdrawal sleeves according to national standard. These standards correspond to ISO 113/1.

For large-sized bearings, both adapter sleeves and withdrawal sleeves are provided with lubrication grooves, so that hydraulic systems can be used when mounting and dismounting (suffix H). The dimensions of threads for the connection to the hydraulic system are given in the tables below.

Tapered bore bearing mounting with adapter or withdrawal sleeves, bearing radial clearance after mounting and axial displacement necessary to obtain proper clearance are subjects treated in the chapter "Bearing mounting and dismounting",





Connecting threads for adapter sleevs

Symbol		Connection dimensions			Number of entries
over	up to	M	f	l	
–			mm		–
H3032H	H3060H	M6	4,2	9	1
H3132H	H3160H	M6	4,2	9	1
	H3260H	M6	4,2	9	1
H2332H	H2356H	M6	4,2	9	1
H3964H	H3984H	M6	3,5	9	1
H3064H	H3084H	M6	3,5	9	1
H3164H	H3184H	M6	3,5	9	1
H3264H	H3284H	M6	3,5	9	1
H3988H	H39/500H	M8	6,5	12	1
H3088H	H30/500H	M8	6,5	12	1
H3188H	H31/500H	M8	6,5	12	1
H3288H	H32/500H	M8	6,5	12	1
H39/530H	H39/560H	M8	6	12	1
H30/530H	H30/560H	M8	6	12	1
H39/630H		M8	6	12	1
H30/630H		M8	6	12	1

Connecting threads for withdrawal sleevs

Symbol		Connection dimensions			Number of entries
over	up to	M	f	l	
–			mm		–
AH3032H	AH3040H	M6	4,2	9	1
AH3132H	AH3140H	M6	4,5	9	1
AH3232H	AH3240H	M6	4,5	9	1
AH2332H	AH2340H	M6	4,5	9	1
AH2236H	AH2240H	M6	4,5	9	1
AH24044H	AH24064H	M6	8	9	2
AH24144H		M6	8	9	2

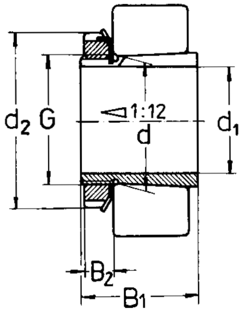
Lock nuts, locking washers and locking clamps

Lock nuts are used to fasten bearings and other parts on shafts. They are also used for bearing mounting on adapter sleeves or their dismounting from withdrawal sleeves.

Lock nuts are manufactured according to national standard

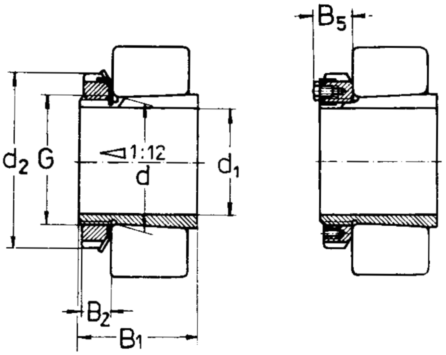
Locking washers and locking clamps are used for lock nuts securing. They are manufactured according to national standard

Adapter sleeves



Dimensions d1	d	d2	B1	B2	B5	G	Designation sleeve	lock nut	lock washer	Weight
mm							—			kg
17	20	32	24	7		M20×1	**H204**	**KM4**	**MB4**	0,041
	20	32	28	7		M20×1	**H304**	**KM4**	**MB4**	0,045
	20	32	31	7		M20×1	**H2304**	**KM4**	**MB4**	0,049
20	25	38	26	8		M25×1,5	**H205**	**KM5**	**MB5**	0,070
	25	38	29	8		M25×1,5	**H305**	**KM5**	**MB5**	0,075
	25	38	35	8		M25×1,5	**H2305**	**KM5**	**MB5**	0,087
25	30	45	27	8		M30×1,5	**H206**	**KM6**	**MB6**	0,099
	30	45	31	8		M30×1,5	**H306**	**KM6**	**MB6**	0,109
	30	45	38	8		M30×1,5	**H2306**	**KM6**	**MB6**	0,126
30	35	52	29	9		M35×1,5	**H207**	**KM7**	**MB7**	0,125
	35	52	35	9		M35×1,5	**H307**	**KM7**	**MB7**	0,142
	35	52	43	9		M35×1,5	**H2307**	**KM7**	**MB7**	0,165
35	40	58	31	10		M40×1,5	**H208**	**KM8**	**MB8**	0,174
	40	58	36	10		M40×1,5	**H308**	**KM8**	**MB8**	0,189
	40	58	46	10		M40×1,5	**H2308**	**KM8**	**MB8**	0,224
40	45	65	33	11		M45×1,5	**H209**	**KM9**	**MB9**	0,227
	45	65	39	11		M45×1,5	**H309**	**KM9**	**MB9**	0,248
	45	65	50	11		M45×1,5	**H2309**	**KM9**	**MB9**	0,280
45	50	70	35	12		M50×1,5	**H210**	**KM10**	**MB10**	0,274
	50	70	42	12		M50×1,5	**H310**	**KM10**	**MB10**	0,303
	50	70	55	12		M50×1,5	**H2310**	**KM10**	**MB10**	0,362
50	55	75	37	12		M55×2	**H211**	**KM11**	**MB11**	0,308
	55	75	45	12		M55×2	**H311**	**KM11**	**MB11**	0,345
	55	75	59	12		M55×2	**H2311**	**KM11**	**MB11**	0,420
55	60	80	38	13		M60×2	**H212**	**KM12**	**MB12**	0,346
	60	80	47	13		M60×2	**H312**	**KM12**	**MB12**	0,394
	60	80	62	13		M60×2	**H2312**	**KM12**	**MB12**	0,481
60	65	85	40	14		M65×2	**H213**	**KM13**	**MB13**	0,401
	65	85	50	14		M65×2	**H313**	**KM13**	**MB13**	0,458
	65	85	65	14		M65×2	**H2313**	**KM13**	**MB13**	0,557
	70	92	41	14		M70×2	**H214**	**KM14**	**MB14**	0,593
	70	92	52	14		M70×2	**H314**	**KM14**	**MB14**	0,723
	70	92	68	14		M70×2	**H2314**	**KM14**	**MB14**	0,897
65	75	98	43	15		M75×2	**H215**	**KM15**	**MB15**	0,707
	75	98	55	15		M75×2	**H315**	**KM15**	**MB15**	0,831
	75	98	73	15		M75×2	**H2315**	**KM15**	**MB15**	1,05
70	80	105	46	17		M80×2	**H216**	**KM16**	**MB16**	0,882
	80	105	59	17		M80×2	**H316**	**KM16**	**MB16**	1,03
	80	105	78	17		M80×2	**H2316**	**KM16**	**MB16**	1,28

Adapter sleeves

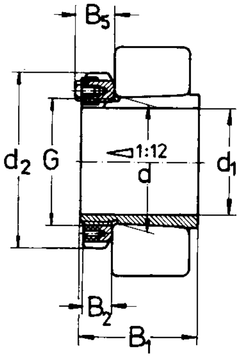


Dimensions							Designation			Weight
d_1	d	d_2	B_1	B_2	B_5	G	sleeve	lock nut	lock washer	
mm							—			kg
75	85	110	50	18		M85×2	**H217**	**KM17**	**MB17**	1,02
	85	110	63	18		M85×2	**H317**	**KM17**	**MB17**	1,18
	85	110	82	18		M85×2	**H2317**	**KM17**	**MB17**	1,45
80	90	120	52	18		M90×2	**H218**	**KM18**	**MB18**	1,19
	90	120	65	18		M90×2	**H318**	**KM18**	**MB18**	1,37
	90	120	86	18		M90×2	**H2318**	**KM18**	**MB18**	1,69
85	95	125	55	19		M95×2	**H219**	**KM19**	**MB19**	1,37
	95	125	68	19		M95×2	**H319**	**KM19**	**MB19**	1,56
	95	125	90	19		M95×2	**H2319**	**KM19**	**MB19**	1,92
90	100	130	58	20		M100×2	**H220**	**KM20**	**MB20**	1,49
	100	130	71	20		M100×2	**H320**	**KM20**	**MB20**	1,69
	100	130	76	20		M100×2	**H3120**	**KM20**	**MB20**	1,80
	100	130	97	20		M100×2	**H2320**	**KM20**	**MB20**	2,15
100	110	145	63	21		M110×2	**H222**	**KM22**	**MB22**	1,93
	110	145	77	21		M110×2	**H322**	**KM22**	**MB22**	2,18
	110	145	81	21		M110×2	**H3122**	**KM22**	**MB22**	2,25
	110	145	105	21		M110×2	**H2322**	**KM22**	**MB22**	2,74
110	120	145	72	22		M120×2	**H3024**	**KML24**	**MBL24**	1,93
	120	155	88	22		M120×2	**H3124**	**KM24**	**MB24**	2,64
	120	155	112	22		M120×2	**H2324**	**KM24**	**MB24**	3,19
115	130	155	80	23		M130×2	**H3026**	**KML26**	**MBL26**	2,85
	130	165	92	23		M130×2	**H3126**	**KM26**	**MB26**	3,66
	130	165	121	23		M130×2	**H2326**	**KM26**	**MB26**	4,60
125	140	165	82	24		M140×2	**H3028**	**KML28**	**MBL28**	3,16
	140	180	97	24		M140×2	**H3128**	**KM28**	**MB28**	4,34
	140	180	131	24		M140×2	**H2328**	**KM28**	**MB28**	5,55
135	150	180	87	26		M150×2	**H3030**	**KML30**	**MBL30**	3,89
	150	195	111	26		M150×2	**H3130**	**KM30**	**MB30**	5,52
	150	195	139	26		M150×2	**H2330**	**KM30**	**MB30**	6,63
140	160	190	93	27,5		M160×3	**H3032**	**KML32**	**MBL32**	5,21
	160	210	119	28		M160×3	**H3132**	**KM32**	**MB32**	7,67
	160	210	147	28		M160×3	**H2332**	**KM32**	**MB32**	9,14
150	170	200	101	28,5		M170×3	**H3034**	**KML34**	**MBL34**	5,99
	170	220	122	29		M170×3	**H3134**	**KM34**	**MB34**	8,38
	170	220	154	29		M170×3	**H2334**	**KM34**	**MB34**	10,2
160	180	210	109	29,5		M180×3	**H3036**	**KML36**	**MBL36**	6,83
	180	230	131	30		M180×3	**H3136**	**KM36**	**MB36**	9,50
	180	230	161	30		M180×3	**H2336**	**KM36**	**MB36**	11,3
170	190	220	112	30,5		M190×3	**H3038**	**KML38**	**MBL38**	7,45
	190	240	141	31		M190×3	**H3138**	**KM38**	**MB38**	10,8

Adapter sleeves

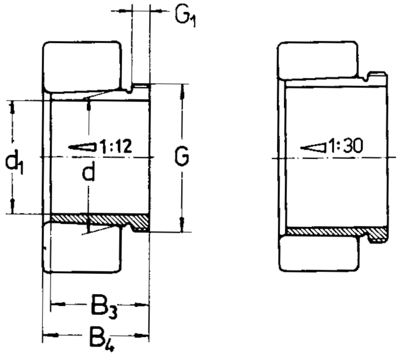
Dimensions							Designation			Weight
d_1	d	d_2	B_1	B_2	B_5	G	sleeve	lock nut	lock washer	
mm							—			kg
170	190	240	169	31		M190×3	**H2338**	**KM38**	**MB38**	12,6
180	200	240	120	31,5		M200×3	**H3040**	**KML40**	**MBL40**	9,19
	200	250	150	32		M200×3	**H3140**	**KM40**	**MB40**	12,1
	200	250	176	32		M200×3	**H2340**	**KM40**	**MB40**	13,9
200	220	260	128	30	41	Tr220×4	**H3044**	**HM3044**	**MS3044**	10,3
	220	280	161	36		Tr220×4	**H3144**	**HM3144**	**MB44**	14,7
	220	280	186	36	44	Tr220×4	**H2344**	**HM2344**	**MB44**	16,7
220	240	290	133	34	46	Tr240×4	**H3048**	**HM3048**	**MS3048**	13,2
	240	300	172	38		Tr240×4	**H3148**	**HM3148**	**MB48**	17,3
	240	300	199	38	46	Tr240×4	**H2348H**	**HM3148H**	**MB48**	19,7
240	260	310	145	34	46	Tr260×4	**H3052**	**HM3052**	**MS3052**	15,3
	260	330	190	39		Tr260×4	**H3152**	**HM3152**	**MB52**	22,0
	260	330	211	39		Tr260×4	**H2352H**	**HM3152H**	**MB52**	24,2
260	280	330	152	38	50	Tr280×4	**H3056**	**HM3056**	**MS3056**	17,7
	280	350	195	41		Tr280×4	**H3156**	**HM3156**	**MB56**	24,5
	280	350	224	41		Tr280×4	**H2356H**	**HM3156**	**MB56**	27,8
280	300	360	168	42	54	Tr300×4	**H3060**	**HM3060**	**MS3060**	22,8
	300	380	208	40	53	Tr300×4	**H3160H**	**HM3160H**	**MS3160**	30,2
	300	380	240	40	53	Tr300×4	**H3260H**	**HM3160**	**MS3160**	34,1
300	320	380	171	42	55	Tr320×5	**H3064H**	**HM3064H**	**MS3064**	24,6
	320	400	226	42	56	Tr320×5	**H3164H**	**HM3164**	**MS3164**	34,9
	320	400	258	42	56	Tr320×5	**H3264H**	**HM3264H**	**MS3264**	39,3
320	340	400	187	45	58	Tr340×5	**H3068H**	**HM3068H**	**MS3068**	28,7
	340	440	254	55	72	Tr340×5	**H3168H**	**HM3168H**	**MS3168**	49,5
	340	440	288	55	72	Tr340×5	**H3268H**	**HM3168**	**MS3168**	51,5
340	360	420	188	45	58	Tr360×5	**H3072H**	**HM3072H**	**MS3072**	30,5
	360	460	259	58	75	Tr360×5	**H3172H**	**HM3172H**	**MS3168**	54,2
	360	460	299	58	75	Tr360×5	**H3272H**	**HM3172**	**MS3172**	60,5
360	380	450	193	48	62	Tr380×5	**H3076H**	**HM3076H**	**MS3076**	35,8
	380	490	264	60	77	Tr380×5	**H3176H**	**HM3176H**	**MS3176**	61,7
	380	490	310	60	77	Tr380×5	**H3276H**	**HM3176**	**MS3176**	69,5
380	400	470	210	52	66	Tr400×5	**H3080H**	**HM3080H**	**MS3076**	41,3
	400	520	272	62	82	Tr400×5	**H3180H**	**HM3180H**	**MS3180**	70,6
	400	520	328	62	81	Tr400×5	**H3280H**	**HM3180**	**MS3180**	96,0
400	420	490	212	52	66	Tr420×5	**H3084H**	**HM3084H**	**MS3084**	43,7
	420	540	304	70	90	Tr420×5	**H3184H**	**HM3184H**	**MS3180**	84,2
	420	540	352	70	89	Tr420×5	**H3284H**	**HM3184**	**MS3184**	112
410	440	520	228	60	77	Tr440×5	**H3088H**	**HM3088H**	**MS3088**	65,2
	440	560	307	70	90	Tr440×5	**H3188H**	**HM3188H**	**MS3188**	104

Adapter sleeves



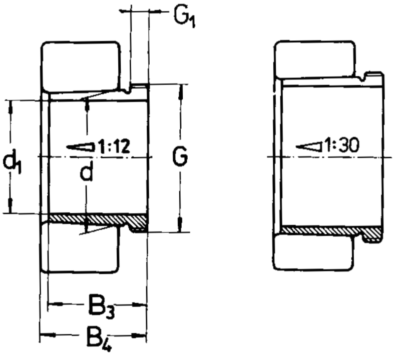
Dimensions							Designation			Weight
d_1	d	d_2	B_1	B_2	B_5	G	sleeve	lock nut	lock washer	
mm							—			kg
410	440	560	361	70	88	Tr440×5	**H3288H**	**HM3188**	**MS3188**	135
430	460	540	234	60	77	Tr460×5	**H3092H**	**HM3092H**	**MS3088**	69,5
	460	580	326	75	95	Tr460×5	**H3192H**	**HM3192H**	**MS3188**	116
	460	580	382	75	94	Tr460×5	**H3292H**	**HM3192**	**MS3192**	154
450	480	560	237	60	77	Tr480×5	**H3096H**	**HM3096H**	**MS3096**	73,3
	480	620	335	75	95	Tr480×5	**H3196H**	**HM3196H**	**MS3196**	133
	480	620	397	75	94	Tr480×5	**H3296H**	**HM3196**	**MS3196**	187
470	500	580	208	68	83	Tr500×5	**H39/500H**	**HM30/530**	**MS30/500**	76,0
	500	580	247	68	85	Tr500×5	**H30/500H**	**HM30/500H**	**MS3096**	81,8
	500	630	356	80	100	Tr500×5	**H31/500H**	**HM31/500H**	**MS31/500**	143
	500	630	428	80	99	Tr500×5	**H32/500H**	**HM31/500**	**MS31/500**	191
500	530	630	216	68	89	Tr530×5	**H39/530H**	**HM30/530**	**MS30/530**	91,0
	530	630	265	68	90	Tr530×5	**H30/530H**	**HM30/530**	**MS30/530**	105
530	560	650	227	75	96	Tr560×6	**H39/560H**	**HM30/560**	**MS30/560**	101
	560	650	282	75	96	Tr560×6	**H30/560H**	**HM30/560**	**MS30/560**	117
560	600	700	239	75	96	Tr600X6	**H39/600H**	**HM30/600**	**MS30/600**	128
	600	700	289	75	96	Tr600X6	**H30/600H**	**HM30/600**	**MS30/600**	147
600	630	730	254	75	96	Tr630×6	**H39/630H**	**HM30/630**	**MS30/630**	121
	630	730	301	75	96	Tr360×6	**H30/630H**	**HM30/630**	**MS30/630**	139
630	670	780	264	80	101	Tr670×6	**H39/670H**	**HM30/670**	**MS30/670**	174
	670	780	324	80	101	Tr670×6	**H30/670H**	**HM30/670**	**MS30/670**	193
670	710	830	286	90	111	Tr710×7	**H39/710H**	**HM30/710**	**MS30/710**	217
	710	830	342	90	111	Tr710×7	**H30/710H**	**HM30/710**	**MS30/710**	221
710	750	870	291	90	111	Tr750×6	**H39/750H**	**HM30/750**	**MS30/750**	226
750	800	920	303	90	111	Tr800×7	**H39/800H**	**HM30/800**	**MS30/800**	294
	800	920	366	90	111	Tr800×7	**H30/800H**	**HM30/800**	**MS30/800**	311
800	850	980	308	90	115	Tr850×7	**H39/850H**	**HM30/850**	**MS30/850**	307
850	900	1 030	326	100	125	Tr900×7	**H39/900H**	**HM30/900**	**MS30/900**	374
	900	1 030	400	100	125	Tr900×7	**H30/900H**	**HM30/900**	**MS30/900**	387
900	950	1 080	344	100	125	Tr950×8	**H39/950H**	**HM30/950**	**MS30/950**	362

Withdrawal sleeves



Dimensions d1	d	B3	B4	G	G1	Designation sleeve	lock nut	Weight
mm						—		kg
35	40	29	32	M45×1,5	6	AH308	KM9	0,090
	40	40	43	M45×1,5	7	AH2308	KM9	0,128
40	45	31	34	M50×1,5	6	AH309	KM10	0,109
	45	44	47	M50×1,5	7	AH2309	KM10	0,164
45	50	35	38	M55×2	7	AH310	KM11	0,137
	50	50	53	M55×2	9	AH2310	KM11	0,209
50	55	37	40	M60×2	7	AH311	KM12	0,161
	55	54	57	M60×2	10	AH2311	KM12	0,253
55	60	40	43	M65×2	8	AH312	KM13	0,189
	60	58	61	M65×2	11	AH2312	KM13	0,297
60	65	42	45	M75×2	8	AH313	KM15	0,253
	65	61	64	M75×2	12	AH2313	KM15	0,395
65	70	43	47	M80×2	8	AH314	KM16	0,280
	70	64	68	M80×2	12	AH2314	KM16	0,466
70	75	45	49	M85×2	8	AH315	KM17	0,313
	75	68	72	M85×2	12	AH2315	KM17	0,534
75	80	48	52	M90×2	8	AH316	KM18	0,365
	80	71	75	M90×2	12	AH2316	KM18	0,597
80	85	52	56	M95×2	9	AH317	KM19	0,429
	85	74	78	M95×2	13	AH2317	KM19	0,670
85	90	53	57	M100×2	9	AH318	KM20	0,461
	90	63	67	M100×2	10	AH3218	KM20	0,570
	90	79	83	M100×2	14	AH2318	KM20	0,779
90	95	57	61	M105×2	10	AH319	KM21	0,532
	95	67		M105×2	11	AH3219	KM21	0,655
	95	85	89	M105×2	16	AH2319	KM21	0,886
95	100	59	63	M110×2	10	AH320	KM22	0,582
	100	64	68	M110×2	11	AH3120	KM22	0,650
	100	73	77	M110×2	11	AH3220	KM22	0,767
	100	90	94	M110×2	16	AH2320	KM22	0,998
105	110	68	72	M120×2	11	AH3122	KM24	0,760
	110	68	72	M120×2	11	AH322	KM24	0,663
	110	82	86	M125×2	11	AH3222	KM25	1,04
	110	82	91	M115×2	13	AH24122	KM23	0,730
	110	98	102	M125×2	16	AH2322	KM25	1,35
115	120	60	64	M130×2	13	AH3024	KM26	0,750
	120	73	82	M125×2	13	AH24024	KM25	0,650
	120	75	79	M130×2	12	AH3124	KM26	0,950

Withdrawal sleeves

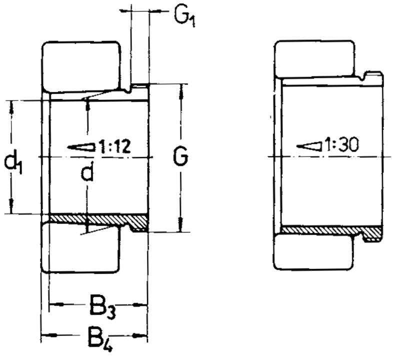


Dimensions						Designation		Weight
d1	d	B3	B4	G	G1	sleeve	lock nut	
mm						—		kg
115	120	90	94	M135×2	13	**AH3224**	**KM27**	1,30
	120	93	102	M130×2	13	**AH24124**	**KM26**	1,00
	120	105	109	M135×2	17	**AH2324**	**KM27**	1,60
125	130	67	71	M140×2	14	**AH3026**	**KM28**	0,930
	130	78	82	M140×2	12	**AH3126**	**KM28**	1,08
	130	83	93	M135×2	14	**AH24026**	**KM27**	0,840
	130	94	104	M140×2	14	**AH24126**	**KM28**	1,11
	130	98	102	M145×2	15	**AH3226**	**KM29**	1,58
	130	115	119	M145×2	19	**AH2326**	**KM29**	1,97
135	140	68	73	M150×2	14	**AH3028**	**KM30**	1,01
	140	83	88	M150×2	14	**AH3128**	**KM30**	1,28
	140	83	93	M145×2	14	**AH24028**	**KM29**	0,910
	140	99	109	M150×2	14	**AH24128**	**KM30**	1,25
	140	104	109	M155×3	15	**AH3228**	**KM31**	1,84
	140	125	130	M155×3	20	**AH2328**	**KM31**	2,33
145	150	72	77	M160×3	15	**AH3030**	**KM32**	1,15
	150	90	101	M155×3	15	**AH24030**	**KM31**	1,04
	150	96	101	M165×3	15	**AH3130**	**KM33**	1,79
	150	114	119	M165×3	17	**AH3230**	**KM33**	2,22
	150	115	126	M160×3	15	**AH24130**	**KM32**	1,56
	150	135	140	M165×3	24	**AH2330**	**KM33**	2,82
150	160	77	82	M170×3	16	**AH3032**	**KM34**	2,06
	160	95	106	M170×3	15	**AH24032**	**KM34**	2,33
	160	103	108	M180×3	16	**AH3132**	**KM36**	3,21
	160	124	130	M180×3	20	**AH3232**	**KM36**	4,08
	160	124	135	M170×3	15	**AH24132**	**KM34**	3,00
	160	140	146	M180×3	24	**AH2332**	**KM36**	4,72
160	170	85	90	M180×3	17	**AH3034**	**KM36**	2,43
	170	104	109	M190×3	16	**AH3134**	**KM38**	3,40
	170	106	117	M180×3	16	**AH24034**	**KM36**	2,80
	170	125	136	M180×3	16	**AH24134**	**KM36**	3,21
	170	134	140	M190×3	24	**AH3234**	**KM38**	4,80
	170	146	152	M190×3	24	**AH2334**	**KM38**	5,25
170	180	92	98	M190×3	17	**AH3036**	**KM38**	2,81
	180	105	110	M200×3	17	**AH2236H**	**KM40**	3,75
	180	116	122	M200×3	19	**AH3136**	**KM40**	4,22
	180	116	127	M190×3	16	**AH24036**	**KM38**	3,10
	180	134	145	M190×3	16	**AH24136**	**KM38**	3,68
	180	140	146	M200×3	24	**AH3236**	**KM40**	5,32
	180	154	160	M200×3	26	**AH2336**	**KM40**	5,83

Withdrawal sleeves

Dimensions						Designation		Weight
d_1	d	B_3	B_4	G	G_1	sleeve	lock nut	
mm						—		kg
180	190	96	102	Tr205×4	18	AH3038	HML41T	3,32
	190	112	117	Tr210×4	18	AH2238	HM42T	4,25
	190	118	131	M200×3	18	AH24038	KM40	3,50
	190	125	131	Tr210×4	20	AH3138	HM42T	4,89
	190	145	152	Tr210×4	25	AH3238	HM42T	5,90
	190	146	159	M200×3	18	AH24138	KM40	4,28
	190	160	167	Tr210×4	26	AH2338	HM42T	6,36
190	200	102	108	Tr215×4	19	AH3040	HML43T	3,80
	200	118	123	Tr220×4	19	AH2240	HM44T	4,68
	200	127	140	Tr210×4	18	AH24040	HM42T	3,93
	200	134	140	Tr220×4	21	AH3140	HM44T	5,49
	200	153	160	Tr220×4	25	AH3240	HM44T	6,68
	200	158	171	Tr210×4	18	AH24140	HM42T	5,10
	200	170	177	Tr220×4	30	AH2340	HM44T	7,54
200	220	111	117	Tr235×4	20	AH3044	HML47T	7,40
	220	138	152	Tr230×4	20	AH24044	HM46T	8,25
	220	145	151	Tr240×4	23	AH3144	HM48T	10,4
	220	170	184	Tr230×4	20	AH24144	HM46T	10,2
	220	181	189	Tr240×4	30	AH2344	HM48T	13,5
	220	181	189	Tr240×4	30	AH3244H	HM48T	13,5
220	240	116	123	Tr260×4	21	AH3048	HML52T	8,75
	240	138	153	Tr250×4	20	AH24048	HM50T	9,00
	240	144	150	Tr260×4	21	AH2248	HM52T	11,1
	240	154	161	Tr260×4	25	AH3148	HM52T	12,0
	240	180	195	Tr260×4	20	AH24148	HM50T	12,5
	240	189	197	Tr260×4	30	AH2348	HM52T	15,5
	240	189	197	Tr260×4	30	AH3248H	HM52T	14,0
240	260	128	135	Tr280×4	23	AH3052	HML56T	10,7
	260	155	179	Tr290×4	26	AH2252H	HM58T	12,5
	260	162	178	Tr270×4	22	AH24052H	HM54T	10,5
	260	172	179	Tr290×4	26	AH3152H	HM58T	16,0
	260	202	218	Tr280×4	22	AH24152H	HM56T	14,0
	260	205	213	Tr260×4	30	AH2352	HM58T	17,5
	260	205	213	Tr290×4	30	AH3252H	HM58T	17,5
260	280	131	139	Tr300×4	24	AH3056H	HML60T	11,0
	280	162	179	Tr290×4	22	AH24056H	HM58T	11,5
	280	175	183	Tr310×5	28	AH3156H	HM62T	15,5
	280	202	219	Tr300×4	22	AH24156H	HM60T	15,0
	280	212	220	Tr310×5	30	AH2356	HM62T	19,5
	280	212	220	Tr310×5	30	AH3256H	HM62T	19,5

Withdrawal sleeves



Dimensions						Designation		Weight
d_1	d	B_1	B_2	G	G_1	sleeve	lock nut	
mm						—		kg
280	300	145	153	Tr320×5	26	**AH3060H**	**HML64T**	13,0
	300	184	202	Tr310×5	24	**AH24060H**	**HM62T**	14,0
	300	192	200	Tr330×5	30	**AH3160H**	**HM66T**	19,0
	300	224	242	Tr320×5	24	**AH24160H**	**HM64T**	18,5
	300	228	236	Tr330×5	34	**AH3260H**	**HM66T**	23,5
300	320	149	157	Tr345×5	27	**AH3064H**	**HML69T**	14,5
	320	184	202	Tr330×5	24	**AH24064H**	**HM66T**	15,0
	320	209	217	Tr350×5	31	**AH3164H**	**HM70T**	22,5
	320	242	260	Tr340×5	24	**AH24164H**	**HM68T**	20,5
	320	246	254	Tr350×5	36	**AH3264H**	**HM70T**	27,5
320	340	162	171	Tr365×5	28	**AH3068H**	**HML73T**	17,5
	340	206	225	Tr360×5	26	**AH24068H**	**HM72T**	18,0
	340	225	234	Tr370×5	33	**AH3168H**	**HM74T**	26,5
	340	264	273	Tr370×5	38	**AH3268H**	**HM74T**	32,0
	340	269	288	Tr360×5	26	**AH24168H**	**HM72T**	25,5
340	360	167	176	Tr385×5	30	**AH3072H**	**HML77T**	19,0
	360	206	226	Tr380×5	26	**AH24072H**	**HM76T**	20,0
	360	229	238	Tr400×5	35	**AH3172H**	**HM80T**	30,0
	360	269	289	Tr380×5	26	**AH24172H**	**HM76T**	26,0
	360	274	283	Tr400×5	40	**AH3272H**	**HM80T**	33,0
360	380	170	180	Tr410×5	31	**AH3076H**	**HML82T**	23,5
	380	208	228	Tr400×5	28	**AH24076H**	**HM80T**	23,5
	380	232	242	Tr420×5	36	**AH3176H**	**HM84T**	36,0
	380	271	291	Tr400×5	28	**AH24176H**	**HM80T**	31,0
	380	284	294	Tr420×5	42	A3276H	**HM84T**	45,5
380	400	183	193	Tr430×5	33	**AH3080H**	**HML86T**	27,0
	400	228	248	Tr420×5	28	**AH24080H**	**HM84T**	27,0
	400	240	250	Tr440×5	38	**AH3180H**	**HM88T**	39,5
	400	278	298	Tr420×5	28	**AH24180H**	**HM84T**	35,0
	400	302	312	Tr440×5	44	**AH3280H**	**HM88T**	51,5
400	420	186	196	Tr450×5	34	**AH3084H**	**HML90T**	29,0
	420	230	252	Tr440×5	30	**AH24084H**	**HM88T**	29,0
	420	266	276	Tr460×5	40	**AH3184H**	**HM92T**	46,0
	420	310	332	Tr440×5	30	**AH24184H**	**HM88T**	39,0
	420	321	331	Tr460×5	46	**AH3284H**	**HM92T**	77,0
420	440	194	205	Tr470×5	35	**AH3088H**	**HML94T**	36,0
	440	242	264	Tr460×5	30	**AH24088H**	**HM92T**	32,0
	440	270	281	Tr480×5	42	**AH3188H**	**HM96T**	69,0
	440	310	332	Tr460×5	30	**AH24188H**	**HM92T**	42,5
	440	330	341	Tr480×5	48	**AH3288H**	**HM96T**	81,0
440	460	202	213	Tr490×5	37	**AH3092H**	**HML98T**	40,0
	460	285	296	Tr510×6	43	**AH3192H**	**HM102T**	70,0
	460	332	355	Tr480×5	32	**AH24192H**	**HM96T**	50,0
	460	349	360	Tr510×6	50	**AH3292H**	**HM102T**	97,0

Withdrawal sleeves

Dimensions						Designation		Weight
d_1	d	B_1	B_2	G	G_1	sleeve	lock nut	
mm						—		kg
460	480	205	217	Tr520×6	38	**AH3096H**	**HML104T**	44,0
	480	295	307	Tr530×6	45	**AH3196H**	**HM106T**	82,0
	480	340	363	Tr500×5	32	**AH24196H**	**HM100T**	51,5
	480	364	376	Tr530×6	52	**AH3296H**	**HM106T**	114
480	500	163	172	Tr520×6	32	**AH39/500H**	**HMLL104T**	31,0
	500	209	221	Tr540×6	40	**AH30/500H**	**HML108T**	47,0
	500	313	325	Tr550×6	47	**AH31/500H**	**HM110T**	90,0
	500	360	383	Tr530×6	35	**AH241/500H**	**HM106T**	57,0
	500	393	405	Tr550×6	54	**AH32/500H**	**HM110T**	120
500	530	175	185	Tr550×6	37	**AH39/530H**	**HMLL110T**	47,0
	530	230	242	Tr560×6	45	**AH30/530H**	**HML112T**	62,0
	530	370	394	Tr550×6	35	**AH241/530H**	**HM110T**	86,0
530	560	180	190	Tr580×6	37	**AH39/560H**	**HMLL116T**	55,0
	560	240	252	Tr590×6	45	**AH30/560H**	**HML118T**	76,0
	560	393	417	Tr580×6	38	**AH241/560H**	**HM116T**	97,0
560	600	413	439	Tr630×6	38	**AH241/600H**	**HM126T**	120
570	600	192	202	Tr625×6	38	**AH39/600H**	**HMLL125T**	57,0
	600	245	259	Tr630×6	45	**AH30/600H**	**HML126T**	77,0
600	630	210	222	Tr655×6	40	**AH39/630H**	**HMLL131T**	64,0
	630	258	272	Tr670×6	46	**AH30/630H**	**HML134T**	91,0
	630	440	466	Tr650×6	40	**AH241/630H**	**HM130T**	130
630	670	216	228	Tr695×6	41	**AH39/670H**	**HMLL139T**	107
	670	280	294	Tr710×7	50	**AH30/670H**	**HML142T**	126
670	710	228	240	Tr740×7	43	**AH39/710H**	**HMLL148T**	123
	710	286	302	Tr750×7	50	**AH30/710H**	**HML150T**	133
710	750	234	246	Tr780×7	44	**AH39/750H**	**HMLL156T**	128
750	800	245	257	Tr830×7	45	**AH39/800H**	**HMLL166T**	183
	800	308	326	Tr850×7	50	**AH30/800H**	**HML170T**	211
800	850	258	270	Tr880×7	50	**AH39/850H**	**HMLL176T**	184
850	900	265	277	Tr930×8	51	**AH39/900H**	**HMLL186T**	226
	900	335	355	Tr950×8	55	**AH30/900H**	**HML190T**	248
900	950	282	297	Tr980×8	50	**AH39/950H**	**HMLL196T**	227

ULPIA RULMENTI BUCURESTI

URB

ROMANIA - EUROPEAN UNION

Rolling elements

The rolling elements used for bearings which can be separately supplied are: balls, cylindrical rollers and needle rollers.

Balls

Balls of bearings steels are produced to the hardness of 60 - 66 HRC and in various grades. The values of the tolerances and form deviations are in accordance with ISO 3290 and national standard . Within each grade, the balls are sorted into ball gauges, depending on diameter. Ball lots result after manufacturing, which belong to one of the gauge. The gauge is marked on the corresponding lot package. Ball designation consists of a prefix which represents the grade, followed by the basic designation. This one consists of the letters "BR", followed by the value of the nominal ball diameter D_W and by the suffix which represents the value of the gauge, preceded by letter "P" for nought or positive values and letter "M" for negative values.

Example: 20BR 12.7 P2
- nominal diameter 12,7
- ball grade 20
- gauge $+2\,\mu m$

In this case, the gauge interval is of $2\,\mu m$ (according to table 1) and lot mean diameter D_{wmL} will be 12,701 - 12,703 mm).

At request, special balls of other materials than bearing steels can be manufactured (e.g. stainless steels, drilling bit steels). In this case, the letters in the basic designation will be "BS".

Tolerances of hardened steel balls

Table 1

Ball grade	**Ball diameter** D_W		**Tolerances**			**Gauge interval**	**Gauge mean values**
	over	up to	V_{Dws}	t_{Dw}	V_{DwL}	I	S
	mm		µm				
3		12,7	0,08	0,08	0,13	0,5	−5...−0,5; 0; +0,5...+5
5		6	0,1	0,1	0,25	1,0	−6...−1,0; 0; +1,0,...6
	6	13,5	0,13	0,13	0,25	1,0	−6...−1,0; 0; +1,0,...6
10		13,5	0,2	0,2	0,5	1,0	−9...−1,0; 0; +1,0...+9
16		25,4	0,35	0,35	0,5	2,0	−10...−2,0; 0; +2,0...+10
20		25,4	0,5	0,5	0,5	2,0	−10...−2,0; 0; +2,0,...+10
28		38,1	0,7	0,7	1,4	2,0	−12...−2,0; 0; +2,0...+12
40	25,4	50,8	1	1	2	4,0	−16...−4,0; 0; +4,0...+16
	50,8	76,2	2	2	2	4,0	−16...−4,0; 0; +4,0...+16
100		12,7	2	2	4	10,0	−40...−10,0; 0; +10,0...+40
	76,2	127	2,5	2,5	5	10,0	−40...−10,0; 0; +10,0...+40
	127	152,4	3,5	3,5	5	10,0	−40...−10,0; 0; +10,0...+40
200	175	250	5	5	10	15,0	−60...−15,0; 0; +15,0...+60

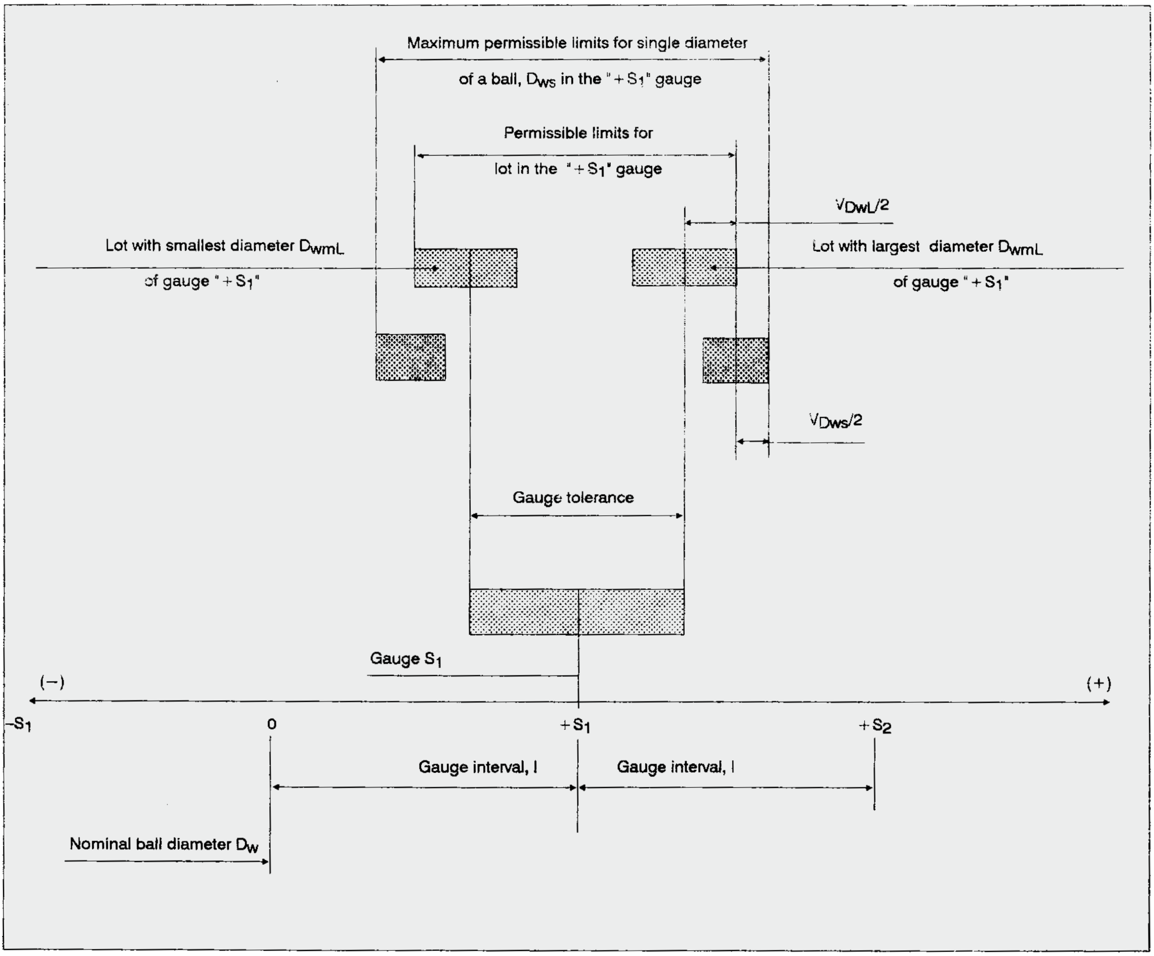
Designations

D_w	- nominal ball diameter
D_{ws}	- single diameter of a ball: the distance between two parallel planes in contact with the ball surface
D_{wm}	- mean ball diameter: arithmetical mean of the largest and smallest single ball diameters
D_{wmL}	- mean diameter of ball lot: arithmetical mean of mean diameters D_{wm} of the smallest and largest ball in the lot.
V_{Dws}	- single ball diameter variation: difference between the largest and smallest single diameters D_{ws} of one ball
V_{DwL}	- lot diameter variation: difference between the mean diameter D_{wm} of the largest ball and that of the smallest ball in the lot.
t_{Dw}	- deviation from spherical form.
I	- ball gauge interval: difference between the mean diameters of the largest and the smallest ball of the gauge - the value is pre-established for each ball grade.
L	- lot: a definite quantity of balls manufactured under uniform conditions and considered as an entity which is to be in the same time qualitatively take over. The balls are of the same material, have the same nominal diameter, belong to the same grade and have been manufactured under uniform technological and organizational conditions).
S	- gauge: the amount in a series of values of gauges pre- established for each ball grade by which lot mean diameter differ from the nominal ball diameter

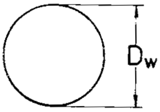
The relationships between the deviations of the lot and the gauge are shown in the figure below.

As a lot is allocated to a gauge based on the mean ball diameter D_{wmL}, the two gauge limits may be further exceeded by $V_{DwL}/2$. In addition, for a single value the limits may be exceeded by $V_{Dws}/2$.

The diameter variation of the balls in the same package do not always correspond to the variation of the ball diameter V_{DwL} prescribed for a lot in table 1.



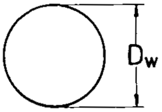
Steel balls



Diameter Dw mm	inch	Weight /1 000 pcs. kg	Designation —
1		0,004	BR1
1,5		0,014	BR1,5
1,588	1/16	0,016	BR1,588
2		0,033	BR2
2,381	3/32	0,055	BR2,381
2,5		0,064	BR2,5
2,5		0,064	BS2,5
3		0.111	BR3
3		0,111	BS3
3,175	1/8	0,132	BR3.175
3,175	1/8	0,132	BS3,175
3,5		0,177	BR3,5
3,969	5/32	0,257	BR3,969
4		0,263	BR4
4		0,263	BS4
4,5		0,374	BR4,5
4,762	3/16	0,446	BR4,762
5		0,514	BR5
5.5		0,679	BR5,5
5.556	7/32	0,702	BR5,556
6		0,882	BR6
6,35	1/4	1,03	BR6,35
6,5		1,13	BR6,5
7		1,41	BR7
7,144	9/32	1,5	BR7,144
7,5		1,74	BR7,5
7,938	5/16	2,06	BR7,938
7,938	5/16	2,06	BS7,938
8		2,1	BR8
8,5		2,52	BR8,5
8,731	11/32	2,66	BR8,731
9		3	BR9
9,525	3/8	3,55	BR9,525
10		4,11	BR10
10,319	13/32	4,43	BR10,319
11		5,47	BR11
11,112	7/16	5,64	BR11,112
11,112	7/16	5,64	BS11,112
11,5		6,25	BR11,5
11,906	15/32	6,93	BR11,906
12		7,1	BR12
12,5		8,03	BR12,5
12,5		8,03	BS12,5
12,7	1/2	8,42	BR12,7
13		9,03	BR13
13,494	17/32	10,1	BR13,494
14		11,3	BR14
14,288	9/16	12	BR14,288
14,288	9/16	12	BS14,288

Diameter Dw mm	inch	Weight /1 000 pcs. kg	Designation —
15		13,9	BR15
15,081	19/32	14,1	BR15,081
15,875	5/8	16,5	BR15,875
15,875	5/8	16,5	BS15,875
16		16,8	BR16
16,669	21/32	19,1	BR16,669
17		20,2	BR17
17,462	11/16	21,9	BR17,462
17,462	11/16	21,9	BS17,462
18		24	BR18
18,256	23/32	25	BR18,256
19		28,2	BR19
19,05	3/4	28,4	BR19,05
19,05	3/4	28,4	BS19,05
19,844	25/32	32,4	BR19,844
20		32,9	BR20
20,638	13/16	36,2	BR20,638
21		38,1	BR21
21,431	27/32	40	BR21,431
22		43,8	BR22
22,225	7/8	45,2	BR22,225
22,225	7/8	45,2	BS22,225
23		49,6	BR23
23,812	15/16	55,5	BR23,812
24		56,8	BB24
25		64,2	BR25
25,4	1"	67,4	BR25,4
26		72,3	BR26
26,988	1"1/16	80,8	BR26,988
28		90,2	BR28
28,575	1"1/8	95,5	BR28,575
30		111	BR30
30,162	1"3/16	113	BR30,162
31,75	1"1/4	132	BR31,750
32		135	BR32
33		146	BR33
33,338	1"5/16	152	BR33,338
34		162	BR34
34,925	1"3/8	175	BR34,925
35		177	BR35
36		192	BR36
36,512	1"7/16	200	BR36,512
38		225	BR38
38,1	1"1/2	227	BR38,1
39,688	1"9/16	257	BR39,688
40		263	BR40
41,275	1"5/8	290	BR41,275

Steel balls



Diameter D_w		Weight /piece	Designation
mm	inch	kg	—
42,862	1"11/16	0,324	BR42,862
44,45	1"3/4	0,361	BR44,45
46,038	1"13/16	0,403	BR46,038
47,625	1"7/8	0,446	BR47,625
49,212	1"15/16	0,490	BR49,212
50		0,514	BR50
50,8	2"	0,539	BR50,8
53,975	2"1/8	0,646	BR53,975
55		0,679	BR55
57,15	2"1/4	0,769	BR57,15
60		0,882	BR60
60,325	2"3/8	0,902	BR60,325
63,5	2"1/2	1,03	BR63,5
65		1,13	BR65
66,675	2"5/8	1,22	BR66,675
69,85	2"3/4	1,40	BR69,850
73,025	2"7/8	1,60	BR73,025
75		1,74	BR75
76,2	3"	1,82	BR76,2
80		2,10	BR80
82,55	3"1/4	2,31	BR82,55
85		2,52	BR85
88,9	3"1/2	2,89	BR88,9
90		3,00	BR90
95		3,52	BR95
95,25	3"3/4	3,55	BR95,25
100		4,11	BR100
110		5,47	BR110
120		7,10	BR120
127	5"	8,42	BR127
130		9,02	BR130
140		11,2	BR140
150		13,9	BR150

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